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Assessment of the first long-term renovation strategies under the Energy Performance of Building Directive (Art. 2a)

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Contents

Abstract

The report assesses the Long-term Renovation Strategies (LTRS) submitted by Member States between 2020 and 2022 (LTRS 2020) in compliance with Article 2a of the Energy Performance of Building Directive (EU 2018/844). The EBPD sets out a framework for LTRSs to support the renovation of national buildings stocks into highly energy-efficient and decarbonised building by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings. The report present the results of the assessment of the LTRSs and evaluation of the strategies' compliance with the Directive and checks if all the requirements were adequately addressed in each national strategy.

Acknowledgements

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Executive summary

Policy context

It is necessary and urgent to intervene on the building sector for reaching the EU's carbon neutrality, energy efficiency and renewable energy objectives. The EU should reduce buildings' greenhouse gas emissions by 60%, their final energy consumption by 14% and energy consumption for heating and cooling by 18%[1] in order to achieve the net 55% emission reduction target by 2030. The abovementioned objectives will remain unattainable with the current level of energy renovation rate, which is as low as about 1% per year[2].

National long-term building renovation strategies are key policy and planning instruments intended to support the transformation towards a highly efficient and decarbonised building stock by 2050. The entry into force of the Energy Performance of Buildings Directive (EPBD) revisions in 2018[3] implied transferring the provisions on long-term renovation strategies, formerly in Article 4 of the Energy Efficiency Directive (EED), to a new Article 2a in the revised EPBD, strengthened with a number of additional requirements[4].

More recent policy developments confirmed and reinforced the importance of these increased requirements. In the framework of the European Green Deal ambitions[5], the Commission adopted in October 2020 the 'Renovation Wave for Europe' initiative[6] with the objective to at least double the annual energy renovation rate of residential and non-residential buildings by 2030 and to foster deep energy renovations.

Main findings

The compliance assessment shows a positive picture. All strategies could be considered as compliant except for the very last two Art 2a provisions. Indeed the majority of Member States (MS), did not provide supporting evidence on those specific points (i.e. 'public consultation' and 'latest LTRS implementation details'). The results change by including these two provisions in the analysis, and the assessment identified different levels of compliance for MSs, but still only 3 strategy updates were considered non-compliant.

Overall, the highest-scored renovation strategy as regards compliance is the one from Spain (36/40 – 89% of total possible points), followed by the one from Belgium Wallonia (35/40 – 88%), Finland (33/40 – 83%), Italy and Lithuania (30/40 – 75%).

a) Compliance

The overall level of compliance of the strategies is synthetized in four different categories determined based on the criteria and scores indicated below:

- NON-COMPLIANT: two requirements or more of Article 4 are either missing or considered unsatisfactorily covered (i.e. score = 0 or 1);
- NOT FULLY COMPLIANT: if the strategy is not compliant with only one requirement of Article 4 failed (i.e. 0 or 1), and/or at least three requirements assessed to be inadequate/partially compliant (i.e. score = 2);
- ALMOST FULLY COMPLIANT: if it has been assessed to be inadequate/partially compliant (i.e. score = 2) for maximum two requirements;
- FULLY COMPLIANT; if the strategy meets all the basic requirements (all the scores ≥ 3) for all the requirements.

The results below present the compliance assessment, including also shortages in the last two Art 2a provisions

Non-compliant strategies

According to our analysis, only three renovation strategies out of twenty-nine, do not meet the basic requirements of EPBD Article 2a. This means that in these strategies at least two mandatory requirements have been evaluated

[1] Compared to 2015 levels, see SWD (2020) 176 final.
[2] https://publications.jrc.ec.europa.eu/repository/handle/JRC122143
[3] 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 was published in the EU Official Journal (L156) and entered into force on 9 July 2018. Member States will have to transpose the directive into national law by 10 March 2020.
[4] Annex A reports a detailed list of EPBD Art 2a provisions.
[5] COM (2019) 640 final: The European Green Deal. The overall objective is to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy, with no net emissions of greenhouse gases in 2050. In its Climate Target Plan 2030 (COM(2020) 562 final) the Commission has further proposed to cut net greenhouse gas emissions (GHG) in the EU by at least 55% by 2030 compared to 1990.
[6] COM(2020) 662 final

to be insufficiently covered (score <2). This is the case of the strategies provided by the following Member States: Belgium Brussels, Czechia, and Slovenia, that did not sufficiently address the last 2 mandatory clauses (i.e. 'public consultation' and 'latest LTRS implementation details').

Non-fully compliant strategies

Thirteen strategies are deemed to be not fully compliant with Article 2a; all of them have been evaluated as not compliant only in one of the mandatory requirement of Article 2a (i.e. to provide latest LTRS implementation details'). These are the strategies from: Austria, Croatia, Estonia, France, Germany, Greece, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal and Romania.

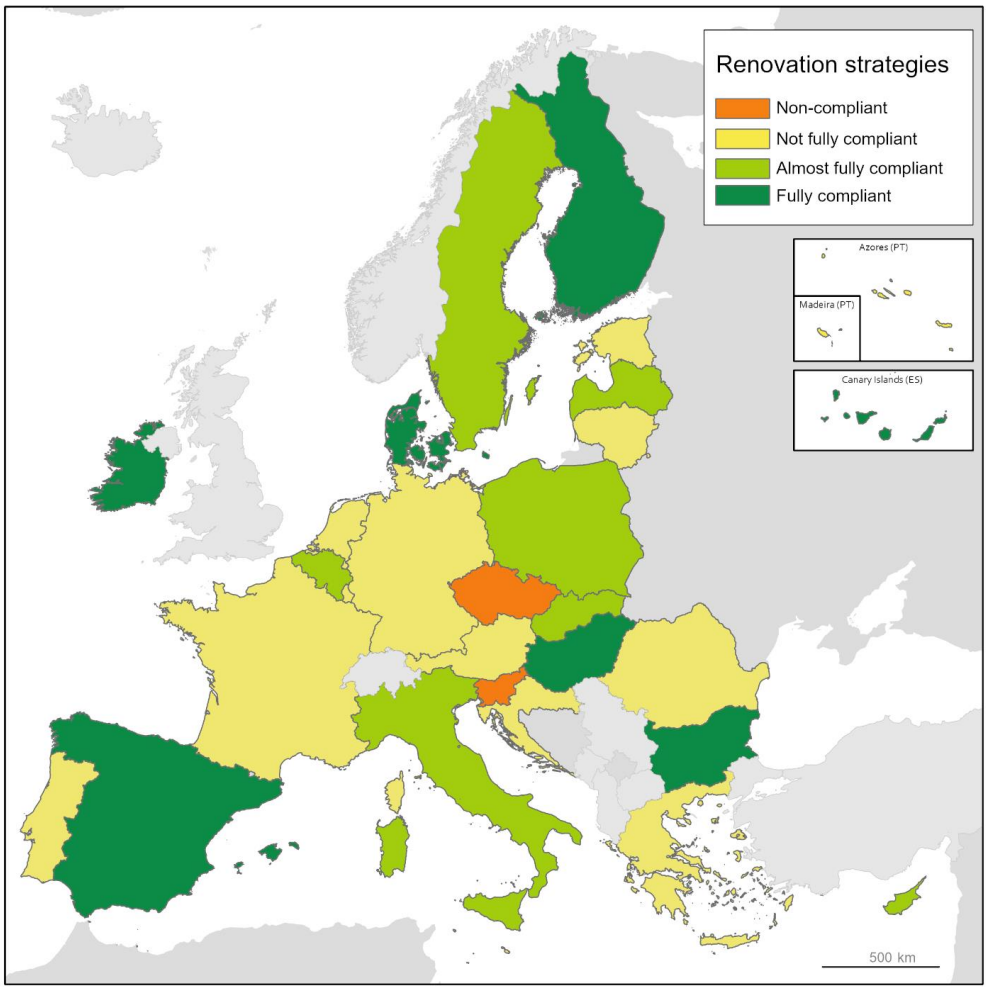
Almost fully compliant strategies

Seven strategies have been evaluated as 'Almost fully compliant'; it means that they have been assessed to be partially compliant (i.e. score=2) for maximum two requirements: Belgium Wallonia, Flanders, Cyprus, Italy, Latvia, Slovakia and Sweden.

Fully compliant strategies

Six strategies were assessed as 'Fully compliant' to requirements of Article 2a: Bulgaria, Denmark, Finland, Hungary, Ireland and Spain.

Figure 1. Compliance evaluation of the 2020 long-term renovation strategies.



Source: JRC 2022

b) Recommendations

The submission of the strategies has been delayed in the majority of the cases, with only five MSs[7] (i.e. FI, NL, BE-Brussels, DK and SE) respecting March 2020 deadline. Nearly 40% of the total LTRS (11 out of 29) were submitted only in the course of 2021[8] or later. The delays, partly due to the exceptional and unexpected circumstances of the COVID-19 emergency are expected to negatively affect the comparability among the plans elaborated in different Member States. Latecomers had indeed the possibility to elaborate further their documents and include in their strategy also considerations linked to the COVID-19 crisis and the latest EU policy initiatives, such as the Renovation Wave. Whenever possible the assessment took into account the different contexts and timing when each strategy was drafted and submitted.

Member States provided a reasonably detailed description of their building stock, with all the strategies assessed as fully compliant for this clause (score ≥3). Recognising the improvements in comparison with LTRS submitted in the past (Castellazzi et al., 2019), the assessment of the strategies on this specific provision underlined once more **the need and importance of a more uniform approach: guidelines and harmonised templates should be further improved and used by MSs in their reporting**. This would foster comparability and a structured approach in the description of the existing building stock helping in the definition of more tailored actions.

As already mentioned, the provision of the details of the implementation of the latest LTRS (Article 2a.6) is the one worst addressed by MS, with only 8 out of 29 strategies providing clear information on the implementation of the 2017 LTRS measures and actions. Policies monitoring and evaluation of implemented polices have a key role in the design of new measures and fine-tuning of the existing ones, and this very low performance may indicate that MSs misunderstood this new requirement.

Also the obligation to carry out a strategy public consultation was poorly addressed by Member States. As the LTRS should be the reference document for the transformation of national building stock towards 2050 decarbonisation, a comprehensive consultation of the public involving all relevant stakeholders is fundamental.

As indicated in the Renovation Wave Communication[9], tackling energy poverty and worst-performing buildings is one of the area that deserve specific attention. Member States seem to have recognised the importance of energy poverty and in general, the actions and measures proposed appears adequate. All but one strategy include specific measures to address energy poverty in their LTRS.

EPBD Article specifically requires MSs to provide an evidence-based estimate of expected energy savings and wider benefits. The reviewed LTRSs well understood the importance of this provision, including in all the strategies a specific section to discuss expected energy savings and multiple benefits, such as the one related to health, indoor air quality, and positive economic impacts. Nevertheless, in half of the cases, MSs did not provide a quantification of the potential wider benefits.

As a final remark, it can be noted that while the compliance of the strategies, excluding the last two clauses, is generally high, the SWD "Analysis of the national long-term renovation strategies"[10], which complements the analysis of this Report, highlighted that the level of ambition of LTRS is not always in line with the 2050 decarbonisation goals.

This may suggest the opportunity for a revision of the Directive that reinforces MSs strategic planning and reporting tools to make them more focussed on actions, with clear, quantified, comparable and verifiable indication of objectives, milestones and resources. Improving template harmonization and providing additional support to MSs on the less addressed points of the LTRSs (e.g. progress monitoring, public consultation), are also important steps in the road to the 2050 building stock decarbonisation goal.

Quick guide

The EPBD, in its Article 2a, requires Member States to establish a comprehensive strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings.

[7] FI, NL, BE-BCR, DK, and SE. Denmark provided an additional document to complement the strategy in August 2021.
[8] PL submitted its strategy in 2022.
[9] COM(2020) 662 final.
[10] See SWD(2021) 365 final/2: Analysis of the national long-term renovation strategies.

The structure of the report is as follows. Chapter 2 presents the assessment methodology. The results of the general assessment of the 29 renovation strategies received by the Commission are presented in Chapter 3. In Chapters 4 to 12 the compliance of the strategies against each of the requirements of Article 2a is analysed in detail. Chapter 13 concludes and suggests recommendations. The Annexes appended to the report present, the EPBD Art.2a provisions, summaries of the 29 renovation strategy evaluations and the policies and measures to address energy poverty identified in the LTRSs.

1 Introduction

National long-term building renovation strategies are key policy and planning instruments intended to support the transformation towards a highly efficient and decarbonised building stock by 2050. The entry into force of the Energy Performance of Buildings Directive (EPBD) revisions in 2018[11] implied transferring the provisions on long-term renovation strategies, formerly in Article 4 of the EED, to a new Article 2a in the revised EPBD, strengthened with a number of additional requirements[12].

A roadmap must underpin long-term strategies, establishing measures and quantifiable progress indicators. The measures included must facilitate the cost-effective transformation of existing buildings into nearly zero-energy buildings. The indicators will help assessing progress towards the long-term 2050 goal of reducing greenhouse gas emissions in the Union by 80-95%, compared to 1990.

Member States must also define indicative milestones for 2030, 2040 and 2050 and must specify how they contribute to achieving the Union's energy efficiency targets set out in the Energy Efficiency Directive (Directive 2012/27/EU). Finally, to support the mobilisation of investment for renovation, Member States must facilitate access to mechanisms for the aggregation of projects, the reducing of the perceived risk of energy efficiency operations for investors, the use of public funding to leverage additional private-sector investment, guiding investments into an energy efficient public building stock, and accessible and transparent advisory tools. The Commission's "Smart Finance for Smart Buildings initiative" further support these provisions.

Long-term renovation strategies must also explicitly include national actions to alleviate energy poverty.

The strategies have to undergo public consultation before submission to the European Commission, being this consultation as inclusive as possible.

More recent policy developments confirmed and reinforced the importance of these changes and increased requirements, as well as the centrality of the long-term renovation strategies. In the framework of the European Green Deal ambitions[13], the Commission adopted in October 2020 the 'Renovation Wave for Europe' initiative[14] with the objective to at least double the annual energy renovation rate of residential and non-residential buildings by 2030 and to foster deep energy renovations.

It is indeed necessary to intervene on the building sector for reaching the EU's carbon neutrality, energy efficiency and renewable energy objectives. The EU should reduce buildings' greenhouse gas emissions by 60%, their final energy consumption by 14% and energy consumption for heating and cooling by 18%[15] in order to achieve the net 55% emission reduction target by 2030.

Approximately three out of four existing buildings in the EU were constructed before current energy requirements were in place and it is estimated that almost all of them (85-95%) will still be in use by 2050. The abovementioned objectives will remain unattainable with the current level of energy renovation rate, which is as low as about 1% per year[16].

In addition to climate, environmental goals and mitigation of energy expenditures, investing in building renovation can inject a much-needed stimulus in the construction sector and the broader economy, with a positive impact on GDP and employment[17]. Several studies recognised that building renovations bring also other wider benefits, both at societal and individual/micro level such as health[18], productivity, innovation, energy security, and inclusiveness, which are mutually reinforcing in a virtuous process[19].

[11] 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 was published in the EU Official Journal (L156) and entered into force on 9 July 2018. Member States will have to transpose the directive into national law by 10 March 2020.
[12] Annex A reports a detailed list of EPBD Art 2a provisions.
[13] COM (2019) 640 final: The European Green Deal. The overall objective is to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy, with no net emissions of greenhouse gases in 2050. In its Climate Target Plan 2030 (COM(2020) 562 final) the Commission has further proposed to cut net greenhouse gas emissions (GHG) in the EU by at least 55% by 2030 compared to 1990.
[14] COM(2020) 662 final.
[15] Compared to 2015 levels, see SWD (2020) 176 final.
[16] https://publications.jrc.ec.europa.eu/repository/handle/JRC122143.
[17] Renovation works are labour-intensive, create jobs, and make investments often rooted in local supply chains. They generate demand for highly energy-efficient and renewable equipment and professional works and services, which improves the long-term market and quality value of properties. This can be very valuable for a sector where more than 90% of operators are SMEs, severely affected by the COVID-19 crisis.
[18] https://publications.jrc.ec.europa.eu/repository/handle/JRC129218.
[19] https://publications.jrc.ec.europa.eu/repository/handle/JRC120683.

With the Communication on the Renovation Wave, the EU seeks also to contribute to Europe's just transition stressing the importance of retrofitting of social and affordable housing, addressing the urgency of tackling energy poverty and worst-performing buildings.

The Renovation Wave also highlighted the importance and opportunity to link building energy renovations to other structural interventions. In particular, it calls for considering removing accessibility barriers for people with disabilities and the elderly, ensuring high air quality and good water management, removing of and protect against harmful substances, focussing on disaster prevention and protection against climate-related hazards, fire, and seismic risks.

With last July's proposal to revise the Energy Efficiency Directive, the Commission proposes to enhance the exemplary role of the public sector by introducing an annual renovation obligation of 3 % for public buildings and the revision proposal of the Renewable Energy Directive (COM/2021/557) presented in 2021, also foresees a new benchmark of 49% RES use in the building sector by 2030[20]. In addition, a legislative proposal revising the Energy Performance of Buildings Directive (EPBD) was adopted on 15th December 2021. One of the most important elements of this revision is to reinforce the role of national planning instruments for implementing the overall objective of the Directive towards a decarbonised building stock by 2050. Based also on the experience and recommendations in JRC previous assessment and in the present report, the legislative proposal notably reinforces the long-term renovation strategies (to be renamed national renovation plans) and the comparability of the data submitted by Member States, by introducing a harmonized template[21]. As an additional important piece of the Fit for 55 package, the revision proposal of the Renewable Energy Directive.

The COVID-19 crisis accelerated the need to rethink, redesign and modernise EU buildings, and to integrate renewables into their technical heating, cooling and electrical systems to make them fit for a greener and digital society. Building renovation is indeed a unique opportunity to foster economic recovery and resilience and it plays a central role in MSs' Recovery and Resilience Plans[22]. Nearly all Member States are using the Recovery and Resilience Facility funds[23] for investments in building renovation and clean transport, and many are using it to invest in renewable energy. In this context, Member States have significantly built on the 'flagship initiatives' put forward by the Commission[24], in particular the 'Power up', 'Renovate' and 'Recharge and refuel' flagship initiatives. The Commission also adopted an assessment module on building renovation and energy efficiency to give Member States practical guidance on how to prepare reforms and investment projects for renovation under the Recovery and Resilience Facility[25].

Following-up and building upon previous evaluations of the first and second building renovation strategies, published by the JRC in 2016 and 2019 respectively (Castellazzi et al. 2016 and 2019), this study provides an in-depth assessment of the LTRS compliance to the EPBD requirements. JRC detailed assessment of the LTRS is at the basis of the SWD "Analysis of the national long-term renovation strategies" and the current report complements the analysis already illustrated in that document.

As of February 2022, all 27 Member States submitted their LTRS. Belgium submitted 3 separate regional strategies: for this reason, the strategies analysed are 29 in total. The submission has been delayed in the majority of the cases, with only five MSs[26] respecting the 10 March 2020 deadline. Figure 1 shows that nearly 40% of the total LTRS (11 out of 29) were submitted only in the course of 2021 or later[27].

The delays, partly due to the exceptional and unexpected circumstances of the COVID-19 emergency could affect negatively the comparability among the plans elaborated in different Member States. Latecomers had indeed the possibility to elaborate further their documents and include in their strategy also considerations linked to the COVID-19 crisis and the latest EU policy initiatives, such as the Renovation Wave. Whenever possible the assessment took into account the different contexts and timing when each strategy was drafted and submitted[28].

[20] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0557&from=EN

[21] These changes and their impacts as the scope will be analysed in future reports, of the current report is limited to the assessment on LTRS submitted before the latests EPBD revisions.

[22] See SWD(2021) 365 final/2: Analysis of the national long-term renovation strategies.

[23] The Recovery and Resilience Facility, which the European Council agreed to endow with EUR 672.5 billion, 37% of which is targeted to climate-related expenditure, supports renovation investment and energy efficiency related reforms across Member States.

[24] Annual Sustainable Growth Strategy 2021, COM(2020) 575 final, 17 September 2020, section IV.

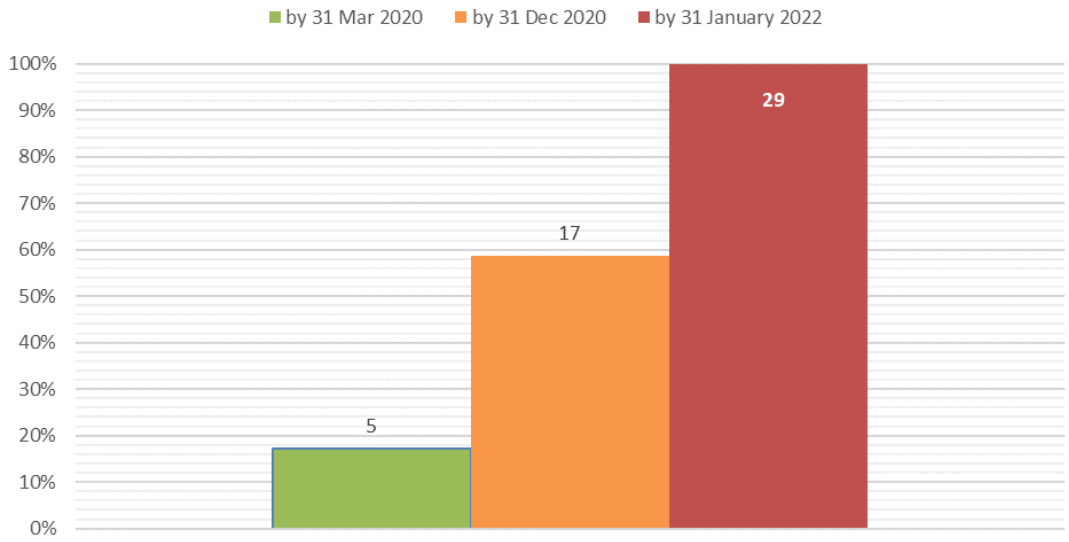
[25] https://ec.europa.eu/info/sites/info/files/component_renovation.pdf

[26] FI, NL, BE-BCR, DK, and SE. Denmark provided an additional document to complement the strategy in August 2021.

[27] Poland submitted its LTRS in January 2022.

[28] For BPIE (2020) these delays may also indicates that many MSs does not seem to recognise the urgency of actions in the building sector and fail in giving it the necessary priority. They also stressed that delayed submissions hampered and slowed down the work of the European Commission, that would have needed a clearer and full picture of MS plans much earlier, especially as input to the Renovation Wave Communication.

Figure 2. Submission time of the LTRS (cumulative % and n. of submitted strategies).



Source: JRC 2022

2 Methodology

As in the assessment of the first and second Member States' long-term renovation strategies (Castellazzi et al., 2016 and 2019), this JRC report focus mainly on compliance aspects: evaluating how the 2020 strategies comply with the provisions of EPBD Article 2a.

The evaluation template used for the compliance assessment follows the structure indicated in the Commission's recommendation on building renovation[29].

In particular, this recommendation specifies the areas that Member States are requested to address under each of EPBD Article 2a requirements and provides guidelines on how to comply with them.

All the strategies have been evaluated against all the EPBD requirements, grouping the clauses in 8 different sections, that have been scored assessing to which extent the clauses have been addressed from a compliance perspective (see table 1).

Table 1. Art.2a requirements and clauses grouping

	LTRS Sections	**EPBD clauses**
1	National Building Stock, and expected share of renovated building	Art.2a.1a
2	Cost-effectiveness approaches of renovations, including trigger points identification	Art.2a.1b
3	Policies and actions on deep renovations of building, including staged deep renovation and building renovation passports	Art.2a.1c Art.2a.1d Art.2a.1e Art.2a.1f
	Policies and action on worst-performing buildings and energy poverty	
	Policies and action on public buildings	
	Overview of national initiatives to promote smart technologies and skills and education in the construction and energy efficiency sector	
4	Evidence-based estimate of expected energy savings and wider benefits	Art.2a.1g
5	Building renovation milestones for 2030, 2040, and 2050 and progress indicators	Art.2a.2
6	Mechanisms for Mobilisation of investments, through: the aggregation of projects, and packaged solutions, the Reduction of the perceived risk for investors, the use of public funds to leverage private-sector investment or address specific market failures, guiding investments into an energy efficient public building stock and Accessible and transparent advisory tools (e.g., one-stop-shops)	Art.2a.3
7	Summary of the results of the strategy public consultation	Art.2a.5
8	Implementation details of the latest Long-term renovation strategy	Art.2a.6

Source: JRC 2022

The assessment tried to balance, in line with the needs of DG ENER, the different sections grouping them by topic when opportune. Point 3 and 6, indeed synthesise under one final score different clauses, as they all refer to policies, measures (point 3) and mechanisms for mobilization of investments (point 6). Also in the MSs' LTRS these aspects have been sometimes treated together.

In some sections of the evaluation template, numerical information is collected and showed, while other sections report more qualitative information gathered in the review of the national strategies. For some sections, information on the presence/absence of a specific element (e.g. the optional information on fire safety and risks related to intense seismic activity (Art2a.7), with comments, when necessary.

In this case, it has been assessed if these information has been reported in detail (Yes), partially (Partial) or not reported (No).

The evaluation template used for this assessment exercise is included as Annex C to the present report, together with all the evaluation country fiches.

The evaluation and discussion of Member States' building renovation policies are beyond the scope of this study. Therefore, only the information provided by Member States in their submitted renovation strategy documents has been reviewed and evaluated. They have been complemented, when necessary, by official information retrieved from the 2020 National Energy and Climate Plans (NECPs), Third party information, as well as information retrieved from other official and unofficial sources has not been taken into account unless when explicitly indicated by Member States in their strategy documents.

The scores in this exercise reflect the extent to which a clause has been addressed by MS in terms of compliance. They do not have to be considered as an evaluation of the appropriateness, impact, efficacy, or effectiveness of a specific approach. The report aims to present the evidence of the national strategies and does not assess the level

[29] Commission Recommandation (EU) 2019/798, notified under document C(2019) 3352.

of ambition of each strategy in presenting the national roadmap towards the decarbonisation of the building stocks by 2050. The report does not imply a policy position of the European Commission nor interferes with compliance legal check performed by DG ENER.

In some cases, in agreement with DG ENER, Member States (e.g. DK) sent additional documents several months after the first submission: in these cases, the assessment has been revised accordingly.

In order to be consistent with previous JRC studies (Castellazzi et al., 2016 and 2019), in the appraisal of the strategies each section was scored on a 0-5 scale, where:

0 = MISSING – the item is not covered at all, or only described in another source;

1 = UNSATISFACTORY – only the most cursory coverage of the item;

2 = INADEQUATE or PARTIALLY COMPLIANT– item addressed poorly, with insufficient detail, or with important aspects missing;

3 = ADEQUATE – meets the basic minimum requirements;

4 = GOOD – topic is described in some detail;

5 = EXCELLENT – exemplary coverage of the topic.

In addition to compliance with the requirements of Article 2a of the EPBD and level of detail, the assessment considered other criteria:

- Level of details/Appropriateness/Comprehensiveness: to assess to what extent the indicated measures are contributing to the objectives of the strategy and whether they are sufficient detailed and appropriate to reach them;
- Identification of good practices: e.g. measures with high impact, high efficiency and/or innovative.

The assessment exercise also identified and formulated recommendations for each strategy.

Four different categories are set up to indicate the level of the overall compliance of the strategies; these have been determined based on the criteria reported below:

NON-COMPLIANT: two requirements or more of Article 4 are either MISSING or UNSATISFACTORY covered (i.e. scores 0 or 1);

NOT FULLY COMPLIANT: if the strategy is not compliant with only one requirement of Article 4 failed (i.e. 0 or 1), AND/OR at least three requirements assessed to be INADEQUATE/PARTIALLY COMPLIANT (i.e. score = 2);

ALMOST FULLY COMPLIANT: if it has been assessed to be INADEQUATE/PARTIALLY COMPLIANT (i.e. score = 2) for maximum two requirements;

FULLY COMPLIANT; if the strategy meets all the basic requirements (all the scores ≥ 3) for all the requirements.

3 Assessment of the compliance with EPBD Art.2a mandatory elements

According to the methodology and the scoring system described in Chapter 2, each strategy has been evaluated against the all the mandatory requirements of EED Article 2a.

Table 2 presents the results of the evaluation of each long-term renovation strategy against the requirements of the EPBD, synthesised in 8 scores.

The colour coding of the first column of table 1 reflects the assessment as follows:

RED = Non-compliant strategy; two requirements or more of Article 4 are either MISSING or UNSATISFACTORY covered (i.e. scores 0 or 1);

YELLOW = Strategy not fully compliant; the strategy is not compliant with only one requirement of Article 4 failed (i.e. 0 or 1), AND/OR at least three requirements assessed to be INADEQUATE/PARTIALLY COMPLIANT (i.e. score = 2);

LIGHT GREEN = Strategy almost fully compliant; it has been assessed to be INADEQUATE/PARTIALLY COMPLIANT (i.e. score = 2) for maximum two requirements;

GREEN= Strategy fully compliant; the strategy meets all the basic requirements (all the scores ≥ 3) for all the requirements.

Tables 2 and 3 present, respectively, the compliance status (Yes/Partial/No) of all Article 2a clauses and the scores.

Table 2. Compliance summary table.

Clause	AT	BCR	FL	WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
1a	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1b	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y
1c	Y	Y	Y	Y	Y	P	Y	P	Y	Y	Y	Y	Y	P	P	Y	Y	P	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y
1d	Y	Y	Y	Y	P	Y	P	P	Y	P	Y	P	Y	P	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P
1e	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	P	P	Y	Y	Y
1f	Y	Y	Y	Y	Y	Y	P	Y	Y	P	Y	Y	Y	P	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y
1g	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P
3	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	P	N	P	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	P	Y	Y	N	Y	Y
6	N	N	Y	P	Y	N	P	N	Y	N	Y	N	N	N	Y	Y	P	P	N	N	N	N	P	N	N	P	N	Y	Y

Source: JRC 2022

Table 3. Compliance with EPBD Art.2a requirements with individual evaluations (scores)

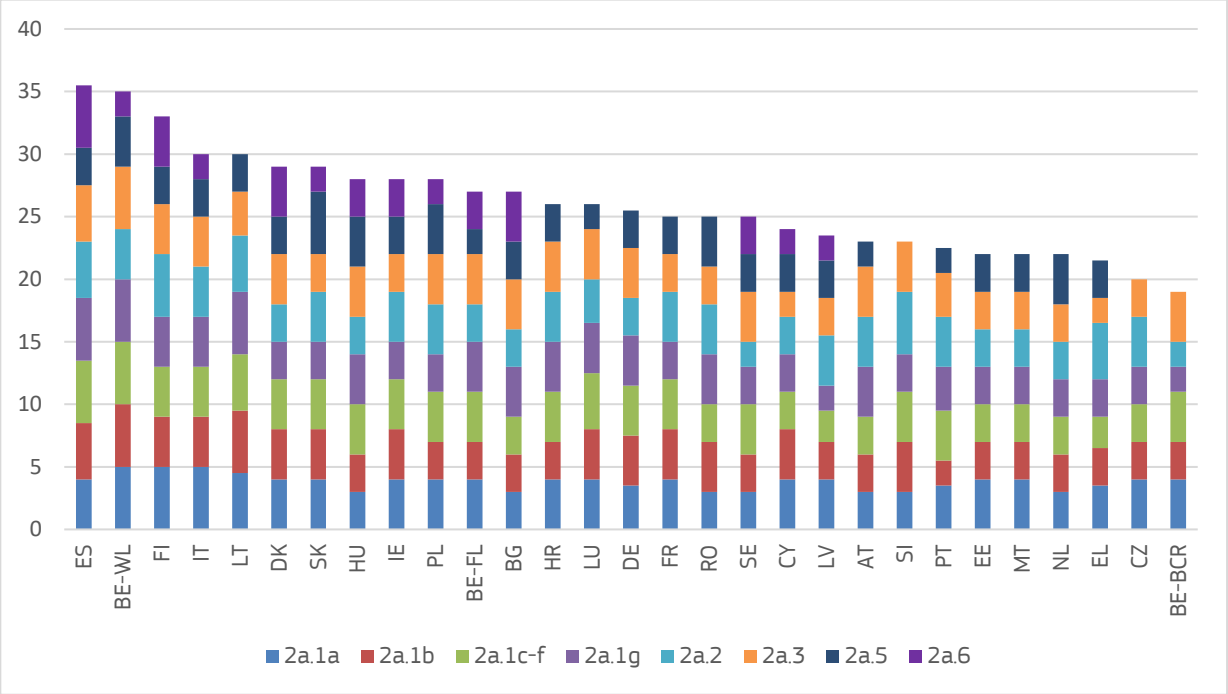
Member State	Building stock overview Art 2a.1a	Cost-effective approach to renovation Art.2a.1b	Policies and actions 2a1c-f	Expected energy savings and wider benefits Art.2a.1g	Roadmap with indicative milestones Art.2a.2	Mechanism for mobilising investments Art.2a.3	Public consultation Art.2a.5	Latest LTRS implementation details Art.2a.6
Austria	3	3	3	4	4	4	2	0
BE - Brussels.	4	3	4	2	2	4	0	0
BE - Flanders	4	3	4	4	3	4	2	3
BE- Wallonia	5	5	5	5	4	5	4	2
Bulgaria	3	3	3	4	3	4	3	4
Croatia	4	3	4	4	4	4	3	0
Cyprus	4	4	3	3	3	2	3	2
Czechia	4	3	3	3	4	3	0	0
Denmark	4	4	4	3	3	4	3	4
Estonia	4	3	3	3	3	3	3	0
Finland	5	4	4	4	5	4	3	4
France	4	4	4	3	4	3	3	0
Germany	3.5	4	4	4	3	4	3	0
Greece	3.5	3	2.5	3	4.5	2	3	0
Hungary	3	3	4	4	3	4	4	3
Ireland	4	4	4	3	4	3	3	3
Italy	5	4	4	4	4	4	3	2
Latvia	4	3	2.5	2	4	3	3	2
Lithuania	4.5	5	4.5	5	4.5	3.5	3	0
Luxembourg	4	4	4.5	4	3.5	4	2	0
Malta	4	3	3	3	3	3	3	0
Netherlands	3	3	3	3	3	3	4	0
Poland	4	3	4	3	4	4	4	2
Portugal	3.5	2	4	3.5	4	3.5	2	0
Romania	3	4	3	4	4	3	4	0
Slovakia	4	4	4	3	4	3	5	2
Slovenia	3	4	4	3	5	4	0	0
Spain	4	4.5	5	5	4.5	4.5	3	5
Sweden	3	3	4	3	2	4	3	3

Source: JRC 2022

Figure 3. Comparison of the scores of the evaluations of 2020 LTRS presents a comparison of the scores of 2020 evaluations, against each of the EPBD Art.2a requirements.

Overall, the highest-scored renovation strategy as regards compliance is the one from Spain (36/40 – 89% of total possible points), followed by the one from Belgium Wallonia (35/40 – 88%), Finland (33/40 – 83%), Italy and Lithuania (30/40 – 75%).

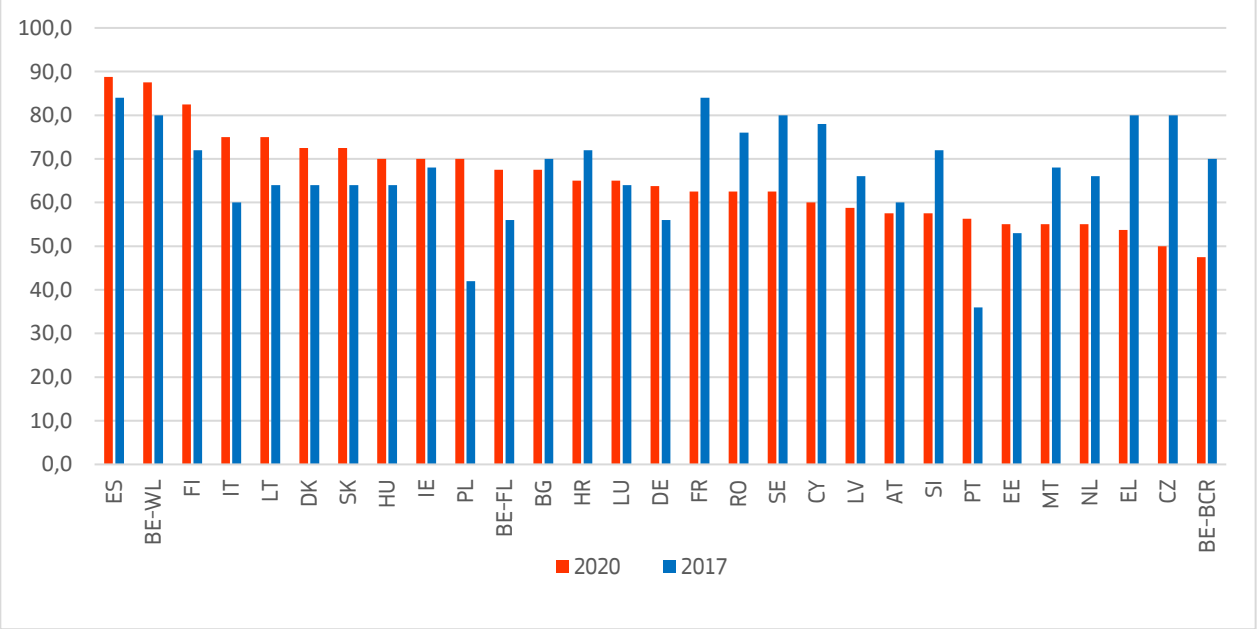
Figure 3. Comparison of the scores of the evaluations of 2020 LTRS.



Source: JRC 2022

Figure 4 shows a comparison of the % of compliance of the 2020 strategies versus 2017 one. Even if the two documents reflect different legislative requirements, the comparison is informative of how some MS strategies maintained a good complaiance level of also under the new EPBD requirements (e.g. Spain, Wallonia, Filland), whereas others submitted a "weaker" strategy in 2020, in terms of compliance. This could mean that not all the new mandatory provisions have been well understood and/or addressed by Member states (e.g. on the public consultation and on providing implementation details of the latest Long-term renovation strategy). This can be improved with the update of the current strategies foreseen in 2024.

Figure 4. Comparison of the compliance (%) of 2020 vs 2017 strategies.



Source: JRC 2022

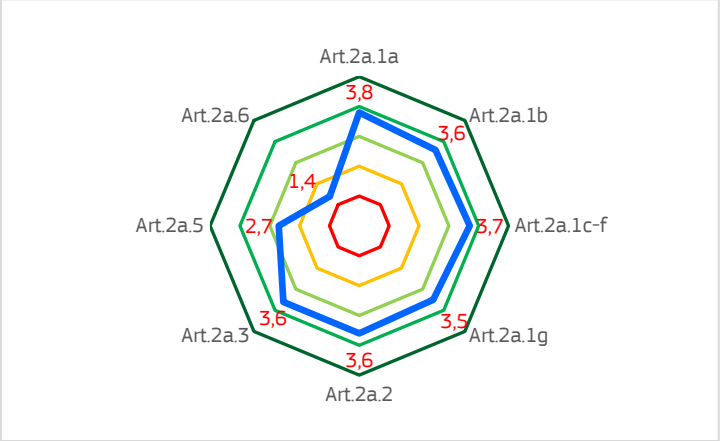
On average, as can been seen in Figure 5, the strategies addressed well the majority of the Art.2a provisions (average score >3.5), with the exception of clause 5 on public consultation (average score 2.7) and clause 6, the

requirement to provide implementation details of 2017 LTRS, that was missing in more than half of the analysed strategies and received the lowest scores (1.4 on average).

It is important to highlight that the vast majority of MSs failed to provide supporting evidence on the last two mandatory Art 2a provisions and in particular the "*implementations from 2017 LTRS*").

Without these specific shortages, which regards annexes to the main LTRS document, all the strategies would have been compliant.

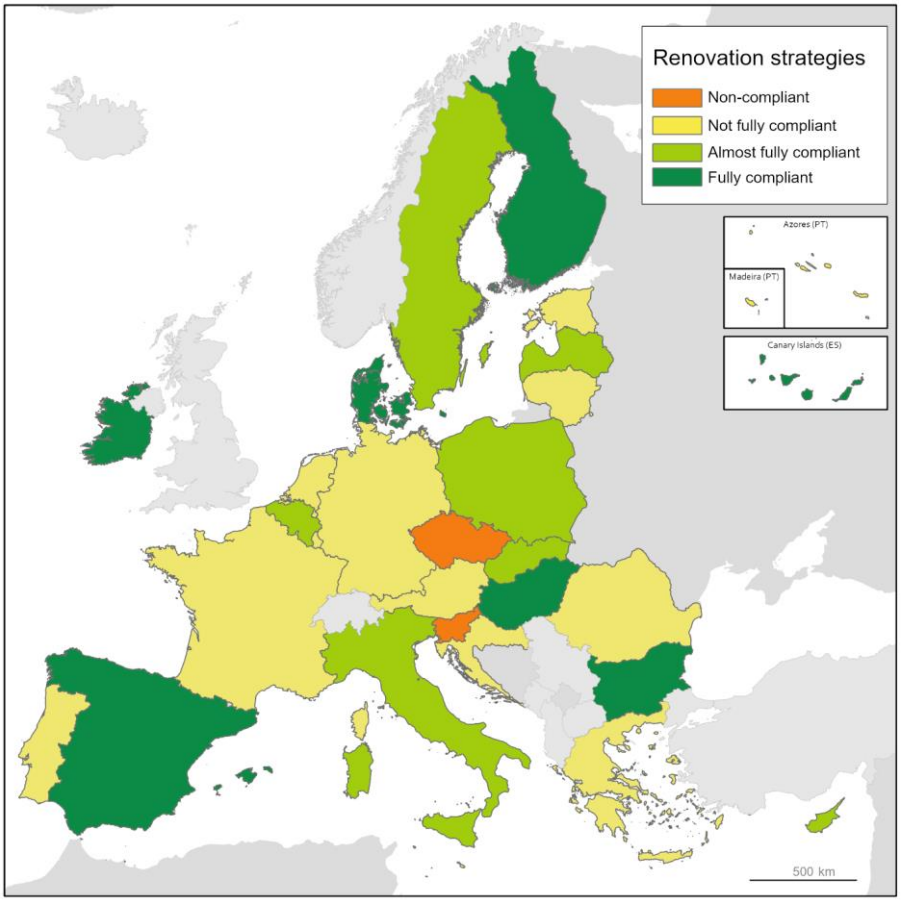
Figure 5. Average scores of the 28 renovation strategy evaluations.



Source: JRC 2022

Figure 6 shows in a map the results of the overall EPBD Article 2.a compliance assessment.

Figure 6. Map illustrating the result of the evaluation of the 2020 renovation strategies.



Source: JRC 2022

Non-compliant strategies

According to our analysis, only three renovation strategies out of twenty-nine, do not meet the basic requirements of EPBD Article 2a. This means that in these strategies at least two mandatory requirements have been evaluated to be insufficiently covered (score <2). This is the case of the strategies provided by the following Member States: Belgium Brussels, Czechia, and Slovenia, that did not sufficiently address the last 2 mandatory clauses (i.e. 'public consultation' and 'latest LTRS implementation details').

Non-fully compliant strategies

Thirteen strategies are deemed to be not fully compliant with Article 2a; all of them have been evaluated as not compliant only in one of the mandatory requirement of Article 2a (i.e. to provide latest LTRS implementation details'). These are the strategies from: Austria, Croatia, Estonia, France, Germany, Greece, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal and Romania.

Almost fully compliant strategies (OR Acceptable strategies)

Seven strategies have been evaluated as 'Almost fully compliant'; it means that they have been assessed to be partially compliant (i.e. score=2) for maximum two requirements: Belgium Wallonia, Flanders, Cyprus, Italy, Latvia, Slovakia and Sweden.

Fully compliant strategies

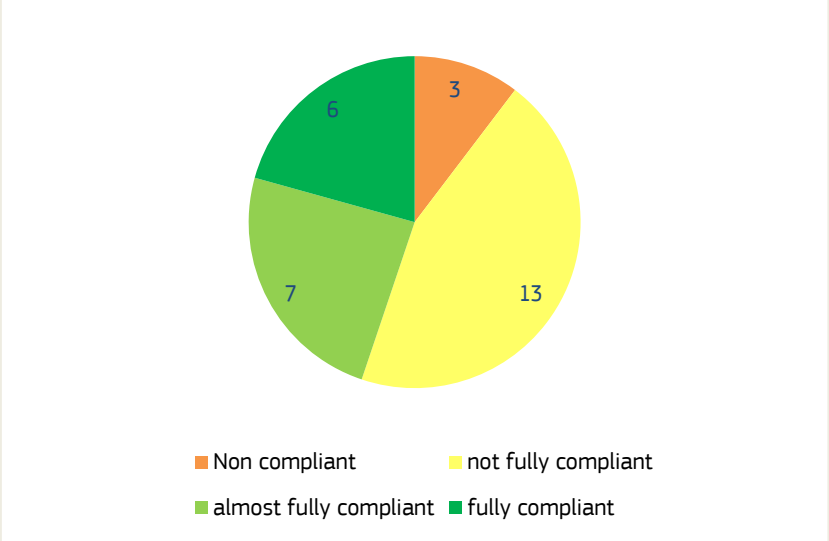
Six strategies were assessed as 'Fully compliant' to requirements of Article 2a: Bulgaria, Denmark, Finland, Hungary, Ireland and Spain.

Table 4. Summary of strategies compliance with EPBD Article 2a mandatory requirements.

Non-compliant strategies Belgium Brussels, Czechia, and Slovenia
Not fully compliant strategies Austria, Croatia, Estonia, France, Germany, Greece, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal and Romania
Almost compliant strategies Belgium Wallonia, Belgium Flanders, Cyprus, Italy, Latvia, Slovakia and Sweden
Fully compliant strategies Bulgaria, Denmark, Finland, Hungary, Ireland and Spain

Source: JRC 2022

Figure 7. Number of strategies compliant with EPBD Article 2a mandatory requirements



Source: JRC 2022

Concerning the coverage of each of the requirements of EPBD Article 2a, the following strategies have been selected as good examples for each section, to combine a "Best of" building renovation strategy (Table 5).

Table 5. A "Best Of" building renovation strategy.

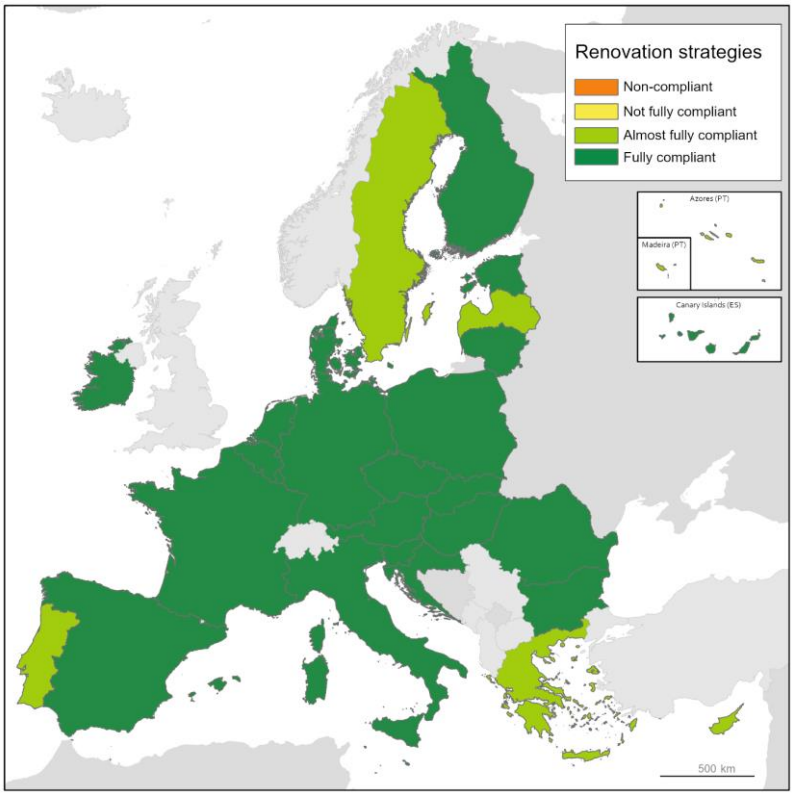
Section	**Good practice example**
Overview of building stock – 1a	Italy, Belgium Wallonia and Finland
Identification of cost-effective approach to renovation – 1b	Lithuania
Policies and action to stimulate cost-effective renovation – 1(c to f)	Belgium Wallonia
Evidence-based estimate of expected energy savings and wider benefits – 1g	Belgium Wallonia, Lithuania and Spain
Roadmap including measurable progress indicators and indicative milestones - 2	Finland, Greece Lithuania and Spain
Mobilisation of investments mechanism- 3	Belgium Wallonia and Spain
Public consultation-5	Slovakia and Belgium Wallonia
Latest LTRS implementation details - 6	Spain and Finland

Source: JRC 2022

It is worth to mention, that not considering the last two mandatory, but “ancillary” requirements, all the strategies would be assessed as compliant. Therefore, we consider the current exercise much more positive than the previous rounds of submission.

Indeed, without the omissions on the last two requirements (which could be amended by integrating supporting documentation), Twenty-three strategies would be fully compliant, and 6 almost fully compliant (Brussels capital region, Cyprus, Greece, Latvia, Portugal and Sweden) as Figure 8 shows.

Figure 8. Map illustrating the result of the evaluation of the 2020 renovation strategies excluding the last two requirements.



Source: JRC 2022

4 Overview of the building stock – Article 2a.1a

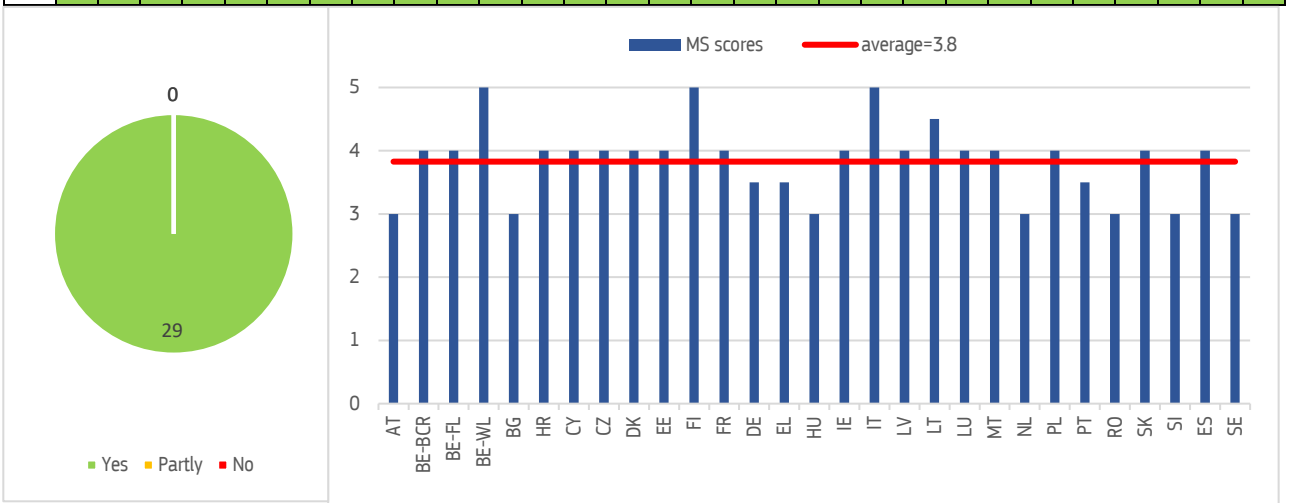
EPBD Article 2a.1a, as already provided by EED Article 4a, prescribes that LTRS shall include as a starting point, an overview of the national building stock. A good knowledge of the existing building stock is a prerequisite for the development of an effective building renovation strategy. This has been well understood and implemented by Member States that, on average, provided a reasonably detailed description of their building stock, with all the strategies that have been assessed as fully compliant in relation to this clause (score ≥3) (see Figure 9). This section has the highest average score (3.8 out of 5), among all the sections.

The following aspects have been considered for the evaluation and scoring of the requirement of this provision both for the residential and non-residential sector[30]:

- Identification of the main building types;
- Number of dwellings, area and energy consumption;
- Identification of age bands;
- Distribution of Energy Performance Certificate ratings by building sector/type;
- Information on climatic zones;
- Information on ownership (i.e., public, private or mixed);
- Information on tenure (i.e., owner occupied, rented or mixed);
- Identification of energy use and performance characteristics of each building combination;
- The expected share of renovated buildings in 2020.

Figure 9. LTRS compliance check and scores – Art 2a.1.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
1a	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y



Source: JRC 2022

While Member States generally provided a very good description of their building stock (with 18 LTRS scored ≥ 4 for this clause), the assessment highlights some room from improvement.

Data and details on non-residential building stock continue to be a missing piece in several strategies. On the one hand, the difficulties in the collection of this information are well known, on the other hand MSs should put more effort to collect and report data on non–residential buildings, prioritizing public buildings, schools and hospitals.

[30] The building stock evaluation template used for the assessment is provided in ANNEX C

Recognising the improvements in comparison with LTRS submitted in the past (Castellazzi et al., 2017), the assessment of the strategies on this specific provision underlined once more **the need and importance of a more uniform approach: guidelines and harmonised templates should be further improved and used by MSs in their reporting. This would foster comparability and a structured approach in the description of the existing building stock helping in the definition of more tailored actions.**

As a new requirement introduced EPBD, MSs shall provide the expected share of renovated buildings in 2020. This share may be expressed in different ways, e.g. as a percentage, an absolute number of buildings or renovated floor area per type of building, and is a first important milestone that set the benchmark for the subsequent milestones in 2030 and 2040.

However, only less than half of strategies (13 out of 29) included this information, using a variety of indicators and calculation methodologies (see Table 6).

Table 6. Information provided in the LTRS on expected share of renovated buildings in 2020.

Member state	Type of indicator	Information provided
Croatia	%	The share of renovated buildings from the total building stock is estimated at around 5% in 2020. Between 2014 and 2020 the annual energy renovation rate is 0.7% corresponding to 1.35 mill m^2 renovated yearly. In 2020, the renovation rate was expected to increase to 1%.
Cyprus	%	About 13% of residential buildings and 18% of service buildings "moderate" renovate at 2020.
Czechia	% m^2	Floor area of renovated buildings for single-family buildings, for multi-apartment buildings, and for non-residential buildings are provided. The figures are provided as pictures and therefore the concrete numbers cannot be traced. The LTRS however states that 25% of single-family houses and 40% of multi-apartment buildings (but 55% for panel houses) have been renovated in 2019.
Denmark	%	As regards the expected share of renovated buildings in 2020, about 20% of the building stock built before 1980 has never been energy renovated; 55-60% have been light renovated (-30% energy consumption); 20-25% average renovated (-30/-60% energy consumption); deep renovation (-60% energy consumption reduction) has yet a very limited penetration (5%).
Estonia	m^2	The surface to be renovated p/year in 2020 is 500 000 m^2.
Hungary	%	To determine the renovation rate of residential buildings, a survey has been carried out in 2012 and 2020. The calculated yearly renovation rate is about 1%. The share of insulated residential building in 2020 (per building type) is used as a proxy of the share of renovated buildings: Detached Houses (33%), Panel buildings (44%), Large Condominiums (26%), Small Condominiums (16%).
Ireland	Absolute number	An estimated 23 000 homes were renovated in Ireland in 2019 of which approximately 1 500 were renovated to a BER level of B2 or better. In the period between 2000 and 2019, circa one-third of homes had some renovation work done with Government or energy supplier support and since the introduction of the Building Regulations in 2006 and the improved level of energy performance and regulations introduced from 2011.
Latvia	m^2	LTRS shows the objectives and performance indicators for national policies on the energy performance of buildings (in terms of renovated floor area of public buildings) expected in 2020 (678 460 m^2) and the actual values in 2017 (398 707 m^2).
Lithuania	m^2 Absolute number	By 2020, 58 774 units (8% of the building stock) of new and renovated buildings to at least energy class B are reported. They account for 29 481 mill m^2 and represent 15% of the total floor area.
Luxembourg	%	Share of renovated residential buildings is assessed based on estimate extrapolations of renovation figures since 2008, expressed in "full-term renovation equivalents"; This leads to 10-14% of renovated buildings in 2020.
Poland	% m^2	The projected share of residential buildings (68%), and public buildings (45%) that have been energy renovated by 2020 is provided, by building ages.
Romania	%	The document explain that around 6% of buildings are renovated by 2020. Residential buildings are 5% (3% for rural area and 8% for urban area, 7% multi-residential) and 5% for administrative buildings, hotels and restaurants and 10% for warehouses. Other categories considered are schools (15%), hospitals (1%) and social housing (1%).
Slovakia	%	The share of renovated family houses in Slovakia at the end of 2020 is 52.6% of total dwellings (52.6% at end 2020); the share of renovated multi-apartment buildings at the end of 2020 is 71 % (the level of renovation is not specified, but multi-apartment buildings renovated more than twenty years ago will need to be renovated again).

Source: JRC 2022

Overall, the strategies including more detailed information on their building stocks are the one provided by Belgium Wallonia, Finland, Italy and Lithuania.

The Italian strategy can be considered a best practice in this section as it provides a very detailed overview of the Italian building stock, mainly based on 2018 data collected from several sources (e.g. ISTAT, ENEA, CRESME, ANCE, NZEB national observatory, EPC National database, State Property Agency database etc.). The building stock is presented by climatic zones, size, age, energy consumption, conservation status with a very good level of detail both for the residential and non-residential sectors. The non-residential building stock is also broken down into: schools, offices, hotels, commercial buildings, hospital/healthcare facilities, penitentiaries, and barracks. Thermal and electricity Energy consumption indicators are also provided for all the building categories, together with the main findings from the digital EPC database and the State Property Agency database. A national portal on the energy performance of buildings has been established in 2020, collecting, in a unique digital public database, all the information on the Italian building stock (e.g., size, energy performance, suggested renovation good practices etc.). An estimate of the current annual renovation rate is also provided. For this, a "virtual deep renovation rate" indicator has been developed, considering all the renovation interventions (including minor interventions) and, from the energy-saving obtained, calculating the virtual equivalent deep renovations needed to obtain these savings. The current virtual rate of deep renovation is 0.85% (with energy-saving of 0.33 Mtoe/year). This renovation rate expresses how much m^2 would have been renovated if the measures promoted through "Ecobonus and Bonus Casa" measures had all been deep renovations.

Wallonia also provided a comprehensive and detailed statistical overview of the building stock. This includes a detailed analysis of building types, ages, tenures, level of insulation, energy performances, type of heating systems etc. for residential and non-residential buildings. The overview is based on recent data from different sources. A link to the detailed description of the building types (and their U values) used for the cost optimal analysis is also provided. The expected share of renovated buildings is provided for years 2025 - 2050.

The National Building Stock overview in the Finnish LTRS is comprehensive and very well presented. It also reports additional details compared to what is required by EPBD Art. 2a.1a. It includes the following indicators for both the Residential and Non-residential building stock: number of housing units, number of buildings, floor area (in 2020):

- Age structure by decade of completion;
- Energy efficiency by age group with average heating energy consumption and energy classes as indicators;
- Share of renovated buildings in 2020;
- Share of the worst-performing segment, i.e., buildings in energy classes F and G of the building stock in 2020;
- Heating energy consumption, including delivered energy and energy generated with heat pumps;
- CO_2 emissions in 2020.

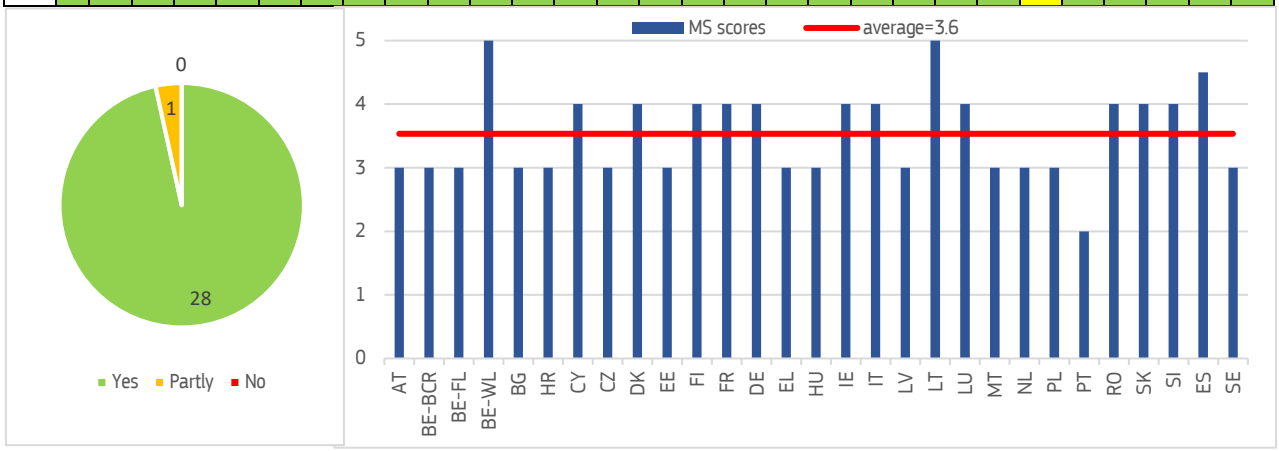
5 Cost-effectiveness approaches of renovation - Article 2a.1b

Article 2a.1b of the EPBD provides that each strategy shall include the identification of cost-effective approaches to renovation relevant to the building type and climatic zone, considering potential relevant trigger points, in the life-cycle of the building.

All the strategies were compliant with this provision (average score 3.6) with only PT assessed as partially compliant (score=2), even if only half provided a good/excellent coverage of this provision (Score ≥4) (see Figure 10). Moreover, in several cases, Members States referred to the cost-optimal analysis already developed in 2013 to transpose the EPBD requirements, with only some (e.g. BRC, FL, IE, IT, LV, LU, MT, NL, SI) that provided clear details on the updated calculations, that were due by March 2018[31].

Figure 10. LTRS compliance check and scores – Art 2a.b

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
1b	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y



Source: JRC 2022

Belgium Wallonia and Lithuania presented a very satisfactory approach, with the latter one that can be a good practice example to comply with Article 2a.1b.

The Lithuanian LTRS describes with good level of detail a comprehensive methodology to identify the most cost-effective renovation approach. Energy efficiency measures and renewable energy measures grouped into 33 renovation packages to achieve energy classes from C to A++ (NZEB level) are analysed. Considering the type of building, period of construction and the energy classes, 816 different combinations resulted. The strategy reported the following steps:

- Calculation of key indicators for each combination (investment costs, projected energy-savings, economic benefits, the expected financial and economic return);
- The saving of 1 kWh in terms of financial and economic returns are calculated for each simulated combination;
- All combinations are ranked in terms of return (€/kWh) with the highest grade assigned to the packages of renovation with maximum economic benefit;
- Setting the primary energy-saving target at the building stock level in GWh or %;
- A list of combinations that satisfies the primary energy target is selected;
- Changing the energy-saving target, renovation investments and energy-saving curve is obtained.

