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Legislation

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Contents

[1] Text with EEA relevance.

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.

Corrigenda

[1] Text with EEA relevance.

II

(Non-legislative acts)

REGULATIONS

COMMISSION IMPLEMENTING REGULATION (EU) 2019/781

of 15 May 2019

concerning the authorisation of a preparation of 3-phytase produced by *Komagataella phaffii* (CECT 13094) as a feed additive for chickens for fattening or reared for laying, laying hens and minor poultry species for fattening, for breeding and reared for laying (holder of authorisation Fertinagro Nutrientes S.L.)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition ([1]), and in particular Article 9(2) thereof,

Whereas:

(1) Regulation (EC) No 1831/2003 provides for the authorisation of additives for use in animal nutrition and for the grounds and procedures for granting such authorisation.

(2) In accordance with Article 7 of Regulation (EC) No 1831/2003 an application was submitted for the authorisation of a preparation of 3-phytase produced by *Komagataella phaffii* (CECT 13094). That application was accompanied by the particulars and documents required under Article 7(3) of that Regulation.

(3) That application concerns the authorisation of a preparation of 3-phytase produced by *Komagataella phaffii* (CECT 13094) as a feed additive for chickens for fattening, chickens reared for laying, laying hens and minor poultry species for fattening, for breeding and reared for laying, to be classified in the additive category 'zootechnical additives'.

(4) The preparation of 3-phytase as liquid formulation was already authorised as a feed additive by Commission Implementing Regulation (EU) 2017/895 ([2]) for chickens for fattening and laying hens.

(5) The European Food Safety Authority ('the Authority') concluded in its opinion of 27 November 2018 ([3]) that, under the proposed conditions of use, 3-phytase produced by *Komagataella phaffii* (CECT 13094), previously identified as *Komagataella pastoris,* does not have an adverse effect on animal health, consumer safety or the environment. It was also concluded that the additive may have a dermal and respiratory sensitisation potential. Therefore, the Commission considers that appropriate protective measures should be taken to prevent adverse effects on human health, in particular as regards the users of the additive. The Authority has also concluded that as the solid and liquid formulations are equivalent in terms of efficacy, the solid formulation of the additive has a potential to be efficacious for the target species. The Authority does not consider that there is a need for specific requirements of post-market monitoring. It also verified the report on the method of analysis of the feed additive in feed submitted by the Reference Laboratory set up by Regulation (EC) No 1831/2003.

([1]) OJ L 268, 18.10.2003, p. 29.
([2]) Commission Implementing Regulation (EU) 2017/895 of 24 May 2017 concerning the authorisation of a preparation of 3-phytase produced by *Komagataella pastoris* (CECT 13094) as a feed additive for chickens for fattening and laying hens (holder of authorisation Fertinagro Nutrientes S.L.) (OJ L 138, 25.5.2017, p. 120).
([3]) EFSA Journal 2019;17(1):5543.

(6) The assessment of the 3-phytase shows that the conditions for authorisation of 3-phytase produced by *Komagataella phaffii* (CECT 13094), as provided for in Article 5 of Regulation (EC) No 1831/2003, are satisfied. Accordingly, the use of that preparation should be authorised as specified in the Annex to this Regulation.

(7) The measures provided for in this Regulation are in accordance with the opinion of the Standing Committee on Plants, Animals, Food and Feed,

HAS ADOPTED THIS REGULATION:

Article 1

The preparation specified in the Annex, belonging to the additive category 'zootechnical additives' and to the functional group 'digestibility enhancers', is authorised as an additive in animal nutrition, subject to the conditions laid down in that Annex.

Article 2

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 15 May 2019.

For the Commission
The President
Jean-Claude JUNCKER

ANNEX

Identification number of the additive	Name of the holder of authorisation	Additive	Composition, chemical formula, description, analytical method	Species or category of animal	Maximum age	Minimum content	Maximum content	Other provisions	End of period of authorisation
						Units of activity/kg of complete feedingstuff with a moisture content of 12 %			
Category of zootechnical additives. Functional group: digestibility enhancers									
4a25	Fertinagro Nutrientes S.L.	3-phytase EC 3.2.1.8	*Additive composition* Preparation of 3-phytase produced by *Komagataella phaffii* (CECT 13094) having a minimum activity of: 10 000 FTU (1) /g Solid form *Characterisation of the active substance* 3-phytase (EC 3.2.1.8) produced by *Komagataella phaffii* (CECT 13094) *Analytical method* (2) For the quantification of 3-phytase activity in the feed additive and premixtures: — colorimetric method based on the enzymatic reaction of phytase on the phytate For the quantification of 3-phytase activity in feedingstuffs: — colorimetric method based on the enzymatic reaction of phytase on the phytate – EN ISO 30024	Chickens for fattening or reared for laying Minor poultry species for fattening or reared for laying or for breeding	—	500 FTU		1. In the directions for use of the additive and premixtures, the storage conditions and stability to heat treatment shall be indicated. 2. For users of the additive and premixtures, feed business operators shall establish operational procedures and organisational measures to address potential risks resulting from its use. Where those risks cannot be eliminated or reduced to a minimum by such procedures and measures, the additive and premixtures shall be used with personal protective equipment, including skin and breathing protection.	5 June 2029
				Laying hens		1 000 FTU			

(1) 1 FTU is the amount of enzyme which liberates 1 micromole of inorganic phosphate per minute from a sodium phytate substrate at pH 5,5 and 37 °C.
(2) Details of the analytical methods are available at the following address of the Reference Laboratory: https://ec.europa.eu/jrc/en/eurl/feed-additives/evaluation-reports.

DIRECTIVES

COMMISSION DIRECTIVE (EU) 2019/782

of 15 May 2019

amending Directive 2009/128/EC of the European Parliament and of the Council as regards the establishment of harmonised risk indicators

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides ([1]), and in particular the second subparagraph of Article 15(1) thereof,

Whereas:

(1) Directive 2009/128/EC aims to reduce risks and impacts of pesticide use on human health and the environment and to promote the use of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides.

(2) In its report of October 2017 on Member State National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides ([2]), the Commission undertook to work with Member States towards reaching a consensus on the development of harmonised risk indicators.

(3) In December 2017, in its response to the European Citizens Initiative 'Ban glyphosate and protect people and the environment from toxic pesticides' ([3]), the Commission undertook to establish harmonised risk indicators in order to monitor trends in risk reduction from pesticide use at Union level.

(4) It is necessary to establish harmonised risk indicators in order to measure the progress achieved in meeting those objectives at Union level, which will enable Member States to manage and to report on risk at national level.

(5) Article 15(4) of Directive 2009/128/EC requires the Commission to calculate risk indicators at Union level using statistical data collected in accordance with Union legislation concerning statistics on plant protection products and other relevant data, in order to estimate trends in risks from pesticide use.

(6) Article 1(3) of Regulation (EC) No 1185/2009 of the European Parliament and of the Council ([4]) requires that the statistics produced in accordance with that Regulation, together with other relevant data, serve the purpose of Articles 4 and 15 of Directive 2009/128/EC, namely the establishment of National Action Plans and the

([1]) OJ L 309, 24.11.2009, p. 71.
([2]) Report from the Commission to the European Parliament and the Council of October 2017 on Member State National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides — COM(2017) 587 final.
([3]) Communication from the Commission of 12 December 2017 on the European Citizens' Initiative 'Ban glyphosate and protect people and the environment from toxic pesticides' — C(2017) 8414 final.
([4]) Regulation (EC) No 1185/2009 of the European Parliament and of the Council of 25 November 2009 concerning statistics on pesticides (OJ L 324, 10.12.2009, p. 1).

calculation of indicators. To date, no harmonised approach at Union level for collecting statistics on the use of plant protection products has been achieved under Regulation (EC) No 1185/2009 and therefore no such data is available.

(7) Article 53 of Regulation (EC) No 1107/2009 of the European Parliament and of the Council ([5]) allows, in special circumstances, Member States to authorise for a period not exceeding 120 days, the placing on the market of plant protection products, for limited and controlled use, where such a measure appears necessary because of a danger which cannot be controlled by any other reasonable means. In these cases, Member States may authorise plant protection products containing either approved or non-approved active substances.

(8) A harmonised risk indicator can only be based on statistical data collected in accordance with the Union legislation concerning statistics on plant protection products and other relevant data, and, in the absence of statistics on the use of plant protection products, the only such relevant and currently available data are statistics on the placing on the market of plant protection products, and the number of authorisations granted by Member States in special circumstances under Article 53 of Regulation (EC) No 1107/2009. Such indicators should be supplemented with other indicators so that other risk elements can be included.

(9) It is appropriate that the categorisation of active substances used in this Directive mirror the categorisation provided for in Regulation (EC) No 1107/2009, as either low-risk active substances, candidates for substitution or other active substances, based, amongst others, on the classification under Regulation (EC) No 1272/2008 of the European Parliament and of the Council ([6]).

(10) Active substances under Regulation (EC) No 1107/2009 can be either chemical active substances or micro-organisms. Directive 2009/128/EC requires Member States to give wherever possible priority to non-chemical methods of pest management. It is therefore appropriate, when establishing harmonised risk indicators, to categorise chemical active substances and micro-organisms separately.

(11) In cases where Member States grant authorisations under Article 53 of Regulation (EC) No 1107/2009 concerning non-approved active substances, the quantities of non-approved active substances contained in the plant protection products subsequently placed on the market are communicated by Members States to the Commission in accordance with Article 3 of Regulation (EC) No 1185/2009. To date, there is no harmonised approach at Union level for collecting data on the specific quantities of approved active substances contained in plant protection products placed on the market linked to authorisations granted under Article 53 of Regulation (EC) No 1107/2009.

(12) By combining the statistics produced in accordance with Regulation (EC) No 1185/2009 and the information on active substances in accordance with Regulation (EC) No 1107/2009, including if they are low risk active substances, candidates for substitution, or other active substances, a method of calculation can be established to produce a hazard-based harmonised risk indicator which estimates potential risks from pesticide use.

(13) Pending the putting in place of a Union-wide harmonised data collection system on the quantities of active substances placed on the market under Article 53 of Regulation (EC) No 1107/2009, it is justified to establish a harmonised risk indicator based on the number of authorisations granted under that Article.

(14) In order to calculate harmonised risk indicators to reflect the relative risk of using plant protection products containing different categories of approved active substances and non-approved active substances, weighting factors should be established for this purpose.

(15) In order to measure progress in the area with a reasonable frequency, and given that Member States are required to produce data under Regulation (EC) No 1185/2009 on an annual basis and transmit it to Eurostat within 12 months of the end of the reference year, the calculation of harmonised risk indicators should be performed annually, and published at the latest 20 months after the end of the reference year in question.

(16) The measures provided for in this Directive are in accordance with the opinion of the Standing Committee on Plants, Animals, Food and Feed,

([5]) Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).

([6]) Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1).

HAS ADOPTED THIS DIRECTIVE:

Article 1

Amendment to Annex IV to Directive 2009/128/EC

Annex IV to Directive 2009/128/EC is replaced by the text in the Annex to this Directive.

Article 2

Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 5 September 2019 at the latest.

When Member States adopt these measures, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the text of the provisions which they adopt in the field covered by this Directive.

Article 3

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

Article 4

Addressees

This Directive is addressed to the Member States.

Done at Brussels, 15 May 2019.

For the Commission
The President
Jean-Claude JUNCKER

ANNEX

'ANNEX IV

SECTION 1

Harmonised Risk Indicators

The harmonised risk indicators are listed in Sections 2 and 3 of this Annex.

SECTION 2

Harmonised Risk Indicator 1: Hazard-based Harmonised Risk Indicator based on the quantities of active substances placed on the market in plant protection products under Regulation (EC) No 1107/2009

1. This indicator shall be based on statistics on the quantities of active substances placed on the market in plant protection products under Regulation (EC) No 1107/2009, provided to the Commission (Eurostat) under Annex I (Statistics on the placing on the market of pesticides) of Regulation (EC) No 1185/2009. Those data are categorised into 4 Groups, which are divided into 7 Categories.

2. The following general rules shall apply for the calculation of Harmonised Risk Indicator 1:

   (a) the Harmonised Risk Indicator 1 shall be calculated on the basis of the categorisation of active substances into the 4 Groups and 7 Categories set out in Table 1;

   (b) the active substances in Group 1 (categories A and B) shall be those listed in Part D of the Annex to Commission Implementing Regulation (EU) No 540/2011 ([1]);

   (c) the active substances in Group 2 (categories C and D) shall be those listed in Parts A and B of the Annex to Implementing Regulation (EU) No 540/2011;

   (d) the active substances in Group 3 (categories E and F) shall be those listed in Part E of the Annex to Implementing Regulation (EU) No 540/2011;

   (e) the active substances in Group 4 (category G) shall be those not approved under Regulation (EC) No 1107/2009, and therefore not listed in the Annex to Implementing Regulation (EU) No 540/2011;

   (f) the weightings in row (vi) in Table 1 shall apply.

3. Harmonised Risk Indicator 1 shall be calculated by multiplying the annual quantities of active substances placed on the market for each Group in Table 1 by the relevant hazard weighting set out in Row (vi), followed by the aggregation of the results of these calculations.

4. The quantities of active substances placed on the market for each Group and Category in Table 1 may be calculated.

([1]) Commission Implementing Regulation (EU) No 540/2011 of 25 May 2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards the list of approved active substances (OJ L 153, 11.6.2011, p. 1).

Table 1

Categorisation of active substances and hazard weightings for the purpose of calculating Harmonised Risk Indicator 1

Row	Groups						
	1		2		3		4
(i)	Low-risk active substances which are approved or deemed to be approved under Article 22 of Regulation (EC) No 1107/2009, and which are listed in Part D of the Annex to Implementing Regulation (EU) No 540/2011		Active substances approved or deemed to be approved under Regulation (EC) No 1107/2009, and not falling in other categories, and which are listed in Parts A and B of the Annex to Implementing Regulation (EU) No 540/2011		Active substances approved or deemed to be approved under Article 24 of Regulation (EC) No 1107/2009, which are candidates for substitution, and which are listed in Part E of the Annex to Implementing Regulation (EU) No 540/2011		Active substances which are not approved under Regulation (EC) No 1107/2009, and therefore which are not listed in the Annex to Implementing Regulation (EU) No 540/2011
(ii)	Categories						
(iii)	A	B	C	D	E	F	G
(iv)	Micro-organisms	Chemical active substances	Micro-organisms	Chemical active substances	Which are not classified as: Carcinogenic Category 1A or 1B and/or Toxic for Reproduction Category 1A or 1B and/or Endocrine disruptors	Which are classified as: Carcinogenic Category 1A or 1B and/or Toxic for Reproduction Category 1A or 1B and/or Endocrine disruptors, where exposure of humans is negligible	
(v)	Hazard Weightings applicable to quantities of active substances placed on the market in products authorised under Regulation (EC) No 1107/2009						
(vi)	1		8		16		64

5. The baseline for Harmonised Risk Indicator 1 shall be set at 100, and is equal to the average result of the above calculation for the period 2011-2013.

6. The result of Harmonised Risk Indicator 1 shall be expressed by reference to the baseline.

7. The Member States and the Commission shall calculate and publish the Harmonised Risk Indicator 1 in accordance with Article 15(2) and 15(4) of Directive 2009/128/EC for each calendar year and at the latest 20 months after the end of the year for which the Harmonised Risk Indicator 1 is being calculated.

SECTION 3

Harmonised Risk Indicator 2: Harmonised Risk Indicator based on the number of authorisations granted under Article 53 of Regulation (EC) No 1107/2009

1. This indicator shall be based on the number of authorisations granted for plant protection products under Article 53 of Regulation (EC) No 1107/2009 as communicated to the Commission in accordance with Article 53(1) of that Regulation. Those data are categorised into 4 Groups, which are divided into 7 Categories.

2. The following general rules shall apply for the calculation of the Harmonised Risk Indicator 2:

   (a) the Harmonised Risk Indicator 2 shall be based on the number of authorisations granted under Article 53 of Regulation (EC) No 1107/2009. It shall be calculated on the basis of the categorisation of active substances into the 4 Groups and 7 Categories set out in Table 2 of this Section;

   (b) the active substances in Group 1 (categories A and B) are listed in Part D of the Annex to Implementing Regulation (EU) No 540/2011;

   (c) the active substances in Group 2 (categories C and D) are those listed in Parts A and B of the Annex to Implementing Regulation (EU) No 540/2011;

   (d) the active substances in Group 3 (categories E and F) shall be those listed in Part E of the Annex to Implementing Regulation (EU) No 540/2011;

   (e) the active substances in Group 4 (category G) shall be those not approved under Regulation (EC) No 1107/2009, and therefore not listed in the Annex to Implementing Regulation (EU) No 540/2011;

   (f) The weightings in row (vi) in Table 2 of this Section shall apply.

3. The Harmonised Risk Indicator 2 shall be calculated by multiplying the number of authorisations granted for plant protection products under Article 53 of Regulation (EC) No 1107/2009 for each Group in Table 2 by the relevant hazard weighting set out in Row (vi), followed by the aggregation of the results of these calculations.

Table 2

Categorisation of active substances and hazard weightings for the purpose of calculating Harmonised Risk Indicator 2

Row	Groups			
	1	2	3	4
(i)	Low-risk active substances which are approved or deemed to be approved under Article 22 of Regulation (EC) No 1107/2009, and which are listed in Part D of the Annex to Implementing Regulation (EU) No 540/2011	Active substances approved or deemed to be approved under Regulation (EC) No 1107/2009, and not falling in other categories, and which are listed in Parts A and B of the Annex to Implementing Regulation (EU) No 540/2011	Active substances approved or deemed to be approved under Article 24 of Regulation (EC) No 1107/2009, which are candidates for substitution, and which are listed in Part E of the Annex to Implementing Regulation (EU) No 540/2011	Active substances which are not approved under Regulation (EC) No 1107/2009, and therefore which are not listed in the Annex to Implementing Regulation (EU) No 540/2011

Row	Groups						
	1		2		3		4
(ii)	Categories						
(iii)	A	B	C	D	E	F	G
(iv)	Micro-organisms	Chemical active substances	Micro-organisms	Chemical active substances	Which are not classified as: Carcinogenic Category 1A or 1B and/or Toxic for Reproduction Category 1A or 1B and/or Endocrine disruptors	Which are classified as: Carcinogenic Category 1A or 1B and/or Toxic for Reproduction Category 1A or 1B and/or Endocrine disruptors where exposure of humans is negligible	
(v)	Hazard Weightings applicable to the number of authorisations granted under Article 53 of Regulation (EC) No 1107/2009						
(vi)	1		8		16		64

4. The baseline for Harmonised Risk Indicator 2 shall be set at 100, and is equal to the average result of the above calculation for the period 2011-2013.

5. The result of the Harmonised Risk Indicator 2 shall be expressed by reference to the baseline.

6. The Member States and the Commission shall calculate and publish the Harmonised Risk Indicator 2 in accordance with Article 15(2) and 15(4) of Directive 2009/128/EC for each calendar year and at the latest 20 months after the end of the year for which Harmonised Risk Indicator 2 is being calculated.'

DECISIONS

POLITICAL AND SECURITY COMMITTEE DECISION (CFSP) 2019/783

of 30 April 2019

on the appointment of the EU Force Commander for the European Union military operation in Bosnia and Herzegovina and repealing Decision (CFSP) 2018/355 (BiH/28/2019)

THE POLITICAL AND SECURITY COMMITTEE,

Having regard to the Treaty on European Union, and in particular Article 38 thereof,

Having regard to Council Joint Action 2004/570/CFSP of 12 July 2004 on the European Union military operation in Bosnia and Herzegovina ([1]), and in particular Article 6(1) thereof,

Whereas:

(1) Pursuant to Article 6(1) of Joint Action 2004/570/CFSP, the Council authorised the Political and Security Committee (PSC) to take the relevant decisions on the appointment of the EU Force Commander for the European Union military operation in Bosnia and Herzegovina (the 'EU Force Commander').

(2) On 27 February 2018 the PSC adopted Decision (CFSP) 2018/355 ([2]), appointing Major General Martin DORFER as EU Force Commander.

(3) The EU Operation Commander has recommended the appointment of Brigadier General Reinhard TRISCHAK as the new EU Force Commander to succeed Major General Martin DORFER as from 26 June 2019.

(4) The EU Military Committee agreed to the recommendation of the EU Operation Commander on 18 March 2019.

(5) Decision (CFSP) 2018/355 should therefore be repealed.

(6) In accordance with Article 5 of Protocol No 22 on the position of Denmark, annexed to the Treaty on European Union and to the Treaty on the Functioning of the European Union, Denmark does not participate in the elaboration and the implementation of decisions and actions of the Union which have defence implications.

(7) On 12 and 13 December 2002 the Copenhagen European Council adopted a declaration stating that the Berlin Plus arrangements and the implementation thereof will apply only to those Member States of the Union which are also either NATO members or members of the Partnership for Peace programme and which have consequently concluded bilateral security agreements with NATO,

HAS ADOPTED THIS DECISION:

Article 1

Brigadier General Reinhard TRISCHAK is hereby appointed EU Force Commander for the European Union military operation in Bosnia and Herzegovina (operation ALTHEA) as from 26 June 2019.

Article 2

Decision (CFSP) 2018/355 is hereby repealed.

([1]) OJ L 252, 28.7.2004, p. 10.

([2]) Political and Security Committee Decision (CFSP) 2018/355 of 27 February 2018 on the appointment of the EU Force Commander for the European Union military operation in Bosnia and Herzegovina and repealing Decision (CFSP) 2017/682 (BiH/26/2018) (OJ L 68, 12.3.2018, p. 12).

Article 3

This Decision shall enter into force on 26 June 2019.

Done at Brussels, 30 April 2019.

For the Political and Security Committee
The Chairperson
S. FROM-EMMESBERGER

COMMISSION IMPLEMENTING DECISION (EU) 2019/784

of 14 May 2019

on harmonisation of the 24,25-27,5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union

(notified under document C(2019) 3450)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) ([1]), and in particular Article 4(3) thereof,

Whereas:

(1) The 24,25-27,5 GHz ('26 GHz') frequency band is being studied as a candidate band for International Mobile Telecommunications for 2020 and beyond ([2]) (IMT-2020), which is part of the agenda of the World Radiocommunication Conference 2019 (WRC-19) ([3]). IMT-2020 represents the 5G framework of radio standards developed by the Radiocommunication Sector of the International Telecommunication Union (ITU-R) based on mobile broadband technology.

(2) According to the ITU Radio Regulations ([4]), the 25,25-27,5 GHz frequency band is allocated worldwide to the mobile service on a co-primary basis. The 24,25-25,25 GHz frequency band is not allocated to the mobile service in Region 1 of the ITU, which includes the European Union. That does not prevent the Union from using this frequency band for wireless broadband electronic communications services as long as it complies with international and cross-border obligations under the ITU Radio Regulations at its external borders.

(3) The Commission Communication '5G for Europe: An Action Plan' ([5]) ('5G action plan') sets out a coordinated Union approach to the deployment of 5G services as of 2020. The 5G action plan calls for the identification of pioneer frequency bands for the launch of 5G services by the Commission in cooperation with the Member States, taking into account the opinion of the Radio Spectrum Policy Group (RSPG).

(4) The RSPG has adopted three opinions on a strategic spectrum roadmap for 5G in Europe ([6]) ('RSPG Opinions'), in which it identified the 26 GHz frequency band as one pioneer band for 5G and recommended to Member States that they make a sufficiently large portion of that band, e.g. 1 GHz, available for 5G by 2020 in response to market demand.

(5) The 26 GHz frequency band provides high capacity for providing innovative wireless broadband electronic communications services with 5G technology based on small cells ([7]) and with a block size of 200 MHz. In accordance with the European Electronic Communications Code (EECC) ([8]), Member States must allow the use of at least 1 GHz of the 26 GHz frequency band by 31 December 2020 in order to facilitate 5G rollout, provided that there is clear evidence of market demand and of the absence of significant constraints for migration of existing users or band clearance. The EECC also provides that measures taken by Member States pursuant to that requirement must comply with the harmonised conditions set by technical implementing measures in accordance with the Radio Spectrum Decision.

([1]) OJ L 108, 24.4.2002, p. 1.
([2]) ITU-R Resolution 238 (WRC-15) regarding potential frequency bands for the future development of International Mobile Telecommunications for 2020 (IMT-2020) and beyond.
([3]) Agenda item 1.13 of WRC-19 according to ITU-R Resolution 809 (WRC-15).
([4]) Link: http://www.itu.int/pub/R-REG-RR
([5]) COM(2016) 588 final.
([6]) Opinion on spectrum related aspects for next-generation wireless systems (5G) (RSPG16-032 final) of 9 November 2016, Second Opinion on 5G networks (RSPG18-005 final) of 30 January 2018, Opinion on 5G implementation challenges (RSPG19-007 final) of 31 January 2019.
([7]) Cells with a size of up to a few hundreds of meters.
([8]) Article 54 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (OJ L 321, 17.12.2018, p. 36).

(6) Portions of the 26 GHz frequency band are used in the Member States for terrestrial fixed wireless connections ('fixed links') including backhauling ([9]). The approach to managing the co-existence between terrestrial wireless broadband electronic communications services, including next-generation or 5G, and fixed links at national level, should allow flexibility for Member States.