As a conclusion even a conservative estimation of economic benefits outweighs the investment costs.

The Lithuanian strategy also identified trigger points, divided per building type[32].

[31] According to the EPBD, the first cost-optimal calculations were due to march 2013, to be updated by March 2018.

[32] These are: a) change of ownership for single-family house; b) District renovation for apartment buildings; c) EPCs are required when renting or selling industrial buildings; d) Renewal of rental contract for commercial buildings with obligations to provide EPC and to modernise the technical systems, and introduce renewable energy.

5.1 Trigger points

The EPBD defines trigger points as an opportune moment in the life-cycle of a building for carrying out energy efficiency renovations. Focusing on energy efficiency at trigger points should limit the risk of missing opportunities to renovate and increase possible synergies with other actions. Trigger points may lead to cost-effective renovation thanks to economies of scale achieved when energy-related renovations and other necessary work or planned renovation, occur at the same time, encouraging more holistic and synergic approaches in energy renovation projects.
A trigger point could be:

- a transaction (e.g. the sale, rental or lease of a building, its refinancing, or a change in its use);
- a renovation (e.g. an already planned wider non-energy-related renovation);
- a disaster/incident (e.g. fire, earthquake, flood).

Article 2a.1b prescribes to include in the LTRS a discussion on potential relevant trigger points.

Almost two-thirds (19/29) of the strategies identified and presented trigger points in their strategies, with a variable level of detail (see table 7). Some also used them to design specific polices to stimulate energy renovations (e.g. the Danish mandatory requirement to include energy renovation once the building owner renovates the different parts of the building due to wear).

Table 7. Trigger points identified in the LTRSs.

Member state	**Trigger points references in the LTRS**
Austria	The LTRS raises the issue of trigger points, but relates them largely to economic points of use. It refers to guidelines of OIB from April 2019 asking for optional use of refurbishment roadmaps.
Belgium-Brussels	Trigger points have been identified (e.g. building change of ownership, non-energy efficiency related renovation works)
Belgium Flanders	Trigger points are identified, i.e. transactions (sale, inheritance) or the start of a new lease, need or the desire for increased comfort, and discussed in details (providing also the number of buildings sold, transferred, inherited every year). They play an important role in the strategy: "identifying key moments in a building's lifetime are ideal to exploit the potential for deep renovation at the most convenient time and with the highest cost-effectiveness. Stimulating deep renovation in these key moments helps to spread efforts more evenly over time horizon 2050".
Belgium Wallonia	The trigger points are identified as: • Purchase/sale, change of tenant or owner, works for reasons other than energy efficiency improvement; • Replacement of end-of-life systems; • Installation of renewable energy systems during roof changes or renovations.
Croatia	Besides grants for energy renovation with high co-financing, the Croatian LTRS mentions that most likely situations that could trigger the energy renovation of the existing buildings is the change of ownership and the deterioration of the heating system. Moreover, it is expected that the structural retrofitting of more than 24000 buildings affected by the March 2020 earthquake will trigger energy renovation.
Cyprus	The following trigger points are mentioned: 1) transfer to a new owner, 2) lease to a new tenant, 3) when static upgrading occurs and 4) change of building use and/or additions are made. The 4th trigger point is determined as the most likely one to lead to a major renovation according to the results of a conducted public consultation preceding the preparation of the Long Term Strategy.
Denmark	DK has a requirement in the Building Regulations that profitable energy savings must be carried out when the building owner renovates the different parts of the building due to wear.
Finland	In the Finnish LTRs trigger points have been identified for each type of buildings e.g. change of ownership (for single family houses), renovation/joint renovation project implemented in the neighbourhood (for terraced houses and block of flats), by combining the projects, this approach can create benefits in the form of cost savings or a higher-quality outcome in terms of energy efficiency improvements.
France	Trigger points are mentioned in the LTRS in the frame of several programmes (e.g. financial support is not enough to trigger deep renovation), but not clearly established.
Germany	Trigger points are clearly identified (i.e. change of ownership, complete refurbishment etc). - A table is presented that clearly shows the renovation obligations that come into force once a trigger point is reached.
Hungary	The following trigger points have been identified: • for residential buildings: ownership transactions (sale, inheritance, change of tenant, planned or extraordinary maintenance (e.g. storm damage, plant big failure), building enlargement, specific financial incentive availability; • for public buildings: availability of grand/incentive for renovation, change of users, change of building function, change of ownership (less frequent for the public sector).

Member state	Trigger points references in the LTRS
Italy	Trigger points have been identified and discussed in detail: financial transaction (e.g. sale, lease, change of use), wider renovation not related to energy performance or a disaster/accident (for example, a fire or earthquake), Major renovations, facade/roof reconstruction.
Lithuania	Trigger points are identified depending on the building type: - for single-family house: change of ownership; - for apartment buildings: district renovation is seen as a key measure to initiate and accelerate the energy renovation; - for industrial buildings: generally owners invest in the modernisation of the buildings to reduce maintenance costs. EPCs are required when renting or selling industrial buildings; - for other non-residential buildings: many of them are commercial buildings, rented. When renewing rental contract, the owners are required to provide the EPC and to modernise the technical systems, and to introduce renewable energy;
Malta	Trigger points are discussed in a specific section of the strategy. The following have been identified: rental decision, building change of use, maintenance work, introduction of renovation obligations or the introduction of minimum energy performance criteria for the buildings, in order to be rented or sold.
Poland	Trigger points have been identified and described: change of ownership, change of purpose of the building, repair of damages, conventional renovation, asbestos removal, specific financial incentive availability.
Romania	'Trigger thresholds for the renovation are identified, they includes transactions (e.g. sale or lease/lease, refurbishment), local authority proposals from owners of apartments and homeowners' associations for the renovation disaster events and Planned major capital overhaul of the building.
Slovakia	the resolution of the systemic/structural failure of a multi-apartment building that can be regarded as the trigger point for its later major renovation.
Slovenia	"Wider renovations": refurbishment that includes, in addition to the energy aspect, other aspects of renovation (e.g. anti-seismic, fire, flood, quality of the internal environment, etc.).
Sweden	'The LTRS gives a definition of Trigger: 'Trigger' means a suitable point in a building's life cycle for carrying out energy efficient renovation. Examples of triggers include a sale, change of tenant/landlord, renovation or damage.

Source: JRC 2022

6 Policies and actions - Article 2a1(c-f)

EPBD Articles 2a1(c-d) prescribes that the each LTRS shall encompass:

1c. Policies and actions on deep renovations of building, including staged deep renovation and building renovation passports;
1.d Policies and action on worst-performing buildings and energy poverty;
1.e Policies and action on public buildings;
1.f An overview of national initiatives to promote smart technologies and skills and education in the construction and energy efficiency sector.

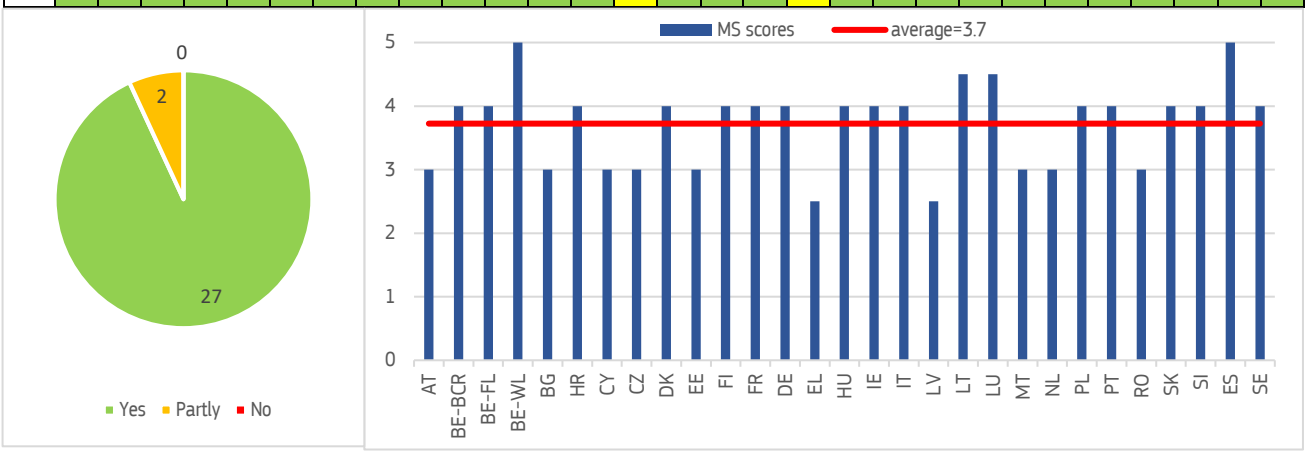
As described in the methodology section we reviewed and assessed these clauses individually, but assigning them a final aggregate score, in view of similarities and possible complementarities of the different items at stake.

This section is the core part in the majority of the 2020 renovation strategies. Together with the description of the building stock, it obtained the highest marks in the evaluation with an average score of 3.7 out of 5 (see Figure 11).

Overall, Member States addressed exhaustively Article 2a1(c-f) requirements, providing a comprehensive set of policies covering the EPBD provisions with all the strategies that were fully compliant (score ≥3), with the exception of the one from Greece and Latvia (score 2.5).

Figure 11. LTRS compliance check and scores – Art 2a.1(c-f).

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
c-f	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y



Source: JRC 2022

However, the mandatory clauses analysed in this section have been addressed by MS with a different level of details, with the large majority of MS providing a good overview of policies to target all public buildings; whereas the provision on policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty (clause 1d) have been sufficiently covered by 2/3 of the strategies (see Table 8). More details on actions targeting energy poverty are presented in section 6.1.

Table 8. Sub-clauses compliance check.

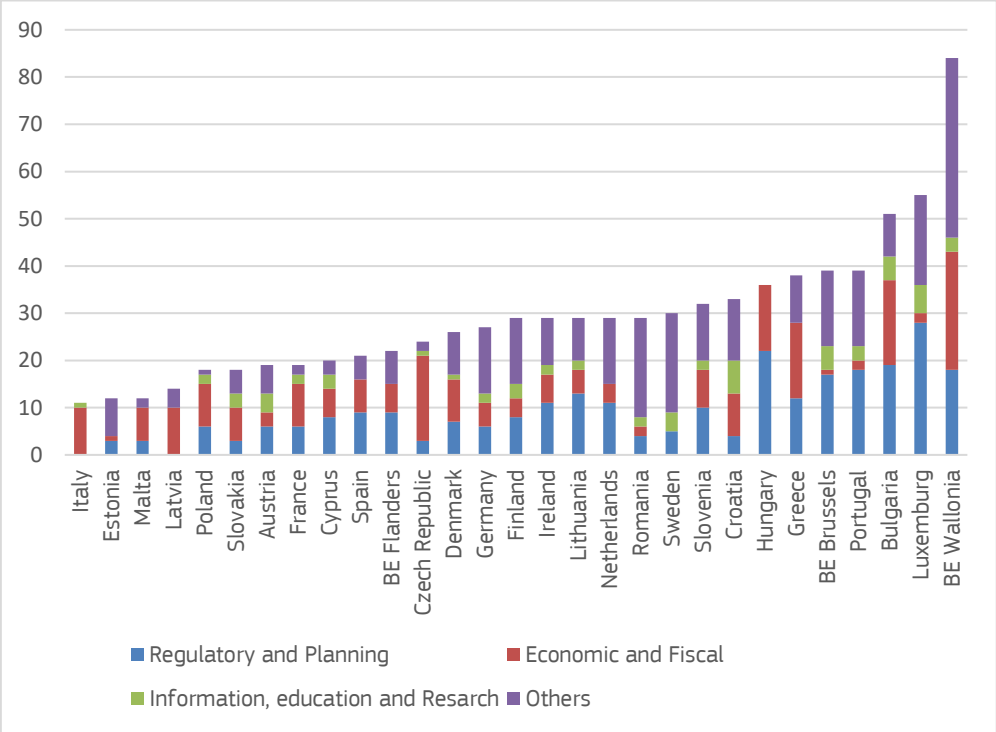
Clause	AT	BCR	FL	WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
1c	Y	Y	Y	Y	Y	P	Y	P	Y	Y	Y	Y	Y	P	P	Y	Y	P	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y
1d	Y	Y	Y	Y	P	Y	P	P	Y	P	Y	P	Y	P	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P
1e	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	P	P	Y	Y	Y
1f	Y	Y	Y	Y	Y	Y	P	Y	Y	P	Y	Y	Y	P	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y

Source: JRC 2022

MSs in total described 845 policies and measures in their strategies (nearly 30 per strategy, on average). The assessment analysed and categorised (per type, sector and status of implementation) all of them.

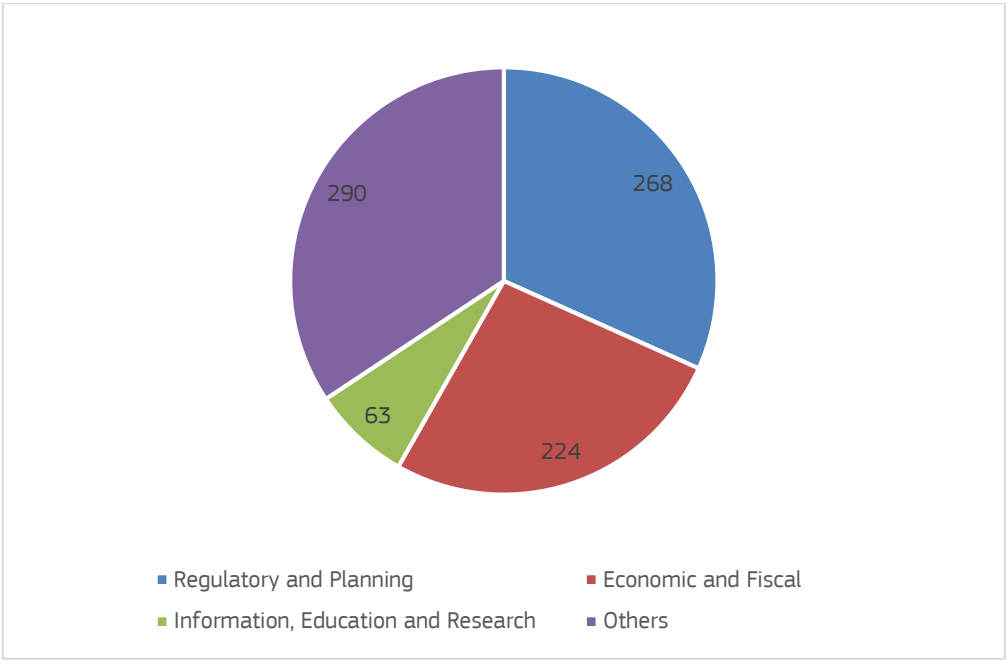
Figures 12, 13 and 14 present the number of measures targeting building renovation included in the 29 analysed strategies, divided by country and type and per status of implementation.

Figure 12. Number of all the measures in the building sector (implemented and planned) by country and type.



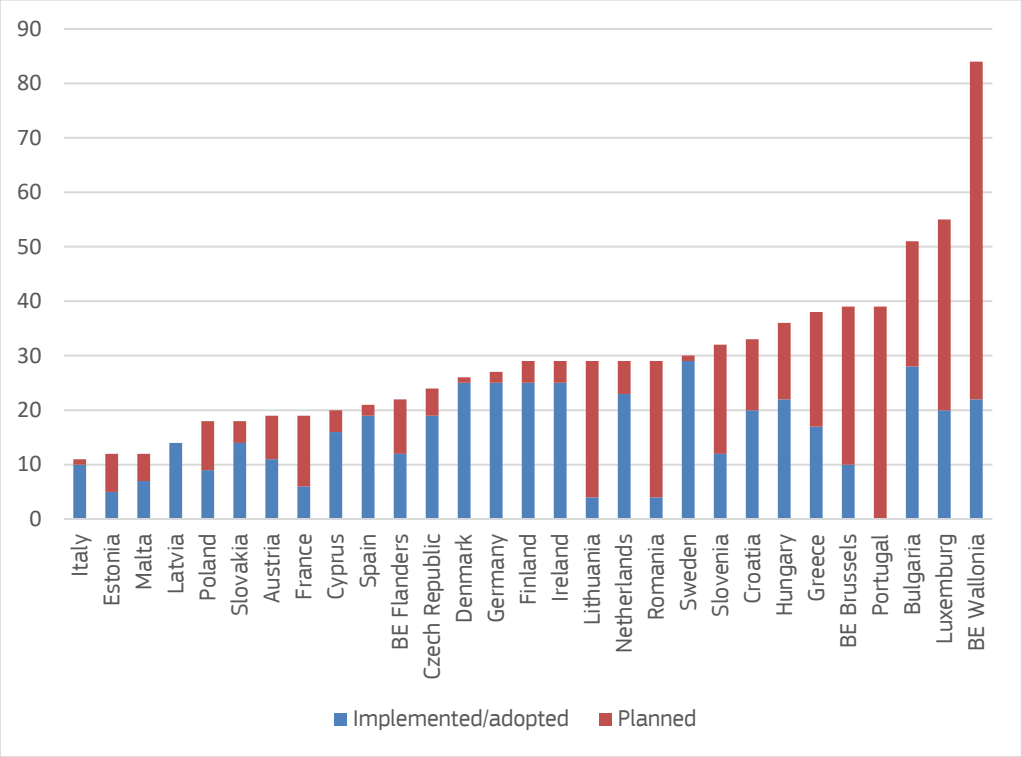
Source: JRC 2022

Figure 13. Total measures by type.



Source: JRC 2022

Figure 14. Number of implemented/adopted vs planned measures by country.



Source: JRC 2022

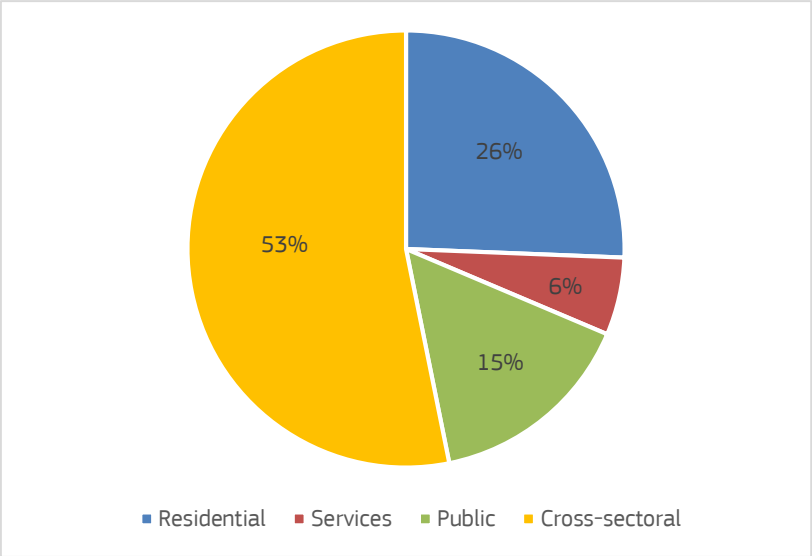
There is a great heterogeneity of policy packages in different Member States, in terms of absolute number, implementation status, and policy type. Eight countries reported less than 20 measures, and 3 MSs reported more than 40 measures each, (with BE Wallonia reporting the highest number of 84 measures). The vast majority of countries reported in their strategies between 20 and 40 measures. Some MSs reported mostly or all planned measures (PT, LT) while a few others (LV, IT, SE) reported mostly or all implemented measures. All the remaining ones reported a more balanced mix of measures planned and implemented. Both the number and the implementation status are not proxies for the "quality" and effectiveness of the measures themselves and of the strategies, which are not evaluated here.

In general financial/fiscal and regulatory/planning measures are the most common ones in almost all countries, and all the building sectors benefit from a wide range of policy measures (Figure 13 and 14).

The majority of the measures reported (53%) are not sector-specific but they are horizontal measures targeted more than one sector. Twenty-six percent of the measures specifically address the residential sector, while only 6% are targeted to the service sector.

Public buildings are well covered by a comprehensive set of measures.

Figure 15. Share of measures targeting the different building sectors.[33]



Source: JRC 2022

Overall, the strategies which include more detailed information on Article 2a1(c-f) clauses are the ones from Belgium Wallonia and Spain, followed by Lithuania and Luxemburg.

A number of good practices from many different MSs has been extracted and presented in the COMMISSION STAFF WORKING DOCUMENT "Analysis of the national long-term renovation strategies" Brussels (SWD(2021) 365 final/2).

[33] Cross-sectoral measures are the one targeting all the sectors.

6.1 Focus on energy poverty

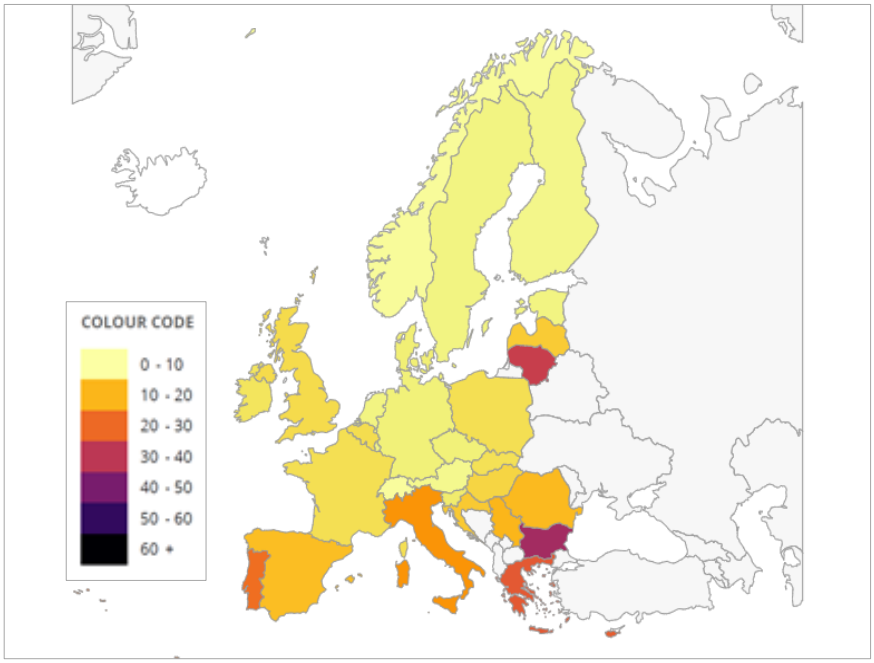
Energy poverty seriously undermines social inclusion, wellbeing, and people's ability to participate actively in and benefit from the energy transition. The European Pillar of Social Rights (Principle 20) indicates energy services among the essential services everyone shall have access to, calling for support measures for those in need. United Nations Sustainable Development Goal n. 7 also concerns access to affordable, reliable, sustainable and modern energy for all. The Renovation Wave communication assigns to energy poverty mitigation a key role, making it one of the pillars of the initiative. This is further reinforced by the EC Recommendations on energy poverty published together with the Renovation Wave Communication in 2020[34].

Energy poverty is commonly defined as the inability of a person or family to keep their dwelling adequately warm during the winter or cool during the summer. Empirical understanding, thus, considers energy poor households those that cannot afford to fulfil their residential needs for heating, cooling, lighting and other energy services[35].

Three main factors drives energy poverty, at least in the EU: a) low incomes, b) poor energy performance of buildings, and c) high energy costs (Kyprianou et al, 2019).

Energy poverty affects a substantial share of the population across the EU. Survey-based indicators show that 7.3% of the EU population is unable to keep their homes adequately warm, in 2018, and 6.6 % have fallen into arrears in their utility bills. In 2019, energy poverty still affected up to 31 million people in the European Union. Figure 16 depicts the percentage of the EU population that is unable to keep their home adequately warm, in 2018. The Baltic, East EU and the Mediterranean countries appears as the most affected ones.

Figure 16. Inability to keep home adequately warm as a percentage of the population in EU28 (EPOV 2021).



Source: EU Energy Poverty Observatory 2021

In addition, the health, social, and economic crisis caused by the COVID-19 pandemics, has pushed more people into poverty[36] and increased the number of households unable to afford energy services. The recent sharp escalation in gas and electricity prices, primarily due to global demand for gas soaring as economic recovery is picking up higher demand not matched by increased supply, is a high concern for citizens, businesses, MSs and the

[34] COMMISSION RECOMMENDATION (EU) 2020/1563 of 14 October 2020 on energy poverty.

[35] In order to measure its extent and intensity, a variety of energy poverty indicators have been developed and are applied in several countries and at EU level. During its duration (2016-2020) the EU Energy Poverty Observatory (EPOV) project selected a set of indicators to measure energy poverty. Four different primary indicators for energy poverty are identified, of which two are based on self-reported experiences of limited access to energy services (based on EU-SILC data) and the other two are calculated using household income and/or energy expenditure data (based on HBS data). Additionally, a set of 19 secondary indicators are extracted from different data sources, mainly the Eurostat (ESTAT) website, EU-SILC and the Building Stock Observatory (BSO). The EPOV Methodology Guidebook (Thema and Vondung, 2020), shows the calculation, interpretation and detailed database of all indicators.

[36] The World Bank estimates that 150 million people worldwide have slipped back into poverty as a result of the COVID19 pandemic (Lackner, et al, 2021).

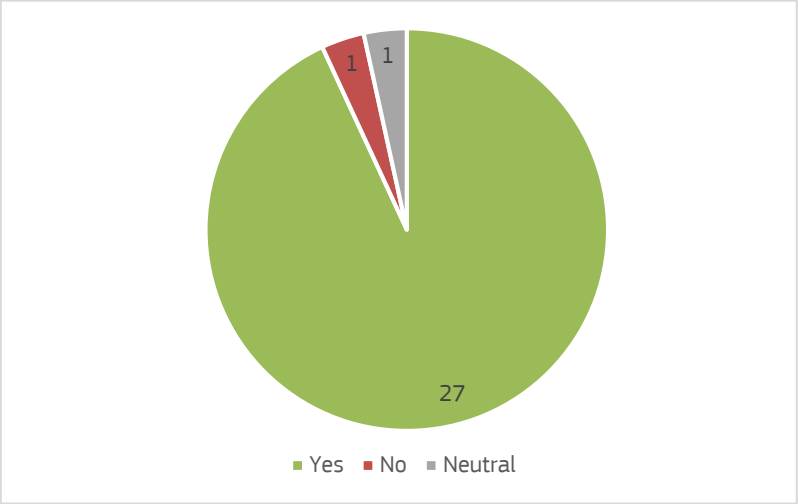
European institutions. Among many other negative effects on the economy, this risks exacerbating energy poverty exposure and vulnerability. To mitigate the negative impact on households and businesses, the Commission established a toolbox of short and longer-term measures[37]. In the medium and long term, the suggested policy response should focus on making the EU more efficient in the use of energy.

The lack of energy efficiency is a key factor driving exposure to energy poverty because of the potential disproportionate high loss of useful energy during energy conversions in the home (Bouzarovski and Petrova, 2015). The low energy performance in houses and buildings, and the use of inefficient energy appliances lead to higher energy needs and hence higher costs.

One of the main problems that determine energy poverty is the bad condition of the building where households lives and, in particular their low energy performance. Energy poor people often reside in social or non-profit housing that is often badly maintained and of poor thermal quality. The thermal quality, energy and environmental standards of the social housing in Europe is of lower quality than the average building stock (Santamouris et al., 2014).

Member States seem to have recognised the importance of the issue and in general, actions and measures proposed appears adequate. As indicated in Figure 17, all but two strategies (CZ and SE) include specific measures to address energy poverty in their LTRS. Sweden explicitly stated in its strategy that it does not consider any distinction between "energy poverty" and poverty, broadly defined. Consequently, there are no measures in place specifically addressing energy poverty.

Figure 17. MSs reporting on energy poverty measures in their LTRS.



Source: JRC 2022

Annex D summarises energy poverty policies and actions for each Member State.

As recognised also in the "Electricity Directive"[38], national social security systems are important in alleviating energy poverty. They can channel support to those most affected and Member States can target specific payments to those most at risk to help them cover their bills in the short term. Such measure can be also complemented by measures to avoid disconnections. In addition, policy measures based on aids (in the form of discounts on energy bills additional income, etc.) can also play an important role as energy poverty is in most of the cases linked to a general condition of poverty. However, at the same time it is important that such measures, which are effective as short-term mitigation, are not seen as an alternative to addressing issues like housing with poor insulation or inefficient appliances. Buildings' energy efficiency improvements represents a structural intervention with a long-term impact on energy poverty reduction.

[37] Communication on "Tackling rising energy prices: a toolbox for action and support", COM(2021) 660.
[38] Directive (EU) 2019/944 on common rules for the internal market for electricity.

6.2 Worst-performing buildings

As indicated in the Renovation Wave Communication (COM(2020) 662 final), tackling energy poverty and worst-performing buildings is one of the area that deserve specific attention.

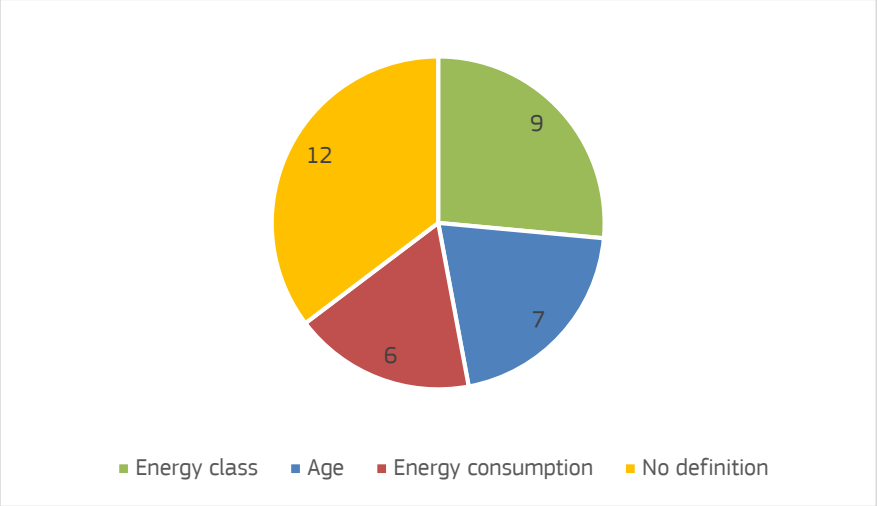
Some Member States used a mixture of different approaches to define their worst-performing stock: energy class, age, energy consumption. A summary of the approaches adopted by Member States is shown in Table 9 and Figure 18. In terms of EPC class (chosen by 7 countries plus Flanders and Wallonia regions of Belgium), the energy label threshold varied from energy label G (in case of Germany) to energy label C (in case of Croatia for coastal areas). It is difficult to draw comparisons between labels used across Member States as the methodological approaches largely differ from country to country. Large variations are also observed in cases where worst-performance was linked to the age of a building: for Estonia and Romania the threshold was set at 2000, while for Sweden buildings constructed between 1945 and 1975 were deemed as worst-performing. A total of 6 countries defined worst-performance according to the annual primary or final energy consumption (kWh/m^2/y), while no information was found in 12 other countries (including Brussels region of Belgium).

Table 9. Summary of LTRS definitions used to define "worst-performing buildings"

Type of indicator	Frequency	Countries/regions that used this indicator	Definitions
Energy class	9	BE (Flanders, Wallonia), BG, DE, FR, HR, LT, SE, SI	Buildings with EPC class: C or below (HR - coastal), D or below (HR - continental, LT), E or below (BG), F or below (BE, FR, SE, SI), G (DE)
Age	7	AT, EE, IT, RO, SE, SK, SI	Buildings built before: 1976 (IT), 1980 (AT, SI), 1983 (SK), 2000 (EE, RO); Buildings built between: 1945-1975 (SE)
Energy consumption	6	BG, DE, HU, LV, MT, RO	Buildings with annual energy consumption of more than: 76 kWh/ m^2/y (MT - delivered energy), 200 kWh/ m^2/y (DE, LV), 262 kWh/ m^2/y (MT - primary energy), 300 kWh/ m^2/y (HU, RO), 340 kWh/ m^2/y (BG)
No definition	12	BE -BCR, CZ, DK, EL, ES, FI, IE, LU, NL, PL, PT	-

Source: JRC 2022

Figure 18. Overview of indicators used in LTRS to define "worst-performing buildings"[39]



Source: JRC 2022

Prioritizing interventions on the worst-performing segment of the building stock is essential to maximise the achievements from renovations and it is important to urge all MSs, which have not done so, to address this requirement in their LTRS.

[39] Some Member States used two indicators.

7 Evidence-based estimate of expected savings and wider benefits – Article 2a.1g

EPBD Article 2a.1g specifically requires MSs to provide an evidence-based estimate of expected energy savings and wider benefits.

As stated in the Commission's recommendations on building renovations[40], the evaluation of possible wider benefits associated with energy efficiency measures may enable a holistic and integrated approach at national level, with synergies with other policy areas. The recommendations provide a possible framework for defining indicators of multiple benefits and an estimate of expected energy savings and wider benefits, among them:

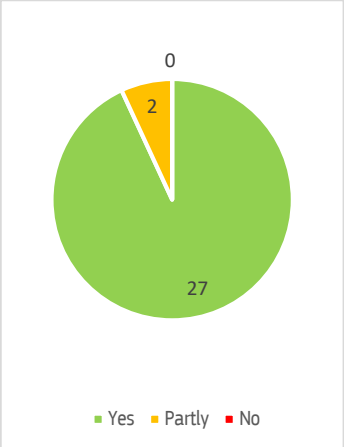
- Reduction in households' energy costs/ reduction of energy poverty;
- Energy savings;
- Average/aggregate indoor air quality indices (IAQIs) and thermal comfort index (TCI);
- Cost of avoided illnesses/reduction in health costs attributable to energy efficiency measures;
- Disability Adjusted Life Year (DALY)/Quality Adjusted Life Year (QALY) improvements;
- Labour productivity gains from better working environment and improved living conditions;
- Reduction of emissions;
- Employment in the building sector and in the whole economy;
- GDP increase in the building sector and in the whole economy;
- Energy security, reduction in the share of energy imports;
- Removal/prevention of accessibility barriers for persons with disabilities.

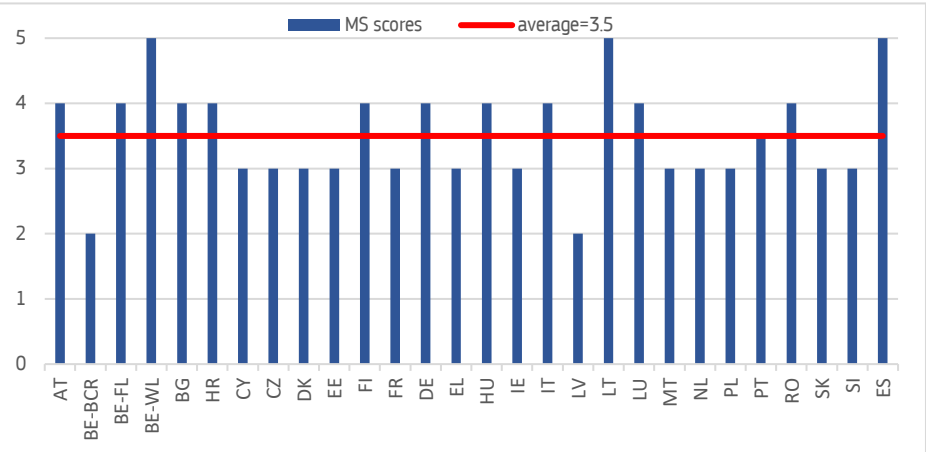
A growing body of scientific literature recognises the importance of multiple benefits (or co-benefits) and try to quantify them[41]. Examples of calculation mechanisms used by research groups in monetising multiple benefits includes the MBENEFIT[42] and the COMBI[43] H2020 Projects. A number of mechanisms/methodologies and sources are identified for each of the impacts[44].

The reviewed LTRS seem to reflect this importance as all of them include a specific section to discuss expected energy savings and wider benefits, such as the one related to health, indoor air quality, and positive economic impacts. Nevertheless, in half of the cases, MSs did not provide a quantification of the potential wider benefits (see Figure 20).

Figure 19. LTRS compliance check and scores – Art 2a.1g.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
1g	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

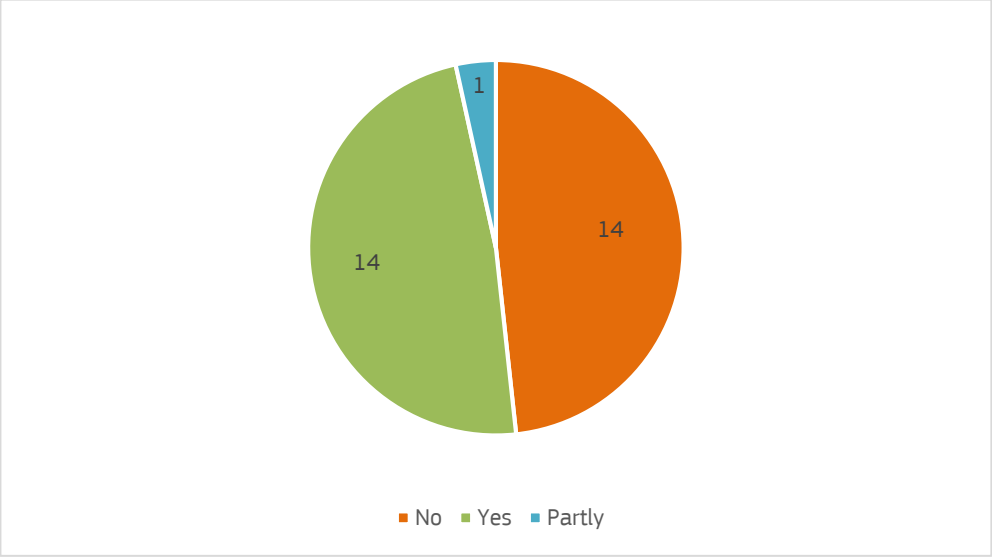




Source: JRC 2022

[40] Commission Recommendation (EU) 2019/786 of 8 May 2019 on building renovation.
[41] See, for instance the review of Paci and Shnapp (2021).
[42] https://www.mbenefits.eu/
[43] https://combi-project.eu
[44] These are fully described in Shnapp et al. (2020).

Figure 20. Quantification of wider benefits.

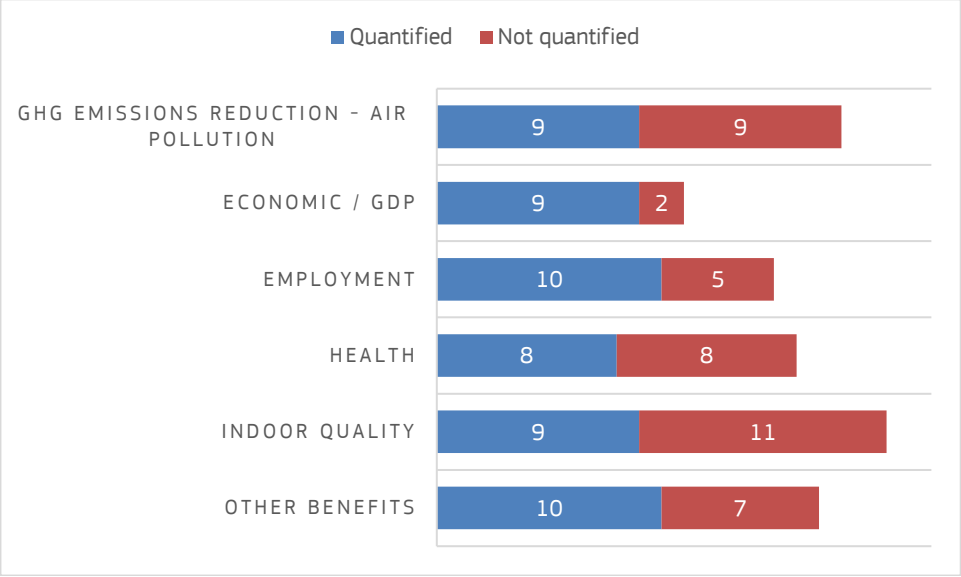


Source: JRC 2022

Looking in details to the wider benefits indicated by MSs in their strategies, indoor quality and GHG emissions/reduced air pollution appears the one most frequently reported (by 21 and 18 MSs respectively) but they are quantified only in 50% or less of the cases. Fewer MSs indicated macroeconomic co-benefits such as GDP growth and employment attributable to building renovations (11 and 15 respectively), but most of them also provided a quantification (9 and 10 MSs). Figure 21 shows these numbers for the main categories of wider benefits identified in the LTRSs.

A variety of additional co-benefits have been indicated by MSs in seventeen cases and they are grouped under "other benefits". They include tax revenues, increased value of properties, labour productivity, skills improvements, fire protection, energy security, and R&D and innovation.

Figure 21. Co-benefits indicated in the LTRS.



Source: JRC 2022

Except in three cases (FR, AT and PL), MSs included two or more co-benefits in their strategies. On average, between 3 and 4 different types of co-benefits are reported, with six MSs[45] reporting 5 or more. This is a purely

[45] Belgium-Flanders, Bulgaria, Croatia, Luxembourg, Slovakia, and Slovenia.

quantitative assessment, which do not necessarily reflect the quality of the reporting: for instance both Slovakia and Slovenia reported numerous co-benefits, but without quantifying them.

The strategies that better addressed this provision are the one from Wallonia, Lithuania and Spain. The Wallonian strategy identifies wider (multiple) benefits of the renovation. It provides detailed and sound quantification of the GHG emission reduction potential and scenarios (with the overall aim of carbon neutrality by 2050). Depending on the scenario the GHG emissions are expected to drop by 51 - 56% by 2030 for residential buildings, and by 52 - 62 % for non-residential buildings. Other multiple benefits are discussed more on the qualitative level and using mostly evidence from international studies. The LTRS expects that the average household energy bill (kWh) can be reduced by almost 40% by 2030, by half by 2035 and by 60% by 2050 through the implementation of the strategy, simultaneously improving the "resilience" of households to energy price fluctuations. The jobs creation is also discussed, estimating that the strategy could lead to a creation of "several thousands of jobs". Furthermore, other benefits, such as increased productivity, tax revenues from increased activity are mentioned.

In the Lithuanian LTRS Environmental, economic and social benefits, split into monetised and non-monetised, are discussed. The total value of the monetised benefits is estimated at around € 75.4 billion over 2021 and 2050. The value disaggregated per energy-savings, CO_2 emissions reduction, increase in the GDP, improving people health and work capacity, increasing the value of buildings, reducing the pollution and benefits for vulnerable residents is presented in detail. The investment of each € 1 million is expected to create between 19 and 37 jobs per year. The investment of each € 1 is estimated to increase the country's GDP by € 0.5. To estimate the health benefits, for each invested € 1 a benefit of € 0.32 was considered. The following wider benefits have been also qualitatively identified: increasing the energy independence, lowering the investments in the production capacity of energy, increasing the life of the buildings, reducing fossil fuel and RES subsidies and redirecting the funds to clean technologies.

In the Spanish strategy, 'Socio economic benefits, e.g. saving on energy bills, increased GDP of 0.47% in 2030, generation of 33-88 000 jobs in 2030 (+0.44%), improved indoor air quality and health, are calculated using the INPUT-OUTPUT model DENIO, developed by B3C. The methodology is robust and explained in details. Results are reported for GDP, employment, public savings and redistributive effects in the base scenario simulations. For wider benefits, health and indoor air quality are considered. The methodology is based on an extrapolation and application of results of the study J. Ortiz and J. Salom, 2016 to the base scenario. The LTRS is transparent about the limits of this approach, but still the results may be taken as indicative of a possible impact.

8 Roadmap including measurable progress indicators and indicative milestones – Article 2a.2

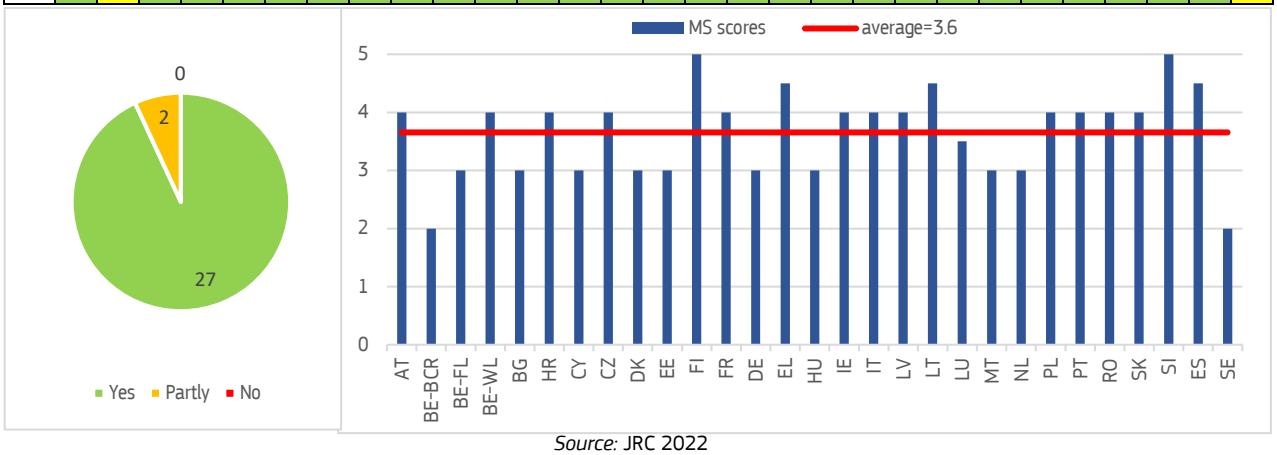
One of the key elements of an effective building renovation roadmap is to set clear and ambitious targets including intermediate milestones. For this reason a new requirement, which did not exist under Article 4 of the EED, have been introduced in EPBD Art2.a:

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.

The majority of the 2020 strategies addressed well this provision, providing a long-term vision towards a 2050 goal to decarbonise their building stock, with specific intermediate building stock milestones. All the strategies have been evaluated as compliant, with scores ranging from 3 to 5, with a high variance within this range. The only exceptions in this section are Belgium Brussels and Sweden, which have been assessed as partially compliant - score: 2 (See Figure 22). This section does not present the result of the evaluation of the LTRS ambition level based on the indicators, but only presents the indicators included in MS strategies.

Figure 22. LTRS compliance check and scores – Art 2a.2.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
2	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P



Source: JRC 2022

The strategies present a large variety of indicators to specify milestones, with the majority of Member States providing them in terms of CO_2 emission reduction and energy savings (see Table 10).

Among the best LTRS reporting on this clause are: Finland, Greece, Lithuania, Spain, Hungary and Romania.

The Finnish strategy provides a clear roadmap to 2050, with indicative building renovation targets, milestones, measurable progress indicators determined for 2030, 2040, and 2050. The development of the building stock (residential and non-residential), as well as the estimated change between 2020-2050, are clearly described. Heating primary and final energy consumption for 2020-2030-2040-2050 are also reported. Other progress indicators such as CO_2 emission reduction, the share of NZEB for each type of building are included.

The Greek LTRS states the milestone of upgrading 12-15% of buildings and or building units within the decade 2021-2030 through targeted policy measures (in some sections of the report, the objective is described as energy upgrade of 15% of houses, so clarification on the scope of the objective is necessary). Moreover, the LTRS lays down a roadmap that aims to achieve a reduction in final energy demand in buildings of 8% compared to 2015 levels by 2030, 20-28% by 2040 and 28-40% by 2050. These milestones are based on the results of the MS50 scenarios concerning energy upgrade of the building stock until 2050 calculated using the energy model PRIMES Buildings Model (PRIMES-BuiMo). Whilst the evolution of the number of energy upgraded buildings in 2040 and 2050 is not given, the expected building envelope upgrades in residential and non-residential until 2050 is discussed for the various scenarios considered in the analysis. In particular, 23% of the residential stock will have

an upgraded building envelope by 2030, 36-42% by 2040 and 45-49% by 2050. In terms of non-residential buildings, these figures are equivalent to 9% by 2030, 14-16% by 2040 and 19-20% by 2050. A roadmap that summarises the milestones in terms of energy upgrades in heating and hot water systems is also provided. The combination of low, medium and deep renovation measures that would enable the achievement of these milestones is discussed in the context of annual renovation rates of the building envelopes for each scenario in 3 different income classes. Finally, the analysis provides the overall investment costs for the various scenarios considered.

In Lithuania it is planned to renovate 74% of the building stock, to reduce the primary energy consumption by 60%, to reduce the primary energy consumption from fossil fuels by 100% and to reduce the CO_2 emissions by 100% by 2050. Indicative milestones are offered for 2030, 2040 and 2050 (having 2020 as starting year) in terms of energy-savings with and without renewable energy, CO_2 savings, units and floor area of worst-performing buildings and renovated buildings. The indicators are disaggregated per building type: single-family houses, apartment buildings, industrial buildings and other non-residential. No prediction on NZEBs is provided.

In the Spanish strategy indicative expected results are reported for 2030, 2040 and 2050 based on the estimates of alternative scenarios. A comparison with the NECP target is indicated as well as an estimate of the emission reductions (cumulative 2020-2050 emission reduction of 14 613 937 tCO_2eq for the residential sector). Estimates are provided for both the residential and tertiary sectors. Chapter 11 indicates the milestones in the framework of the NECP targets: they are reported in terms of final energy consumption and CO_2 emission reductions. A matrix of progress indicators is specified for the residential sector, tertiary sector, and public buildings. Specific indicators are defined for public investments, for energy poverty (linked to the National Strategy for Energy Poverty) and for public R&D investments in the building sector. The detailed compliance assessment of the LTRSs (Annex B) reports the details of the milestones indicated by each MS.

Table 10. Type of basic milestones and progress indicators chosen by Member States.

MS	Decarbonisation (%,$MtCO_2eq$)			Renovation rate (% per year)			Renovation of Building Stock (%)			Energy Savings (%, GWh, PJ, ktoe)		
	2030	2040	2050	2030	2040	2050	2030	2040	2050	2030	2040	2050
AT	✓	✓	✓	✓	✓	✓				✓	✓	✓
BE - Brussels	✓	✓	✓			✓			✓			✓
BE - Flanders	✓	✓	✓	✓	✓	✓				✓	✓	✓
BE – Wallonia	✓	✓	✓				✓	✓	✓	✓	✓	✓
BG	✓	✓	✓				✓	✓	✓	✓	✓	✓
CY	✓						✓			✓	✓	✓
CZ			✓	✓	✓	✓				✓	✓	✓
DE	✓			✓						✓		
DK	✓		✓							✓	✓	✓
EE			✓				✓	✓	✓			✓
EL	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
ES	✓	✓	✓				✓	✓	✓	✓	✓	✓
FI	✓	✓	✓				✓	✓	✓	✓	✓	✓
FR	✓	✓	✓							✓	✓	✓
HR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HU	✓	✓	✓	✓	✓	✓				✓	✓	✓
IE	✓						✓	✓	✓			
IT	✓		✓	✓	✓	✓			✓	✓		✓
LT	✓	✓	✓				✓	✓	✓	✓	✓	✓
LU	✓	✓		✓	✓	✓				✓	✓	✓
LV			✓		✓		✓	✓	✓	✓		
MT	✓	✓	✓	✓	✓	✓				✓	✓	✓
NL	✓		✓				✓			✓		
PL	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓
PT	✓	✓	✓				✓	✓	✓	✓	✓	✓
RO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SE	✓	✓	✓							✓	✓	✓
SI	✓		✓				✓	✓	✓	✓	✓	✓
SK	✓	✓	✓				✓	✓		✓	✓	✓

Source: JRC 2022

It worth to be noted that there is a variety of different indicators, approaches and methodologies which makes it difficult to assess the effectiveness of the strategies at EU level. A harmonised approach would help. The Commission's proposal to revise the EPBD addresses this matter.

9 Mechanism to support the mobilisation of investments – Article 2a.3

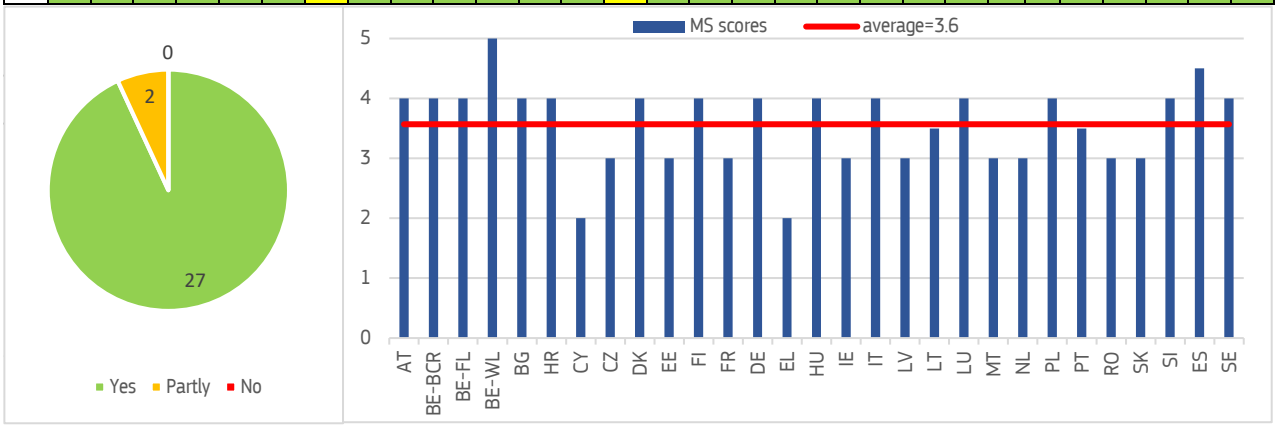
To increase the rate and depth of energy renovation, and achieve the decarbonisation on the building stock by 2050, the financing aspects plays a key role. The EU dedicates an unprecedented volume of resources to finance the Renovation Wave, including the Recovery and Resilience Facility, Cohesion Policy Funds, InvestEU[46], the European Energy Efficiency Fund, dedicated Horizon Europe calls for research and innovation, and the ELENA facility, among others. Attracting private investments[47] and stimulate green loan financing is also essential, Member States, in turn are required (EPBD Art 2a.3) to actively facilitate access to financial mechanisms to support the mobilisation of investments[48], through:

a. The aggregation of projects under single or multiple ownership, to make them more attractive to investors;
b. The educing the perceived risk of energy efficiency financing for investors and the private sector;
c. The use of public funds to leverage private investment;
d. The guidance of investments into an energy efficient public building stock;
e. The provision of better advice in the market, such as one-stop shops.

Overall the strategies performed well on this new mandatory requirements, with 26 strategies assessed as fully compliant (scores ≥3), and only two (i.e. Cyprus and Greece) partially compliant (See Figure 23).

Figure 23. LTRS compliance check and scores – Art 2a.3.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
3	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y



Source: JRC 2022

The strategies that better addressed Article.2a.3 are the one from Belgium Wallonia and Spain.

The Wallonian strategy envisages that aggregation of projects will be promoted through investment platforms or groups, and consortia of small and medium-sized enterprises, to allow access to the investor and package solutions for potential clients. Specifically, one measure encourages and facilitates group renovation approaches by tools, interlocutors, by promoting insurance schemes for collective loans, by establishing a working group with liquidators/trade union representatives, etc. In the mid-term, the support should be integrated into one-stop-shops.

One specific measure, on strengthening the exemplary role of public buildings, also aims to facilitate the financing of projects by structuring mechanisms for mobilising complementary funding (Public Private Partnership, citizen funding, etc.), in particular by aggregating projects and reducing (perceived) risks. Measure 44 aims to stimulate and support the development of cooperatives active in energy renovation.

[46] https://europa.eu/investeu/home_en.
[47] The Energy Efficiency Financial Institutions Group (EEFIG) is an initiative started by the European Commission Directorate-General for Energy and the United Nations Environment Programme Finance Initiative (UNEP FI) in 2013. It addresses barriers to energy efficiency financing through both policy design and market-based solutions to increase the scale of energy efficiency investments across Europe. See: https://ec.europa.eu/eefig/index_en
[48] This new provision 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.

The LTRS has a diversified strategy to reduce the (perceived) risks of renovation by pooling projects (aggregation measures above, promoting projects by cooperatives, pooling of projects for EPC, establishing a de-risking platform and training for the banking sector, guarantee of loans for the disadvantaged groups, etc.).

Support to EPC projects and third-party financing is explored in detail in the LTRS, including the development and standardisation of tools and documents, training in the banking sector, facilitating access to capital for smaller ESCOs, developing pilot projects, monitoring of the EPC and ESCO market, etc.

Public-private partnerships are specifically promoted by measure 36 through structuring and disseminating communication to local authorities on existing PPP solutions, organising standard documents to facilitate the use of innovation partnerships and organising a programme to support the use of innovation partnerships: appoint a team of legal, financial and technical experts to assist (public authorities wishing to launch an innovation partnership project) in structuring and implementing innovation partnership contracts. Comprehensive support for households in the form of a one-stop-shop is one of the key elements of the LTRS. The main actions include coordination of sustainable housing information advisers, financial support to one-stop-shop pilot projects, developing tools and guides to facilitate to promote renovation, integrating social aspects in the advisory service, etc.

In the Spanish strategy appropriate mechanisms are indicated for aggregation of projects; e.g. the H2020 project AUNA, recently started, created a platform/forum for financial actors with the aim of developing smart finance solutions including project aggregation and perceived risk reduction strategies. It is proposed to continue working on the possibility of creating a guarantee system or a “Limited Guarantee Fund” to cover possible defaults on loans from private financial institutions. Mechanisms from Law 8/2013 introduced different possibilities for the public sector to complement the financing of renovation and urban renewal (reinvestments of town-planning gains by changes of use or increases of construction, rent of roofs for installation of solar panels, etc.), which are implemented at the local level. Spain counts on a developed and diffused network of one-stop-shops (“ventanillas unicas”) services managed at the local and regional level, which offers a variety of integrated services (including financial and technical advice) to citizens.

10 Public consultation – Article 2a.5

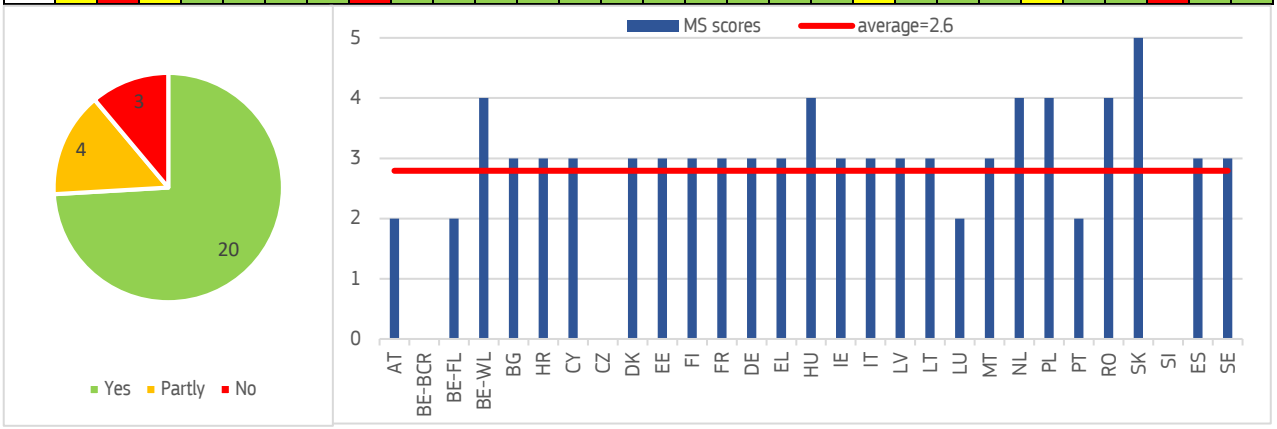
The LTRS is conceived as the reference document for the transformation of national building stock towards 2050 decarbonisation. It involves a number of different stakeholders and it should take into account the views of all interested parties.

Therefore the EPBD now, in its Article 2a.5, makes it mandatory for Member States to carry out a public consultation on long-term renovation strategy prior to submitting it to the Commission and annex a summary of the results to the strategy.

Seven Member States failed to adequately address this important requirement: three strategies lack a public consultation and four reported insufficient information on the process. The average score is lower than 3, indicating that in many cases the information provided was limited (see Figure 24).

Figure 24. LTRS compliance check and scores – Art 2a.5.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
5	P	N	P	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	P	Y	Y	N	Y	Y



Source: JRC 2022

Nevertheless, some Member States (e.g. Wallonia, Hungary, The Netherlands, Romania) understood the relevance of this provision and addressed well this EPBD clause.

In the development of the Slovakian strategy, several stakeholders have been directly involved (e.g. representatives of individual departments, civil associations active in the field of buildings (renewal or construction), representatives of research sites and professional associations and organisations, representatives of Slovak towns and municipalities, the general public). The renovation strategy also went through an interdepartmental consultation procedure and public consultation via the publicly accessible web portal www.slov-lex.sk. The results of the consultation are presented in detail in an attached document that includes the main points raised by all the relevant stakeholders involved (45 entities) and how they have been taken into account.

The Walloon strategy for the long-term energy renovation of the building has been drawn up on the basis of several working groups and consultations with stakeholders and experts from the building and related sectors (construction materials, glass, etc.) and academic, economic and public entities. Wallonia has conducted a process of benchmarking and consulting stakeholders (the methodology used is presented in detail in an Annex of the LTRS).

It worth to mention also the Croatian approach: through the Open Partnership Dialogue, action stakeholders, local and state representatives, academia, construction and energy professionals were connected and had the opportunity to contribute to the development of the LTRS. The meetings' summaries are integrated into the strategy document. Moreover, a Charter of stakeholder cooperation to decarbonise buildings by 2050 was initiated by the Croatian government, which aims to promote energy efficiency and to provide training on the EU objectives.

11 Implementation details of latest LTRS – Article 2a.6

Articles 2a.6 prescribes that Each Member State shall annex the details of the implementation of its most recent long-term renovation strategy to its long-term renovation strategy, including on the planned policies and actions.

Monitoring and evaluation is an essential phase of the policy cycle: measuring achievements against targets and milestones is the basis for fine-tuning ongoing measures and for planning and designing new ones.

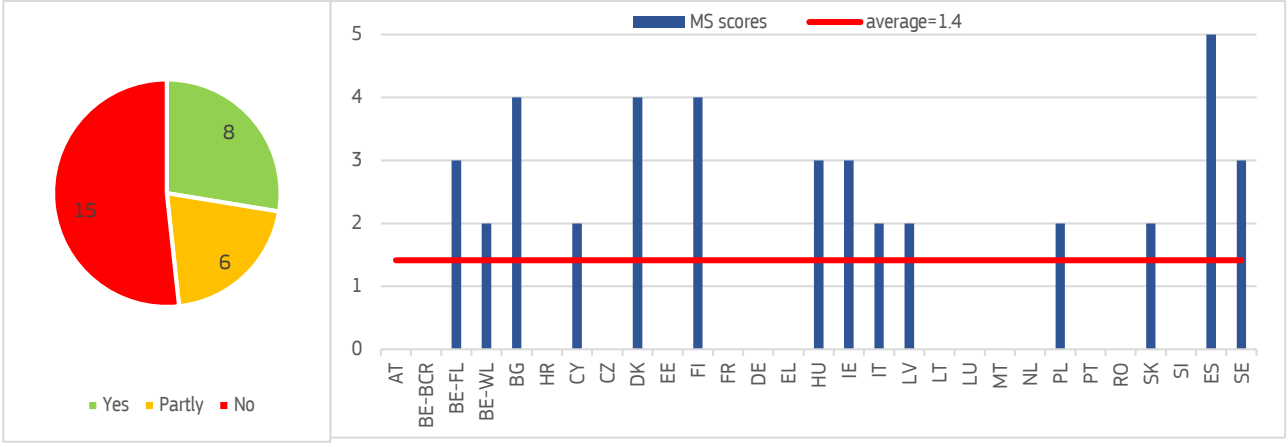
Nevertheless, this mandatory clause is the one with the highest rate of not compliance. Only 8 out of 28 strategies provided sufficient details on the implementation of the 2017 LTRS measures and actions. Fifteen MSs did not provide any information on this clause.

This very low compliance may indicate that MSs misinterpreted this new requirement or underestimated the importance of this provision, considering it as marginal or as an optional supplement to the strategy.

It is important to highlight that, the failure in reporting on this clause have a significant impact on the overall evaluation of non-compliance of the strategies. Without this specific shortage, all of them would have been assessed as compliant (24) or almost fully compliant (4).

Figure 25. LTRS compliance check and scores – Art.2a.6.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
6	N	N	Y	P	Y	N	P	N	Y	N	Y	N	N	N	Y	Y	P	P	N	N	N	N	P	N	N	P	N	Y	Y



Source: JRC 2022

Among the few strategies that well addressed this requirement, the ones from Spain, Bulgaria, Denmark and Finland can be considered as good practices.

The Spanish strategy reports all implementation measures (articulated in 9 main areas) in Chapter 10. They are mainly in the planning phase. A catalogue and following-up of existing measures is indicated in Chapter 4. Detailed information are reported even if, for most of the measures, there is not a quantification of impacts, objectives and financial resources.

The progress report on the implementation of policies and measures for the renovation of buildings in Bulgaria set put in NEEAP 2014-2020 and updated in 2017 is included as Annex 1 of the Bulgarian LTRS.

The status of implementation of the 2017 Danish LTRS is presented in Annex 5 "Implementation overview of the long-term renovation strategy of 2014/2017"; it includes a list of measures and the status of their implementation at March 2020.

Finland provides a table that includes a description of the planned measures they are divided into the following categories; Far-sighted property management, Know-how, education and training of the labour force, Digitalisation, innovations and business operations, Communications, Financial incentives.

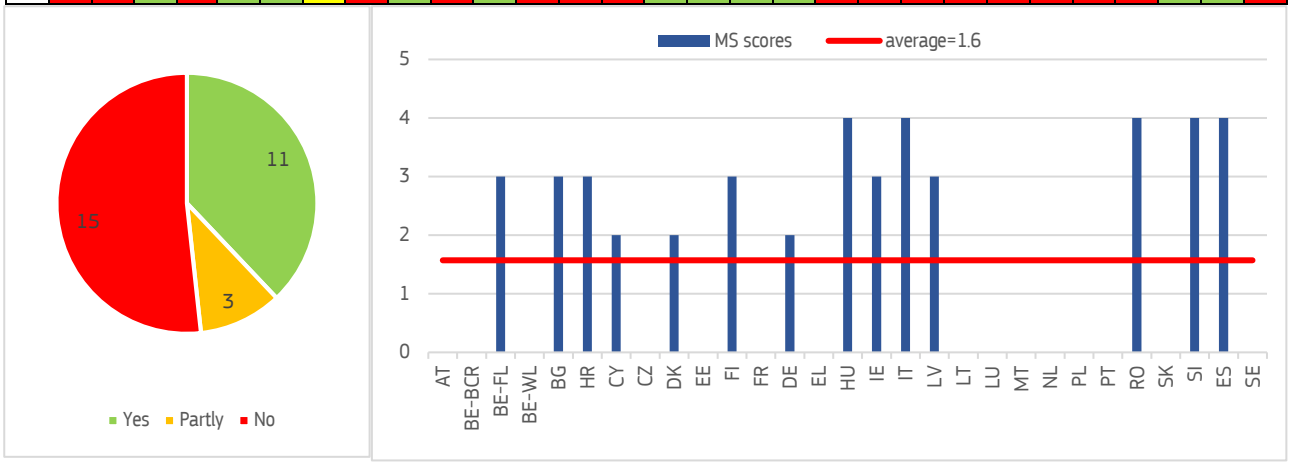
12 Safety– Article 2a.7 (optional)

The EPBD Art2a includes also an optional clause (Article 2a.7) providing 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.

In general, Member States received positively this suggestion. Even if not a mandatory requirement half of the strategies included information on this topic: in 11 cases they are considered above the compliance threshold (see figure 26).

Figure 26. LTRS compliance check and scores – Art.2a.7.

Clause	AT	BE-BR	BE-FL	BE-WL	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
7	N	N	Y	N	Y	Y	P	N	P	N	Y	N	P	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	Y	Y	N



Source: JRC 2022

In the following table the information related to the 14 strategies that addressed this clause are reported (Table 11): in particular, 9 included information on fire safety, 8 on risks related to intense seismic activities and 6 on asbestos removal[49].

Table 11. Information on fire safety, risks related to intense seismic activity and asbestos removal (Optional) - Art.2a.7.

Member State	Information provided
Belgium-Brussels	Brussels region reports that before renovation, a diagnosis of the building is performed. If during this procedure, asbestos is detected, the renovation plan must include specific recommendations for its safe removal.
Belgium - Flanders	An integrated win-win approach with the asbestos safe objective and the asbestos safety obligations for public buildings by 2034 and 2040 respectively is included. Where possible energy renovation will also be accompanied by asbestos and vice versa.
Bulgaria	The strategy mentions that due to poor technical state and based on current requirements, already in Bulgaria the energy renovation of residential buildings includes works for improving the safety state of the buildings alongside with increasing the energy performance. This practice will be further maintained.

[49] Asbestos removal is not explicitly cited in the Article 2.a.7 clause; however, in the amended EPBD (2018/844/EU) 14th indent is stated that "Member States should support energy performance upgrades of existing buildings that contribute to achieving a healthy indoor environment, including through the removal of asbestos and other harmful substances, preventing the illegal removal of harmful substances, and facilitating compliance with existing legislative acts such as Directives 2009/148/EC [6] and (EU) 2016/2284 [7] of the European Parliament and of the Council." Thus we decided to include asbestos removal information on this table. More information provided in Maduta et al, Towards energy efficient and asbestos-free dwellings through deep energy renovation, EUR 31086 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-52961-3, doi:10.2760/00828, JRC129218.

Member State	Information provided
Croatia	The Croatian LTRS mentions that the existing fire safety requirements are in some cases not applicable for existing buildings and there is a need of creating mandatory fire safety requirements for existing buildings subjected to renovation. Moreover, all safety assessments indicate that seismic activities represent the one of the major risks in Croatia. The 2020 amendment of the Technical regulation on the rational use of energy and heat retention in buildings requires to assess the existing state of the buildings and to design measures to improve the healthy indoor climate as well as the fire and seismic behaviour when energy renovation is planned. Several technical measures for improving the seismic behaviour including for buildings with cultural value are included. Guidelines, catalogue of materials and good practices should be made available and should be constantly updated with new materials and new technologies.
Cyprus	The following references to safety issues are made: 1. Seismic resistance upgrade of buildings measure: in accordance with the proposed amendment to the Energy Performance of Buildings Regulation Act, the owner of a building whose permit was issued before 1994, must appoint a suitable designer prior to a major renovation who will prepare a report on the status of the building and estimated residual life, accompanied by recommendations on how to address seismic activity issues. This aims to adequately inform building owners at the appropriate time by allowing for a more complete technical and financial assessment. 2. Research project SupERB: the 3 year project (2019-2022), aims at developing a novel integrated approach for the optimal simultaneous upgrade of buildings both in terms of seismic resistance and energy efficiency.
Denmark	In the strategy is stated that fire safety is already covered by existing Directives and that there is no intense seismic activity in Denmark;
Finland	Finnish Decree 4/2013 of the Ministry of the Environment, requires that when planning or implementing a renovation or replacement project concerning the building envelope or technical systems, the measures must be selected so as to ensure correct functioning of the thermal and acoustic insulation, moisture barriers and fire insulation of the structures.
France	France acknowledge that asbestos is still present in very large quantities in buildings and the renovation works could be source of high exposure thus a preliminary assessment of the site. This is regulated by the decree of May 2017 concerning the identification of asbestos before certain operations (with amendments in 2019 and 2020). The eco-loan for social housing, the main mechanism for social housing energy renovation in France, includes an additional top-up of EUR 3000 per dwelling if asbestos is identified in the building
Germany	Fire safety is included in energy advice and information in the framework of the individual building refurbishment roadmap. Regarding asbestos presence, in 1983 an action plan containing guidelines for the safe removal of asbestos was put in place. The guidelines were amended in 1996 and again revised in 2019. However, the presence of asbestos in existing building is still an open issues. The share of such buildings is estimated to be around 80%. As a result of the National Asbestos Dialogue, information on the safe renovation of existing buildings containing asbestos will be available soon.
Hungary	Building safety issues such as fire safety, and seismic risk, together with issues related to obsolescence of electrical systems, and gas equipment and appliances possible leakages, are discussed in a specific section of the strategy (i.e. section VII.2). Also integrated measures for asbestos removal in buildings are included (e.g. section VIII.1). During renovations, the replacement of asbestos-containing materials (such as asbestos roofs) often takes place. Hungary plans to monitor the quantities of asbestos waste generated by building renovation among the indicators on health impact.
Ireland	in the LTRS is stated that "There is an also very low level of seismic activity in Ireland resulting in very minimal fire safety and risk in relation to energy efficiency renovations.
Italy	Fire safety issues and risk related to seismic activity are discussed in detail in section in the strategy. In order to optimise the cost-benefit of building renovations, safety and energy efficiency policies are integrated and some measures promoting an holistic deep renovation approach (seismic safety + energy efficiency) have been implemented (e.g. ecobonus+ sismabonus" focused on multi-apartment buildings). Deep renovation and/or reconstruction after a seismic event has been identified as a key trigger point for energy renovations (i.e. "opportunity window ").
Latvia	The document reports specific standards addressing fire safety, namely: Regulations on Latvian Construction Standard LBN 201-15 "Fire Safety of Buildings".
Poland	Poland is a best practice among the MSs in addressing asbestos registration and removal from existing buildings. Besides the national asbestos database and the national programme for making Poland asbestos-free by 2032, there are several public renovation programmes that coordinate energy efficiency upgrades of public and private buildings with asbestos and other hazardous materials removal.
Romania	A list of complementary measures for both fire and seismic risk is implemented, finding the possible relations with energy efficiency building renovations.
Slovenia	Detailed information provided: safety and energy efficiency, are viewed in an integrated way in building renovation
Spain	This information are reported with details. Recent technical and legislative developments are reported for both fire risk and safety, and for seismic activity.

Source: JRC 2022

13 Conclusions and policy recommendation

The compliance assessment shows a positive picture. All strategies could be considered as compliant except for the very last two Art 2a provisions. Indeed the majority of Member States (MS), did not provide supporting evidence on those specific points (i.e. 'public consultation' and 'latest LTRS implementation details'). The results change by including these two provisions in the analysis, and the assessment identified different levels of compliance for MSs, but still only 3 strategy updates were considered non-compliant (13 non-fully compliant, 7 almost compliant and 6 fully compliant).

The submission of the strategies has been delayed in the majority of the cases, with only five MSs[50] (i.e. FI, NL, BE-Brussels, DK and SE) respecting March 2020 deadline. Nearly 40% of the total LTRS (11 out of 29) were submitted only in the course of 2021 or later. The delays, partly due to the exceptional and unexpected circumstances of the COVID-19 emergency are expected to negatively affect the comparability among the plans elaborated in different Member States. Latecomers had indeed the possibility to elaborate further their documents and include in their strategy also considerations linked to the COVID-19 crisis and the latest EU policy initiatives, such as the Renovation Wave. Whenever possible the assessment took into account the different contexts and timing when each strategy was drafted and submitted.

Overall, the highest-scored renovation strategy as regards compliance is the one from Spain (36/40 – 89% of total possible points), followed by the one from Belgium Wallonia (35/40 – 88%), Finland (33/40 – 83%), Italy and Lithuania (30/40 – 75%).

On average, the strategies addressed well the majority of Art.2a provisions (average score >3.5), with the exception of clause 5 on public consultation (average score 2.7) and clause 6, the requirement to provide implementation details of 2017 LTRS, that was missing in more than half of the analysed strategies and received the lowest scores (1.4 on average).

Member States provided a reasonably detailed description of their building stock, with all the strategies assessed as fully compliant for this clause (score ≥3). Recognising the improvements in comparison with LTRS submitted in the past (Castellazzi et al., 2019), the assessment of the strategies on this specific provision underlined once more the need and importance of a more uniform approach: guidelines and harmonised templates should be further improved and used by MSs in their reporting. This would foster comparability and a structured approach in the description of the existing building stock helping in the definition of more tailored actions.

Almost two-thirds (18/29) of the strategies identified and presented trigger points in their strategies, with a variable level of detail. Some also used them to design specific polices to stimulate energy renovations (e.g. the Danish mandatory requirement to include energy renovation once the building owner renovates the different parts of the building due to wear).

Overall, Member States addressed exhaustively Article 2a1(c-f) requirements, providing a comprehensive set of policies covering the EPBD provisions with all the strategies that were fully compliant (score ≥3), with the exception of the one from Greece and Latvia (score 2.5).

The large majority of strategies include a good overview of policies to target all public buildings; whereas the provision on policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty (clause 1d) have been sufficiently covered by 2/3 of the strategies.

As indicated in the Renovation Wave Communication[51], tackling energy poverty and worst-performing buildings is one of the area that deserve specific attention. Member States seem to have recognised the importance of energy poverty and in general, and the actions and measures proposed appears adequate. All but one strategy include specific measures to address energy poverty in their LTRS.

As regards worst-performing building, they have been identified by the majority of Member States, using a mixture of different approaches (e.g. energy class, age, energy consumption).

EPBD Article specifically requires MSs to provide an evidence-based estimate of expected energy savings and wider benefits. The reviewed LTRSs well understood the importance of this provision, including in all the strategies a specific section to discuss expected energy savings and multiple benefits, such as the one related to health, indoor air quality, and positive economic impacts. Nevertheless, in half of the cases, MSs did not provide a quantification of the potential wider benefits.

[50] FI, NL, BE-BCR, DK, and SE. Denmark provided an additional document to complement the strategy in August 2021.
[51] COM(2020) 662 final

One of the key elements of an effective building renovation roadmap is to set clear and ambitious targets including intermediated milestones. This was well understood by Member States that in the majority of the 2020 strategies provided a long-term vision towards a 2050 goal to decarbonise their building stock, with specific intermediate building stock milestones. In most cases milestones for 2030 and 2050 were set, but not always for 2040. All the strategies have been evaluated as compliant for this provision, with scores ranging from 3 (sufficient) to 5 (outstanding), with a high variance within this range. The only exceptions in this section are Belgium Brussels and Sweden, which have been assessed as partially compliant.

As already mentioned, the provision of the details of the implementation of the latest LTRS is the one worst addressed by MS, with only 8 out of 29 strategies providing some details on the implementation of the 2017 LTRS measures and actions. Policies monitoring and evaluation of implemented polices has a key role in the design of new measures and fine-tuning of the existing ones, and this very low performance may indicate that MSs misunderstood this new requirement or underestimated the importance of this provision, considering it as marginal or as an optional supplement to the strategy.

Also, the obligation to carry out a strategy public consultation and annex a summary of the results was poorly addressed by Member States, with four strategies that did not report any information and four that provided only few details. As the LTRS should be the reference document for the transformation of national building stock towards 2050 decarbonisation, a comprehensive consultation of the public involving all relevant stakeholders is fundamental.

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.

As a final remark, it can be noted that while the compliance of the strategies, excluding the last two clauses, is generally high, the SWD (2021) 365[52], which complements the analysis of this Report, highlighted that the level of ambition of LTRS is not always in line with the 2050 decarbonisation goals.

This may suggest the opportunity for a revision of the Directive that reinforces MSs strategic planning and reporting tools to make them more focussed on actions, with clear, quantified, comparable and verifiable indication of objectives, milestones and resources. Improving template harmonization and providing additional support to MSs on the less addressed points of the LTRSs (e.g. progress monitoring, public consultation), are also important steps in the road to the 2050 building stock decarbonisation goal.

[52] COMMISSION STAFF WORKING DOCUMENT "Analysis of the national long-term renovation strategies" Brussels (SWD(2021) 365 final/2).

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List of abbreviations and definitions

AUER	Sustainable Energy Development Agency (Bulgaria)
BCR	Brussel Capital Region
BER	Building Energy Rating (Ireland)
BGN	Bulgarian lev
BRP	Building Renovation Passport
BSO	Building Stock Observatory
CNG	Compressed Natural Gas
DEEP	De-Risking Energy Efficiency Platform
DHW	Domestic Hot Water
EE	Energy Efficiency
EED	Energy Efficiency Directive
EEEF	Energy Efficiency Fund
EEFIG	Energy Efficiency Financial Institutions Group
EEOS	Energy Efficiency Obligation Scheme
EIB	European Investment Bank
ELENA	European Local Energy Assistance
EPBD	Energy Performance of Building Directive
EPC	Energy Performance Certificate
EPOV	EU Energy Poverty Observatory
ERDF	European Regional Development Fund
ESCO	Energy Service Company
ESTAT	Eurostat
EU-SILC	EU Statistics on Income and Living Conditions
FEC	Final energy Consumption
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation
GIS	Geographical Information System
GDP	Gross Domestic Product
HVAC	Heating, Ventilation & Air Conditioning
IAQ	Indoor air quality indices
IEA	International Energy Agency
IF	Investment Fund
LPG	Liquefied Petroleum Gas
LTRS	Long-Term Renovation Strategies
MFF	Multiannual Financial Framework
MFH	Multi Family Houses
MS	Member State
NDP	National Development Plan

NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan
NIB	Nordic Investment Bank
NSI	National Statistical Institute
NZEB	Nearly Zero energy Building
OIB	Austrian Institute of construction engineering
OP	Operational Programme
PaMs	Policies and Measures
PPP	Public Private Partnership
PV	Photovoltaic
RES	*Renewable* Energy Systems
SFH	Single Family Houses
SME	Small and medium-sized enterprises
SWD	Staff Working Document
TCI	Thermal comfort index
VAT	Value added tax
WAM	With Additional Measure (scenario)
WEM	With Existing Measures

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Annexes

Annex A – EPBD Article 2a

The Directive, in its Article 2a, requires EU Member States (MS) to establish a long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonised building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings. Each long-term renovation strategy shall be submitted by 10 march 2020, (and updated every three years thereafter) and shall include:

(1a) an overview of the national building stock, based, as appropriate, on statistical sampling and expected share of renovated buildings in 2020;

(1b) 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;

(1c) 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;

(1d) 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;

(1e) policies and actions to target all public buildings;

(1f) 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; and

(1g) an evidence-based estimate of expected energy savings and wider benefits, such as those related to health, safety and air quality.

(2) 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.

(3) 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:

(3a) 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;

(3b) the reduction of the perceived risk of energy efficiency operations for investors and the private sector;

(3c) the use of public funding to leverage additional private-sector investment or address specific market failures;

(3d) guiding investments into an energy efficient public building stock, in line with Eurostat guidance; and

(3e) accessible and transparent advisory tools, such as one-stop-shops for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments.

(5) To 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.

(6) The details of the implementation of its most recent long-term renovation strategy to its long-term renovation strategy, including on the planned policies and actions.

(7) Each Member State may use its long-term renovation strategy to address fire safety and risks related to intense seismic activity affecting energy efficiency renovations and the lifetime of buildings.

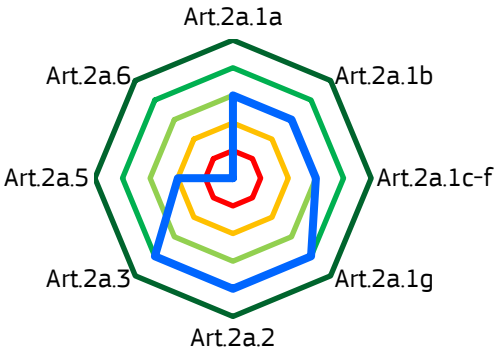
Annex B - Summary of the detailed compliance assessment of the 2020 Long-term renovation strategies

Legend: Y=Yes; N=No; P=Partly; U=Unclear

AUSTRIA

1. EPBD Art.2a COMPLIANCE

Introduction The LTRS was submitted as a separate document after the NECP. It complements the NECP as the information on Art. 2a EPBD was largely missing in it. The LTRS goes beyond the minimum requirements under the EPBD as it largely sums up comprehensive efforts and projects undertaken at the federal state and local levels. The assessment relates to the German-language version of the LTRS.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement		Score (1-5)
1a	**National Building Stock, and expected share of renovated building**	Y	**3**

Building and dwelling numbers are given for main residences. All other information relates to per capita or per dwelling data, which is not fully compatible (see table building stock). Notably, detailed information for schools & hospitals is missing. Statistics for non-residential buildings are not included. The LTRS notes that the data for non-residential buildings lag behind data collection for residential buildings. However, as the bulk of historic CO_2 emission reductions have been achieved in the residential building sector (32 percentage points of 35% for the period 1990-2017), the analysis focuses on residential buildings. Energy Performance Certificates are broadly used for add-ons (consultation services, information hotlines, online calculation tools) at the regional and local levels.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	1 973 979	4 300 049	-	(LTRS) Buildings in 2011
	SFH	1 727 129	2 012 092	-	(LTRS) Buildings in 2011
	MFH	246 850	2 287 857	-	(LTRS) Buildings in 2011
Non resident	TOTAL	-	-	-	Styria region: all buildings built before 1980 are identified as worst-performing (in 1883 the first energy regulation were introduced).
	PUBLIC	-	-	-	
	OFFICES	-	-	-	

b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

Cost-effectiveness considerations are included in the LTRS, including an estimate of overall refurbishment costs (€ 5 336 million in 2017).

Trigger points are identified but related only to the economic depreciation of a building component, rather than sales or lease of a dwelling.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

- Deep renovations, including staged renovations and building renovation passports, are part of the federal Austrian buildings law.
- Fiscal support mechanisms and information support mechanisms exist at the federal level but to a larger extent at the regional and local levels.
- **Energy poverty** is addressed by a leverage factor included in the energy efficiency obligation scheme under the federal energy efficiency law. Savings achieved in low-income households are leveraged with a factor of 1.5, which renders this segment more interesting for the obligated energy suppliers.

- An overview of the **worst-performing** sector of the national buildings stock is not presented; measures addressing this sector are presented in the LTRS for some regions.
- Measures to address **split incentives** and market failures are described at the regional level as well, but not for the federal level.
- For **public buildings**, an energy-saving potential of 84.7 GWh has been assessed for 2021-2030. This is to be addressed by using contracting and refurbishment planning measures, a refurbishment offensive (#mission2030) for the public sector and public procurement of energy-efficient building components. The federal level and the regions have agreed on a voluntary agreement for CO_2 reduction in the public sector, which is largely to be achieved by building renovation.
- Initiatives to increase **skills and education** in the construction sector are in place and planned to be updated.
- The LTRS reports the promotion of **smart technologies** largely based on technical guidelines, participation in international projects and networks (IEA & Horizon 2020). The list of regional and local smart city initiatives is very comprehensive and extremely advanced.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**
The LTRS presents a very comprehensive modelling approach to determine energy demand, use of energy carriers and GHG emissions until 2050 based on 5 model runs, which have been cross-checked, validated and co-developed with stakeholders. Air quality and additional benefits are discussed in a qualitative manner, but not quantified.			

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**
Renovation milestones are based on comprehensive modelling of several scenarios, which have been counter-checked, calibrated and validated with experts in stakeholder rounds. The milestones are defined as corridors for GHG emissions. A clear contribution to the energy efficiency targets is not discussed.			
2030	• 60% decarbonisation of the building stock by 2030 (vs 1990). • Reduction of energy consumption: - 56% (from 1990 levels).		
2040	• Reduction of energy consumption: - 70% (from 1990 levels).		
2050	• 80% decarbonisation of the building stock by 2050 (vs 1990). • Renovation rate (across all building types) to be increased to 3% from current 1.5% p.a. (for the 2020-2050 period).		

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	**4**
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

Several projects and cooperations (IEA, ELENA, H2020 and others) on contracting and **project bundling** at the federal and federal state level are presented in the LTRS.

- **De-risking** is addressed in the framework of participation in the De-Risking Energy Efficiency Platform (DEEP) database of the Energy Efficiency Financial Institutions Group (EEFIG) (pp. 154). The state-owned Kommunalkredit Austria and its subsidiary Kommunalkredit Public Consulting (KPC) have special guidelines favouring investments in energy efficiency. Further de-risking initiatives exist at the regional level.
- Use of **public funding** to mobilise private sector investment (Art. 2a 3c) is existing at the regional level in all federal states. For guiding investments into an energy-efficient **public building stock**, the federal level largely uses contracting and ESCO initiatives (Energie Contracting Program and CO-MOD – Contracting Modular).
- **Advisory tools** are existing at federal level, where the klimaaktiv Kompetenzpartner (qualified experts) are presented as one-stop-shop and through various programmes in the federal states.

Summary results of the public consultation	P	**2**
Several rounds of consultation have been taking place and are documented. Results of the consultation are, however, not provided as annex to the LTRS.		

Implementation details of latest LTRS	N	**0**

Fire safety and intense seismic activity risks (optional)	N

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Austria is applying a comprehensive set of measures to address building renovation in a good practice mix of regulatory requirements, fiscal and economic incentives and informative measures. The LTRS sets a clear list of milestones until 2050, expressed in GHG emission corridors. The strategy focuses on phasing out the use of coal and oil for heating and is underpinned by comprehensive modelling efforts that have been cross-validated by the federal states and external stakeholders. The LTRS modelling estimates that the set of measures is adequate to achieve the 80% decarbonisation of the buildings stock, "given good economic conditions". The modelling of fuel use and GHG impacts and the concertation of modelling results with federal states and experts is clearly good practice. LTRS reports on activities at the federal, federal state and local level. The measures are in place across all government levels, which guarantees to tailor measures to local needs. Despite the comprehensive reporting on ongoing activities, energy-saving figures are not provided for the individual PaMs. In some cases, the task-sharing between the federal government and the federal states is not clearly described. Building certificates are mainly addressed at the federal state level and used there as a basis for add-ons such as online support tools or counselling services. Quantitative indicators other than GHG or CO_2 reduction figures that allow tracking of support (% of renovated buildings, % of NZEBs, etc.) are largely not reported.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS is comprehensively bundling information of existing and planned policies across all government levels, which is extremely helpful. However, some of the information provided (e.g., planned wind parks etc.) are not relevant/appropriate. Some relevant information, notably in terms of energy consumption, is missing. In some cases, the policy choices for addressing the LTRS are not fully clear and leave room for interpretation.

Good practices

Regulatory measures:
Austria is applying a solid set of regulatory measures and buildings standards, which are to be updated at regular intervals.

Tools and mechanisms to support the mobilisation of finance:
Renovation activities are largely incentivised via the use of soft loans and grants.

Public sector:
The public sector largely recurs to contracting solutions, including energy performance contracting solutions for energy-efficient renovation. School and hospital buildings are addressed by initiatives at the regional and local levels.

Tackling worst-performing buildings and energy poverty:
Leverage factor for addressing energy poverty in the EEO scheme: In the federal law on increasing energy efficiency in companies and the federal government (Bundes- Energy Efficiency Act - EEffG), it is stipulated that at least 40% of all efficiency measures have to be effective for households in the residential sector. Measures for low-income households are to be rated with a factor of 1.5. This means that measures that are implemented in the case of low-income budgets, as well as concrete projects with social services and debt counselling centres, are weighted with the factor 1.5. For obligated companies (energy suppliers), this represents an incentive to become more active in this area in order to reduce energy poverty. Examples of such measures include qualified energy consulting by consultants with social work experience or equipment replacement. Household measures represent a share of 37.3% of the total savings with annual savings of 25.4 PJ. In low-income households, measures were implemented with annual savings of 0.62 PJ set.

Other measures:
The Austrian smart city activities, which are largely implemented at the regional and local levels are very promising in terms of investigating the inclusion of e-mobility as well as smart metering/grids and derived energy services.

Strengths and Innovative approaches

Whereas the individual instruments to tackle building efficiency seem to cover the "classic" measures, the Austrian concept is very interesting as it applies these instruments largely at the federal state and local levels, with the federal government only providing key framework legislation. This is relevant in terms of regional adaptation to the local situation (e.g., by putting a "Masterplan Gründerzeit"/Art Nouveau in Vienna to address historic buildings for the core of the city and running at the same time the very innovative Smart City Aspen in the outer Aspen town quarter of Vienna. Likewise, school refurbishing is be addressed at the regional/local level with several projects mentioned. In addition, the LTRS demonstrates strongly the use of multi-level-governance and the participation in EU projects to test innovative approaches (again at the regional and local level) across the country.

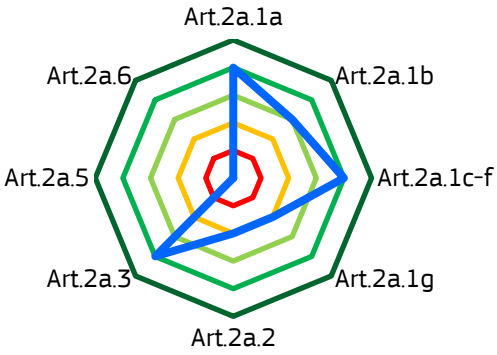
Recommendations

- In some cases (e.g., specifications for deep renovation, the existence of an EPC database at the national level), it remains unclear whether these apply at regional or even project level or whether they are installed at the federal level. A clearer overview or the use of the template for LTRS reporting would increase clarity on the strategy and the existing measures;
- Energy-saving impacts could be provided for the individual measures;
- A clear and comprehensive assessment of co-benefits could be provided.

BELGIUM – Brussel Capital Region

1. EPBD Art.2a COMPLIANCE

Introduction The Brussels Capital Region "STRATEGIE DE REDUCTION DE L'IMPACT ENVIRONNEMENTAL DU BATI EXISTANT EN REGION DE BRUXELLES-CAPITALE AUX HORIZONS 2030-2050", was provided as a separated stand-alone document in March 2020 and it goes beyond the energy dimension, including also other environmental and sustainability aspects (e.g., reuse of building material after demolition). The document was available in French when assessed.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

The strategy includes (in Annex 1) a comprehensive and detailed analysis of buildings by type, age, tenancy, and energy performances (including insulation type), as well as consumptions by energy carriers and end-use. The share of renovated buildings is provided only until the year 2013. Different sources of datasets are matched (e.g., energy balance, national statistics, specific studies).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	573 275	-	-	
	SFH	257 974	-	-	Terraced, semi-detached, detached and other residential
	MFH	315 301	-	-	
Non resident	TOTAL	623 126	-	-	38 543 commercial buildings, 39 607 social housing units
	PUBLIC	-	-	-	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

The results and main conclusions of the 2017 study on cost optimality for the residential building are presented in Annex 2 (11 building types and 2 500 architectural different configurations have been considered). The methodology appears reliable, and the identified cost-optimal levels are quite ambitious. Trigger points have been identified (e.g., building change of ownership, non-energy efficiency-related renovation works) and a well-defined strategy (including and combining awareness-raising/communication/training/funding actions) to take advantage of these opportunities/key moments is provided.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

A comprehensive set of policies and measures on deep renovation have been adopted and already implemented in BCR. In the 2020 LTRS this set of measures is very well improved/strengthened, with the inclusion of several new measures, described in detail in 34 "Fiches" (in Annex), covering new **Regulatory requirements**, funding and incentive schemes, awareness-raising and training actions with a detailed description that includes the target groups, the actors involved and a roadmap with intermediate targets (e.g., at 2020, 2030, 2040 and 2050).

All the EPBD Art.2a1 requirements, i.e., building **renovation passports**, staged deep renovations, **energy poverty** alleviation actions, **worst-performing** building, **skills and education** programmes, exemplary role of **public buildings**, have been

considered and addressed by a well-balanced and planned set of policy measures, although energy-saving impacts and budget figures are not regularly established.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	P	**2**
The impact of the Strategy is not quantified in terms of energy-savings, cost savings for the owners and the tenant, or in terms of jobs, health and environmental impacts (from the planned target of a 2050 average 100 kWh/m^2/y primary energy consumption for residential, it can be estimated a reduction of the 53% of the current average primary consumption in the residential sector). As regards wider benefit, the strategy mentions that energy renovation will improve the indoor air quality and comfort and will help reduce the GHG emissions and improve the quality of the environment.			

2	**Roadmap including measurable progress indicators and indicative milestones**	P	**2**
Building renovation targets, milestones, progress indicators determined for 2030, 2040, and 2050 are not provided in the strategy. Only an indicative target for 2050 is provided: for residential buildings, an average of 100 kWh/m^2/y primary energy consumption, for tertiary, energy neutrality for heating, domestic hot water, cooling and lighting. Nevertheless, a clear and well-described roadmap, with 2030, 2040, and 2050 intermediate targets and progress indicators is provided for each of the 34 planned measures/actions.			
2030	-		
2040	• 100% public buildings energy neutral by 2040		
2050	• Renovation rate: more than 2% (for 2020-2050) • Renovation of building stock: 80% residential (2020-2050) • Energy savings by 2050: Residential sector: 53% reduction. 100 kWh/m/y primary energy consumption. Tertiary sector: energy neutral for heating, domestic hot water, cooling and lighting		

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	
The strategy includes a comprehensive set of measures for the mobilisation of investments and activating all funding levers: Mobilisation of citizen savings, attractive banking products, tax incentives, third-party investments, equity financing, the activation of EU funds, etc. These innovative financing mechanisms are described in tree specific datasheets: “innovative financing mechanisms”, “Introducing tax incentives for renovation housing stock energy”, and “financing from European funds”. The development of energy performance-based financing mechanisms and the promotion of ESCO market is also included, together with advisory and coaching tools (i.e., one-stop-shops, facilitators, energy advisors). The current financial support mechanism (e.g., the Brussels green loan and the energy bonus) will be revised and strengthened to be adapted to better support the upcoming renovation obligations of the residential stock. All the EPBD Art.2a.3 requirements are well addressed. As regards public buildings, according to the Energy Pact provisions, they will be energy neutral by 2040.			

Additional information

Summary results of the public consultation	N	**0**

Implementation details of latest LTRS	N	**0**

Fire safety and intense seismic activity risks (optional)	N

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The BRC renovation strategy is a detailed and structured document with a high level of ambition. Its strength includes going beyond the energy dimension to embrace also wider environmental and sustainability aspects, but without touching on macro-economic (GDP, employment) or health impacts. It has a specific focus on the residential sector and it makes a comprehensive overview, with detailed information and data, of the residential building stock and an update of the cost-optimal calculations, with a clear identification of trigger points. It shows a comprehensive and well-balanced set of policies to stimulate deep renovation, including a very interesting and innovative "phased renovation obligation" measure that, starting from 2021, will make it mandatory for homeowners to implement 5 building renovation measures (identified through a mandatory energy performance certificate). The strategy recognises the key importance of financial aspects of building renovations, and it includes a comprehensive set of measures for the mobilisation of investments and activate all funding levers. Energy poverty issues are taken into account with specific measures (e.g., improving the energy performance of social housing buildings) and, with mechanisms implemented under various measures, to prioritise vulnerable households.

Level of details/ Appropriateness/ Comprehensiveness

The residential building stock is well detailed. The existing and planned set of measures is comprehensive and covers a broad spectrum of instruments well combining regulatory, financial and awareness-raising actions.

Good practices

Regulatory measures:
The planned "phased renovation obligation" measure; This measure, to be adopted by 2021, will make it mandatory for homeowners to implement 5 choice measures (identified in the mandatory energy performance certificate) every five years, starting from 2030, with the objective to reduce the building stock energy consumption to the 2050 target. That is a very interesting and innovative measure that, with the support of the proper funding and financing mechanisms, can lead to the deep renovation of the residential building stock.

Tools and mechanisms to support the mobilisation of finance:
Reform of property taxation to be adapted to promote building renovation investment: modulation of registration and /or inheritance tax in relation to the completion of energy-savings works; temporary exemption or reduction of property tax, in case of an ambitious energy renovation (e.g., when several recommendations of the mandatory energy performance certificate are carried out at the same time).

- Introduction of a bonus scheme linked to the renovation obligations of the residential stock. The premiums will be available if the work is carried out at least one year before the deadlines set out as regards "Energy performance requirements and obligations", with an increase in the amounts granted when several priority measures are carried out at the same time. In particular, a bonus will be granted for the establishment of a renovation plan by an architect.
- Establishment of a project facilitator to help entities develop EPCs and choose suitable ESCO. This facilitating body will also play the role of aggregator of applications in order to limit the expenditure of ESCO in research and project planning.

Public sector:
100% green electricity supply for public buildings: will be imposed in the very short term for the Brussels regional administrations.

Tackling worst-performing buildings and energy poverty:
Revision of the energy bonus mechanism" in order to include vulnerable households.

The Measure "Revision of the Brussels green loan" foresee a 0% loan rate for a vulnerable target audience.

Other measures:
n/a

Strengths and Innovative approaches

Strength: a very comprehensive set of measures, covering all the building renovation dimensions: regulatory, financial, awareness-raising, user behaviour, trainings, supporting schemes;

Innovative approaches: The planned "phased renovation obligation" measure (see above).

Recommendations

Consider including:

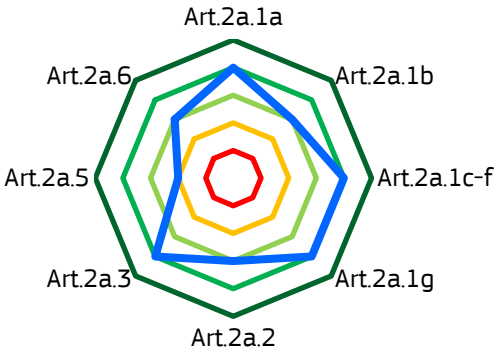
- Cost-benefits analysis in terms of jobs, energy cost savings, health and emission reductions and scenario analysis to investigate different policy/intervention options.
- Indicative building renovation milestones determined for 2030, 2040, and 2050 indicating how they contribute to achieving the Union's energy efficiency targets and including progress indicators determined.
- Energy-saving impacts and budget for all measures.
- Information on the non-residential building stock (e.g., figures on Hospitals, Schools).

BELGIUM – Flemish Region

1. EPBD Art.2a COMPLIANCE

Introduction

The Flemish LTRS was provided as a separated stand-alone document in June 2020.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

The Flemish building stock is described with recent data and a good level of detail for both the residential and non-residential sectors. Building categories considered are residential buildings (single-family homes, apartments, collective residential buildings), public buildings (federal government, Flemish government, provincial and municipal authorities, public companies, education, welfare, health), non-residential buildings (offices, commercial buildings, utility buildings). More than half of the buildings have an energy performance certificate EPC (1.5 million out of 2.7 million), that is mandatory in the case of the sale/lease of an existing building and for new buildings. Only 3.5% of the existing buildings meet the 2050 energy performance target (100 kWh/m²/y), and 96.5% of the building stock need to be renovated (3% per year, 90 000 residential

		No. of buildings	No. of dwellings	Floor area (m²)	Notes and sources
Residential	TOTAL	2 292 963	2 986 907	-	Land registry building stock statistics 2019
	SFH	2 137 915	-	-	Terraced 652 055; semi-detached 587 359; detached 898 501
	MFH	131 693	848 992	-	Apartment buildings
Non resident	TOTAL	416 574	-	-	
	PUBLIC	-	-	-	
	OFFICES	-	-	-	77 524 commercial buildings, 339 050 others

1b	Cost-effective approaches to renovations and trigger points identification	Y	3

The cost optimal calculation methodology, the assumptions and the cost optimum levels for renovations are described (for 9 building types) and are based on the results of a 2012 study (referenced). The strategy 2050 long-term objective of a primary energy consumption of less than 100 kWh/m²/y for all the residential buildings is cost-optimal only for the terraced townhouse. For all dwellings, the objective is in the cost-effective zone and for most dwellings, even relatively close to the cost optimum with a limited total current additional cost of 1% to 6% above the cost-optimal point. Only in the case of the detached farmhouse is the total current cost to achieve E57 or 92 kWh/m²/y, 20% higher than the cost optimum. This dwelling is consequently an example of the lock-in effect, whereby insulating it to a sub-optimal level in the past leads to a limited rate of return for additional measures in the present. Cost-effective measures (e.g., insulation level, boiler substitution, ventilation systems) are also described, both for residential and non-residential buildings. New studies on the cost-optimal levels of energy performance requirements are planned for 2022. A detailed analysis of renovation trigger points is also provided. The trigger points play an important role in the strategy and their identification allow to assess the related renovation potential and to link support and/or regulatory measures that take into account the specificities of these moments.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

The Flemish strategy includes a comprehensive package of measures for the residential and the non-residential sector, covering all the requirements of the EPBD articles 2.a1 including **staged deep renovations**, **building passport**, further development of the EPC + as an advisory tool, an overview of the **worst-performing** segment of the national building stock, measures to overcome **split-incentive** and alleviate **energy poverty**. Specific incentives for deep renovations are foreseen in the framework of trigger points (e.g., transactions, purchase, inheritance, rent). For the non-residential buildings, a renovation obligation within 5 years after acquisition for tertiary will be introduced, together with a mandatory EPC for all large non-residential buildings. In order to emphasise the exemplary role of public buildings, an Energy Efficiency Action Plan has been in place since 2016, with the aim of reducing CO_2 emissions by 2030 by 40% and reducing primary energy consumption by 27% compared to 2015. This was converted, for the entities belonging to the Flemish Government, to an annual savings target of 2.09% of primary energy use. In the first instance, this annual savings target will run from 2017 to 2020. The 2019-2024 coalition agreement takes the commitment to increase the annual savings target to 2.5% from 2021 onwards.

Initiative to promote **smart technologies** (i.e., Smart Readiness Indicator, digital energy meters) and skills and education in the construction sector (listed at www.energiebewustontwerpen.be) are also described.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

The expected energy-savings and GHG emissions (-85% compared to the 2005 levels) reduction up to 2050 (with 2025, 2030, 2040 milestones) have been estimated. Wider benefits have been identified and quantified: structural positive impact on society and the quality of life (every euro invested in energy efficiency can generate between € 1 and € 5 in the economy, health, avoidance of climate impacts, energy security and resource use), economy stimulus (Investments to renovate the existing buildings until the 2050 target are estimated to be more than € 200 billion), Employment (The implementation of the renovation strategy can contribute to this challenge by creating at least 25 000 local stable jobs over the next 4 years. The need for additional capacity will also continue to grow to 40 000 and more by 2030) alleviation of energy poverty, improvement of students' performance and offices productivity increases.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

A roadmap for the Renovation scheme for the Flemish Region towards 2050 has been defined for both residential and non-residential buildings (starting point 2017), including the evolution of final energy use, the evolution of the use of fossil fuels and associated greenhouse gas emissions, the estimate of the investment resources necessary to carry out the renovations. The methodology is described in detail (3 scenarios have been developed).

While the overall 2050 objective (all building in class A, 75% energy performance improvement) and the 3 scenarios are well described (e.g., 2030 different scenario milestones are -18%, -26% or -33%), it is unclear which of the scenario have been selected and is considered the chosen roadmap. The building stock investment needs and their evolution over the years is also described in detail for each scenario.

2030	-
2040	-
2050	• Decarbonisation: 74% (Residential), 100% (Non-residential) by 2050. • 70% reduction in energy use (Residential) and 33% reduction in energy use (Non-residential) by 2050. • All buildings (old and new) to have energy performance class A by 2050 (75% energy performance improvement).

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

To support the cost-effective transformation of the Flemish building stock, there are several initiatives in the Flemish Region

facilitating access to finance:

Aggregation of projects: Flemish Burn Premium. Since October 2017, a premium for project leaders who renovate collectively a number of dwellings (at least 10) in order to make this energy-efficient. The project leader shall support the citizen in achieving energy-saving investments; "LIFE IP BE REEL! 2018-2024": The Flemish cities of Antwerp and Mechelen, in the context of this project, are organising various demonstration projects for collective renovation.

Reduction of Risk: The H2020 Energy-efficient Mortgages Initiative (EEMI) (https://energyefficientmortgages.eu) works on mortgages/credits that take into account the positive impact of the improved energy efficiency of a project on the value of assets and credit risk. The EEMI is composed of the Energy-efficient Mortgages Action Plan (EEAP) and the Energy-efficient Data Portal & Protocol Initiative (EeDPP):

- EAESMAP aims to create a mortgage financing mechanism that stimulates real estate owners to improve the energy efficiency of their building or acquire an already energy-efficient building through favourable mortgage terms. The cornerstone of the initiative is the assumption that energy efficiency has a risk-mitigating effect for banks as a result of the impact on a borrower's ability to pay out its loan and on the value of the property.
- EEODPP is intended to support the energy-efficient mortgage financing mechanism by providing a market-driven protocol that facilitates the large-scale collection of data on energy-efficient mortgage assets. In the long term, the data will be accessible through a common centralised portal which allows for continuous tracking of the performance of the energy-efficient mortgage assets and facilitates the tagging of such assets with a view to issuing energy-efficient bonds.

The Professional Association of Credit and Febelfin works on the implementation, at the Belgian level, of the EEDAP. It has been in line with the VEA for a long time.

Use of public funds: In 2012, the Flemish Government established a Climate Fund. The Flemish Climate Fund is funded by the proceeds from the auction of European emission rights, inter alia. Through this Fund, recurrent income is available to the Flemish Government to finance the Flemish climate policy; issue of green bonds to improve the energy efficiency of its buildings, build affordable housing and finance passive schools in the framework of 'Schools of Morgen'; Flemish green loan: interest-free energy loan: € 15 000 and duration of 10 years. Since 2015, 21 000 energy loans have been granted for a total of € 175 million. Since 2019, only interest-free loans to people from the priority target group have been granted; Emergency fund: A fund was set up for certain target groups who do not have sufficient financial resources to make their home energy-efficient. An interest-free loan of up to € 25 000 can be granted to the emergency buyers, poor owners who are required to purchase a poor quality dwelling. Only when the home is disposed of, or at the latest after 20 years, the loan must be reimbursed. A first call (€ 15.5 million, covering 625 loans) was launched by the Minister of Energy at the beginning of 2020.

One-stop-shops: In 19 energy houses financed by energy policy, with a scope covering the whole territory of Flanders, all citizens have been able to provide a uniform set of advice and guidance for energy-saving since 2019.

Additional information

Summary results of the public consultation	P	**2**
Given the tight time lag between the formation of the government and the delivery of the renovation strategy, extensive public consultation has not been carried out, independently of other the ongoing cooperation and public consultation initiatives (e.g., The Renovation pact, Power groups, BE-REEL platform, and Energy poverty programme). However, the Flemish Government Agreement 2019-2024 provides for an effective participation path to closely involve all stakeholders — citizens, civil society, businesses and the various authorities — in the further development of the Flemish climate policy. This long-term strategy will continue to be further discussed with the different stakeholders in the coming months and years as part of the participation path set out in the VEKP. Based on this path and further substantiation, the strategy can be further refined and adapted where necessary.		

Implementation details of latest LTRS	Y	**3**
The status of implementation of the 2017 LTRS strategy is reported in section 1.3. The key elements of the 2017 residential long-term renovation strategy were the commitment of a long-term target of 2050 (see above), the development of a housing pass, an update of the energy performance certificate and the roll-out of the 2016 Energy Poverty Programme		

Fire safety and intense seismic activity risks (optional)	Y	3
Integrated win-win approach with the asbestos safe objective and the asbestos safety obligations for public buildings by 2034 and 2040 respectively. Where possible, energy renovation will also be accompanied by asbestos and vice versa.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Flemish long term renovation strategy is a comprehensive document addressing all the EPBD Art.2a provisions. It provides a good description of the building stock, both residential and non-residential and of the cost optimal calculation methodology,

including a detailed analysis on the renovation trigger points, that play an important role in the strategy and their identification allow to assess the related renovation potential and to link support and/or regulatory measures that take into account the specificities of these moments.

A well designed and ample set of measures are mentioned in the strategy, including some mandatory renovation provisions for (i.e., compulsory renovation after transfer of ownership of non-residential buildings). Several initiatives for the mobilisation of investment in deep renovations have been put in place e.g., for the aggregation of projects and reduction of risk, use of public funds. The Flemish Region accounts for 15.9% of households affected by energy poverty (445 000) and In March 2016, the Flemish Government adopted an Energy Poverty Programme with 34 actions to protect energy users from disconnection and achieve energy-savings in the homes of vulnerable families.

A roadmap for the Renovation scheme for the Flemish Region towards 2050 has been included for both residential and non-residential buildings (starting point 2017), including the evolution of final energy use, the evolution of the use of fossil fuels and associated greenhouse gas emissions, the estimate of the investment resources necessary to carry out the renovations.

While the overall 2050 objective (all residential building in class A, 75% energy performance improvement, non-residential sector carbon neutral), and 3 scenarios to reach this ambitious target are well described (e.g., 2030 different scenario milestones are -18%, -26% or -33%), the LTRS could clarify which of the three scenarios have been selected and is considered as the selected roadmap

Level of details/ Appropriateness/ Comprehensiveness

Although the level of detail of the strategy is good, some information on measures is missing (e.g., budget, expected impact).

Good practices

Regulatory measures:

Mandatory minimum energy performance for non-residential buildings from 2030 onwards. From 2030, these buildings will have to reach a minimum energy performance label to be defined. The public buildings in Flanders provide a good example by meeting the minimum energy performance label by at least 2 years earlier.

Compulsory renovation after transfer of ownership for non-residential buildings (from 2021 at the latest five years after a notary transfer in full ownership).

Minimum energy performance requirements in the Flemish Housing Code:

The roof insulation standard and the glass standard from the Flemish Housing Code:

- Mandatory roof insulation: by 2020, all roofs of independent dwellings (single-family houses, studios and apartments, i.e., no chambers) should be insulated with an R-value of at least 0.75.
- Mandatory double-glazed units: by 2023, all dwellings must be fitted with double-glazed units.

[note: the standard for roof insulation (R-value of 0.75) is far from the objective 2050 (R-value 4.5). However, the conditions of the current energy contributions are already in line with 2050, which makes it possible to expect that owners of roof insulation will always do so in line with this long-term purpose. The same reasoning applies to the double glass standard].

Tools and mechanisms to support the mobilisation of finance:

The green bonds and the Flemish energy loans (interest-free energy loan for the priority target group: € 15 000 and duration of 10 years).

Public sector:

For the healthcare sector: Aim to achieve annual energy-savings of 2.09% per year (per health institution) and 27% savings by 2030; Funds are made available to finance tailored energy performance diagnoses. This should lead to an action plan with different possible investments and a feasibility study of ESCO contracts; The institutions undertake, in return for the provision of services free of charge, to implement the measures with a payback period of less than 5 years. If they do not do so, the energy performance diagnosis must be reimbursed; For measures with a longer payback period, the Climate Fund funds have developed an instrument to provide financial incentives to these investments. However, the application of these measures remains non-binding. All new buildings in the sector have been defined from 2018 onwards (defined as cost-optimal levels in the EPN methodology) and sustainable; Monitoring and benchmarking tools are being developed in cooperation with the Flemish Energy Company.

Tackling worst-performing buildings and energy poverty:

An "Emergency fund" was set up for certain target groups who do not have sufficient financial resources to make their home energy-efficient (Decree of the Flemish Government of 17 May 2019). An interest-free loan with deferred repayment amounting to up to € 25 000 can be granted to the buyers in duress, poor owners who purchase poor quality housing from necessity. Only when the dwelling is sold, or at the latest after 20 years, must the loan be repaid. A first call (€ 15.5 million, providing 625 loans) was launched by the Minister for Energy at the beginning of 2020.

Other measures:

An integrated win-win approach with the asbestos safe objective and the asbestos safety obligations for public buildings by 2034 and 2040, respectively (exemplary). Consideration of the building construction footprint and impact of demolition/dismantling

Premium for demolition and reconstruction: since 2019, there has been a contribution of € 7 500 for the demolition of one or more buildings situated in the Flemish Region and the reconstruction of one or more dwellings or a multi-apartment building.

Strengths and Innovative approaches

Good scenario analysis (including a description of the methodology);

Comprehensive and well-balanced measures package covering all the sectors and target groups (including energy poverty alleviation actions);

Innovative/ frontrunner: introduction of some mandatory renovation requirements:

Compulsory renovation after transfer of ownership for non-residential buildings (from 2021 at the latest five years after a notary transfer in full ownership). Mandatory minimum energy performance for non-residential buildings from 2030 onwards. From 2030, these buildings will have to reach a minimum energy performance label to be defined. The public buildings in Flanders provide a good example by meeting the minimum energy performance label by at least 2 years earlier.

Recommendations

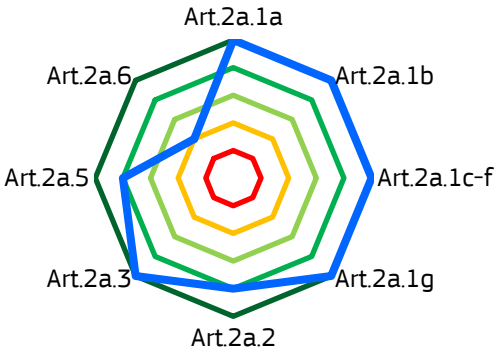
The LTRS presents with good level of details three scenarios with different milestones, but it could be better clarified which of these options has been chosen as the renovation strategy roadmap 2020-2030-2040-2050;

Even if stakeholders have been involved in the development/drafting process a formal public consultation process could be foreseen.

BELGIUM – Wallonia Region

1. EPBD Art.2a COMPLIANCE

Introduction The first version of this strategy was published on 30 April 2014. The first update was carried out in 2017, annexed to the National Energy Efficiency Action Plan submitted to the Commission by 30 April 2017, and to the NECP submitted in December 2019. The current LTRS is the second update of this strategy and was submitted in November 2020.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**5**

Wallonia provided a comprehensive and detailed statistical overview of the building stock (information provided in chapter 1 and in Annex 2). This includes a detailed analysis of building types, ages, tenures, level of insulation, energy performances, type of heating systems etc. for residential and non-residential buildings. The overview is based on recent data from different sources. A link to the detailed description of the building types (and their U values) used for the cost optimal analysis is also provided. The expected share of renovated buildings is provided for years 2025 - 2050.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	1 628 547	-	
	SFH	-	1 351 694	-	detached single-family house 33% of total housing, semi-detached 24%, terraced single-family house 27%
	MFH	-	276 853	-	
Non resident	TOTAL	-	-	-	
	PUBLIC	-	-	-	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**5**

The cost-effective approaches described in the renovation strategy is a summary of the COZEB cost-optimality studies. The methodology is described in the strategy and in Annex 3 (e.g., time horizon 30y for residential buildings, 20y for tertiary), together with the building types considered (14 typologies of single-family houses were analysed in the COZEB 2 study, 6 apartment buildings, 5 office buildings and 4 schools). The results of the study, indicating the cost-optimal retrofit level per building type are provided. The methodology appears reliable. Trigger points have been identified (see Detailed information TAB).

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**5**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Building renovation passports: Building passports are a red thread throughout the whole LTRS (with respect to monitoring, roadmaps, etc.). They will play an important role in raising awareness and informing the renovation strategy. Specifically, the core measure 15 details the individual actions and steps to implementing the building passport and related renovation and monitoring of the building stock.

Energy poverty: Energy poverty affects around 25% of Walloon households. The LTRS devotes two main (complex) measures to energy poverty (#26, #27), and the issue is also implicitly or explicitly mentioned in other parts of the LTRS. The building stock is assessed in terms of energy consumption and energy class, thus identifying the "worst performers". The creation of cadastres for public housing [Action 3.1] and public tertiary buildings [Action 7.1] will make it possible to identify the worst-performing buildings to be targeted (renovated) as a matter of priority. For private buildings, the identification of priority targets will be made possible by the gradual deployment of the EPB certificate for all existing buildings [Action 4.13] and the proactive detection of energy poverty situations [Action 26.1].

The LTRS identifies and addresses further market failures. Specifically, the **split incentives** have been explicitly targeted. The regulatory framework should provide owners — including landlords — and other investors with a clear signal to plan their investments. The LTRS plans to introduce an obligation to increase the energy performance of buildings every 5 years, which, as the LTRS states, suits the rental market cycle, where the average lease period is 5 years. Specifically, measure 28 supports and encourages landlords/landladies to improve the overall energy performance of their buildings by various means, including a system of adjusting the rent according to energy performance, communication and promotion, investigating possible incentives, exploring various good practices, facilitating the relocation of tenants during major works, etc.

The **public sector** is at the forefront of the measures and expected to play an exemplary role through exemplary renovations and others. Specifically, exemplary renovation of public housing will be carried out through Public housing renovation plan (Measure 6) to achieve the average decarbonised EPB A label by 2040 (~5 000 dwellings/year), complemented by further activities to support the plan above (e.g., Public consultation, studies, etc). In addition, the exemplary role of public buildings (measure 7) will be strengthened through a number of activities, including coordinated service in the form of one-stop-shops, strengthening the role of internal energy managers, and facilitating the financing (by, e.g., the EPC, PPP, and other). Interestingly, the LTRS also aims at incorporating social, ethical, and environmental clauses into the public works contracts, thus going beyond the pure energy efficiency targets in the renovation strategy.

Increasing **skills in the construction sector** are covered in detail by two measures (18, 19), including training needs evaluation, development of training modules, on-site training, capacity building in the renovation sector through an Employment and Renovation Alliance, implementing and promoting quality label of insulation, ventilation, and HVAC companies (NRQUAL), and incorporating it in the building passport. Apart from that, ways to an effective commitment on the part of professionals to renovation projects for residential buildings will be explored. The LTRS also focuses on promoting and educating about better materials, i.e., again going beyond "pure" energy efficiency. Annex 6 gives an overview of initiatives to promote smart technologies and skills.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**5**
The energy-savings for the key measures have been estimated. However, a detailed methodology to estimate the savings has not been provided. The LTRS also identifies and estimates wider (multiple) benefits of the renovation, including GHG emission reduction, job creation and wider economic benefits.			

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**
The LTRS defines the key renovation milestones in terms of energy-savings and greenhouse gas emissions reduction. It also defines a very detailed set of progress indicators based on which the milestones have been formulated, including the annual energy consumption and GHG emissions, number of EPB certificates, renovation rate and number of buildings undergoing deep renovation, etc.			
2030	• GHG emissions are expected to drop by 51-56% by 2030 for residential buildings, and by 52-62 % for non-residential buildings		
2040			
2050	• 100% decarbonisation by 2050 • By 2050 70.3% reduction in average energy consumption (tertiary and residential). Residential buildings: consumption of less or equal 85 kWh/m^2/y (A label), 41% reduction in primary energy consumption. Tertiary buildings: zero energy/energy neutral building stock (heating, warm water, cooling, lighting).		

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**5**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	
Aggregation: Generally, the LTRS envisages that aggregation of projects will be promoted through investment platforms or groups, and consortia of small and medium-sized enterprises, to allow access to the investor and package solutions for potential clients. Specifically, Measure 29 encourages and facilitates group renovation approaches by tools, interlocutors, by			

promoting insurance schemes for collective loans, by establishing a working group with liquidators/trade union representatives, etc. In the mid-term, the support should be integrated into one-stop-shops.

Measure 7.16 on strengthening the **exemplary role of public buildings** also aims to "Facilitate the financing of projects by structuring mechanisms for mobilising complementary funding (PPP, citizen funding, other), in particular by aggregating projects and reducing (perceived) risks. Measure 44 aims to stimulate and support the development of cooperatives active in energy renovation.

The LTRS has a diversified strategy to **reduce the (perceived) risks** of renovation by pooling projects (aggregation measures above, promoting projects by cooperatives, pooling of projects for EPC, establishing a de-risking platform and training for the banking sector, guarantee of loans for the disadvantaged groups, etc).

Support to EPC projects and third-party financing is explored in detail in the LTRS, including the development and standardisation of tools and documents, training in the banking sector, facilitating access to capital for smaller ESCOs, developing pilot projects, monitoring of the EPC and ESCO market, etc.

Public-private partnerships are specifically promoted by measure 36 through structuring and disseminating communication to local authorities on existing PPP solutions, organising standard documents to facilitate the use of innovation partnerships and organising a programme to support the use of innovation partnerships: appoint a team of legal, financial and technical experts to assist (public authorities wishing to launch an innovation partnership project) in structuring and implementing innovation partnership contracts.

Comprehensive support for households in the form of a **one-stop-shop** is one of the key elements of the LTRS. The main actions include coordination of sustainable housing information advisers, financial support to one-stop-shop pilot projects, developing tools and guides to facilitate to promote renovation, integrating social aspects in the advisory service, etc.

Additional information

Summary results of the public consultation	Y	**4**
The Walloon strategy for the long-term energy renovation of the building has been drawn up on the basis of several working groups and consultations with stakeholders and experts from the building and related sectors (construction materials, glass, etc.) and academic, economic and public entities. Wallonia has conducted a process of benchmarking and consulting stakeholders (the methodology used is presented in Annex 1 of the LTRS).		

Implementation details of latest LTRS	P	**2**
The strategy refers to the 2017 LTRS and at places provides information on the ongoing activities, which were presumably part of the 2017 LTRS. The consultations and working groups clearly worked on the improvement of the 2017 LTRS, taking it as a benchmark for further development. Measures 4 and 5 are devoted to monitoring the results and evaluation and regular updates of the building renovation strategy.		