(7) The use of the 24,25-26,65 GHz portion of the 26 GHz frequency band for automotive short-range radars should be gradually phased out by 1 January 2022 ([10]). There is a steady trend in the market development for automotive short-range radars towards new deployments in the 77-81 GHz frequency band harmonised at Union level ([11]). Therefore, no co-existence issues with automotive short-range radars are identified.

(8) The 24,25-24,5 GHz portion of the 26 GHz frequency band is designated at Union level for transport and traffic telematics devices, in particular for automotive radars ([12]) on a non-protected and non-interference basis. There is no current or planned use of those automotive radars in the band ([13]), while such use increases in the 76-81 GHz frequency range.

(9) The 24,25-27 GHz portion of the 26 GHz frequency band is used for radio determination devices ([14]), which operate in 'underlay' mode based on ultra-wide band technology ([15]). Such use should be adaptable to the evolution of use of the 26 GHz frequency band for terrestrial wireless broadband electronic communications services.

(10) Some portions of the 26 GHz frequency band are used for space and satellite services across the Member States. These services comprise within the 25,5-27 GHz range space-to-earth communications to earth stations in the Earth Exploration Satellite Service (EESS) ([16]), in the Space Research Service (SRS) and supporting the European Data Relay System (EDRS), as well as earth-to-space communications to satellite on-board receivers in the Fixed Satellite Service (FSS) within the 24,65-25,25 GHz range. Therefore, those space and satellite services should be appropriately protected against interference from terrestrial wireless broadband electronic communications services. They also need prospects for further development. Furthermore, the 24,45-24,75 GHz and 25,25-27,5 GHz portions of the 26 GHz frequency band are used worldwide for communications between non-geostationary and geostationary satellites in the Inter-Satellite Service (ISS), including the EDRS.

(11) Next-generation (5G) terrestrial services should be rolled out within the 26 GHz frequency band under harmonised technical conditions. These conditions should safeguard the continued operation and development of satellite earth stations (in the EESS, SRS and FSS) with frequency allocations within the band in order for earth stations to be authorised in the future based on transparent, objective and proportionate criteria. Those conditions should equally ensure that existing and future satellite services are unlikely to have a significant negative impact on terrestrial 5G deployment and coverage.

(12) Pursuant to Article 4(2) of the Radio Spectrum Decision, the Commission gave the European Conference of Postal and Telecommunications Administrations (CEPT) a mandate to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union, including in the 26 GHz frequency band.

(13) In response to that mandate, CEPT issued Report 68 ([17]) ('the CEPT Report') on 6 July 2018. This specifies harmonised technical conditions in the 26 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union, which are suitable for 5G use. Those

([9]) According to the ITU Radio Regulations in their version of 2016, the whole 26 GHz band is allocated to the Fixed Service on a co-primary basis in Europe.
([10]) Pursuant to Commission Decision 2005/50/EC of 17 January 2005 on the harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community (OJ L 21, 25.1.2005, p. 15).
([11]) Pursuant to Commission Decision 2004/545/EC of 8 July 2004 on the harmonisation of radio spectrum in the 79 GHz range for the use of automotive short-range radar equipment in the Community (OJ L 241, 13.7.2004, p. 66).
([12]) Pursuant to Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices (OJ L 312, 11.11.2006, p. 66).
([13]) In the context of Wideband Low Activity Mode applications.
([14]) Such as level probing radars.
([15]) Pursuant to Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (OJ L 55, 23.2.2007, p. 33).
([16]) Mainly for the Copernicus programme, Eumetsat meteorological programmes and different earth observation systems.
([17]) CEPT Report 68: 'Report B from CEPT to the European Commission in response to the Mandate "to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union", Harmonised technical conditions for the 24,25-27,5 GHz ("26 GHz") frequency band', link: https://www.ecodocdb.dk/document/3358.

technical conditions are consistent with 5G standardisation developments regarding channelling arrangements ([18]), namely channel size or duplex mode of operation, and active antenna systems and are therefore conducive to global harmonisation. They assume synchronised operation of neighbouring systems of different operators, which ensures that the spectrum is used efficiently. Unsynchronised or semi-synchronised operation of neighbouring systems requires further studies in order to develop relevant harmonised technical conditions. Such operation remains possible with geographical separation.

(14) The technical conditions provided in the CEPT Report for the use of the 26 GHz frequency band are based on the assumption of an authorisation regime based exclusively on individual rights of use, which is also conducive to ensuring appropriate co-existence with current band use. Any other authorisation framework such as general authorisation or a combined individual/general authorisation regime could require additional technical conditions in order to ensure appropriate coexistence of terrestrial systems capable of providing wireless broadband electronic communications services with other services in the band, in particular taking due account of continued deployment of FSS, EESS and SRS satellite earth stations.

(15) The CEPT Report also provides guidance and technical conditions for the use of the 26 GHz frequency band for terrestrial wireless broadband electronic communications services, including 5G, to ensure the protection of existing space and satellite services and fixed links within the 26 GHz frequency band as well as services in adjacent bands.

(16) Co-existence between terrestrial wireless broadband electronic communications services (including 5G) and earth stations in the EESS, SRS and FSS operating in the 26 GHz frequency band can be ensured by applying, where appropriate, technical constraints to the deployment of terrestrial services in a limited geographical area around a satellite earth station. In this regard, deploying new earth stations preferably away from locations with high population density or high human activity may represent a proportionate approach to facilitating such co-existence. Moreover, CEPT has been developing technical toolkits ([19]) to support 5G deployment based on individual authorisation while allowing in a proportionate way the continued use of current and planned EESS/SRS receiving earth stations and FSS transmitting earth stations in the relevant portions of the 26 GHz frequency band. These toolkits can facilitate coexistence in fulfilling the obligations under this Decision.

(17) Coexistence between terrestrial wireless broadband electronic communications services (including 5G) and satellite receivers in the FSS and ISS, including EDRS, is currently feasible, subject to technical conditions that address the antenna elevation of wireless broadband base stations.

(18) Member States should assess the possibility of continuing to operate fixed links in the 26 GHz band based on shared spectrum use with terrestrial wireless broadband electronic communications services, including 5G, or discontinuing their operation in the band. Such an assessment should take into consideration potential mitigation techniques, and national and cross-border coordination as well as the extent of 5G deployment, subject to market demand for 5G systems, in particular in less-populated and rural areas. The possibility of shared spectrum use as a national option depends on, among other things, the availability of detailed information on the deployment of fixed links and the feasibility of assigning large blocks of contiguous spectrum to 5G systems. To that end, CEPT provides technical guidance on the co-existence between terrestrial wireless broadband electronic communications services, including 5G, and fixed links, taking into account progressive 5G deployment.

(19) Terrestrial wireless broadband electronic communications services, including 5G, in the 26 GHz frequency band should provide appropriate protection to the EESS (passive) in the 23,6-24 GHz frequency band ([20]). Specific measures may be required at national level to ensure radio astronomy stations operating in the 23,6-24 GHz frequency band are protected. These measures are likely to constrain usability of the full 26 GHz band around such stations. The protection of the EESS (passive) in the 50,2-50,4 GHz and 52,6-54,25 GHz frequency bands is ensured by the existing generic spurious emission limits applying to base stations ([21]).

([18]) 3GPP standardisation (Release 15, TS 38.104 transposed as ETSI TS 138104) defines the 26 GHz frequency band (band n258) for use with New Radio (NR) technology based on time division duplex, and channel bandwidths of 50 MHz, 100 MHz, 200 MHz, and 400 MHz.

([19]) Such as ECC Recommendation (19)01 'Technical toolkit to support the introduction of 5G while ensuring, in a proportionate way, the use of existing and planned EESS/SRS receiving earth stations in the 26 GHz band and the possibility for future deployment of these earth stations'. These toolkits provide among other things methodologies to national administrations to determine the coordination areas around the earth stations.

([20]) According to the ITU Radio Regulations in their version of 2016 (see footnote 5.340), all emissions are prohibited in the 23,6-24 GHz frequency band in line with protection thresholds given in relevant ITU-R Recommendations (such as ITU-R RA.769-2 with regard to the Radio Astronomy Service).

([21]) By virtue of ITU-R Recommendations.

(20) The use of unmanned aerial vehicles ('UAVs') such as drones with terrestrial wireless broadband electronic communications networks that use the 26 GHz frequency band could have an impact on existing use such as satellite receivers in the FSS and ISS. As a result, connectivity from base stations to terminal stations on board UAVs should be prohibited in the 26 GHz frequency band, and only connectivity from terminal stations on board UAVs to base stations should be allowed in compliance with applicable air traffic management regulation. In this regard, the connectivity from terminal stations on board UAVs to base stations could have a significant impact on, for example, the separation distance to EESS/SRS earth stations co-using the 26 GHz band. This requires further study, which may deliver supplementary harmonised technical conditions. Using UAVs with wireless broadband electronic communications networks should not hinder the deployment of future EESS/SRS earth stations.

(21) Provision should be made for cross-border agreements between spectrum users or national administrations to ensure the implementation of this Decision in order to avoid harmful interference and improve spectrum efficiency and convergence in spectrum use.

(22) This Decision ensures that Member States take up the 26 GHz frequency band for next-generation (5G) wireless broadband electronic communications services based on legally binding technical conditions in accordance with CEPT Report 68 and in line with the Union's policy objectives.

(23) The notion of 'designating and making available' the 26 GHz frequency band in the context of this Decision refers to the following steps: (i) the adaptation of the national legal framework on frequency allocation to include the intended use of this band under the harmonised technical conditions set in this Decision, (ii) the initiation of all necessary measures in order to ensure coexistence with existing use in this band, to the extent necessary, (iii) the initiation of the appropriate measures, supported by the launch of a stakeholder consultation process where appropriate, in order to allow the use of this band in accordance with the applicable legal framework at Union level, including the harmonised technical conditions of this Decision.

(24) Member States should report to the Commission on the implementation of this Decision, in particular as regards the gradual introduction and development of terrestrial 5G services in the 26 GHz frequency band and any co-existence issues, to help assess its impact at Union level as well as its timely review. Such a review can also address the suitability of the technical conditions to ensure adequate protection of other services, in particular space services such as satellite receivers in the FSS and ISS, including EDRS, taking into account the development of terrestrial wireless broadband electronic communications services, including 5G.

(25) The measures provided for in this Decision are in accordance with the opinion of the Radio Spectrum Committee established by the Radio Spectrum Decision,

HAS ADOPTED THIS DECISION:

Article 1

This Decision harmonises the essential technical conditions for the availability and efficient use of the 24,25-27,5 GHz frequency band in the Union for terrestrial systems capable of providing wireless broadband electronic communications services.

Article 2

By 30 March 2020, Member States shall designate and make available on a non-exclusive basis the 24,25-27,5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services, in compliance with the essential technical conditions set out in the Annex.

Depending on the authorisation regime applied in this band, Member States shall analyse if it is necessary to impose additional technical conditions in order to ensure appropriate co-existence of terrestrial systems capable of providing wireless broadband electronic communications services with other services in the band.

Article 3

Member States shall ensure, in compliance with the relevant technical conditions in the Annex, that the terrestrial systems referred to in Article 1 appropriately protect:

(a) systems in adjacent bands, in particular in the Earth Exploration Satellite Service (passive) and in the Radio Astronomy Service in the 23,6-24,0 GHz frequency band;

(b) earth stations in the Earth Exploration Satellite Service and in the Space Research Service for space-to-earth communications operating within the 25,5-27,0 GHz frequency band;

(c) satellite systems for earth-to-space communications in the Fixed Satellite Service operating within the 24,65-25,25 GHz frequency band;

(d) satellite systems for inter-satellite communications operating within the 24,45-24,75 GHz and 25,25-27,5 GHz frequency bands.

Article 4

Member States may allow the continued operation of fixed links within the 24,25-27,5 GHz frequency band, if the terrestrial systems referred to in Article 1 can co-exist with such fixed links through managed shared spectrum use.

Member States shall regularly monitor the need for continuing the operation of fixed links referred to in the first subparagraph of this Article.

Article 5

Under the condition that the number and locations of new earth stations are determined as not to impose disproportionate constraints on the systems referred to in Article 1, subject to market demand, Member States shall ensure, that the continued deployment of earth stations is made possible:

— in the Earth Exploration Satellite Service (space-to-earth) or in the Space Research Service (space-to-earth) within the 25,5-27,0 GHz frequency band;

— in the Fixed Satellite Service (earth-to-space), within the 24,65-25,25 GHz frequency band.

Article 6

Member States shall facilitate cross-border coordination agreements to enable operation of the terrestrial systems referred to in Article 1, taking into account existing regulatory procedures and rights, as well as relevant international agreements.

Article 7

Member States shall report to the Commission on the implementation of this Decision by 30 June 2020.

Member States shall monitor the use of the 24,25-27,5 GHz frequency band, including the progress on co-existence between the terrestrial systems referred to in Article 1 and other systems using the band, and report their findings to the Commission upon request or at their own initiative to allow a timely review of this Decision.

Article 8

This Decision is addressed to the Member States.

Done at Brussels, 14 May 2019.

For the Commission
Mariya GABRIEL
Member of the Commission

ANNEX

TECHNICAL CONDITIONS REFERRED TO IN ARTICLES 2 AND 3

1. **Definitions**

Active antenna systems (AAS) means a base station and an antenna system where the amplitude and/or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This excludes long-term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product.

Synchronised operation means operation of two or more different time division duplex (TDD) networks, where simultaneous uplink (UL) and downlink (DL) transmissions do not occur, that is at any given moment in time either all networks transmit in downlink or all networks transmit in uplink. This requires the alignment of all DL and UL transmissions for all TDD networks involved as well as synchronising the beginning of the frame across all networks.

Unsynchronised operation means operation of two or more different TDD networks, where at any given moment in time at least one network transmits in DL while at least one network transmits in UL. This might happen if the TDD networks either do not align all DL and UL transmissions or do not synchronise at the beginning of the frame.

Semi-synchronised operation means operation of two or more different TDD networks, where part of the frame is consistent with synchronised operation, while the remaining portion of the frame is consistent with unsynchronised operation. This requires the adoption of a frame structure for all TDD networks involved, including slots where the UL/DL direction is not specified, as well as synchronising the beginning of the frame across all networks.

Total radiated power (TRP) is a measure of how much power a composite antenna radiates. It equals the total conducted power input into the antenna array system less any losses in the antenna array system. TRP means the integral of the power transmitted in different directions over the entire radiation sphere as shown in the formula:

$$TRP \stackrel{\text{def}}{=} \frac{1}{4\pi} \int_0^{2\pi} \int_0^{\pi} P(\vartheta,\varphi)\sin(\vartheta)d\vartheta d\varphi$$

where P(ϑ,φ) is the power radiated by an antenna array system in direction (ϑ,φ) given by the formula:

$$P(\vartheta,\varphi) = P_{Tx}\, g(\vartheta,\varphi)$$

where P_{Tx} denotes the conducted power (measured in Watts), which is input into the array system, and g(ϑ,φ) denotes the array systems directional gain along the (ϑ, φ) direction.

2. **General Parameters**

1. The duplex mode of operation in the 24,25-27,5 GHz frequency band shall be time division duplex.

2. The assigned block size shall be a multiple of 200 MHz. A smaller block size of 50 MHz or 100 MHz or 150 MHz, adjacent to the assigned block of another spectrum user, is also possible to ensure efficient use of the full frequency band.

3. The upper frequency limit of an assigned block shall be aligned with or spaced at a multiple of 200 MHz from the upper band edge of 27,5 GHz. If a block is smaller than 200 MHz according to paragraph 2 or needs to be offset to accommodate existing uses, this offset shall be a multiple of 10 MHz.

4. The technical conditions contained in this Annex are essential to address the mutual coexistence of terrestrial systems capable of providing wireless broadband electronic communication services and the coexistence of such systems with systems in the Earth Exploration Satellite Service (passive) in the form of limits on unwanted emissions into the 23,6-24 GHz frequency band as well as with space station receivers in the form of restrictions on the elevation of the main beam of the AAS of an outdoor base station. Additional measures may be required at a national level to ensure coexistence with other services and applications ([1]).

([1]) Such as radio astronomy services.

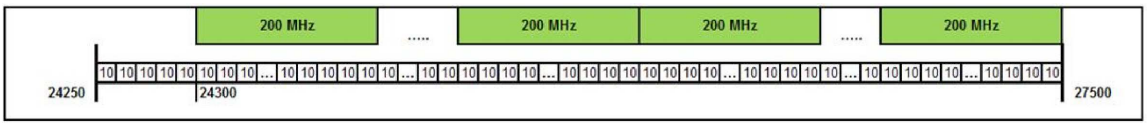
5. Use of the 24,25-27,5 GHz frequency band for communications with unmanned aerial vehicles shall be limited to the communication link from the terminal station on board the unmanned aerial vehicle to a base station of the terrestrial wireless broadband electronic communications network.

6. Base station and terminal station transmission within the 24,25-27,5 GHz frequency band shall be in compliance with the block edge mask in this Annex.

Figure 1 provides an example of a possible channelling arrangement.

Figure 1

Example of a channelling arrangement within the 24,25-27,5 GHz frequency band



3. **Technical conditions for base stations — Block Edge Mask**

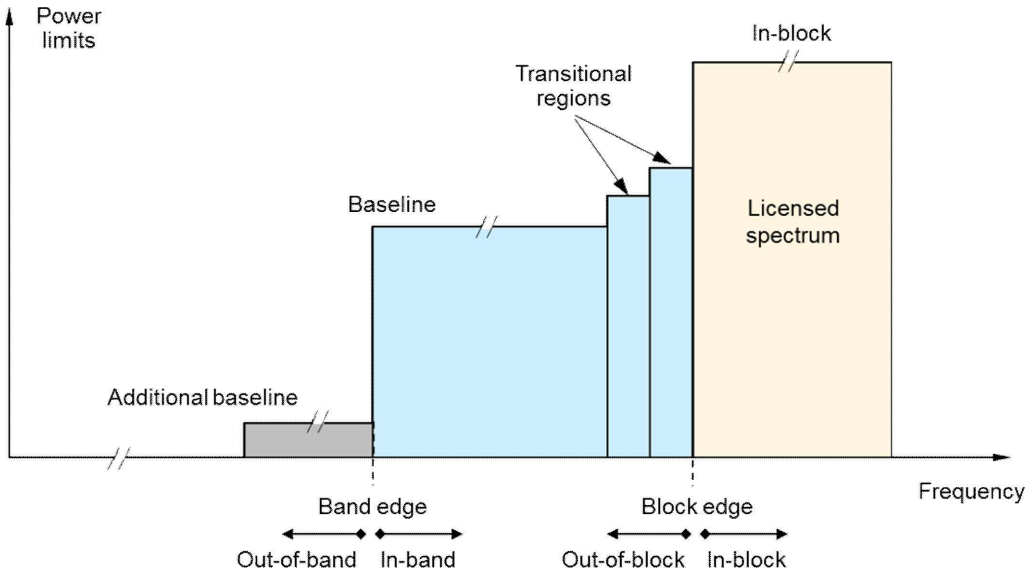
The technical parameters for base stations, called block edge mask (BEM) set out in this section, are an essential component of the conditions necessary to ensure coexistence between neighbouring wireless broadband electronic communications networks in the absence of bilateral or multilateral agreements between operators of such neighbouring networks. Operators of wireless broadband electronic communications services in the 24,25-27,5 GHz band may agree, on a bilateral or multilateral basis, less stringent technical parameters provided that they continue to comply with the technical conditions applicable for the protection of other services, applications or networks and with their cross-border obligations. Member States shall ensure that those less stringent technical parameters can be used by agreement among all affected parties.

A BEM is an emission mask that defines power levels as a function of frequency relative to the edge of a block of spectrum assigned to an operator. It consists of several elements as shown in Table 1. The baseline power limit ensures that the spectrum of other operators is protected. The additional baseline power limit (out-of-band limit) ensures that the spectrum for services and applications outside the 24,25-27,5 GHz frequency band is protected. The transitional region power limit enables a roll-off of power levels from the in-block to the baseline power limit and ensures co-existence with other operators in adjacent blocks.

Figure 2 shows a general BEM applicable to the 26 GHz frequency band.

Figure 2

Illustration of a block edge mask



No harmonised in-block power limit is specified. Tables 2 and 3 assume synchronised operation. Unsynchronised or semi-synchronised operation also necessitates the geographical separation of neighbouring networks. Tables 4 and 6 specify out-of-band power limits for base stations and terminal stations respectively to ensure the protection of the Earth Exploration Satellite Service (EESS) (passive) in the 23,6-24,0 GHz frequency band. Table 5 provides an additional technical condition for base stations to facilitate co-existence with satellite systems in the earth-to-space Fixed Satellite Service (FSS) and in the Inter-Satellite Service (ISS).

Table 1

Definition of BEM elements

BEM element	Definition
In-block	Assigned spectrum block for which the BEM is derived.
Baseline	Spectrum within the 24,25-27,5 GHz frequency band used for terrestrial wireless broadband electronic communications services, not including the operator's block under consideration and corresponding transitional regions.
Transitional region	Spectrum adjacent to an operator's block.
Additional baseline	Spectrum within bands adjacent to the 24,25-27,5 GHz frequency band, where specific power limits apply with respect to other services or applications.

Table 2

Base station transitional region power limit for synchronised operation

Frequency range	Maximum TRP	Measurement bandwidth
Up to 50 MHz below or above an operator's block	12 dBm	50 MHz

Explanatory note

The limit ensures coexistence between wireless broadband electronic communications networks in adjacent block(s) within the 26 GHz frequency band and in synchronised operation.

Table 3

Base station baseline power limit for synchronised operation

Frequency range	Maximum TRP	Measurement bandwidth
Baseline	4 dBm	50 MHz

Explanatory note

The limit ensures coexistence between wireless broadband electronic communications networks in non-adjacent blocks within the 26 GHz frequency band and in synchronised operation.

Table 4

Base station additional baseline power limit

Frequency range	Maximum TRP	Measurement bandwidth
23,6-24,0 GHz	– 42 dBW	200 MHz

Explanatory note

The out-of-band limit applies to the maximum emissions in the 23,6-24,0 GHz band for the protection of the EESS (passive) in all stipulated modes of base station operation (that is to say maximum in-band power, electrical pointing, carrier configurations).

Table 5

Additional condition applying to AAS outdoor base stations

Requirement on elevation of the main beam of AAS outdoor base stations
When deploying such base stations, it shall be ensured that each antenna is normally transmitting only with the main beam pointing below the horizon and in addition the antenna shall have mechanical pointing below the horizon except when the base station is only receiving.

Explanatory note

The condition applies to the protection of space station receivers such as in the FSS (earth-to-space) and in the ISS.

4. **Technical conditions for terminal stations**

Table 6

Terminal station additional baseline power limit

Frequency range	Maximum TRP	Measurement bandwidth
23,6-24,0 GHz	– 38 dBW	200 MHz

Explanatory note

The out-of-band limit applies to the maximum emissions in the 23,6-24,0 GHz frequency band for the protection of the EESS (passive) for all stipulated modes of terminal station operation (that is to say maximum in-band power, electrical pointing, carrier configurations).

COMMISSION IMPLEMENTING DECISION (EU) 2019/785

of 14 May 2019

on the harmonisation of radio spectrum for equipment using ultra-wideband technology in the Union and repealing Decision 2007/131/EC

(notified under document C(2019) 3461)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) ([1]), and in particular Article 4(3) thereof,

Whereas:

(1) Commission Decision 2007/131/EC ([2]) harmonises the technical conditions for spectrum use by radio equipment based on ultra-wideband ('UWB') technology in the Union. It ensures that radio spectrum is available across the Union under harmonised conditions, eliminates barriers to the take-up of UWB technology and aims at creating an effective single market for UWB systems with significant economies of scale and benefits to the consumer.

(2) Although ultra-wideband signals are typically of extremely low power, the possibility of harmful interference with existing radiocommunication services exists and needs to be managed. Therefore, this Decision on the harmonisation of radio spectrum for UWB equipment should avoid harmful interference (including where this might arise from access to the radio spectrum by radio astronomy, earth exploration satellite and space research systems) and balance the incumbent services' interests against the overall policy objective of providing favourable conditions for the introduction of innovative technologies for the benefit of society.

(3) On 16 March 2017, the Commission issued a permanent mandate, pursuant to Decision No 676/2002/EC, to the European Conference of Postal and Telecommunications Administrations ('CEPT') to identify the technical conditions for the harmonised introduction of radio applications based on UWB technology in the Union in order to provide updated technical conditions for such applications.

(4) In response to that permanent mandate, CEPT adopted a report ([3]) where it proposed four measures. Firstly, the technical conditions should describe material sensing devices in a more neutral way in order to allow for innovative solutions. Secondly, it should be possible to use the conditions for generic UWB usage also for material sensing applications. Thirdly, there should be a − 65 dBm/MHz limit for all material sensing devices including building material analysis (BMA) in the 8,5-10,6 GHz band. Fourthly, the possibility of a trigger-before-transmit mitigation for vehicular access control systems based on UWB technology should be introduced in the 3,8-4,2 GHz and 6-8,5 GHz frequency bands.

(5) This Decision should support the overall harmonisation of the UWB regulatory framework in order to improve consistency of limits and mitigation techniques between the different UWB regulations and allow for innovative solutions in the field of UWB technology.