Fire safety and intense seismic activity risks (optional)	N

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The LTRS aims at reducing the energy consumption in the building sector by 70% by 2050 (compared to 2005). It provides a comprehensive background analysis of the existing building stock, as well as the renovation scenarios to reach the above target and connected investment needs. The set of policies and measures to reach the target is complex and well described. The resulting energy-savings are estimated for a group of main measures, wider benefits have been identified. The system of progress indicators is robust, thus allowing to monitor the progress of the strategy and success of the measures.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS is very detailed and comprehensive in nearly every aspect. The measures are highly appropriate and clearly "linking the dots", i.e., using the detailed overview of the building stock and major barriers to energy renovation to develop a very detailed set of interlinked measures to address the main barriers and to mobilise investment to finance the renovation.

Good practices

Regulatory measures:
The LTRS plans to formulate obligations to improve the energy performance of buildings at the trigger points of building life (purchase/sale, change of tenant, gifts/successions, other renovation works). In particular, an obligation to carry out the energy efficiency action within 5 years of the purchase will be introduced.

Tools and mechanisms to support the mobilisation of finance:
Pilot initiatives such as support to create local cooperatives, repayable advances, credits not attached to the person but to the building, etc. are among the main innovative instruments that are to be put into practice. The LTRS also explores the issuance

of green bonds.

The LTRS aims to support renovation in rental housing specifically, by, e.g., providing support to relocate the tenants during major works, etc. The specific renovation bonus system has also been targeting landlord/tenants specifically. They have been able to benefit from bonuses provided that housing is rented in accordance with the indicative rent scale. There is the option to link additional bonuses to the actual consumption after renovation (not only based on audit).

Tax incentives have been in force in Belgium. In addition to that, the LTRS aims to specifically link the VAT reductions to deep renovation (or other works, if proven more suitable than deep renovation) (Measure 41).

Measure 43 aims at exploring the possibilities of developing “stone” credit solutions, i.e., credit that is linked to the building, rather than the person, based on pilots carried out, e.g., in Spain.

The establishment of local cooperatives will be promoted to allow for the aggregation of projects. A feasibility study will be carried out to assess the establishment of 150 such cooperatives in the region.

Public sector:
Exemplary renovation of public housing will be carried out through Public housing renovation plan (Measure 6) to achieve the average decarbonised EPB A label by 2040 (~5 000 dwellings/year), complemented by further activities to support this plan (e.g., Public consultation, studies, etc). In addition, the exemplary role of public buildings (measure 7) will be strengthened through a number of activities, including coordinated service in the form of one-stop-shops, strengthening the role of internal energy managers, and facilitating the financing (by, e.g., the EPC, PPP, and other).

The subsectors of schools, hospitals, and defence are not specifically targeted in the LTRS.

Tackling worst-performing buildings and energy poverty:
Energy poverty affects around 25% of Walloon households. The LTRS devotes two main (complex) measures to energy poverty (26, 27), and the issue is also implicitly or explicitly mentioned in other parts of the LTRS. The building stock is assessed in terms of energy consumption and energy class, thus identifying the "worst performers". The creation of cadastres for public housing [Action 3.1] and public tertiary buildings [Action 7.1] will make it possible to identify the worst-performing buildings to be targeted (renovated) as a matter of priority. For private buildings, the identification of priority targets will be made possible by the gradual deployment of the EPB certificate for all existing buildings [Action 4.13] and the proactive detection of energy poverty situations [Action 26.1].

Other measures:
The LTRS stresses the need to work on a governance mechanism. It describes well the general assigning of responsibilities and roles. It is also focusing on pilot projects with the aim to carry out at least one major renovation pilot campaign per year, focusing on specific targets such as public buildings and public interest housing.

Strengths and Innovative approaches

The LTRS is very detailed and based on thorough background analyses and consultation processes. It has a strong and credible system of milestones (in 5 year intervals) and monitoring progress indicators. It includes a number of Innovative solutions, including strong emphasis on one-stop shops, aggregation of projects, and information based on building observatory. The measures are evenly distributed among subsectors and provide a good balance between regulatory/planning, information/education and economic/fiscal measures. The LTRS features strong support to EPC development, PPPs, and other. It is strongly focused on supporting rental housing renovation and also the most vulnerable households. Innovative instruments, such as linking the loans to the building, instead of the person/organization will also be explored.

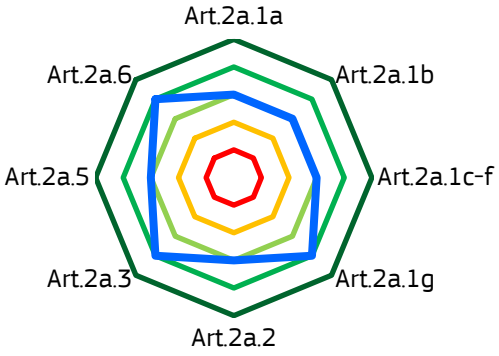
Recommendations

Given its level of detail, the LTRS could be improved by a better structuring of information. An overview of available funding (estimate of budgetary levels and their link to the respective measures) could also be added. More details on the methods to estimate the expected savings could also improve the document.

BULGARIA

1. EPBD Art.2a COMPLIANCE

Introduction: The Bulgarian LTRS was provided as a separate document months later after the NECP. The targets, the milestones and measures related to building renovation are found in both documents. However, the LTRS has a more systematic approach and provides additional information. It is composed of a main document and three annexes.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	3

The Bulgarian LTRS provides a detailed overview of the building stock in terms of the number m² of floor area, age bands, energy classes' distribution, ownership and energy sources for both residential and non-residential buildings. The strategy also includes some details on the technical systems in buildings. For non-residential buildings, a breakdown of data for administrative buildings, education buildings and childcare facilities is provided as they have the largest share of energy certified buildings. Moreover, the strategy includes figures on the energy performance trends from 2001 to 2017 in the residential and services sector.

However, no information is available on the climatic zones, buildings envelope (U-values) and a number of NZEBs. The share of renovated buildings is not provided, although the number of energy renovated buildings under some energy renovation programmes is provided for 2014-2018 in Annex 1 of the LTRS.

The strategy labels the Bulgarian building stock as energy inefficient. An analysis on applying renovations measures to achieve the regulatory energy consumption class in the residential buildings shows that with the measures prescribed in the existing energy certificates, only 6% of the buildings could achieve more than 60% energy-saving.

		No. of buildings	No. of dwellings	Floor area (m²)	Notes and sources
Residential	TOTAL	1 365 898	3 204 575	240 614 647	
	SFH	1 291 549	1 490 460	118 300 032	
	MFH	66 865	1 640 120	117 158 877	
Non resident	TOTAL	-	-	104 923 288	Schools, childcare facilities, social housing, hospitals
	PUBLIC	-	-	39 456 019	
	OFFICES	-	-	14 878 947	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	3

The strategy addresses cost-effective approaches based on global cost methodology. Reference buildings have been defined for single-family houses, multi-family houses and for the following non-residential buildings: administrative buildings, schools, kindergartens and hospitals. Other non-residential buildings require a tailor-made approach. The energy consumption of each reference building is simulated using only one climatic zone (no.7), which is considered to be representative of the average climate conditions of Bulgaria.

Trigger points have not been explicitly identified in the Bulgarian strategy. It is mentioned that through the technical passport of building, a compulsory document reflecting the technical state of the building and works needed to be carried out to bring the building in line with the current requirements, the owners and the authorities will have objective information to determine the opportune moment for the energy renovation of the building. Another aspect to be considered when planning the renovation works of some buildings is the presence of protected species of birds and mammals (bats) so that the renovation activities and timetable is adapted to the identified species.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Three levels of renovation are defined in the Bulgarian strategy based on energy-savings (low, medium and high) and also staged energy renovations are mentioned. Renovation measures targeting the envelope, technical systems and the use of renewable energy are grouped into packages. Several renovation packages are proposed for each category of buildings (Annex 1). Some packages lead to NZEB renovation level. For each package, the primary energy consumption and saving, the CO_2 emissions saving, the investment needed, the renewable energy use and its share are estimated. Buildings in energy classes E, F and G are identified as the worst energy performing buildings. The relative share of primary energy-savings in buildings belonging to energy classes D, E and F (G is assimilated to F) are estimated for each renovation package.

The Bulgarian strategy mentions that a **building renovation passport** (BRP) would be extremely useful for residential buildings to help building inspectors to recognize the green value of energy renovation and to link them to green mortgages. However, no other details on BRP are provided.

The **split incentives** dilemma is not addressed in the strategy.

The LTRS addresses the issues of **energy poverty**. Although the share of Bulgarian households that cannot face unexpected expenses with their own funds is 32.1% (NSI 2018 data), such as the participation in co-financing energy renovation schemes, there is a relatively low share of people receiving heating allowances (3.6% in the 2019/2020 cold season) due to eligibility criteria. The Bulgarian people at risk of energy poverty are spread in multi-dwellings buildings forming a social mix with high-income citizens rather than being concentrated in individual buildings. Thus, tailored policies and measures to the different needs of tenants of multi-apartment buildings are needed, and it should be done at a local/municipal level. Moreover, before the full liberalisation of the energy market, a mechanism to protect vulnerable electricity consumers will be implemented to provide them with the minimum amount of electricity needed.

Several measures and policies targeting the Bulgarian **public sector** are reported throughout the strategy. Special attention is given to schools, kindergartens, hospitals and administrative buildings. ESCOs are seen as the most promising mechanism for the energy renovation of all public buildings.

The participation of Bulgaria in the Expert Group on the EPBD will allow the dissemination of information on new technological solutions and their applicability in buildings. The introduction of a common EU scheme for establishing an indicator for the readiness of buildings for smart management is to be analysed.

Measures to promote **skills and education** in the construction and energy efficiency sector include supporting technical schools to develop modules for increasing the professional competencies as well as supporting qualification centres to create and conduct special training for workers in the construction and energy efficiency sectors. The creation of a register of skilled workers is also proposed.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

Based on the 1 537.8 GWh energy-saving achieved between 2014 and 2018, the expected energy-saving by 2020 is estimated at 2039.75 GWh, assuming the same rate of implementation. Moreover, energy-savings and CO_2 emissions savings projection until 2050 are made. Breakdowns of values in residential and non-residential buildings are presented.

The Bulgarian strategy identifies wider benefits:

- Reducing the CO_2 emissions and air pollution;
- Increasing the household disposable income;
- Alleviation of energy poverty;
- Health benefits;
- Creating new jobs: over 17 600 new jobs estimated for 2021-2030;
- Increasing the GDP: annual growth of BGN 557 million by 2030;
- Increasing the value of buildings: studies of sale agencies show that the current sale value of renovated apartments increased by 10-15%;
- Reducing import dependency;
- Positive overall impact on the public budget.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

The Bulgarian strategy offers indicative milestones based on savings achieved during previous years. The indicators are energy-savings, renovated area and CO_2 emissions saving. The milestones are in line with the Bulgarian NECP for 2021-2030 and targets 27.89% saving in the primary energy consumption and 31.69% saving in the final energy consumption compared

to 2017 PRIMES baseline forecast. Due to a lack of information on existing NZEB, no projection on the number of NZEB is made.	
2030	• Decarbonisation: by 2030 1.3 mill tonnes CO_2 emissions saved (period 2021-2030); • Building stock renovation: by 2030 +8% renovated area in 10y (22 203 509 m^2); • Energy savings: By 2030 2917 GWh 6.9% energy savings.
2040	• Decarbonisation: by 2040: 2.9 mill tonnes CO_2 emissions saved (2031-2040; • Building stock renovation: by 2040 +18% renovated area in 10y (49 570 668 m^2) 26% cumulative; • Energy savings: By 2030 2917 GWh 6.9% energy savings; by 2040 6502 GWh energy savings.
2050	• Decarbonisation: by 2050: 3.2 mill tonnes CO_2 emissions saved (2041-2050); • Building stock renovation: by 2050 +20% renovated area in 10y (55 823 015 m^2) 46% of the total floor area of the existing building stock; • Energy savings: by 2050: 7329 GWh energy savings.

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

Creating online **platforms to aggregate** similar projects at the municipal or regional levels, as well as its connection to other local/municipal platforms is mentioned in the strategy.

Creating financial instruments suitable for different groups and types of buildings **using public resources** and gradually increasing the private investments is foreseen within the first priority of the second strategic objective while mobilising investment into energy-efficient buildings through ESCOs and energy efficiency obligation scheme is foreseen within the second priority of the same objective. Moreover, under the analysis of existing barriers, the strategy identifies several perceived risks of investors in ensuring sustainable financial instruments for decarbonising the building stock and details **measures to overcome the risks**.

Under the third objective of the strategy, one priority is to implement **information campaigns** at the national and local levels to increase people awareness of the benefits of energy efficiency in buildings. 20 such campaigns are planned for the next decade. Moreover, information on complete renovation of buildings to owners and investors via the one-stop-shop model is planned to be implemented by 2030.

Additional information

Summary results of the public consultation	Y	**3**
Annex 2 of the Bulgarian LTRS represents the summary of the public consultation on the renovation strategy. The consultation was organized as a two-day workshop. Lists of discussed topics and participants are also included.		

Implementation details of latest LTRS	Y	**4**
The progress report on the implementation of policies and measures for the renovation of buildings in Bulgaria set put in NEEAP 2014-2020 and updated in 2017 is included as Annex 1 of the Bulgarian LTRS.		

Fire safety and intense seismic activity risks (optional)	Y	**3**
The strategy mentions that due to poor technical state and based on current requirements, already in Bulgaria the energy renovation of residential buildings includes works for improving the technical state of the buildings alongside with increasing the energy performance. This practice will be further maintained.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Bulgarian LTRS is developed on a vision for the renovation of the Bulgarian building stock by 2050. Priorities to reach the roadmap targets for 2030, 2040 and 2050 are grouped into three strategic objectives: harmonisation of legislation, sustainable financial mechanism and support for capacity building. A well-structured and comprehensive analysis of the existing barriers for each priority and measures to overcome the barriers are included. Packages of energy renovation measures for different types of buildings are proposed and analysed in terms of energy saving, CO_2 emissions savings, investment need and share of renewable energy. Wider benefits such as health benefits, job creation, the increased value of buildings, reduced energy import dependency and overall positive impact on the public budget are discussed. The progress indicators proposed to be monitored in the next decades are the renovated area, energy-savings and CO_2 emissions savings (table below). Under the proposed measures, 45% of the total Bulgarian building stock (60% of the existing residential buildings and 17% of the non-residential buildings) will be renovated by 2050. The targets are in line with the policies and measures foreseen in the Bulgarian NECP and should lead to 27.89% energy-savings in the primary energy consumption and 31.69% energy-savings in the final energy consumption by 2030 compared to PRIMES 2007 reference scenario.

Based on the investment needed for the energy renovation programmes already implemented in Bulgaria and on the energy-efficiency measured proposed, the investment need for the implementation of the LTRS is estimated. Several new funding opportunities and financial mechanics are analysed, and the development of the National Decarbonisation Fund is proposed.

Level of details/ Appropriateness/ Comprehensiveness

The overall level of details of the Bulgarian LTRS is high and the projections made are based on achieved results of the already implemented energy renovation programmes. The assessment of the existing barriers and measures to overcome them is well-structured. Some key information is missing in the overview of the building stock: existing and expected a number of NZEB, details on the EPC, current share of renovated building.

Good practices

Regulatory measures:

The energy performance certificate of a building in use shall be updated when any of the following activities are performed and result in altering the energy performance of the building: refurbishment or reconstruction, major renovation or overhaul when more than 25% of the building envelope are covered.

The owners of buildings with a total gross floor area exceeding 250 m^2 must implement the measures for achieving the minimum required energy consumption class prescribed by the first audit within three years from the date of accepting the results of the audit.

State and municipal administrations, which own public buildings in the tertiary sector, are obliged to manage energy efficiency. The management is carried out by implementing programmes, activities and measures for energy efficiency improvement and conducting annual analyses of energy consumption. For the purpose of energy efficiency management, the owners of enterprises, similarly to the owners of buildings, are also obligated to draw up annual reports based on a model and submit these to the AUER.

Tools and mechanisms to support the mobilisation of finance:

Several financial mechanisms are discussed in the strategy. Some of them are already well known and have been successfully implemented in Bulgaria, such as revolving funds, guarantee funds and special credit lines (e.g., Home Energy Efficiency Credit Line) and others have a lower potential or changes in the Bulgarian legislation are needed for full benefits: Green Mortgages, On-bill financing, Performance Contracts. The development of a National Decarbonisation Fund is proposed to be the main financing scheme in the implementation of the Bulgarian LTRS.

Public sector:

Detailed information on the potential of energy renovation of schools, kindergartens, hospitals and administrative buildings is provided.

Other measures targeting the public sector:

- Implementation of energy management systems in 20 public buildings by 2030;
- Training for local authorities;
- Online platform to aggregate projects on public buildings, including a list of verified contractors;
- Green Bonds for public buildings owned by state or local authorities.

Tackling worst-performing buildings and energy poverty:

The energy renovation measures are primarily targeting buildings in energy class E, F and G. A detailed analysis of the projected energy saving and CO_2 emissions reduction can be consulted in Annex 1 of the LTRS. The renovation of multi-family residential buildings with a view to upgrading them to energy class C will lower the average monthly cost of heating homes and may result in low-income households being able to improve their living conditions sufficiently to be dropped from the category of households at risk of energy poverty. Specific criteria to identify people at risk of energy poverty as well as measures to protect them are foreseen in the long term, and a mechanism to protect vulnerable electricity consumers before

the full liberalisation of the electricity market is to be introduced.

Other measures:
The current practice of energy renovation in Bulgaria already includes additional works to improve the technical state of the buildings.

Strengths and Innovative approaches

Systematic approach: vision, objectives towards the vision, priorities under each objective followed by policies and measures under priorities and finally indicators to measure the progress;

Detailed and well-defined measures and packages on energy renovation, including energy and CO_2 emissions savings, expected share of renewable energy and investment needed for single and multi-family buildings, administrative buildings, hospitals, schools and kindergartens are provided in Annex 3 of the LTRS;

The establishment of the National Decarbonisation Fund to support the LTRS implementation.

Recommendations

Additional information could be provided on the following points:

Existing building stock: current number of NZEB, EPC details;

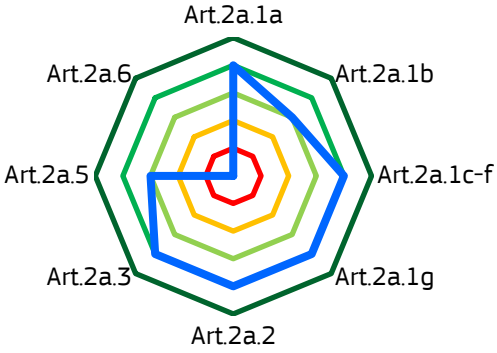
The current renovation rate;

The CO_2 emissions in buildings to quantify the relative reduction and the overall impact in the EU 2050 decarbonisation target.

CROATIA

1. EPBD Art.2a COMPLIANCE

Introduction The LTRS was under development at the time of submitting the NECP. Therefore, it is not included in the plan. However, several measures and indicative milestones are mentioned in the NECP and detailed in the LTRS. The document is well structured and covers all sections.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	4

The LTRS includes a detailed overview of the Croatian building stock in terms of no. of m² (and sometimes No. of buildings) by building type, age, climate zone, ownership and location. In addition, information on buildings with cultural value and buildings owned by the Croatian army is available. Between 2014 and 2019, about 5.7 million m² have been renovated (0.7% annual renovation rate). The total no. of m² by building type available for renovation in 2020 is presented and the expected renovated area in each decade, until 2050, is estimated.

The evolution of the buildings envelope's U-values is available based on the age of the buildings.

Regarding the energy performance of buildings, the share of energy classes by building type based on heating energy demand and primary energy is presented, using data from EPC system. However, no information on energy use values and energy carriers are available.

The performance of the buildings' systems is expressed in terms of the ratio of energy supplied and required energy for heating and cooling by building type and age bands, thus emphasising the improvement over years. No other details on the building systems are provided.

		No. of buildings	No. of dwellings	Floor area (m²)	Notes and sources
Residential	TOTAL	762 398	-	146 924 679	
	SFH	471 708	-	90 371 355	
	MFH	290 690	-	56 553 324	
Non resident	TOTAL	142 670	-	57 493 554	
	PUBLIC	-	-	9 022 627	Only schools and hospitals
	OFFICES	-	-	9 310 763	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	3

The steps taken and parameters used in the cost-optimal method are summarized in the LTRS with reference to the "HRN EN 15459/2008 Energy performance of building – Economic evaluation procedure for energy systems in buildings and Commission Delegated Regulation 244/2012".

The main identified trigger point is represented by grants for energy renovation with high co-financing. Other likely situations that could trigger the energy renovation of the existing buildings in Croatia are the change of ownership and the deterioration of the heating system. Moreover, it is expected that the structural retrofitting of more than 24 000 buildings affected by the March 2020 earthquake will trigger the energy renovation.

1c	**Policies and actions on deep renovations, including building renovation passports**	P	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

A detailed overview of the Croatian **existing policies and programmes on building renovation** is presented. Between 2014 and 2019, 5.7 million m^2 of floor area (0.7% annually) have been renovated in Croatia, failing to achieve the very ambitious renovation target of 3.5% of the floor area of the building stock per year. The introduction of **building renovation passports** is not mentioned in the LTRS.

Existing barriers to building renovation are identified; the strategy identifies the financial aspect (e.g., weak financial capacity of local administration, lack of strong and continuous financial incentives) as the main energy renovation barrier, followed by low citizen purchasing power and lack of awareness and participation of the public in such actions. The Croatian legislation is seen as satisfactory and does not constitute a technical barrier in building renovation. Nevertheless, the use of energy from renewable sources is not enough regulated. To overcome the identified barriers, six categories of measures are proposed: strategic, legislative, technical, financial, communication and research and development.

Buildings in energy class D or below for continental Croatia and class C or below for coastal Croatia have been identified as the **worst energy performing buildings**. Such buildings represent between 19% and 82% depending on the building type from the total building stock and energy renovation actions will primarily focus on them (see table in Building Stock data). Three energy renovation programmes, part of the Integrated National and Energy Climate Plan 2021-2030, targeting single-family houses (ENU-3), multi-family houses (ENU-4) and public buildings (ENU -5), are fully described. The programmes are to be continued until 2050 with measures adjusted based on the 2021-2030 experience.

No specific measures are taken to address **split-incentive dilemmas**, as so far, it has not proven to be an obstacle in the Croatian energy renovation actions, especially in the residential sector where the housing ownership is high. However, for the commercial sector, restrictions in renting or selling buildings in energy class D or below are foreseen in the future.

As a **market failure**, the Croatian LTRS identifies the migration from rural to recently developed urban areas and the citizens' preferences for new buildings instead of old buildings, which often remain abandoned. Although the affordability index is high in the depopulated area, the cost of energy renovation is high compared to the value of the property, so energy renovation becomes unattractive. The Croatian LTRS aims to alleviate **energy poverty**. Programmes designed to help citizens at risk of energy poverty are included (e.g., Measure UET-5 and Energy Poverty Programme including the use of renewable energy). Based on these, definition and identification of energy poverty criteria are to be developed. Additionally, open dialogue with stakeholders on the energy poverty criteria has already started.

The Croatian LTRS includes a comprehensive overview of policies and measures for **public buildings** (ENU-5, ENU-7 and ENU-9) with a focus on buildings with cultural value (ENU-6) and buildings owned by the Croatian army.

Policies and measures on **smart technologies and well-connected buildings and communities** are defined at a city level through smart city strategies giving examples of such Croatian cities. The strategy addresses electro-mobility by planning the integration of charging points for electric vehicles. Developing skills and promoting technologies related to NZEB standards in building renovation are also foreseen (ENU-2). Moreover, a dedicated programme for improving the urban environment is planned for the next decade (MS-9).

In Croatia, **skills and education in construction and energy efficiency** are promoted via several projects aimed at training the Croatian workers (Croskills), increasing the number of experts in energy-efficient buildings (Fit-to-NZEB), enhancing the multidisciplinary approach in sustainable construction (Green Building Pro), digitalizing the construction and use of modern IT technologies (BuildUp). The NZEB Roadshow project coordinated by the Faculty of Construction in Zagreb targets the dissemination of NZEB know-how among professionals, public administration, producers, investors, workers, students. The creation of a Centre of Excellence on energy-efficient buildings is also planned.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

Energy saving and CO_2 reduction have been projected considering two scenarios (developed for the NECP):

S0 – energy-saving achieved with existing measures (reference scenario) and

S2 – energy-savings achieved with the implementation of the LTRS;

The projections show that in scenarios, S2 buildings contribute by 57% in 2030 and by 65% in 2050 in the total energy-savings while in the overall CO_2 reductions it is expected a 36% contribution in 2030 and around 40% in 2050.

Going further, the LTRS estimates that based on its targets, in 2030, Croatia will account for 0.65% in the total primary energy consumption and 0.72% in the final energy consumption in the EU.

The Croatian LTRS discusses several wider benefits such as gross value added, employment, tax revenues, aesthetic value, improving life quality and reducing health risks and poverty.

2	Roadmap including measurable progress indicators and indicative milestones	Y	4

The Croatian LTRS main milestone indicators are the annual renovation rate (renovated floor area), energy saving and CO_2 emission reduction. Based on the 2030 targets, the Croatian LTRS estimates that Croatia will account for 0.65% of total primary energy consumption and 0.72% of the final energy consumption in the EU, in 2030.

Based on the information provided by the Croatian Energy Certificate Information System the number and the floor area of buildings renovated complying the NZEB concept are going to be used as indicators as well. Other indicators planned to be monitored are: heating and cooling energy need before and after renovation, energy-savings in the delivered energy, the use of energy from renewable sources before and after renovation and contribution to the economic development (e.g., no. of employees required by the renovation process).

2030	• Renovation rate: 3% by 2030; • Renovation of building stock: 25% by 2030; • 0.6 PJ energy savings and 67.8 kt CO_2 – eq reduction in non – residential; • 5.6 PJ energy savings and 249.6 kt CO_2 – eq reduction in residential.
2040	• Renovation rate: 3.5% by 2040; • Renovation of building stock: 60% by 2040; • 2.4 PJ energy savings and 156.9 kt CO_2 – eq reduction in non – residential; • 11.3 PJ energy savings and 402.5 kt CO_2 – eq reduction in residential.
2050	• Renovation rate: 4% by 2050; • Renovation of building stock: 100% by 2050; • 4.9 PJ energy savings and 262.5 kt CO_2 – eq reduction in non – residential; • 14.4 PJ energy savings and 649.7 kt CO_2 – eq reduction in residential; • reducing the energy consumption in residential buildings by 31% (vs 2017).

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	The aggregation of projects, and packaged solutions	Y	4
3b	Reduction of the perceived risk for investors	Y	
3c	Use of public funds to leverage private-sector investment or address specific market failures	Y	
3d	Guiding investments into an energy-efficient public building stock	Y	
3e	Accessible and transparent advisory tools (e.g., one-stop-shops)	P	

The Croatian strategy highlights the importance of this topic and discusses several ways through which the **aggregation of projects** can be done in Croatia. Project aggregation platforms are one possibility. Croatia already has a well-developed national energy management system that gathers data from **public buildings** allowing for analyses of energy consumption before and after renovation. The extension to all types of buildings and the connection with the Energy Performance Certificate System could provide reliable information on buildings. Bringing together stakeholders to create investment groups, development of small and medium-sized enterprise consortia grouped around specific themes and packaged renovation solutions are also discussed.

The Croatian strategy presents a detailed overview of the existing funds for the energy renovation programmes carried out until 2020 and identifies the current financial barriers. Improvements have been achieved after the implementation of the energy renovation project under the **ESCO model** in line with Eurostat guidance. However, it is stated that deep renovation through such a model can be achieved with grant incentives. Otherwise, deep renovations are not attractive due to long payback periods. Two main measures are proposed to minimise the financial barriers: providing grants for the energy renovation and the development of financial instruments to monitor energy service providers.

The involvement of private investors and banks has been minimal and limited to the commercial sector. New funding schemes are needed to sustain the investment required by the ambitious measures foreseen in the LTRS. An overview of the financial measures to accelerate the implementation of the LTRS has been included. The **European Structural and Investments funds** are seen as the primary source of funds. Measures to make the energy renovation more attractive and to mobilise private investors are included in the strategy. To stimulate investment, Open Partnership Dialogue action is seen as one effective tool. The importance of **One-Stop-Shop** is discussed by the Croatian strategy. However, it is not clear if and when such service will be available in Croatia.

Additional information

Summary results of the public consultation	Y	3

Through the **Open Partnership Dialogue,** action stakeholders, local and state representatives, academia, construction and energy professionals were connected and had the opportunity to contribute to the development of the LTRS. The meetings' summaries are integrated into the document. Moreover, a Charter of cooperation to decarbonise buildings by 2050 was initiated by the Croatian government, which aims to promote energy efficiency and to provide training on the EU objectives.

Furthermore, the Croatian LTRS was under public consultation for a period of 10 months and the results are available on the official website of the Croatian Ministry of Spatial Planning, Construction and State Property.

Implementation details of latest LTRS	N	0

Fire safety and intense seismic activity risks (optional)	Y	3

The Croatian LTRS mentions that the existing fire safety requirements are in some cases not applicable for existing buildings and there is a need of creating mandatory fire safety requirements for existing buildings subjected to renovation.

Moreover, all safety assessments indicate that seismic activities represent the one of the major risks in Croatia.

The 2020 amendment of the Technical regulation on the rational use of energy and heat retention in buildings requires to assess the existing state of the buildings and to design measures to improve the healthy indoor climate as well as the fire and seismic behaviour when energy renovation is planned. Several technical measures for improving the seismic behaviour including for buildings with cultural value are included.

Guidelines, catalogue of materials and good practices should be made available and should be constantly updated with new materials and new technologies.

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Croatian LTRS encompasses with a high level of detail most of the EPBD elements. The strategy presents a detailed overview of the existing buildings with trends in terms of the number of square metres of floor area by 2050, the expected share of renovated buildings and the expected share of NZEBs. The strategy also provides an overview of the existing policies and measures for renovation, identifying the main barriers. The proposed renovation programmes cover all types of buildings. Special measures are drawn for buildings with the worst energy performance, buildings with poor seismic behaviour, buildings with cultural value, building owned by the Croatian army and for citizens at risk of energy poverty.

A long-term roadmap with strategic objectives and measurable indicators is included. The indicative renovation milestones for 2030 was set in the Croatian NECP, while the projections for 2040 and 2050 were estimated in Croatia's Energy Development Strategy and further discussed in the renovation strategy. Two renovation scenarios - reference scenario and LTRS scenario - were used to estimate the energy-savings and CO_2 emissions reduction and to highlight the benefits of the LTRS. In the reference scenarios, the projections are based on the trend of recent years, whereas in the LTRS, starting from a renovation rate of 0.7% in 2020, the renovation rate is gradually increasing from 1% to 3% between 2021-2030, from 3% to 3.5% between 2031 and 2040 and up to 4% in 2050. In the latter scenario, the energy-savings in buildings are estimated to be around 65% in 2050, while the corresponding reduction in CO_2 emissions will be around 40%. Moreover, the Croatian strategy discusses several wider benefits such as employment, tax revenues, aesthetic value, improving life quality and reducing health risks and energy poverty. A detailed assessment of the investments needed to carry out the ambitious strategy as well as actions to mobilise such investments are included in the strategy. Another important aspect is that the stakeholders, local and state representatives, academia, construction and energy professionals were connected through the Open Partnership Dialogue action and had the opportunity to contribute to the development of the Croatian LTRS.

Level of details/ Appropriateness/ Comprehensiveness

The level of details is high in the Croatia LTRS. Generally, the information provided within is comprehensive and based on evidence.

Good practices

Regulatory measures:
As of 31 December 2018, all new public buildings have to be NZEBs, and it is expected the introduction of additional requirements for the renovation of existing buildings to NZEBs.

Tools and mechanisms to support the mobilisation of finance:
To support the mobilisation of finance, several financial and regulatory mechanisms are proposed:

- The creation of a national revolving fund through ESI Funds that will allow energy service providers to access a long-term source of financing under more favourable conditions;
- The interest subsidy of commercial loans will allow for the placement of financing from commercial banks in the energy renovation of buildings;
- Promoting the development of the energy services market through the implementation of the Public Buildings Renovation Programme – in this segment, public sector projects should also be considered in order to make them financially attractive to private investors;
- Development of typified energy performance contracts and standardised methods for measuring and verifying

energy-savings that will increase the confidence of users and financial institutions in the ESCO model;

- Campaigns to increase users' awareness of the existence of an affordable source of financing;
- Tax incentives for owners who invest in energy renovation when the possibility of using grants have been exhausted.

Public sector:

ENU-5: Energy renovation programme for public sector buildings states that the renovation of public buildings should be guided by NZEB standards everywhere it is technically feasible.

ENU-6: Energy renovation programme for buildings with the status of a cultural asset encourages the use of high-efficiency systems. Special attention is given to the buildings owned and used by the Croatian army.

ENU-7 Systematic management of energy in the public sector involves the use of Energy Management Information System (ISGE) to regularly monitor the energy consumption of all public buildings.

Tackling worst-performing buildings and energy poverty:

The worst-performing buildings are identified and renovation programmes will primarily focus on them (ENU-3: Energy renovation programme for multi-residential buildings; ENU-4: Energy renovation programme for family houses and ENU-5: Energy renovation programme for public sector buildings).

Measure UET-5: Adoption and implementation of the energy poverty programme and Energy Poverty Programme, including the use of renewable energy in residential buildings in assisted regions and areas of special care, are designed to help citizens at risk of energy poverty and vulnerable regions. The alleviation of energy poverty is also addressed in ENU-3 and ENU-4.

Other measures:

Several Croatian cities have developed smart city strategies (smart energy management, smart urban administration, sustainable urban mobility and others).

Skills and education in construction and energy efficiency are already promoted via various projects aimed at training workers, increasing the number of experts in energy-efficient buildings, enhancing the multidisciplinary approach in sustainable construction, digitizing the construction and use of modern IT technologies.

Implementation of sensors to measure indoor air temperature and air quality in all public buildings and facilities is proposed.

Fire safety and risks associated with the seismic activity are addressed in the strategy.

Strengths and Innovative approaches

Well-defined long-term renovation roadmap with clear indicative milestones for 2030, 2040 and 2050 and expected energy-savings and CO_2 emissions reduction.

Detailed assessment of wider benefits.

Open Partnership Dialogue action with impact on several key points of the strategy.

Recommendations

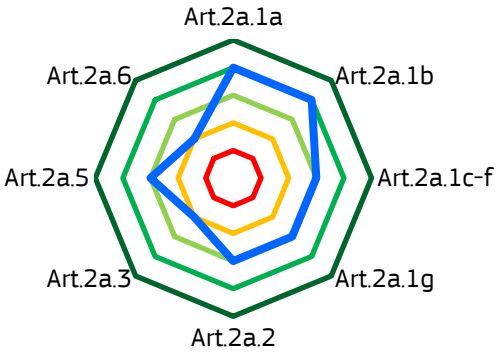
More information on the following aspects could be included:

- the energy consumption of the building stock, buildings systems and energy sources;
- the Building Renovation Passport;
- estimate on the energy consumption from renewable sources (current or projected).

CYPRUS

1. EPBD Art.2a COMPLIANCE

Introduction The strategy is given as a standalone document. The document was available in Greek when assessed.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

While the data on residential buildings is more detailed, the overall completeness of the information is satisfactory.

Some limitations of the provided data include: (1) certain data are presented in a non-extractable format (i.e., graphs) and (2) some data stem from estimations/modelling. The provided data are summarised as follows:

1. Overview (number, floor area) of building stock (residential, non-residential)
2. Distribution of buildings (number, floor area) by type, climatic zone, and construction period (residential, non-residential)
3. Characteristics of typical houses by building type and construction period (residential)
4. Percentage of dwellings with insulation (residential)
5. Estimated average energy demand in buildings by end use and building type (residential, non-residential)
6. Final energy consumption in buildings by fuel (residential, non-residential)
7. Stock of heating and air conditioning systems (residential, non-residential)

Information on public buildings (stock, estimated energy demand) is also presented.

In addition, the expected share of renovated buildings is given in a graphical format.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	431 059	303 278	34 735 467	
	SFH	-	120 091	17 542 708	
	MFH	-	198 299	19 912 782	
Non resident	TOTAL	29 119	-	7 956 730	
	PUBLIC	1 087	-	1 885 945	
	OFFICES	5 970	-	895 500	Private offices only

1b	Cost-effective approaches to renovations and trigger points identification	Y	4

Annex II presents potential energy-savings and associated costs of 4 reference buildings undergoing NZEB renovation: single-family house constructed in 2003, apartment block constructed in 2006, office building and hotel. The costs are expressed as "additional costs in relation to planned renovation" and range from € 34 070 to € 108 280 depending on the type of building. In the Cypriot context, an NZEB renovation is equivalent to energy class A for residential buildings and B+ for non-residential buildings. The Cypriot authorities identify 4 trigger points:

1. Transfer to a new owner
2. Lease to a new tenant
3. When static upgrading occurs
4. Change of building use and/or additions are made.

The 4th trigger point is determined as the most likely one to lead to a major renovation according to the results of a conducted public consultation preceding the preparation of the Long Term Strategy (see Annex I).

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	P	

The LTRS measures range from regulatory (e.g., minimum energy performance requirements), information and awareness-raising measures to financial incentives and R&D measures. On energy poverty, 4 measures are described, including more favourable financial incentives, lower electricity prices and protection of vulnerable groups in critical periods. On the issue of split incentives, the LTRS recognises that around 60% of the total housing stock (tenants, multi-owners) may be affected. While some actions have been taken, considerations are currently being made on how to address this issue. For example, the Save & Upgrade incentives can be used in rental or multi-owner properties, and SMEs can directly apply for grants regardless of whether they own or rent their premises. Other measures, such as the application of minimum requirements for rented buildings, are currently under review. On public buildings, LTRS has stressed all relevant legislative measures (central government renovations, NZEB standards for new buildings, requirement for lease of only high efficient buildings, display of EPCs). For the renovation of central government buildings, € 20 million of the EU Structural Funds was secured for the period 2014-2020 and new funds for 2021-2027 are planned to be used for deep renovations and other measures. For schools, the installation of photovoltaic systems with a total capacity of 4 MW and roof insulation and EU funds are secured for technical assistance with the aim to develop a long-term strategy for the upgrading of public schools to NZEB. On smart technologies, no concrete measures are stipulated in the Cypriot LTRS except that the draft law amending the Energy Performance of Buildings Regulation Act enables the Minister for Energy, Trade and Industry to issue a decree setting out matters relating to the common system of assessment of the smart readiness indicator. Information on training of all the professionals involved in the energy performance of buildings (independent experts and installers) is given in Section 8.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

The expected energy-savings of 3 scenarios (technical, realistic and baseline) for the entire period until 2050 for residential and non-residential buildings are provided in graphical format. In terms of economy-wide benefits, it is estimated that the energy upgrades of the building stock will help decouple economic growth from conventional fuels. By implementing the 'realistic' scenario, energy intensity in buildings, i.e., energy consumption per unit of gross national product (GDP), is expected to be halved by 2050. The investments made for energy upgrades for the period 2020-2030 are estimated to increase GDP by 0.25%. In terms of environmental benefits, the energy upgrades of buildings are said to be one of the elements contributing to the objective of reducing emissions by 24% by 2030 and will result in a reduction of more than 40 thousand tonnes of CO_2 until 2030. In terms of social benefits, it is expected that improving thermal comfort conditions will inevitably improve indoor quality and living conditions, however, no quantification is made.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

The milestones are based on a "realistic" scenario based on estimates made by GIZ (2017) and Zangheri (2016). These milestones are expressed as energy-savings equivalent to 56 ktoe, 112 ktoe and 163 ktoe compared to the baseline scenario by 2030, 2040, and 2050. They are derived by assuming a mixture of minor, moderate and deep renovations, where the latter is assumed to yield on average more than 60% of energy-savings and is to be applied in 1 every 6 renovations. Based on the calculations presented in the Cypriot NECP, around 33 000 residential buildings and 10 000 non-residential buildings are expected to be renovated by 2030.

2030	• Around 33 000 residential buildings and 10 000 non-residential buildings are expected to be renovated by 2030. • Savings: 56 ktoe; • Total consumption: 640 ktoe.
2040	• Savings: 112 ktoe; • Total consumption: 650 ktoe.
2050	• Savings: 163 ktoe; • Total consumption: 640 ktoe.

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	P	**2**
3b	**Reduction of the perceived risk for investors**	N	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	N	
3d	**Guiding investments into an energy-efficient public building stock**	N	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	P	

Although several of the mechanisms listed in EPBD Art. 2a.3 are not described/reported in the documents (e.g., project

aggregation, risk reduction mechanisms), Cyprus has put in place some financial mechanisms to mobilise investments, such as:

- Continuation of existing financial incentive schemes: based on proposals for the 2021-2027 programming period of the European Structural Funds, support is envisaged for energy upgrades of existing dwellings to NZEBs (€ 40 million budget), energy efficiency measures in SMEs (€ 15 million budget) and municipalities (€ 15 million budget).
- Energy efficiency obligation scheme: this is expected to contribute to the 2030 Article 7 requirement by 41.1% or about 100 ktoe through energy efficiency improvements in residential, commercial and industrial installations as well as vehicles. The measures are divided into awareness-raising and technical measure and are estimated to trigger € 150 million in investments in the target sectors (incl. buildings) for the period 2020-2030.
- Energy Fund to provide soft loans for energy efficiency through the involvement of commercial banks.

In terms of energy advisory services, a new tool that calculates the costs and benefits of different energy-saving and renewable energy measures in homes has been developed. A public information campaign on energy efficiency has also been run in 2019 with the aim to raise awareness among households and businesses.

Additional information

Summary results of the public consultation	Y	**3**
Annex I presents the results of a public consultation exercise which entailed a questionnaire disseminated in the context of the elaboration of the Long-term Renovation Strategy. The answers to the 8 questions of the questionnaire are shared in the annex (responses from 13 stakeholder groups).		

Implementation details of latest LTRS	P	**2**
It is only stated in the conclusions that the building stock remains energy intensive and that the changes brought about by the minimum energy performance requirements and the financial schemes have been important but not sufficient to address a sizeable share of the Cypriot building stock. In addition, the section on policies provides some monitoring data on the impact of past and ongoing financial schemes. The LTRS 2020 does not, however, include a review of the implementation of the 2017 strategy.		

Fire safety and intense seismic activity risks (optional)	P	**2**
The following references to safety issues are made: 1. Seismic resistance upgrade of buildings (new measure under section 4.5.2): in accordance with the proposed amendment to the Energy Performance of Buildings Regulation Act, the owner of a building whose permit was issued before 1994 must appoint a suitable designer prior to a major renovation who will prepare a report on the status of the building and estimated residual life, accompanied by recommendations on how to address seismic activity issues. This aims to adequately inform building owners at the appropriate time by allowing for a more complete technical and financial assessment. 2. Research project SupERB (section 4.4): the project, which has a duration of 3 years (2019-2022), aims to develop a novel integrated approach for the optimal simultaneous upgrade of buildings both in terms of seismic resistance and energy efficiency.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Cyprus has set a comprehensive package of measures on energy efficiency improvements in existing buildings through renovation. The Cypriot LTRS presents a wide range of regulatory requirements, financial incentives and information measures and sets clear milestones, expressed in energy-savings, for 2030, 2040 and 2050. The LTRS modelling estimates that a mixture of minor, moderate and major renovations in residential and non-residential buildings will generate energy-savings of 56, 112 and 163 ktoe by 2030, 2040 and 2050, respectively, equivalent to a reduction in final energy consumption of 8%, 15% and 20% compared to the baseline projections. Existing financial and fiscal measures such as grants and reduced VAT for energy renovations are set to continue beyond 2020, with the support of EU structural and cohesion funds, among other sources, but new measures are (or in the process of being) implemented such as the set-up of an energy efficiency obligation scheme, a loan programme, voluntary agreement with SMEs, etc.

Level of details/ Appropriateness/ Comprehensiveness

The building stock is in general terms described in sufficient detail. The existing set of measures are wide-ranging and some monitoring data (buildings benefited, investments made, energy-savings achieved) are presented for some main financial schemes. Overall, a broad spectrum of instruments is included in the LTRS, combining regulatory, financial and awareness-raising actions. Quantification of the impact of the existing and planned measures as well as more details of the assumptions and results of the scenario analysis would be important elements to consider in enhancing the overall completeness and credibility of the strategy.

Good practices

Regulatory measures:

- The new minimum energy efficiency requirements, which apply from 1 July 2020, entail energy class A for residential buildings and energy category B + all other buildings.
- Increased inspections in commercial advertising that should include EPC information in 2020 and a revision of the methodology for calculating energy performance in EPCs by 2021.
- Set up of energy efficiency obligation scheme.
- Combination of structural and energy upgrades during renovation opportunities.

Tools and mechanisms to support the mobilisation of finance:

- 'Save & Upgrade' scheme expected to finance the renovation of 2 100 residential buildings (€ 20.4 million) and 164 SME buildings (€ 7 million) through the provision of grants until 2020.
- Increase of building ratio by 5% if Energy Class A is met and at least 25% of total energy needs are covered by renewable sources.
- Reduced VAT rate (5% instead of 19%) for housing renovations.

Public sector:

- A total of € 20 million of EU Structural Funds was secured for the renovation of central government buildings for the period 2014-2020 and new funds for 2021-2027 are planned to be used for deep renovations and other measures.
- For schools, installation of photovoltaic systems with a total capacity of 4 MW and roof insulation and EU funds are secured for technical assistance with the aim to develop a long-term strategy for the upgrading of public schools to NZEB.

Tackling worst-performing buildings and energy poverty:

- Lower electricity tariffs for vulnerable consumers.
- Continuation or reconnection of electricity supply in critical periods for vulnerable consumers who face serious health problems.
- Financial incentives for the installation of a residential photovoltaic system using the 'net-metering' method.
- Higher financial support for residential energy upgrades offered by the 'Save & Upgrade' incentives'.

Other measures:

- Business4Climate voluntary agreement for non-ETS industry actors to reduce CO_2 emissions by 8% by 2030.
- Various research and development programmes (VIOLET, SupERB, European Hotels4Climate Project, SMEPower Efficiency).

Strengths and Innovative approaches

- A comprehensive set of measures: regulatory, financial, awareness-raising, user behaviour, training, supporting schemes.
- Proposal for a new fund to develop a specialised loan scheme for energy renovations, which will help diversify the current portfolio of economic measures and get the involvement of commercial banks.
- Possible development of a long-term strategy for upgrades of public schools to NZEB levels.
- Several new or revised measures including lift of exemptions for historical buildings, strengthened EPCs, green tax reform, EEOS, voluntary agreement for SMEs.

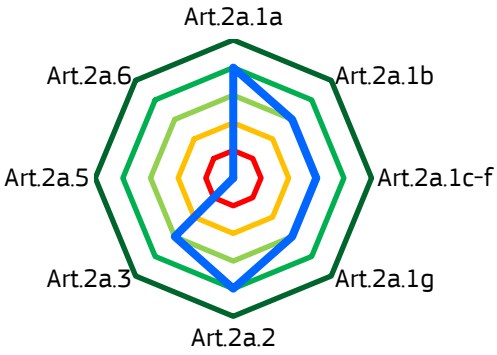
Recommendations

- Provide energy saving impacts for individual measures, so the LTRS fails to demonstrate how the various policies and measures will contribute towards the proposed milestones.
- More information is welcome on some assumptions underpinning the renovation scenarios (e.g., energy-savings in kWh/m^2 in minor or moderate renovations in residential buildings, energy-savings in non-residential buildings) and results (e.g., the percentage drop in consumption of realistic scenario against baseline scenario in 2030, 2040, 2050).
- A more detailed elaboration of the assessment of co-benefits is recommended, and a possible revision of the milestones with a view of increasing ambition.

CZECHIA

1. EPBD Art.2a COMPLIANCE

Introduction The Czech LTRS was provided as a separate, stand-alone document in June 2020. It was prepared by the Ministry of Industry and Trade. The document was available only in Czech, when assessed.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

The National Building Stock is described in detail in Section 2 (2.1.1 for the residential sector and 2.2.1 for the non-residential sector). In the residential sector, the buildings are stratified into single-family houses and multi-family buildings. Single-family houses are further divided according to their type, floors, and floor area. Construction rates are provided according to the type of ownership. The multi-apartment buildings are stratified as to age, the number of floors, floor area. The non-residential buildings are stratified as to building type (use), number and floor area. Tenure typology in public buildings is also provided.

The specific share of renovated buildings is provided as graphs/pictures and therefore it was not possible to extract the precise data. However, the LTRS states that 25% of single-family houses and 40% of multi-apartment buildings (but 55% panel houses) have been renovated in 2019. In 2014-2018, 31% of the renovations in multi-family buildings were low renovations, 50% were moderate renovations, 19% were deep renovations. In 2014-2018, 35% of the renovations in single family houses were low renovations, 45% were moderate renovations, 20% were deep renovations. The shares seem to apply to 2020 as well. We can estimate from Figure 15 that around 55% of non-residential buildings have been renovated in 2019-2020. More specifically, approximately 27% were low renovations, 44% were middle renovations, and 30% were deep renovations (based on estimates from EPC).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	1 766 046	4 312 964	351 183 505	
	SFH	1 554 794	1 896 931	194 957 505	
	MFH	211 252	2 416 033	156 226 000	
Non resident	TOTAL	613 134	-	248 300 000	
	PUBLIC	117 753	-	71 301 617	
	OFFICES	18 922	-	2 698 403	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

The LTRS defines two cost-effective standards for building renovation. The first is based on the so-called recommended values of the U-value based on norm ČSN 730540 (2011) and slightly improved technology (heat source) efficiency. That is also perceived as moderate (average) renovation standard (approaching low-energy building standard) in the LTRS.

The second standard is based on the lower limit of the interval of the so-called passive values of the U-value according to the same norm, high-efficiency heat sources, and use of forced air-ventilation and waste-heat recovery. The overall renovation of the building approaches a passive standard.

The two standards are also based on calculations of the cost-optimal level requirements under the Energy Performance of Buildings Directive.

The reference standard is the low (shallow) renovation, which is based on the so-called "required" U-values, without an improvement in heat sources efficiency.

The LTRS does not explicitly define trigger points (but evaluates the main motivation factors for renovation at different actors). The Decree 78/2013 Coll. on energy performance of buildings defines the key trigger point as "major change in the existing

building". However, there does not seem to be any further requirements.

1c	**Policies and actions on deep renovations, including building renovation passports**	P	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

The LTRS provides a comprehensive **set of measures** to stimulate the renovation of the building stock. The measures are divided into existing measures and measures to fulfil the optimal scenario. The existing measures include fiscal (economic), legislative, and education measures. The "upcoming" measures newly entail a communication campaign, in combination with a strong focus on technical assistance to good quality projects, including EPC. The economic measures in the upcoming period are closely related to the new MFF. They should be more reliant on financial instruments rather than the existing prevalence of investment grants. However, the LTRS is less specific about the concrete steps to reach this.

The building stock is described in detail. However, the least performing segments of the buildings are not specifically highlighted.

The split-incentives dilemma is analysed in the section describing barriers in the buildings sector. It is perceived as one of the main barriers, especially in the multi-apartment buildings owned by cooperatives. The key instrument to deal with split-incentives seems to be the communication campaign focused on attracting attention to energy efficiency measures and explaining their benefits.

The market failures are identified in the LTRS, mainly related to the setting of the economic incentives, lack of knowledge and awareness (asymmetry in information and bounded rationality), and administrative intensity.

Energy poverty has not been explicitly addressed in the LTRS.

Policies on public buildings are well-defined and comprehensive. The LTRS emphasizes the role of Energy Performance Contracting. It supports technical assistance in developing energy efficiency and specifically EPC projects, and assistance to public tender for EPC projects. Apart from that, investment grants are the main form of support (Operational Programme Environment and its successor in 2021-2027). The LTRS strives to move from investment grants to a wider plethora of financial instruments. Implementation of energy management is also supported.

Smart technologies are supported mainly through Operational Programme Enterprise and Innovation for Competitiveness and its successor programme in 2021-2027, aimed at enterprises (supporting monitoring, automation, and demand management in buildings). Additional support stems mainly from research projects (National Research and Innovation Strategy for Smart Specialisation of the Czech Republic (RIS3 Strategy), and Theta programme.

Education - The certified experts (e.g., energy auditors, and other) are "obliged to continue their professional education and monitor information necessary for the proper performance of their activities". The Ministry of Industry and Trade runs a programme supporting education activities (workshops, seminars, publications).

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

The estimate of energy-savings potential for the different building sectors is calculated based on a thorough analysis of the building stock, including a large pool of buildings for statistical analysis and modelling.

The LTRS develops three main scenarios: basic (business as usual with existing measures), optimal, and hypothetical. The three scenarios differ mainly by the share of low, moderate, and deep renovation of the building stock, and the increased renovation rates in the latter two scenarios. While the definition of the basic scenario is based on the current situation in renovations ("depth" and renovation rate), the definition of the other scenarios, by contrast, seems a bit arbitrary.

The basic scenario leads to 7% savings in 2030 and 20% savings in 2050. The optimal and hypothetical scenarios differ mainly by the depth of renovation and renovation rates. The optimal scenario leads to energy-savings of 9% in 2030 and 23.5% in 2050. The hypothetical scenario then reaches 17% savings in 2030 and 44% savings in 2050.

Wider benefits are discussed indirectly. GHG emission savings of the optimal scenario are estimated. Measures related to indoor air quality are assessed qualitatively (description of legislative measures and voluntary certifications). Other wider benefits are not specifically mentioned.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**

The LTRS presents indicative milestones of the optimal scenario, which is the expected scenario in CZ for 2020 - 2050. The milestones are expressed as unitary energy consumption for heating in MJ/m^2.year - total, residential and non-residential.

Progress indicators have not been explicitly determined, but the LTRS states that the indicator of unitary heating consumption was chosen due to the availability of data for reporting (final energy consumption in households for heating).

2030	• Total: 426 MJ/m^2/y (118 kWh/m^2/y) • Residential: 488 MJ/m^2/y

	• Non-residential 338 MJ/m²/y
2040	• Total: 368 MJ/m².y (102 kWh/m²/y) • Residential: 425 MJ/m²/y • Non-residential 287 MJ/m²/y
2050	• Total: 325 MJ/m²/y (90 kWh/m²/y) • Residential: 369 MJ/m²/y • Non-residential 260 MJ/m²/y • Final energy consumption in 2050: 289 PJ. • Renovation rate for: single-family houses: 1.4%, • multi-apartment buildings: 0.79% • public and commercial buildings: 2% • Decarbonisation: About 40% GHG reduction by 2050 • By 2050: 23.5% reduction in energy use

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	N	**3**
3b	**Reduction of the perceived risk for investors**	P	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

In general, the availability of financing is not a major barrier for energy efficiency projects and renovations. However, there is a general lack of awareness and distrust towards the existing financing schemes (mostly investment grants) due to the perceived high administrative intensity of the programmes. The EPC projects are a rather well-established practice (with the exception of government facilities, which are still bound by budgetary and accounting restrictions).

Reduction of perceived risk. There are a number of measures aimed at supporting technical assistance, which should lead to a reduced risk related to energy efficiency projects. In addition, the LTRS supports "good quality" projects which then serve as good practice examples. The communication campaign is planned to further reduce the perceived risk and barriers of energy efficiency projects.

Leverage of public funding. There is a number of financial instruments in place (GreenSavings programme and Integrated Regional Operational programme for residential sector, Operational programme Environment for public sector, Operational Programme Enterprise and Innovation for Competitiveness for commercial sector). The programmes take mostly the form of investment grants and will be continued in the next programming period (2021-2027). However, the LTRS aims to put a much higher focus on financial instruments, which would lead to higher leverage of public finances. There are a handful of financial instruments (soft loans by Czech Moravian Guarantee Bank, co-financing loan by the GreenSavings Programme) in place, but used only to a limited extent. The upscaling of the financial instruments is sketched in the present LTRS.

Investment in public buildings. The LTRS seems strong in the strategy for renovation in public buildings, especially at the municipal and regional levels. The measures cover a combination of investment grants, technical assistance, support to EPC, and support to energy management. The buildings owned by the state still face barriers in the development of EPC.

Advisory tools. The LTRS includes the continuation of the subsidized system of Energy consulting and information centres, provided free consultation services, with the newly introduced option to provide the consultations "on-site". Additional measures entail the launch of a wide communication and promotion campaign.

Additional information

Summary results of the public consultation	N	**0**
Based on information on the website of the Ministry of Industry and Trade, the Ministry held a public consultation. However, the LTRS does not include any information on the results of the consultation process.		

Implementation details of latest LTRS	N	**0**
The 2017 LTRS is not part of the current LTRS.		

Fire safety and intense seismic activity risks (optional)	N
These points have not been raised in the LTRS.	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The LTRS was submitted in June 2020. It includes the analysis of the national building stock (residential and non-residential), identifies three scenarios and chooses the optimal scenario to be followed, that is expected to bring 9% energy-savings in 2030 and 23.5% in 2050. It identifies the main barriers to higher renovation rate and higher share of deep renovation. The strategy to support the optimal scenario covers existing (mostly economic) measures and planned measures. The planned measures are a combination of economic measures (investment grants for residential and non-residential buildings financed through structural funds and sales of emission allowances), communication campaigns, support to technical assistance for energy efficiency projects with a special focus on EPC, and education measures. There is also a network of energy consulting centres. The planned economic measures are mostly a follow-up of the existing programmes with little update. The LTRS plans to introduce other financial instruments (soft loans, guarantees), but has been rather vague about it.

The LTRS is characterised by a certain degree of uncertainty due to the collision of the timing with the current state of preparation for the MFF 2021 - 2027. Most measures on the LTRS are reliant on the final setting of the programmes under the MFF.

Level of details/ Appropriateness/ Comprehensiveness

The measures in the LTRS are appropriate. They are mostly described in a sufficient level of detail, even though some core elements are missing, especially with respect to quantification of expected impacts and contribution of the measures to the overall EE targets and monitoring of progress.

Good practices

Regulatory measures:
The update of the decree 78/2013 introduces stricter requirements for nearly zero energy buildings, and also updates (tightens) the parameters of the so-called reference buildings. Other mandatory requirements pertain to indoor air quality (but do not seem to be additional to the EU requirements).

Tools and mechanisms to support the mobilisation of finance:
New GreenSavings Programme is a long-term programme for the renovation of residential buildings financed from emission allowances under EU ETS. The subprogram has newly introduced a guarantee for co-financing of the investment grants.

EPC projects are encouraged through a subsidy scheme supporting the preparatory documentation for the EPC in the public sector (feasibility study, tender dossier for ESCO and implementation of the EPC project).

Further development of soft loans and guarantees are under preparation or in the planning stage.

Public sector:
Schools and healthcare facilities are explicitly listed as the recipients of the technical assistance support to develop EPC projects. The rest of the measures are aimed at the public sector in general, including but not specifically highlighting this type of buildings.

The Operational Programme Environment (OPE) provides investment grants to public sector buildings, supporting thermal renovation and HVAC, new buildings in passive house standards, monitoring and automation in buildings, and further adaptive measures.

There is technical assistance to energy efficiency projects in the state-owned buildings supported by ELENA (EIB), aiming at increasing the absorption capacity of the OP E programme.

Financial support to implement energy management in public (and other non-residential) buildings.

There is also an ongoing project entitled "Regional energy planning and technical assistance in preparation and implementation of energy-saving projects". The main output of the project should be the methodology for technical assistance for the development of energy efficiency projects in the regions (focused on municipalities up to 25 the inhabitants). The description of the project seems to lead to a concept of one-stop-shops, even though it is not explicit in the LTRS.

Tackling worst-performing buildings and energy poverty:
The LTRS does not specifically and explicitly aim at energy-poor and vulnerable households. Social housing has not been explicitly marked out, either.

Other measures:
Energy consulting and information centres provide free consulting services. They will newly provide also "on-site" consultations.

"Good quality", complex energy efficiency projects are supported through grant for feasibility study and energy assessment, including very detailed analysis on the options and their cost-effectiveness. The projects then serve as good practice examples.

Strengths and Innovative approaches

- There is a detailed analysis of the building stock and potential for energy-savings, including expected investment costs. The potential savings and costs are based on thorough statistical analysis and modelling.
- The barriers to energy efficiency measures uptake in the building sector are analysed in detail. The LTRS strives for

adaptation of the policy measures to the identified barriers in the specific subsectors.

— The LTRS strongly emphasizes the role of technical assistance and energy management for the take up of energy efficiency projects, especially in the non-residential sector.

— Detailed communication campaign to promote energy efficiency has been envisaged.

Recommendations

More details could be provided on the following points:

— Impacts of the individual measures or group of measures (even though the resulting savings are often a result of a combination of measures).

— How the financial instruments (other than investment grants) are going to be implemented and promoted.

— A timeline for the planned measures.

— Trigger points.

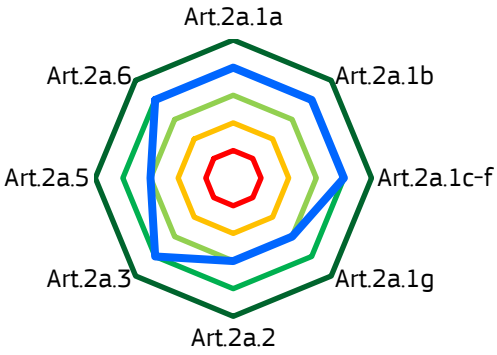
— Wider benefits.

— Energy poverty/vulnerable households' measures.

DENMARK

1. EPBD Art.2a COMPLIANCE

Introduction The DK LTRS was provided as a separated stand-alone document in March 2020 and complemented in August. It is Drafted by the Danish Energy Agency and it is composed by 2 main documents (LTRS part 1 and part 2) and 8 Annexes, including several reports of the Danish Building Research Institute. The second part of Denmark's renovation strategy includes the indicative milestones has been updated with the indicative milestones decided by the Government for 2030, 2040 and 2050, and describes the additional measures decided since the notification of the first part of Denmark's LTRS.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	4

The overview of the building stock is set out in the report (Annex 1 and 1a) entitled "Heat savings in existing buildings: potential and economy" (by the Danish Building Research Insitute-SBi, 2017), which, on the basis of the data from over 600.000 energy labels, describe (e.g., per building types, construction periods, insulation levels, heat demand) and assess the energy state of the building stock and the energy saving potential in the event of renovation (approximately 30% by 2050 in compliance with the requirements of the Building Regulations). It is estimated that approximately 80-85% of the energy saving potential of renovation in the total Danish building stock is in buildings built before 1980 (buildings built from 1980 onwards are built in accordance with a building regulation which places significantly higher requirements for insulation compared to existing requirements for buildings built before 1980).