(6) This Decision provides for regulatory limits and identifies mitigation techniques to ensure an efficient usage of spectrum while ensuring coexistence with other spectrum users. Technological evolution may provide other solutions that ensure at least an equivalent level of spectrum protection. For this reason, the use of alternative mitigation techniques, such as solutions found in future possible harmonised standards produced by the

([1]) OJ L 108, 24.4.2002, p. 1.
([2]) Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (OJ L 55, 23.2.2007, p. 33).
([3]) CEPT Report 69 – Report from CEPT to the European Commission in response to the Mandate 'Ultra-Wideband technology in view of a potential update of Commission Decision 2007/131/EC', approved on 26 October 2018 by the Electronic Communications Committee.

European Standardisation Organisations, should be allowed provided they ensure at least an equivalent level of performance and spectrum protection and verifiably respect the established technical requirements of this regulatory framework.

(7) Decision 2007/131/EC has been amended several times. In the interest of legal clarity Decision 2007/131/EC should be repealed.

(8) The measures provided for in this Decision are in accordance with the opinion of the Radio Spectrum Committee,

HAS ADOPTED THIS DECISION:

Article 1

The purpose of this Decision is to harmonise the technical conditions for the availability and efficient use of radio spectrum by equipment using ultra-wideband technology in the Union.

Article 2

For the purposes of this Decision, the following definitions shall apply:

(a) 'equipment using ultra-wideband technology' means equipment incorporating, as an integral part or as an accessory, technology for short-range radiocommunication, involving the intentional generation and transmission of radio-frequency energy that spreads over a frequency range wider than 50 MHz, which may overlap several frequency bands allocated to radiocommunication services;

(b) 'non-interference and non-protected basis' means that no harmful interference may be caused to any radiocommunication service and that no claim may be made for protection of these devices against interference originating from radiocommunication services;

(c) 'indoors' means inside buildings or places in which the shielding will typically provide the necessary attenuation to protect radiocommunication services against harmful interference;

(d) 'motor vehicle' has the same meaning as set out in Article 3(11) of Directive 2007/46/EC of the European Parliament and of the Council ([4]);

(e) 'railway vehicle' has the same meaning as set out in Article 3(1)(4) of Regulation (EU) 2018/643 of the European Parliament and of the Council ([5]);

(f) 'e.i.r.p.' means equivalent isotropically radiated power, which is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain);

(g) 'maximum mean power spectral density' means the average power per unit bandwidth (centred on that frequency) radiated in the direction of the maximum level under the specified conditions of measurement and which is specified as e.i.r.p. of the radio device under test at a particular frequency;

(h) 'peak power' means the power contained within a 50 MHz bandwidth at the frequency at which the highest mean radiated power occurs, radiated in the direction of the maximum level under the specified conditions of measurement and which is specified as e.i.r.p.;

(i) 'total power spectral density' means the average of the mean power spectral density values measured over a sphere around the measurement scenario with a resolution of at least 15 degrees;

(j) 'onboard aircraft' means the use of radio links for communications purposes inside an aircraft;

(k) 'LT1' means systems intended for general location tracking of people and objects that can be put into service on an unlicensed basis.

([4]) Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (OJ L 263, 9.10.2007, p. 1).

([5]) Regulation (EU) 2018/643 of the European Parliament and of the Council of 18 April 2018 on rail transport statistics (OJ L 112, 2.5.2018, p. 1).

Article 3

Within six months after this Decision takes effect, Member States shall designate and make available the radio spectrum, on a non-interference and non-protected basis, for equipment using ultra-wideband technology provided that such equipment meets the conditions set out in the Annex and it is used indoors or, if it is used outdoors, it is not attached to a fixed installation, a fixed infrastructure or a fixed outdoor antenna. Equipment using ultra-wideband technology which meets the conditions set out in the Annex shall also be allowed in motor and railway vehicles.

Article 4

Member States shall monitor the use of the bands identified in the Annex by equipment using ultra-wideband technology, in particular to ensure that all the conditions laid down in Article 3 of this Decision continue to be relevant, and report their findings to the Commission.

Article 5

Decision 2007/131/EC is repealed.

Article 6

This Decision is addressed to Member States.

Done at Brussels, 14 May 2019.

For the Commission
Mariya GABRIEL
Member of the Commission

ANNEX

1. **GENERIC ULTRA-WIDEBAND (UWB) USAGE**

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	– 90 dBm/MHz	– 50 dBm
1,6 < f ≤ 2,7 GHz	– 85 dBm/MHz	– 45 dBm
2,7 < f ≤ 3,1 GHz	– 70 dBm/MHz	– 36 dBm
3,1 < f ≤ 3,4 GHz	– 70 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) or DAA ([2])	– 36 dBm or 0 dBm
3,4 < f ≤ 3,8 GHz	– 80 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) or DAA ([2])	– 40 dBm or 0 dBm
3,8 < f ≤ 4,8 GHz	– 70 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) or DAA ([2])	– 30 dBm or 0 dBm
4,8 < f ≤ 6 GHz	– 70 dBm/MHz	– 30 dBm
6 < f ≤ 8,5 GHz	– 41,3 dBm/MHz	0 dBm
8,5 < f ≤ 9 GHz	– 65 dBm/MHz or – 41,3 dBm/MHz using DAA ([2])	– 25 dBm or 0 dBm
9 < f ≤ 10,6 GHz	– 65 dBm/MHz	– 25 dBm
f > 10,6 GHz	– 85 dBm/MHz	– 45 dBm

([1]) Within the 3,1 GHz to 4,8 GHz band. The Low Duty Cycle ('LDC') mitigation technique and its limits are defined in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (OJ L 153, 22.5.2014, p. 62) and respect the technical requirements of this Decision.

([2]) Within the 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz bands. The Detect and Avoid ('DAA') mitigation technique and its limits are defined in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

2. **LOCATION TRACKING SYSTEMS Type 1 (LT1)**

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	– 90 dBm/MHz	– 50 dBm
1,6 < f ≤ 2,7 GHz	– 85 dBm/MHz	– 45 dBm

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
2,7 < f ≤ 3,4 GHz	– 70 dBm/MHz	– 36 dBm
3,4 < f ≤ 3,8 GHz	– 80 dBm/MHz	– 40 dBm
3,8 < f ≤ 6,0 GHz	– 70 dBm/MHz	– 30 dBm
6 < f ≤ 8,5 GHz	– 41,3 dBm/MHz	0 dBm
8,5 < f ≤ 9 GHz	– 65 dBm/MHz or – 41,3 dBm/MHz using DAA (1)	– 25 dBm or 0 dBm
9 < f ≤ 10,6 GHz	– 65 dBm/MHz	– 25 dBm
f > 10,6 GHz	– 85 dBm/MHz	– 45 dBm

(1) The DAA mitigation technique and its limits are defined in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-2 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

3. **UWB DEVICES INSTALLED IN MOTOR AND RAILWAY VEHICLES**

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	– 90 dBm/MHz	– 50 dBm
1,6 < f ≤ 2,7 GHz	– 85 dBm/MHz	– 45 dBm
2,7 < f ≤ 3,1 GHz	– 70 dBm/MHz	– 36 dBm
3,1 < f ≤ 3,4 GHz	– 70 dBm/MHz or – 41,3 dBm/MHz using LDC (1) + e.l. (4) or – 41,3 dBm/MHz using TPC (3)+ DAA (2) + e.l. (4)	– 36 dBm or ≤ 0 dBm or ≤ 0 dBm
3,4 < f ≤ 3,8 GHz	– 80 dBm/MHz or – 41,3 dBm/MHz using LDC (1) + e.l. (4) or – 41,3 dBm/MHz using TPC (3)+DAA (2) + e.l. (4)	– 40 dBm or ≤ 0 dBm or ≤ 0 dBm
3,8 < f ≤ 4,8 GHz	– 70 dBm/MHz or – 41,3 dBm/MHz using LDC (1) + e.l. (4) or – 41,3 dBm/MHz using TPC (3)+DAA (2) + e.l. (4)	– 30 dBm or ≤ 0 dBm or ≤ 0 dBm
4,8 < f ≤ 6 GHz	– 70 dBm/MHz	– 30 dBm

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
6 < f ≤ 8,5 GHz	– 53,3 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) + e.l. ([4]) or – 41,3 dBm/MHz using TPC ([3]) + e.l. ([4])	– 13.3 dBm or ≤ 0 dBm or ≤ 0 dBm
8,5 < f ≤ 9 GHz	– 65 dBm/MHz or – 41,3 dBm/MHz using TPC ([3])+DAA ([2]) + e.l. ([4])	– 25 dBm or ≤ 0 dBm
9 < f ≤ 10,6 GHz	– 65 dBm/MHz	– 25 dBm
f > 10,6 GHz	– 85 dBm/MHz	– 45 dBm

([1]) The LDC mitigation technique and its limits are defined in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([2]) The DAA mitigation technique and its limits are defined in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([3]) The Transmit Power Control ('TPC') mitigation technique and its limits are defined in clauses 4.7.1.1, 4.7.1.2 and 4.7.1.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([4]) The exterior limit (e.l.) ≤ – 53,3 dBm/MHz is required. The exterior limit is defined in clauses 4.3.4.1, 4.3.4.2 and 4.3.4.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

Technical requirements to be used within the bands 3,8-4,2 GHz and 6-8,5 GHz for vehicular access systems using trigger-before-transmit are defined in the following table.

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
3.8 < f ≤ 4,2 GHz	– 41,3 dBm/MHz with trigger-before-transmit operation and LDC ≤ 0,5 % (in 1h)	0 dBm
6 < f ≤ 8,5 GHz	– 41,3 dBm/MHz with trigger-before-transmit operation and LDC ≤ 0,5 % (in 1h) or TPC	0 dBm

'Trigger-before-transmit' mitigation is defined as a UWB transmission that is only initiated when necessary, specifically where the system indicates that UWB devices are nearby. The communication is either triggered by a user or by the vehicle. The subsequent communication can be considered as 'triggered communication'. The existing LDC mitigation applies (or alternatively TPC in the 6 GHz to 8,5 GHz range). An exterior limit requirement must not be applied when using the trigger-before-transmit mitigation technique for vehicular access systems.

Trigger-before-transmit mitigation techniques that provide an appropriate level of performance in order to comply with the essential requirements of Directive 2014/53/EU shall be used for vehicular access systems. If relevant techniques are described in harmonised standards or parts thereof the references of which have been published in the *Official Journal of the European Union* under Directive 2014/53/EU, performance at least equivalent to these techniques shall be ensured. These techniques shall respect the technical requirements of this Decision.

4. UWB ONBOARD AIRCRAFT

The values for maximum mean power spectral density (e.i.r.p.) and maximum peak power (e.i.r.p.) for short-range devices using UWB technology, with or without use of mitigation techniques are listed in the table below.

Technical requirements			
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)	Requirements for mitigation techniques
f ≤ 1,6 GHz	– 90 dBm/MHz	– 50 dBm	
1,6 < f ≤ 2,7 GHz	– 85 dBm/MHz	– 45 dBm	
2,7 < f ≤ 3,4 GHz	– 70 dBm/MHz	– 36 dBm	
3,4 < f ≤ 3,8 GHz	– 80 dBm/MHz	– 40 dBm	
3,8 < f ≤ 6,0 GHz	– 70 dBm/MHz	– 30 dBm	
6,0 < f ≤ 6,650 GHz	– 41,3 dBm/MHz	0 dBm	
6,650 < f ≤ 6,6752 GHz	– 62,3 dBm/MHz	– 21 dBm	notch of 21 dB should be implemented to meet the – 62,3 dBm/MHz ([1]) level
6,6752 < f ≤ 8,5 GHz	– 41,3 dBm/MHz	0 dBm	7,25 to7,75 GHz (FSS and MetSat (7,45 to 7,55 GHz) protection) ([1]) ([2]) 7,75 to 7,9 GHz (MetSat protection) ([1]) ([3])
8,5 < f ≤ 10,6 GHz	– 65 dBm/MHz	– 25 dBm	
f > 10,6 GHz	– 85 dBm/MHz	– 45 dBm	

([1]) Alternative mitigation techniques, such as the use of shielded portholes, may be used if they ensure at least an equivalent performance.

([2]) 7,25 to 7,75 GHz (Fixed Satellite Service) and 7,45 to 7,55 GHz (Meteorological Satellite) protection: – 51,3 – 20 × $\log_{10}$(10[km]/x[km])(dBm/MHz) for heights above ground of over 1 000 m, where x is the aircraft height above ground in kilometres, – 71,3 dBm/MHz for heights above ground of 1 000 m and below.

([3]) 7,75 to 7,9 GHz (Meteorological Satellite) protection:
– 44,3 – 20 × $\log_{10}$(10 [km]/x[km]) (dBm/MHz) for heights above ground of over 1 000 m, where x is the aircraft height above ground in kilometres, and – 64,3 dBm/MHz for heights above ground of 1 000 m and below.

5. MATERIAL SENSING DEVICES USING UWB TECHNOLOGY

5.1. Introduction

UWB material sensing devices are split into two classes:

— Contact based UWB material sensing devices, for which the UWB transmitter is only switched on when in direct contact with the material under investigation;

— Non-contact based UWB material sensing devices, for which the UWB transmitter is only switched on when it is near the investigated material and the UWB transmitter is directed towards the material under investigation (for example manually by using a proximity sensor or by mechanical design).

Material sensing devices based on UWB technology shall comply either with the generic UWB regulation based on technical conditions specified in section 1 of this Annex or with the specific limits for material sensing devices as defined in sections 5.2 and 5.3.

The generic UWB regulation excludes fixed outdoor installations. Emissions radiated by a material sensing device must not exceed the limits of the regulation for generic UWB usage specified in section 1. Material sensing devices must fulfil the requirements of mitigation techniques specified for the generic use of UWB in section 1.

The specific limits for material sensing devices including the mitigation techniques are listed in the following tables. Emissions radiating from material sensing devices permitted under this Decision must be kept to a minimum and in any case not exceed the emission limits within the following tables. Compliance with the specific limits must be ensured by the device placed on a representative structure of the investigated material. The specific limits listed in the following tables are applicable in all environments for material sensing devices, except those to which note 5 of these tables, which excludes fixed outdoor installation in certain applicable frequency ranges, applies.

5.2. **Contact based material sensing devices**

The specific limits for maximum mean power spectral density (e.i.r.p.) and maximum peak power (e.i.r.p.) for contact based material sensing devices using UWB technology are defined in the table below.

Technical requirements for contact based UWB material sensing devices		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,73 GHz	− 85 dBm/MHz (1)	− 45 dBm
1,73 < f ≤ 2,2 GHz	− 65 dBm/MHz	− 25 dBm
2,2 < f ≤ 2,5 GHz	− 50 dBm/MHz	− 10 dBm
2,5 < f ≤ 2,69 GHz	− 65 dBm/MHz (1) (2)	− 25 dBm
2,69 < f ≤ 2,7 GHz (4)	− 55 dBm/MHz (3)	− 15 dBm
2,7 < f ≤ 2,9 GHz	− 70 dBm/MHz (1)	− 30 dBm
2,9 < f ≤ 3,4 GHz	− 70 dBm/MHz (1) (6) (7)	− 30 dBm
3,4 < f ≤ 3,8 GHz (4)	− 50 dBm/MHz (2) (6) (7)	− 10 dBm
3,8 < f ≤ 4,8 GHz	− 50 dBm/MHz (6) (7)	− 10 dBm
4,8 < f ≤ 5,0 GHz (4)	− 55 dBm/MHz (2) (3)	− 15 dBm
5,0 < f ≤ 5,25 GHz	− 50 dBm/MHz	− 10 dBm
5,25 < f ≤ 5,35 GHz	− 50 dBm/MHz	− 10 dBm
5,35 < f ≤ 5,6 GHz	− 50 dBm/MHz	− 10 dBm
5,6 < f ≤ 5,65 GHz	− 50 dBm/MHz	− 10 dBm
5,65 < f ≤ 5,725 GHz	− 50 dBm/MHz	− 10 dBm
5,725 < f ≤ 6,0 GHz	− 50 dBm/MHz	− 10 dBm
6,0 < f ≤ 8,5 GHz	− 41,3 dBm/MHz (5)	0 dBm
8,5 < f ≤ 9,0 GHz	− 65 dBm/MHz (7)	− 25 dBm

Technical requirements for contact based UWB material sensing devices		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
9,0 < f ≤ 10,6 GHz	− 65 dBm/MHz	− 25 dBm
f > 10,6 GHz	− 85 dBm/MHz	− 45 dBm

([1]) Devices using the Listen Before Talk ('LBT') mechanism are permitted to operate in the 1,215 GHz to 1,73 GHz frequency range with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the 2,5 GHz to 2,69 GHz and 2,7 GHz to 3,4 GHz frequency ranges with a maximum mean e.i.r.p. spectral density of − 50 dBm/MHz and a maximum peak e.i.r.p. of − 10 dBm/50 MHz. The LBT mechanism is defined in clauses 4.5.2.1, 4.5.2.2 and 4.5.2.3 of ETSI Standard EN 302 065-4 V1.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([2]) To protect the radio services, non-fixed installations must fulfil the following requirement for total radiated power:
(a) In the 2,5 GHz to 2,69 GHz and 4,8 GHz to 5 GHz frequency ranges, the total power spectral density must be 10 dB below the maximum e.i.r.p. spectral density.
(b) In the 3,4 GHz to 3,8 GHz frequency range, the total power spectral density must be 5 dB below the maximum e.i.r.p. spectral density.

([3]) To protect the Radio Astronomy Service (RAS) in the 2,69 GHz to 2,7 GHz and 4,8 GHz to 5 GHz bands, the total power spectral density must be below -65 dBm/MHz.

([4]) Limitation of the Duty Cycle to 10 % per second.

([5]) No fixed outdoor installation is permitted.

([6]) Within the 3,1 GHz − 4,8 GHz band, devices implementing LDC mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The LDC mitigation technique and its limits are defined in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When LDC is implemented, note 5 applies.

([7]) Within the 3,1 GHz − 4,8 GHz and 8,5 GHz - 9 GHz bands, devices implementing DAA mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of − 41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The DAA mitigation technique and its limits are defined in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When DAA is implemented, note 5 applies.

5.3 **Non-contact based material sensing devices**

The specific limits for maximum mean power spectral density (e.i.r.p.) and maximum peak power (e.i.r.p.) for non-contact based material sensing devices using UWB technology are defined in the table below.

Technical requirements for non-contact based UWB material sensing devices		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,73 GHz	− 85 dBm/MHz ([1])	− 60 dBm
1,73 < f ≤ 2,2 GHz	− 70 dBm/MHz	− 45 dBm
2,2 < f ≤ 2,5 GHz	− 50 dBm/MHz	− 25 dBm
2,5 < f ≤ 2,69 GHz	− 65 dBm/MHz ([1]) ([2])	− 40 dBm
2,69< f ≤ 2,7 GHz ([4])	− 70 dBm/MHz ([3])	− 45 dBm
2,7 < f ≤ 2,9 GHz	− 70 dBm/MHz ([1])	− 45 dBm
2,9 < f ≤ 3,4 GHz	− 70 dBm/MHz ([1]) ([6]) ([7])	− 45 dBm
3,4 < f ≤ 3,8 GHz ([4])	− 70 dBm/MHz ([2]) ([6]) ([7])	− 45 dBm
3,8 < f ≤ 4,8 GHz	− 50 dBm/MHz ([6]) ([7])	− 25 dBm

Technical requirements for non-contact based UWB material sensing devices		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
4,8 < f ≤ 5,0 GHz ([4])	− 55 dBm/MHz ([2]) ([3])	− 30 dBm
5,0 < f ≤ 5,25 GHz	− 55 dBm/MHz	− 30 dBm
5,25 < f ≤ 5,35 GHz	− 50 dBm/MHz	− 25 dBm
5,35 < f ≤ 5,6 GHz	− 50 dBm/MHz	− 25 dBm
5,6 < f ≤ 5,65 GHz	− 50 dBm/MHz	− 25 dBm
5,65 < f ≤ 5,725 GHz	− 65 dBm/MHz	− 40 dBm
5,725 < f ≤ 6,0 GHz	− 60 dBm/MHz	− 35 dBm
6,0 < f ≤ 8,5 GHz	− 41.3 dBm/MHz ([5])	0 dBm
8,5 < f ≤ 9,0 GHz	− 65 dBm/MHz ([7])	− 25 dBm
9,0 < f ≤ 10,6 GHz	− 65 dBm/MHz	− 25 dBm
f > 10,6 GHz	− 85 dBm/MHz	− 45 dBm

([1]) Devices using the Listen Before Talk ('LBT') mechanism are permitted to operate in the 1,215 GHz to 1,73 GHz frequency range with a maximum mean e.i.r.p. spectral density of − 70 dBm/MHz and in the 2,5 GHz to 2,69 GHz and 2,7 GHz to 3,4 GHz frequency ranges with a maximum mean e.i.r.p. spectral density of − 50 dBm/MHz and a maximum peak e.i.r.p. of − 10 dBm/50 MHz. The LBT mechanism is defined in clauses 4.5.2.1, 4.5.2.2 and 4.5.2.3 of ETSI Standard EN 302 065-4 V1.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([2]) To protect the radio services, non-fixed installations must fulfil the following requirement for total radiated power:
(a) In the 2,5 GHz to 2,69 GHz and 4,8 GHz to 5 GHz frequency ranges, the total power spectral density must be 10 dB below the maximum e.i.r.p. spectral density.
(b) In the 3,4 GHz to 3,8 GHz frequency range, the total power spectral density must be 5 dB below the maximum e.i.r.p. spectral density.

([3]) To protect the Radio Astronomy Service (RAS) in the 2,69 GHz to 2,7 GHz and 4,8 GHz to 5 GHz bands, the total power spectral density must be below − 65 dBm/MHz.

([4]) Limitation of the Duty Cycle to 10 % per second.

([5]) No fixed outdoor installation is permitted.

([6]) Within the 3,1 GHz − 4,8 GHz band, devices implementing LDC mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of − 41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The LDC mitigation technique and its limits are defined in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When LDC is implemented, note 5 applies.

([7]) Within the 3,1 GHz − 4,8 GHz and 8,5 GHz - 9 GHz bands, devices implementing DAA mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of − 41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The DAA mitigation technique and its limits are defined in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When DAA is implemented, note 5 applies.

Peak power threshold values for the LBT mechanism to ensure the protection of radio services listed below are defined in the following table.

Technical requirements of the LBT mechanism for material sensing devices		
Frequency range	Radio service to be detected	Peak power threshold value
1,215 <f ≤ 1,4 GHz	Radiodetermination service	+ 8 dBm/MHz
1,61<f ≤ 1,66 GHz	Mobile satellite service	− 43 dBm/MHz

Technical requirements of the LBT mechanism for material sensing devices		
Frequency range	Radio service to be detected	Peak power threshold value
2,5 < f ≤ 2,69 GHz	Land mobile service	− 50 dBm/MHz
2,9 < f ≤ 3,4 GHz	Radiodetermination service	− 7dBm/MHz

Additional requirements for radar detection: continuously listening and automatic switch-off within 10 ms for the related frequency range if the threshold value is exceeded (table with LBT mechanism). A silent time of at least 12 s while listening continuously is necessary before the transmitter can be switched on again. This silent time during which only the LBT receiver is active must be ensured even after the device is switched off.

RECOMMENDATIONS

COMMISSION RECOMMENDATION (EU) 2019/786

of 8 May 2019

on building renovation

(notified under document C(2019) 3352)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

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

Whereas:

(1) The Union is committed to developing a sustainable, competitive, secure and decarbonised energy system. The Energy Union and the energy and climate policy framework for 2030 establish ambitious Union commitments to further reduce greenhouse gas emissions by at least 40 % by 2030 when compared with 1990, to increase the proportion of consumption of renewable energy, and to make energy savings in accordance with Union level ambitions, improving the Union's energy security, competitiveness and sustainability. Directive 2012/27/EU of the European Parliament and of the Council ([1]) as amended by Directive (EU) 2018/2002 of the European Parliament and of the Council ([2]), establishes an energy efficiency headline target of at least 32,5 % savings at Union level by 2030. Directive (EU) 2018/2001 of the European Parliament and of the Council ([3]) sets a binding target of at least 32 % energy from renewable sources at Union level by 2030.

(2) Buildings are central to the Union's energy efficiency policy as they account for nearly 40 % of final energy consumption.

(3) The 2015 Paris Agreement on climate change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 21) boosts the Union's efforts to decarbonise its building stock. Given that almost 50 % of the Union's final energy consumption is for heating and cooling, of which 80 % is used in buildings, the Union's achievement of its energy and climate goals is linked to its efforts to renovate building stocks by giving priority to energy efficiency, applying the 'energy efficiency first' principle and considering the deployment of renewables.

(4) The Commission highlighted the importance of energy efficiency and the role of the building sector for the achievement of the Union's energy and climate goals and for the transition to clean energy in its Communication on energy efficiency and its contribution to energy security and the 2030 framework for energy and climate policy ([4]), in its Communication on a Framework Strategy for a Resilient Energy Union with a Forward-looking Climate Change Policy ([5]), and in its Communication on a European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy ([6]). The latter Communication stresses that energy efficiency measures should play a central role in achieving a climate neutral economy by 2050 and reducing energy consumption by as much as half compared to 2005.