As regards the expected share of renovated buildings in 2020, about 20% of the building stock built before 1980 has never been energy renovated; 55-60% have been lightly renovated (-30% energy consumption); 20-25% average renovated (-30/-60% energy consumption); deep renovation (-60% energy consumption reduction) has yet a very limited penetration (5%).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	1 563 885	-	313 600 000	
	SFH	1 461 327	-	221 300 000	
	MFH	102 558	-	92 300 000	
Non resident	TOTAL	153 695	-	122 700 000	
	PUBLIC	44 515	-	38 300 000	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	4

The strategy refers to the report (Annex 3) of the Danish Building Research Institute, "Cost-optimal levels of minimum energy performance requirements in the Danish Building Regulations", that evaluates the minimum energy performance requirements set in the most recent DK building code (BR18) in relation to the EPBD. This study includes a detailed assessment of cost-effectiveness of different new building types and renovation options, including envelope technologies, ventilation systems, heat recovery, automation and RES Options). In relation to the new housing examples, the present minimum energy requirements in BR 18 are very restrictive, with a deviation of up to 30% from the point of cost optimality if PV is not part of the energy solution and until 40% if PV is part of the solution. Moreover, the report "Heat savings in existing buildings" (SBI 2017) identify concrete renovation measures for the Danish building stock in the most widely used building types, demonstrating that implementation of the aforementioned renovation measures in connection with compliance with the requirements of the current Building Regulations (BR18) is cost-effective.

As regards trigger points, DK has a requirement in the Building Regulations that require that energy renovation works must be carried out when the building non energy related building renovation are implemented.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

The strategy includes a comprehensive and well-balanced set of measures to stimulate the renovation of the building stock, covering all the EPBD requirements. The measures are divided into Regulation & standards (e.g., Tightened building regulations BR18), Financial incentives (a new "pool for EE in buildings" incentive), Information (energy labelling), training and advice ("better home" program). The status of implementation of the existing measures is also described in a specific Annex (Annex 5).

- The **"Pool for energy-savings in buildings**" focuses on the least energy-efficient buildings segment, to realise the full savings potential cost-effectively; the Building Regulations provide that only viable energy renovations must be carried out.
- "**Better Boost Mechanism**" meets the EU's description of a building renovation passport.
- **Split incentives**: a scheme has been set in privately rented buildings to allow for a rent increase — by agreement between the parties — to be calculated on the basis of the total agreed and documented costs of the energy improvement works.
- **Energy poverty:** allowances/subsidies are given to the economically weakest part of the pensioners (Heat supplement); Aid by municipalities on an individual basis to pay particularly high heating bills for a person who has been affected by changes in his or her circumstances (e.g., unemployment or sickness).
- **Public buildings**: pursuant to a Circular on EE, all ministries are obliged to reduce their energy consumption by 14% in 2020 compared to 2006 (the State has already) reduced its energy consumption by 10.9% in the period 2006-2018).
- **Skills and education**: setting up of Knowledge centre for energy-savings in buildings; The Knowledge Centre for Energy saving in Buildings, among other tools and training materials, is targeted at the vocational education and training system.
- **Data and digitalisation**: Denmark has a focus on how to better exploit the potential of data and increase digitisation so that energy efficiency improvements are implemented where they offer the most value, and so the transaction costs of energy renovations are reduced; The 2018 Energy Agreement allocated DKK 19 million in 2018, DKK 33 million in 2019, DKK 34 million in 2020 and DKK 44 million annually in 2021-2024 for the overall information and data effort.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

The Danish Energy Agency's baseline projection (see table 3 "Evolution of the net consumption") is used as a basis for carrying out an evidence-based estimate of expected energy-savings. The Danish Energy Agency carry out annual basic projections on how energy consumption, energy production and greenhouse gas emissions will evolve, subject to a "Frozen Policy" scenario. From 2020 to 2030 the net heat consumption per m 2 is reduced by 4.4% and compared to a baseline with unchanged consumption per m^2, net heat consumption in 2030 is reduced by 5.9 PJ, compared to 2020 (excluding the impact of the demolition of existing buildings). Preliminary calculations show that the building pool of DKK 200 million per year in 2021-2024 will have an impact in 2030 of about 1.2 PJ. The rest of the reduction can be attributed to a combination of the other instruments aimed at existing buildings, i.e., an active information effort, a functioning energy labelling scheme and the requirements of the Building Regulations. As regards wider benefits, they are discussed qualitatively but not quantified: improved indoor climate and thermal comfort, better air, better light, reduced energy costs, reduced GHG emissions, increased employment.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

The Danish government has set an ambitious overall (all sectors) GHG reduction target for 2030 by 70% compared to 1990 levels and to have a building fossil-free energy supply by 2050.

2030, 2040 and 2050 Indicative non-binding milestones/targets have been set in connection with the Danish Climate agreement approved in June 2020: to reduce by 5% the actual net heat consumption per m^2 in homes by 2030 (vs 2018) and reduce building heat losses by 10%, 19% and 28% by 2030, 2040 and 2050 respectively.

2030	• Net heat consumption per m2 reduced by 5% between 2018 and 2030.
2040	• Reduction in the calculated heat loss: 19%.
2050	• Reduction of heating needs by 35% by 2050. • A 100% fossil-free energy supply by 2050. • Energy consumption of existing building stock reduced by 50%.

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

According to the strategy, the financing of energy efficiency initiatives is not a major barrier for most projects in Denmark. This is due to a well-established practice of furnishing loans for energy efficiency projects through home equity loans. The Danish pension funds and other parties are able to participate in energy projects by pooling projects in cooperation with other actors as well as through ESCO and EPC schemes.

- **Loans for finance renovations**: Mortgage credit system: A much used system of well-established mortgage institutions lending money to building owners with certainty on the value of the building. The financing is obtained through the sale of obligations. The rules for mortgage credit institutions ensure that the obligations are highly secure, which means the interest on loans to buildings owners is low. Building owners can thus obtain financing for the renovation of their buildings; Municipal Mortgage Credit (Kommunekredit): A special credit institution providing financial services to municipalities and regions, including loans. The funding is provided through the issuance of bonds, including green bonds, to finance, for example, energy efficient building renovations.
- **Tools for the reduction of risk**: From 2019, the energy label has been strengthened by raising the quality of the label and promoting dissemination. It is thus expected that the label could become an even more important tool to support energy efficiency renovations; Default value catalogue: The Danish Energy Agency has been prompted by the setting of default values for energy-savings in order to simplify the calculation of realised energy-savings. This is done by a simple multiplication of the value by the number of initiatives carried out. The basis for the default values is a professionally qualified tender for the energy-savings resulting from an activity;
- SBI guideline 269: The instructions deal with the method and process of carrying out the energy renovation projects for large buildings from the ideal phase to the operational phase. The advice shall provide guidance to the parties involved in a renovation project on how energy renovation projects are implemented at all stages. The instructions help to realise the energy gains from major renovation projects.
- **Use of Public funds** to leverage additional private investments:
    - the BoligJobordning scheme grants a tax credit of up to DKK 12 200 per person per year (in 2019) for renovation works (e.g., insulation, replacement of windows, the improvement of the heating system, the replacement of heating systems.
    - Heat pumps on subscription: In this scheme, selected companies install, own and operate a heat pump in private buildings. The building owner typically pays only a connection contribution and a bill in relation to the used heat. The selected companies will receive a grant per heat pump installed. The scheme will expire in 2020 but will continue under a new scheme focusing on the scrapping of oil boilers.
    - Grants for scrapping oil boilers: The pool covers the years 2021 - 2024 (DKK 20 million/y) to support the replacement of oil-fired boilers with individual heat pumps.
- **Pool for energy-savings in buildings**: This subsidy scheme which, starting from 2021 will substitute the current Energy Efficiency Obligation scheme, will allocate DKK 200 million/y in 2021-2024 with a competitive bidding procedure. The incentive is granted based on the ratio of subsidy per saved kWh in the individual projects. Subsidies are first granted to the project with the lowest costs per saved kWh, then to the one representing the second lowest costs, and so on. Similar schemes are foreseen for public buildings (DKK 100 million/y in 2021-2024), and for non-residential buildings (DKK 300 million/y in 2021-2024).
- **Advisory tools and one-stop-shop**: "Better Houses" is a voluntary and market-driven scheme from the Danish Energy Agency focusing on energy renovation of buildings. The aim is to make it easier for owners of buildings, mostly homeowners, to energy renovate by creating an "one-stop-shop" for energy renovation, where the owner only has to contact one certified building contractor and to get overall counselling on energy renovation of the entire building.

Additional information

Summary results of the public consultation	Y	3

The strategy has been sent in consultation at the beginning of 2020. The results of the consultation are presented in detail in Annex 6, that includes the main points raised by the 10 relevant stakeholders involved, broken down into sections linked to the main subject of the LTRS.

Implementation details of latest LTRS	Y	4
The status of implementation of the previous DK LTRS is presented in Annex 5 "Implementation overview of the long-term renovation strategy of 2014/2017"; it includes a list of measures and the status of their implementation at March 2020.		

Fire safety and intense seismic activity risks (optional)	P	2
In the strategy is stated that fire safety is already covered by existing Directives and that there is no intense seismic activity in Denmark;		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Denmark presented a comprehensive strategy addressing all the EPBD Art.2a provisions, providing a good description of the building stock and identifying the worst-performing segment (80-85% of the energy-saving potential of renovation in the total Danish building stock is in buildings built before 1980). A well designed and ample set of measures are mentioned in the strategy, divided in Financial, normative and informative instruments. Several initiatives for the mobilisation of investment in deep renovations have been put in place and, according to the strategy, the financing of energy efficiency initiatives is not a major barrier for most projects in DK. The Energy Efficiency Obligation Scheme, which played a very important role in the previous LTRS, with 45% of the annual target realised within households, will cease at the end of 2020 and will be substituted with a new energy-saving subsidies scheme based on a competitive bidding procedure. Indicative non-binding milestones for the efficiency of the building stock in 2030, 2040 and 2050 have been provided in an amendment of the main document, together with two recent studies on the "compliance with the energy requirements of the Building Regulations when renovating existing buildings" and on "Behavioural insights within the energy labelling scheme" prepared by the Danish Energy Agency.

Level of details/ Appropriateness/ Comprehensiveness

The package of policy measures described in the strategy appears appropriate to meet the goals of the strategy itself.

Good practices

Regulatory measures:

— Trigger points identification: Denmark has a requirement in the Building Regulations that profitable energy-savings must be carried out when the building owner renovates the different parts of the building due to wear.

— Split incentives: A scheme has been set up to 'clean urban regeneration' of energy renovations in privately rented buildings. The scheme allows for a rent increase — by agreement between the parties — to be calculated on the basis of the total agreed and documented costs of the energy improvement works.

— New building codes (BR18) with tightened minimum energy requirements for new buildings and the introduction of a even more restrictive voluntary requirements ("Building 2020" class).

Tools and mechanisms to support the mobilisation of finance:

— Pool for energy-savings in buildings: The scheme is planned (DKK 200 million for 2021-2024) to be implemented as a subsidy scheme with a competitive bidding procedure. The subsidy is granted based on the ratio of subsidy per saved kWh in the individual projects. Subsidies are first granted to the project with the lowest costs per saved kWh, then to the one representing the second lowest costs, and so on. The same scheme will be used to finance energy efficiency interventions in the non-residential sector (DKK 300 million for 2021-2024) and in the public sector (DKK 100 million for 2021-2024). These measures will substitute the current EEOS that will be concluded at the end of 2020.

— Tax credit of up to DKK 12 200 per person per year (in 2019) for work pay, including VAT for craft services which are carried out in the dwelling. The deduction is, inter alia, possible to be taken into account in the event of insulation, replacement of windows, the improvement of the heating system, the replacement of heating systems, etc.

— ESCO/EPC scheme: since 2016, energy companies install, finance, run and maintain heat pumps installed in smaller residential and commercial buildings. Customers have no up-front investment cost but pay for the supplied heat much as they would for district heating. This has increased the number of heat pump installations, and heat pumps in the scheme tend to operate more efficiently because they are run by professionals rather than building owners. The initiative is targeting mainly areas without supply of natural gas or district heating.

Public sector:

— 2014 Circular on energy efficiency in state institutions: all ministries obliged to reduce their energy consumption by 14% in 2020 compared to 2006. On 17 January 2020, a revised circular entered into force, introducing additional requirements for the institutions within the central government.

Tackling worst-performing buildings and energy poverty:

— The National Building Fund, a self-governing institution, whose funds originate from the tenants of the general housing

sector. The Fund supports, among other things, the renovation of social housing, thus also providing indirect support for energy improvements

The Green housing agreement: DKK 30 billion program for the green renovation of public housing in the period 2020-2026

Other measures:

— There is an interesting requirement for energy efficiency improvements. They must be implemented if the marginal investment for such improvements is profitable for the building owner. If the repayment period for the marginal investment for energy-saving is less than three-quarters of the lifetime of the energy-saving measure, the saving is defined as profitable and must then be carried out.

— Data and digitalisation: promotion of the use of data and digitalisation as a driver for energy efficiency and flexible energy use in buildings, including support for a data-based energy management approach (the 2018 Energy Agreement allocated DKK 19 million in 2018, DKK 33 million in 2019, DKK 34 million in 2020 and DKK 44 million annually in 2021-2024 for the overall information and data effort).

Strengths and Innovative approaches

A well balanced and comprehensive policy package, including all the typology of measures (Regulatory, Financial, informative, voluntary).

The new "Pool for energy-savings" subsidy schemes (for residential, non-residential and public buildings) are based on a competitive bidding procedure, even if not an absolute novelty (a similar system based on Energy Efficiency Auctions is already in place in DE and CH) can be considered interesting and innovative. Subsidies are granted based on the ratio of subsidy per saved kWh in the individual projects. Subsidies are first granted to the project with the lowest costs per saved kWh, then to the one representing the second lowest costs, and so on.

Recommendations

Additional information could be provided on the following points:

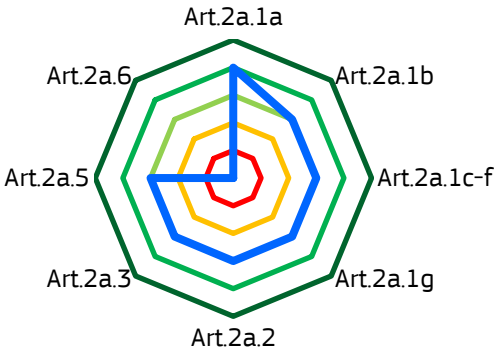
— Indicative milestones for the efficiency of the building stock in 2030, 2040 and 2050 and a roadmap for the achievement of these targets (including their contribution to the achievement of the EU's energy efficiency targets). They will be published in the context of the upcoming "Climate Action Plan".

— The conclusion of the Energy Efficiency Obligation Scheme at the end of 2020: clarification on why this very successful measure will be concluded and if the proposed alternative measures (e.g., "pool for energy-savings") will be effective and able to deliver the same energy-savings may complement the LTRS.

ESTONIA

1. EPBD Art.2a COMPLIANCE

Introduction Estonia LTRS was submitted as a separate document from the NECP. It was commissioned by the Ministry of Economic Affairs and Communications and carried out by the Tallinn University of Technology. It is built upon the objectives set by Estonia's National Energy and Climate Plan for 2030 (REKK 2030) and the Energy Economy Development Plan for 2030 (ENMAK 2030). The English machine translation was used to perform the assessment.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement					Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**					Y	**4**
The National Building Stock is presented in the document and is divided in the following categories: residential, non-residential and Public sector buildings. Within each group, a split into different types of buildings is provided. The following indicators are included for each category: No. of dwellings, surface area and in the case of residential and non-residential buildings an illustration of the location of the buildings in 5 different areas is also provided.							
		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources		
Residential	TOTAL	177 750	-	48 376 000			
	SFH	155 150	-	19 998 000			
	MFH	22 600	-	28 378 000			
Non resident	TOTAL	375 000	-	62 000 000			
	PUBLIC	5 292	-	5 930 000			
	OFFICES	4 010	-	4 300 000			

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**
Cost-effective measures to renovate different building types and policy measures to stimulate cost-effective deep renovation of buildings are included in the document (without the expected energy-savings contribution). Details of the cost for different type of building renovation are also provided.			

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	P	
The strategy presents a group of energy efficiency improvement measures, including staged deep renovation available for residential and non-residential buildings, which, if implemented, will lead to at least an energy class C. (Art. 2a 1c). These are: aid support for the insulation of external walls, roof or beech insulation, replacement of windows with triple glazed windows, renewal of the heating system, installation of thermostatic valves, and installation of heat recovery ventilation system. (insulation of the wall or a heat pump for exhaust air). Building automation: system upgrade/correction, Changing the lighting of the whole building into LED lights and demand-driven management of inefficient lights with LED lights, Upgrade of the heating system (system balancing- exchange of heat source), Cooling system equilibration or installing a complete new system. Policy measures on **worst-performing** segment of National building stock are referred to in the strategy as those measures applicable to the building stock built prior to 2000. No reference to measures/information related to the **split-incentive** dilemma. Suggestions on how to overcome market failure have been described and a Task Force on accessibility has been			

launched at the State Chancellery to ensure that renovation of buildings is accessible to all groups of the population (Art. 2a 1d). Regarding **public buildings** (Art.2a 1e), the central government should purchase buildings or conclude new leases only in buildings that meet at least minimum energy performance requirements. Supporting aid measures for improving the energy efficiency of central government buildings as well as support for energy-efficient local authority buildings have been included in the strategy. A section related to deployment of **new technologies** is reported in the document describing technological solutions to increase the volume of building reconstruction (without providing any data) and skills and education in the construction of buildings and energy efficiency has been identified as extremely important, but no organized trainings or guidelines are currently available (Art. 2a 1f).

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	P	**3**

No quantification of expected energy-savings are provided for any policy measure described. The LTRS acknowledges that wider benefits should be analysed in more detail. At the same time, it mentions that the strategy to ensure energy-savings, a healthy indoor climate in buildings and a high-quality spatial environment is estimated to improve the living and working conditions of 80% of the Estonian population.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

Indicative building renovation targets, some measurable progress indicators determined for 2030, 2040, and 2050 are provided in the strategy, together with the development of the building stock (residential and non-residential and public sector). The EE LTRS commits to reconstructing 22% of the total building stock by 2030. 64% of the total building stock by 2040 and to rebuild the entire existing building stock (built prior to 2000) cost-effectively into nearly zero-energy buildings by 2050. The potential CO_2 savings from the renovation of existing buildings is 3.9 $MtCO_2$ in 2050, representing an 89% reduction compared to 4.4 $MtCO_2$ emission in 2020. No other progress indicators for 2030-2040-2050 are provided.

2030	• to renovate 22% of the total building stock by 2030
2040	• the target is to renovate 64% of the total building stock by 2040
2050	• to renovate the entire existing building stock (built prior to 2000) cost-effectively into nearly zero-energy buildings by 2050. • a total of 141 000 existing buildings representing 54 million m^2 are waiting to be renovated in the next 30 years. • 89% % decarbonisation by 2050 (vs 2020) • Energy savings: 60% reduction in energy use by 2050

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	N	**3**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	P	
3d	**Guiding investments into an energy-efficient public building stock**	N	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	N	

No information related to project aggregation supporting building renovations (Art. 2a. 3a). Some measures encouraging lending to improve the energy efficiency of buildings, encouraging public investment in an energy-efficient building stock can be found in the document (Art. 2a 3b). Public-private partnerships to address specific market failures, as well as subsidies and the creation of the revenue needed to finance the measures are provided in the LTRS. (Art. 2a 3c) given the limited resources of public funding, the document acknowledges the need to increase the use of EU funds, revenue from ETS and other public funds to leverage additional private sector investment or to address specific market failures. No reference has been made to guiding investments into energy efficiency public building stock (Art. 2a. 3d). The document also acknowledges the necessity to prepare some guidance material for building reconstruction options, available financial mechanisms. Consumers' awareness-raising measures and advisory tools should also be developed (Art. 2a. 3e).

Additional information

Summary results of the public consultation	Y	**3**

The preparation of the renovation strategy was supported by a strategic advisory group consisting of different organizations involved in the construction of multi dwelling and small residential buildings and in market-based instruments for the reconstruction of non-residential buildings. In drawing up the strategy Also 5 Steering Group meetings were held during the preparation of the LTRS. The Steering Group included representatives from the Ministry of Economic Affairs and Communications, the Ministry of Finance, the Ministry of the Environment, KredEx, the Riigi Kinnisvara AS, the Environmental Investment Centre and Tallinn University of Technology. The results and observations resulting from the public consultation

were included in the document.

Implementation details of latest LTRS	N	0
Estonian LTRS included an Annex with a list of existing building reconstruction measures, but regarding the monitoring, no details of the measures implemented for the 2017 LTRS were provided		

Fire safety and intense seismic activity risks (optional)	N

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Estonian long term renovation strategy is a comprehensive document that covers all the EPBD Articles provisions and provides a fairly good level of information. The strategy is very ambitious and has two main objectives. Firstly it aims to renovate the entire Estonian building stock (for all buildings built until 2000) by turning them into nearly zero-energy buildings by 2050. Secondly, it aims to improve the living and working conditions of 80% of the population by demolishing unoccupied buildings and reconstructing health-friendly and safer homes affordable to all. The building stock is fairly described but can be further improved with additional information. The planned cost-effective measures focus on replacing/improving the heating system to reduce heat loss. Several bottlenecks to building renovation have been identified in the document. In order to overcome those bottlenecks, the strategy proposes to employ state funded financial mechanisms in the form of loans, guarantees and support, but also introduce new technologies, as well as developing information and awareness measures, increasing data availability to building and improve the monitoring process. In order to increase investments in building renovation from the private sector, Kredex proposes to create supplementary services and financial aids. The existing binding legislation requires minimum energy performance for major renovation for both residential and non-residential and central government buildings. The LTRS provides intermediate milestones and a roadmap to 2050 with a list of existing and planned measures to be implemented in the next decade. The current effort, so far, has been inadequate to reconstruct the existing building stock by 2050, and if the current trend continues, only the central government-owned buildings (representing 1.5% of the building stock!) will be able to be renovated according to planning. Therefore, it seems necessary to increase the public funding sources and investments from private owners to successfully implement the strategy and to lead towards the decarbonisation of the building stock.

Level of details/ Appropriateness/ Comprehensiveness

The description of the building stock is comprehensive but can be improved by adding further details (energy consumption per building type, data on different climatic zones, type of tenure of the buildings, energy use and performance characteristic for each type of building). The actions and planned measures described could be expanded and do cover only the following policy instruments: Regulatory, economic and fiscal.

Good practices

Regulatory measures:
Minimum energy performance requirement is mandatory for major renovation for both residential and non-residential and Central government buildings. In the Estonian energy performance regulation for buildings, the cost-optimal level of energy efficiency for major renovations corresponds to energy performance certificate class C. On the scale of energy labels, class A denotes a nearly zero-energy building and class C denotes the energy efficiency level of a major renovation.

Tools and mechanisms to support the mobilisation of finance:
In order to promote building renovations, Estonia offers supporting aid up to 30-40-50% depending on the decreasing amount of CO_2 emissions, the energy label class to be achieved, the location and size of the building. Financing measures such as loans, guarantees and grants are available and are based on an energy audit of the building SA KredEx (the State credit foundation) offers a mortgage loan guarantee for the purchase of a new home or for the renovation of an existing one.

Public sector:
The main part of the buildings owned by the central government are schools and offices, and 25% of the real estate area owned by the central government is at least class C of the energy label. Health care buildings, educational buildings and tertiary buildings are in the best condition. Information on the energy label for real estate owned by the central government is provided for 49% of the total area of real estate. In terms of surface area, 25% of the total area owned by the central government sector with energy label classes A, B or C is 200 000 m^2. In the case of rented areas, Indoor air-conditioning surfaces rented by the central government 30% correspond to energy label classes A, B or C, with a total of 230 000 m^2.

Tackling worst-performing buildings and energy poverty:
It is estimated that by 2050 up to 5 000 apartment blocks and up to 10 000 non-residential buildings will fall out of use. To tackle worst-performing buildings, Estonia offers demolition aid to local authorities for the demolition of abandoned residential and non-residential buildings. No information is provided related to the renovation of social houses. With regard to energy poverty, a Task Force on Accessibility has been launched at the State Chancellery to ensure that the renovation of buildings is accessible to all social class groups of the Estonian population.

Other measures:
A detailed analysis of the cost for a complete renovation of the building stock and the breakdown for different types of building up to 2050 is reported.

Strengths and Innovative approaches

Estonia long term building renovation strategy target is very ambitious since it aims to cost-effectively renovate the entire building stock into nearly zero-energy buildings by 2050. The successful implementation of the strategy will ensure energy-savings, a healthy indoor climate in buildings and a high-quality spatial environment, and it is estimated to improve the living and working conditions of 80% of the Estonian population. There are some existing financial mechanisms already in place for building renovations offering aid up to 30-40-50% that are linked to the impact of energy-savings, CO_2 emissions avoided, energy class, to be achieved that can be very successful with the necessary funding sources.

Recommendations

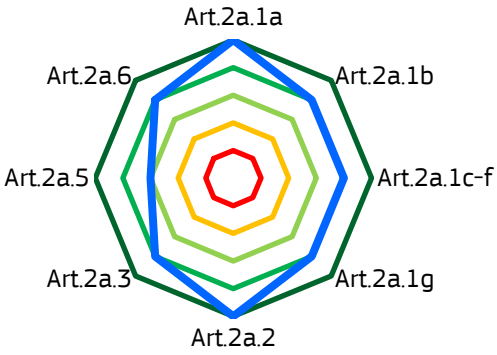
It seems crucial to look for further funding resources (EU budget, ERDF, Cohesion Funds, further funds for National budgetary strategy) and investments to achieve the entire renovation of the building stock into nearly zero-energy building by 2050.

Also the current technologies, labour supply and skills involved in buildings renovation need additional efforts to to achieve the increase in the volume of renovations Required for the ambitious LTRS goals.

FINLAND

1. EPBD Art.2a COMPLIANCE

Introduction The Long Term Renovation Strategy 2020-2050 was submitted in March 2020 as a separate document. It is a very detailed document that has a strong focus on the decarbonisation of the building stock implementing repair actions to reduce the carbon footprint.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**5**

The National Building Stock overview is comprehensive and very well presented. It also reports additional details compared to what is required by EPBD Art. 2a.1a. It includes the following indicators for both the Residential and Non-residential building stock:

- number of housing units, number of buildings, floor area (in 2020);
- Age structure by decade of completion;
- Energy efficiency by age group with average heating energy consumption and energy classes as indicators;
- Share of renovated buildings in 2020;
- Share of the worst-performing segment, i.e., buildings in energy classes F and G of the building stock in 2020;
- Heating energy consumption, including delivered energy and energy generated with heat pumps;
- CO_2 emissions in 2020.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	1 244 000	3 000 000	305 000 000	Total of single-family houses, semi-detached houses, terraced houses and multi-apartment buildings
	SFH	1 182 000	1 600 000	201 000 000	No of buildings: 1 100 000 single-family and semi-detached houses; 82 000 terraced houses No of dwellings: 1 200 000 single-family and semi-detached houses; 400 000 terraced houses Floor area: 166 000 000 single-family and semi-detached houses; 35 000 000 terraced houses
	MFH	62 000	1 400 000	104 000 000	Multi-apartment buildings
Non resident	TOTAL	144 700	-	110 000 000	
	PUBLIC	-	-	-	
	OFFICES	28 940	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

Part of the main cost-effective approach highlighted in the LTRS for Finland is related to removing all the vacant buildings from the building stock. According to the projections, unused building stock will become more common in Finland, and by 2050, only 70% of Finnish building stock will remain. Also, to ensure cost-effectiveness, investments in energy efficiency improvements should be combined by careful maintenance and building automation. Details of possible energy efficiency measures to be implemented and Trigger points for each type of building have also been described.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Finland describes a comprehensive set of policy measures to support deep renovation. Almost all the Policies and Measures (PAMs) have been adopted and already implemented. The document also includes a list of measures for each building component/system improving energy efficiency aiming to decarbonize heating for each different type of building. The 2020 LTRS only added a few new Regulatory and Information measures. Although the strategy is also based on the demolition of vacant/unused buildings which by 2050, will result in a 30% decrease of the building stock for buildings completed by 2020, it includes a good mix of policies and actions covering: new binding legislation and requirements in energy efficiency renovations, voluntary agreements, incentive schemes, information, awareness-raising, training and educational measures following a clear roadmap with intermediate targets related to heating energy consumption (e.g., 2020, 2030, 2040 and 2050).

All the EPBD Art.2a1d requirements, i.e., detailed indicators and actions (subsidy for energy efficiency improvement and demolition) related to the **worst-performing** segment of the national building stock, concrete actions to address issues related to the split-incentive dilemma, addressing the market failures and alleviation of energy poverty, have been considered and addressed by a well-balanced and planned set of policy measures, however, no energy-savings contribution was reported. Policies and actions targeting **public buildings** (Art.2a. 1e) have been described: voluntary agreements by municipalities, public procurement measures, energy subsidy for measures involving an ESCO, phasing out oil heating in the public buildings. Finally, an exhaustive section covering the use, application and benefits of smart technologies, **know-how and education** (Art. 2a. 1f) are also included.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

Energy-savings contributions are not reported for each individual measure; however, the document mentions that "the realised development of the building stock, renovation projects and the actions introduced are expected to cut the energy consumption of residential and non-residential buildings by half by 2050." Also, Thanks to the currently valid binding legislation and the plans to be realised, CO_2 emissions of the building stock completed by 2020 will be reduced by 90% by 2050. Good maintenance ensures the correct functioning of the building and promotes the property energy efficiency influencing the longevity and indoor conditions of the property. Wrong renovation solutions have caused indoor air problems in the past. A programme on humidity and mildew (2009–2016) provided information and instructions on how to resolve problems in residential buildings will continue in a national indoor air and health programme (2018–2028). The document also indicates that the implementation of the LTRs will lead to 12 000 person-years in the construction products industry and service industries, as well as at construction sites.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**5**

Indicative building renovation targets, milestones, measurable progress indicators determined for 2030, 2040, and 2050 are provided in the strategy. The development of the building stock (residential and non-residential), as well as the estimated change between 2020-2050, are clearly described. Heating primary and final energy consumption for 2020-2030-2040-2050 are reported. Other progress indicators such as CO_2 emission reduction, the share of NZEB for each type of building are also included.

2030	• 55.5 TWh Consumption of heating energy (gross) for residential and service building.
2040	• 45.1 TWh Consumption of heating energy (gross) for residential and service building.
2050	• 36.4 TWh Consumption of heating energy (gross) for residential and service building . • The goal is for all buildings (residential and non-residential) to have an energy class of C or above by 2050. • Removing all vacant buildings from the building stock (by 2050, only 70% of the Finnish building stock will remain). • CO_2 emissions reduced by 90% by 2050.

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

Joint building renovation projects (Art. 2a 3a) have been prepared and are supported by a Legal Act Joint Building Ventures Act. This applies to both new buildings and renovation projects. With regard to the provision of Art. 2a. 3b, **de-risking**, many measures to reduce the perceived risk of energy efficiency operations for investors are currently taking place in Finland. Banks can offer loans used to cover renovations costs up to a max of 50% of the building's market value. Leasing based funding solutions for projects where a renovation to improve energy efficiency is paid monthly according to the leasing model are available. Supporting customers with the issue of **green bonds** so that enterprises and financial institutions can collect funding for projects that support their responsibility agenda. In general, funding for renovation projects are available and public funding has to be allocated to projects that will introduce new solutions to the market. Self-financing, market based external funding but also international financial institutions, e.g., Nordic Investment Bank (NIB), European Investment Bank (EIB), European Energy Efficiency Fund (EEEF), are also available **to leverage additional private sector investment** (Art. 2a 3c). A way to allocate investments for improving the energy efficiency of the public building stock is supporting the implementation of ESCO projects in the public sector with an ESCO subsidy (which will lead to higher incentives). In Finland, the consulting services aiming for energy efficiency improvements are well-established. There are many **advisory tools** and energy consulting associations available for energy efficiency renovation solutions, consulting and training (Art. 2a. 3e).

Additional information

Summary results of the public consultation	Y	3
The preparation of the renovation strategy was supported by a strategic advisory group consisting of representatives of real estate and construction industry associations and representatives of government agencies. The advisory group convened four times in 2019 and 2020 and the summary of the results are included in the LTRs.		

Implementation details of latest LTRS	Y	4
Finland provides a Table that includes a description of the planned measures they are divided into the following categories; Far-sighted property management, Know-how, education and training of the labour force, Digitalisation, innovations and business operations, Communications, Financial incentives.		

Fire safety and intense seismic activity risks (optional)	Y	3
Finnish Decree 4/2013 of the Ministry of the Environment requires that when planning or implementing a renovation or replacement project concerning the building envelope or technical systems, the measures must be selected so as to ensure the correct functioning of the thermal and acoustic insulation, moisture barriers and fire insulation of the structures.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Finnish renovation strategy is a comprehensive and structured document that covers all the EPBD Articles provisions providing an accurate and detailed level of information going well beyond the minimum required. The strategy has a strong focus on becoming carbon neutral (aiming to reduce by 2050, 90% of CO_2 emissions of the building stock completed by 2020) and cutting the energy consumption of residential and non-residential buildings by half by 2050. The LTRs clearly describes the building stock and the planned cost-effective measures to reduce heat losses for each different type of buildings. Trigger points and barriers have been identified and clearly presented for both residential and non-residential buildings. The existing and new binding legislation to support the implementation of energy efficiency policies (voluntary agreements among companies and in the public sector, EPCs, subsidies and incentives to support and stimulate deep renovation and the implementation of smart energy systems and smart buildings in the residential sector, the demolition of unused/vacant buildings that by 2050 will reduce to 70% the Finnish building stock completed by 2020, the accessible funding and financial instruments allocated to energy efficiency building renovations projects supported by a well-established consulting, informative, awareness-raising campaign service and measures to support the small share of vulnerable households, make the Finnish LTR a well-balanced strategy with intermediate milestones and a clear roadmap to 2050.

Level of details/ Appropriateness/ Comprehensiveness

The description of the building stock is accurate and comprehensive, very well detailed and goes beyond the level of information required. The actions and planned measures cover a broad range of policy instruments: Regulatory, voluntary, economic, fiscal and awareness-raising.

Good practices

Regulatory measures:
A binding legislation concerning Energy Performance Certificate entered into force in 2008 and an amendment on Nearly Zero Energy Buildings entered into force in 2018. For existing buildings, an EPC is required when selling or renting out the building. In the future, Finland will make the energy class a mandatory piece of information when announcing the sale or rent of a housing unit. A specific set of requirements must be followed for the building envelope and the technical system in case of building renovation and the nearly zero energy level is the same as for new buildings. The efficiency of heating systems must be improved when the related equipment and systems are replaced with respect to the refurbished components.

Tools and mechanisms to support the mobilisation of finance:
In general, funding energy efficiency improvements is not an issue in Finland. In order to promote building renovation and investments in new technologies, Finland offers higher tax incentives when the energy efficiency improvement is significantly higher than the level required; also, higher rate of energy subsidies is available for project involving ESCO. Banks can offer loans for energy efficiency building renovation up to a max of 50% of the building's market value. Leasing based funding solutions for projects where a renovation to improve energy efficiency is paid monthly are available. Supporting customers with the issue of green bonds so that enterprises and financial institutions can collect funding for projects that support their responsibility agenda or offering green loans to customers are also available.

Public sector:
Investments in energy-efficient public building stock are supported by ESCO subsidies that can be granted to any company for investment in regular technology. The subsidy is 25% for companies and corporations included in the scope of the energy agreement scheme. If the ESCO project uses new technology, an additional subsidy of a maximum of 40% is available. Also, the Competence Centre for Sustainable and Innovative Public Procurement (KEINO) established in 2018 to support and assist contracting authorities in the development of sustainable, innovative public procurement.

Tackling worst-performing buildings and energy poverty:
Energy subsidy for the renovation of the building envelope and technical system in the case of a housing unit/residential building with humidity/microbial damage or indoor air problems and also for the planning costs of renovations in such housing units are available in Finland. - Demolition subsidy covering 90% of the demolition costs - An amendment of the Limited liability Companies Act. to offer housing companies the opportunity to demolish a building. - (Energy poverty) Subsidies in the form of housing allowance and social assistance to cover the housing costs (water, heating bills, rent and maintenance change of the home).

Other measures:
n/a

Strengths and Innovative approaches

Strengths: a coherent, reliable long-term strategy supported by a very comprehensive mix of policy measures covering: Regulatory (new binding legislation and requirements, well-established EPC system), voluntary agreements also extended to municipalities, Fiscal (incentive schemes for all types of buildings renovation, tax credits, subsidies), information, awareness-raising, training and educational measures.

- Promotion of innovative approaches incentivising the use of new technologies (building automation, smart systems, smart buildings) during building retrofitting and for building maintenance.
- Promotion of energy efficiency improvements higher than the required level by increasing the incentives available if the energy efficiency improvements is significantly higher than the mandatory required level.

Recommendations

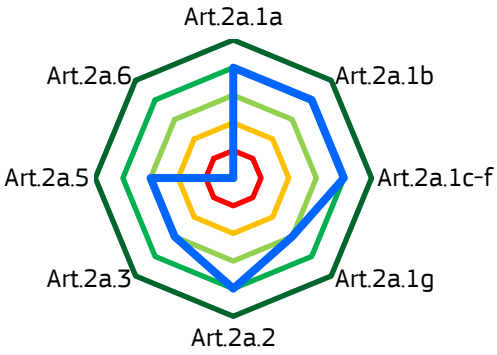
More details on the following aspects could be provided:

- Energy-savings contribution of the actions.
- Information on non-residential (no. of Hospitals, Schools).
- Data related to the type of ownership (public/private/mix) and type of tenure (owned occupied/rented) Data related to electro mobility and the impact of the measures described on air quality and the wider benefits.

FRANCE

1. EPBD Art.2a COMPLIANCE

Introduction The LTRS was submitted as a separate document after the NECP. It complements the NECP as the information on Art. 2a EPBD was largely missing in it. The LTRS goes beyond the minimum requirements under the EPBD as it largely sums up efforts and projects undertaken at the national and regional levels. The assessment relates to the French-language version of the LTRS.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

- The overview of the national building stock is given based on statistical data retrieved for a census in 2013, and updated for special sectors in 2015 and 2016. A further update is presently done and should be finished by the end of 2020.
- A share of renovated buildings in 2020 is not included in the LTRS. Overview tables present estimates on the inclusion of upgraded building components in residential buildings, differentiated along with age bands.
- The overall presentation of data is very comprehensive and detailed and as such, a solid basis for further works. As many topics are presented in graphs rather than tables, it is difficult to extract detailed figures for all sectors (see tab building stock data).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	35 400 000	-	Source: INSEE data 2018 (LTRS); 29.7 million are main residences;
	SFH	59%	20 886 000	-	Percentage in terms of total housing stock
	MFH	41%	14 514 000	-	Percentage in terms of total housing stock
Non resident	TOTAL	-	-	973 000 000	Schools, hospitals, communal residence
	PUBLIC	-	-	373 000 000	
	OFFICES	-	-	225 000 000	

1b	**Cost-effective approaches to renovations and trigger points identification**	P	**4**

- Chapter 3 presents a very detailed and comprehensive methodology for establishing cost-effective approaches for renovation. This approach is fine-tuned by covering 8 building types (6 residential, one office and one school building) and various refurbishment options.
- Technical specifications and calculation methods are very clearly laid down and documented, including the option to use renovation support programmes put in place by the government.
- Clear trigger points for renovation are, however, not identified.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

- **Art. 2a 1c: Staged renovations** are addressed by the concept of "bâtiment basse consommation [BBC] compatible", certifying that each renovation lot is compatible with an overall renovation roadmap leading to a Nearly Zero Energy Buildings - NZEB.

- Several programmes and initiatives at the national and regional level address staged renovations and regional programmes, which are monitored under the Effinergie initiative (see https://www.effinergie.org/web/bbc-par-etapes)
- **Art. 2a 1d:** Polices to address the **worst-performing segment** of the building stock are in place, notably with a renovation obligation that will come into force in 2023. The obligation is part of the revised energy and climate law of 8 November 2019. It foresees the following measures:
    - Rent calculations and property estimates will be based on the completion of renovation measures which take the building out of the status of "thermal sieve/passoire thermique" (term used to designate worst-performing buildings, i.e., classes F and G) by 1 Jan 2021. This will ban worst-segment property owners from increasing the rent between two lettings without undertaking energy renovations.
    - Energy performance diagnostics and rental contracts for housing must include information on the actual primary and final energy consumption of housing and an estimate of the theoretical amount of energy expenditure by 1 January 2022 at the latest;
    - An obligation to display the theoretical amount of estimated energy expenditure in property advertisements by 1 January 2022 at the latest;
    - Finally, an **obligation to renovate** these dwellings. With regard to this obligation to renovate, starting from 1 January 2023, energy performance will become a criterion for assessing the decency of housing. From this date, dwellings whose final energy consumption will exceed a certain threshold, defined by decree, may no longer be rented out;
    - From 1 January 2028, all dwellings with excessive energy consumption will have to be renovated.
- A very comprehensive set of measures to address **energy poverty** has been put in place, covering EEO, advice and financial support.
- **Market barriers** acting against NZEB are clearly listed.
- **Art. 2a 1e**: A comprehensive set of policies addressing the **public sector** is put in place. This comprises city renovation plans, an open data list of public buildings' energy performance and technical features, regulatory measures (banning of oil boilers) and financial support.
- **Art. 2a 1f**: **Smart technologies** are not addressed in the LTRS.
- The government has put in place a comprehensive set of **skills and education programmes** in the construction sector; among others, online "Massive Open Online Courses (MOOC)" classes have been set up for renovation experts who lead to certified qualifications (see https://www.mooc-batiment-durable.fr)

1g	Evidence-based estimate of expected energy-savings and wider benefits	Y	3

- Section 5 discusses the theoretical and practical works to set up an analysis of energy-savings; however, the analysis focuses on GHG reductions.
- The 8 standard technical sheets on building types present estimates of energy-savings.
- Energy-saving estimates per policy measures have not been included in the LTRS.
- Wider benefits are addressed regarding health benefits but not estimated or monetized.

2	Roadmap including measurable progress indicators and indicative milestones	Y	4

The LTRS gives clear guidance on the renovation milestones both in terms of GHG reduction (overall building stock) and reduction of final energy consumption (tertiary and public sector):

2030: -40% FEC; 2040: -50% FEC; 2050: -60% FEC, all compared to 2010.

2030	• 60% decarbonisation of the building stock by 2030 (vs 1990). • Reduction of energy consumption: - 56% (from 1990 levels).
2040	• Reduction of energy consumption: - 70% (from 1990 levels).
2050	• 80% decarbonisation of the building stock by 2050 (vs 1990). • Renovation rate (across all building types) to be increased to 3% from current 1.5% p.a. (for the 2020-2050 period).

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	P	**3**
3b	**Reduction of the perceived risk for investors**	P	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	P	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

- **Art. 2a 3a: Aggregation** of projects is not directly addressed in the LTRS. It is however part of some sub-programmes such as energiesprong.fr, which aim to roll out renovations works at larger level.
- **Art.2a.3b: Reduction of perceived risk** is not directly addressed, but again part of the key financing and economic instruments put in place.
- **Art.2a.3c**: The use of **public funding to leverage additional private-sector investment** is only addressed indirectly in terms of individual programmes but not comprehensively discussed in the LTRS.
- **Art.2a.3d**: A comprehensive package of measures is in place to guide investments into an energy-efficient public building stock, notably supporting regional and local actions.
- **Art.2a.3e**: A comprehensive set of **advisory tools** has been put in place and is working across different strands (focus on building types, regions) and actors (targeting home owners, building professionals, public sector actors at the regional and local levels).

Additional information

Summary results of the public consultation	Y	3
The public consultation of the LTRS is described in detail in section 6.		

Implementation details of latest LTRS	N	0
Information on the implementation of the 2017 LTRS is not provided. However, monitoring issues of the 2020 strategy are addressed comprehensively in section 5.3 of the LTRS. A national renovation observatory is put in place. Monitoring comprises the following indicators: — Monitoring based on the concept of “renovation equivalents” per year — Annual energy consumption of existing building stock — Repartition of building stock per energy performance class (annual monitoring) — Repartition of building stock per heating system		

Fire safety and intense seismic activity risks (optional)	N
Fire safety is briefly mentioned, but safety issues are not addressed in detail in the LTRS.	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

France is applying a comprehensive set of measures to address building renovation. The measures included in the LTRS present a comprehensive mix of regulatory requirements, fiscal and economic incentives and informatory measures. The measures are in place across all government levels, which guarantees to tailor measures to local needs. Several initiatives, such as adapting the originally Dutch concept of "EnergieSprong", has been adapted to national circumstances and is tested. The overall milestones and measures to reach these milestones are clearly explained. As updated housing stock data will be available in (late) 2020, this will allow further fine-tuning of the existing instruments.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS comprehensively presents the national strategy for building renovation at an appropriate level. In the case of the use of investments and the discussion of energy savings triggered by building renovation this could have been further elaborated. The presentation is very clear and detailed, including technical renovation sheets per individual building type. The building stock data is presented in the form of graphs which in some cases does not allow to extract of exact numbers.

Good practices

Regulatory measures:
The LTRS shows a very ambitious stance in terms of obligatory renovation works:

- Long-term renovation obligation for dwellings with excessive energy consumption.
- Long-term renovation obligation for owners of tertiary buildings over 1 000m² in line with the 2030-2040-2050 renovation targets. This is a frontrunner regulation in the EU.

Tools and mechanisms to support the mobilisation of finance:
The LTRS reports on a very comprehensive set of financial tools, covering the whole range of financial leverages, spanning from tax incentives, reduced VAT rates to green loans. This package is clearly tailored to the individual needs through adapted sub-programmes and as such very well addressing target groups.

Public sector:

- The 2018 Renovation plan foresees a dedicated reduction objective for energy consumption in the public sector: An energy-consumption reduction target for the building stock belonging to the Government and its agencies has also been enshrined in the Plan: 'In conformity with the overall objectives of the Plan for the Energy Renovation of Buildings, the State thus sets itself the objective of reducing the energy consumption of its building stock by 15% by 2022 in relation to 2010. The purpose for the State is to move closer to the path leading to achievement of the statutory objective for the stock of tertiary-sector buildings.'
- The 2030-2040-2050 milestones for the reduction of energy consumption in the public sector prolong this strive for continuous energy consumption improvement.
- The obligation to ban oil heating in public sector buildings by 2030.
- A dedicated task force for school renovation is to be put in place.

Tackling worst-performing buildings and energy poverty:

- The supplemented and reinforced 2018 Law on the Development of the Digital Housing and Development (ELAN) and the 2019 Climate Energy Act (LEC), strongly addresses the worst-performing buildings by:
    - The reliability and enforceability of the energy performance diagnosis (DPE) as from 1 January 2021;
    - The obligation to carry out an energy audit of the most energy-intensive units from 1 January 2022 onwards;
    - The introduction of a work obligation for the most energy-intensive units by 1 January 2028;
    - The establishment of an annual report on the achievement of the energy renovation targets for housing, and in particular the eradication of energy passes, to be submitted to Parliament on 1 July each year.
- A very comprehensive set of measures is put in place to address energy poverty, inter alia via the EEO scheme and dedicated information and grants.

Other measures:
n/a

Strengths and Innovative approaches

- The set of measures to address energy poverty is very comprehensive and very well-tailored.
- The regulatory measures to address the worst part of the building stock and renovation obligations for large service sector buildings are clear frontrunners in the EU and a clearly strong stance on refurbishment requirements.
- The governance of building refurbishing (creation of a national renovation observatory, collection and aggregation of data) is very promising and might serve as a blueprint for other countries.
- Clear obligations and targets for public sector buildings demonstrate the exemplary role of the public sector very well.
- The use of electronic logbooks for energy performance as an upgrade of energy performance certificates is very interesting and deserves further looking into.

Recommendations

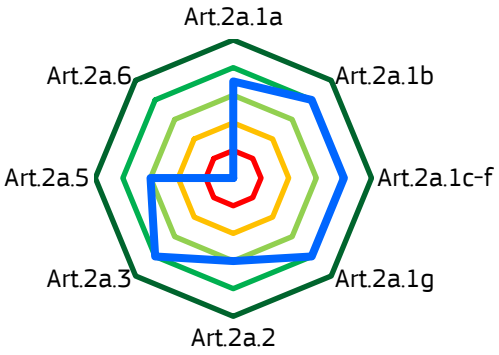
More details on the following aspects could be provided:

- Expected savings per measure.
- Specifications of the model underlying the scenario analysis and it links to the NECP modelling exercises (WEM/WAM).
- The use of EPC: this could be further elaborated, especially because many activities on the ground are in place.

GERMANY

1. EPBD Art.2a COMPLIANCE

Introduction Germany has submitted the LTRS after the NECP. In the meantime, the federal government had adopted a national climate strategy that comprises several additional measures for the building sector. These measures are not included in the NECP, but are taken up in the LTRS.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**3.5**

- The LTRS provides a **clear overview of residential buildings**, including per age band and energy category. Further evidence is included in textual form but not systematically presented in overview tables/graphs.
- The overview of **non-residential buildings is not very comprehensive.**
- The overview of **public-sector** buildings **is missing**.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	9 000 000	40 000 000	1 732 000 000	Source: LTRS (there are also 1 million dwellings in non-residential buildings)
	SFH	4 000 000	9 000 000	-	Single and two family houses
	MFH	5 000 000	21 000 000	-	Apartment blocks
Non resident	TOTAL	3 500 000	-	2 350 000 000	Total heated non-residential buildings
	PUBLIC	175 000	-	-	Local authority buildings used for education, mainly in the form of schools for general education
	OFFICES	687 279	-	316 000 000	Defined as "office-like businesses" - they represent the most common building type

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

Cost-effectiveness is addressed and **trigger points** have been clearly identified. Rather than presenting a theoretical framework on cost-optimality the LTRS assigns dedicated policy measures to achieving cost-optimality and discusses the economic mechanisms and historic energy-saving achievements of these instruments.

A table is presented that clearly shows the renovation obligations that come into force once a trigger point is reached.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

- **Art. 2a 1c**: The LTRS presents an overview table showing how the individual measures address specific needs and trigger points for renovation, thereby explaining the overall rationale of the German PaM catalogue.
- The **worst-performing part of the national building stock** (30% of the total dwelling space are in this segment) is clearly identified (i.e., buildings in G energy class, consuming more than 200 kWh/m^2/y). Measures to address this segment

are presented.

- **Market failures** and barriers are comprehensively discussed and mechanisms as well as PaMs, acting to overcome these barriers are presented, albeit in a general manner.
- **Split incentives** are discussed and measures to overcome this presented (information and dedicated support programmes.
- Regarding **Energy poverty (Art.2a.1d)**, measures (information and check-up programmes) to alleviate this situation are comprehensively described. Detailed numbers on energy-poor households are, however, not advanced. These measures are:
    - Federal support for energy advice from consumer centres and "Electricity saving Check Active";
    - Housing allowance (part of the overall social welfare payments).
- **Public buildings (Art. 2a 1e)**: A bundle of measures (regulatory, fiscal support, use of energy performance contracting) is applied at the federal level. Fiscal support schemes in the framework of the national climate initiative are installed to support the renovation of municipal public buildings. In terms of governance, a cross-ministry meeting of secretaries of state addresses building renovation in cross-cutting manner.
- **Smart technologies (Art. 2a 1f)**: This is addressed in a comprehensive manner, largely describing research and innovation programmes that the federal level has initiated to test technologies, technology integration, business models/start-ups and several deployments and real-life labs.
- **Qualification and education measures** are integrated into curricula and life-long-learning programmes for professionals. Quality safeguards have been enacted by defining qualification levels for energy advice and building sector professionals.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

Wider benefits are assessed in the framework of the building renovation roadmap, which is subsidised by 80% from federal-state funding programmes. Issues addressed concern mould, indoor climate, health issues, burglary protection, fire safety and sonic protection, asbestos and pollution protection.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

- A clear renovation milestone for 2030 is set, quantified milestones for 2040 and 2050 are missing. The LTRS argues that these milestones are set in a "qualitative manner" (see next "detailed info" tab). The LTRS mentions that the milestones will be quantified with the next update of the LTRS once "national and European specifications" are provided.
- Clear progress indicators and sub-indicators are developed or continue to be in further development.

2030	• Reduction of greenhouse gas emissions to 70 $MtCO_2eq$ by 2030, which represents a 67% reduction compared to 1990. • Reduction of non-renewable primary energy consumption to 2000 PJ (556 TWh) by 2030. • From 2030 onwards, the renovation rate is expected to increase from around 1.3% to over 2% for single and two-family houses and from around 1.5% to over 2% for apartment blocks.
2040	-
2050	-

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	**4**
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

- **Art.2a.3a**: Regarding **project aggregation**, the LTRS reports a regional project (ACE - Asset class Energy Efficiency) that tests and evaluates the aggregation of projects by a consortium of a regional energy agency (KEA of Baden-Wuerttemberg), a university and a research institute.
- This project aims at reducing the perceived risk of EE investment. No further information on **de-risking** initiatives is provided **(Art.2a.3b)**.
- **Art.2a.3c Public funding to leverage** additional private investments is largely in use via several dedicated support schemes run by BAFA and KfW. The funding schemes will be transformed into an umbrella instrument to have a clearer trade-mark and simplified access to finance.
- **Art.2a.3d: Several schemes exist** to support municipalities to engage in energy efficiency. The scheme is run by the

Federal ministry for environmental affairs (BMU).

- **Art.2a.3e**: A comprehensive set of **advisory instruments** is in place that have largely tailored and refined advisory services to the different needs (energy poverty, residential, SMEs, industry, etc.). This advisory offers also inform about access to financing instruments.
- A digital **one-stop-shop** is planned to be set up to combine the existing information in a transparent manner.

Additional information

Summary results of the public consultation	Y	**3**
Several public consultations have taken place. The results are annexed to the LTRS.		

Implementation details of latest LTRS	N	**0**
Monitoring is shortly addressed in section 3.3. Monitoring of reaching the milestones will be included in the annual monitoring of the German energy transition, which has to be presented to the German parliament by the federal government.		

Fire safety and intense seismic activity risks (optional)	P	**2**
Fire safety is included in energy advice and information in the framework of the individual building refurbishment roadmap.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Germany is applying a comprehensive set of measures to address building renovation in a balanced mix of regulatory requirements, fiscal and economic incentives and informative measures. Especially fiscal support and energy advice measures have been considerably stepped up and refined to address different target groups. The measures are in place across all government levels, which guarantees to tailor measures to local needs. A quantitative milestone is set only for 2030, whereas milestones for 2040 and 2050 are qualitatively described. Data on building consumption has been provided. The LTRS states that the government will work on retrieving more comprehensive and systematic data on the non-residential sector.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS overall presents a good overview of data, strategies and PaMs. A clear focus is on putting in place policies and measures, whereas the overall strategies and data are less well presented. The LTRS contains many relevant information, which, however, is mostly "hidden" in lengthy explanations rather than giving clear overviews.

Good practices

Regulatory measures:

- With the energy efficiency and the climate strategies, a comprehensive set of strategic orientations has been put in place.
- The recast Building Energy Law (Gebäudeenergiegesetz) combines all relevant building legislation in one law, thereby creating transparency on the existing regulatory framework.
- Energy performance certificates are well established and form the basis for many measures such as advice or renovation roadmaps.
- A research programme is investigating into support measures for building renovation leading to an “almost climate-neutral building stock” by 2050 ("EnEffGebäude").

Tools and mechanisms to support the mobilisation of finance:

- The catalogue of fiscal support measures has been considerably refined and tailor-made to specific target groups.
- Reduced VAT rates are planned to support renovation activities.
- ESCO and EPC market performance is monitored and developed by a dedicated government agency (Bundesstelle Energieeffizienz BfEE), which also has the task to boost the market and monitor results. This institutional set-up of market development is a clear best practice.

Public sector:

- In the public sector, a comprehensive set of measures exists to foster energy efficient regulation. This comprises regulatory standards but also information and tailored programmes on how to apply energy performance contracting in the public sector.
- The federal level has installed support programmes for renovation actions at the municipal level (note: this also covers schools and hospitals as these are attributed to the local level).

Tackling worst-performing buildings and energy poverty:

— The worst-performing buildings are identified in terms of energy consumption and energy class. Dedicated fiscal support and advice instruments are in place to address this segment.

— Energy poverty is largely addressed within the overall social benefit system. In addition, advice and support programmes are in place (energy check-ups).

Other measures:

The government intends to set up a digital one-stop-shop to bundle information in a transparent manner on the existing support schemes provided by the federal government (via KfW and BAFA), the federal states and the municipalities.

Strengths and Innovative approaches

— The LTRS very clearly details how PaMs are used to address existing needs and barriers in the building sector (see NOTES section below). This systematic matching of needs and measures is a good practice to identify policy gaps and overlaps.

— The identification of trigger points for cost-effective renovations is very clear.

— The digital one-stop-shop presents an interesting concept to increase transparency on existing schemes and measures.

— ESCO market development is safeguarded by a dedicated federal government agency (Bundesstelle Energieeffizienz).

Recommendations

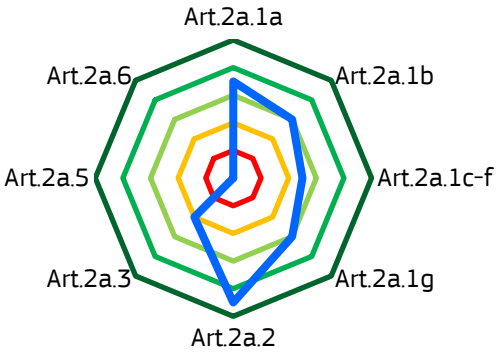
— The presentation of building stock data could be more systematic regarding non-residential buildings.

— The set of indicators to track progress could be further developed and systemised.

GREECE

1. EPBD Art.2a COMPLIANCE

Introduction The strategy is given as a standalone document.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**3.5**

The national building stock is described in terms of:

1. Number of building stock by building type, climatic zone and construction period;
2. Number of buildings by building type and energy performance class in 2011-2018;
3. Estimated average energy consumption and savings potential by type of building and climatic zone;
4. Final energy consumption in residential and non-residential buildings by fuel and end-use;
5. Number of residential and non-residential buildings by type of heating system.

The tenure, ownership and location of buildings are not covered in the overview. Stock data are primarily expressed in the number of buildings rather than floor area. Information on public buildings is also presented, but it is mentioned that usage and energy data on public buildings are rather limited.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	4 631 528	-	-	
	SFH	2 116 707	-	-	
	MFH	2 514 821	-	-	
Non residential	TOTAL	221 643	-	-	
	PUBLIC	112 000	-	-	
	OFFICES	53 064	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

This section presents the cost-optimal energy performance levels ($kWh/m^2/y$) in residential and non-residential reference buildings by type of building, construction period and climatic zone together with associated costs (€ per m^2). The data stem from the 2018 cost-optimality report submitted by the Greek authorities in the context of the Energy Performance of Buildings Directive. No other information is given and trigger points are not discussed.

1c	**Policies and actions on deep renovations, including building renovation passports**	P	**2.5**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	P	

The LTRS discusses the national policy framework for the period 2014-2020 and 2020-2030. The 2020-2030 framework consists of regulatory, information and financial/fiscal measures with the main focus on residential and **public buildings.** Measures include the "Save at home programme", the "Save I and II programmes" for local and regional authorities, the accelerated depreciation scheme in businesses, the increase of building coverage ratio in energy-efficient buildings, the offset/compensation of arbitrary fines in case of energy upgrades and others. For the period 2020-2030, the review of the legislative framework for buildings is foreseen with a view of supporting the energy upgrade of 12-15% of buildings and

integrating new minimum requirements concerning the need to **increase the number of NZEBs**. The possibility to move from the reference building approach to the actual operation of the building will also be examined. Other legislative measures include the upgraded role of energy managers in public buildings, **the implementation of energy management systems according to the ISO 50001 standard in public buildings and measures to support vulnerable groups**. In terms of financial measures, the Save at home and Save programmes will continue with the addition of a "smart" component to enhance energy autonomy in homes, more support to address energy poverty and other updated features. The "Electra" programme will focus on financial support for **energy renovations in public buildings** and the National Energy Efficiency Fund is expected to provide the basis for new financial instruments supporting energy efficiency and energy services market. The possibility to develop new hybrid innovative financial instruments that **combine public and private financing** and include mechanisms such as lease financing, **risk-sharing instruments** and insurance will be considered. Even if they are also mentioned in the discussion, it is not clear how the energy efficiency obligation scheme and the establishment of new competitive energy-saving procedures for industry and services in the context of the EED Article 7 will contribute to energy efficiency improvements in buildings.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

The expected savings (new annual and cumulative) by 2020 for 5 policy measures are summarised. However, the amount of savings that these measures are expected to generate after 2020 is not mentioned. As a result, it is not clear how the proposed policies are expected to contribute to the 2030 objective of 12-15% building stock upgrades. The energy upgrade of 15% of Greek homes in 2021-2030 as well as other energy efficiency improvements in the building stock is expected to lead to approximately **€ 8 billion increase in domestic value added and to create and maintain 22 thousand new full-time jobs on an annual basis throughout the period**. The increase in the income of the related employees is expected to amount to about € 3.4 billion.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4.5**

The LTRS states the milestone of **upgrading 12-15% of buildings and or building units within the decade 2021-2030** through targeted policy measures (in some sections of the report, the objective is described as energy upgrade of 15% of houses, so clarification on the scope of the objective is necessary). Moreover, the LTRS lays down a roadmap (Figure 32) **that aims to achieve a reduction in final energy demand in buildings of 8% compared to 2015 levels by 2030, 20-28% by 2040 and 28-40% by 2050**. These milestones are based on the results of the MS50 scenarios concerning energy upgrade of the building stock until 2050 calculated using the energy model PRIMES Buildings Model (PRIMES-BuiMo). Whilst the evolution of the number of energy upgraded buildings in 2040 and 2050 is not given, the expected building envelope upgrades in residential and non-residential until 2050 is discussed for the various scenarios considered in the analysis. In particular, **23% of the residential stock will have an upgraded building envelope by 2030, 36-42% by 2040 and 45-49% by 2050**. In terms of non-residential buildings, these figures are equivalent to 9% by 2030, 14-16% by 2040 and 19-20% by 2050. A roadmap that summarises the milestones in terms of energy upgrades in heating and hot water systems is also provided. The combination of low, medium and deep renovation measures that would enable the achievement of these milestones is discussed in the context of annual renovation rates of the building envelopes for each scenario in 3 different income classes. Finally, the analysis provides the overall investment costs for the various scenarios considered.

2030	• Upgrade 12-15% of buildings by 2030 • Final energy demand reduction in buildings of 8% compared to 2015 levels • Upgrade of 23% of building envelopes in residential and 9% in non-residential buildings • Radical reduction in oil use in buildings, 47% gas boilers, use of aerothermal heat pumps, and 11% reduction in traditional biomass combustion
2040	• Final energy demand reduction in buildings of 20-28% compared to 2015 levels • Upgrade of 36-42% of building envelopes in residential and 14-16% in non-residential buildings • No oil-fired boilers, 12-21% aerothermal heat pumps, 20% gas boilers, 83-86% solar thermal heaters
2050	• Renovation rate by 2050: 1.6% (doubling the 2015 one) • 45-49% of building envelopes in residential and 19-20% in non-residential buildings by 2050. • 28-40% Final energy demand reduction (vs 2015) by 2050 • No electric boilers, 15-50% aerothermal heat pumps, 14-64% gas boilers, 83-92% solar thermal heaters

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	P	**2**
3b	**Reduction of the perceived risk for investors**	P	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	P	
3d	**Guiding investments into an energy-efficient public building stock**	N	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	N	

The LTRS mentions that innovative financial blended programmes will be designed in cooperation with the domestic financial sector, which will combine public and private funding with favourable conditions to support the improvement of energy efficiency in specific sectors with high potentials, such as tertiary, domestic and industry. To this end, new mechanisms such as gross lending on favourable terms, leasing financing, risk-sharing instruments (e.g., mixed insurance instruments, guarantees) as well as mechanisms focused on the accumulation of investments will be considered. The existence of an Insurance Guarantee Schemes-IGSs will help in this direction by reducing the technical and financial risk.

Innovative financial tools may also be used by ESCOs to secure funding for the implementation of energy efficiency investments and better management of the repayment schemes while the extension of their application to other sectors (SMEs) will be considered. It should be stressed that the above elements are general ideas under consideration and no concrete plans are laid down in the LTRS on how these will be realised.

Additional information

Summary results of the public consultation	Y	**3**
The Greek LTRS went through a public online consultation in December 2020. The comments received are presented in Annex 3, together with answers.		

Implementation details of latest LTRS	N	**0**
Information on the implementation of the 2017 LTRS is not provided in the strategy.		

Fire safety and intense seismic activity risks (optional)	Y
This info is not reported in the strategy.	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Greece has presented a comprehensive set of 2030, 2040 and 2050 milestones that are expressed in energy-savings, number of renovated buildings, and number of upgrades building envelopes and building technical systems. The evolution of the package of policy measures on energy efficiency from 2014-2020 to 2021-2030 is described, covering a wide range of regulatory requirements, financial incentives and information measures.

Level of details/ Appropriateness/ Comprehensiveness

The roadmap, which covers detailed, measurable progress indicators and milestones, is based on a robust methodology that examines different decarbonisation scenarios. The data sources and concepts behind each scenario are thoroughly described, together with the results and implications in terms of energy-savings, necessary investments, renovation rates etc. More information on how the milestones will be achieved in practice, would help formulate clear conclusions on the adequacy of the proposed policy framework against these milestones. The existing policy framework in 2014-2020 and future framework in 2021-2030 are briefly described, however, an assessment of the collective generated energy-savings, the share of renovated buildings, etc. is missing.

Good practices

Regulatory measures:

- Improved regulatory framework and strengthening the role of energy manager for public buildings
- Promotion of energy management systems in public buildings
- Mandatory installation of solar thermal systems in new buildings, which are radically renovated
- As of 31.12.2023, all public authority buildings should be classified as energy class B or above

Tools and mechanisms to support the mobilisation of finance:

— Financial programmes for the renovation of residential buildings in the new programming framework

— Financial programmes for the renovation of public buildings sector in the new programming framework

— Fiscal and urban planning incentives for the implementation of energy-saving interventions in residential buildings and tertiary sector (outside government)

— Consideration of innovative blended financial schemes and establishment of a National Energy Efficiency Fund to stimulate the energy services market

Public sector:

— Financial programmes for the renovation of public buildings sector in the context of the new programming period

— Promotion of EPC in the public sector through targeted financial programmes for energy efficiency in the public sector

— Energy class B or above for all public authority buildings as of 31.12.2023

Tackling worst-performing buildings and energy poverty:

— Special support for economically vulnerable and energy vulnerable households in the Save at home financial incentive scheme

— Energy upgrading of residential buildings and energy vulnerable households and promotion of RES installation for covering their energy needs

Other measures:
N/a

Strengths and Innovative approaches

— A detailed list of milestones in 2030, 2040 and 2050 backed by elaborated 2050 scenarios, which are developed using the energy model PRIMES Buildings Model (PRIMES-BuiMo)

— A comprehensive set of policy measures which some original approaches such as increase of building coverage ratio in energy-efficient buildings and offset of arbitrary fines in case of energy upgrades

— New focus on measures of financial nature such as National Energy Efficiency Fund, Electra programme and consideration of innovative financial models that blend different sources

Recommendations

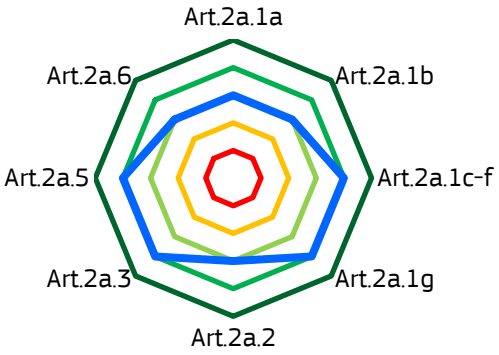
More details on the following aspects could be provided:

— Building renovation passports and measures to address split measures to support vulnerable groups and tackle energy poverty as well as innovative financial schemes.

HUNGARY

1. EPBD Art.2a COMPLIANCE

Introduction The Hungarian LTRS drafted by the Ministry of Innovation and technology was provided as a separated stand-alone document in June 2021, months later the NECP, with the title "Long Renovation Strategy on the basis of Directive (EU) 2018/844 with a view to fulfilling the eligibility conditions for the payment of cohesion funds for the period 2021-2027".



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**3**

The strategy provides building stock data for the residential and public buildings (commercial buildings are included among public buildings). Compared to the previous LTRS, the typology of building categories has been revised. The main sources of data are the 2011 and 2016 national census and statistical surveys (e.g., 2020 survey on building retrofit). Residential buildings are divided into 27 different categories in relation to building type (terraces houses, small and large condominium), age, and surface. The final energy consumption is on average between 205-225 kWh/m^2/y and the current annual renovation rate is approximately 1%. An estimate of the evolution of the number of residential dwellings until 2050 is also presented (approximately a 250 000 unit decrease in the period 2020-2050). Public buildings (e.g., health and social buildings, public offices, cultural, educational, hospital, sports facilities) are characterized by year of construction and floor area only.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	2 772 488	3 727 164	274 149 410	Based on the national census of 2011 (No. of buildings) and 2016 (dwellings) and corrected on the basis of demographic projections for 2020. Single family includes independent houses with up to 3 apartments (semidetached and terraced houses).
	SFH	2 660 857	2 333 726	200 573 410	No. of buildings (2011); No. of dwellings (2016 adjusted to 2020).
	MFH	111 631	1 393 438	73 576 000	No. of buildings (2011); No. of dwellings (2016 adjusted to 2020).
Non resident	TOTAL	-	-	-	No. of public buildings above 250 m^2 (includes hospitals, health social accommodation, sport facilities, cultural and education building, public administration offices, commercial).
	PUBLIC	23 819	-	50 334 765	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

The Strategy extensively builds on the concept of cost optimality approach (the methodology is based on the governmental degree 7/2006 laying down the building energy requirements, and integrated by a 2020 study by Multicontact Consulting Kft). On the basis of the examination of more than 400 renovation packages for the different types of buildings, 13 energy renovation packages have been identified and presented in the strategy (5 for residential buildings, 8 for public buildings).

Trigger points have been identified and described; for residential buildings: ownership transactions (sale, inheritance, change of tenant, planned or extraordinary maintenance (e.g., storm damage, plant big failure), building enlargement, specific financial incentive availability. For public buildings: availability of grand/incentive for renovation, change of users, change of building function, change of ownership (less frequent for the public sector).

1c	**Policies and actions on deep renovations, including building renovation passports**	P	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Policies and actions to promote deep renovations are described in the strategy (e.g., home renovation programme) and listed in a summary table (35 measure listed, including the date of implementation, the ministry responsible and the indicative financial needs).

Worst-performing buildings have been identified: the ones consuming more than 300 kWh/m^2/y. Some of them, due to structural problems and low comfort, will be demolished (because it does not worth renovating them). The **split-incentive dilemma** is discussed and some measures to address it are described (e.g., promoting building energy certificate, possible application of building renovation subsidies by tenants), together with an analysis of the HU rental market.

To address current market failures, the following measures have been identified: introduction of EPC contracts for renovation and involvement of ESCO in projects (e.g., preparation of model EPC contracts and improving the legal framework to facilitate this kind of contracts).

The **Energy poverty** issue is discussed in the strategy (families spending more than 25% of their total income; it can be due to 1. low income, 2. high energy prices, 3. low energy efficiency), and the more concerned households have been identified (e.g., large families and pensioners living alone), together with the regions more effected (northern HU and South Transdanubia regions). To address energy poverty, the following measures are described: reduction of energy supply cost (from 2013), social fuel scheme (from 2011) and energy efficiency awareness-raising campaigns.

It is to be noted that **worst-performing buildings** often belong to the category of households to be supported on the basis of their income situation. Polices for the energy improvement of **public buildings** are also described: energy modernisation of health institutions using ESCO contracts, the introduction of a mandatory energy audit in public institutions from 2023 (larger than 250m^2), use of grants financed by EU funds (e.g., EU EE funds ELENA facility). The possible introduction of **green bonds** is also discussed. Measure to promote **smart technologies** (e.g., obligation to install smart meters, revision of the current regulatory framework to promote demand-side management) and to improve skills and education are also included in the strategy.

The **building passport** has not yet been introduced ("If the system of refurbishment passports is introduced, this may be accompanied by a draft proposal for deep renovation, which means a clear plan to be known to the buyer/tenant").

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

Building renovation wider benefits are described in the strategy: improved indoor comfort in hospitals (11% reduction of hospitalisation duration and 20% cost reduction), in workplaces (12% work performance improvement), schools (3-8% improved educational performance), and in residential buildings (reduction of health problems). Replacement of lead pipes, asbestos elements in buildings and obsolete electrical/gas systems, and the related security, health and indoor comfort improvements are also discussed.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**3**

Indicative 2030, 2040 and 2050 targets in relation to energy efficiency in buildings are provided in terms of CO_2 emission reduction (e.g., -38%@2030, -60% @2040 and 90% in 2050), energy consumption in public buildings (18%, -40% and -60%), percentage of NZEB (20%, 60% and 90%). No scenario analysis to support these targets is presented.

Proper monitoring indicators are provided for the majority of the measures.

2030	• Decarbonisation: by 2030: 38% • Renovation rate 3% by 2030 • Percentage of NZEB: 20%
2040	• Decarbonisation: by 2040: 60% • Energy savings: By 2040 40% in public buildings (vs 2018-2020 consumption). • Percentage of NZEB: 60%
2050	• Decarbonisation: by 2050: 90% • 90% share of NZEB at 2050 • Energy savings: by 2050 60% in public buildings (vs 2018-2020 consumption). • Percentage of NZEB: 90%

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

The strategy includes a list of measures and actions for the mobilisation of investments, covering all the mechanisms listed in Art.2a.3 (a to e).

To address building renovation high capital requirements and the need to **aggregate projects**, securitisation and **green bond** financial instruments will be used. For reducing the investment risk, the concept of a green finance guarantee organisation, the establishment of a green bank and the introduction of public guarantee schemes are under discussion. The Hungarian National Bank will provide a **risk-reduction** guarantee to credit institutions in case of green financial products (e.g., loans for building renovation). This will lead to a reduction of at least 0.3% interest points (green interest rebate). A building renovation **dedicated soft loan revolving fund** to mobilize private investment has been in place since 2017. For the 2021-2027 programming period, a combination of non-reimbursable and repayable assistance is justified in order to ensure the efficient use of EU funds. In line with **Eurostat guidelines**, Hungary is examining the introduction of **Energy Performance Contracts** (EPC), to promote energy efficiency improvements in public buildings. Moreover, the national framework for ESCO market is under revision following the EC recommendation in order to overtake the current barriers that hampered this financing mechanism (e.g., high volume on non-EU refundable funds, low global energy prices, the long payback time of public building renovation projects). It is important to develop contractual elements related to financial and technical risk-sharing and compensation. It is necessary to develop a regulation specific to ESCO services in order to enable the development of the regulated market, including one or more contract templates, which may also simplify such negotiations.

As regards **information and energy efficiency advices**, the National Energy Network was set up in 2017 to provide free advice and technical assistance to public institutions, promoting the setting up of energy management systems and energy audits. Other awareness-raising and information initiatives are also described (online information portal on best practices, organization of information campaign, organisation of conferences, information days and campaigns). The introduction of **One-stop-shops** from 2023 is also discussed in the document.

Additional information

Summary results of the public consultation	Y	4
The LTRS went through a public consultation in August 2020, with the active participation of professional organisations, banks and stakeholders (list of participants not provided). The results of the public consultation are presented at the end of each section, in relation to each provision of EPBD article 2.a (e.g. accurate monitoring and monitoring of the public building stock and related investments, as well as access to the database of stakeholders (e.g., municipalities) are necessary for the implementation of a well-designed and effective strategy; On the basis of the feedback received, the importance of the introduction of EPC contracts by professional organisations for ESCO schemes has been confirmed etc.).		

Implementation details of latest LTRS	Y	3
An evaluation of the measures of the 2015 national building energy strategy is presented in an Annex (annex 1).		

Fire safety and intense seismic activity risks (optional)	Y	4
Building safety issues such as fire safety and seismic risk, together with issues related to obsolescence of electrical systems and gas equipment and appliances possible leakages, are discussed in a specific section of the strategy (i.e. section VII.2). Also, integrated measures for asbestos removal in buildings are included (e.g. section VIII.1).		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Hungarian strategy addresses all the requirements of EPBD Art.2a. It includes a good description of the building stock, with a particular focus on public buildings, a comprehensive package of existing and planned measures and a list of well-designed progress indicators to monitor their implementation. The public sector will play an exemplary role in the decarbonisation of the building stock (with a specific yearly target of renovating 5% of public buildings by 2030, and the introduction of mandatory energy audits). The implementation of the measures will be monitored by the establishment of the so-called building

renovation monitoring system (ÉMOR). This will enable the continuous processing of feedback loops and, if necessary, the establishment of new intervention points. Wider benefits are also identified and quantified, together with trigger points, and a summary of the implementation of the previous LTRS is presented in an Annex. The strategy went through public consultation in August 2020 ant the results of this consultation are presented for all Art.2a provisions.

Level of details/ Appropriateness/ Comprehensiveness

The level of details is good. The strategy follows the EPBD Art.2a structure, and each of the 35 foreseen measures is described in detail, providing information on the implementation timeframe, the responsible ministry and the indicative financial needs.

Good practices

Regulatory measures:
Introduction of mandatory energy efficiency audits in public buildings (owned or used and larger than 250m^2), in order to understand the building energy performance characteristics and provide advice on energy efficiency actions. The audit shall be repeated every 4 years.

Tools and mechanisms to support the mobilisation of finance:
introduction of an Energy Efficiency Obligation Scheme from (January 2021).

Measure to promote and facilitate the use of Energy Performance Contracts and ESCO project (e.g., revision of the current legal framework, the definition of contract templates).

Good combination of non-reimbursable and repayable assistance in order to ensure the efficient use of EU funds (e.g., ELENA, cohesion funds, EU Energy Efficiency Fund).

Green capital requirements for housing scheme: lower interest rate for loans financing energy efficiency action in buildings: at least 0.3% points discount for the construction on energy-efficient buildings (Energy rating BB), and/or installation of solar panel, replacement of space heater, insulation etc.

Public sector:
Exemplary role of the public sector: to strengthen the annual renovation rate of the public buildings stock to 5%, by 2030.

Introduction of mandatory energy efficiency audits in public buildings (owned or used and larger than 250m^2), in order to understand the building energy performance characteristics and provide advice on energy efficiency actions. The audit shall be repeated every 4 years.

Energy modernisation of 10 hospitals: for the first 2 sample projects, the allocated budget is the following: equity capital HUF 1 518 150 000, partly investment loan HUF 3 542 350 000.

Tackling worst-performing buildings and energy poverty:
Reduction of energy supply cost (measure in place since 2013), social fuel scheme (from 2011).

Among energy efficiency related actions, the energy efficiency obligation scheme (EEOS) is specifically expected to support vulnerable consumers.

The “increased use of decentralised heating solutions and electricity production penetration” are expected to help decrease energy poverty. Awareness-raising, information and consulting campaigns should promote low-cost energy efficiency investments that can be implemented by homeowners themselves, “resulting in substantial savings”.

Other measures:
The implementation of the strategy measures will be monitored by the establishment of the so-called building renovation monitoring system (ÉMOR). This will enable the continuous processing of feedback loops and, if necessary, the establishment of new intervention points.

Strengths and Innovative approaches

- Good use of EU funds (e.g., Cohesion funds, ELENA facility, combining non-reimbursable assistance with loans and green bonds;
- Good focus on monitoring the implementation of the measure using proper indicators and schemes, e.g. with the establishment of the Building Renovation Monitoring system (EMOR) and a database on public buildings.

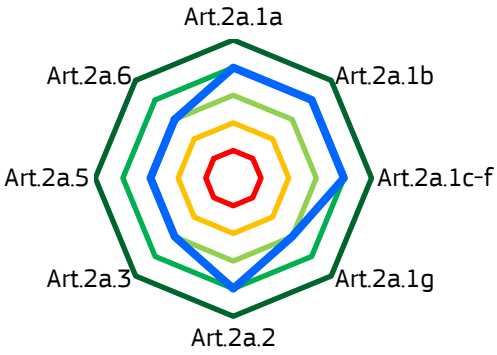
Recommendations

- Opportunity for more ambitious NZEB definition/requirements;
- A scenario analysis to explore different policy options and different strategic decisions could be included in future.

IRELAND

1. EPBD Art.2a COMPLIANCE

Introduction The LTRS was submitted as a separate document from the NECP and it has been developed based on the guidance issued by the European Commission. The Long-Term Renovation Strategy includes Ireland's existing building renovation policies which are set out in a range of policy documents, most notably the Climate Action Plan and the National Energy and Climate Plan.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

The building stock is well presented in the LTRS, accurately reporting the no. and the energy consumption of both Residential and public and commercial buildings. The age bands, tenure and the energy class distribution among residential and non-residential, including the year of construction is reported as well as the climate corrected energy consumption and the split between fossil fuel and electricity. Energy use and energy carrier, together with some performance characteristics of the residential building stock, have been included. Share of renovated buildings in 2020 is missing. However, the document mentions that an estimated 23 000 homes were renovated in Ireland in 2019.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	1 700 000	1 697 665	-	No. of buildings: Occupied residences;
	SFH	1 487 500	1 493 945	-	
	MFH	212 500	203 720	-	
Non resident	TOTAL	124 000	-	-	Commercial and public
	PUBLIC	15 000	-	-	
	OFFICES	45 683	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

The identification of trigger points is exhaustively reported in the document; also an assessment of cost-optimal calculations for residential and non-residential buildings has been carried out in 2013 and in Sept 2018 by the Department of Houses (and the studies are available at https://www.housing.gov.ie/sites/default/files/publications/files/200407_irish_2019_non-domestic_cost_optimal_report_revised_.pdf and https://www.housing.gov.ie/sites/default/files/publications/files/200407_irish_2018_residential_cost_optimal_report_revised_0.pdf). Planning and local government this will be revised every 5 years, and the regulations will be reviewed if the performance levels deviate from the cost-optimal. The assessment demonstrates the shift away from fossil fuels; the installation of oil boilers has dropped from 36% to 4% in new dwellings, and electrical systems (primarily heat pumps) make up 44% of heating systems in new dwellings, with this percentage growing each year steadily.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Ireland is currently implementing a number of policy measures addressing deep renovations of buildings. Deep retrofit Programme provides 50% funding to homes upgrading to a very high level of efficiency (switching from fossil fuel to a minimum A3 BER), incorporating renewables. Another milestone target for Ireland Climate Action Plan is to install 600 000

heat pumps (400 000 in existing buildings) by 2030. A pilot for **BRP (Building Renovation Passport)** in the Irish market was launched in early 2020 and will facilitate and encourage renovation at appropriate stages in the life of a property or its occupants.

18% of dwellings have been identified as a **challenging segment** of the Irish building stock, for these traditional buildings, which include historical buildings, a pilot 10 module course to provide building professionals and specifiers with guidance and insights on how to appropriately improve the energy efficiency through renovation, has been made available and a report on Deep Energy Renovation of Traditional Buildings - addressing Knowledge Gaps and Skills Training in Ireland has been published. An Expert Advisory Group was established to analyse the results of a Public Consultation aiming to address the **split-incentive dilemma** both in the residential and public sector buildings; the results highlighted the benefits of the right tax incentives, grants, technical support and appropriate regulation. The Public Sector Bodies can enter into new rental or leasing agreements for private sector buildings with a BER level of at least A3. A number of **market failure** issues have been highlighted: The lack of understanding of potential savings; The lack of attractive financing products to persuade people; The limited information on building stock; The limited uptake of efficient or smart technologies. Some of these market failures have been addressed by an external consultancy, Retrofit Taskforce. Ireland is addressing the alleviation of **energy poverty** with 3 main policy measures:

- The social housing upgrades
- The Warmth and Wellbeing Pilot Scheme
- The Better energy communities.

All these improve the living conditions of energy-poor homes, improving the energy efficiency of the buildings.

The **Public sector** energy efficiency strategy aims to achieve national energy efficiency targets of 33% 2020 and 50% by 2030 and drives the implementation of the policies and action on public buildings (The social housing upgrades, renovations of historical buildings, the transposition of the NZEB requirements of EPBD applicable to all buildings, Pathfinders programme to test approaches, build best practice and capacity to develop a replicable, scalable retrofit model for the public sector building stock (schools, central government buildings)). The value of technologies and smart systems to help improve energy efficiency is recognised and being promoted in Ireland. Ireland is implementing The National **Smart Metering Programme** aims to replace the mechanical electricity meters with new digital meters in all households in Ireland. New products and services will also enable consumers to shift some of their consumption to off-peak times of day when electricity is cheaper. Also, The Optimising Power at Work programme targets the optimisation of existing Building Management Systems in each building. **Training** programmes that cover energy efficiency and installation of energy efficiency products are available from the national training body, the Education & Training Boards, Universities, along with private sector training providers, accredited by a variety of national and international bodies.

1g	Evidence-based estimate of expected energy-savings and wider benefits	P	3
Only NECP projected energy efficiency savings for 2020 and 2030 (relative to 2001-2005 baselines) based on a WAM scenario are reported at the sector level. For Wider benefits, the LTRS reports that for every € 1 invested in insulation, it results in € 0.78 benefit in reduced days of work missed.			

2	Roadmap including measurable progress indicators and indicative milestones	Y	4
A monitoring and reporting system operated by SEAI, to which every public sector body is legally required to report, is in place. The milestones are: in the residential sector: The objective is to reduce CO_2eq emissions from the built environment by 40%-45% relative to 2030 projections as well as retrofitting 500 000 homes to a BER level of B2 or cost-optimal equivalent or carbon equivalent by 2030; Although no real "milestones" were formally set for 2040 for the residential sector a further 500 000 retrofits can be considered as an expected milestone. For the commercial sector, it is expected that an indicative milestone of two-thirds of commercial buildings retrofitted to a BER of B will be reached by 2040. Residential sector: 1.5 million houses to be retrofitted. All commercial buildings retrofitted to a BER of B by 2050. According to the LTRS, it is projected that approximately 355 000 new dwellings will be constructed to a Building Energy Rating (BER) level of A by 2030. The LTRS also includes the commitment to an average 7% per annum reduction in overall greenhouse gas emissions from 2021 to 2030 (a 51% reduction over the decade) and to achieving net-zero emissions by 2050.			
2030	• Retrofit 500000 homes to an EPC B2 or cost-optimal equivalent or carbon equivalent by 2030 (average of 50000 homes each year). • Install 600000 heat pumps by 2030. • In the commercial and public sectors, upgrade at least one-third of total commercial premises to EPC B by 2030. • to reduce CO_2eq emissions from the built environment by 40%-45%.		
2040	• Retrofit 1 million houses by 2040 and 1.5 million by 2050. • For the commercial sector, it is expected that an indicative milestone of two-thirds of commercial buildings. retrofitted to a BER of B will be reached by 2040.		
2050	• Residential sector: 1.5 million houses to be retrofitted. • All commercial buildings retrofitted to a BER of B by 2050.		

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	P	**3**
3b	**Reduction of the perceived risk for investors**	P	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	P	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

- The Retrofit Taskforce has been established to oversee the design and development of a new retrofit delivery model with a specific focus on the residential sector and **aggregation** is a key component of the approach, however, the combination of high numbers of rural dwellings and single-family homes makes retrofit project aggregation more challenging in Ireland.
- Some measures such as **Building Renovation Passport** can also help in de-risk investments in that area and facilitate phased deep retrofit.
- It is not very clear what is the share of **public funding leveraging** additional private sector investment or how it addresses specific market failures; however, there is a range of Government supports and grant schemes in place. - In order to promote retrofit in the public building stock, the Local Government is currently funding € 20 million Large Scale Retrofit programme of the least energy-efficient social homes. Also, the National Development Plan (NDP) provides € 750 million in funding over the period to 2027 to improve energy efficiency in public buildings, with a further separate allocation for deep retrofit of schools.
- In 2019, an **Expert Advisory group** was established to try to find solutions for the split-incentive and the multi-occupancy building consent problems. Also the Re-designed consumer-friendly Building Energy Rating (BER) Certificates and the introduction of pre and post-renovation BER's and the BER advisory report will be able to inform homeowners regarding the energy efficiency performance of their home and guide them to the best cost-effective retrofit solution. In addition, a new **One-stop-shop** will be developed to advise consumers on clear standards, contractual obligations for energy efficiency retrofits and identify service providers that can offer quality assurance.

Additional information

Summary results of the public consultation	Y	3
A number of public consultations have taken place in relation to the Energy Performance of Buildings Directive, including a specific public consultation to inform the development of the Long-Term Renovation Strategy. This was carried out from December 2019 to January 2020 in parallel with a consultation on removing barriers to energy efficiency in the rental sector by addressing the split-incentive problem. These public consultations were open to all organisations and individuals.		

Implementation details of latest LTRS	Y	3
An update on progress in relation to the expected outputs set out in Ireland's Long-Term Renovation Strategy covering the period 2017 to 2020 has been reported in the document.		

Fire safety and intense seismic activity risks (optional)	Y
In the LTRS is stated that "There is an also very low level of seismic activity in Ireland resulting in very minimal fire safety and risk in relation to energy efficiency renovations".	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Irish LTRS is a comprehensive and structured document that covers almost all of the EPBD Article provisions and provide a good and accurate level of detail. The LTRS is based on indicative milestones set by the Climate Action Plan and the National Energy and Climate Plan, which focus on a CO_2 emissions reduction in the built environment through the retrofit of existing buildings in the residential, public and commercial sectors. The approach applied by Ireland focuses on the reduction of CO_2 emissions from the built environment by 40%-45% relative to 2030 projections through the retrofit of 1 500 000 buildings by 2050 with an indicative 2030 target aiming to retrofit 500 000 homes to a BER level of B2 or cost-optimal equivalent or carbon equivalent. The document clearly describes the building stock and the existing and planned policies measures to retrofit and improve the energy efficiency of the building stock. Trigger points and barriers have been identified and clearly presented for both residential and non-residential buildings. The application of energy performance regulations for existing and new buildings together with a clear Building Energy Rating (BER) certification system and a clear definition of cost-optimal

performance support the implementation of energy efficiency policies (subsidies and incentives to support and stimulate deep renovation, obligation scheme on energy suppliers and distributors, the aim to install 600 000 heat pump by 2030, the energy efficiency strategy in the public sector, the huge social housing upgrade and the upgrade of schools and local authorities buildings). The accessible funding (€ 750 million from NDP) and financial instruments allocated to energy efficiency building renovations projects supported by a consulting, informative, awareness-raising service and real effective energy efficiency measures to support and improve the living conditions of vulnerable households, make the Irish LTRS a balanced strategy with intermediate milestones and a clear roadmap to 2050.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS document is comprehensive and overall it includes a good level of details of the residential and public, and commercial building stock. The existing and planned measures are described, although no energy-savings contribution is reported. The LTRS is based on the guidance provided by the European Commission and the level of comprehension is appropriate.

Good practices

Regulatory measures:
Major Renovations to dwellings are required to achieve a cost-optimal performance. This is in line with the National Development plan and will bring dwellings undergoing Major Renovation to a BER level of B2. EPBD requirements for buildings undergoing major renovations to be brought up to cost-optimal level were introduced to Building regulations for non-residential buildings in 2017 and for dwellings in 2019. NZEB for non-residential buildings was introduced into the Building Regulations in December 2017 and applied from 1 January 2019. This specifies NZEB performance requirements for new non-residential buildings and Major Renovation requirements for existing buildings.

Tools and mechanisms to support the mobilisation of finance:
The take up of EPCs in Ireland up to now has been very moderate. Tax incentives are available through different programmes for homes upgrading to a high level of efficiency (Deep Retrofit, Better Energy Warmer Scheme, Warmth and Well Being Scheme). A higher carbon tax rate (€ 80 per CO_2 tonne) will be applied to finance energy efficiency interventions in the built environment. In order to provide easier access to tailored finance for residential energy efficiency investments, the use of Smart Finance for Smart Buildings loan scheme has been considered.

Public sector:
Public sector energy efficiency strategy aims to achieve national energy efficiency targets of 33% by 2020 and 50% by 2030 and drives the implementation of the policies and action on public buildings (The social housing upgrades, renovations of historical buildings, the transposition of the NZEB requirements of EPBD applicable to all buildings, the Pathfinders programme to test approaches and building best practice and capacity to develop a replicable, scalable retrofit model for the public sector building stock (schools, central government buildings).

Tackling worst-performing buildings and energy poverty:
Policies and measures to protect energy-poor consumers are provided under the Strategy to Combat Energy Poverty. The strategy includes housing upgrade energy efficiency measures (e.g., the Better Energy Warmer Homes Scheme) and social protection measures (e.g., the Household Benefits Package). The Social Housing Retrofit Programme under which the social housing stock is expected to undergo significant energy efficiency renovations is also a key policy designed to address energy poverty in Ireland. Under Phase 2 of this programme, it is planned to retrofit social dwellings more than 40 years old (30% of the social housing stock) to a B2 equivalent BER.

Other measures:
Other existing measures such as the Better Energy Programme, the Deep Retrofit Programme, Energy Efficiency strategy and sustainable communities as well as some new ones: the creation of a new retrofitting delivery model to achieve economies of scale, the upgrade of Local Authorities housing stock and development of smart finance initiative to offer guarantee-based products among others, seem to have a high energy efficiency impact.

Strengths and Innovative approaches

The LTRS sets very clear and ambitious targets and milestones towards 2030 and 2050 for the renovation of the existing building stock. It is based on the Climate Action Plan and the National Energy and Climate Plan. The Programme also includes the commitment to an average 7% per annum reduction in overall greenhouse gas emissions from 2021 to 2030 (a 51% reduction over the decade) and to achieve net-zero emissions by 2050. Ireland is implementing policies and measures to protect the most vulnerable households under the strategy to combat energy poverty, and a budget of € 20 million (from the increased carbon tax) is being provided to retrofit social housing. There is a good mix of regulatory, fiscal, information and education measures and the BER (Building Energy Rating) fully support the renovations of existing buildings and also dictates what the requirements for new NZEBs are. In order to improve the energy efficiency of public buildings, the NDP (National Development Plan) has allocated € 750 million over the period to 2027. A new retrofitting delivery model to achieve economies of scale, upgrade of Local Authorities housing stock and development of smart finance initiative to offer guarantee-based products, among others, are identified as the new actions.

Recommendations

A quantified impact of the policies and measures in energy-savings could added in the next review of the document.

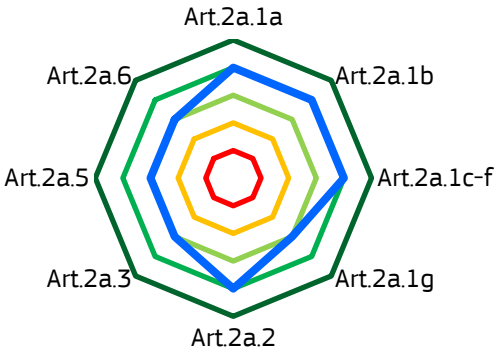
Additional information on energy savings forecast should complement the very clear targets and milestones expressed as

number of buildings to be retrofitted. This would make easier to assess whether the policy measures described are adequate to reach the targets.

ITALY

1. EPBD Art.2a COMPLIANCE

Introduction The Italian LTRS, drafted by the Ministry of the Ecological Transition, was provided as a separate, stand-alone document in April 2021, months later the NECP.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**5**

The strategy provides a very detailed overview of the Italian building stock, mainly based on 2018 data collected from several sources (ISTAT, ENEA, CRESME, ANCE, NZEB national observatory, EPC National database, State Property Agency database etc.). The building stock is presented by climatic zones, size, age, energy consumption, conservation status with a very good level of detail both for the residential and non-residential sectors. The non-residential building stock is also broken down into: schools, offices, hotels, commercial buildings, hospital/healthcare facilities, penitentiaries, barracks. Thermal and electricity Energy consumption indicators are also provided for all the building categories, together with the main findings from the digital EPC database (SIAPE) and the State Property Agency database. A national portal on the energy performance of buildings has been established in 2020, collecting, in a unique digital public database, all the information on the Italian building stock (e.g., size, energy performance, suggested renovation good practices etc.).

An estimate of the current annual renovation rate is also provided. For this, a "virtual deep renovation rate" indicator has been developed, considering all the renovation interventions (including minor interventions) and, from the energy-saving obtained, calculating the virtual equivalent deep renovations needed to obtain these savings. The current virtual rate of deep renovation is 0.85% (with energy-saving of 0.332 Mtoe/year). This renovation rate expresses how much m^2 would have been renovated if the measures promoted through "Ecobonus and Bonus Casa" measures had all been deep renovations.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	12 420 000	32 000 000	3 049 806 184	22% of dwellings is not occupied
	SFH	9 298 410	-	1 347 849 624	Mono and bi-familiar houses
	MFH	3 121 993	-	1 701 956 558	Totals do not match due to different data sources
Non resident	TOTAL	1 576 159	-	-	Non-residential buildings are 11% of the total of buildings; 27 000 hospitals, 56 000 schools, 57 129 private, and 17 229 public.
	PUBLIC	793 627	-	187 570 340	
	OFFICES	74 358	-	63 013 170	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

The strategy describes the methodology applied for the cost-optimal analysis of the building stock for new and renovated buildings as required by Art. 5 EPBD Recast. A reference to the 2013 calculation report is provided, together with a comprehensive summary of the results of the 2018 calculation, including:

- The new calculation assumptions and the main novelties (introduction of additional building types and renovation levels, improved calculation method including thermal bridges, updated energy costs);
- The main results for 5 building types (for new and existing buildings, considering 2 construction ages) for the 2 most populated energy classes (E and B).

From the cost-optimal calculation results that the building envelope is cost-effective mainly for the new buildings and the buildings built in 1946-1976; for the single-family house the use of HP and FV is the best solution (full electric buildings). FV can cover 50-70% of the energy consumption of the new residential buildings, 10-20% of the existing ones.

Trigger points (intervention "opportunity windows" in the LTRS) have been identified and discussed: e.g., a financial transaction such as sale, rental, change of use), a large building renovation not related to energy performance or a disaster/accident (e.g.

fire or earthquake).

A model has been developed to identify, for each building type, climatic zones and for both the residential and non-residential sector, the most cost-effective renovation interventions to reach the 2030 and 2050 renovation targets.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Existing policies and measures to support and promote **deep building renovation** are described with a good level of detail, both for the residential (private and public) and non-residential (private and public) sectors. The main policy measures mentioned in the strategy are represented by: regulatory measures such as the application of EPBD standards, the Ecobonus/Superbonus tax credit scheme, the "Conto Termico" and the White Certificate Scheme (Certificati Bianchi). The majority of these measures are already in place for years, and they will be improved, reinforced and complemented, e.g., with the Recovery and Resilience Facility and EU structural funds. Building renovation barriers and **worst-performing buildings** have been identified, e.g., the one build before 1976, and the public buildings (social housing building stock in particular). Specific measures have been identified to address these segments (e.g., Ecobonus/Superbonus). The Ecobonus is also the main measure identified to tackle **energy poverty** issues: within the Ecobonus tax rebate incentive, it is possible, for low-income families, to transfer the credit to a financial institution in order to reduce/annul the upfront cost of energy renovation interventions; The "Superbonus 110%" extends this possibility to everyone. The ecobonus can also be used to improve the energy performance of the **social houses stock**. Measures for the renovation of the **public building** stock are described in detail (e.g., ad hoc strategy for the renovation of the central government buildings, white certificates, Conto termico, The National Energy Efficiency Fund, the Kyoto Fund for energy efficiency renovations in public schools and universities, structural funds etc.). A central and local administration "burden-sharing" system is under study to identify the number of public buildings to be renovated annually. A specific section of the strategy is dedicated to illustrating in a comprehensive way the measures to promote **smart technologies** and to **education and skills** capacity building; The most important measures (Conto termico, Ecobonus, White certificate include provisions to promote building automation and control systems. Energy communities, as a way to incentivise nearly zero energy districts, are also promoted. The implementation of the **building renovation passport** is not mentioned in the document.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

Estimated energy-savings in 2030 and 2050 are reported in the document, split between residential and non-residential sectors.

Wider benefits (e.g., economic growth, increased added value, increased jobs, reduced family energy bill, reduced energy poverty, increased energy security, improved conform and health of building occupant) have been calculated in detail for the year 2030 using different econometric tools (input-Output and social accounting matrix): additional 79 000 new jobs per year, -13% energy import, -15% energy bill reduction etc.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**

In the strategy, the building renovation target for the years 2030 and 2050 are presented for the residential and the non-residential sector, together with the result of a comprehensive model estimating the annual renovation rate needed to reach these targets for all the building categories (the results of 2 "comparative methodology" models are presented: one more theoretical, and one more realistic and ambitious). For the residential sector, 0.33 Mtep/year final energy shall be saved by 2030, and the sector will be decarbonised by 2050 (the energy consumption will pass from 32Mtep in 2020 to 13 Mtep - all from RES - at 2050). This means that two-thirds (66%) of the current residential building stock need to be renovated by 2050.

For the non-residential sector, 0.24 Mtep/y of final energy to be saved by 2030, and sector "almost" decarbonised by 2050 (from 15.7 Mtep in 2020 to 11Mtep and 0.6 $MtCO_2$ at 2050). This means that 80% of the current non-residential building stock need to be renovated by the year 2050.

The roadmap to achieve these ambitious targets foreseen an overall requalification rate (residential and non-residential sectors) of 2% for the years 2020-2030 (about double of the current one), increased to 2.6% for the period 2040-2050 (about 3 times the current one). This means that it is necessary to renovate 2/3 of the current building stock. The residential sector reached the 2020 NEEAP 2017 targets, while the non-residential one did not. Thus, for the 2020-2030 period, the needed renovation rate of the residential sector is 1.9% vs 2.8% of the non-residential; for the following periods, the renovation rates are closer, i.e., 2.6% vs 2.7%.

2030	• Decarbonisation: By 2030: 32.7 $MtCO_2$ emissions (residential) 10.9 $MtCO_2$ emissions (non-residential); • Renovation rate: by 2030: 2% and 2.8 % (2020-2030) - non-residential • Energy savings: By 2030: 0.33 Mtoe/year (1.14 Mtoe/y) savings – residential and 0.24 Mtoe/y savings non-residential;

2040	• Renovation rate: by 2040 2.6%.
2050	• Decarbonisation: by 2050: 0.6 $MtCO_2$ emissions • Renovation rate: by 2050: 2.6%. • By 2050 66% of the existing buildings renovated; 80% of the current non-residential buildings renovated. Energy savings: By 2050: 13 Mtoe final energy consumption (residential),11 Mtoe final energy consumption (non-residential)

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

The strategy describes the existing financial and administrative barriers to building renovations (e.g., high upfront costs, difficult access to credit, high investment risk perception, information asymmetry, split incentive) and the existing financial measures to tackle them (e.g., use of EPC and ESCO financing schemes, Public-Private Partnership, target subsidies linked to energy performance, aggregation and de-risking tools, such as guarantee funds etc.). Among the financial measures, the following are listed and described in detail: The National Energy Efficiency Fund, Fund for the purchase and/or renovation of buildings (Plafond house — energy upgrading, Guarantee fund for the first house, Contotermico, Ecobonus and 110% Superbonus, EPCs, Green bonds, EU structural funds and White Certificates. Almost all the financial mechanisms are already in place for years. It has been decided to upgrade (e.g., 110% Superbonus), rationalise and complement (e.g., ecobonus + sismabonus) existing well functioning financial instruments, instead to set up “ex novo” ones, that are often likely to be less effective due to their longer time for full implementation.

As regards transparent advisory tools, one-stop-shops are not fully established yet. the LTRS reports some existing examples of one-stop-shops (e.g.” Iren” and “Fratello Sole”, “Punti Energia Clima per Comuni-PECC” by the ENEA and GSE agreement in progress), but the full development of these tools have still to be developed: “accessible and transparent advice and planning tools will be developed for guiding citizens in the process of improving the performance of their own buildings."

Additional information

Summary results of the public consultation	Y	**3**

The strategy went through public consultation, involving both local and regional authorities (that in the Italian constitutional set-up have a key role in achieving the energy and climate objectives) and other stakeholders (e.g., citizens, companies, workers’ associations, industry, NGO, professionals in the sector, financial institutions and investment funds, etc.). 32 stakeholders (22 associations and 10 companies) provided some comments. A summary of the result of the public consultation is provided in the strategy.

Implementation details of latest LTRS	P	**2**

A specific Annex detailing the status of implementation and the monitoring of the 2017 LTRS is not provided; however, some info on the implementation of 2017 measures are reported (e.g., number of interventions of contotermico, energy-savings).

Fire safety and intense seismic activity risks (optional)	Y	**4**

Fire safety issues and risk related to the seismic activity are discussed in detail in section 3.2 of the strategy. In order to optimise the cost-benefit of building renovations, safety and energy efficiency policies are integrated and some measures promoting a holistic deep renovation approach (seismic safety+energy efficiency) have been implemented (e.g., "ecobonus+sismabonus" focused on multi-apartment buildings). Deep renovation and/or reconstruction after a seismic event has been identified as a key trigger point for energy renovations (i.e., "opportunity window/finestra di opportunità".

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Italian renovation strategy, which went through a public consultation involving both local and regional authorities, fully complies with almost all of the EPBD provisions. It provides a very good overview of the building stock, both residential and non-residential, an estimate of the current annual renovation rates and properly identifies and discuss trigger points / "building renovation opportunity windows". It also includes a summary of the results of the cost-optimal methodology and of a modelling tool used to estimate the m^2 to be renovated to reach the 2030 and 2050 targets set in the NECP and in the LTRS, followed by a detailed description of the existing and planned measures and policies, broken down by public/private and residential/non-residential sectors, to reach these targets. Actions to promote smart technologies, skills and training and financial mechanisms to mobilise investment and an estimate of wider benefits, calculated in detail using different econometric tools, are reported as well. Safety and energy efficiency policies have been integrated to promote a holistic deep renovation approach and reduce the overall costs (e.g., "ecobonus+sismabonus" measures).

To fully decarbonise the building residential sector and "almost" decarbonise the non-residential one at 2050 (with residual 0.6 $MtCO_2$ emissions), the strategy foresees that in the next 30 years, two-thirds of the existing buildings need to be renovated. This means that the current renovation rate needs to be doubled (from 0.85% to 2%) for the period 2020-2030 and to be tripled for the period 2030-2050.

Level of details/ Appropriateness/ Comprehensiveness

Very good level of detail, with good use of robust modelling analysis to support the chosen policy options and set the specific renovation targets. The model and calculation assumptions are also described with a good level of detail.

Good practices

Regulatory measures:

- Deep renovation interventions are stimulated/promoted giving additional "building volume bonus" (e.g., a bonus of 5% m^3 additional building volume, in the case a new building or a major renovated one cover the energy needs with RES, exciding by at least 30% the minimum mandatory requirement for RES.
- It is under study the possibility to introduce mandatory building renovation requirements in relation to "opportunity windows"/trigger points, e.g., in case of major seismic safety works, major renovations, façade and roof rebuilding; This mandatory requirement will be supported by financial incentives.

Tools and mechanisms to support the mobilisation of finance:

- Good integration of seismic safety and energy efficiency measures to promote a holistic deep renovation approach and reduce the overall costs (e.g., "ecobonus+sismabonus" focused on multi-apartment buildings).
- Ecobonus and 110% Superbonus tax deduction system, with the possibility to transfer the "tax credit" to a financial institution to reduce/annul the upfront cost: Instead of the tax deduction, it is possible to choose to get a discount of the same amount in the invoice applied directly by the supplier equal to the maximum amount to be paid. Therefore, if a renovation costs € 10 000, which entitles to a 50% deduction, only € 5 000 will be paid to the supplier. In the case of Superbonus, the total cost of the intervention will be paid/anticipated by the supplier. The superbonus covers 110% of the costs of energy efficiency and can be combined with works for structural seismic improvements; moreover, it helps with the recovery of the economy after Covid-19 and, in the process, ensuring tax compliance in the local building industry. This measure, covering the expenses incurred between July 2020 and 2023, will be partially financed with the Recovery and Reform Plan Funds and we will help the economic recovery.

Public sector:

Establishment of the State Property Agency database:

For reducing the expenditure of the use of buildings by public authorities and to optimise their management (e.g., maintenance planning, rental optimisation, rational use of available spaces, reduce the overall operating cost, including energy supply), IT tools (e.g., a data base, and an IT portal to collect the data) have been introduced to better manage the public buildings and plan their use. Moreover, an IT tool ("Iper") have been developed to assess the energy performance of all the state-owned buildings and compare them to energy performance benchmark to identify the critical buildings and plan energy efficiency measures

Tackling worst-performing buildings and energy poverty:

Within the Ecobonus tax rebate incentive, it is possible for low-income families to transfer the credit to a financial institution in order to reduce/annul the upfront cost of energy renovation interventions; The "Superbonus 110%" extend this possibility to all the subjects. The ecobonus can also be used to improve the energy performance of the social house's stock.

Other measures:

- A feed-in tariff to incentive "energy communities" and renewable energy auto consumption to promote of nearly zero energy districts. Some examples of existing energy communities are described,
- Some research projects in the field of building renovations are also described (e.g., National Technology Energy cluster, "Ricerca di Sistema" projects).

Strengths and Innovative approaches

— Good integration of safety and energy efficiency policies, to promote an holistic deep renovation approach and reduce the costs (e.g., “ecobonus+sismabonus” focused on multi-apartment buildings).

— Very detailed description of the building stock, based mainly on data from digital databases. The information on the building stock has been fully digitalised in recent years.

— Good use of modelling and scenario analysis.

— good use of existing measures (e.g., ecobonus), upgraded, simplified and complemented with additional measures (e.g., 110% Superbonus).

Recommendations

More details on the following aspects could be provided:

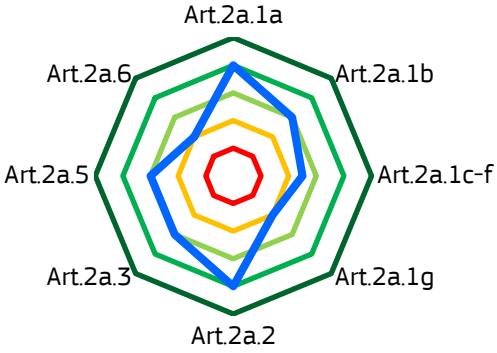
— Information on the building passport, and on the implementation of one-stop-shops.

— Good targets and measures until 2030, but missing a clear roadmap and policy for the 2040-2050 period, when the biggest renovation effort (triplication of the current renovation rate).

LATVIA

1. EPBD Art.2a COMPLIANCE

Introduction: The LTRS was submitted as a stand-alone document and was not included in the NECP. Please note this assessment was performed not using the official translation of the EC but the machine translation. Information needed extra checks, and some data from certain figures were missing.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

The National Building Stock overview is comprehensive and presented with a fair amount of details, however, it can be further improved by also including the non-residential age bands of the buildings, the energy class for both residential and non-residential buildings, data in relation to the climatic zone. However, in addition to the requirements of EPBD Art. 2a.1a., a detailed categorization by ownership for different types of dwelling was provided together with a territorial breakdown of each type of dwelling and also an illustration of the number of different multi-apartment buildings coming into service from 1941 until 2019. Also, average heating consumption for office, educational and Multi-dwelling buildings has been included.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	363 991	-	91 080 000	Community accommodation included
	SFH	309 929	-	36 500 000	
	MFH	53 415	-	53 750 000	
Non resident	TOTAL	1 006 847	-	115 500 000	Schools and health
	PUBLIC	5 131	-	8 950 000	
	OFFICES	7 124	-	6 530 000	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

The main results of a report on the calculation of cost-optimal published in 2018 are reported, e.g., the minimum thermal performance of different buildings elements (and a weblink to the full report is provided).

[Report on the calculation of cost-optimal levels of minimum energy performance requirements in accordance with Article 5 of Directive 2010/31/EU on the energy performance of buildings. Available at: https://em.gov.lv/lv/nozares_politika/majokMnformadja_un_skaidrojumi/gandriz_nulles_energies_eas.]

Trigger points have not been identified.

1c	**Policies and actions on deep renovations, including building renovation passports**	P	**2.5**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	P	

Art. 2a.1c: Policy measures specifically addressing deep renovations of buildings (mainly replacement or upgrade of the residential heating system in the residential and municipal buildings) are described as part of more generic measures such as Promoting energy efficiency in residential buildings or in public buildings.

Building renovation passports: since 2010, the Law on Management of Residential Houses foresees that every residential building shall have a paper or electronic file including all the building information (e.g., technical documentation, energy passport, audit findings etc.).

Art.2a.1d on a) worst-performing buildings is partly addressed, one measure requiring the manager of a residential building who must plan energy efficiency improvement measures if the heating and DHW exceed certain values is included. b) information on the split incentives dilemma is not reported. c) A few market failures have been highlighted: one related to the low solvency of homeowners and the need for additional funding. d) alleviation of energy poverty in Latvia is an issue, access to affordable housing to all is currently a challenge, 15.2% of Latvia population experience severe housing deprivation. Some solutions have been indicated, and a target to reduce the energy poverty rate to 7.5% by 2030 has been set. Art.2a.1e Energy efficiency improvements and renewable energy use in municipal and public buildings are funded by EU funds and state budget, a 2030 target including thermal energy consumption in buildings (kWh/m^2/y) has been set. Art.2a.1f For initiatives to promote smart technologies, the document only mentions the smart meters rollouts to be concluded by 2023.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	P	**2**
Expected energy-savings and GHG emission reductions are linked to measures and described in the document; very little information is provided on wider benefits - Art.2a.1g.			

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**
Building renovation milestones have been set for 2030-2040-2050. For some measures, progress indicators (energy-savings and GHG emission reductions, the number of buildings to be retrofitted) have been determined.			
2030	• 30% multi-apartment buildings renovated (4 860 buildings) 500 000 m^2 public buildings renovated by 2030		
2040	• 3% per year of the building floor area of central government buildings by 2040 • 8100 multi apartment buildings renovated by 2040		
2050	• 1 869 kt CO_2eq emissions reduction (80 %) by 2050 • Goal: all new buildings to meet the NZEB requirements and ensure the renovation and conversion of all buildings to meet the requirements of zero or nearly zero energy buildings by 2050.		

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	N	**3**
3b	**Reduction of the perceived risk for investors**	N	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	P	
3d	**Guiding investments into an energy-efficient public building stock**	N	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	P	

Art.2a.3c It is not very clear from the document how much Public funding to leverage additional private sector investment is currently taking place, but further public funding is needed. Art.2a.3e The document acknowledges the need to raise public awareness of the importance of renovation of multi-apartment buildings as well as to develop a favourable public opinion on the modernisation of multi-apartment buildings and to ensure the availability of detailed, clear and high-quality building information and financing instruments.

The LTRS mentions: the creation of a Transformation fund for hazardous and structurally degraded multi-apartment, the creation of a long-term low-interest loan for the construction of low-cost housing (€ 50 million for both of them) to leverage additional private investment.

The LTRS mentions that every residential house must have its own 'home property', which includes a technical passport (plans, schemes), project documentation, energy passport and energy plan, findings from a technical survey of the house. No further details are provided on building passport.

Additional information

Summary results of the public consultation	Y	**3**
The preparation of the LTRS was supported by a number of different players who contributed to the final strategy. Different views and opinions were taken into account and are presented under Annex 2 of the document.		

Implementation details of latest LTRS	P	**2**
Annex 1 includes a short update on the implementation of measure 3.4.4.1 'Measures to improve the heat insulation of residential buildings' indicating the budget made available, number of projects covered and also an update on measure 3.4.4.1 'Measures to improve the heat insulation of residential buildings', which resulted in heat energy-savings between 30 and 40% compared to the previous amount of heat energy. The importance of further developing the ESCO market and more stringent building standards to be applied as of 1st Jan 2020 has also been highlighted as key to the successful implementation of the building renovation strategy.		

Fire safety and intense seismic activity risks (optional)	Y	3
The document reports specific standards addressing this, namely: Regulations on Latvian Construction Standard LBN 201-15 “Fire Safety of Buildings”.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Latvia LTRS is a fairly broad document, aiming to climate neutrality by 2050. There is a strong effort to ensure that the energy poverty rate in Latvia is less than 7.5% (currently, 15.2% of people experience severe housing deprivation). The LTRS clearly describe the building stock (although some additional information should be integrated). The existing and more stringent thermal requirements for building envelope, the subsidies, loans and grants to support the renovation of different buildings in the residential, public and municipal sector, together with new and additional funding sources that are needed to successfully implement the strategy could seem adequate to meet the indicative milestone and target set. Strong emphasis is also given to developing the ESCO market and designing EPC for both the public sector and the private sector, which could significantly raise the number of renovation projects.

Also, the indicative forecast of the financing required for the renovation of the whole building sector and its even distribution by decade, with an investment need of 30% by 2030 and 2040 respectively, as well as 40% of the financial resources are needed to restructure the building stock by 2050.

Level of details/ Appropriateness/ Comprehensiveness

The description of the building stock is fairly comprehensive and detailed but could be further improved with the inclusion of non-residential age bands of the buildings, energy classes for both residential and non-residential, data in relation to the climatic zone. Additional data on the worst-performing buildings, trigger points, building passports and one-stop-shop, as well as more details on the current number of nearly zero-energy buildings. The recommended EC template, could further improve the reporting. The actions and planned measures cover the following policy instruments: economic, fiscal and awareness-raising.

Good practices

Regulatory measures:
Regulatory measures are in place in Latvia. Stricter thermal requirements for building envelope came into effect in 2015 with LBN 002-15 on energy certification of buildings, which lays down minimum permitted levels of heating for both renewable/renovated buildings and new buildings, as well as requirements for the gradual transition of new buildings to nearly zero-energy buildings. From 2019 onwards, all new constructions of state and local government property and from 2021, all new buildings must be nearly zero-energy buildings.

Tools and mechanisms to support the mobilisation of finance:
Best practices can be identified in the municipal aid through tax incentives where municipalities can benefit from tax relief under certain parameters and Regulations to carry out building renovation. Local governments may set reliefs at 90, 70, 50 or 25% of the amount of real estate tax depending on the type of category. - Creation of a long-term low-interest loan for the construction of low-cost housing. - ALTUM loan for energy efficiency improvements backed by the EIB, where the financing is complemented by a guarantee of € 3 million from the ‘Private Finance for Energy Efficiency (PF4EE) facility’ provided by the EU under the LIFE programme. A grant, where the amount of the grant depends on the number of children in the family. - Aid for improving the energy efficiency of non-residential buildings and renewables introduction of energy resources organized by ALTUM it is based on the financial resources of the Green Bonds issue amounting to € 20 million for companies and institutions wishing to make energy efficiency improvements with funding of up to € 2 850 000 per project available, with only 15% of the company’s own participation.

Public sector:
The LTRS does not explicitly mention measures directly addressing renovations of schools, hospitals and other public sector buildings but does provide energy data (heating) and the decrease in terms of energy consumption per annum (kWh/m^2//y).

Tackling worst-performing buildings and energy poverty:
Energy poverty and providing access to housing for all in Latvia is an issue to be addressed. Latvia set a 2030 energy poverty target to ensure that the energy poverty rate in Latvia is less than 7.5% (currently, 15.2% of people experience severe housing deprivation). Among the measures tackling energy poverty are renovating and increasing the number f social housing, creating a tool for housing support for disadvantaged people to change residence allowing them to participate in the labour market, the Support programme “Balst” which provides aid for the purchase or construction of housing supporting Latvian families with a non-reimbursable state subsidy for the purchase or construction of housing for families with at least three children.

Other measures:
n/a

Strengths and Innovative approaches

Latvia LTRS clearly highlights the funding gap that would be needed to renovate the entire building stock including for each building category (multi-apartment buildings, private homes, non-residential buildings), the total number of buildings and surface area where cost-effective renovation can take place, cost of energy efficiency per m^2. Total financial and actual financial needed and potential funding needs over a 10 years period. This analysis is extremely important to show the financial sources needed to successfully implement the LTRS in Latvia. An innovative measure can be identified in the municipal aid through tax incentives where municipalities can benefit from tax relief under certain parameters and Regulations to carry out building renovation. Local governments may set reliefs at 90, 70, 50 or 25% of the amount of real estate tax depending on the type of category.

Recommendations

Include additional information in future reporting on worst-performing buildings, trigger points, building passports and one-stop-shop, as well as more details on the current number of nearly zero-energy buildings.

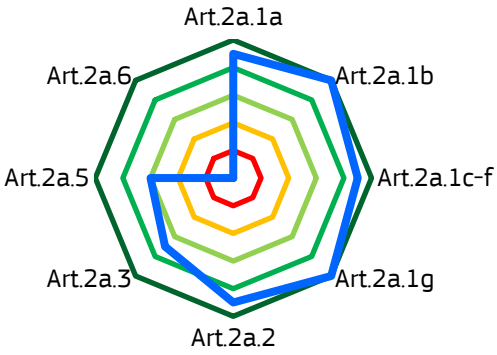
The main challenges for Latvia, where future efforts should be concentrated, are:

- The mobilization of additional public and private investments.
- The share of energy poverty 15.2%, much higher than the EU average (7.5%).

LITHUANIA

1. EPBD Art.2a COMPLIANCE

Introduction Although the Lithuanian LTRS was submitted (in April 2021) as an independent document; it is part of the NECP and the measures related to deep renovation, energy efficiency and RES in buildings are presented in both documents using the same codes and names to provide traceability.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4.5**

The overview of the Lithuanian building stock is provided with a high level of details based on 2019 data of the national Lithuanian Register of Immovable Property. As of December 2019, 2.6 million buildings with a floor area of 235.3 million m^2 are registered in Lithuania.

The existing buildings are presented by type, year of construction, type of ownership, wall materials, presence of EPCs, energy classes and type of heating system in terms of units, square meters and percentage. Only 2% are publicly owned, while 45% have mixed ownership facts that could complicate the decision-making process of the renovation. Considering that 75% of the existing buildings were built before 1992, by 2050, they will be 60 years old and renovation works are required to keep them in use. Based on the existing EPCs, the energy consumptions (GWh/year) of the building stock for heating, DHW preparation and electricity as well as the total primary energy consumption and the CO_2 emissions ($ktCO_2$/year) disaggregated per building sub-type and energy classes are also provided. The primary energy consumption by type of fuel is also included. Residential buildings consume 66% of the total primary energy consumption of the building stock, and 77% of the total primary energy consumption is attributed to building in energy class D and lower. An additional source (Lithuanian Association of Heat Suppliers) is used to compare the data on buildings connected to the district heating system. An estimation of abandoned and unheated buildings is also included. In Lithuania, the NZEBs correspond to energy class A++. By January 2020, 46 such buildings with a floor area of 149 000 m^2 were registered. A figure on existing NZEBs by type is also provided.

The strategy includes a presentation of the renovation programmes carried out in Lithuania. Between 2013 and 2020, about 2 631 apartment blocks were renovated and about 419 were renovated before 2013.

An overview of the public buildings owned by the state and local authorities is also included. Public buildings represent 2% of the total building stock, and they are responsible for 8% of the total primary energy consumption of the building stock. Although their energy renovation does not necessarily lead to important energy-saving, successful renovation could serve as leading by example.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	570 513	-	129 003 573	
	SFH	529 492	-	69 540 001	
	MFH	41 021	-	59 463 572	
Non resident	TOTAL	92 534	-	73 303 172	
	PUBLIC	6 554	-	11 454 891	Schools, hospitals
	OFFICES	10 377	-	10 096 910	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**5**

Chapter 2 of the Lithuanian strategy includes a comprehensive methodology to identify the most **cost-effective renovation approach**.

Energy efficiency measures and renewable energy measures grouped into 33 renovation packages to achieve energy classes from C to A++ (NZEB level) are analysed. Considering the type of building, period of construction and the energy classes, 816 different combinations resulted.

The following steps are reported:

- Calculation of key indicators for each combination (investment costs, projected energy-savings, economic benefits, the expected financial and economic return);
- The saving of 1 kWh in terms of financial and economic returns are calculated for each simulated combination;
- All combinations are ranked in terms of return (€/kWh) with the highest grade assigned to the packages of renovation with maximum economic benefit;
- Setting the primary energy-saving target at the building stock level in GWh or %;
- A list of combinations that satisfies the primary energy target is selected;
- Changing the energy-saving target, renovation investments and energy-saving curve is obtained.

It is concluded that even a conservative estimation of economic benefits outweighs the investment costs. The maximum economic return at the building stock level is between 45% and 55% (16 - 20 GWh/year) of energy-savings. This corresponds to renovation to class B with RES measures or a smaller part to class B and A. The most cost-effective renovation packages are identified.