([1]) 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).

([2]) Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency (OJ L 328, 21.12.2018, p. 210).

([3]) Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (OJ L 328, 21.12.2018, p. 82).

([4]) Impact Assessment accompanying the document Communication from the Commission to the European Parliament and the Council Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy (SWD(2014) 255 final).

([5]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank *'A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'* (COM(2015) 80 final).

([6]) Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank *'A Clean Planet for all — a European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy'* (COM(2018) 773 final).

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

(6) Directive 2010/31/EU of the European Parliament and of the Council ([7]) ('EPBD') is the main legislation, together with Directive 2009/125/EC of the European Parliament and of the Council ([8]) and Regulation (EU) 2017/1369 of the European Parliament and of the Council ([9]), addressing energy efficiency in buildings in the context of the 2030 energy efficiency targets. The EPBD has two complementary objectives, namely to accelerate the renovation of existing buildings by 2050 and to support the modernisation of all buildings with smart technologies and a clearer link to clean mobility.

(7) In 2018 the EPBD was amended by Directive (EU) 2018/844 of the European Parliament and of the Council ([10]) in order to accelerate building renovation in the Union.

(8) Adequate financial instruments to overcome market failures, a sufficient workforce with the right skills, and affordability for all citizens are of central importance if the Union is to achieve and sustain higher renovation rates. An integrated approach and consistency across all relevant policies is necessary for the modernisation of the built environment involving all relevant parties, including safety, affordability, environmental and circular economy aspects.

(9) The amendments to the EPBD create a clear path towards achieving a low and zero-emission building stock in the Union by 2050, underpinned by national roadmaps with milestones and domestic progress indicators, and by public and private financing and investment. National long-term renovation strategies with a solid finance component in line with the requirements of Article 2a of the EPBD are required to ensure the renovation of existing buildings into highly energy efficient and decarbonised buildings by 2050, facilitating the cost-effective transformation of all existing buildings into nearly zero-energy buildings.

(10) Apart from accelerated renovation rates, a Union-wide and sustained increase in deep renovations is necessary. National strategies with clear guidelines and outline measurable, targeted actions as well as promoting equal access to financing, including for the worst performing segments of the national building stock, for energy-poor consumers, for social housing and for households subject to split-incentive dilemmas, while taking into consideration affordability, are required in line with Article 2a of the EPBD.

(11) To ensure that the most effective application of financial measures related to energy efficiency are applied in the best way in building renovation, the EPBD now requires that those financial measures are linked to the quality of renovation works in light of the targeted or achieved energy savings of the renovation. National legislation transposing the requirements of Article 10 of the EPBD is required to ensure that financial measures for energy efficiency are linked to energy performance, the level of certification or qualification, to an energy audit, or to the improvement achieved as a result of the renovation, which should be assessed by comparing energy performance certificates issued before and after the renovation, by using standard values or by another transparent and proportionate method.

(12) It is necessary to obtain high-quality data on the building stock which could be partially generated by the databases that almost all Member States are currently developing and managing for energy performance certificates. Those databases can be used for compliance checking and for producing statistics on the regional or national building stocks. Article 10 transposition measures are required to allow data to be gathered on the measured or calculated energy consumption of certain buildings and to make available aggregated anonymised data.

(13) The amendments to the EPBD also update the general framework for the calculation of the energy performance of buildings. National legislation transposing the requirements of the amended Annex I to the EPBD is required to ensure transparency and consistency.

([7]) Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (OJ L 153, 18.6.2010, p. 13).

([8]) Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (OJ L 285, 31.10.2009, p. 10).

([9]) Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU (OJ L 198, 28.7.2017, p. 1).

([10]) Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency (OJ L 156, 19.6.2018, p. 75).

(14) National legislation transposing the requirements of the revised Article 20(2) of the EPBD is required to increase the information which should be provided to owners or tenants of buildings or building units and to ensure that it is provided through accessible and transparent advisory tools.

(15) Member States are to bring into force the laws, regulations and administrative provisions transposing Directive (EU) 2018/844 by 10 March 2020.

(16) The full transposition and effective implementation of the amended EPBD, is fundamental to support the achievement of the 2030 energy efficiency targets and to put the Union on track for the full decarbonisation of national building stocks by 2050.

(17) The EPBD leaves to Member States a wide margin of discretion when designing their building codes and implementing technical requirements regarding renovations, building certificates and technical building systems in a way which fits best the national climatic conditions and building stocks. This Recommendation aims at explaining the substance of these technical requirements and the different ways in which the objectives of the Directive can be achieved. It also presents the experience and best practices the Commission has seen amongst Member States.

(18) The Commission is committed to work closely with the Member States in their transposition and effective implementation of the EPBD. To this end the present Recommendation has been prepared to explain in more detail how certain provisions of the EPBD should be read and can be best applied in the context of national transposition. The aim in particular is to ensure a uniform understanding across Member States in the preparation of their transposition measures. This Recommendation does not alter the legal effects of the EPBD and is without prejudice to the binding interpretation of the EPBD as provided by the Court of Justice. This Recommendation deals with subjects in the EPBD which are complex, demanding to transpose and have high potential in terms of impact on the energy efficiency of buildings. This Recommendation focuses on the provisions relating to the renovation of buildings and concerns Articles 2a, 10, 20 and Annex I to the EPBD, which include provisions on long-term renovation strategies, financing mechanisms, incentives, information and the calculation of energy performance of buildings. Provisions in the EPBD dealing with modernisation and technical building systems are addressed in a separate Recommendation.

(19) Therefore this Recommendation should allow Member States to achieve strong impacts in terms of energy performance of their renovated building stock,

HAS ADOPTED THIS RECOMMENDATION:

1. Member States should follow the guidelines provided in the Annex to this Recommendation in transposing the requirements laid down by Directive (EU) 2018/844.

2. This Recommendation is addressed to the Member States.

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

Done at Brussels, 8 May 2019.

For the Commission
Miguel ARIAS CAÑETE
Member of the Commission

ANNEX

1. **INTRODUCTION**

Directive 2010/31/EU ('EPBD') requires Member States to adopt long-term renovation strategies and establish minimum requirements for the energy performance of newly constructed buildings and existing buildings undergoing major renovation.

Directive 2012/27/EU ('EED') contained provisions on building renovation and long-term strategies for mobilising investment in the renovation of national building stocks.

The EPBD and the EED have been amended by Directive (EU) 2018/844, which entered into force on 9 July 2018. The EPBD, in its Article 2a, sets out a framework for long-term renovation strategies ('LTRSs') to support the renovation of national building stocks into highly energy-efficient and decarbonised buildings by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings ('NZEBs'). In accordance with the Directive, the strategies will be supported by financial mechanisms for the mobilisation of investment in building renovation needed to achieve these goals.

In accordance with Article 10 of the EPBD, policies and measures are required to:

(a) link financial measures for energy efficiency improvements in the renovation of buildings to the targeted or achieved energy savings;

(b) allow data to be gathered on the measured or calculated energy consumption of certain buildings; and

(c) make available aggregated anonymised data.

Pursuant to Article 20 of the EPBD, information must be provided to owners or tenants of buildings or building units through accessible and transparent advisory tools.

The EPBD sets out a common general framework for determining buildings' energy performance, including the indicators and calculations to be used. These guidelines support correct implementation in national and regional regulatory frameworks. They reflect the views of the Commission. They do not alter the legal effects of the EPBD and are without prejudice to the binding interpretation of its Articles 2a, 10 and 20 and its Annex I, as provided by the Court of Justice of the European Union.

2. **LONG-TERM RENOVATION STRATEGIES**

2.1. **Aim**

The obligation for Member States to establish an LTRS of their national building stock has been moved to the EPBD from the EED. Article 1 of Directive (EU) 2018/844 introduced into the EPBD a new Article 2a on LTRSs and repealed Article 4 of the EED, which required Member States to establish a long-term strategy for mobilising investment in the renovation of national building stocks.

The EPBD now includes:

(a) a stronger reference to energy poverty; and

(b) new references to:

  (i) health, safety and air quality;

  (ii) initiatives to promote smart technologies, skills and education;

  (iii) policies targeting the worst-performing segments of national building stocks;

(iv) 'split-incentive' dilemmas ([1]);

(v) market failures; and

(vi) public buildings.

Strong LTRSs are expected to accelerate the cost-effective renovation of existing buildings, which are currently subject to a low renovation rate, and ensure an increase in deep renovations. A strategy is not an end in itself, but a starting Point for stronger action.

2.2. **Scope**

The EPBD expands the scope of Member States' LTRSs. Like for the strategies established under Article 4 EED, LTRSs apply to the national stock of public and private, residential and non-residential buildings. However, the amended EPBD introduces new and broader obligations and identifies new areas of policy and action to be covered in the LTRSs.

Pursuant to Article 2a of the EPBD, Member States must, inter alia:

(a) establish a comprehensive strategy aimed at achieving a highly efficient and decarbonised building stock by 2050 and cost-effective transformation of existing buildings into NZEBs;

(b) set out a roadmap with measures, measurable progress indicators and indicative milestones for 2030, 2040 and 2050;

(c) carry out a public consultation on their strategy before submitting it to the Commission and set out arrangements for further inclusive consultation during implementation;

(d) facilitate access to mechanisms through smart financing to support the mobilisation of investment; and

(e) submit their strategy as part of their final ([2]) integrated national energy and climate plan (NECP) ([3]) and provide information on implementation in their integrated national energy and climate progress reports.

2.3. **Obligation to establish a comprehensive strategy to achieve a highly decarbonised building stock by 2050**

2.3.1. *Mandatory elements of the LTRS*

Member States' LTRSs should cover existing elements (see Article 4 of the EED) and new elements (see Article 2a of the EPBD). Each LTRS must now encompass the elements below.

2.3.1.1. Overview of the national building stock — Article 2a(1)(a) of the EPBD

Article 4(a) of the EED already provided that the starting point of the LTRSs was an overview of the national building stock.

Article 2a(1)(a) of the EPBD provides that each LTRS 'shall encompass an overview of the national building stock, based, as appropriate, on statistical sampling and expected share of renovated buildings in 2020'.

([1]) A 'split incentive' arises between the owner and the tenant of a building or among owners where the party who pays for energy retrofits or efficiency upgrades cannot recover the full benefits and savings.

([2]) By way of derogation, the first LTRS is to be submitted to the Commission by 10 March 2020 (the deadline for transposing Directive (EU) 2018/844). Thereafter, LTRSs are to be submitted with the final NECP.

([3]) Article 3 of Regulation of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action (the 'Governance Regulation').

The expected share of renovated buildings may be expressed in various ways, for example:

(a) as a percentage (%);

(b) as an absolute number; or

(c) in m^2 of renovated space per type of building.

Renovation depth (e.g. 'light', 'medium' and 'deep') could also be used for greater accuracy. Transformation into NZEBs could be another indicator ([4]) More generally, 'deep renovation' should result in both energy and greenhouse gas efficiency.

The 'expected share' is not intended to be a binding target, but rather a figure that realistically represents the likely rate of completed building renovation in 2020. Member States can also mention the expected share of completed renovation for 2030, 2040 and 2050, in line with the requirement to provide indicative milestones for those years.

2.3.1.2. Cost-effective approaches to renovation — Article 2a(1)(b) of the EPBD

Article 4(b) of the EED already required Member States to identify in their LTRSs cost-effective approaches to renovation relevant to building type and climatic zone.

Article 2a(1)(b) of the EPBD provides that each LTRS 'shall encompass the identification of cost-effective approaches to renovation relevant to the building type and climatic zone, considering potential relevant trigger points, where applicable, in the life-cycle of the building;'.

Recital 12 of Directive (EU) 2018/844 clarifies that a 'trigger point' is 'an opportune moment in the life-cycle of a building, for example from a cost-effectiveness or disruption perspective, for carrying out energy efficiency renovations'.

A trigger point could be:

(a) a transaction (e.g. the sale, rental ([5]) or lease of a building, its refinancing, or a change in its use);

(b) renovation (e.g. an already planned wider non-energy-related renovation) ([6]); or

(c) a disaster/incident (e.g. fire, earthquake, flood) ([7]).

Certain buildings may not be subject to trigger points, hence the qualification 'where applicable'.

Linking energy-efficiency renovation with trigger points should ensure that energy-related measures are not neglected or omitted at a later stage in the life-cycle of the building. Focusing on energy efficiency at trigger points should limit the risk of missing opportunities to renovate and increase possible synergies with other action.

Trigger points may lead to cost-effective renovation due to the economies of scale that can be achieved if energy-related renovation is carried out at the same time as other necessary work or planned renovation.

([4]) The following renovation depths have been developed in the context of the EU Building Stock Observatory on the basis of primary energy savings:
— light (less than 30 %);
— medium (between 30 % and 60 %); and
— deep (over 60 %).
NZEB renovations are not defined in terms of a specific primary energy saving threshold, but according to official national NZEB renovation definitions.

([5]) Recital 9 of Directive (EU) 2018/844 encourages Member States to consider introducing or continuing to apply requirements for a certain level of energy performance for rental properties, in accordance with energy performance certificates (EPCs). This type of measure, which would go beyond the requirements of the EPBD, would introduce a requirement to renovate worst-performing buildings before they are rented.

([6]) E.g. renovations to improve accessibility for people with reduced mobility, to improve building safety (e.g. for fire, flood, seismic or faulty electrical risks) or to remove asbestos.

([7]) Intervention after a disaster or incident may be urgent and/or temporary. However, efforts should still be made to take account of energy efficiency requirements. Member States could explore the possibility of incentivising insurance companies to inform clients of available financing instruments (thereby also reducing their costs following a natural disaster/accident).

2.3.1.3. Policies and action on deep renovation — Article 2a(1)(c) of the EPBD

Article 4(c) of the EED already required Member States to ensure that LTRSs encompass policies and actions to stimulate cost-effective deep renovation of buildings, including staged deep renovation.

Article 2a(1)(c) of the EPBD provides that each LTRS 'shall encompass policies and actions to stimulate cost-effective deep renovation of buildings, including staged deep renovation, and to support targeted cost-effective measures and renovation for example by introducing an optional scheme for building renovation passports'.

Deep renovations are those leading to refurbishment that reduces both the delivered and final energy consumption of a building by a significant percentage compared with pre-renovation levels, leading to very high energy performance ([8]). According to the staff working document accompanying the Commission's 2013 report on *Financial support for energy efficiency in buildings* ([9]), 'deep renovation' can be considered as renovation that leads to significant (typically more than 60 %) efficiency improvements.

The EPBD refers to building renovation passports (BRPs) as an example of a measure whereby Member States can support targeted cost-effective renovation and staged deep renovation. The EPBD does not specify in detail what constitutes a BRP, but a number of common elements have been identified elsewhere ([10]), which may be used as examples: it is an electronic or paper document outlining a long-term (15-20 year) step-by-step renovation roadmap (with ideally as few steps as possible) for a specific building which may result from an on-site energy audit fulfilling specific quality criteria and outlining relevant measures and renovations that could improve its energy performance ([11]).

2.3.1.4. Policies and action on worst-performing buildings and energy poverty — Article 2a(1)(d) of the EPBD

In accordance to Article 2a(1)(d) of the EPBD, each LTRS must encompass 'an overview of policies and actions to target the worst-performing segments of the national building stock, split-incentive dilemmas, and market failures, and an outline of relevant national actions that contribute to the alleviation of energy poverty'.

This is a new element which did not exist under Article 4 of the EED. Member States' LTRSs will now have to give an overview of policies and actions that target:

(a) worst-performing segments of the national building stock;

(b) split-incentive dilemmas ([12]);

(c) market failures; and

(d) the alleviation of energy poverty.

([8]) Recital 16 of the EED.

([9]) Staff working document (SWD(2013) 143 final) accompanying the Commission's report to the European Parliament on *Financial support for energy efficiency in buildings* (COM(2013) 225 final).

([10]) See 2016 report from Buildings Performance Institute Europe; http://bpie.eu/wp-content/uploads/2017/01/Building-Passport-Report_2nd-edition.pdf

([11]) Article 19a of the EPBD requires the Commission, before 2020, to conclude a feasibility study on the possibilities and timeline for introducing an optional BRP on these lines to complement the energy performance certificates. The study will provide an in-depth overview of existing BRP schemes.

([12]) Article 19 of the EED already requires Member States to 'evaluate and if necessary take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency, without prejudice to the basic principles of the property and tenancy law of the Member States. In particular as regards the split of incentives between the owner and the tenant of a building or among owners, with a view to ensuring that these parties are not deterred from making efficiency-improving investments that they would otherwise have made by the fact that they will not individually obtain the full benefits or by the absence of rules for dividing the costs and benefits between them, including national rules and measures regulating decision-making processes in multi-owner properties'.

The overview should include at least a short description of each policy and action, its scope and duration, the allocated budget and the expected impact.

Member States are to determine the worst-performing segments of their national building stock, for example by:

(a) setting a specific threshold, such as an energy performance category (e.g. below 'D');

(b) using a primary energy consumption figure (expressed in kWh/m² per year); or even

(c) targeting buildings built before a specific date (e.g. before 1980).

On 'split-incentive dilemmas', Member States are encouraged to consult the Joint Research Centre (JRC) 2014 report *Overcoming the split-incentive barrier in the building sector*' ([13]).

The term 'market failures' refers to a range of problems that tend to delay the transformation of the building stock and the tapping of cost-effective energy savings potential. These may include, for example:

(a) a lack of understanding of energy use and potential savings;

(b) limited renovation and construction activity in a post-crisis context;

(c) a lack of attractive financing products;

(d) limited information on building stock; and

(e) limited uptake of efficient and smart technologies ([14]).

The reference to 'energy poverty' in the amended EPBD is not new. The EED refers to 'energy poverty' (Article 7 and Recital 53 of the EED) and 'fuel poverty' (Recital 49 of the EED). Energy poverty is a result of a combination of low income, high energy expenditure and dwellings' poor energy performance — effective action to alleviate energy poverty should therefore include energy efficiency measures alongside social policy measures. While several Member States' LTRSs already address energy poverty, the EPBD now requires that LTRSs outline 'relevant national actions that contribute to the alleviation of energy poverty' ([15]).

Article 2a(1)(d) of the EPBD, together with Recital 11 of Directive (EU) 2018/844, provides Member States with sufficient flexibility to implement the legislation in the light of national conditions, without interfering with their social policy competencies ([16]).

2.3.1.5. Policies and action on public buildings — Article 2a(1)(e) of the EPBD

Pursuant to Article 2a(1)(e) of the EPBD, each LTRSs must encompass 'policies and actions to target all public buildings'.

The scope of LTRSs under Article 4 of the EED already included certain public buildings. However, Article 2a of the EPBD now requires LTRSs to include specific policies and actions that target all public buildings. This should include ongoing initiatives by Member States to fulfil their obligations under the EPBD and the EED ([17]).

([13]) https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/overcoming-split-incentive-barrier-building-sector

([14]) Impact assessment accompanying the proposal for a Directive of the European Parliament and of the Council amending Directive 2010/31/EU on the energy performance of buildings (COM(2016) 765), Commission staff working document.

([15]) Under Article 3(3)(d) of Regulation (EU) 2018/1999, where a Member State finds that it has a significant number of households in energy poverty, it must include in its NECP a national indicative objective to reduce energy poverty and measures to address it, and report on progress in the context of its annual reports.

([16]) Recital 11 of Directive (EU) 2018/844 states that 'the need to alleviate energy poverty should be taken into account, in accordance with criteria defined by the Member States. While outlining national actions that contribute to the alleviation of energy poverty in their renovation strategies, the Member States have the right to establish what they consider to be relevant actions'.

([17]) Under Articles 5 and 6 of the EED, Member States already have obligations as regards buildings owned and occupied by central government and the procurement of buildings by central government.

Both the EED and the EPBD require public authorities to lead by example by becoming early adopters of energy efficiency improvements; see, in particular, Articles 5 and 6 of the EED, which apply to 'public bodies' buildings'.

However, Article 2a(1)(e) of the EPBD is broader in scope than Articles 5 and 6 of the EED, as it concerns all public buildings and not just 'public bodies' buildings' ([18]) that are owned and occupied by central government. Policies and actions under Article 2a(1)(e) should include, for example, buildings that are occupied (e.g. leased or rented) by local or regional authorities and buildings that are owned by central government and regional or local authorities, but not necessarily occupied by them.

Unlike Article 5(2) of the EED ([19]), Article 2a of the EPBD does not exempt any categories of public building. It thus in principle applies to buildings that may be exempt, in a certain Member State, from the renovation obligation pursuant to Article 5(2) of the EED. Many of the buildings listed in Article 5(2) of the EED can make a significant contribution to the achievement of national objectives.

Financial mechanisms and incentives should promote public authorities' investments in an energy-efficient building stock, for example by means of public-private partnerships or optional energy performance contracts ([20]) through off balance sheet financing in line with Eurostat accounting rules and guidance ([21]).

2.3.1.6. Incentives to use smart technologies and skills — Article 2a(1)(f) of the EPBD

One of the objectives of the revision of the EPBD was to bring it up to date with technological developments such as smart building technologies and to facilitate the uptake of electric vehicles and other technologies, both through specific installation requirements and by ensuring that building professionals can deliver the requisite skills and know-how.

Article 2a(1)(f) of the EPBD provides that LTRSs 'shall encompass an overview of national initiatives to promote smart technologies and well-connected buildings and communities, as well as skills and education in the construction and energy efficiency sectors'.

This is a new element which did not exist under Article 4 of the EED. Member States' LTRSs will now have to give an overview of national initiatives that promote:

(a) smart technologies and well-connected buildings and communities; and

(b) skills and education in the construction and energy efficiency sectors.

The overview should include at least a short description of each initiative, its scope and duration, the allocated budget and the expected impact.

([18]) 'Public bodies' are defined in Article 2(8) of the EED as 'contracting authorities' within the meaning of Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (OJ L 134, 30.4.2004, p. 114).

([19]) Under Article 5(2) EED, Member States may decide not to set or apply the requirements referred to in paragraph 1 to the following categories of building:
(a) buildings officially protected as part of a designated environment, or because of their special architectural or historical merit, in so far as compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance;
(b) buildings owned by the armed forces or central government and serving national defence purposes, apart from single living quarters or office buildings for the armed forces and other staff employed by national defence authorities; and
(c) buildings used as places of worship and for religious activities.

([20]) Recital 16 of Directive (EU) 2018/844.

([21]) In May 2018, Eurostat and the European Investment Bank launched their new practitioners' guide on the statistical treatment of energy performance contracts. It will help public authorities and market actors understand the conditions under which such contracts can be considered off balance sheet. It will help public authorities prepare and finance projects by mobilising private capital and expertise; http://www.eib.org/en/infocentre/publications/all/guide-to-statistical-treatment-of-epc.htm

Smartness in buildings is an essential part of a decarbonised, renewable-intensive and more dynamic energy system geared to achieving the 2030 EU targets on energy efficiency and renewable energy, and a decarbonised EU building stock by 2050. Pursuant to Article 2a(f) of the EPBD, LTRSs must describe national initiatives on smart technologies and well-connected buildings and communities that may, for example, aim to:

(a) achieve high energy efficiency by optimal operation of the building and facilitate the maintenance of technical building systems;

(b) strengthen the role of demand-side flexibility in increasing the share of renewables in the energy system and making sure that the benefits are cascaded down to consumers;

(c) ensure that the building users' needs are covered and they can effectively interact with the building; and

(d) contribute to the establishment of well-connected buildings ([22]), and smart communities also supporting citizen-centric and open standard based solutions for smart cities.

Member States may consider adopting measures that encourage the deployment of recharging points and ducting infrastructure for electric vehicles in the context of building renovation projects, even if the renovation is not considered to be a 'major renovation' within the meaning of Article 2(10) of the EPBD.

The training of energy experts is essential in ensuring the transfer of knowledge on issues related to EPBD implementation. According to Article 17 of the EPBD, Member States must already ensure the independent energy performance certification of buildings and inspection of heating and air-conditioning systems by qualified and/or accredited experts. LTRSs should present an overview of national initiatives promoting the skills that building professionals need to apply new techniques and technologies in the field of NZEBs and energy renovation.

2.3.1.7. Estimate of energy savings and wider benefits — Article 2a(1)(g) of the EPBD

Article 4(e) of the EED already required that LTRSs give an evidence-based estimate of expected energy savings and wider benefits.

Pursuant to Article 2a(1)(g) of the EPBD, each LTRSs must encompass 'an evidence-based estimate of expected energy savings and wider benefits, such as those related to health, safety and air quality'.

The amendment provides a non-exhaustive list of the type of wider benefits that LTRSs should evaluate. Certain measures to address energy performance can also contribute to a healthy indoor environment. Measures should for instance aim to:

(a) prevent the illegal removal of harmful substances such as asbestos ([23]);

(b) facilitate compliance with legislation on working conditions, health and safety, and emissions ([24]); and

(c) promote higher levels of comfort and well-being for occupants, e.g. by ensuring complete and homogenous insulation ([25]), coupled with the appropriate installation and adjustment of technical building systems (in particular, heating and air-conditioning, ventilation and building automation and control).

Wider benefits may also include lower illness and health costs, greater labour productivity from better working and living conditions, more jobs in the building sector, and reduced emissions and whole life carbon ([26]).

([22]) Well-connected buildings are buildings which have a communication infrastructure which allows them to interact effectively with their environment.
([23]) Removal that does not comply with applicable health and safety requirements.
([24]) Recital 14 of Directive (EU) 2018/844.
([25]) See reference to 2009 World Health Organisation guidelines in Recital 13 of Directive (EU) 2018/844.
([26]) Carbon emissions stemming from the whole life cycle of the building.

The evaluation of potential wider benefits associated with energy efficiency measures may enable a more holistic and integrated approach at national level, highlighting synergies that can be achieved with other policy areas and ideally involving other government departments, e.g. those responsible for health, environment, finance and infrastructure.

In connection with these elements, it is generally recognised that efforts to reduce operational energy usage typically have embodied consequences, in terms of the carbon emissions linked to manufacturing of construction products and to construction. Therefore, reducing day-to-day energy use ideally should not be looked at in isolation, as there will inevitably be a carbon cost/benefit trade-off. Although something not explored in the EPBD, a whole life carbon approach would help identifying the overall best combined opportunities for reducing lifetime carbon emissions, and helps avoid any unintended consequences. It furthermore helps find the most cost-effective solution. Ultimately, a low carbon building is one that optimises the use of resources and thereby limits carbon emissions during construction and use, over its lifetime.

Renovation can be conducted in such a way that when the building reaches the end of its life or undergoes another major renovation, different construction products or materials can be separated from each other. This allows for reuse or recycling, which can substantially reduce the volume of demolition waste going to landfill. The possibilities for circularity in the future depend directly on how renovation is conducted, which materials are chosen and how they are assembled. The recycling of materials can have a positive impact on energy consumption, as manufacturing primary construction products normally requires more energy than using secondary ones.

Benefits may also include measures to adapt buildings to climate change ([27]), in particular measures such as shading devices that protect buildings against overheating during heat waves that have a direct impact on a building's energy consumption by reducing the need for active cooling ([28]). In addition, for new buildings and buildings undergoing major renovations, it is recommended that efforts are undertaken to avoid the creation of accessibility barriers for persons with disabilities and, where possible, existing accessibility barriers should be removed ([29]).

Finally, in their evidence-based estimate of benefits relating to health, safety and air quality, Member States may include the effects of action they take under Article 7(5) of the EPBD ([30]). In addition, they may include the effects of action under Article 2a(7) of the EPBD, which refers to fire safety and risks related to intense seismic activity.

2.3.2. *Roadmap — Article 2a(2) of the EPBD*

Pursuant to Article 2a(2) of the EPBD,

> 'In its long-term renovation strategy, each Member State shall set out a roadmap with measures and domestically established measurable progress indicators, with a view to the long-term 2050 goal of reducing greenhouse gas emissions in the Union by 80-95 % compared to 1990, in order to ensure a highly energy-efficient and decarbonised national building stock and in order to facilitate the cost-effective transformation of existing buildings into nearly zero-energy buildings. The roadmap shall include indicative milestones for 2030, 2040 and 2050, and specify how they contribute to achieving the Union's energy efficiency targets in accordance with Directive 2012/27/EU.'

([27]) See Commission Communication A Clean Planet for all — A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM(2018)773 final), with a particular focus on buildings and energy efficiency measures in the accompanying in-depth analysis https://ec.europa.eu/clima/policies/strategies/2050_en

([28]) See for example 'Overheating in buildings: adaptation responses' in 'Building Research & Information' (https://www.tandfonline.com/loi/toc/rbri20/45/1-2).

([29]) The provisional agreement resulting from interinstitutional negotiations reached on 19 December 2018 on a Proposal for a directive of the European Parliament and of the Council on the accessibility requirements for products and services (COM(2015) 615 — C8-0387/2015 — 2015/0278(COD)), contains a number of voluntary accessibility requirements for the built environment. Relevant standardisation mandates to CEN, Cenelec and ETSI include: mandate M/420 in support of European accessibility requirements for public procurement in the built environment and mandate M/473 to include 'Design for All' in relevant standardisation initiatives.

([30]) Actions that relate to healthy indoor climate conditions, fire safety and risks linked to intense seismic activity.

This is a new element which did not exist under Article 4 of the EED.

The underlying objective is to achieve a highly energy-efficient and fully decarbonised building stock; this is essential to delivering on the EU's goal of reducing greenhouse gas emissions. A 'decarbonised' building stock is not defined in EU legislation, but it can be considered as one whose carbon emissions have been reduced to zero, by reducing energy needs and ensuring that remaining needs are met to the extent possible from zero-carbon sources. This approach allows for various routes to decarbonisation, taking into account the Member State's national energy mix, preferences, potential and characteristics.

As the strategies are to set out a long-term vision to deliver on a 2050 decarbonisation goal, Member States should go beyond a simple inventory of existing measures (which provide the near-term elements) and provide a long-term view of the development of future policies and measures. The roadmap framework in the new Article 2a seeks to achieve this.

According to Article 2a(2), roadmaps must include:

(a) *measurable progress indicators* — these can be quantitative or qualitative variables to measure progress towards the long-term 2050 goal of reducing greenhouse gas emissions in the Union and ensuring a highly energy-efficient and decarbonised national building stock. They can be revised if necessary; and

(b) *indicative milestones* — these can be quantitative or qualitative objectives. Member States must 'include indicative milestones for 2030, 2040 and 2050 and specify how they will contribute to achieving the Union's energy efficiency targets in accordance with [the EED]'.

Member States can tailor their milestones and indicators to national specificities. The intention is not to introduce a sectoral target for the building sector, nor to establish legally binding targets. It is for Member States to define the specific milestones and to decide whether to make such objectives binding for the building sector (thus going beyond obligations in the EPBD). However, Member States should keep in mind that the setting of ambitious and clear milestones is key to reducing investor risks and uncertainties, and engaging stakeholders and business. The availability of consistent and reliable data is a major factor in determining measurable indicators.

In accordance with Article 2a paragraph 2, the LTRS must specify how the milestones for 2030, 2040 and 2050 contribute to the indicative headline target defined by Member States in accordance with Article 3 of the EED, since buildings are a key pillar of energy efficiency policy. This information can help policymakers shape future energy efficiency policies and design appropriate measures.

The following table presents a possible framework for defining indicators and milestones:

EPBD Article 2a	Indicators (with a view to reduction of GHG emissions + decarbonisation of building stock + facilitation of cost-effective transformation)	Milestones (which contribute to EU energy efficiency targets)
Paragraph 1		
(a) overview of the national building stock, based, as appropriate, on statistical sampling and expected share of renovated buildings in 2020;	— No of buildings/dwellings/m^2: — per building type — per building age — per building size — per climatic zone — Annual energy consumption: — per building type — per end use — Annual % of renovated buildings: — per renovation type	— Energy savings (in absolute and relative % terms) per building sector (residential, non-residential, etc.) — % of renovated buildings (per renovation type) — CO_2 emissions reduction in the building sector (renovation/new buildings) — % of NZEBs (per building sector)

EPBD Article 2a	Indicators (with a view to reduction of GHG emissions + decarbonisation of building stock + facilitation of cost-effective transformation)	Milestones (which contribute to EU energy efficiency targets)
	— per building sector — residential/non-residential — Renovated m^2: — per building type — per building size, — per building age — Number of EPCs: — per building type — per energy class — Number/m^2 of NZEBs: — per building sector	
(b) identification of cost-effective approaches to renovation relevant to the building type and climatic zone, considering potential relevant trigger points, where applicable, in the life-cycle of the building;	— Cost-effectiveness of main renovation measures (e.g. net present values, payback period, investment costs per annual savings): — per building type — per climatic zone — Total energy saving potential: — per building sector	
(c) policies and actions to stimulate cost-effective deep renovation of buildings, including staged deep renovation, and to support targeted cost-effective measures and renovation, for example by introducing an optional scheme for building renovation passports;	— Total and annual proportion of buildings undergoing deep and NZEB renovation — Public incentives for deep renovation — Public and private investments in deep renovations — Energy savings from deep renovations	
(d) overview of policies and actions to target the worst-performing segments of the national building stock, split-incentive dilemmas and market failures, and an outline of relevant national actions that contribute to the alleviation of energy poverty;	— Public investments in policy addressing the issues mentioned (split incentives, energy poverty, etc.) — % of rented houses with EPCs below a certain performance level — Energy poverty indicators: — % of people affected by energy poverty — proportion of disposable household income spent on energy — arrears on utility bills — population living in inadequate dwelling conditions (e.g. leaking roof) or with inadequate heating and cooling — % of buildings in lowest energy classes	— % reduction of people affected by energy poverty — % reduction of buildings in the lowest energy classes

EPBD Article 2a	Indicators (with a view to reduction of GHG emissions + decarbonisation of building stock + facilitation of cost-effective transformation)	Milestones (which contribute to EU energy efficiency targets)
(e) policies and actions to target all public buildings;	— m^2 of renovated public buildings: — per building type — per building size — per climatic zone	— Energy savings in public buildings
(f) overview of national initiatives to promote smart technologies and well-connected buildings and communities, as well as skills and education in the construction and energy efficiency sectors;	— No of buildings equipped with building energy management systems (BEMSs) or similar smart systems: — per building type (focus on non-residential) — Public and private investments in smart technologies (including smart grids) — Citizens participating in energy communities — No of graduated students — university courses with focus on energy efficiency and related smart technologies — professional/technical training (EPC certifiers, HVAC inspectors, etc.) — No of installers skilled in new technologies and working practices — Budget of national research programmes in the field of building energy efficiency — Participation of national universities in international scientific research projects (e.g. H2020) on energy efficiency in buildings-related topics	— Percentage of buildings equipped with BEMSs or similar smart systems: — per building type
(g) evidence-based estimate of expected energy savings and wider benefits, such as those related to health, safety and air quality.	— Reduction in energy costs per household (average)/decrease in energy poverty — Actual energy savings achieved — Average/aggregate indoor air quality indices (IAQIs) and thermal comfort index (TCI) — Cost of avoided illnesses/reduction in health costs attributable to energy efficiency measures — Reduction of whole life carbon — Disability Adjusted Life Year (DALY)/Quality Adjusted Life Year (QALY) improvements attributable to the improvement of building stock and living conditions	

EPBD Article 2a	Indicators (with a view to reduction of GHG emissions + decarbonisation of building stock + facilitation of cost-effective transformation)	Milestones (which contribute to EU energy efficiency targets)
	— Labour productivity gains from better working environment and improved living conditions — Reduction of emissions — Employment in the building sector (No of jobs created per EUR million invested in the sector) — GDP increase in the building sector — % energy imports for the Member State (energy security measures) — Removal/prevention of accessibility barriers for persons with disabilities	
Paragraph 3		
(a) the aggregation of projects, including by investment platforms or groups, and by consortia of small and medium-sized enterprises, to enable investor access as well as packaged solutions for potential clients;	No of integrated/aggregated projects	
(b) reduction of the perceived risk of energy efficiency operations for investors and the private sector;	Perceived risk of energy efficiency operation (survey-based)	
(c) use of public funding to leverage additional private-sector investment or address specific market failures;	Public investments as percentage of total investments in energy saving Public-private partnership initiatives	
(d) guiding investments into an energy efficient public building stock, in line with Eurostat guidance; and	Investment in energy efficiency renovation on the public building stock	
(e) accessible and transparent advisory tools, such as one-stop shops for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments.	One-stop shop initiatives in place Awareness-raising initiatives (number, target audience reached, target audience taking action)	— No of one-stop shop initiatives — Awareness is raised and leads to concrete action

2.3.3. *Public consultation and monitoring*

Article 2a(5) of the EPBD provides that:

> '[t]o support the development of its long-term renovation strategy, each Member State shall carry out a public consultation on its long-term renovation strategy prior to submitting it to the Commission. Each Member State shall annex a summary of the results of its public consultation to its long-term renovation strategy.

Each Member State shall establish the modalities for consultation in an inclusive way during the implementation of its long-term renovation strategy.'

This is a new element which did not exist under Article 4 of the EED. The consultation relates to the complete LTRS, including the financing mechanisms to mobilise investment, to which Member States are to facilitate access.

As public consultations can improve policy results, the EPBD makes them mandatory, but leaves each Member State to determine the consultation format (e.g. open or targeted) and method (e.g. face-to-face meeting-s/events, written submissions or online questionnaire). Member States may already have procedures for consultation on major policy or legislative initiatives that could be applied in the case of an LTRS ([31]).

According to Article 2a(5) of the EPBD, Member States must carry out a public consultation before submitting their LTRS to the Commission, regardless of whether this is already required by national legislation. Public consultation during implementation of the LTRS, which is also required under Article 2a(5) of the EPBD, is an opportunity for Member States to respond to progress and address gaps.

Member States may also consider setting up a stakeholder platform ([32]). The identification and consultation of stakeholders can contribute significantly to the successful implementation of the LTRS. The direct or indirect involvement of stakeholders associated with the energy upgrade of buildings is essential for the dissemination of the LTRS and the collection of data, and can promote consensus and acceptance of the LTRS ([33]).

Member States may take the above factors into account when planning their public consultations. In accordance with Article 2a paragraph 5, Member States must establish the modalities for consultation in an inclusive way during the implementation of its long-term renovation strategy. Member States should allow sufficient time to consult on the LTRS before submitting it to the Commission.

Pursuant to Article 2a(5) of the EPBD, a summary of the consultation must be annexed to the LTRS. It could outline, for example, the duration, period, type (open or targeted), method (face-to-face meetings/events, written comments or online), number of participants, type of participant (associations, private individuals, architects, regional and city administrations, other relevant local authorities, etc.), main comments and conclusions.

2.3.4. *Safety issues*

Article 2a(7) of the EPBD provides that Member States may use LTRSs to address fire safety and risks related to intense seismic activity that affect energy efficiency renovations and the lifetime of buildings. The provision should be read in conjunction with Article 7 ([34]), which requires Member States to address those issues in buildings undergoing major renovation.

([31]) Under Article 10 of the Governance Regulation, Member States are also required to have a public consultation procedure in place for the purpose of preparing the draft and final NECPs well before their adoption, without prejudice to any other Union law requirements.
([32]) For example, see www.buildupon.eu
([33]) Under Article 11 of the Governance Regulation, Member States must establish a permanent multi-level energy dialogue, bringing together local authorities, civil society organisations, the business community, investors and other relevant stakeholders to discuss options for energy and climate policies.
([34]) The new final paragraph of Article 7 EPBD adds two new obligations in relation to buildings undergoing major renovation — Member States must:
— encourage high-efficiency alternative systems, in so far as feasible; and
— address the issues of healthy indoor climate conditions, fire safety and risks related to intense seismic activity.

Safety is an area of national competence and the relevant national regulations should be applied in view of the building use (e.g. residential, non-residential, school, hospital), the occupants (e.g. vulnerable occupants such as children, persons with disabilities, or seniors) and building typology (e.g. low-rise, high-rise) ([35]).

The trigger points (see Section 2.3.1.2. above) may also be opportune moments for assessing safety aspects in a building and conversely, safety upgrades may be good moments to address energy efficiency performance.

Less expensive housing tends to be older with obsolete electrical installations, making energy-poor consumers particularly vulnerable ([36]). Measures such as regular inspections (in particular before a renovation) and upgrades to bring electrical installations up to safety standards can dramatically improve electrical safety. The safety inspection of electrical and gas installations and appliances is also to be encouraged.

European standards ('eurocodes') provide a comprehensive, up-to-date tool for structurally designing buildings and executing other civil engineering works with a view to seismic safety ([37]) and structural fire design ([38]).

Member States are expected to apply the common methods developed under EU legislation to assess and classify construction products' reaction to fire performance ([39]), resistance to fire ([40]) and performance when used in rooves ([41]), keeping in mind fire-spread and safe escape.

Member States can encourage the installation of appropriate ventilation and sprinkler systems, and the safe and correct installation of equipment that could have a fire-safety impact, such as photovoltaic (PV) panels and recharging points for electric vehicles.

Fire-prevention measures and policies such as fire-safety inspections, awareness-raising through home visits and mitigating measures such as the installation of smoke detectors can also play an important role.

Member States and interested stakeholders may benefit from the work of the Fire Information Exchange Platform (FIEP) ([42]), which the Commission set up to facilitate the exchange of information between competent national authorities and other stakeholders so that they can benefit from lessons learned and best practices on fire safety. This should enhance regulatory authorities' ability to fulfil their tasks in full knowledge of the advantages and disadvantages of the regulatory choices they have to make.

2.4. **Obligation to facilitate access to mechanisms to support the mobilisation of investments — Article 2a(3) of the EPBD**

Article 2a(3) of the EPBD requires Member States to facilitate access to financial mechanisms to support the mobilisation of investments in the renovation needed to achieve the goals in Article 2a(1), i.e. a highly energy-efficient and decarbonised building stock by 2050 and the cost-effective transformation of existing buildings

([35]) In line with the principle of subsidiarity, safety issues are regulated at Member State level. Issues such as those related to the choice of materials, general building safety regulations and the structural performance of buildings are regulated at national level and are outside the scope of the Directive.
([36]) In the EU, degraded or faulty electrical installations cause 32 home fires every hour (20-30 % of all domestic fires); https://www.energypoverty.eu/news/addressing-safety-and-energy-poverty-better-protect-vulnerable-consumers
([37]) EN 1998: Design of structures for earthquake resistance (Eurocode 8).
([38]) Specific parts of EN 1991, EN 1992, EN 1993, EN 1994, EN 1995, EN 1996 and EN 1999 applicable to various materials, e.g. concrete, steel, timber, etc.
([39]) Commission Delegated Regulation (EU) 2016/364 of 1 July 2015 on the classification of the reaction to fire performance of construction products pursuant to Regulation (EU) No 305/2011 of the European Parliament and of the Council (OJ L 68, 15.3.2016, p. 4).
([40]) Commission Decision 2000/367/EC of 3 May 2000 implementing Council Directive 89/106/EEC as regards the classification of the resistance to fire performance of construction products, construction works and parts thereof (OJ L 133, 6.6.2000, p. 26).
([41]) Commission Decision 2001/671/EC of 21 August 2001 implementing Council Directive 89/106/EEC as regards the classification of the external fire performance of roofs and roof coverings (OJ L 235, 4.9.2001, p. 20).
([42]) https://efectis.com/en/fire-information-exchange-platform-fiep/

into NZEBs. Article 2a(3) of the EPBD sets out possible mechanisms and builds on Article 20 of the EED, which requires Member States to facilitate the establishment of financing facilities, or the use of existing ones, for energy efficiency improvement measures.

Article 2a(3) of the EPBD provides that:

> 'To support the mobilisation of investments into the renovation needed to achieve the goals referred to in paragraph 1, *Member States shall facilitate access to appropriate mechanisms* for:
>
> (a) the aggregation of projects, including by investment platforms or groups, and by consortia of small and medium-sized enterprises, to enable investor access as well as packaged solutions for potential clients;
>
> (b) the reduction of the perceived risk of energy efficiency operations for investors and the private sector;
>
> (c) the use of public funding to leverage additional private-sector investment or address specific market failures;
>
> (d) guiding investments into an energy efficient public building stock, in line with Eurostat guidance; and
>
> (e) accessible and transparent advisory tools, such as one-stop-shops for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments.'

This provision did not exist under Article 4 of the EED.

To drive their LTRSs, Member States will need to create access to a range of financial mechanisms to support the mobilisation of investments, in particular considering how to use innovative financing to effectively enable small clients and small providers.

The following is a non-exhaustive list of generic examples of types of financial mechanism:

(a) aggregation of projects

- (i) procurement by a municipality of an energy-service contract ([43]) for retrofitting multi-family buildings (financed through energy savings);
- (ii) capacity-building and stakeholder dialogue to improve relevant entities' ability to offer aggregation services;
- (iii) procurement by a group of municipalities of an energy-service contract for some of their public buildings; and
- (iv) offering integrated renovation services — an entity (e.g. energy agency, local or regional authority, energy service company ('ESCO'), financial institution) could create a one-stop shop offering renovation services and financing, in quite a standardised way, making it possible to refinance the aggregated projects.
- (v) See also section 7.2 of the Commission Staff Working Document *Good practice in energy efficiency* ([44]).

(b) reduction of perceived risk

- (i) standardisation (e.g. through protocols, certification, standards) to reduce performance risks *ex post*;
- (ii) mortgages/loans that take account of the positive impact of the energy efficiency component of a project on the value of the asset and on default risk;

([43]) Energy performance contracting can deliver improvements on infrastructure and equipment performance. Usually, up-front investment by the client is not necessary and the energy efficiency investments are repaid directly through the energy savings generated. See JRC information page (https://e3p.jrc.ec.europa.eu/articles/energy-performance-contracting) and the H2020 Transparense project (www.transparense.eu). The core principles of energy performance contracts are outlined in the *EPC code of conduct* (http://www.transparense.eu/eu/epc-code-of-conduct/).

([44]) Commission Staff Working Document Good practice in energy efficiency Accompanying the document Proposal for a Directive of the European Parliament and of the Council amending Directive 2012/27/EU on Energy Efficiency SWD/2016/0404 final — 2016/0376 (COD) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1535361114906&uri=CELEX:52016SC0404).

(iii) refinancing (funds, bonds, factoring) to provide ESCOs and financial investors with long-term financing;

(iv) on-tax financing — i.e. the money lent for investment in building improvements is repaid through property tax;

(v) on-bill financing — i.e. the loan is repaid through the utility bill, with the energy savings covering the investment costs;

(vi) support for collecting evidence of the real technical and financial performance of energy efficiency investments, e.g. contributing to the European de-risking energy efficiency platform (DEEP) database (see below), or creating similar national databases;

(vii) encouraging the development and use of guidance on how to assess the risk for energy efficiency investments; and

(viii) guarantees for beneficiaries and guarantee facilities for financial intermediaries.

See also section 7.3 of the *Good practice in energy efficiency* mentioned above.

(c) public funding ([45])

(i) loan schemes co-financed by public funds;

(ii) risk-sharing instruments (e.g. loans, guarantee facilities and technical assistance);

(iii) grants targeting vulnerable consumers;

(iv) grants for technical assistance and to cover the costs of energy performance certificates (EPCs) and energy audits, and (where these are not mandatory) to encourage their use and raise awareness of investment opportunities; and

(v) energy efficiency funds.

See also section 7.1 of the Commission's 2016 good practice document.

(d) guiding investment in an energy-efficient public building stock

(i) assistance for the use of energy performance contracts (market facilitators, framework contracts, practical guides, etc.);

(ii) a legislative framework conducive to the development of ESCOs and the energy services market in general;

(iii) capacity-building through project development assistance, training, peer-to-peer assistance, etc.; and

(iv) facilitating the aggregation of small projects in public buildings (e.g. similar projects from different municipalities or public owners).

(e) accessible and transparent advisory tools and energy advisory services

(i) one-stop shop or integrated service for financing and renovation;

(ii) advisory services;

(iii) technical guidance on financing and renovation; and

(iv) financial education to improve the understanding of different financial instruments.

Examples of financing mechanisms are set out in sub-section 2.6.

([45]) Without prejudice to compliance with the relevant State aid rules, in particular Articles 38 and 39 of Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (OJ L 187, 26.6.2014, p. 1) (the General Block Exemption Regulation) and Section 3.4 of the EU Guidelines on State aid for environmental protection and energy.

These provisions are in line with the Commission's Smart Finance for Smart Buildings (SFSB) initiative ([46]) the first pillar of which concerns the more effective use of public funds through:

(a) capacity-building to promote the deployment of financial instruments (e.g. sustainable energy investment fora ([47]));

(b) the development of flexible energy efficiency and renewable financing platforms; and

(c) clarification of the accounting treatment of energy performance contracts.

This will make it possible to channel and combine public funds more effectively and speed up the deployment of financial instruments. Flexible financing platforms will offer final beneficiaries more attractive financing options through the sharing of risk and the best use of public funds, including European Structural and Investment Funds and the European Fund for Strategic Investments.

The second SFSB pillar (aggregation and project development assistance) includes:

(a) making more project development assistance available at EU level; and

(b) encouraging the development of local/regional one-stop shops for energy efficiency services.

This will help project developers bring good project ideas to maturity and facilitate building owners', households' and companies' access to information and energy efficiency services, enabling the development of large-scale investment programmes. The dedicated local or regional one-stop shops will facilitate the aggregation of projects, making them more attractive for the financial market.

The third pillar (de-risking) is implemented by the Energy Efficiency Financial Institutions Group (EEFIG) through the following initiatives:

(a) the open-source DEEP database, which provides evidence on the real technical and financial performance of energy efficiency investments ([48]); and

(b) the EEFIG underwriting tool ([49]), a consensual framework for underwriting energy efficiency investments — this is intended to provide guidance on assessing the risks and benefits associated with such investments.

These initiatives can help the market correctly assess the risks and benefits associated with energy efficiency investments, thus building trust in them and making them more attractive to project promoters, investors and financial institutions.

Pursuant to Article 7 of and Annex I to Regulation (EU) 2018/1999 of the European Parliament and of the Council ([50]) Member States' NECPs must include a general overview of the investments required to meet the various objectives, targets and contributions. This must include information on existing investment flows and forward investment assumptions with regard to planned policies and measures, and risk factors, barriers and public finance support or resources to address them.

([46]) Annex *Accelerating clean energy in buildings* to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank Clean Energy For All Europeans, COM(2016) 860 final (https://ec.europa.eu/energy/sites/ener/files/documents/1_en_annexe_autre_acte_part1_v9.pdf).