The following **trigger points** are identified:

- Single-family house: change of ownership;
- Apartment buildings: district renovation is seen as a key measure to initiate and accelerate the energy renovation;
- Industrial buildings: generally, owners invest in the modernisation of the buildings to reduce maintenance costs. EPCs are required when renting or selling industrial buildings;
- Other non-residential buildings: many of them are commercial buildings, rented. When renewing a rental contract, the owners are required to provide the EPC and to modernise the technical systems, and introduce renewable energy.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4.5**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

A list of policies and actions put in place in the Lithuanian NECP to promote deep renovation are presented in the LTRS. Among these, upgrading to energy class C over 5 000 apartments and about 960 000 m^2 of public buildings by 2030 is expected to bring energy-savings of 1.9 TWh and 0.19 TWh, respectively. Moreover, energy suppliers have to ensure consumers' education and advice and energy companies will save energy according to energy-savings agreements. The introduction of a **building passport** system is mentioned under the action concerning the inventory of the building stock and database creation. No other details are offered. In the strategy, the **worst energy performing buildings** are identified as building in energy class D or lower. In Lithuania, they account for 66% of the total building stock. The associated primary energy consumption is 31 591 GWh/year, representing 77% of the total primary energy consumption of the building stock. Currently, these buildings represent a priority in the renovation programmes. In 2013 municipalities were asked to identity worst-performing buildings, and buildings with thermal energy consumption over 150 kWh/m^2/y were identified and prioritised in the Programme for the renovation (modernisation) of multi-apartment buildings.

The following **split incentives dilemma** is identified: user incentive dilemma (owner-tenant dilemma, fix rent including utilities), the dilemma of efficiency (owner-tenant dilemma, the tenant pays for the actual utilities), the dilemma of incentives between different owners/users incentives (the buildings is used by more than one owner/tenant) and temporary incentives dilemmas (when the owner/tenant does not know long it will use the buildings). In Lithuania, 89.9% of the building's users are also owners; therefore, owner-tenant dilemmas are of little importance. Multiple owners/tenants related dilemma is considered relevant and it is addressed through several actions: a renovation decision can be taken with only 50% plus one vote, disadvantaged people are supported 100% by the state in the renovation process and information campaigns on energy renovation are carried out for all buildings' owners.

The Lithuanian strategy identifies and addresses the following **market failures**:

- Lack of information on the benefits of energy renovation: education and advisory activities are currently taking place and planned beyond 2020;

- Low renovation rate due to unfavourable economic cycle: renovation projects included in the plan to boost the economy after Covid-19;

- Lack of attractive financial instruments: loans for the installation of solar power stations, loans for small renovation projects, funds for the renovation of multi-apartment buildings, preferential loans for the renovation of public buildings;

- Insufficient data on the building stock;

- Insufficient use of smart technologies;

The strategy addresses **energy poverty**. An overview of factors and indicators on energy poverty is presented and the situation in Lithuania over the past 10 year is analysed. The measure and actions put in place to address energy poverty in Lithuania are divided as follows: (i) general measures to increase revenues, (ii) general measures to increase energy efficiency

and (iii) targeted measures: socio-economic measures such as heating aids, measures targeting a particular housing (multi-apartment buildings) and energy type and measures targeting specific areas/regions.

A list of measures and actions to promote energy efficiency in **public buildings** is presented: energy renovation of public buildings, agreements with energy suppliers to educate and advise the consumers and energy-saving agreements for energy companies. More than 8.6 TWh energy-savings are expected by 2030.

Lithuania has several national policies to promote **smart technologies** and connected communities as well as **skills and education** in the construction and energy efficiency sector.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**5**

Environmental, economic and social benefits split into monetised and non-monetised are discussed in the Lithuanian LTRS. The total value of the monetised benefits is estimated at around € 75.4 billion over 2021 and 2050. The value disaggregated per energy-savings, CO_2 emissions reduction, increase in the GDP, improving people health and work capacity, increasing the value of buildings, reducing the pollution and benefits for vulnerable residents is presented in a table below. The investment of each € 1 million is expected to create between 19 and 37 jobs per year. The investment of each € 1 is estimated to increase the country's GDP by € 0.5. To estimate the health benefits, for each invested € 1 a benefit of € 0.325 was considered.

Currently, in Lithuania, the vulnerable people are receiving heating and DHW aid by being reimbursed the heating costs that exceed 10% of the difference between the family income and the state-supported income. It is expected that by 2050, the need for heating aid will decrease by 80%, thus saving an average of € 0.58 million per year.

The LTRS addressed the following non-monetised benefits: increasing the energy independence, lowering the investments in the production capacity of energy, increasing the life of the buildings, reducing fossil fuel and RES subsidies and redirecting the funds to clean technologies and finally, the growth of other sector and new business in the construction and energy sectors.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4.5**

By 2050, it is planned to renovate 74% of the building stock, to reduce the primary energy consumption by 60%, to reduce the primary energy consumption from fossil fuels by 100% and to reduce the CO_2 emissions by 100%. Indicative milestones are offered for 2030, 2040 and 2050 (having 2020 as starting year) in terms of energy-savings with and without renewable energy, CO_2 savings, units and floor area of worst-performing buildings and renovated buildings. The indicators are disaggregated per building type: single-family houses, apartment buildings, industrial buildings and other non-residential. No prediction on NZEBs is provided.

2030	• Decarbonisation: by 2030 24% • Renovation of buildings stock: By 2030 17%
2040	• Decarbonisation: by 2040 60% • Renovation of buildings stock: by 2040 43%
2050	• Decarbonisation: by 2050 100% • Renovation of buildings stock: by 2050 74% • 100% reduction of annual primary energy consumption from fossil fuels by 2050

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	
3b	**Reduction of the perceived risk for investors**	P	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	**3.5**
3d	**Guiding investments into an energy-efficient public building stock**	P	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

Aggregation of projects is addressed as one of the actions to support the implementation of the renovation strategy by attracting construction companies and major financial institutions and stimulating research in innovative technologies.

More active involvement of the municipalities and closer to the consumer in the renovation process is foreseen by collecting data on the building stock at a municipal level, drawing up municipal LTRS as well as proposing a financial model.Due to low energy prices and long payback periods, it is expected that the renovation strategy will require incentives from public funds. Accordingly, attractive financing solutions must be developed. Although the current financing model of the renovation of multi-apartment buildings in Lithuania is recognised as good practice in the EU, additional mechanisms based on private sector involvement such as ESCO models should be considered. Currently, the ESCO market in Lithuania is one of the least developed among MSs. There are no clear common criteria to which companies can be classified as ESCOs, and there is no list of such companies. Moreover, the legal framework is incomplete. The **one-stop-shops** will be implemented as entities under the coordination of municipalities and will have to provide methodological and advisory support to citizens. In addition, the establishment of a competence centre is planned, and it will be responsible for the development of standardized documents and procedures, development of rules and technical requirements, aid of municipalities and consultation.

Additional information

Summary results of the public consultation	Y	3
The Lithuanian LTRS was under public consultation through meetings (October – November 2020) and online through the E-citizen portal. A table that summarises the comments and suggestions received is included in the strategy.		

Implementation details of latest LTRS	N	0
n/a		

Fire safety and intense seismic activity risks (optional)	N
n/a	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

LT submitted a comprehensive and ambitious 2020 LTRS, addressing almost all of the EPBD requirements. It presents a good overview of the existing building stock with a high level of detail using existing data in the Lithuanian Register of Immovable Property by the end of 2019. Based on the issued EPCs, the energy performance of the existing buildings is presented. Worst-performing buildings are identified as buildings in energy class D or below and they represent 66% of the total building stock. Public buildings represent 2% of the total building stock, and a list of measures to promote their energy efficiency is included. The identification of the most cost-effective renovation approach is complex and includes: renovation measures and packages, energy class targets, investment costs, estimated energy and CO_2 savings, projected energy and CO_2 costs, expected financial and economic benefits, technical barriers and the time of initiation. The data is disaggregated per building type. The simulation identifies the maximum economic benefit for renovation to energy class B with RES measures and A. For higher energy classes (A+, A++ or NZEB), the technical constraints are challenging. The strategy addresses split incentive dilemmas in a complex and clear approach, identifies market failures, and proposes several measures to overcome them. The energy poverty situation in Lithuania over the last 10 years is presented, and measures put in place to address energy poverty are mentioned. Existing (ongoing) measures on public buildings and worst-performing buildings are included and several national initiatives to promote smart technologies and smart building management are discussed.

The objective of the Lithuanian LTRS is to fully decarbonise the building stock by 2050 by achieving the following targets: to renovate 74% of the building stock, to reduce the annual primary energy consumption by 60%, to reduce the annual primary energy consumption from fossil fuels by 100% from and to reduce the CO_2 emissions by 100%. Indicative milestones are provided per building type. Achieving the targets will require € 60 billion up to 2050 but the benefits are estimated at around € 75.3 billion over the same period. The financing mechanism is mentioned, but indicative budgetary support is not clearly provided. A list of 21 actions developed under 5 measures - integrated planning and monitoring, cross-compliance of measures, adequate funding, effective communication and a robust implementation framework - to support the implementation of the renovation strategy are presented.

Level of details/ Appropriateness/ Comprehensiveness

The level of details is high; the document is comprehensive and appropriate for its scope.

Good practices

Regulatory measures:

When a building is sold or leased must have a valid EPC.

Starting with 1 January 2019, new public buildings must be energy class A++ (NZEBs).

Starting with 1 January 2021, all new buildings must be energy class A++ (NZEBs).

Pollution tax for buildings consuming more than a certain limit of energy (e.g., more than 150 kWh/m^2/ y) or CO_2 emission.

Tools and mechanisms to support the mobilisation of finance:

Implemented financial mechanisms to support the renovation of buildings are presented:

- Loans for the installation of solar power stations/parks managed by Public Investment Development Agency (VIPA) of Lithuania;
- Loans for small renovation projects through Energy Efficiency Financing Platform (heating system modernisation, changing the windows etc.);
- Preferential loans for the renovation of public buildings (heating and lighting systems) through European Regional Development Fund;
- Lending funds for the renovation of multi-apartment buildings through two programmes: one managed by VIPA and Jessica II Fund managed by the European Investment Bank;

New actions to support the implementation of the LTRS are planned:

- Financial incentives depending on the energy efficiency level;
- Reduction of energy costs subsidies to decrease the renovation payback and make the renovation more attractive to owners;
- Introduction of a pollution tax for buildings consuming more than a certain limit of energy (e.g., more than 150 kWh/m^2/ y) or CO_2 emissions;
- ESCO model should become more economically viable after reducing the payback period of the renovation investment;
- The aggregation of projects should allow exploiting economies of scale, reducing both the need for public funds and private investments.

Public sector:

About 960 000 m^2 of public buildings will be renovated to at least energy class C by 2030 (0.19 TWh).

Renovation rates of buildings for non-residential buildings of public ownerships are projected up to 2050.

Communication to raise awareness on the benefits of renovation for public building managers.

Tackling worst-performing buildings and energy poverty:

The current renovation programme of the multi-apartment buildings (which started in 2005) prioritises the renovation of buildings that consume more than 150 kWh/m^2/yr built before 1993. In order to ensure a successful implementation, programme administrators are appointed.

To carry out the renovation, an agreement of 50% plus one vote of the owners is sufficient.

Vulnerable people entitled to heating aid receive 100% support in the renovation process.

Communication to raise awareness on the benefits of renovation for all type of owners.

Other measures:

Introducing an additional tax if the building consumes more than a certain limit of kWh/m^2 and/or CO_2 emissions is called a pollution tax. The vulnerable population should be supported through financial allowances. The taxes could be collected by the building's owners and used to renovate the building. Information on the expected pollution tax should be made publicly available.

Currently, in Lithuania, the energy price is low and is directly and indirectly subsidised by various mechanisms. **Reducing the energy subsidies** to make to shorten the payback period of the renovation would make the renovation more attractive to owners. Specific attention is to be paid to people at risk of energy poverty as this measure could increase energy poverty.

Agreements with energy suppliers to consumer education and advice between 2021 and 2030.

Agreements with energy companies to achieve energy-savings of 1 TWh between 2014 and 2019 and. Three companies signed the agreement, and two achieved their targets. The target for 2021 and 2030 is 5.5 TWh.

Strengths and Innovative approaches

Detailed building stock overview and comprehensive assessment of the cost-effectiveness approach of renovation;

Ambitious and clear targets;

New measures to trigger energy renovation and to make it more attractive to owners (pollution tax, full energy costs);

Recommendations

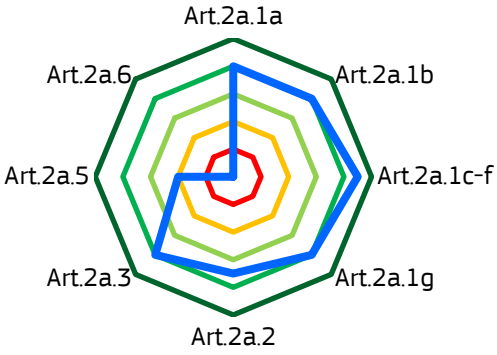
More details on the following aspects could be provided:

- Information on budgetary resources to support the implementation of the renovation strategy;
- The period of implementation of the planned measures to support the implementation of the renovation strategy.

LUXEMBOURG

1. EPBD Art.2a COMPLIANCE

Introduction: The LTRS was submitted as a separate document after the NECP. It complements the NECP as the information on Art. 2a EPBD was largely missing in it. The LTRS goes beyond the minimum requirements under the EPBD as it largely sums up comprehensive efforts and projects undertaken at the federal state, and local levels. The assessment relates to the German-language version of the LTRS.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	4

- The **overview of the national building stock** is given based on statistical data retrieved for a census in 2011 and updated for special sectors in 2017. A further update is expected, with a new census planned for 2021.
- **Buildings data** is presented in **age bands** but not in terms of energy classes for the residential sector. Less solid data is available for the tertiary and public sectors.
- A **share of renovated buildings in 2020** is estimated to be in the **range of 10-14%** in the LTRS. The underlying assumptions and estimates for this are clearly laid out in the LTRS.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	207 959	26 000 000	2011 Data (last STATEC Census), number of "residential units" (dwellings); Floor area estimated at 30 000 000 m^2 in 2015 and 34 000 000 m^2 in 2020
	SFH	-	114 000	-	
	MFH	-	88 000	-	
Non resident	TOTAL	-	-	12 500 000	Semi-residential category included; estimates for stock built before 1985 (3.4 to 6.3 million m^2) and stock built after 2018 (500 000 m^2); stock built between 1985-2017 is 7 130 000 m^2. LU defines "public buildings" as central government buildings (710 buildings: 3 000 000 m^2) and public buildings managed by municipalities. They include public administration offices, schools, hospitals, and public sports venues, among others.
	PUBLIC	2 431	-	4 800 000	
	OFFICES	-	-	4 060 000	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	4

- Cost-effectiveness approaches have been identified based on scenario analysis for the residential and non-residential sector in a dedicated consultancy study (KostOpti 2019). The results have been used to draw conclusions on stepping up support (PrimHouse) for residential buildings and as the basis for further tightening standards for non-residential buildings.
- Trigger points for renovation are not presented.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4.5**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

- Regarding **policies and actions (Art.2a.1c)**, a comprehensive barrier analysis has been undertaken, and a comprehensive set of measures put forward to overcome these barriers.
- The **segment of worst-performing buildings** of the national building stock is clearly identified as the following four market segments: 1. Conditionally rehabilitable buildings (nominal or ensemble protection); 2. Buildings without monument or ensemble protection with the highest average energy consumption; 3. Underused buildings; 4. Social housing.
- Several measures to address this segment are presented. Clear differentiation is made between residential and non-residential buildings.
- The **split-incentive dilemma** is addressed. The LTRS identifies a good practice to address this issue used in Austria (Erneuerungs- und Verbesserungsbeitrag - EVB), which is planned to be implemented in LU as well: In Austria's non-profit housing construction, the EVB is a third component of the rent, in addition to cold rent and operating costs. Tenants pay a monthly contribution which is used to build up reserves for renovations. The maximum amount of the contribution increases with the age of the building. The payment of the EVB as a special-purpose renovation reserve means that the renovation costs are saved in the long term and are not "randomly" passed on to the tenants who live in the building at the time of the major renovation.
- Market failures are addressed and have been investigated in by a dedicated study (Ploss 2020). As a mitigating measure, the app "myrenovation" is to be further developed to close information gaps about funding and financing schemes.
- **Energy poverty** is clearly defined and assessed for Luxembourg. A set of indicators was developed by a consultancy study (LISER, 2020) to detect energy poverty in a systematic manner in the framework of overall poverty detection. The LU statistical office Statec is presently developing two indicators to monitor energy poverty:
  1. Energieaufwandsrate (Taux d'Effort Energétique (TEE)) ;
  2. Niedrige Einkommen und hohe Ausgaben (Bas Revenus et Dépenses Elevées (BRDE).
- **Public buildings (Art. 2a 1e)** are clearly addressed, and policy measures to increase energy efficiency in the public sector are presented.
- National initiatives to promote smart technologies are presented. They are largely integrated into the overall energy market regulation. Smart meter roll-out is expected to be completed by the end of 2020.
- **Skills and education issues** are addressed, and initiatives to enhance these are presented in training and education programmes. The LTRS advances the measures "Further training on energy and economic optimisation of renovations in non-residential buildings" (W1-N) and "Further training to reduce the need for cooling energy in the future climate" (W2-N) to complement existing programmes.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**4**

- **Building energy-savings are comprehensively presented in various scenarios** that have been developed in a dedicated study (bottom-up by Energieinstitut Vorarlberg (Ploss 2017) and top-down by Fraunhofer IREES, the latter in the NECP framework.
- **Wider benefits** (jobs, GHG reductions, health benefits by avoiding mildew, indoor air quality) are identified and compared with MS with similar "building traditions" as LU (DE, AT, CH).
- The analyses **differentiate between residential and non-residential buildings.**

2	**Roadmap including measurable progress indicators and indicative milestones**	P	**3.5**

- **Indicative milestones** are presented for **2020, 2030 and 2040**, and 2050 are clearly presented. The milestones **only relate to residential buildings**. Non-residential buildings are mentioned but are not included due to missing data (p. 163). The milestones are underpinned by secondary indicators such as renovation rate, heat energy consumption, average U-values) which allows for more detailed tracking of progress. These sub-indicators are to be further developed.
- A **contribution towards the EU's EE target is not presented**.

2030	• 4611 GWh/a end energy consumption (residential buildings)
2040	• 3551 GWh/a end energy consumption (residential buildings)
2050	• 2715 GWh/a end energy consumption (residential buildings)

	• 58% reduction of final energy demand by 2050 vs 2020. • Renovation rate of the building stock at 3% per year, corresponding to approximately 4 500 housing units per year. • Boiler exchange rate: approx. 5% p.a.

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	N	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

- **Art.2a.3a and b**: LU is working on a **dedicated de-risking instrument (investment platform with the aim of project bundling to allow projects to become attractive for EPC)**. In autumn 2019, a project to develop tools and methodologies for a future de-risking platform was launched by the Ministry of Energy, in cooperation with the EIB (European Investment Bank) and myenergy. This project will continue in 2020, in close cooperation with the Ministry of Economy and the Ministry of Finance, involving banks and relevant market actors.
- **Art.2a.3c**: The **national funding programme PrimeHouse** is presently and updated to include deep renovation support starting in 2021. The de-risking instrument is to support renovations by project bundling.
- **Art.2a.3d**: Not addressed.
- **Art. 2a 3a**: Myenergy is the national structure for promoting a sustainable energy transition, whose role is, inter alia, to provide information and support and accompany the efficient use of energy. Myenergy is acting as the LU one-stop-shop for building renovations.

Additional information

Summary results of the public consultation	P	2
A public hearing was foreseen (half-day workshop) but had to be postponed to 2021 due to Covid-19. The LTRS mentions several earlier consultations on long-term building renovation in 2019 and 2017.		

Implementation details of latest LTRS	N	0

Fire safety and intense seismic activity risks (optional)	N
The LTRS contains a section 7 “Fire safety and risks related to seismic activity”, but states that at present these topics are not relevant for LU and are not therefore covered in the document	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Luxembourg is presenting a comprehensive set of measures to address building renovation. The measures included in the LTRS present a mix of regulatory requirements, fiscal and economic incentives and informatory measures. The measures have been considerably stepped up in comparison to the NEEAP and the LTRS 2017. The measures are tailored to dedicated needs such as barriers against deep renovation, energy poverty etc. The LTRS makes good comprehensive use of underlying research studies, which makes its findings very solid. Concepts and analyses from neighbouring countries with "similar building styles" (namely DE, AT, CH) have been screened for comparative data and measures. The Austrian measure of "Erneuerungs- und Verbesserungsbeitrag" (cost-sharing for renovations between landlord and tenant) is considered for uptake in LU. The overall milestones are clearly set, but relate to residential buildings only. As updated housing stock data will be available in 2021, this will allow further fine-tuning of the existing instruments.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS comprehensively presents the national strategy for building renovation at an appropriate level. In the case of the use of investments and the display of energy-savings triggered per measure, this could have been further elaborated. The presentation is very clear and detailed regarding the individual sections. Many promising measures have been taken up, but they are still in the early planning stage and will probably having an impact only after-2030.

Good practices

Regulatory measures:
The LTRS foresees the further stepping up of the already overall stringent building codes. The role of Energy Performance Certificates is, however, not addressed in a broad manner. Mandatory renovation works for allowing future letting are presented as an "idea".

According to the LTRS, Luxembourg is the first country in the EU to introduce the 'near-zero energy building' (NZEB) standard for residential buildings as of 1 January 2017. The early introduction of this far-reaching standard has allowed Luxembourg to reduce CO_2 emissions in the residential sector despite the growth of the population. This policy will be complemented by a new regulation in summer 2020, which will gradually require climate neutrality for both residential and non-residential new buildings by 2023. A presentation of the NZEB standard is not provided in the LTRS.

Tools and mechanisms to support the mobilisation of finance:

- The **PrimeHouse** support scheme is an existing scheme that is to be upgraded to allow for deep renovations.
- **Adopted VAT** rates are planned to support building renovation.
- The planned **de-risking instrument,** the investment bundling platform, seems a promising instrument (platform intended to bundle several projects so as to make them attractive for EPCs).
- The planned **EEO scheme** will also apply to savings through renovations, but too little details are given to judge the ambition/relevance of this.

Public sector:
Several PaMs address renovation activities in the public sector and form a comprehensive package. The planned concept of "**ultra-efficient public buildings**" and the **school renovation package** (2019 stock-taking with pupils on options for renovations which will be followed up by implementation) stand out as promising measures

Tackling worst-performing buildings and energy poverty:

- The segment of **worst-performing buildings** of the national building stock is clearly identified, and several measures to address this segment (subsidy schemes) are presented.
- Energy poverty is clearly defined and assessed for Luxembourg. A set of indicators was developed by a consultancy study LISER, 2020) to detect energy poverty in a systematic manner in the framework of overall poverty detection. The LU statistical office Statec is presently **developing two indicators to monitor energy poverty**: 1) Energieaufwandsrate (Taux d'Effort Energétique - TEE); 2) Niedrige Einkommen und hohe Ausgaben (Bas Revenus et Dépenses Elevées (BRDE).

Other measures:
n/a

Strengths and Innovative approaches

- A **very structured and clear** presentation following the provisions of the EPBD.
- **Measures are clearly identified**, sorted (residential/non-residential) and attributed to solving dedicated needs in terms of renovation (energy poverty, deep renovations)
- Overall the **presentations in sections 1-5** (see above) are **exemplary**. They are very clear and to the point.
- The LTRS builds on a **considerable number of underlying research studies**, which makes the findings very solid.
- The **discussion of energy poverty** is very comprehensive and a clear **good practice** in comparison to other LTRSs.
- The measures are considerably stepped up in comparison to the NEEAP and the 2017 LTRS. Many innovative measures are presented; however, many are labelled as "ideas" only.

Recommendations

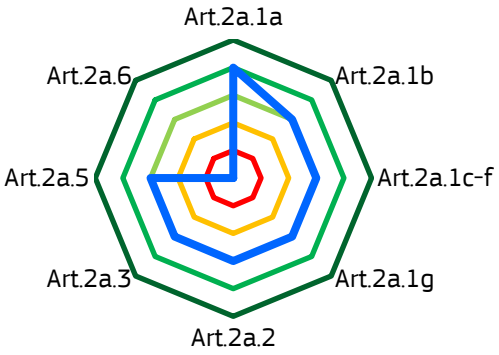
More details on the following aspects could be provided:

- The expected savings per measure.
- The milestones for non-residential buildings.
- The use of Building Certificates**.**

MALTA

1. EPBD Art.2a COMPLIANCE

Introduction: The Maltese LTRS was provided as a separate stand-alone document in June 2021, months later than the NECP. The main sources used to compile the strategy are the data on planning permits from the Planning Authority (PA), the electricity consumption data provided by Enemalta, the Maltese standards and regulations published in the Technical Document F and near Zero Energy Buildings (NZEB) plans, the data published in the eight cost-optimality reports (published by the BRO) and the 2015 report Analysis for a Cost-Effective and Efficient Heating & Cooling published by the Ministry for Energy and health. Official government forecasts and data produced for the National Energy and Climate Plan (NECP) (published in 2019) were also used to develop the analysis supporting the assessment of costs and impacts.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	4

The strategy provides a detailed overview of the national building stock, both for the residential and non-residential sector, based on data from the previous LTRS (2017), 2011 census and National Statistics Office (NSO) updates (e.g., 2018, 2020), EPC database (covering 20-25% of the existing buildings). Data from 2018 show that the number of dwellings has increased by 23% since 2011.

The report gives a clear picture of the particular attributes of the Maltese buildings, including the distribution by building types (single-family, terraced house, multifamily/apartment buildings etc.), age band, ownership structure (about 76% of the occupied residential dwellings are owned by the household living in them), dwelling size and energy use. A clear overview of the non-residential building stock including analyses of the different building categories: hotels, offices, educational buildings, hospitals, retirement houses and sport facilities. An estimate of the energy performance and consumption of the building stock per building type, extrapolated from the EPC database, is also provided.

Maltese buildings, on average, use less energy than other EU countries. While Maltese buildings are not particularly well insulated, the climate and the habits of the local population are the main driving factors behind the low energy use.

As regards the renovation rate, also due to the long payback of the renovation investments, it is quite low: about 0.5% in 2020 (estimated to increase to 0.7% in 2025).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	180 744	19 621 376	Only occupied dwellings (2011 Census data)
	SFH	-	63 706	10 447 784	Only occupied dwellings (2011 Census data); Floor areas calculated using average dwelling size from EPC database
	MFH	-	89 064	9 173 592	Only occupied dwellings (2011 Census data); Floor areas calculated using average dwelling size from EPC database
Non resident	TOTAL	-	-	-	
	PUBLIC	84	-	161 280	
	OFFICES	-	-	-	

Clause	Requirement	Score (1-5)	
1b	**Cost-effective approaches to renovations and trigger points identification**	Y	3

The results of an analysis of cost-optimal energy efficiency refurbishments published in 2019, based on a sample set of buildings for each category (ranges represent the extreme values of the buildings analysed), are presented. It shows that, often, the estimated primary energy needs for buildings included in the EPC dataset are lower than the energy efficiency estimated after a cost-optimal refurbishment.

A comprehensive list of retrofit cost-effective measures to reduce the energy consumption of the Maltese building stock are reported and discussed in a dedicated strategy chapter (e.g. roof and wall insulation, the chance of windows, shading, green

roofs, heat pumps and use of renewable energy sources.

Maltese households rarely undertake extensive interventions in their dwellings, thereby limiting the opportunities of energy efficiency improvements. Modern heat pumps are generally a very efficient way to provide heating and cooling (at low temperatures) in Malta climate. If coupled with renewable electricity, they can provide thermal comfort at a low carbon intensity.

Trigger points are discussed in a specific section of the strategy. The following have been identified: rental decision, building change of use, maintenance work, the introduction of renovation obligations or the introduction of minimum energy performance criteria for the buildings in order to be rented or sold.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	P	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

In order to achieve the building renovation national energy targets and comply with European legislation, Malta follows a two-fold approach which is composed of enforcing minimum standards through legal obligations and providing financial incentives to new buildings going above minimum requirements and to existing buildings to improve their energy performance. These means are complemented by voluntary agreements, Energy Efficiency Obligation (EEO), education and information campaigns and training. The financial incentive schemes (e.g., grant schemes to cover 40-50% of the costs for double glazing, roof insulation, PV, solar water heater and Heat Pumps and tax credits) have contributed the largest part to energy-savings in Malta (74% of cumulative end use energy-savings in the period 2014 to 2020) which confirms their effectiveness. There is no financial scheme or incentive in place for the public sector buildings. However, relevant ministries and public bodies have committed additional funds when full refurbishments programmes have been implemented, for example, in schools and hospitals. Specific grant to finance the sustainable renovation of historical privately owned buildings are also in place; the government is active by mandating ministries to follow energy-efficiency purchases guidelines, carrying out audits of the majority of the buildings it uses, and by carrying out a substantial number of energy-efficient renovations.

The implications of staged deep renovation versus one-step renovations are discussed (e.g. lock-in dilemma, cost spread over the years, etc.). Both approaches are deemed valid and to be adapted case by case. Even though ownership of residential dwellings is very common in Malta (around 76% of occupied residential dwellings are owned by households), the number of rented units – especially in other buildings categories such as offices, retail outlets, restaurants – is increased and this can pose a challenge to renovation due to split incentives. This issue is discussed in detail in the strategy, together with the possible measures to address it.

Although the Maltese climate is mild and low winter temperatures are rare, energy poverty issues are still present (affecting about 6.6% of the Maltese population. Reducing general poverty is part of Malta's National Strategic Policy for Poverty Reduction and for Social Inclusion 2014-2024, which acknowledges the multidimensional forms of poverty, but some specific measures addressing energy poverty are in place. National initiatives to promote smart technologies (e.g., smart meters installation, SmartCity Malta project etc.) and skills and education (e.g. the Building Industry Consultative Council training and Skills Building initiative) in the construction sector are also described.

No information on the implementation of building passports is provided.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

The total expected energy-savings from dwellings and non-dwellings (cumulatively) have been calculated with a model (described in the "strategy impact assessment document", not provided), and it is expected to amount to over 60 500 GWh of primary energy up to 2050. These, combined with an increasing share of renewables in the generation mix, are equivalent to a reduction of 4.4 $MtCO_2$ by 2050. For the residential sector, the energy consumption will be reduced by 40% compared to the baseline in 2050 and by 45% for the non-residential sector.

Further benefits associated with the savings and with the actions promoted by the strategy have been identified:

- Savings on the energy bill (and positive impact on energy poverty). Household bills will be less burdensome for vulnerable families and reduce health consequences associated with underheated or undercooled dwellings;
- Substantial savings associated with ETS carbon permits (lower energy demand will reduce fossil fuel generation), which will further lower the energy bill;
- Creation of new jobs: between 1 200 and 4 300 jobs per year created in the construction and energy services sectors;
- Increase in skills and innovation in the construction and energy services sectors;
- Increased quality and comfort in dwellings and in the working environment may lead to health and wellbeing impacts such as reduced illness;
- Reduced amount of land and sea space dedicated to renewable generation;
- Reduced harmful emissions from fossil fuel electricity generation and domestic gas-powered appliances leading to environmental benefits and improved air quality (and related health benefits);

— Improved national energy security and reduced operational and capital cost for the electricity grid. Growing shares of renewables pose particular challenges to island nations, as the import/export of electricity with neighbouring countries is limited by interconnectors' capacity. A lower overall electricity demand will help manage peak periods more easily and reduce the need for additional backup capacity."

2	Roadmap including measurable progress indicators and indicative milestones	Y	3

Measurable progress indicators to assess progress towards ensuring a highly energy-efficient and decarbonised national building stock, and indicative milestones for 2030, 2040 and 2050 are indicated in the strategy.

The LTRS implementation will be monitored by calculating, at regular intervals (e.g. 2 years), the following indicators: building sector energy use and CO_2 emissions reduction and the number of NZEBs.

The indicative targets foresee an average energy consumption reduction in the residential sector by 18% in 2030, 20% in 2040 and 25% in 2050 (compared to the 2018). Building sector CO_2 emission will be reduced by 38%, 61% and 75%, respectively.

2030	• average residential energy consumption: 22 kWh/m^2/y (-18% from 2018) • Decarbonisation: by 2030 Residential: -39%, Non-residential:-38% • Renovation rate: Residential: up to 5%-6% from 2025 onwards, non-residential 1.1% by 2030, public buildings: 5.4 renovation rate up to 2030.
2040	• average residential energy consumption: 21 kWh/m^2/y (-20% from 2018) • Decarbonisation: by 2040 Residential: -60%, Non-residential:-62%
2050	• average residential energy consumption: 20 kWh/m^2/y (-25% from 2018) • Decarbonisation: by 2050: Residential: -74%, Non-residential: -77%, 4.5 MtCO_2 • Renovation rate: Residential: to 2.5% by 2050 • Energy savings 25% by 2050 (60 000 GWh primary savings).

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	The aggregation of projects, and packaged solutions	N	3
3b	Reduction of the perceived risk for investors	N	
3c	Use of public funds to leverage private-sector investment or address specific market failures	Y	
3d	Guiding investments into an energy-efficient public building stock	Y	
3e	Accessible and transparent advisory tools (e.g., one-stop-shops)	Y	

Measures for the mobilisation of investment are described in strategy, including financial incentive schemes (e.g. grants to cover 40-50% share of the renovation investment costs, tax credits, green/eco loans) to leverage additional private-sector investment. Specific instruments for the aggregation and reduction of the perceived investment risk are not described and reported in the document. Although the implementation of one-stop-shops is not cited, energy advisory service schemes, aiming to reinforce energy consumers' own ability to make decisions and help to choose the most effective investments, are foreseen in the strategy.

Additional information

Summary results of the public consultation	Y	3

The strategy went on public consultation in May 2021. The results of the open consultation are presented in an Annex (Annex 1).

Implementation details of latest LTRS	N	0

No information on the implementation of the 2017 LTRS is provided.

Fire safety and intense seismic activity risks (optional)	N

No information reported on fire safety and risks related to intense seismic activity.

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Maltese building renovation strategy covers with a good level of detail most of the EPBD Art.2a elements. The strategy presents a detailed overview of the existing residential and non-residential buildings, that on average, although not particularly well insulated, have a low energy consumption due to the mild climate.

The strategy also provides an overview of the existing policies and measures for renovation, identifying the main barriers. Malta follows a two-fold approach, which is composed of enforcing minimum standards through legal obligations and providing financial incentives to new buildings going above minimum requirements and to existing buildings to improve their energy performance. Although the mild climate, energy-poverty is still present in Malta, and a set of dedicated measures to tackle it are in place.

Wider benefits and measurable progress indicators to assess progress towards ensuring a highly energy-efficient and decarbonised national building stock, and indicative milestones for 2030, 2040 and 2050 are indicated in the strategy; the residential/non-residential sectors 40/45% energy 2050 consumption reduction targets are deemed adequate, considering the current low energy consumptions.

Level of details/ Appropriateness/ Comprehensiveness

The overall level of details is good. In particular, the building stock is described with a very good level of detail, both for the residential and non-residential sectors. The measure package is deemed appropriate and comprehensive.

Good practices

Regulatory measures:

Introduction of MEPS: Minimum standards concerning overall energy use will be introduced to existing buildings that are rented (landlords will have to reach a minimum efficiency level before being allowed to rent out the building). Other minimum standards will also apply to existing buildings, at such time when an owner decides to replace appliances or elements of the building fabric. For example, minimum standards concerning the thermal rating of windows, HVAC systems or water heaters will be progressively introduced. The aim is to avoid the installation of the most inefficient fixtures and equipment available on the market.

Tools and mechanisms to support the mobilisation of finance:

The ERDF, launched in 2007 and lasted until 2013 before it got relaunched due to its successful uptake for the period of 2016-2020, was developed to financially support businesses in their investments into energy-saving measures as well as to utilise alternative energy sources. This scheme is based on competitive calls that interested businesses have to apply for. Based on those, the applications are ranked; the highest-ranked qualify for the grant. Once allowed for this grant scheme, businesses are offered a minimum grant value of € 12 500, provided the total project value lays between € 25 000-200 000.

The most common measures financed from this scheme were PV systems and power factor corrections, rooftop insulations and solar water heaters.

Green loans: Over the last 10 years, commercial banks, like HBSC, Bank of Valletta and APS Bank, offer green loans or 'eco loans' with the aim of providing financial assistance in relation to purchases having a positive impact on the environment. Such loans may be used to assist in the capital investment of purchases of renewable energy systems, energy-efficient equipment, interventions to the buildings envelope and green mobility, depending on the particular product offered and subject to approval by the bank.

Public sector:

The main initiative for the public sector is underpinned by the leading by example strategy: the government is active by mandating ministries to follow energy-efficiency purchases guidelines, carrying out audits of the majority of the buildings it uses, and by carrying out a substantial number of energy-efficient renovations;

- The Building and Construction Authority will launch a review of the public building stock, aimed at evaluating its energy-saving potential and a list of priority actions, including whether projects could be grouped, staged or outsourced (via energy performance contracting) to save on the cost of renovation.
- Appointment of energy officers for public buildings and Implementation of energy management systems in public buildings (by 2025). Officers responsible for energy management shall be appointed in each public building by 2023.

Tackling worst-performing buildings and energy poverty:

The following measures have been specifically designed in Malta to address households vulnerable to energy poverty:

- The **energy benefit scheme** is the main and longest standing instrument to tackle energy poverty in Malta. It aims to decrease the energy cost burden of low-income and vulnerable households. Approximately € 4-5 million are budgeted by the Maltese government (Ministry of Social Policy). In 2017, 20 488 consumers received the energy benefit.
- The **Energy Incentives Advice Scheme** for Vulnerable Households was set up by EWA in 2018 aiming at reducing the energy and water consumption through the replacement of old and inefficient appliances, specifically targeting vulnerable households. This scheme is executed in collaboration with LEAP and funded with € 200 000 annually. Based on 470 home visits, EWA identified 277 households that needed a replacement of a fridge-freezer, washing machine and air

conditioning unit as these are considered high energy consumers.

— The **Eco-reduction scheme** under which households that consume either:

- Less than 2 000 kWh per year in a single household;
- Less than 1 750 kWh per person in a two or more-person household receive a direct rebate on 15-25% of their electricity bills.

This policy incentivises efficiency and lower consumption, while also having a positive effect on the bills of low-income households who fall within the consumption limit.

Other measures:
According to the Skills building initiative, by 2025, the government will develop a scheme to train and certify professionals and tradesmen of various levels in order to obtain a mandatory skill card which would need to be presented to work in the respective sectors. Certification will be extended to installers of several technologies, and a life-long-learning approach will be adopted through regular training sessions addressed to skill card holders.

Strengths and Innovative approaches

Good measure package, covering all the policy aspects.

Good monitoring plan, including measurable progress indicators (average delivered energy demand kWh/m^2/y per dwelling, CO_2 emissions, number on NZEB buildings), and indicative 2030, 2040 and 2050 milestones.

Recommendations

More details on the following aspects could be provided:

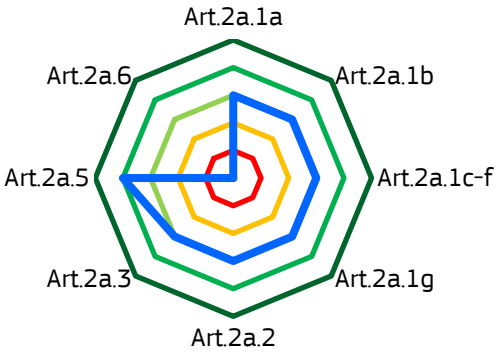
– Building passports and one-stop-shops.

– The growing demand for air conditioning and the related impact on energy consumption could be investigated in more detail.

THE NETHERLANDS

1. EPBD Art.2a COMPLIANCE

Introduction: The LTRS was submitted as a separate document from the NECP. Climate Agreement is the successor to the Energy Agreement and forms the basis of the long-term renovation strategy. The assessment was performed based on the English version of the document.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**3**

Tot number of buildings residential and non-residential are provided. Missing the total area and energy consumption, age bands for non-residential, energy class for the residential buildings, type of tenure. Only the expected number of dwellings are reported without including the expected share of renovated buildings in 2020.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	7 800 000	-	In 2019 there were just over 7.8 million homes in the Netherlands
	SFH	-	-	-	
	MFH	-	-	-	
Non resident	TOTAL	470 000	600 000 000	-	
	PUBLIC	12 000	12 000 000	-	
	OFFICES	-	90 000 000	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**3**

Some information related to the cost-effectiveness of building renovation measures are reported in the LTRS, (Cost Optimality Study, Cost indicators), but the identification of trigger points is missing. The main conclusions of a recent study on cost optimality by Arcadis (February 2018) are reported (5 to 9 packages of measures per type of residential unit and 10 to 16 packages of measures per use/function considered. For non-residential buildings, a minimum of 10 packages of measures were calculated per use/function and reference building).

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

- Deep renovations aiming to make the built environment gas-free are described, with no mentioning of building renovation passport but Energy labels are mandatory for new buildings or when a property is sold or rented.
- Many **fiscal support** and information support mechanisms exist at the district, regional and local levels to tackle the worst-performing segment of the national building stock.
- Some policies and actions to target the worst-performing segments of the building stock are included (i.e. mandatory requirement for offices to have a minimum "C" energy label by 2023. **Energy poverty is not an issue** in the Netherlands; however, it is addressed by protecting tenants from high energy costs and by supporting households with a

lower income.

- **Split incentive** dilemma is well addressed by NL several measures are in place to support landlords to recover some of their investments from the tenants and will be implemented by amending the Law on renting.
- To prevent market failures, the Dutch government involves all stakeholders intensively in the transformation of buildings by means of the **district-oriented approach** and well-organised participation.
- To tackle public buildings, NL is establishing sectors roadmaps and monitoring programmes, but no specific targets for **public buildings** renovations are reported.
- **Education and training** activities are included in the LTRS.
- The LTRS also reports the promotion of **Smart Technology** supporting measures such as Innovation Programmes, a Demonstration Energy Innovation Scheme (DEI), and obligations for large non-residential to have an extensive energy and building management system from 2026.

1g	Evidence-based estimate of expected energy-savings and wider benefits	Y	3

Energy-savings related to the period 2020-2030 have been identified in the document; gas consumption by households will decrease from 264 PJ to 234 PJ in 2030 also thanks to the gas-free programme and measures supported by the Government. Since 2013, electricity will be falling from 78 PJ in 2020 to 71 PJ in 2030, thanks to improved and more efficient appliances, the increased use of heat pumps and an increase in the installation of solar panels. In the service sector, gas consumption is expected to decrease from 117 PJ in 2020 to 82 PJ in 2030.

According to the National Institute for Public Health and the Environment (RIVM) the measures in the Climate Agreement can produce benefits for health, safety and nature, through the elimination of fossil sources. For health, the benefits come above all from the replacement of internal combustion engines (petrol, diesel, LPG and CNG) by electric motors. As a result, less NOx gases and particulates will be released into the atmosphere. The estimate is that these emissions may fall by 10% by 2030 relative to 2016. Moreover, noise pollution in built-up areas will decline.

2	Roadmap including measurable progress indicators and indicative milestones	Y	3

The LTRS is based on the CO_2 objectives set by the Climate Agreement; indicative milestones towards 2030-2040-2050 are based on CO_2 emission reduction and are established assuming a linear reduction in GHG emissions between the indicative milestones for 2030 and 2050. A Climate and Energy Outlook scenario based on Low, estimate, High forecasts is presented, showing the expected CO_2 emissions in 2030. An objective of the Climate Agreement is to gradually insulate 1.5 million residential and other buildings by 2030 in the district-oriented approach and to make them gas-free, or at least ready to switch over to another, sustainable source of heat ('gas-free-ready').

2030	• Gradually insulate 1.5 million residential and other buildings and make them gas free, or at least ready to switch over to another, sustainable source of heat ('gas-free-ready') by 2030 • Gas-free-ready by 2030 using more renewables and more sustainable sources • No more fossil fuel used in the building environment by 2030 • 49% less GHGs in 2030 than in 1990; Forecasts (not targets): Saving of 3.4 Mt CO_2 in built environment); Gas consumption by households will fall steadily to 234 (bandwidth 214-249) PJ in 2030
2040	• The Netherlands has also not established any CO_2 reduction targets for 2040.
2050	• Vision for all buildings to be sustainable by 2050 • CO_2 emissions in 2050 = 1.5 $MtCO_2eq$ • 95% CO_2 emissions reduction by 2050

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	The aggregation of projects, and packaged solutions	Y	3
3b	Reduction of the perceived risk for investors	Y	
3c	Use of public funds to leverage private-sector investment or address specific market failures	Y	
3d	Guiding investments into an energy-efficient public building stock	P	
3e	Accessible and transparent advisory tools (e.g., one-stop-shops)	Y	

- Specific measure such as the Renovation Accelerator promotes the **aggregation** of projects into bigger investments that are easier to finance, allowing large-scale renovation of rental homes.
- **De-risking** is partially addressed by pooling public and private money to make attractive financing for building owners and by sharing the risk through government participation. The NL support this with The Heating Fund and the National Energy-savings. Art. 2a 3b.
- Art. 2a.3d, the LTRS mentions that the **public sector** of the Netherlands works with roadmaps aiming at CO_2 neutral Central Government Portfolio but do not describe the measures in place to guide investments into an energy-efficient public building stock.

— A digital platform is available to building owners and occupants to provide **energy advisory services**, on relevant energy efficiency home improvements and financing instruments and possible subsidies, Art.2a.3e

Additional information

Summary results of the public consultation	Y	**4**
The summary of the results of the extensive public consultation process are included in Chapter 9 of the LTRS.		

Implementation details of latest LTRS	N	**0**

Fire safety and intense seismic activity risks (optional)	N

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Netherlands is applying a district oriented approach with a set of measures to address building renovation in both residential and non-residential buildings. This approach integrates environmental policy into urban planning, and it is based on roadmaps to be implemented by municipalities that also identify available sources of energy in their district. Indicative building renovation milestones towards 2030-2040-2050 are based on the Climate Agreement and calculated using a linear reduction of GHG emission and straight conversion of the 95% CO_2 emission reduction 2050 target indicated in the Climate Act. An objective of the Climate Agreement is also to gradually insulate 1.5 million residential and other buildings by 2030 in the district-oriented approach and make them gas-free, or at least ready to switch over to another, sustainable source of heat ('gas-free-ready'). Although it is not possible to assess the impact and therefore the ambition of the actions described, the policies and measures are represented by a good mix of regulatory requirements, a wide range of available fiscal and economic incentives and information measures. The role of the public sector and the municipalities in the district oriented approach will be key for the successful transition of the current heating systems based on fossil fuels to a more sustainable heating solution based on renewables which will lead to a gas-free districts scenario. Current regulatory policies and fiscal measures to support this scenario seem promising, it is however, challenging to see how the Netherlands will achieve 95% CO_2 emission reduction by 2050 (compared to 1990) transforming almost 8 million homes and ca. 500 000 non-residential buildings into well-insulated properties heated with renewable heat in which clean electricity is generated/consumed by 2050.

Level of details/ Appropriateness/ Comprehensiveness

The LTRS was built upon the Climate Agreement; therefore, they sometimes do not fully address some specific Articles provisions required by EPBD (Art. 2a, Art. 10, Art. 20). The details of the residential and non-residential building stock can be further improved. The existing and planned measures are described although energy-savings contribution is not reported. The level of comprehensiveness is appropriate.

Good practices

Regulatory measures:
The Netherlands is applying substantial regulatory measures and buildings standards. Both new residential and non-residential buildings must meet the 'Nearly Energy-neutral Buildings' requirements by Jan 2021. NL has also set a specific target to reach a minimum level of energy performance for non-residential buildings.

Tools and mechanisms to support the mobilisation of finance:
Renovation activities are mostly incentivised via the use of tax reduction and tax exemption, reduced VAT rates, VAT refund, investments costs deduction, depreciation of investment, favourable loans and interest rates

Public sector:
In the district level approach applied by the Netherlands, municipalities are in charge of the transition to gas-free districts; therefore, they play a key role in the identification of alternative and more sustainable heating solutions to replace the current heating system based on fossil fuels. The goal is to reach 1.5 million buildings to be gas-free or gas free ready by 2030.

Tackling worst-performing buildings and energy poverty:
Although the LTRS does not provide detailed data on this, the number of very badly performing homes in the Netherlands is limited. In order to tackle the worst-performing buildings, the Netherlands has set minimum requirements for all the office buildings and for all the total rental housing stock. To support the implementation of the retrofitting measures, subsidies schemes for insulating existing homes are in place.

Split incentives in the residential sector will be addressed by amending the laws on renting. Concerning energy poverty, in the Netherlands there is an obligation for landlords to improve residential properties up to the 'standard' aiming to protect tenants from high energy costs.

Other measures:

Other measures that help to promote the financing of investments are: the **Renovation Accelerator**, to promote aggregation of projects into bigger investments opportunity, *Energisprong*, which pools renovations of residential properties on a smaller scale and provide valuable lessons on the scaling up of these kinds of investment.

Strengths and Innovative approaches

The Dutch district-oriented approach is an innovative, promising approach at the centre of the LTRS for the Netherlands. The public sector and the municipalities will play a very important role in the decision-making process towards the refurbishment of buildings and the identification of sustainable sources for replacing fossil fuel-based traditional heating systems with the main goal to achieve gas-free districts by 2030. Several programmes and roadmaps are in place to support this transition at the district and local levels across the country. A reasonable regulatory framework, with mandatory measures and building requirements supported by a large number of fiscal measures to encourage building retrofitting, seems to ensure the successful implementation of this approach.

Recommendations

Include additional information on the methodology and/or models used to forecast emission reduction in 2030-2040-2050, energy consumption kWh/m^2 for the building stock, % yearly rate of renovation and % buildings to be renovated, % of NZEB, overall investment need for the implementation of the strategy).

The use of the template for LTRS reporting could increase clarity on the strategy, the indicative milestones and the existing and planned measures.

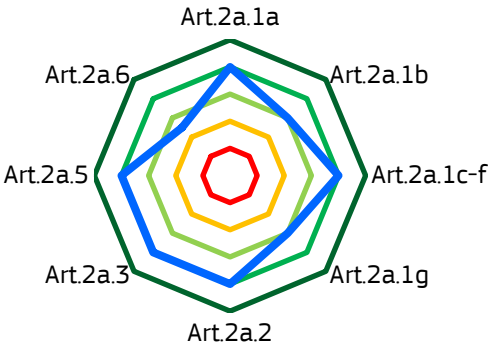
More details on the following aspects could be provided in the next revision of the strategy:

- Share of renovated buildings or an absolute no or an in m^2 per type of building in 2020.
- Energy consumption (kWh/m^2/y) of the building stock and/or for each different type of buildings.
- Quantification of energy-saving contribution for the individual measures.
- Information on barriers and investment needs.
- Data related to electro mobility, health, indoor quality and a clear and comprehensive assessment of co-benefits.
- A reference to a database for EPC or energy labels and related data.

POLAND

1. EPBD Art.2a COMPLIANCE

Introduction: The Polish LTRS, approved by the Council of Ministers on 9/02/2022, was provided as a separated stand-alone document in February 2022, months later the NECP.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	4

The strategy includes a good overview of the residential and non-residential building stock, described in terms of type, energy consumption (including energy carrier), heating systems, age, and ownership. Different sources of data have been used: the results of the 2011 National Population and Housing Census updated with data on new buildings put into service in 2012-2019, and the GUGiK (National summary of building data as at 1 January 2020). The results of a 2019 survey on multi-apartments renovation works are presented: 60% of these buildings have been already energy renovated (or do not need to be renovated), 40% (or 210 000 buildings) need still to be renovated. The most common renovation measures are also presented (e.g. envelope and windows replacement). The share of renovated residential buildings and public buildings in 2020, by year of construction is also presented, together with an estimate of the residual potential final energy savings in the residential sector (147 TWh, which is about 75% of their current level of final energy demand).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	6 160 900	-	1 101 686 000	
	SFH	5 604 000	-	-	
	MFH	556 900	-	-	
Non resident	TOTAL	8 607 000	-	464 730 000	
	PUBLIC	420 000	-	-	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	3

Cost-effective approaches to renovation has been indicated and analysed in depth in the strategy (chapter 3). Several renovation approaches are presented (e.g. renovation packages), including example of economic calculation (payback time and energy savings) for real buildings (residential, non-residential buildings, heritage buildings), in case of shallow and deep renovations. The calculations confirm that under current market conditions, energy renovation is cost-effective for a significant percentage of buildings, which will increase with the expected increase in unit heating costs in the next years. In the case of residential buildings, cost effective renovation reduces final energy demand by 75% compared to current levels and reduces by about 10 % of total annual greenhouse gas emissions and a quarter of total dust emissions in Poland.

Trigger points have been identified and described: change of ownership, change of purpose of the building, repair of damages, conventional renovation, asbestos removal, and specific financial incentive availability.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

In the Polish strategy a comprehensive set of measures is described. Three types of policy measures are listed as measures expected to stimulate renovations: (1) legislative measures (mainly EPBD-related measures such as min energy performance levels and regulation on fuel quality and air quality programmes) , (2) financial incentives such as grant schemes for building renovation (i.e. Thermomodernisation and Repair Fund) funded by the State budget and by EU structural funds, (3) Planning and organisational tools (i.e. National Energy advisers, Central Register of Building Emissions, Covenant of Mayor). The details measure description includes the allocated budget and the implementation road map.

Measures addressing public buildings and for alleviating energy poverty are also included.

Poland also supports the development of smart technologies and well-connected buildings and communities. Smart and energy efficient construction is one of the national Smart Specialisations. The state of play of smart technology deployment in Poland is described in details in section 6.2).

Skill and education needs in the construction sector are discussed in the document. In Poland, in 2013, an analysis of the available statistics indicated that of the total number of persons employed in the construction sector at the end of 2010, 865 228 people, 40%, i.e. ca. 317 560 people worked in the construction and refurbishment of buildings (e.g. energy auditors, engineers, architects, construction workers, RES installers). The following training action will be implemented to address the increasing need of energy renovation specialised workers: revision and completion of training programmes for installers, creation of a new training system based on modified training programmes, where each installer applying for a certificate would be subject to a mandatory examination.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

An estimate of total energy savings and emission reduction is provided in the strategy:

• final energy savings in residential buildings of 147 TWh, which is about. 75 % of their current level of final energy demand;

• reduction of CO_2 emissions by more than 37 million tonnes per year, which is about. 10 % of total annual greenhouse gas emissions in Poland.

• reduction in dust emissions of around 89 000 tonnes per year, which is about a quarter of total dust emissions in Poland, and reduction of harmful asbestos fibres.

Moreover, it is stated that energy renovation could create additional 100 000 jobs, and reduce energy costs.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**

In order to define the most efficient renovation roadmap, the results of a 2021-2050, scenario analysis are presented in details, assuming a climate-neutral building stock in 2050. The "Recommended scenario", combines the advantages of the "rapid and deep renovation" and the "staged renovation" scenarios; This scenario assumes an 3.8% average annual renovation rate and that by 2027 all buildings with an EP index greater than 330 kWh/m^2/y and by 2035 buildings with an EP indicator greater than 230 kWh/m^2/y will be upgraded. Moreover, by 2050 65% of buildings will have an EP ratio of no more than 50 kWh/m^2/y and 22 % between 50 and 90 kWh/m^2/y. The remaining 13 % of buildings that cannot be technically or economically upgraded will reach the EP ratio in the range of 90- 150 kWh/m^2/y.

Indicative 2030, 2040 and 2050 targets in relation to energy efficiency in buildings are provided in terms of total number of renovated building (e.g. 2.4 million in 2030, 5.2 in 2040 and 7.5 in 2050), and number of deep renovations (e.g. 0.5 million in 2030, 2.3 in 2040 and 4.7 in 2050).

The total investment need for the renovation of buildings in 2021-2050 is also provided: around. PLN 1.54 trillion.

Key performance indicators to monitor the implementation of the strategy (e.g. number of renovations, number of deep renovation, share of households using coal etc.) are also described, together with their 2030, 2040 and 250 target values.

2030	• 2.4 million buildings renovated (of which 0.5m deep renovated) • 3.6% average renovation rate • 70% Share of thermally insulated residential buildings in the total housing stock • phasing out the use of coal in cities by 2030 • moving away from fossil-based sources (including natural gas) as primary energy carriers for the thermal renovation of residential and non-residential buildings by 2030, while maintaining the possibility of hybrid solutions and zero-emission alternatives
2040	• 5.2 million building renovated (of which 2.3m deep renovated) • 4.1% average renovation rate phasing out the use of coal in all residential buildings by 2040, while maintaining the possibility of using smokeless fuels until 2040

2050	• a climate neutral building stock • 7.5 million building renovated (of which 4.7 million deep renovated) • 3.7% average renovation rate • 65% of building with an EP<50 kWh/m^2/y, and 22% between 50 and 90 • phasing out the use of fossil fuels by replacing heat sources or using zero-emission alternatives (e.g. biomethane, synthetic fuels, hydrogen) in other buildings with parallel deep thermomodernisation by 2050 • investment need (2020-2050): PLN 1.54 trillion (EUR 0.3 trillion)

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	N	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	U	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

The strategy a detailed overview of the existing measures for the mobilisation of building renovation investments. The main financial incentives are public national funds (e.g. NFOSiGW "Clean air", Thermomodernisation and Repair Fund; Fund for Environment Protection and Water management). European funds (e.g. European Regional Development Fund: EUR 1.7 billion 2014-2020 2014-2020; Cohesion Fund: EUR 164.7 million) and budget from local authorities.

Public funds are extensively used to promote building renovations, with a good use of EU resources: between 2014 and 2019, public funding of around PLN 14.7 billion made it possible to leverage additional private-sector investment to a total of PLN 22.8 billion.

NFOSiGW "Clean air" program, plans to allocate PLN 103 billion (EUR 20 billion) over ten years (2018-2029) to finance the renovation of ca. 3 million single-family houses, through non-repayable form grants (PLN 63.3 billion) and loans (PLN 39.7 billion).

The aggregation of project is promoted in the support programmes in order to obtain more favourable funding from Polish and European financial institutions. This formula has already passed an exam in the case of the thermomodernisation of public buildings financed by the EEA.

Accessible and transparent advisory tools, such as one-stop-shops and "Investor Comprehensive Service" for consumers and energy advisory services are discussed in the strategy, as a key tool to assist all types of public or private actors involved in the renovation process of the facilities.

Perceived risk reduction tools are not mentioned.

Additional information

Summary results of the public consultation	Y	**4**

The results of the LTRS public consultation, held in February 2021, are presented as an Annex to the strategy. During the public consultation, the draft Cabinet Resolution adopting the "Long-term Building Renovation Strategy" received comments from more than 30 entities mainly representing: a) professional organisations related to construction, energy, engineering and heating, b) energy companies, c) local government entities, d) public administration entities, e) natural persons.

Participants in the public consultation accepted the main strategic orientations of the "Long-term Building Renovation Strategy", including, inter alia, the recommended scenario for the thermal renovation of buildings presenting a roadmap for 2030, 2040 and 2050. However, some comments focused on the detailed implementation of the policy on improving the energy efficiency of buildings and on the substantive scope of the document have been raised and discussed.

Implementation details of latest LTRS	P	**2.5**

In the strategy a specific section on the implementation of its 2017 LTRS (including the planned policies and actions), is missing, but a detailed overview of building renovation investments for the period 2014-2019 (i.e. PLN 23billion; EUR 4.8billion), in relation to the main supporting programmes/measures (e.g. European funds, Fund for thermomodernisation, thermomodernidsation relief, NFOSiGW programme) is provided.

Fire safety and intense seismic activity risks (optional)	N

2 General assessment: Ambitions, strengths, and weaknesses

Summary

The Polish strategy cover all the elements of EPBD Art.2a. It includes a good overview of the residential and non-residential building stock, presents several possible cost effective renovation packages and describes a comprehensive set of measures expected to stimulate renovations. This encompasses (1) legislative measures (mainly EPBD-related measures such as min EP levels and regulation on fuel quality and air quality programmes), (2) financial incentives such as grant schemes for building renovation (i.e. Thermomodernisation and Repair Fund) funded by the State budget and by EU structural funds, (3) Planning and organisational tools (i.e. National Energy advisers, Central Register of Building Emissions, Covenant of Mayor).

In order to define the most efficient renovation roadmap, the results of a 2021-2050, scenario analysis are presented in details, assuming a climate-neutral building stock in 2050. According to the "Recommended scenario", by 2050 65% of buildings will have an EP ratio of no more than 50 kWh/m^2/y and 22 % between 50 and 90 kWh/m^2/y.

Indicative 2030, 2040 and 2050 targets in relation to energy efficiency in buildings are provided in terms of total number of renovated building (e.g. 2.4 million in 2030, 5.2 in 2040 and 7.5 in 2050), and number of deep renovations ((e.g. 0.5 million in 2030, 2.3 in 2040 and 4.7 in 2050), together an estimate of the 2021-2050 total investment (around PLN 1.54 trillion; EU 308 billion).

The results of the LTRS public consultation, held in February 2021, are presented as an Annex to the strategy.

Level of details/ Appropriateness/ Comprehensiveness

The level of details is good. The strategy follow the EPBD Art.2a structure and the energy efficiency policy framework described in the document is comprehensive, covering all the sectors.

Good practices

Regulatory measures:

• Introduction of requirements to include the removal of harmful hazardous substances, including asbestos, in refurbished buildings.

• Regulation of the Minister for Energy on quality requirements for solid fuels and creation of the Central Emissions Register of Buildings.

Tools and mechanisms to support the mobilisation of finance:

• The Fund for Thermomodernisation and Repairs (FTIR) to support deep energy renovation of multi-family houses (amount of bonus depending on the degree of improvement in the energy efficiency of the building), The FTIR is one of the oldest and continuously functioning tools to promote energy efficiency in Europe (has been in existence without interruption since 1998).

• Good use of EU funds to finance energy renovation grant programmes.

Public sector:

The NFOŚiGW grants co-financing in the form of grants for energy renovation investments in public buildings and repayable aid in the housing sector.

Tackling worst-performing buildings and energy poverty:

The 'Stop Smog' programme targets energy poor people living in single-family homes. The scheme is addressed to all municipalities that can demonstrate poor air quality on their territory, i.e. concentrations of air pollutants exceeding EU standards.

The programme covers the implementation in these households of projects consisting of:

• replacement of heating equipment or systems with low-carbon standards;

• decommissioning of heating equipment or systems and connection to district heating, electricity or gas networks;

• thermomodernisation of the building.

Other measures:

Projects for the deployment of smart meters, smart city solutions and other smart building innovations are supported by EU and national funds, such as the National Centre for Research and Development and the National Environmental Protection Fund programmes and Water Management.

"HUMAN SMART CITIES. Smart cities co-created by residents' — a grant competition addressed to local authorities, the main objective of which is to create, using smart solutions, a city as a living space, shared responsibility for which is also shared by residents taking an active part in management and co-determination. The competition was launched in 2017 and was decided in 2019. Finally, support was received by 24 cities, which implement projects with a total value of PLN 44.7 million, of which PLN 39.5 million is a grant awarded. The projects will run until the end of 2022.

Strengths and Innovative approaches

— Good use of grant schemes (with a focus on already secured EU structural funds) for financing building renovation projects.