([47]) Sustainable energy investment fora have organised public events across the Union, bringing together ministry representatives and finance and energy stakeholders from several Member States to exchange knowledge and good practices, with parallel national roundtables and webinars.

([48]) https://deep.eefig.eu/

([49]) http://www.eefig.eu/index.php/underwriting-toolkit

([50]) Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (OJ L 328, 21.12.2018, p. 1).

2.5. **Financial incentives, market barriers and information — Articles 10 and 20 of the EPBD**

A number of other EPBD articles relevant to the provisions of Article 2a were also amended.

2.5.1. *Financial measures linked to savings — Article 10(6) of the EPBD*

2.5.1.1. Obligations

The EPBD acknowledges the role of financial initiatives and information campaigns in implementing the regulatory framework properly and achieving the EPBD's objectives. Article 10(6) of the EPBD provides that:

> 'Member States shall link their financial measures for energy efficiency improvements in the renovation of buildings to the targeted or achieved energy savings, as determined by one or more of the following criteria:
>
> (a) the energy performance of the equipment or material used for the renovation; in which case, the equipment or material used for the renovation is to be installed by an installer with the relevant level of certification or qualification;
>
> (b) standard values for calculation of energy savings in buildings ([51]);
>
> (c) the improvement achieved due to such renovation by comparing energy performance certificates issued before and after renovation ([52]);
>
> (d) the results of an energy audit;
>
> (e) the results of another relevant, transparent and proportionate method that shows the improvement in energy performance.'

This is a new paragraph. Its requirements apply as from its entry into force via national legislation (i.e. by the transposition deadline at the latest). It applies to all types of financial measure, including tax measures. It is recommended that, where possible, it also be applied to existing measures (e.g. in the case of support schemes, Member States are encouraged to consider and introduce amendments applicable to future financial support) ([53]).

It is already common for financial measures for energy efficiency to be accompanied by conditions or obligations requiring final beneficiaries to prove project performance and the effective use of public money. The requirement applies irrespective of whether the renovation in question constitutes a 'major renovation' within the meaning of Article 2(10) of the EPBD.

Article 10(6) of the EPBD allows for different approaches to linking financial support to the quality of energy renovation, but it provides flexibility to the Member States as to its implementation according to national or regional conditions. However, the provision provides that Member States must use one or more of the abovementioned criteria (a) to (e).

Competencies and skills are central to ensuring the quality of a renovation, so financial measures for energy efficiency should require that renovation measures are implemented by qualified or certified installers. This is particularly relevant in the case of criterion (a) above, according to which — a qualified and certified installer is to be involved in order to install the equipment or material used for the renovation and verify the improvements. However, this requirement has to take into consideration national regulations regarding relevant professions.

([51]) As regards standard values for calculating energy savings in buildings (criterion (b), there are already many technologies with such values linked to their performance (LED lighting, double-/triple-glazed windows, etc.). In addition, several EU-funded projects aim to define standard values (e.g. the multEE project funded under Horizon 2020; http://multee.eu/).

([52]) As regards criterion (c), EPCs are an effective tool for documenting energy savings as a result of financial support for energy renovation. They are already used in relation to many financial instruments applied in different Member States and are the instrument most likely to be used for defining green mortgages in the context of the 'energy efficiency mortgage' initiative (ongoing).

([53]) However, beneficiaries should be able to rely on previous decisions and commitments concerning public financial support for specific projects.

In addition to appropriate installation, an assessment of the results of the renovation by qualified or certified inspectors is encouraged in order to ensure quality assurance.

2.5.1.2. Transposition and implementation of Article 10(6) of the EPBD

Having chosen the quality criteria to be applied, Member States should disseminate and communicate the national measures transposing Article 10(6) of the EPBD to all appropriate authorities/agencies (i.e. operational authorities) responsible for designing and implementing financial measures. This is important to ensure that the design and implementation of the measures are linked to one or more of the criteria.

Member States should review their national regulation regarding relevant professions of installers in order to ensure that only qualified and certified installers are involved in the renovation process.

2.5.2. *Databases for EPCs — Article 10(6a) of the EPBD*

2.5.2.1. Obligations

Article 10(6a) of the EPBD provides that:

> '[d]atabases for energy performance certificates shall allow data to be gathered on the measured or calculated energy consumption of the buildings covered, including at least public buildings for which an energy performance certificate, as referred to in Article 13, has been issued in accordance with Article 12.'

EPC registers and databases can:

(a) be a key instrument for greater compliance;

(b) improve knowledge of the building stock;

(c) provide policymakers with better information; and

(d) support operators' decisions ([54]).

Member States do not have to establish a database or register. Where such a database exists or is introduced, Member States must comply with this new provision ([55]). It is for them to determine the frequency with which the database should be updated with new (actual or calculated) energy consumption data.

Article 10(6a) of the EPBD requires that EPC databases allow for the gathering of consumption data (measured or calculated) of the buildings covered. These must include at least public buildings for which an EPC has been issued on the basis of Article 13 of the EPBD, i.e. buildings occupied by public authorities that are frequently visited by the public and have a total useful floor area of over 250 m² (i.e. buildings for which an EPC is required under Article 12(1) of the EPBD.

Member States are free to determine what 'frequently visited' means, but the interpretation used in transposing Article 10(6a) of the EPBD should be consistent with that for Articles 12 and 13 of the EPBD (which have already been transposed).

Member States are free to find the data from other sources and register it in EPC databases.

([54]) Recital 34 of Directive (EU) 2018/844 states that '[h]igh-quality data on the building stock is needed and this could be partially generated by the databases that almost all Member States are currently developing and managing for energy performance certificates'.

([55]) Recital 34 of Directive (EU) 2018/844 clarifies that '… [w]here the independent control system for energy performance certificates is complemented by an optional database going beyond the requirements of Directive 2010/31/EU …'.

2.5.2.2. Transposition and implementation of Article 10(6a) of the EPBD

If they have an EPC database, Member States should:

(a) examine whether the arrangements allow for the gathering of measured or calculated energy consumption data and amend them if necessary to comply with the obligation in Article 10(6a);

(b) ensure that at least the data for public buildings with an EPC that are visited frequently by the public is fed into the database; and

(c) update the data, ideally at least once a year.

2.5.3. *Aggregated anonymised data — Article 10(6b) of the EPBD*

Article 10(6b) of the EPBD provides that:

> '[a]t least aggregated anonymised data compliant with Union and national data protection requirements shall be made available on request for statistical and research purposes and to the building owner.'

Member States have to take the necessary action to ensure that this requirement is met. This provision does not require them to make changes to existing databases, but to ensure that the legislative framework allows the data to be made available in accordance with obligations in the Article.

2.5.4. *Information — Article 20(2) of the EPBD*

Article 20(2) of the EPBD provides that:

> 'Member States shall in particular provide information to the owners or tenants of buildings on EPCs, including their purpose and objectives, on cost-effective measures and, where appropriate, financial instruments, to improve the energy performance of the building, and on replacing fossil fuel boilers with more sustainable alternatives. Member States shall provide the information through accessible and transparent advisory tools such as renovation advice and one-stop shops.
>
> At the request of the Member States, the Commission shall assist Member States in staging information campaigns for the purposes of paragraph 1 and the first subparagraph of this paragraph, which may be dealt with in Union programmes.'

Article 20 of the EPBD was amended to clarify Member States' obligation to provide information to tenants or owners. The (non-exhaustive) list of cases now includes an obligation to provide information on replacing fossil fuel boilers ([56]) with more sustainable alternatives.

Article 20(2) of the EPBD requires that 'Member States shall provide the information through accessible and transparent advisory tools such as renovation advice and one-stop shops'.

([56]) A fossil fuel boiler includes a solid fuel boiler, a boiler space heater or a boiler combination heater that uses fossil fuel. A solid fuel boiler is a device equipped with one or more solid fuel heat generators that provides heat to a water-based central heating system in order to reach and maintain at a desired level the indoor temperature of one or more enclosed spaces, with a heat loss to its surrounding environment of not more than 6 % of rated heat output (see Article 2 and Annex I, of Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers (OJ L 193, 21.7.2015, p. 100)). A boiler space heater means a space heater that generates heat using the combustion of fossil fuels and/or biomass fuels, and/or using the Joule effect in electric resistance heating elements. A boiler combination heater is means a boiler space heater that is designed to also provide heat to deliver hot drinking or sanitary water […] (see Article 2 of Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters (OJ L 239, 6.9.2013, p. 136)). Ecodesign requirements for fossil fuel coal boilers will apply from 1 January 2022 and will ban certain products from being placed on the market on the grounds of energy efficiency and NOx, PM, CO_2 and VOCs emissions. Ecodesign requirements for fossil fuel gas and oil boilers up to 400 kW apply today and ban certain products from being placed on the market based on energy efficiency and NOx emissions. Gas and oil boiler space heaters and boiler combination heaters are covered by Regulation (EU) No 813/2013 and solid fuel boilers by Regulation (EU) 2015/1189. Regulation (EU) 2015/1189 does not ban solid fossil fuel boilers from the market.

2.6. **Submission of LTRS and progress reporting**

2.6.1. *Submission of LTRS*

According to Article 2a(8) of the EPBD ([57]), the LTRS must be submitted to the Commission 'as part of' each Member State's final NECP. The LTRS should be submitted as an annex to the NECP.

According to Article 3(1) of Regulation (EU) 2018/1999, the deadline for submission of the final NECP is 31 December 2019 and every 10 years thereafter.

However, by way of derogation set out in Article 2a(8) of the EPBD, the deadline for submission of the first LTRS is at the latest 10 March 2020, three months after the deadline for the final NECP. Member States are nevertheless advised to aim to have their LTRS finalised at the same time as their final NECP so that the LTRS can be fully taken into account in, and shape the NECP.

According to Article 4(b)(3) of Regulation (EU) 2018/1999, as part of their NECPs Member States must set out the objectives, targets and contributions for each of the five dimensions of the Energy Union. The mandatory elements to be included in the draft and final NECP are:

(a) indicative milestones ([58]);

(b) roadmap with domestically established measurable progress indicators ([59]);

(c) evidence-based estimate of expected energy savings and wider benefits ([60]); and

(d) contributions to the Union's energy efficiency targets ([61]) pursuant to the EED in accordance with Article 2a of the EPBD.

These key elements were to be included in the draft NECP that was due by the end of 2018 and must feature in the final NECP to be submitted by the end of 2019. The key elements are central to the objectives in the NECPs and underpin the reinforced, fully fledged LTRSs.

2.6.2. *Progress reporting*

Chapter 4 of Regulation (EU) 2018/1999 sets out reporting obligations related to NECPs, including reporting related to LTRS.

Article 17 of the Regulation (EU) 2018/1999 requires Member States to submit integrated national energy and climate progress reports ('Progress Reports') by 15 March 2023 and every two years thereafter.

Pursuant to Article 17(2)(c) of Regulation (EU) 2018/1999, these Progress Reports must include mandatory information on energy efficiency which is defined in Article 21 of Regulation (EU) 2018/1999.

2.6.2.1. Reporting on national trajectories, objectives and targets

According to Article 21(a) of Regulation (EU) 2018/1999, Progress Reports must include information on the implementation of national trajectories, objectives, and targets. In relation to buildings and long-term renovation strategies, this includes:

(a) indicative milestones of the LTRS; and

(b) contributions to the Union's energy efficiency targets pursuant to the EED in accordance with Article 2a of the EPBD;

(c) where applicable, an update of other national objectives set out in the NECP.

([57]) In accordance with Article 4(b)(3) and Section 3.2 of Annex I to Regulation (EU) 2018/1999.
([58]) Article 2a(2) of the EPBD.
([59]) Article 2a(2) of the EPBD.
([60]) Article 2a(1)(g) of the EPBD.
([61]) Article 2a(2) of the EPBD.

2.6.2.2. Reporting on policies and measures

Pursuant to Article 21(b) of Regulation (EU) 2018/1999, Progress Reports must include information on the implementation of policies and measures, includingLTRS in accordance with Article 2a of the EPBD.

2.6.2.3. National objectives

Finally, in accordance with Article 21(c) of Regulation (EU) 2018/1999, which refers to Part 2 of Annex IX to Regulation (EU) 2018/1999, Progress Reports must also include additional information relating to national objectives, including major legislative and non-legislative policies, measures, financing measures and programmes implemented in the preceding 2 years to achieve the objectives referred to in Article 4(b) of Regulation (EU) 2018/1999 including those which improve the energy performance of buildings (Paragraph (a) of Part 2 of Annex IX to Regulation (EU) 2018/1999).

2.7. **Good practice for complying with Article 2a of the EPBD**

This section sets out guidance on good practice which will be useful for the Member States in the implementation of the requirements of Article 2a. It follows the structure of the previous section.

The building renovation strategies submitted by Member States in 2014 and 2017 under Article 4 of the EED will be the building blocks for the future LTRSs. The *National energy efficiency action plan (NEEAP) guidance* ([62]) includes detailed instructions for the inclusion of certain elements in those strategies — relevant sections are referred to below. This is a useful starting point, as Directive (EU) 2018/844 builds on the obligations as regards building renovation strategies.

2.7.1. *Overview of national building stock — Article 2a(1)(a) of the EPBD*

Details of items to be covered in the overview of national building stock are set out in Annex B, section 1, guidance 57 of the *NEEAP guidance*.

Member States are encouraged to take into consideration the requirements of the INSPIRE Directive ([63]) when preparing their overview. Buildings are one of the 34 data themes addressed by that Directive and national and local public administrations are expected, by 2020, to make large datasets containing relevant information (e.g. dates of construction, current use and condition) discoverable and downloadable. The JRC's 2016 technical report on *Buildings-related datasets accessible through the INSPIRE geoportal* ([64]) may be useful in this respect.

The 2017 LTRSs from Wallonia (Belgium), France and Malta are examples of good practice in presenting an overview of the national building stock ([65]).

2.7.2. *Cost-effective approaches to renovation — Article 2a(1)(b) of the EPBD*

Annex B, section 2 of the *NEEAP guidance* provides detailed indications on how to identify cost-effective approaches to renovation.

([62]) SWD(2013) 180 final; https://ec.europa.eu/energy/sites/ener/files/documents/20131106_swd_guidance_neeaps.pdf
([63]) Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (OJ L 108, 25.4.2007, p. 1).
([64]) See: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC102276/jrc102276_buildings_related_datasets_in_the_inspire_geoportal_def_pubsy%20-isbn-issn.pdf
([65]) *Assessment of second long-term renovation strategies under the Energy Efficiency Directive*, JRC Science for Policy report (2018).

The 2014 LTRS from the Brussels Capital Region and the 2017 LTRSs from Wallonia (Belgium) and Bulgaria have been identified as examples of good practice in cost-effective approaches ([66]).

See also the Buildings Performance Institute Europe (BPIE) 2016 factsheet *Trigger points as a must in national renovation strategies* ([67]).

Industrialised retrofitting

Industrialised retrofitting by way of serial prefabrication off-site of insulating facade and roof elements including cabling, tubing and glazing can result in more cost-effective renovation and low-disturbance of residents during the renovation.

The E2ReBuild ([68]) project investigated, promoted, and demonstrated cost-effective and advanced energy-efficient retrofit strategies for two-storey residential buildings that create added value.

The 2ndskin ([69]) project brought different stakeholders from the building industry together, aiming at integrating their expertise and objectives into an innovative building retrofitting for multi-storey residential buildings concept that achieves zero energy use while offering up-scaling possibilities. The hypothesis of the project is that zero-energy refurbishment can be promoted and its rate can increase by the application of prefabricated façade modules, which increase installation speed and minimise disturbance for the occupants.

Rental and energy performance

To further support the necessary improvements in their national rental stock, Member States should consider introducing or continuing to apply requirements for rental properties' EPCs to demonstrate a certain level of energy performance (see Recital 9 of Directive (EU) 2018/844). In doing so, Member States should consider establishing financial mechanisms that will ease any burden on property owners in financing the necessary renovations.

The Dutch government has announced that, from 2023, buildings should have an energy rating of at least 'C' in order to be rented out as office space ([70]).

In England and Wales, the Energy Efficiency (Private Rented Property) Regulations 2015 establish a minimum level of energy efficiency for privately rented domestic and non-domestic properties. Since April 2018, landlords of such properties have had to ensure that they have an EPC rating of at least 'E' before concluding a new tenancy agreement with new or existing tenants. From 1 April 2020 (for domestic properties) and 1 April 2023 (for non-domestic properties), the requirement will apply to all private rented properties even where there has been no change in tenancy arrangements ([71]).

Scotland has introduced a measure requiring the renovation of low-performing social housing. In Greece, a similar approach applies, according to which, in order to be leased to or acquired by the public sector, buildings should have an EPC rating of at least 'C'. This obligation will apply to all existing lease contracts by 2020.

2.7.3. *Policies and action on deep renovation — Article 2a(1)(c) of the EPBD*

Annex B, Section 3 of the *NEEAP guidance* sets out the information to be provided with regard to policies and measures to promote cost-effective deep renovation.

([66]) *Ibid*. and *Synthesis report on the assessment of Member States' building renovation strategies*, JRC Science for Policy report (2018).
([67]) http://bpie.eu/publication/trigger-points-as-a-must-in-national-renovation-strategies/
([68]) https://www.smartcities-infosystem.eu/sites-projects/projects/e2rebuild
([69]) See: https://projecten.topsectorenergie.nl/storage/app/uploads/public/5a0/c14/5dc/5a0c145dc79f1846323269.pdf
([70]) https://www.akd.nl/en/b/Pages/Office-building-with-energy-label-D-or-worse-banned-as-from-2023.aspx.
([71]) https://www.gov.uk/government/publications/the-private-rented-property-minimum-standard-landlord-guidance-documents

The 2017 LTRSs from the Brussels Capital Region and France are examples of good practice as regards measures to promote deep renovation ([72]).

Roadmaps

The iBRoad project ([73]) is working on an individual building renovation roadmap for single-family houses. The tool looks at the building as a whole and produces a customised renovation (iBRoad) plan over the long term (15-20 years), combined with a building logbook or passport as a record of energy-related interventions. iBRoad found that homeowners and purchasers need more user-friendly and trustworthy advice on the best way of carrying out energy renovations.

iBRoad's report *The concept of the individual building renovation roadmap — an in-depth case study of four frontrunner projects* ([74]) addresses the process of producing and implementing such a roadmap and covers the key issues to be addressed. It also presents real-life examples from Denmark (BetterHome ([75])), Flanders (*Woningpas* and EPC+), France (*Passeport efficacité énergétique*) and Germany (*Individueller Sanierungsfahrplan*).

The Alliance for Deep Renovation in Building (ALDREN) ([76]) also proposes building passports for step-by-step renovation and provides harmonised energy performance ratings via a common European voluntary certification scheme.

Building-related information

The Intelligent Energy Europe (IEE) project Request2Action ([77]) worked on EPCs and how to improve uptake of their recommendations. The proposed solution, which in some cases comes close to a passport, is a 'hub' or one-stop shop for buildings-related information. One example of the approach is the Casa+ hub in Portugal, which is designed for storing EPCs and related data for all residential dwellings, so that offers can be made for renovating them, the outcomes of which would also be registered. Further details can be found in the report on *Recommendations on building hubs* ([78]).

2.7.4. *Policies and actions on worst-performing buildings and energy poverty — Article 2a(1)(d) of the EPBD*

2.7.4.1. Worst-performing segments of the national building stock

The Horizon 2020 ENERFUND project ([79]) addresses the need for easy-to-access and reliable assessments of the energy savings to be obtained through deep energy retrofits, by encouraging more such projects in Europe. The project is developing a decision-making tool rating deep renovation opportunities against a set of parameters — like the credit scores used by banks to rate clients. The tool is presented as an online map displaying the energy performance of individual buildings.

In Denmark, all social housing associations contribute every month to a common 'solidarity fund' which is used to renovate the worst-performing buildings.

Rental property restrictions related to energy performance (as referred to in section 6.2) are also an effective measure to encourage the renovation of worst-performing buildings.

([72]) https://ec.europa.eu/energy/sites/ener/files/documents/2014_article4_en_denmark.pdf
([73]) http://ibroad-project.eu/
([74]) http://ibroad-project.eu/news/the-concept-of-the-individual-building-renovation-roadmap/
([75]) http://bpie.eu/publication/boosting-renovation-with-an-innovative-service-for-home-owners/
([76]) www.aldren.eu
([77]) http://building-request.eu/
([78]) http://building-request.eu/sites/building-request.eu/files/d4.1_recommendations_report_final.pdf
([79]) http://enerfund.eu/

Tax mechanisms are another means by which Member States can encourage the renovation of energy-inefficient buildings; examples include:

(a) income tax deductibility for certain energy efficiency renovation costs (Denmark); and

(b) a tax on energy consumption (Netherlands) ([80]).

2.7.4.2. Split-incentive dilemmas

Rental property restrictions related to energy performance are also an effective measure to encourage the renovation of energy-inefficient buildings. Examples include:

(a) forcing landlords to make improvements (UK ([81])); and

(b) minimum performance levels for rented units, e.g.:

(i) obligatory roof insulation (*Flemish Housing Co*de); and

(ii) minimum EPC levels for offices (Netherlands).

2.7.4.3. Market failures

Annex B, section 3(b) of the *NEEAP guidance* includes an analysis of barriers to renovation in the list of the information items to be provided. Section 3(d) suggests that new policy measures should address such barriers.

The impact assessment that accompanied the proposal to revise the EPBD ([82]) also addresses barriers to the uptake of energy efficiency investments in buildings.

2.7.4.4. Alleviation of energy poverty

The JRC's assessment of the 2017 LTRSs gives an overview of Member States' direct (specific policies and measures) and indirect references (general strategies or initiatives) to ongoing or planned efforts to alleviate energy poverty. Many of the measures take the form of financial incentives targeting segments of the population considered to be under the energy poverty line, low-income households or social housing units. Some countries introduced specific actions targeting energy poverty under their energy efficiency schemes, while others set up dedicated awareness-raising and advisory services.

The EU Energy Poverty Observatory is a valuable source of data and statistics. It has developed energy poverty indicators, gathered an extensive catalogue of policy measures and compiled a comprehensive repository of research. It helps stakeholders involved in designing or implementing energy poverty policy (policymakers, NGOs, public authorities at different levels, researchers and practitioners) to define and measure the phenomenon. It also facilitates the exchange of good practice and provides training materials. It can be of direct assistance to Member States in providing advice and expertise — both *ad hoc* and via its extensive advisory board, which is made up of experienced experts in all aspects of energy poverty.

In France, the national housing agency addresses fuel poverty, inter alia, through its *Habiter mieux* ('Living better') programme. France's energy savings certificates scheme imposes a new obligation specifically aimed at combating fuel poverty. The scheme will fund action among low-income households. France has also set up a 'fuel poverty observatory' to measure fuel poverty situations more accurately and monitor public and private financial aid to disadvantaged households, together with action under local and national initiatives.

([80]) See: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC97408/reqno_jrc97408_online%20nzeb%20report%281%29.pdf
([81]) https://www.gov.uk/government/consultations/domestic-private-rented-sector-minimum-level-of-energy-efficiency
([82]) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016SC0414&from=EN

Under the Irish government's strategy to combat energy poverty and the Healthy Ireland framework, national authorities have set up the Warmth and Wellbeing scheme, a pilot initiative that aims to validate, in the Irish context, international evidence that making homes warmer and more energy-efficient can have a positive effect on the health and wellbeing of people in energy poverty who are also suffering from conditions such as chronic obstructive pulmonary disease and asthma. Under Ireland's social housing investment programme, local authorities are allocated capital funding each year for a range of measures to improve the standard and overall quality of their social housing stock, including retrofitting for greater energy efficiency.

In partnership with the EU Episcope project, Irish Energy Action has developed an EPC mapping tool ([83]). An interactive map illustrates various building characteristics (including energy poverty indicators) in different neighbourhoods in Dublin. The data is aggregated within small areas and electoral divisions. This mapping facilitates a district approach to local policymaking and the formulation of strategies to alleviate energy poverty.

Austria's energy efficiency obligation scheme applies a bonus factor whereby savings achieved in low-income households are weighted with a factor of 1,5. In addition, energy suppliers must run centres that provide information and advice, inter alia, on energy poverty. Other examples of dedicated regional/local programmes in Austria include an energy advice scheme in Vienna and an electricity-saving project for low-income households in the Braunau, Freistadt and Linz-Land districts.

The Netherlands' energy saving agreement for the social rental sector sets housing associations the objective of achieving energy label B (equivalent to energy index 1,25) on average by 2020.

Other examples include:

(a) the PLAGE SISP programme in the Brussels Capital Region;

(b) subsidies for individual energy efficiency measures in vulnerable households in Croatia;

(c) Cohesion policy JESSICA programmes in Lithuania and the Czech Republic;

(d) personalised advisory services for energy efficiency for low-income households in Luxembourg and elsewhere; and

(e) social bonuses or discounts on energy bills for low-income families in Italy and France.

The REACH project ([84]) addressed energy poverty by training vocational school teachers and students as energy advisors. REACH partners made about 1 600 household visits to implement basic energy efficiency measures. In Slovenia, the project helped to trigger a nationwide scheme addressing energy poverty in households. Training packages and the final impact report are available on the project website.

The ASSIST project ([85]) aims to tackle energy poverty and provide specialised services through a network of vulnerable consumer energy advisors ('VCEAs'). VCEAs are to be selected from people with direct experience of vulnerability and/or energy poverty, who will be trained so as to improve their future employability and maximise peer-to-peer benefits. Action includes:

(a) working with feedback systems;

([83]) http://bpie.eu/wp-content/uploads/2017/05/Factsheet_B-170511_v4.pdf
([84]) http://reach-energy.eu/
([85]) The following ASSIST project deliverables could be relevant:
— a report on the main national/regional/local initiatives on energy poverty in the participating countries (https://www.assist2gether.eu/documenti/risultati/report_on_replicable_best_practice_national_and_european_measures.pdf);
— a report on financial measures in the participating countries (https://www.assist2gether.eu/documenti/risultati/report_best_practice_guide_on_financial_measures.pdf)

(b) energy audits;

(c) community-based initiatives;

(d) support in obtaining funds for energy efficiency; and

testing innovative funding mechanisms. The Urban Agenda for the EU ([86]) was initiated within the framework of intergovernmental cooperation in 2016 with the overall objective of including the urban dimension in policies in view of achieving better regulation, better funding and better knowledge for cities in Europe. The Agenda is implemented through Partnerships in a multi-level governance format. One of the Partnerships is focused on Energy Transition. This Partnership aims, inter alia, to improve energy efficiency at a building level through retrofitting for energy efficiency and management including advice provision, also for the benefit of alleviating energy poverty. Moreover, the Partnership for Housing addresses the need to increase affordable housing, among which actions to monitor affordable housing investment, recommendations for preventing evictions by energy efficiency renovation, fostering integrated district-level energy efficiency renovation approaches, and improvement of EU gender-poverty-energy nexus data.

Other projects addressing energy-efficient renovation with a focus on social housing

While the FIESTA project ([87]) did not specifically address energy-poor households, a good proportion of the households involved were in social housing. The project tackled heating and cooling efficiency in families, with a particular focus on the more vulnerable. Free energy helpdesks in 14 cities advised individuals (either face-to-face or online) and carried out door-to-door energy audits. At least 39 other European cities have officially undertaken to replicate the FIESTA model. The project developed user-friendly energy-saving guidance materials for households, such as the *FIESTA energy efficiency guide* ([88]) and short animated films ([89]) in Bulgarian, Croatian, English, Greek, Italian and Spanish.

The Horizon 2020 EnerSHIFT project (February 2016 to January 2019) ([90]) targets the social housing sector in the Liguria region (Italy). It provides technical assistance for the preparation of feasibility studies, with the ultimate objective of launching a tender for investments by ESCOs through an energy performance contract. The project also involves the use of cohesion policy funds to trigger investment. The target is a programme for investing nearly EUR 15 million, resulting in primary energy savings of 14,5 GWh/year.

In September 2018, the award procedure for the first EnerSHIFT tender was concluded, targeting 44 social housing buildings in the province of Genoa (Italy), and the contract should be signed by the end of the year. An agreement with the Liguria banking system is aimed at facilitating ESCOs' access to credit. Regional Law No 10/2004 on the social housing sector was amended to facilitate the implementation of energy performance contracts. As a result, proposed contracts are no longer subject to the formal approval of the tenants.

The Transition Zero project ([91]) aims to improve the spread of NZEBs across Europe, looking specifically at refurbishment in social housing. Building on the success of *Energiesprong* in the Netherlands, Transition Zero is expanding net-zero energy refurbishment in the UK and France, using the social housing sector as a catalyst. *Energiesprong* delivers fully integrated refurbishment packages with long-term guarantees that make the

([86]) https://ec.europa.eu/futurium/en/urban-agenda
([87]) http://www.fiesta-audit.eu/en/
([88]) http://www.fiesta-audit.eu/media/46433/fiesta_en_low.pdf
([89]) http://www.fiesta-audit.eu/en/learning/
([90]) https://enershift.eu
([91]) http://transition-zero.eu/index.php/publications/

solution commercially financeable and scalable. Transition Zero is not limited to the alleviation of energy poverty — it also applies to non-energy-poor housing stock. However, its business model offers viable solutions whereby social housing companies can alleviate problems of affordable housing and energy poverty. Relevant reports have focused on structural finance products for social housing, energy performance guarantees and refurbishment package delivery protocols, tender specifications, the national and regional regulatory context for refurbishment, and market assessment.

2.7.5. *Policies and action on public buildings — Article 2a(1)(e) of the EPBD*

In Croatia, two projects launched in 2015 to facilitate the combined use of European Regional Development Fund (ERDF) and Cohesion Fund investment for the renovation of public buildings have involved:

(a) the preparation of detailed design documentation for energy efficiency and renewable energy system (RES) measures in buildings; and

(b) investment in the energy renovation of school buildings.

From 240 applications, 12 pilot projects were selected for funding (five for design documentation and seven for investments in schools) ([92]).

Slovenia has many heritage public buildings and major energy savings potential. However, such buildings are usually treated as exceptions under the EPBD. Slovenia's policy package includes guidelines (technical recommendations) for the energy renovation of heritage buildings and involves positive criteria to facilitate the application of heritage buildings to qualify for EU cohesion policy funding ([93]).

The Horizon 2020 Premium Light Pro project ([94]) has been working to support the uptake of LED lighting systems among public authorities and private companies across nine EU countries. The aim is to help public authorities develop effective policies to facilitate the implementation of efficient new-generation LED lighting systems in the service sector. Green procurement criteria and guidelines for indoor and outdoor LED lighting systems have been published on the project website.

The EmBuild coordination and support project ([95]) seeks to:

(a) improve regional/municipal authorities' capacity to collect the necessary data to prepare ambitious, sustainable and realistic renovation strategies for public buildings;

(b) identify and analyse cost-effective approaches to renovation;

(c) make policy recommendations to stimulate cost-effective deep renovations of buildings and identify best practices;

(d) guide public investment decisions and facilitate private sector involvement; and

(e) measure and communicate expected energy savings and wider benefits.

2.7.6. *Incentives for smart technologies and skills — Article 2a(1)(f) of the EPBD*

2.7.6.1. Smart technologies

The Horizon 2020 Smart-up project (March 2015 to July 2018) ([96]) aimed to encourage the active use of smart meters and in-house displays by vulnerable consumers in France, Italy, Malta, Spain and the UK. There was a strong engagement strategy in training stakeholders who are in particularly close contact with vulnerable households. More than 550 frontline staff (mainly social workers) were trained in 46 training sessions and went on to advise over 4 460 vulnerable households on:

(a) how to use energy more efficiently;

([92]) See *Concerted Action Report*, November 2016; https://www.epbd-ca.eu/wp-content/uploads/2018/04/CA-EPBD-CCT2-Policies-and-Implementation.pdf
([93]) *Ibid*.
([94]) http://www.premiumlightpro.eu/
([95]) http://bpie.eu/wp-content/uploads/2018/09/local_strategies_Final_NEW.pdf
([96]) https://www.smartup-project.eu/

(b) how to read and understand electricity and/or gas meters; and

(c) how to reduce their energy bills.

In Spain, the project inspired a social programme funded by the municipality of Barcelona to combat energy poverty. As a result, 100 unemployed people were trained and more than 1 800 vulnerable households received advice. Another positive outcome is that 32 % of the trainees are now working in Barcelona's fuel poverty information points. Training packages and the final impact report are available on the project website.

The PEAKapp ([97]) project encourages energy saving based on competitive human nature while also facilitating the consumption of clean and low-priced electricity from the spot market for household customers. Using data from already installed electricity smart-meters, PEAKapp solution creates incentives not only to use energy more efficiently, but also to shift loads towards times of increased production from renewable resources, thus enabling residents of the social housing sector to participate actively in the electricity market and benefit from monetary savings. PEAKapp is currently validating this ICT-solution under real life conditions in more than 2 500 households in Austria, Estonia, Latvia, and Sweden.

The aim of the MOBISTYLE ([98]) project is to motivate behavioural change by raising consumer awareness through a provision of attractive personalized information on user's energy use, indoor environment and health, through information and communication technology (ICT) based services. Behaviour change is achieved through awareness campaigns during which end-users are encouraged to be pro-active about their energy consumption and to simultaneously improve health and well-being. The MOBISTYLE solution and tailor-made services are being validated in real life operating conditions, in five countries ([99]).

Eco-Bot ([100]) aims to utilize recent advances in chat-bot tools and advanced signal processing (i.e. energy disaggregation) using low-resolution smart meter-type data with the goal of changing their behaviour towards energy efficiency behaviours. Eco-Bot targets to a personalized virtual energy assistant to deliver information on itemized (appliance-level) energy usage through a chat-bot tool.

2.7.6.2. Skills development schemes

The BUILD UP Skills ([101]) initiative aims to unite the building workforce in Europe and increase the number of qualified workers. It focuses on the in-work education and training of craftspeople and other on-site workers in the field of energy efficiency and renewable energy in buildings, and has three main components:

(a) establishing national qualification platforms and qualification roadmaps to 2020 (pillar I: 2011-2013);

(b) developing and upgrading qualification and training schemes (pillar II: from 2013); and

(c) Europe-wide coordinated support activities (EU exchanges).

The BUILD UP Skills *Construye2020* project (Spain) ([102]) developed an app for mobile devices which can be used as a training tool on good practices for various activities in the renovation of buildings, in particular aluminium carpentry, insulation, RESs, energy efficiency and efficient installations. The project is working with the national qualification institute to develop a new qualification for the installation of ground-source heat pumps.

BUILD UP Skills Netherlands@Work ([103]) has produced eight blue-collar professional competence profiles, covering skills required for constructing energy-neutral buildings. An app enables blue-collar workers to choose a suitable course on the basis of their previous knowledge.

([97]) http://www.peakapp.eu/
([98]) https://www.mobistyle-project.eu
([99]) Social housing apartments at Kildenparken, Aalborg, Denmark; University buildings at the University of Ljubljana, Slovenia; Apartments in L'Orologio, Turin, Italy; Health care centre in Maastricht, The Netherlands; and residential houses in Wrocław, Poland.
([100]) http://eco-bot.eu/
([101]) http://www.buildup.eu/en/skills
([102]) http://construye2020.eu/
([103]) www.buildupskills.nl

The partners in BUILD UP Skills BEEP (Finland) ([104]) have developed an innovative training approach (for trainers and workers) feeding best practice in energy-efficient construction into a comprehensive toolbox including:

(a) sets of slides and teaching videos in five languages;

(b) self-learning material for workers;

(c) a pilot training course for 'change agents' (experienced workers/mentors who can set an example and explain how to improve the quality of the work); and

(d) an on-site training ambassador who plays a critical role in persuading workers to take the pilot training.

The BUILD UP Skills Qualishell project (Romania) ([105]) supported the implementation of national qualification schemes for installers of thermal insulating systems and high-efficiency window systems to ensure high-performance building envelopes and support the move to NZEBs.

2.7.6.3. Training and certification for experts

In Germany, a national list of energy efficiency experts for the federal government's support programmes in the field of energy efficiency is kept in order to improve local energy consulting services by means of:

(a) uniform qualification criteria;

(b) proof of regular advanced training; and

(c) random checking of results.

Slovenia has a common training/certification article in its legislation transposing the EED, the EPBD and the Renewable Energy Directive ([106]), and is achieving synergies through a coordinated modular training approach.

In Croatia, energy efficiency training programmes for architecture, construction and building services professionals have been running since 2009. The objective is also to improve knowledge among engineers, whose competencies enable them to approach construction work and buildings as a whole in terms of energy characteristics.

Member States could consider incorporating energy efficiency into curricula and programmes for the training of building sector professionals (e.g. engineers and architects) as part of their national educational policy.

2.7.7. *Estimate of energy savings and wider benefits — Article 2a(1)(g) of the EPBD*

Annex B, section 5 of the *NEEAP guidance* lists points that should be evaluated to produce an evidence-based estimate of expected energy savings and wider benefits.

The 2017 LTRSs from Cyprus, the Czech Republic, Finland, Lithuania, Romania and Sweden are good practice examples of efforts to quantify the wider benefits of building renovation ([107]).

([104]) http://finland.buildupskills.eu/
([105]) http://www.iee-robust.ro/qualishell/en/
([106]) 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).
([107]) *Assessment of second long-term renovation strategies under the Energy Efficiency Directive*, JRC Science for Policy report (2018).

The Horizon 2020 COMBI project ([108]) was aimed at quantifying the multiple non-energy benefits of energy efficiency in order to incorporate them into decision-support frameworks for policymaking. The project developed an online tool ([109]) able to visualise and where possible monetise the wider benefits of energy efficiency improvements. Eight of the 21 end-use energy efficiency improvement actions cover buildings ([110]).

There are several ongoing initiatives that aim to reduce whole life carbon. The French E+C- initiative is aiming at an energy carbon regulation for 2020. Finland has set out a roadmap towards low carbon construction. The aim is to implement regulatory life cycle CO_2 threshold limits for different building types by 2025. The impact analysis conducted by VTT, concludes that a total reduction 0,5 millions of tons of CO_2 could be reached in new building annually. It includes additional savings (on top of the revised NZEB energy-efficiency norms) based on the implementation of a full life cycle concept. This is close to 10 % of the overall shortage towards Finland's EU 2030 commitments. In Germany, on the federal level ('Bundesbauten'), new buildings owned by the federal governments have to follow sustainability guidelines. These guidelines are defined in the sustainability rating scheme 'BNB' (Bewertungssystem Nachhaltiges Bauen) and contains LCA calculation and benchmarks for new buildings. A good example on the local level is the London Mayors Environmental Policy, which refers to whole life carbon. Discussions are ongoing how to include the concept in London's central planning reference, due in 2019.

Other resources

— *Promoting healthy and highly energy performing buildings in the European Union* ([111]), JRC report (2017);

— World Health Organisation 'WHO housing and health guidelines' ([112]);

— BPIE study on EU-wide modelling focusing on health, wellbeing and productivity in schools, offices and hospitals ([113]).

2.7.8. *Mechanisms to support the mobilisation of investments — Article 2a(3) of the EPBD*

The following guidance relates to the types of financial mechanism to which Member States must facilitate access.

Another source of examples of successful schemes is Chapter 7 of *Good practice in energy efficiency* (referred to in Section 2.4).

2.7.8.1. Aggregation of projects

(a) The PadovaFIT! project ([114]) aims to retrofit multi-family buildings through energy performance contracting. It aggregates demand within a municipality by grouping all associated buildings to generate a critical mass, ensure favourable economic conditions and guarantee the quality of the work to be carried out by the bidders. Since 2014, the consortium has been engaging condominiums throughout the city of Padua (Italy) to build demand for energy retrofits. In the meantime, the municipality has procured a private ESCO, which will conclude a contract with each condominium, and then finance the energy retrofit, which will be paid for through the energy savings.

([108]) https://combi-project.eu/
([109]) https://combi-project.eu/tool/
([110]) The eight actions concern:
— residential refurbishment of the building shell + space heating + ventilation + space cooling (air-conditioning);
— residential new dwellings;
— residential lighting (all dwellings);
— residential cold appliances (all dwellings);
— non-residential refurbishment of building shell + space heating + ventilation + space cooling (air-conditioning);
— non-residential new buildings;
— non-residential lighting (all buildings); and
— non-residential product cooling (all buildings).
([111]) http://publications.jrc.ec.europa.eu/repository/bitstream/JRC99434/kj1a27665enn%281%29.pdf
([112]) https://apps.who.int/iris/bitstream/handle/10665/276001/9789241550376-eng.pdf?ua=1
([113]) http://bpie.eu/publication/building-4-people-valorising-the-benefits-of-energy-renovation-investments-in-schools-offices-and-hospitals/
([114]) http://www.padovafit.it/english/

(b) The MARTE project ([115]) developed deep energy retrofit investments in buildings in the healthcare sector in the Marche region (Italy). It involved a complex financing structure integrating public (ERDF) and private (ESCO/Energy Performance Contract) resources in a target-oriented way. It also laid the foundation for larger-scale replication in other healthcare structures (in the region and elsewhere in Italy) and in other sectors, such as social housing and waste management, in particular by capacity-building and promoting the Energy Performance Contract model.

(c) The ZagEE project ([116]) provided tailored project development assistance for an aggregated portfolio of energy efficiency and renewable energy investments in Zagreb (Croatia). It targeted the retrofitting of public buildings (city office buildings, primary and high schools, kindergartens, health centres, retirement homes, etc.) and public lighting. The funding scheme used budgetary resources, bank loans, and national and EU grants.

(d) Under the ESCOLimburg2020 ([117]) project, the public energy grid operator Infrax has developed an integrated service to accelerate the energy renovation of municipal buildings, covering all steps from audits to works implementation and finance. Over EUR 20 million has been invested in the refurbishment of public buildings.

(e) The PARIDE project is an excellent example of 'bundling' (in this case, for the renewal of public street lighting) without upfront investment costs for the municipalities concerned and with reduced transaction costs due to joint procurement procedures, for a EUR 25 million energy performance contracting programme for 33 municipalities in the province of Teramo (Italy).

(f) The CITYNVEST ([118]) project compared and produced guidance on innovative finance models for building renovation in Europe ([119]) in *A review of local authority innovative large scale retrofit financing and operational models* and *How to launch ambitious energy retrofitting projects in your region* ([120]), which focuses on 'one-stop shop' approaches to refurbishing public buildings.

2.7.8.2. Reducing the perceived risk of energy efficiency operations

(a) Standardising energy efficiency operations increases investor confidence. Protocols can be deployed to reduce performance risks and training can be organised on implementing the protocols and certifying projects. The Investor Confidence Project (ICP) Europe ([121]), supported by two Horizon 2020 projects (ICPEU and I3CP), develops standardised protocols and associated tools such as project development specifications. Through its stakeholder network, it provides project developers with technical assistance to certify projects and programmes as 'investor-ready energy efficiency' (IREE). It also works with financial institutions to help them incorporate IREE into their investment and lending procedures.

(b) The 'Standardisation and communication of sustainable energy asset evaluation framework' (SEAF) project ([122]) developed a holistic, IT-based platform for the valuation and benchmarking of smaller sustainable energy projects (on energy efficiency, demand response, distributed renewable energy generation, energy storage, etc.), thus bridging the gap between project developers and investors. It developed a tool (eQuad) ([123]) that integrates ICP protocols and includes valuation and optimisation, and risk assessment and transfer (insurance) components.

(c) The Energy-Efficient Mortgage Initiative aims to create a standardised, European-level 'energy-efficient mortgage'. The idea is to give preferential mortgages to building owners seeking to improve the energy efficiency of their buildings by taking account of the positive impact of energy efficiency on the building's value and on payment defaults. The pilot phase started in June 2018, with more than 35 banks committed to participating.

([115]) http://www.marteproject.eu/
([116]) http://zagee.hr/
([117]) http://www.escolimburg2020.be/en
([118]) http://www.citynvest.eu/home
([119]) http://www.citynvest.eu/content/comparison-financing-models
([120]) http://citynvest.eu/content/guidance-how-launch-ambitious-energy-retrofitting-projects-your-region
([121]) http://www.eeperformance.org/
([122]) https://www.seaf-h2020.eu/
([123]) https://www.eu.jouleassets.com/about-equad/

(d) There are ways of making energy efficiency attractive for institutional investors and supporting the refinancing of energy efficiency related assets. The Latvian Baltic Energy Efficiency Fund (LABEEF) provides ESCOs with long-term financing by forfaiting EPC contracts ([124]) and issuing green bonds for energy efficiency.

(e) The EUROPACE project ([125]) is developing a scalable on-tax financing mechanism, whereby the long-term repayment obligation relates to a property rather than its owner, and municipalities ensure repayment via a special levy collected with the property tax bill. On-tax financing mechanisms build on municipalities' existing relationships with their citizens (the property tax system) and have great potential to boost home renovation across income levels.

2.7.8.3. Public funding to leverage private-sector investment or address market failures

(a) Examples of loan schemes co-financed by public funds include:

(i) multi-apartment building modernisation funds (Lithuania) ([126]);

(ii) a combination of loans, technical assistance and grants for the renovation of multi-apartment buildings (Estonia) ([127]);

(iii) *Kreditanstalt für Wiederaufbau* (KfW) grants and loans for energy renovation (Germany) ([128]); and

(iv) SlovSEFF (Slovakia) ([129]).

(b) Examples of risk-sharing instruments (e.g. loans, guarantees and technical assistance) include:

(i) Private Finance for Energy Efficiency (PF4EE) ([130]); and

(ii) the Smart Finance for Smart Buildings guarantee facility (under development).

(c) Work is ongoing to produce an online EU mapping tool, to understand how public funds can be used to support energy efficiency in Europe.

(d) Examples of support for citizens' finance for energy efficiency through cooperation between local authorities and energy cooperatives include the Horizon 2020 REScoop PLUS ([131]) and REScoop MECISE ([132]) projects with partners from across the EU. The latter aims to channel at least EUR 30 million of renewable and energy efficiency investment, including co-investment by citizens and local authorities. It has established a revolving fund to enable the flexible pooling of project finance by cooperatives. *REScoop — municipality approach* ([133]) sets out guidance for public authorities on how to support citizens' investment in local sustainable energy projects.The German CF4EE platform Bettervest ([134]) is the world's first crowd-funding platform for energy-efficiency. It funds projects of companies, NGOs and local authorities and enables high returns in the cost savings. A defined percentage of the savings is distributed to the crowd until the investment plus a previously agreed upon profit has been paid back. SMEs, NGOs and local authorities can finance their energy saving projects and reduce their CO_2 emissions. The platform Bettervest gets a percentage of the overall funding.

(e) The QualitEE project ([135]) (an example of work on EU-wide quality standards on energy efficiency services) aims to scale up investment in building energy efficiency by establishing quality certification frameworks that go beyond the presentation of model contracts. It comprises standardised quality criteria, institutionalisation of the quality assurance process and active promotion schemes. Ultimately, it aims to build trust in energy efficiency services and providers by fostering a common understanding of 'good quality' services, and thus improve the financeability of investment programmes.

([124]) http://sharex.lv/en/latvian-baltic-energy-efficiency-facility-labeef
([125]) http://www.europace2020.eu/
([126]) http://www.vipa.lt/page/dnmfen
([127]) http://www.kredex.ee/en/apartment-association/
([128]) https://www.kfw.de/inlandsfoerderung/Privatpersonen/Bestandsimmobilie/
([129]) http://www.slovseff.eu/index.php/en/
([130]) http://www.eib.org/en/products/blending/pf4ee/index.htm
([131]) http://www.rescoop-ee.eu/rescoop-plus
([132]) http://www.rescoop-mecise.eu/
([133]) https://www.rescoop.eu/blog/rescoop-municipality-approach
([134]) https://www.bettervest.com/en/
([135]) https://qualitee.eu/

2.7.8.4. Guiding investments into an energy efficient public building stock

(a) Examples of assistance to facilitate the use of energy performance contracts include:

(i) contract market facilitators;

(ii) a framework contract to simplify contract procurement (UK);

(iii) practical guides on energy performance contracting;

(iv) projects such as TRUST-EPC-South, which set up a standardised approach allowing for the risk assessment and benchmarking of energy efficiency investments on an established real-estate assessment tool (Green Rating™); and

(v) the GuarantEE project ([136]), which aims to broaden innovative business and financing models for performance-based ESCO projects, addressing more complex environments, e.g. by making energy performance contracting more flexible so as to serve private-sector clients better or addressing rented facilities in 14 European countries.

(b) Examples of initiatives to use energy performance contracts and ESCOs for the renovation of public buildings include:

(i) RE:FIT (UK) ([137]);

(ii) EoL (Slovenia) ([138]);

(iii) 2020TOGETHER (Italy) ([139]);

(iv) PRODESA (Greece) ([140]); and

(v) RenoWatt (Belgium) (a partner of the H2020 Citynvest project) ([141]).

2.7.8.5. Accessible and transparent advisory tools

(a) Examples of the 'one-stop shop' approach or integrated service for the energy renovation of buildings include:

(i) *Energie Posit'If* (France) ([142]) for the refurbishment of condominiums;

(ii) *Picardie Pass Rénovation* ([143]) and Oktave ([144]) (France) for the deep renovation of detached houses; and

(iii) REFURB ([145]), REIMARKT (Netherlands) and the BetterHome initiative (Denmark) for building refurbishment.

The Innovate ([146]) project has carried out an analysis ([147]) of some of the best pilot models in Europe and the services they offer to homeowners.

(b) Member States can set up national sustainable energy investment platforms (e.g. ENERINVEST (Spain) ([148])) to:

(i) organise dialogue with and between key stakeholders;

(ii) develop roadmaps;

([136]) https://guarantee-project.eu/
([137]) https://www.london.gov.uk/what-we-do/environment/energy/energy-buildings/refit/what-refit-london
([138]) http://www.eib.org/attachments/documents/elena-completed-eol-en.pdf
([139]) https://ec.europa.eu/energy/intelligent/projects/en/projects/2020together
([140]) https://www.prodesa.eu/?lang=en
([141]) http://www.gre-liege.be/renowatt/25/renowatt.html (a programme for the renovation of public buildings to enhance energy efficiency by grouping smaller projects to remove technical, legal, administrative and financial barriers. https://ec.europa.eu/energy/sites/ener/files/documents/012_a2_erika_honnay_seif_dublin_28-09-17.pdf
([142]) http://www.energiespositif.fr/
([143]) https://www.pass-renovation.picardie.fr/
([144]) https://www.oktave.fr/
([145]) http://www.go-refurb.eu/
([146]) http://www.financingbuildingrenovation.eu/
([147]) *Inventory of best practices for setting up integrated energy efficiency service package including access to long-term financing to homeowners*, Vesta Conseil and Finance (2018).
([148]) https://www.enerinvest.es/en/

(iii) propose improvements to legal frameworks; and

(iv) develop and validate template documents and contracts, etc., to improve understanding of the market.

(c) General advisory services (e.g. FI-Compass ([149]), the European Investment Advisory Hub) can be set up and technical guidance can be produced on financing the energy renovation of buildings with Cohesion Policy funding ([150]).

(d) Smart Finance for Smart Buildings includes several Union-level initiatives to help Member States set up, and facilitate access to, appropriate mechanisms to support the mobilisation of investments in building renovation:

(i) Sustainable Energy Investments Forums initiative ([151]);

(ii) the ManagEnergy initiative ([152]);

(iii) European Local ENergy Assistance (ELENA) ([153]);

(iv) Horizon 2020: financing energy efficiency calls ([154]); and

(v) general advisory services, e.g. FI-Compass ([155]), the European Investment Advisory Hub ([156]).

2.7.9. *Indicators and milestones*

The renovation strategy impact framework being developed by Build Upon ([157]) may be helpful in illustrating how an integrated set of targets, milestones and indicators can frame an LTRS ([158]).

2.7.10. *Public consultation*

In developing policy and legislation, the Commission relies on a transparent process involving stakeholders (e.g. businesses, public administrations and researchers) and the general public. Its guidelines may be useful for Member States conducting their own consultations ([159]).

The EPBD requirements for consultation on the LTRS (in particular on its development) do not override any existing national obligations. Implementation of the EPBD will rely to a great extent on local initiatives and private financing, so civil society, local governments and the financial and investment sectors will play a valuable role, as will the building and construction industries. The EPBD also requires that Member States consult in an inclusive way during the implementation of the strategy.

([149]) https://www.fi-compass.eu/
([150]) https://ec.europa.eu/regional_policy/en/information/publications/guides/2014/financing-the-energy-renovation-of-buildings-with-cohesion-policy-funding
([151]) A series of public events and national roundtables in Member States, specifically dedicated to energy efficiency finance. Their proceedings present a unique and rich collection of successful front-running initiatives throughout Europe, in particular for the energy renovation of public and private buildings; https://ec.europa.eu/energy/en/financing-energy-efficiency/sustainable-energy-investment-forums
([152]) The 300+ energy agencies in the EU are important drivers and ambassadors for the local and regional energy transition: ManagEnergy supports them in their challenge, offering an in-depth training programme on the fundamentals and best practices of energy efficiency finance in Europe today; https://www.managenergy.eu
([153]) http://www.eib.org/en/products/advising/elena/index.htm
([154]) The updated work programme for 2018-2020 can be found here: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-energy_en.pdf
([155]) https://www.fi-compass.eu/
([156]) http://eiah.eib.org/
([157]) Build Upon is an EU-funded collaborative project on building renovation which brings together governments and businesses, NGOs and households from across 13 countries as a collaborative community to help design and implement national renovation strategies; www.buildupon.eu It aims to create a renovation revolution across Europe by helping countries to deliver strategies for renovating their existing buildings.
([158]) http://buildupon.eu/wp-content/uploads/2016/11/BUILD-UPON-Renovation-Strategies-Impact-Framework.pdf Build Upon notes that this framework is not an attempt to set out a best practice set of targets and impact indicators (which will require further work), but simply aims to frame the concept.
([159]) https://ec.europa.eu/info/sites/info/files/better-regulation-guidelines-stakeholder-consultation.pdf

The following broad principles, which are adapted from the UK government's guidance on consultation (and presuppose a questionnaire-based approach) ([160]), could be useful in the context of public consultation on the LTRSs and for monitoring their implementation ([161]):

(a) Consultations should be clear and concise

Be clear what questions you are asking and limit the number of questions to those that are necessary. Make them easy to understand and easy to answer. Avoid lengthy documents.

(b) Consultations should have a purpose

Take responses into account when taking policy forward. Consult on policies or implementation plans when their development is at a formative stage. Do not ask questions about issues on which you already have a final view.

(c) Consultations should be informative

Give enough information to ensure that those consulted understand the issues and can give informed responses. Where possible, include validated impact assessments of the costs and benefits of the options under consideration.

(d) Consultations are only part of a process

Consider whether informal iterative consultation is appropriate, using new digital tools and open, collaborative approaches. Consultation is not just about formal documents and responses. It is an ongoing process.

(e) Consultations should last for a proportionate amount of time

The length of the consultation should reflect the nature and impact of the proposal. Consulting for too long will delay policy development. Consulting too quickly will not give enough time and will reduce the quality of responses.

(f) Consultations should be targeted and inclusive

Consider the full range of stakeholders affected by the policy, and whether representative groups exist. Consider targeting specific groups if appropriate. Ensure they are aware of the consultation and can access it. Measure the participation of different stakeholder groups and engage in outreach to include as diverse a range of stakeholders as possible.

(g) Consultations should take account of the groups being consulted

Certain stakeholders may need more time to respond. Where the consultation spans all or part of a holiday period, consider what impact this may have and take appropriate mitigating action, such as prior discussion with key interested parties or extension of the deadline. Certain stakeholders such as persons with disabilities and older persons may require information in an accessible format (e.g. online consultation interface or alternative text formats).

(h) Consultations should be agreed before publication

Seek collective agreement before publishing a written consultation, particularly when consulting on new policy proposals.

(i) Consultation should facilitate scrutiny

Publish responses online on the same page as the original consultation and explain:

(i) how many responses have been received;

(ii) from whom they have been received; and

(iii) how they have informed the policy.

([160]) https://www.gov.uk/government/publications/consultation-principles-guidance
([161]) Other less technical, face-to-face public consultation methodologies may also be helpful.

(j) Responses to consultations should be published in a timely fashion

Publish responses within 12 weeks of the consultation or provide an explanation of why this is not possible. Allow appropriate time between closing the consultation and implementing policy or legislation.

Only a few Member States have documented the consultation process for their 2014 and 2017 LTRSs. However, Finland demonstrates good practice ([162]) in involving relevant actors at an early stage — this increases acceptance of jointly developed measures.

In the development of Finnish national building codes, professionals and major organisations in the field are consulted and take an active part in the work, through preliminary studies and consultation fora. Proposals for national definitions and guidelines for NZEBs are being developed with the active involvement of professional organisations in the construction, building design and planning fields.

Building owners' and building maintenance organisations are also involved in developing national transposition rules on energy performance contracts and disseminating the contracts. Cooperation with the building and construction sectors and the active involvement of field professionals have ensured a high degree of compliance with laws, decrees and building codes.

In other sectors, organisations have found innovative ways to come together and solve problems. BUILD UPON's resource library ([163]) documents the experience of innovative multi-stakeholder dialogue processes from other sectors which have helped create a culture of collaboration.

2.7.11. *Financial measures linked to energy savings — Article 10(6) of the EPBD*

In linking financial support to energy savings in Article 10(6) of the EPDB, Member States are encouraged to consider using their public funds more efficiently by granting more support for more effective results and less for less ambitious measures, e.g. by linking the financial advantage (percentage reduction of interest rate, percentage of grant component) to the results achieved (in terms of energy performance, expressed as energy consumption, or on the basis of the EPC rating). The KfW (Germany) uses this model effectively by giving progressively bigger interest rate discounts for projects that lead to higher levels of energy performance.

3. FRAMEWORK FOR CALCULATING BUILDINGS' ENERGY PERFORMANCE

Annex I to the EPBD sets out a common general framework for calculating buildings' energy performance and, inter alia, describing national methodologies. To meet the objectives of energy efficiency policy for buildings, EPCs should be made more transparent by ensuring that all necessary calculation parameters, both for minimum energy performance requirements and for certification, are set out and applied consistently. Annex I to the EPBD has been amended to update the framework accordingly.

3.1. Scope

Annex I to the EPBD has been amended by Directive (EU) 2018/844 in order to improve the transparency and consistency of the 33 different regional and national energy performance calculation methodologies in the following way:

(a) Point 1 better addresses how buildings' energy performance is to be determined and requires Member States to describe their calculation methodologies in line with energy performance of buildings (EPB) standards;

([162]) See: https://ec.europa.eu/energy/sites/ener/files/documents/5_en_autre_document_travail_service_part1_v4.pdf
([163]) https://kumu.io/WorldGBCEurope/build-upon-resource-library#build-upon-resource-library

(b) Point 2a allows for additional numerical indicators for the building's overall energy use or greenhouse gas emissions; and

(c) Points 3, 4 and 5 remain almost unchanged; the text 'where relevant in the calculation' has been deleted in paragraph 4, and calculations must take account of the positive influence of the factors listed therein.

Pursuant to Article 3 of the EPBD, Member States must adopt national methodologies for calculating buildings' energy performance. Its provisions, like those related to the calculation of cost-optimal levels (Articles 4 and 5 of the EPBD) ([164]), remain unchanged.

This section is structured to cover a number of the amended provisions of Annex I to the EPBD:

(a) the obligations to determine and express buildings' energy performance (the first two paragraphs of Point 1, the first paragraph of Point 2, and Point 2a of Annex I); and

(b) the obligation to describe national calculation methodologies transparently in line with EPB standards (third paragraph of Point 1 of Annex I).

The issue of the calculation of primary energy factors under Annex I to the EPBD is addressed in a separate recommendation on guidelines for the modernisation of buildings.

3.2. **Obligations to determine and express buildings' energy performance**

3.2.1. *Determining a building's energy performance — Annex I (point (1) to the EPBD*

In accordance with Annex I (point (1) to the EPBD, the energy performance of a building 'shall be determined on the basis of calculated or actual energy use and shall reflect typical energy use[s]'. This provision is not new. The word 'annual' is deleted in line with the definition of energy performance in Article 2 of the EPBD, making the obligation more flexible.

The revision updates typical energy uses in line with the extended definition of technical building systems (Article 2(3) of the EPBD) and the definition of energy performance (Article 2(4) of the EPBD). In particular, typical energy uses of a building include energy used for space heating, space cooling, domestic hot water, ventilation, built-in lighting and other technical building systems.

The definition of technical building systems has been extended to new areas, such as building automation and control, on-site electricity generation and energy from renewable sources. It is for Member States to decide whether, as a result, the calculation of energy performance should take account of other energy uses (in addition to space heating, space cooling, domestic hot water, ventilation and built-in lighting).

3.2.2. *Expressing a building's energy performance — Annex I (Point 1, second paragraph and point (2a) to the EPBD*

As Annex I (Point 1, second paragraph) to the EPBD provides that 'the energy performance of a building shall be expressed by a numeric indicator of primary energy use in kWh/($m^2 \cdot y$)' ([165]).

If the Member States choose to express energy performance as a ratio of primary energy consumption to a reference building's consumption or as a proportion of a reference building's primary energy use, they should clarify how this dimensionless approach relates to a numeric indicator of primary energy use in kWh/($m^2 \cdot y$).

([164]) EPB calculations for setting minimum energy performance requirements must follow the common methodology framework in 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).

([165]) In accordance with EN ISO 52000-1, when primary energy use is expressed, it must be specified whether it is total, non-renewable or renewable primary energy use.

Annex I (point (2a) to the EPBD allows Member States to consider the following additional numeric indicators:

(a) total, non-renewable and renewable primary energy use; and

(b) greenhouse gas emissions produced(which could be expressed in $kgCO_2eq/(m^2 \cdot y)$).

These indicators may be used in addition to, but not instead of, the common numeric indicator expressed in primary energy use ($kWh/(m^2 \cdot y)$).

Member States may apply other indicators (in addition to those referred to in point (2a) as appropriate, in order to describe energy performance more accurately. Again, such indicators cannot replace the common numeric indicator expressed in primary energy use ($kWh/(m^2 \cdot y)$).

Annex I (Point 1, second paragraph) to the EPBD requires that the primary energy use indicator be used for EPCs and to verify compliance with minimum energy performance requirements. It is highly recommended that Member States also use the same methodology for:

(a) calculating energy performance;

(b) verifying compliance with minimum energy performance requirements; and

(c) issuing EPCs.

However, where different methodologies are used, the results should converge sufficiently to avoid confusion as to a building's energy performance.

Point 4 requires that methodologies for calculating energy performance must take into account the positive influence of the factors that are subsequently listed (i.e. local solar conditions, electricity produced by cogeneration, district heating and cooling systems, and natural lighting ([166])). If a factor is not common in a particular Member State (e.g. climate conditions do not favour solar exposure; no district heating and cooling networks have been developed), consideration should nonetheless be given to whether it has a positive influence on the calculation methodology.

Annex I (Point 1, second paragraph) requires methodology applied for the determination the energy performance of a building to be transparent and open to innovation. This requirement applies to all elements that are part of the calculation, including:

(a) the energy needs of the building, which are the starting point for the calculation of energy performance;

(b) the resulting total primary energy demand from the breakdown of energy needed to cover the uses through national primary energy factors (PEFs);

(c) renewable energy produced on-site and supplied through an energy carrier (pursuant to Point 2, fourth paragraph, this must be treated consistently and on a non-discriminatory basis);

(d) the use of EPB standards;

(e) the best combination of energy-efficiency and renewable measures, which are at the core of the EPBD; and

(f) consideration of national indoor air quality and comfort levels in the calculation of energy performance for different building types ([167]).

3.2.3. *Transposition measures and recommendations*

The main aim of amending Point 1, first and second paragraphs and inserting Point 2a is to clarify current obligations. Under these provisions, Member States are required to:

(a) determine buildings' energy performance on the basis of calculated or actual energy use;

([166]) EN 12464-1 provides specifications of lighting requirements for humans in indoor work places including visual tasks, while EN 15193 provides specifications of calculation procedures and metrics related to the energy performance of buildings. A new European standard on 'daylight in buildings' (EN 17037, published by CEN on 12 December 2018) provides metrics and a methodology for the evaluation of daylighting conditions, which considers variations related to geographical and climatic differences in Europe.

([167]) Regulation (EU) No 244/2012, Annex III, Table 4: 'Each calculation should refer to the same comfort level. *Pro forma* each variant/package/measure should provide the acceptable comfort. If different comfort levels are taken into account, the base of the comparison will be lost'.

(b) determine the energy uses covered by the calculation of energy performance — these must include at least space heating, space cooling, domestic hot water, ventilation and build-in lighting;

(c) express energy performance in terms of primary energy use (kWh/(m² · y));

(d) use the indicator of primary energy use in kWh/(m² · y) for EPCs and to verify compliance with minimum energy performance requirements; and

(e) take account of the positive influence of local solar conditions, electricity produced by cogeneration, district heating and cooling systems, and natural lighting (in line with point (4).

Since these requirements are not entirely new and may already apply in national or regional legislative frameworks, it is suggested that Member States review their building codes and current calculation methodologies and ensure by the transposition date that their transposition measures cover any outstanding points.

Member States may also introduce the additional indicators to express the energy performance of a building referred to in Point 2a. Where additional indicators are defined alongside the required indicator on primary energy use, Member States should include all relevant information to support their use, e.g.:

(a) the unit to be expressed;

(b) whether they apply to all types of building, to new and/or existing buildings;

(c) whether they will be used for energy performance certification and/or to supplement minimum energy performance requirements; and

(d) the methodology for calculating them.

3.3. **Obligation to describe national calculation methodologies transparently**

3.3.1. *National calculation methodologies following EPB standards*

In response to the need for greater comparability and transparency, the EPBD requires Member States to describe their national calculation methodology in line with the national annexes to the overarching standards ([168]) developed by the European Committee for Standardisation (CEN) under mandate M/480.

Each standard has an 'Annex A' — a template providing choices as to specific methods (e.g. simple or more detailed) and (technical, policy or climate-related) input data. Annex A is considered a useful tool for Member States to describe their national calculation methodologies ([169]).

While Recital 40 of Directive (EU) 2018/844 recognises that the use of the EPB standards '[…] would have a positive impact on the implementation of the EPBD', Annex I to the EPBD makes clear that this is not meant to be a legal codification of those standards or to make them mandatory.

As before, Member States are free to adapt their national or regional calculation methodologies to their local and climatic conditions ([170]).

3.3.2. *Transposition measures and recommendations*

In accordance with Annex I, 'Member States must describe their national/regional calculation methodologies following the national annexes to the overarching standards'. Member States will have to meet this requirement at the latest by the transposition deadline, i.e. 10 March 2020 ([171]).

([168]) See section 3.4 for an explanation of the national annexes for the EPB standards (www.epb.center/implementation/national-annexes).

([169]) Annex A to an EPB standard is an empty template that can be filled in with national data and choices. If this Annex is filled in and published by a Member State, it is called a 'national data sheet'. If it is filled in and published by a national standardisation body, as part of the EPB standard, it is called a 'national annex'. There is no fundamental difference between Member States deciding to publish this 'national data sheet' as part of their building regulations or referring to the 'national annex', as published by their national standardisation body.

([170]) E.g. different climatic zones, the practical accessibility of energy infrastructure, local energy grids, different building typologies, etc. (i.e. continental and coastal conditions could differ significantly).

([171]) Article 3 of Directive (EU) 2018/844 requires Member States to communicate to the Commission how they have transposed or implemented new obligations imposed by the EPBD by the transposition deadline (20 months after the date of entry into force, i.e. 10 March 2020). As part of this communication, Member States will have to show that they comply fully with the obligation to describe their calculation methodologies according to the standards.

Member States have several options for notifying compliance with this obligation. One straightforward option is to include the filled-in annexes to the overarching standards when officially notifying the Commission of national measures transposing the EPBD.

In order to facilitate transparency and improve comparability, it is recommended that Member States make the description of their calculation methodologies publicly available, e.g. by uploading the filled-in templates to a website or annexing them to their building codes, etc. In such cases, they may notify the Commission of the publicly available source to prove that they have fulfilled the obligation.

Making the calculation methodology publicly available will also help Member States fulfil the requirement to ensure that '[t]he methodology applied for the determination of the energy performance of a building shall be transparent…' in Annex I (Point 1, second paragraph) to the EPBD.

Where a Member State adopts an EPB standard in full in national law (i.e. it uses the standard (as is) as part of its building regulations implementing the EPBD), it can choose:

(a) to ask its national standardisation body to develop a national annex based on the Annex A template — in that case, it could be considered to have fulfilled the obligation in Annex I to the EPBD in respect of that standard by publishing the national annex together with the national regulations requiring use of the standard in question; or

(b) to publish the filled-in Annex A as a national data sheet:

  (i) as a separate document referred to by the building regulations; or

  (ii) as an integral part of the building regulation implementing the EPBD.

The national annex or data sheet is then used to meet the requirements of the EPBD and facilitate the use of the standard at national level.

When EPB standards are not adopted in full by a Member State, then the Annex A of the standard should be used as a template to describe the national calculation methodology and national choices, ensuring compliance with the EPBD.

3.4. **Additional considerations**

While the general framework for the calculation of the energy performance focuses on the energy use of buildings, Member States may consider integrating other energy related aspects such as the embodied energy of the materials used during the life cycle of the buildings.

3.5. **Overarching EPB standards**

The following overarching EPB standards each describe an important step in the assessment of the energy performance of buildings:

(a) EN ISO 52000-1, Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures ([172]);

(b) EN ISO 52003-1, Energy performance of buildings — Indicators, requirements, ratings and certificates — Part 1: General aspects and application to the overall energy performance ([173]);

(c) EN ISO 52010-1, Energy performance of buildings — External climatic conditions — Part 1: Conversion of climatic data for energy calculations ([174]);

(d) EN ISO 52016-1, Energy performance of buildings — Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads — Part 1: Calculation procedures ([175]); and

(e) EN ISO 52018-1, Energy performance of buildings — Indicators for partial EPB requirements related to thermal energy balance and fabric features — Part 1: Overview of options ([176]).

([172]) https://epb.center/support/documents/m1-overarching-epb/iso-52000-1
([173]) https://epb.center/support/documents/m1-overarching-epb/iso-52003-1
([174]) https://epb.center/support/documents/m1-overarching-epb/iso-52010-1
([175]) https://epb.center/support/documents/m2-building-such/iso-52016-1
([176]) https://epb.center/support/documents/m2-building-such/iso-52018-1

4. SUMMARY OF RECOMMENDATIONS

4.1. LTRSs

(1) In their content and framework, the LTRSs are more comprehensive and ambitious than the strategies for mobilising investment that were required under Article 4 of the EED. Member States are encouraged to give careful consideration to the new elements (e.g. milestones, indicators, longer term vision, trigger points, worst-performing buildings, energy poverty and smart technologies), in order to ensure that the relevant policies and measures are as effective as possible. They are also encouraged to take account of safety issues and to reflect on the requirements of Article 8 of the EPBD as regards electro-mobility and technical building systems.

See sections 2.3.1 and 2.3.4.

(2) Member States are encouraged to take the necessary time, early in the process of preparing their LTRS, to establish a roadmap with measures, measurable progress indicators and indicative milestones for 2030, 2040 and 2050. Ambitious, realistic and clear milestones are key to reducing investor risks and uncertainties, and involving stakeholders and business in the implementation of the policies and measures covered by the LTRS. Work on meaningful indicators and milestones is also an upfront investment that will later support implementation of the policies and measures — and ultimately secure reductions in greenhouse gas emissions, the decarbonisation of building stocks and their cost-effective transformation, thereby helping to achieve the Union's energy efficiency targets.

See section 2.3.2.

(3) Member States' efforts to ensure access to a range of financial mechanisms to help mobilise investment will be central to LTRSs and their successful implementation. Member States are strongly encouraged to take into consideration the numerous examples of effective and successful mechanisms that are in operation elsewhere (see above). In addition, they are encouraged to avail themselves of the support and expert advice that is at their disposal under the SFSB initiatives, in particular (where one has not already been organised) a sustainable energy investment forum.

See sections 2.4 and 2.7.

(4) Strong LTRSs are expected to accelerate the cost-effective renovation of existing buildings, which are currently subject to a low renovation rate. The LTRS is not an end in itself, but a starting point for stronger action to be implemented on the ground and result in higher and deeper renovation rates. The evaluation of potential wider benefits of energy efficiency measures may enable a more holistic and integrated approach at national level, highlighting possible synergies with other policy areas and ideally involving government departments responsible for areas other than energy and buildings, such as the health, environment, finance and infrastructure departments.

See sections 2.3.1.7 and 2.7.7.

(5) Member States are encouraged to allow sufficient time to consult on the development and implementation of their LTRS. By involving the public, consultation can improve policy results. Member States may also consider setting up a stakeholder platform. Identifying and consulting stakeholders can contribute substantially to the successful implementation of the LTRS. The direct or indirect contribution of relevant stakeholders associated with the energy upgrade of buildings is also essential for the dissemination of the LTRS and for data collection and can create a sense of consensus and acceptance of the LTRS.

See sections 2.3.3 and 2.7.10.

(6) Member States are encouraged to ensure close collaboration between officials developing the LTRS and colleagues in other ministries working on the NECP, of which the LTRS forms an integral part.

See sections 2.6 and 2.7.

4.2. **Financial incentives and information**

(7) Member States are encouraged to consider carefully how to ensure that any financial measures for energy efficiency improvements in the renovation of buildings are linked to the targeted or achieved energy savings;

See sections 2.5.1 and 2.7.8.

(8) Member States are encouraged to set up databases (where they do not already exist) so that data can be gathered on the measured or calculated energy consumption of certain buildings and aggregated anonymised data can made available.

See section 2.5.2.

4.3. **Framework for the calculation of the energy performance of buildings**

(9) In revising their building codes and current calculation methodologies, Member States are encouraged to introduce the additional EPB indicators referred to in Point 2a. Where additional indicators are defined alongside the required indicator on primary energy use, they should include all relevant information to support their use, for example:

(a) the unit to be expressed;

(b) whether they apply to all types of building, to new and/or existing buildings;

(c) whether they will be used for energy performance certification and/or to supplement minimum energy performance requirements; and

(d) the methodology for calculating them.

See section 3.2.

(10) National calculation methodologies should be described transparently. In revising their building codes and current calculation methodologies, Member States are encouraged to introduce the additional EPB indicators referred to in Point 2a. Where additional indicators are defined alongside the required indicator on primary energy use, they should include all relevant information to support their use, e.g.:

(a) the unit to be expressed;

(b) whether they apply to all types of buildings, to new and/or existing buildings;

(c) whether they will be used for energy performance certification and/or to supplement minimum energy performance requirements; and

(d) the methodology for calculating them.

See section 3.3.

CORRIGENDA

Corrigendum to Commission Implementing Regulation (EU) 2018/939 of 26 June 2018 entering a name in the register of protected designations of origin and protected geographical indications ('Cidre Contentin'/'Contentin' (PDO))

(Official Journal of the European Union L 166 of 3 July 2018)

On the cover, in the table of contents, and on page 3, in the title, recitals 2 and 3, the first paragraph of Article 1, and in Article 2:

for: 'Contentin',

read: 'Cotentin'.

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