— Robust scenario analysis to identify the most efficient renovation roadmap.

— Detailed overview of renovation packages, per building type.

Recommendations

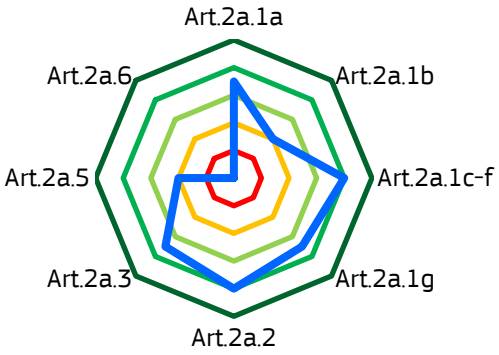
– Wider benefits could be better identified and quantified;

– The current EPCs use a scale (indicator without classification) and they do not allow the determination of specific energy class of the building. The introduction of discrete energy classes linked to final or net energy demand, and the estimation of operation costs in comparison to other buildings could contribute to making the EPCs more useful.

PORTUGAL

1. EPBD Art.2a COMPLIANCE

Introduction: The strategy has been presented as a standalone document, and sent to the EC in March 2021, months later the NECP.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	P	**3.5**

The 2021 PT LTRS provides information on the national building stock (this information was missing in the previous 2014 and 2107 strategies). However, this information is somewhat incomplete. The information on the building stock is mainly arriving from the results of the Energy Performance Certificates issued in the last decade and only residential, divided by construction period and climatic zone. The statistical information is still scattered in several institutions and does not present itself as updated or reliable.

One of the measures proposed by the PT government is to establish a system of indicators where it will be possible to make a complete analysis of the building stock and its evolution.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	5 859 540	4 043 726	-	No of dwellings - No of families: 1.8 Million Difference associated to empty or seasonal housing.
	SFH	2 189 096	-	-	
	MFH	1 639 710	-	-	
Non resident	TOTAL	109 792	-	-	The energy certification database, which covers only a part of the total existing buildings as of July 2018, had a record of 109 792 energy certificates referring to service buildings, of which 6 738 corresponded to large service buildings, 4 405 for small buildings with HVAC systems and 98 649 for small buildings without HVAC systems.
	PUBLIC	-	-	-	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	**P**	**2**

There isn't a clear identification of cost-effectiveness approaches of renovations or clear identification of trigger points. However, the PT LTRS mentions in several occasions these issues, although not going into detail.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

The Portuguese LTRS has been given a great evolution from the latest documents and presents a great number of information in policies regarding **deep renovation and building renovation passports** with dedicated Policies and Measures outlined to tackle these issues. Regarding the renovation of the building stock, Portugal assumes that, by 2050, all of its stock will need to be renovated for the sake of thermal comfort of the population as except for multifamily buildings built after the year 2016,

all buildings have a comfort category IV (worse comfort category), which means that, currently, the present building stock provides some thermal discomfort in more than 95% of the hours of the year.

The thermal comfort analysis allows that for the first time, the Portuguese LTRS identifies and approaches the theme of **Energy Poverty** with a dedicated chapter on this subject (EA5 – COMBATE À POBREZA ENERGÉTICA). Also, the worst-performing segments of the national building stock is taken into consideration in several chapters of the document

The PT LTRS gives out some concern on the **split-incentives dilemma** both at the market flaws evaluation and in the Policies and Measures proposed to tackle this issue.

Regarding **market failures**, the PT LTRS gives an overview for the main market flaws like incentive fragmentation and market deficiencies (e.g. lack of understanding of energy use and potential savings; limited renovation and construction activity in a post-financial crisis context; lack of attractive financing products; limited information about the real estate stock; limited adoption of efficient and intelligent technologies).

Regarding **public buildings** (art.2a 1e), the PT LTRS has given specific policies in this subject - renovation of 5% of the public building stock per year until 2030 and 2.5% until 2050. This will be achieved with the revamping made of the "ECO.AP" project that will accommodate the LTRS and EPBD provisions.

In respect to the provisions of Art2a.1f, the PT LTRS outlines several new measures regarding **smart technologies** in its Policies list with a dedicated subchapter (EA2 – EDIFÍCIOS INTELIGENTES, pp 48) tackling issues like smart buildings, the roll out of the smart readiness indicator, the potentiation of efficiency (energy, hydric, sustainability), the roll-out of smart meters, digital infrastructuring of buildings, electric charging in buildings as per provision of the EPBD, automation systems in buildings, collection of KPIs, etc.).

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3.5**

With the use of a model, the PT LTRS estimates the energy-savings expected to be achieved in different renovation degrees (pp 88 - renovation to increase a level of comfort to reach a passive state in the building). Although the model and calculation methodologies are not explained, the plan presents a quantification of these energy-savings. The plan also presents several wider benefits like occupants' health, work productivity, the property increased value, fighting energy poverty, water consumption reduction, resilience and energy safety increase, other benefits along the construction and real estate ecosystem and supply chains.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**

In chapter 8 (8.2) of the PT LTRS there is the indication of 2030, 2040 and 2050 targets, where among others, are presented the renovation milestones. These indicators range from the percentage of primary energy-savings to local renewables produced or building renovation areas, building renovation percentage or the percentage of reduction of discomfort. Also, in chapter 8 (8.1), the PT LTRS outlines a great number of indicators that will allow for accountability of the progress in the coming years.

2030	• Renovation of building stock: By 2030 363 680 501 m^2 renovated • Energy savings: By 2030 11%
2040	• Renovation of building stock: by 2040 635 637 685 m^2 renovated • Energy savings: by 2040 27%
2050	• Renovation of building stock by 2050 747 953 071 m^2 renovated • Energy savings by 2050 34%

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**3.5**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

The Portuguese LTRS ticks all the boxes in considering the mechanisms of support of the mobilization of public and private investments in order to answer the provisions of Art.2a.3.

Chapter 6.3 of the PT LTRS refers to all these issues, namely:

- Promotion of support mechanisms based on financing models that enhance scale gains and increase the viability of projects and market interest;
- Promotion of forms of financing based on the incorporation of new concepts of financial innovation such as crowdfunding and block-chain;
- Reinforcement of the use of the energy certificate as a standardized tool for evaluating the performance of the building to support the granting of financing, in a logic of reducing the perceived risk and credibility of energy renovation projects;

- Promotion of financing mechanisms by entities in the financial system, promoting long-term financings; Investment orientation towards an energy-efficient public buildings stock, in line with Eurostat guidelines;
- Creation, in conjunction with municipal and regional entities, of accessible and transparent means of advice to consumers on the energy renovation of buildings and the financing instruments available, such as "one-stop-shops" with integrated services at the technical and financing level and that facilitate the grouping of projects, making them more attractive to the financial market;
- Reinforcement of public investment in energy efficiency, contributing to stimulate supplementary investments by the private sector or to correct specific market deficiencies, introducing and / or revitalizing, namely:
    - Credit schemes co-financed by public funds;
    - Risk-sharing instruments;
    - Subsidies targeted at vulnerable consumers;
    - Subsidies for technical assistance and cost coverage for performance certificates
    - Energy and energy audits, when these are not mandatory;
    - Public capital funds for energy efficiency.

It is to be noted that although all these mechanisms are mentioned, there is still the need for a presentation on how these will work.

Additional information

Summary results of the public consultation	P	**2**
There is a mention that the LTRS has been in public consultation, which has been confirmed. However, there is no summary of the results of this public consultation in the document analysed.		

Implementation details of latest LTRS	N	**0**
The PT LTRS does not present any progress monitoring report regarding the 2017 LTRS		

Fire safety and intense seismic activity risks (optional)	N
The PT LTRS does not address fire safety and seismic risks.	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The 2021 Portuguese Long Term Renovation Strategy is a great evolution from the previous documents that this Member State has produced under the EED in 2014 and 2017.

The document presents a good overview of the targets proposed and outlines a new set of measures that aim to give a response to the provisions of the EU Directives in terms of reporting. The rationale of the strategy that is proposed to be implemented in the existing building stock consists of transforming them into buildings with characteristics similar to NZEB in order to respond to other priority challenges relevant to the national context that goes beyond the energy and emissions component, namely, the increase in thermal comfort, the fight against energy poverty, the increase in indoor air quality and the prevention of pathologies in construction and safety, with equally important relevance for the efficient management of material resources, water efficiency and improvement of the environmental performance of buildings.

Overall, this document presents several novelties in the country's strategies in building renovation. Some building stock information is given for the first time, although being limited to information arising from the EPCs collected by ADENE, the Portuguese Energy Agency. No historical information and global description of the full building stock, divided by age group, climatic zones, and typologies of buildings, is given. The LTRS suggests, however, the establishment of a new indicators system that will ideally gather all information of the building stock and monitor the evolution of its renovation.

Energy Poverty is also being given more attention in this strategy, with the Portuguese government addressing the issue fully and dedicating to it a set of measures aiming to reduce the levels of energy poverty in the country.

The same for smart buildings, the LTRS addresses the issues and has dedicated a new set of actions to make buildings smarter, with the introduction of mandatory smart features along with the roll-out of smart meters and the increase of electric mobility and prosumers.

The LTRS is standing on three main axes:

1. The improvement of quality of life, with a priority to reduce energy poverty, increase thermal comfort and improve internal air quality;
2. Economic growth opportunity via the co-benefits associated with the building stock renovation;
3. Meeting the energy and climate targets coordinated with other policy instruments like the NECP.

Some interesting aspects of the strategy concern also the financing structure that the country seems to be wanting to put into place.

Level of details/ Appropriateness/ Comprehensiveness

Overall the Portuguese LTRS presents a good level of appropriateness and this document represents a great evolution from the previous strategies presented. The level of detail could be higher, especially in terms of the actual proposed measures and policy actions that are outlined but not quantified in terms of individual savings per block of measure.

In a general way, the LTRS is comprehensive and at least touches the main points expected in the reporting structure of an LTRS.

Good practices

Regulatory measures:
The PT LTRS has a way of making sure that regulatory tools will be put into action in the coming decades. There is a clear definition of Energy Performance Certificates as a tool to be used in achieving the proposed renovation rates. Also, there is an overall concept that the energy efficiency of the buildings will need to have an NZEB-like energy efficiency by 2050, and the measures try to reflect this.

Tools and mechanisms to support the mobilisation of finance:
There is a big effort from the PT LTRS to properly direct the existing financing mechanisms and the concern to create further mechanisms in order to make the renovation market reality in the coming years, up to 2030. The actions regarding the mobilisation of finance are usually presented as a change into regulation, reorienting fiscal revenue for the improvement of energy and environmental behaviour of buildings.

The new "Portugal 2030" financing mechanism and the European Recovery Fund are two of the new financing mechanisms that will be put into place starting from 2021.

Public sector:
Although there is a mention of the role that public buildings will take place in the overall panorama of the building stock renovation, the main measure regarding public buildings renovation is the revamping of an already existing programme "ECO.AP", which will be restructured in order to accommodate the provisions of the LTRS.

Tackling worst-performing buildings and energy poverty:
The Action Axis 5 (EA5 – COMBATE À POBREZA ENERGÉTICA) is dedicated exclusively to fighting energy poverty. This axis encompasses some interesting actions:

- Dissemination and promotion of existing financial support to local entities that carry out programs to support energy renewal in social housing;
- Study the introduction of tax benefits and energy-saving bonuses integrated into the building energy certification scheme;
- Propose the inclusion of a social criterion in the allocation of financial and tax benefits;
- Support energetically most vulnerable populations or low-income families through, in particular, specific programs to support financing for the renovation of buildings, with a view to making investments in energy efficiency;
- Study the allocation of support for the replacement/acquisition of space heating systems and domestic hot water by efficient systems (for example, solar thermal, heat pumps, surface geothermal), as well as the replacement/acquisition of water terminal devices (taps, showers, cisterns) more efficient from the water and energy points of view;
- Promote the integration of the most vulnerable energy populations or low-income families into renewable energy communities, coupled with the promotion of the replacement of equipment based on fossil sources for electricity;
- Support measures at the level of space heating systems and DHW through the online tool (European project HARP) for the issuance of energy labels for heating equipment, visualization of alternatives in the market and contact with Providers;
- Support measures related to water use devices, which can be supported by water certification systems for products existing at the national level made available by the National Association for the Quality of Building Installations.

Other measures:
n/a

Strengths and Innovative approaches

- A detailed list of monitoring indicators that will improve further versions of the PT LTRS.
- Financing needs and the overall budget is presented and explained.
- Ambition for the whole LTRS up to 2050.
- The LTRS seems to try to tackle "new" issues like smart buildings, Energy Poverty or NZEBs and, at the same time, increase the importance of EPCs role in the whole renovation process.
- There is a great concern on "Thermal comfort" throughout the whole document, and it could even be said that thermal comfort via building renovation is the biggest driver of the strategy for the coming years, considering the approach of the document.

Recommendations

More details on the following aspects could be provided:

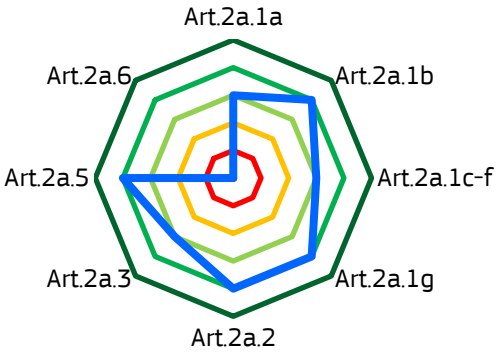
— Description of the national building stock; the data regarding the number of buildings are very general and scarce or only extracted from the EPCs database. The LTRS spots this challenge and proposes a set of indicators to be implemented and monitored in the near future.

— Energy-savings per individual measures the assessment of co-benefits.

ROMANIA

1. EPBD Art.2a COMPLIANCE

Introduction: The strategy is given as a standalone document. The document was available only in Romanian when assessed.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**3**

The data on the building stock have been retrieved from several different sources: the World bank review (2019) and Strategy for mobilising investment in the renovation of residential and commercial buildings, both public and private, existing at the national level (2017) by MLPDA - Ministry of Public Works, Development and Administration.

The number of buildings, the heated surface, the areas built before 2000, the areas renovated by 2020 and the not-renovated areas are specified for types of buildings. The categories chosen include residential, rural, and urban, multi-family dwellings, schools, Hospitals/health establishments and social houses, offices, warehouses, Hotels and Restaurant. Climatic zones have been considered when carrying out the analysis to estimate the investments costs, their effect on energy performance and CO_2 emission reduction. The Tenure of building stock is described to be 94.7% as home ownership.

Some limitations of the provided data include the fact that certain data are presented in a non-extractable format (i.e., graphs).

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	5 318 886	-	582 490 000	
	SFH	5 165 000	-	372 260 000	
	MFH	153 886	-	210 230 000	
Non resident	TOTAL	242 455	-	62 010 000	Schools, healthcare and social housing
	PUBLIC	69 313	-	26 530 000	
	OFFICES	7 500	-	8 360 000	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

Chapter VII presents cost-effectiveness approaches to renovations. For the analysis and identification of cost-effective measures and renovation packages, three different main categories of buildings have been identified: residential buildings with multiple existing apartments, existing single-family buildings (individual) and buildings of educational establishments. Then a further differentiation has been made (8 building types in total), considering the use of a central heating system and on the type of energy sources used (e.g., gas plants, solid biomass stoves, etc.). Special attention to passive cooling and new and efficient cooling systems is given. For each one has been identified the trigger points for the renovation, which includes transactions (e.g., sale or lease/lease, structural/seismic safety refurbishment, disaster event), local authority proposals from owners of apartments and homeowners' associations for the renovation disaster events and Planned major capital overhaul of the building. Moreover, for each category are described Cost-effective renovation approach, the target energy performance (e.g., energy class) and packages of measures.

1c	**Policies and actions on deep renovations, including building renovation passports**	P	**3**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	P	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

- **Deep renovations**: The document describes four different types of buildings. All renovated buildings could reach energy performance levels corresponding to current class A requirements, with the exception of single-family buildings, for which Class B is more appropriate. It is suggested an integrated step-by-step approach (staged renovation) throughout the life of a building to increase energy-savings and energy performance, including through the definition of subsequent renovation phases in order to reach the deep renovation level over time.
- **Building renovation passport** (BRP): It is suggested to include the BRP in the technical book of the building (mandatory document in Romania encompassing all information on the building in question) in chapter D – Operation, maintenance, behaviour tracking over time and post-use of the building. The BRP should be available to owners in digital format and could include other sets of information related to each building, such as funding options available in the area for renovation projects (e.g., green loans, incentives, tax credits), as well as energy bills, equipment maintenance recommendations and ownership obligations. A starting point for the development and implementation of the PRC concept in Romania could be the iBad model developed in the framework of the Horizon 2020 project iBad (www.ibroad-project.eu).
- Today the **energy poverty** is only partially integrated into Romanian legislation. While only 5% of the population receives grants for heating based on income thresholds, the percentage could be 19% if additional criteria such as disposable income and access to energy were used. Several measures are proposed to fully address energy poverty.
- Worst-performing buildings are identified based on age (older than 20 years), total final energy consumption >300 kWh/m^2/y and final energy consumption for heating >200 kWh/m^2/y. Top 3 energy performing categories:
  - Single-family house using natural gas and wood as heating energy in all climate zones;
  - Public and private office buildings using natural gas and district heating located in climate zone II to V;
  - Multi-family buildings and schools using natural gas or district heating in climate zone I to V as well as offices in climate zone 1.

  More than 30% of the apartment owners fall into the category of the most vulnerable population groups and receive state aid. In many cases, the category of socially vulnerable users overlaps with the worst-performing buildings.
- **Split-incentive dilemma**: In Romania, around 90% of the residential apartments are occupied by owners, which makes the problems of split-incentive dilemmas not significant in the medium term. It is therefore not necessary to address these dilemmas as part of the immediate measures of the 2021-2030 implementation of the strategy. However, appropriate financing arrangements allowing the owner or tenant to use the resulting energy cost savings to pay part of the investment could be developed to overcome this dilemma of bias. For newer buildings, current legislation requiring minimum levels of energy performance helps to address the obstacles to split incentives. However, for public buildings, this deterrence factor persists. Therefore, the budgetary regulations will be revised to allow for the preservation of the budgetary savings resulting from the EE improvements until the repayment of the renovation debt, or the central administration should provide budgetary support to the renovation.
- **Market failures and obstacles**: is identified a list of concerns (e.g. limited information on the existing building stock and lack of understanding of energy consumption and potential savings; insufficient market development: construction, materials, limited workforce; a lack of attractive financing products; limited adoption of efficient and smart technologies). Buildings are categorized in a list and for each type are defined Public policies, Technical, Financial, Institutional and Information Obstacles to energy efficiency.
- Policies and action on **public buildings**: Two dedicated programmes are suggested to be developed: a long-term national programme for State-owned public buildings and a long-term national public building programme. Renovation trigger points targeting public buildings are identified, and deep and NZEB renovation are pursued.
- **Smart technologies**: NRP (Romanian National Integrated Energy and Climate Change Plan) contains several priorities for smart technologies. NRP refers to (i) encouraging the development of prosumers together with the development of electricity grids and smart meters; (II) smart distribution of medium and low voltage; general smart meter development goals and smart grids, step-by-step implementation of smart city concept and the IoT deployment in the residential sector; (III) the development of regional clusters for sustainable energy planning, smart energy use in SMEs, the use of renewable resources and the promotion of EE measures, etc., and links the measures proposed by other existing or planned strategies.
- **Skills and education**: There are a series of national programmes promoting energy efficiency in buildings:

○ Effective Romania', a project sponsored by OMV Petrom, which includes the rehabilitation of several schools, the deep renovation of public buildings, energy efficiency information campaigns, the development of a practical guide for energy efficiency and specialised energy efficiency training for public administration representatives; 'Green Building Professional' is a paid programme for the certification and training of specialists in green construction organised by Romanian Council for Green Buildings; and EU-funded programmes BUILD UP Skills Romania with the Skills Roadmap for

Construction in EE and RES, BUS Qualishell with the development of 2 qualification schemes for high performance building envelopes, Train-to NZEB to develop and implement training for construction workers, specialists (architects, designers, experts, energy auditors) and decision-makers for NZEB and Fit-to-NZEB for the development and implementation of various training programmes for deep energy efficiency renovations (at NZEB level). The establishment of the training unit, which authorises and provides training courses and the organisation of courses (renovation and NZEB) is one of the points in the list types of activities to consider for breakdown cost, and it is estimated of € 35 million.

1g	Evidence-based estimate of expected energy-savings and wider benefits	Y	4

Regarding energy-savings, with the simulation of three scenarios and selecting as recommended Scenario 2, savings is estimated as 0.83 Mtoe by 2030.

As a wider benefit, the document provides an estimate for the number of construction workers and engineers required in the construction sector to carry out the planned renovation of buildings in each scenario considered in the Target tab (e.g. around 4 000 new engineering staff will be needed to ensure that the scenario 2 renovation targets will be met).

The Romanian renovation strategy considers the potential health benefits estimated for each scenario. In Scenario 2, the saving relating to health is estimated to be € 1 480 million total (direct 69 and indirect 1 411). Other listed wider benefits are: Improved thermal comfort in apartments, improved social cohesion, reducing energy poverty, urban regeneration, increasing seismic safety, supporting growth and job creation.

2	Roadmap including measurable progress indicators and indicative milestones	Y	4

In Chapter IX, section "Implementation Roadmap, are represented energy-savings, CO_2 emission reduction, increase of NEZB buildings, percentage of reduction of people in energy poverty, % of reduction of building with the lowest energy class, number of one-stop-shop initiatives, and raising awareness that led to concrete action in renovations (% of owners undertaking renovations out of total targeted owners). All these milestones and values, defined as target values for 2030, 2040 and 2050, are expressed in relation to the benchmark value of 2020.

2030	• GHG emission reduction: By 2030 24% • Annual renovation rate: 3.39% (2021-2030) • By 2030 1% increase in NZEB buildings, 19% decrease in worst-performing buildings • Reduction of final energy consumption: By 2030 9% (0.83 Mtoe
2040	• GHG emission reduction: by 2040 50% • Annual renovation rate: 3 3.79% (2031-2040) • By 2040 4% increase in NZEB buildings, 23% decrease in worst-performing buildings • Reduction of final energy consumption: by 2040 3.32 Mtoe energy savings Total consumption: 6.20 Mtoe
2050	• GHG emission reduction: by 2050 80% • Annual renovation rate: 4.33% (2041-2050) • By 2050 77 % of the total floor area of the building stock renovated or rebuilt; 23% increase in NZEB buildings, 26% decrease in worst-performing buildings • Reduction of final energy consumption: by 2050: 65% reduction in final energy consumption (-6.14Mtoe)

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	The aggregation of projects, and packaged solutions	P	3
3b	Reduction of the perceived risk for investors	P	
3c	Use of public funds to leverage private-sector investment or address specific market failures	P	
3d	Guiding investments into an energy-efficient public building stock	P	
3e	Accessible and transparent advisory tools (e.g., one-stop-shops)	P	

— **Aggregation of projects**: is not mentioned.

— **Attracting investors**: In the recommendation for the public founding section, is one of the listed voices in the breakdown of costs for the type of activity, with an investment suggested of € 0.5 million.

— **Perceived risk**: Discussions with selected local banks suggest that they are not yet willing to assume the risks associated with loans to some municipalities and apartments/apartment owners, and the costs of financing for their perceived risks can be high. However, as reimbursements to Placement Funds (PF) are proven, Financial Intermediary (FI) should be introduced in the programme over time.

— **Public funding**: Romania has put in place a revision of the institutional framework for public financial mechanisms. MLPDA (Ministry of Public Works, Development and Administration) will be the coordinator of the National Programme.

A financial institution, an Investment Fund (IF), should mobilise funds and manage financial flows. Under the supervision of the MLPDA, the IF would develop financial needs projections, would help to leverage financing, develop financial mechanisms, manage, serve as a lender or a paying agent for revolving grant schemes/loans and receive reimbursements.

The co-financing programme will be supported by the introduction of deployment intermediaries such as 'financial

intermediaries' (local banks, etc.) and 'implementing intermediates' (municipalities, public or private maintenance companies, ESCOs and utility companies). This mechanism can help building owners implement investments, contribute to the supervision of contractors and help collect reimbursements, provide more benefits to the programme.

- Public building stock: 'Effective Romania' is a project which includes the deep renovation of public buildings.
- A Partial grant funding is proposed, with a strategy for the gradual reduction of grants and support for a strong awareness-raising campaign (communication) and administrative, technical assistance to applicants (one-stop-shop).

Additional information

Summary results of the public consultation	Y	**4**
There is a detailed summary on the Annex 1 of the three rounds of consultations with broad stakeholder groups (in May, June and September 2019). The document reports the key point of discussion for each consultation.		

Implementation details of latest LTRS	N	**0**
Not provided		

Fire safety and intense seismic activity risks (optional)	Y	**4**
A list of complementary measures for both fire and seismic risk is implemented, finding the possible relations with building renovations related to energy efficiency.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

Romania renovation strategy covers the majority of the EPBD Articles provisions, with a medium level of details. The LTRS presents a range of regulatory requirements, information measures and sets milestones, expressed in energy-savings, CO_2 reduction and increased share of renewables for 2030, 2040 and 2050.

Considering the year 2020 defined as a benchmark, the LTRS modelling estimates in the suggested scenario will generate energy-savings (with value expressed as the difference from the benchmark) of 0.83 Mtoe, 3.32 Mtoe and 6.14 Mtoe by 2030, 2040 and 2050 respectively. The forecasted CO_2 reduction for 2050 is 80%.

Has been carried out the analysis and identification of cost-effective measures and renovation packages; trigger points and barriers have been identified. Romanian LTRS reports a list of the main recommended actions to be taken after the approval of the plan to ensure its timely implementation. It is described a list of measures that should be introduced to ensure adequate implementation of the LTRS and to realise the energy-savings potential.

Romania has put in place a revision of the institutional framework for public financial mechanisms. MLPDA (Ministry of Public Works, Development and Administration) will be the coordinator of the National Programme. Regarding Public building stock, the project 'Effective Romania' is tackling the topic of deep renovation of public buildings.

Level of details/ Appropriateness/ Comprehensiveness

The building stock is described in sufficient detail. The planned set of measures and actions suggested cover the revision of the institutional framework for public financial mechanisms, financing instruments, and awareness rising initiatives.

Good practices

Regulatory measures:

Owners are required to provide an Energy Performance Certificate (EPC) when renting or selling the dwelling.

Industrial energy consumers, as well as SMEs with more than 1 000 toe/year energy consumption are required to have an energy manager to organize and coordinate the energy processes.

Tools and mechanisms to support the mobilisation of finance:

Different founding options are considered with both advantages and disadvantages: Grant (100%), Loan and grant, Partly repayable grant (20-60%). Based on the different funding options, four cases are further analysed and a selection of option for each market segment (central government buildings, municipal buildings, multifamily buildings, single-family dwelling, and commercial buildings) is made.

Public sector:

The data presented about the percentage of renovated buildings in 2020 revealed that the highest percentage is for school buildings (15%, while for hospitals it is only 1%).

For the school category buildings is foreseen an Investment of € 874.84 million, with a result of energy-savings of 0.03 Mtoe, a reduction of 0.14 $MtCO_2$ emissions and an increase of renewable energy consumption of 14.81 Mtoe.

For the hospitals, the recommended investment is of € 318.33 million, with an energy-saving of 0.01 Mtoe, a reduction of 0.06 $MtCO_2$ emissions and an increase of renewable energy consumption of 5.28 Mtoe.

The defence sector is not mentioned.

Tackling worst-performing buildings and energy poverty:

In order to renovate the segment with the lowest energy performance from the building stock, around € 3 billion would be needed to finance investments for the 2021-2030 period.

Romanian ordinance addressing energy poverty provides for purely financial support, with no additional measures to incentivise energy efficiency for the reduction of the energy bill, which could bring savings both in household funds and in public budgets. While about 5% of the population receive heating aid, the estimated share of households facing "energy poverty" as defined in other EU countries could be up to 19%. While legislation should be further refined to increase coverage and improve the focus on social protection, its delivery mechanisms and existing institutions provide a good starting point for additional financial support for energy efficiency measures.

Other measures:

The sale or lease of buildings with the lowest energy performance could be considered as trigger points for encouraging renovations in the worst-performing buildings — for instance, incentives to offer a partial renovation grant with the requirement to reach certain energy performance standards.

A governance framework for implementing the strategy is proposed. The constitution of an inter-ministerial committee to coordinate the implementation of the LTRS is envisaged. The committee will be responsible for monitoring and reporting the roadmap indicators. Finally, the strategy summarises the main recommended actions to be taken after the approval of the LTRS to ensure its timely implementation.

Strengths and Innovative approaches

— Romania has put in place a revision of the institutional framework for public financial mechanisms.

— An outstanding assessment is to suggest that if apartment owners refuse to accept renovation proposals, in future there is a risk that they will no longer have access to financial support from public funds.

Recommendations

More details on the following aspects could be provided:

— Energy-saving impacts and budget for all measures.

— Indicative building renovation milestones for 2030, 2040, and 2050 indicating how they contribute to achieving the Union's energy efficiency targets.

— Information on the non-residential building stock (including figures on hospitals, schools).

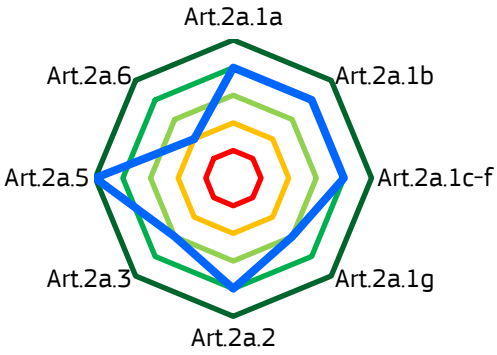
— Cost-benefits analysis in terms of jobs, energy cost savings, health and emission reductions and scenario analysis to investigate different policy/intervention options.

— Discussion and justification of assumptions used in the scenario analysis.

SLOVAKIA

1. EPBD Art.2a COMPLIANCE

Introduction: The SK LTRS was provided as a separate stand-alone document in January 2021, drafted by the Ministry of Transport and Construction, and it is composed of the main document and 6 Annexes, plus a report on the result of the public consultation. The document was available only in Slovak when assessed.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

Slovakia provided a very detailed overview of the national building stock (presented both in the main text and in the Annexes). It uses official data from several sources (e.g. 2011 Population and Housing Census, building Database of the Technical and Testing Institute for Construction up to 2003, the statistical survey on non-residential buildings on an annual basis up to 2016, EPC INFOREG information system). The residential sector is described in 2 segments: the single and the multifamily buildings (predominantly panel blocks), as this latter stock represents a large share in the overall building stock. The approach is correct and the segmentation appropriate as the available energy-related data (energy consumption by year of construction and by construction typology). Well-detailed information on the non-residential sector is also included. Data on the EPC issued for renovated buildings in 2010-2019 are also provided. More than 90% of occupied dwellings in Slovakia are privately owned.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	1 034 206	1 940 400	-	From 2011 census
	SFH	969 360	1 008 795	-	From 2011 census
	MFH	64 846	931 605	-	From 2011 census
Non resident	TOTAL	21 256	-	-	Schools, shops, healthcare, cultural, offices, accommodation, sport, other
	PUBLIC	15 435	-	-	
	OFFICES	2 556	-	-	State owned office only

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

The strategy provides an overview of the results achieved applying the 2013 and 2018 cost-optimal calculation. It is mentioned that 11 reference buildings and from 5 to 12 packages/variants of measures have been considered.

The results of the 2018 calculation of the cost-optimal level of minimum energy performance requirements for nearly zero-energy buildings are also provided (9 reference buildings considered), together with a list of cost-effective renovation measures divided by building categories.

Annex 6 presents a summary of the cost-optimal calculation methodology and the main results.

The need of intervention to solve non energy-related multi-apartment buildings (e.g., balconies and stairs failures) has been identified as a **trigger point** for energy major renovations.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	P	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Policies and measures put in place in Slovakia to stimulate deep renovation of buildings are well described and divided by buildings categories (e.g. multi-apartment, family houses, public and private non-residential). An analysis of the existing barriers to renovation has been conducted, and a list of measures, mainly financed by EU structural funds, have been identified; regulations, the strengthening of building requirements done in 2013 and 2016 and for 2019-2021 also apply for major renovations.

Worst-performing buildings have been identified: the buildings built before 1983, when a stricter thermal standard entered into force, is the least energy-efficient; the non-residential buildings are the most energy-intensive buildings from the whole building stock in Slovakia, with a particular reference to hospitals, schools (mainly primary schools) and school facilities and hotels.

Building passport: it is not foreseen for all the buildings, but carrying out energy audits in public buildings helps to identify renovation measures with the greatest potential for savings and partly fulfils the function of the building passport.

Split incentives: Given the high level of private ownership of apartments (in multi-apartment and family buildings) and the very low rental rate of real estate (about 6%), the Slovak Republic does not face the problem of split incentives flowing from the owner-tenant relationship.

The renovations of the non-residential building sector and **public buildings** have so far taken place at a slow pace. They were mostly financed from Structural Funds (ESIF) and private funds. The Eurostat guidance, adopted in May 2018, has some potential to support the extension of the application of guaranteed energy services in **public buildings**, but only the implementation of deep renovations in the sector has a real potential to prevent lock-in effects.

The Slovak Republic considers **energy poverty** as part of poverty itself: A number of measures have been adopted so far in this area (e.g., National framework strategy for promoting social inclusion and combating poverty, a "housing allowance" to cover part of the cost of housing, including energy).

Under the Construction Act, designers are obliged, within the technical functional and economic conditions of the construction, to design new buildings and renovate existing buildings, including **smart technologies** (e.g., automated control and monitoring systems, smart metering).

Skills and education measures are listed in the strategy: e.g., StavEdu, ingREeS and CraftEdu projects (training programmes for the various types of professionals involved in energy efficiency in buildings, including training on building **smart technologies**). Pilot projects for adult learning have been implemented under Horizon 2020 for new requirements resulting from the industrial revolution, e.g. requirements for nearly zero-energy houses. It is, therefore, necessary to use the knowledge and outputs of these pilot projects and training and implement them at the national level; change in 2015 in the education system to promote dual education (vocational education and on the job practical training) for a smooth transition from education to the labour market.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

The expected cumulative energy-savings have been estimated: 10 518 GWh in 2030, 18 368 GWh in 2040 and 19 006 in 2050.

Several wider benefits are identified and listed, but not quantified:

- Increase of the value of the property and improve the safety and the aesthetic of the dwellings/buildings;
- Increase the comfort and the health of the occupants: better air exchange, less mould issues);
- mitigation and adaptation to climate change effects;
- employment growth, improved economy.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4**

SK LTRS provides a clear building renovation roadmap, including 2030, 2040 and 2050 milestones, in terms of estimated CO_2 emission reduction (-61%, -74%, -87% vs 1990 emissions, respectively), estimated absolute energy consumption and estimated cumulative energy-savings in the building sector.

All buildings are expected to be renovated by 2050.

The model for establishing this roadmap is based on a number of assumptions, the most important of which are the following:

- Electricity and heat supply to be decarbonised by 50% by 2050;
- The level of carbon emissions in gas will be reduced by 25% by 2050;

— Renewable energy sources in buildings will grow; 10% every 5 years;

— The net impact of new buildings on emissions levels by 2050 will be zero.

The renovation scenario in line with the milestones set requires a significant shift from the implementation of partial building renovations (light and medium-sized forms of renovation) to deep renovations (including staged renovation) so that the share of deep renovations reaches 40% in 2050.

By 2030, more than half of the renovation of non-residential buildings should be renovated at a 'moderate renovation level', residential buildings should be renovated to deep renovation levels (reaching a share of 29% in 2030) and all renovated by 2041.

2030	• Decarbonisation: By 2030 5.5 $MtCO_2$ -61% vs 1990 levels • 100% multifamily buildings renovated by 2030 • Energy savings: by 2030: 39.9 TWh in the building sector [10 518 GWh: cumulative energy savings rate]
2040	• Decarbonisation: by 2040: 3.4 $MtCO_2$ -74% vs 1990 levels; • 100% single family buildings renovated by 2040 • Energy savings: by 2040: 33.6 TWh Energy consumption in the building sector
2050	• Decarbonisation: by 2050: Decarbonisation of the building stock 1.8 $MtCO_2$ (-87% vs 1990 levels; -79% vs 2020 emissions) • 40% share of deep renovations on total renovations by 2050 • Energy savings: by 2050: 28.3 TWh Energy consumption in the building sector [19 006 cumulative energy savings rate] 40% reduction energy consumption vs 2020 levels [18 368 GWh cumulative energy savings rate]

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	N	**3**
3b	**Reduction of the perceived risk for investors**	P	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	P	

The SK presents a detailed overview of the existing measures for the mobilisation of building renovation investments.

— Main **financial incentives:**

- Direct subsidies under the Housing Development Programme from the ministry for the modernisation/repair of multifamily buildings, in the form of a contribution to the insulation of a family house for natural persons who own family homes (contribution of € 8 000 and a further increase of € 800 under the law);
- Loans from the State Housing Development Fund (also including EE requirements); and
- The direct subsidies for individual houses.

— Complementary financial instruments:

- Mortgage lending, where State support is provided in the form of a State contribution to mortgage loans and a State contribution to mortgage loans for young citizens (contracts concluded until 31.12.2017) and a tax bonus (contracts concluded as of 1.1.2018) only to natural persons;
- A construction savings scheme with public support granted in the form of a State premium to building savings for natural persons and for housing and non-residential communities.

Since February 2019, in SK public authorities can conclude energy efficiency contracts for the **public sector** (pursuant to Act No 321/2014 on energy efficiency), for the renovation of public buildings, without increasing government debt, according to "the uniform methodology applicable to the European Union" (in line with Eurostat guidance). This allows the public authority to develop and finance projects through the mobilisation of private capital.

The use of **guaranteed energy services** is considered a promising tool to support the renovation of non-residential buildings and is expected to increase more widely in the short term. However, in order to carry out a deep renovation of a non-residential building in view of the longer payback period of such an investment, it is necessary to consider blending repayable and non-refundable **EU Structural Funds** and guaranteed energy services.

Preferential interest rate loans will continue to be the cornerstone of financing for building renovation projects over a long period (about 20 years). These loans, combined with a state subsidy and private equity, constitute a well-established and efficient renovation tool in the residential building segment.

In the **public buildings segment**, EU Structural Funds (both repayable and non-reimbursable) will continue to be the main source of funding, combined with the state budget and private capital from guaranteed energy services. The renovation of private non-residential buildings will be carried out mainly with the help of financial institutions and equity. The most appropriate way of using them is a combination of EU Structural Funds operating as guarantees and private resources of providers to enable deep renovation of the building.

Appropriate combinations of financing of repayable and non-repayable funds (EU structural funds) are used to **reduce the investors' perceived risk**.

Although aggregation of projects and one-stop-shops are not mentioned in the strategies, some energy advisory initiatives are described (e.g., public conferences/workshops, TV energy efficiency programme broadcast etc.).

Additional information

Summary results of the public consultation	Y	5
In the development of the strategy, several stakeholders have been directly involved (e.g. representatives of individual departments, civil associations active in the field of buildings (renewal or construction), representatives of research sites and professional associations and organisations, representatives of Slovak towns and municipalities, the general public). The renovation strategy also went through an interdepartmental and interdepartmental consultation procedure and public consultation via the publicly accessible web portal www.slov-lex.sk. The results of the consultation are presented in detail in an attached document that includes the main points raised by all the relevant stakeholders involved (45 entities) and how they have been taken into account.		

Implementation details of latest LTRS	P	2
A comprehensive description of the implementation of the 2017 LTRS is not provided in the strategy. However, some information (e.g. amount of subsidies and loans granted and related number of apartments renovated) on the status of the implementation of some key SK LTRS 2017 measures (e.g., Housing development programme, State Housing Development Fund) are provided in a specific section (#5) and in an Annex (#2).		

Fire safety and intense seismic activity risks (optional)	N
Fire safety requirements are just listed in reference to the choice of the proper thermal insulation materials. No reference to seismic risk is reported.	

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Slovakian 2020 LTRS addresses the majority of the EPBD requirements with a good level of detail. The document has a direct link to the adopted Integrated National Energy and Climate Plan for 2030 in the energy efficiency dimension (INEKP) and to the adopted Low Carbon Strategy for the Development of the Slovak Republic up to 2030 with an outlook for 2050.

It includes a comprehensive overview of the national building stock, covering both the residential and non-residential sectors; The strategy also identifies the main renovation barriers (e.g. lack of adequate skills, low rate of deep vs light/medium renovations, low quality of EPC) and provides an overview of the existing policies and measures (mainly regulatory, financial, informative and educational) to address them, with good use of EU structural funds. No information on one-stop-shops and Building passports are provided.

Strict and ambitious targets have been set, with particular reference to the residential sector: to renovate all multifamily buildings by 2030 and all single-family buildings by 2040. The objective for multifamily buildings (about half of total SK dwellings) seems to be achievable due to the high renovation rate observed, although the deep renovation share needs to be increased. More difficulties are encountered in the renovation of single-family houses and non–residential buildings.

Wider benefits have been identified and listed (e.g., job creation, improved economy, increased comfort and health), but not quantified.

In the development of the strategy, several stakeholders have been involved, and the results of the public consultation are reported in the strategy, while a comprehensive description of the implementation of the 2017 LTRS is not provided.

Level of details/ Appropriateness/ Comprehensiveness

The level of detail of the description of the building stock is good.

More details would be needed about the energy efficiency requirements linked to the financial incentive schemes and on the energy-savings associated with each measure.

Good practices

Regulatory measures:
The strengthening of building energy requirements done in 2013, 2016 and for 2019-2021 also apply for major renovations "where technically, functionally and economically feasible".

Tools and mechanisms to support the mobilisation of finance:
The use of **guaranteed energy services** is considered a promising tool to support the renovation of non-residential buildings and is expected to increase more widely in the short term; in order to carry out deep renovation of a non-residential building in view of the longer payback period of such an investment, it is necessary to consider blending repayable and non-refundable EU

Structural Funds and guaranteed energy service.

Good use of **EU Structural Funds** (both repayable and non-reimbursable), in combination with state subsidies and private capital to reduce the investors perceived risks.

Public sector:
Financing **public buildings** renovation using EU Structural Funds (both repayable and non-reimbursable), combined with the state budget and private capital from guaranteed energy services: "a combination of EU Structural Funds **operating as guarantees** and private resources of providers to enable the deep renovation" of non-residential buildings.

Tackling worst-performing buildings and energy poverty:
Energy poverty: a housing benefit allowance is intended to cover part of the cost of housing, including energy. The allowance is granted as part of a benefit in material need pursuant to Act No 417/2013. The housing allowance accounts for a significant part of the eligible income for the most deprived and amounts to € 55.80 per month in the case of a household with a single household member, or € 89.20 per month for a household with more than one household member, or for the rental of an apartment by more than one tenant.

Other measures:
Information/advice measures:

Conferences and workshops to inform managers of multi-apartment and non-residential buildings about legislative changes, new technologies, products, innovative construction practices and trends at established conferences dedicated to renovation and insulation. The conferences are organised with the active participation of the Ministry of Transport and Construction of the Slovak Republic, and participants include managers, interest and professional associations, manufacturers, firms carrying out construction works in connection with the renovation of buildings (e.g., thermal protection of buildings, comprehensive renovation of multi-apartment buildings, sustainability in architecture and construction). Expert workshops and symposia are organised regularly in the regions in order to induce managers of multi-apartment and non-residential premises about the right process in carrying out renovations from the initial design of the renovation project to quality implementation.

A television programme called "Energy" broadcast on a monthly basis on public service television is dedicated to energy efficiency, up-to-date information on improving energy performance and effectively provides the necessary information to owners in all areas related to renovation, maintenance and administration. The sessions are also archived and accessible after they have been broadcast on the public portal: Https://www.rtvs.sk/televizia/archiv/14113/205463.

Since 1998, the Ministry has launched an annual "Progressive, Affordable Housing" competition aimed at supporting the development of housing in Slovakia in the field of progressive and affordable housing, presenting positive examples of procurement and the construction of affordable housing.

Since 2010, the 'Best renovated multi-apartment building' competition has been launched every year, with an emphasis on a comprehensive approach to the renovation of a multi-apartment building, the results of which are announced at the Bratislava construction fair.

Strengths and Innovative approaches

Clear roadmap and monitoring of the achievements, in terms of buildings/dwellings renovated, as well as in terms of measures to put in place.

Detailed knowledge of the stock of multifamily dwellings and public buildings.

Good modelling, including the evolution of the renovation level needed in the years 2020-2050 and the estimate of the evolution of the investments needed for the renovation of the building stock, divided by sector (residential/non-residential). Good/robust modelling/scenarion analysis.

Good use of EU Structural Funds (and of the upcoming Recovery and Resilience Facility) to increase the magnitude of the programmes supporting renovations (i.e. the mobilisation of efforts to achieve ambition foresees the use of additional financial resources from the 2021-2027 Multiannual Financial Framework of EUR 750 million for residential buildings, EUR 367,5 million for public buildings. Other additional financial resources should be used from the Recovery and Resilience Facility (NextGenerationEU) within the policies set out in the Moderné Vision and successful Slovakia in the Green Economy Energy Efficiency strand, where the proposed resources are EUR 300 million for improving the energy efficiency of family houses, EUR 130 million for the renovation of historical and monumentally protected public buildings and EUR 200 million for improving the EHB of public buildings).

Recommendations

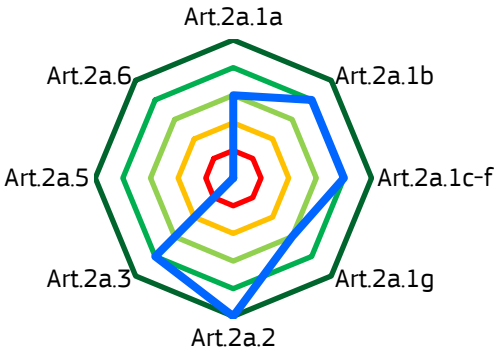
More details on the following aspects could be provided:

- Information on one-stop-shops and Building passports;
- The introduction of one-stop-shops can be a key factor to improve the share of deep renovation; it could be useful to review what offers exist on the market about energy renovations, and particularly to identify whether there are already stakeholders able to offer the coordination of deep/comprehensive renovations;
- Building Energy Performance Certificates (EPC) could be improved and specific measures to address this issue should be put in place, together with the development of reliable building passports.

SLOVENIA

1. EPBD Art.2a COMPLIANCE

Introduction: The long-term energy renovation strategy for 2050 defines the approaches and policies for decarbonising the national building stock by 2050 and lists the measures supporting the building headline targets set in the NECPs. The Slovenian LTRS was submitted as a separate document, not as part of the NECPs, but it is linked to the overall targets set in the NECPs.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**3**

A limited but correct segmentation of the building stock is provided with floor area data for each sector/building type. No specific data on age/construction year and very generic or limited information on other dimensions (ownership, climatic zones, etc.). Instead, the section on government-owned buildings is accurate and detailed, with a comprehensive and updated inventory reported in Annex B.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	-	63 737 000	
	SFH	-	-	46 823 000	One apartment buildings
	MFH	-	-	16 914 000	Multi-apartment buildings
Non resident	TOTAL	-	-	23 400 000	
	PUBLIC	-	-	9 707 000	
	OFFICES	-	-	5 730 000	Only private administrative and office buildings

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4**

Detailed analysis is provided in Annex C. A number of different renovation options were analysed and evaluated. A discussion on trigger points is also provided.

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	P	

A building renovation passport is foreseen, even if not described in detail. This is one key measure to promote integrated building renovation. A specific section on energy poverty is provided, where the worst-performing buildings are identified, as well as measures to tackle energy poverty. The actions on the public building are especially detailed. Initiatives to promote smart technologies are also indicated. Less information on skills and education is available.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	P	**3**

Energy-savings, as well as other objectives, are calculated as a result of analyses and models (also used for NECPs) developed in the context of the LIFE Climate Road 2050 project. A reference to an explanatory Report from IJS-CEU, ("Summary of scenario analysis for deciding on Slovenia's long-term climate strategy to 2050, Report No C3.2 of LIFE Climate Action 2050,

IJS-DP-13286") published in 2020 is indicated. However, a clearer explanation of the model used would help in the interpretation of the results. Wider benefits are listed. They include economic benefits (including employment); real estate value; societal (reduced energy poverty); Incentives for R&D, industrial competitiveness and increased exports, health, improved comfort and higher productivity, environmental benefits (reduced air pollution). In some cases (e.g., employment impact), generic references to scientific articles are reported. Only in the case of reduced air pollution, detailed estimates are provided.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**5**
Very detailed indication of targets and milestones for 2030-2040-2050 for different segments of the building sector is provided. The indicators cover a wide range of aspects from CO_2 emissions reduction to energy-savings and renovated building stock.			
2030	• Overall 70% reduction GHG emissions; 2/3 of energy use in buildings from RES • Residential Sector: a) Energy end-use [PJ] 32.62; Reduction 25% (compared to 2020) b) CO_2 emissions [MT] 1 349; Reduction 45 % c) Single-dwelling buildings [1.000 m^2]: Partial refurbishment 1 558; Medium refurbishment 3 598.8; Comprehensive refurbishment • Public Sector: a)Energy end-use savings: 0.52 PJ; reduction 7% (compared to 2020) b)CO_2 savings: 59.7 Kt; reduction 57%		
2040	• Residential: a) Energy end-use [PJ] 27.45; Reduction 37% (compared to 2020) b) CO_2 emissions [MT] 0.875; Reduction 64% • Public Sector: a) Energy end-use savings: 0.39 PJ; reduction 6% • b) CO_2 savings: 87.2 Kt; reduction 73%		
2050	• 75% reduction CO_2 emissions • 74% of single dwellings 91% of multi-apartment buildings renovated • 45% reduction in final energy consumption Residential: a) Energy end-use [PJ] 26.03; Reduction 40% b) CO_2 emissions [Mt] 0.745; Reduction 70% • Public Sector: a) Energy end-use savings: -0.02 PJ; reduction 0% b) CO_2 savings: 96.9 Kt; reduction 92%		

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	P	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	
Information on the budgetary resources allocated is detailed for the period 2021-2030. However, little information is available on the aggregation of projects. One-stop-shops not explicitly mentioned, but similar advisory offices are foreseen as one key measure, specific for private/residential sector and for public buildings.			

Additional information

Summary results of the public consultation	N	**0**
Not indicated in the text if a public consultation on LTRS was performed.		

Implementation details of latest LTRS	N	**0**

Fire safety and intense seismic activity risks (optional)	Y	**4**
Detailed information provided: safety and energy efficiency are viewed in an integrated way in building renovation.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Slovenian long term building renovation strategy provides a good description of the building stock. A detailed analysis of the barriers to investment in energy efficiency building is also provided, together with the description of a comprehensive package of measures supporting the renovation of residential and non-residential / public buildings. A very detailed set of targets and milestones are identified (for 2030-2040-2050). The investment foreseen is detailed in the short- to the mid-term (2023-2030), but could and should be extended to 2050 (at least with some assumptions), given the ambitions of the 2050 building stock decarbonisation. Additional details on the methodology used to calculate targets/investments needs/etc. are needed to assess the robustness and plausibility of the results.

Level of details/ Appropriateness/ Comprehensiveness

The level of details is generally good, especially for the targets/milestones. However, more details are needed on the individual PAMs (implementation period, financial coverage, identification and quantification of objectives, expected results and contribution to the overall target.

Good practices

Regulatory measures:
Building Passport: This legislation will legally oblige co-owners of multi-apartment buildings to have a building passport. The components of this document are:

- Part 1: Analysis of energy efficiency
- Part 2: Fire safety analysis
- Part 3: Seismic risk analysis

Tools and mechanisms to support the mobilisation of finance:
n/a

Public sector:
n/a

Tackling worst-performing buildings and energy poverty:
Household energy efficiency aid scheme for vulnerable population groups: a broad set of measures and actions to mitigate energy poverty. It comprises short term interventions (renovation of 500 low-income households) with long term ones (inclusion of energy poverty provisions in all relevant building legislation).

Other measures:
n/a

Strengths and Innovative approaches

The Slovenian long term building renovation strategy sets a clear and detailed set of targets and milestones. That will be extremely useful to monitor the implementation and achievements of the targets. The innovativeness of the approach consists of the focus on integrated building renovation (including safety, seismic risk, etc.) as well as a wider perspective on sustainability over the entire life cycle of the buildings. These aspects, however, still needs to be further developed and consolidated into concrete actions and indicators.

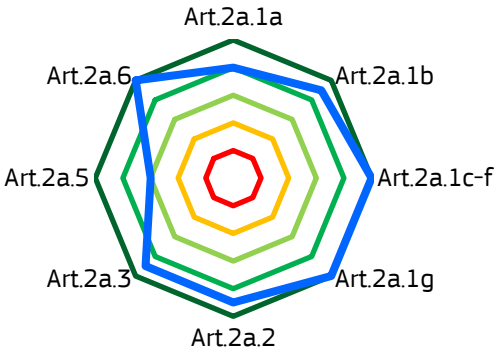
Recommendations

- More information on the individual measures.
- The models used in the calculations can also be better specified, to assess the plausibility/robustness of the results.

SPAIN

1. EPBD Art.2a COMPLIANCE

Introduction: The Spanish LTRS was submitted as a separate document after the NECP. It complements the NECP as the information on Art. 2a EPBD was not reported there. The LTRS goes beyond the expected minimum requirements under the EPBD as it indicates comprehensive efforts and measures undertaken at the national and local levels. All sections are covered, and it took into accounts comments and recommendations on previous versions.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	**4**

The LTRS provides an update of the national building stock. As new Census data will be available in 2021, the 2020 LTRS, differently from the previous strategies, relies on data extracted from the 2018 INE's Household Survey (ECH). The 2018 Survey of Living Conditions (INE) and the European Commission's report on Households, and the European Commission Ageing Report for 2018-2033 have also been used as complementary sources. Detailed information is provided on all relevant aspects. Data sources are clearly reported. Data on the tertiary sector are rich and detailed. Data on floor area or energy consumption of buildings (e.g., energy classes for residential and tertiary sectors) are not reported or not disaggregated. In addition, as multiple data sources are used (and different from the Census data used in 2016), issues of consistency and comparability arise. See entire Chapter 1 of the LTRS.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	-	18 535 900	-	
	SFH	-	5 902 100	-	
	MFH	-	12 633 800	-	
Non resident	TOTAL	12 280 309	-	2 229 342 000	
	PUBLIC	-	-	-	
	OFFICES	295 224	-	117 293 000	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	**4.5**

Cost-effective approaches to renovation has been indicated and analysed in depth. Chapter 7 and 8 are dedicated to specific "menus" of interventions in the residential and tertiary sectors, respectively. It is unclear, however, where trigger points are identified. They are apparently intended in the LTRS mainly as "compulsory" interventions (structural, compulsory maintenance, etc.) linked to "voluntary renovations" (energy efficiency). Some measures (both on the regulatory and financial sides) are under study and consideration to promote synergies and linkages among the two types of intervention

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**5**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	Y	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

Almost all the aspects are treated in the LTRS:

1. **Building renovation passport**, even if not yet formally introduced into a regulatory act, has been analysed in a feasibility study that indicates clear guidelines for policymakers. The passport is indicated as the main tool to support staged deep renovation;

2. Excellent overview of the strategy and actions to mitigate **energy poverty**. Analysis of energy poverty, its social implications and linkages with economic vulnerability.

Specific focus on interventions and renovation approaches dedicated to buildings occupied by vulnerable citizens (in relation to energy poverty) is detailed. Technical details are provided in Annex A.5. The four points are addressed in a structured and articulated strategy, with clear objectives and milestones. An overview of the building stock in the **public sector** is indicated, as well as policies and actions on public buildings (Chapter 10). Explicit and detailed reference is made to **smart technologies,** and specific information on the **education programs** (mainly university courses) is provided.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**5**

Chapter 9 of the LTRS is entirely dedicated to calculating estimated energy-savings and wider benefits. Scenario analysis with different types of interventions is proposed with clear indications of the assumptions and model used. For macroeconomic impacts of the base scenario, the model "Denio" is used (details in Annex A.7); these impacts include GDP, employment, public and private savings, and redistributive effects. Wider benefits are also discussed and quantified with specific reference to indoor air quality and health.

2	**Roadmap including measurable progress indicators and indicative milestones**	Y	**4.5**

Indicative expected results are reported for 2030, 2040 and 2050 based on the estimates of alternative scenarios (Chapter 9). A comparison with the NECP target is indicated as well as an estimate of the emission reductions (cumulative 2020-2050 emission reduction of 14 613 937 t of CO_2eq for the residential sector). Estimates are provided for both the residential and tertiary sectors. Chapter 11 indicates the milestones in the framework of the NECP targets: they are reported in terms of final energy consumption and CO_2 emission reductions (see sub chapter 11.2). A matrix of progress indicators (subchapter 11.3) is specified for the residential sector, tertiary sector, public buildings. Specific indicators are defined for public investments, for energy poverty (linked to the National Strategy for Energy Poverty) and for public R&D investments in the building sector.

2030	• 1.2 million homes (out of 18.7 million primary residence homes) to be renovated by 2030
2040	• 215 875 GWh final energy consumption: 124.172 (residential) + 91.703 (tertiary); 21 853 Energy savings (GWh) final energy, target scenario - Cumulative 2030-2040 in residential sector
2050	• Energy savings of 64 154 GWh (cumulative for 2020-2050) • For residential buildings, a 37% reduction in energy use and 99% reduction in CO_2 emissions by 2050 compared to 2020 • For residential buildings, consumption from heating to be less than 55% by 2050 against 2020 levels. • 7.1 million houses are expected to undergo deep renovation by 2050, lowering their annual consumption by 12 kWh/m^2 per building • The stock of new buildings between 2020 and 2050 is projected to stand at 3.9 million houses, all of them being nearly zero-energy buildings • By 2050 reduction in energy use: Non-residential 33%, Residential: 70%

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	**4.5**
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

Appropriate mechanisms are indicated for **aggregation of projects** (e.g., the H2020 project AUNA, recently started - created a platform /forum for financial actors with the aim of developing smart finance solutions including project aggregation and perceived risk reduction strategies. It is proposed to continue working on the possibility of creating a **guarantee system** or a "Limited Guarantee Fund" to cover possible defaults on loans from private financial institutions. Law 8/2013 introduced different possibilities for the **public sector** to complement the financing of renovation and urban renewal (reinvestments of town-planning gains by changes of use or increases of construction, rent of roofs for installation of solar panels, etc.), which are implemented at the local level. Spain counts on a developed and diffused network of **one-stop-shops** ("ventanillas unicas") services managed at the local and regional level, which offers a variety of integrated services (including financial and technical advice) to citizens.

Additional information

Summary results of the public consultation	Y	3
The public participation process for the review of the LTRS was led by the Ministry of Transport, Mobility and Urban Agenda (MITMA), and took place between September and December 2019, with the participation of GBCe as coordinator of the seminars and facilitator. The description of the public consultation process and methodology is reported in Annex C. Reference to other publicly available sources for further details is also provided: https://gbce.es/eresee-2020.		

Implementation details of latest LTRS	Y	5
All implementation measures (articulated in 9 main areas) are reported in Chapter 10. They are mainly in the planning phase. A catalogue and following-up of existing measures is instead indicated in Chapter 4. Great details are reported even if, for most of the measures, there is not a quantification of impacts, objectives and financial resources.		

Fire safety and intense seismic activity risks (optional)	Y	4
This information is reported with details. Recent technical and legislative developments are reported for both fire risk and safety and for seismic activity.		

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Spanish LTRS builds, in continuity with previous strategies, a comprehensive and well-structured strategy, which covers all the aspects required by EU legislation. It provides all necessary information and details in a transparent way.

It sets ambitious but still achievable objectives and targets. The document indicates a relevant number of ongoing initiatives and design a coherent and articulated implementation plan. Resources seem appropriate with a combination of public and private investments. The strategy interacts in a synergic way with other plans, strategies and frameworks at different levels (e.g., Urban Renewal Plans, National Strategy Against Energy Poverty). The possible improvement relates to quantifying the impact of individual measures toward the targets to better monitor the progress and achievements.

Level of details/ Appropriateness/ Comprehensiveness

The strategy gives detailed information on all the relevant points of the strategy, including model results, description. The strategy is a well-structured, complete and comprehensive strategic document and it is appropriate for its purpose.

Good practices

Regulatory measures:

1. Building Energy Assessment Report (already in place) to be combined with Building Passport (not yet implemented), this is already creating synergies between interventions on the building, making information clearer and more transparent for all different stakeholders and making it possible to group interventions and prepare a roadmap of staged renovations.
2. Regulatory developments on self-consumption and energy communities made bottom-up initiatives more relevant and went in the direction of empowering and engaging citizens to be the protagonist of the energy transition.

Tools and mechanisms to support the mobilisation of finance:

1. Though not particularly innovative, the PAREER II Program for Financing Energy Retrofit of Existing Buildings has been proven as an effective instrument. It includes clear and strong requirements (the actions subject to public financing must improve the total energy rating of the building by at least 1 letter/energy class measured on the EPC scale of CO_2 emissions (kg CO_2/m^2 year); extra financing will be granted to actions that reach energy class "A" or "B", or that increase the initial energy rating of the existing building by more than two letters in the EPC scale.
   Focused on the renovation: € 240 000 000, centrally managed by IDAE, for financing EE in Existing Buildings, it allows combining grants and loans.
2. The implementation of the ESCO scheme (successful example of EOS Energy packages - see box 29 p.129-130) and the capitalisation of energy-savings in large-scale projects such as the district-level action (part of the European FP7 CityFied Project - coordinated by the Cartiff Foundation) in Valladolid Torrelago, Laguna del Duero. In the latter, an entire district has been renovated (building envelopes, district heating, and renewables) with a mix of public and private investments directly managed by the building company and the ESCO (see box 30, p.131).

Public sector:

n/a

Tackling worst-performing buildings and energy poverty:

Probably the most relevant new measure in the LTRS strategy is the National Strategy against Energy Poverty, a coherent and structured set of measures targeted at the worst-performing buildings and the most vulnerable households. A set of clear

targets is indicated.

Other measures:
n/a

Strengths and Innovative approaches

The specific attention given to the topic of energy poverty and the solutions proposed deserves mention as a point of strength of the LTRS.

The involvement of local authorities is also an important strength, as well as the smart use and direct application of H2020 research projects (e.g., EuroPACE; AUNA) or other European projects (e.g. Build Upon, FP7 CityFied Project). The strategy interacts and deploys synergies with other relevant plans, not only the NECP, but also Urban Renovation Plans, policies for social inclusion, etc.

Recommendations

The following aspects could be improved in the next revision of the strategy:

- Quantification of the impacts of the individual policies and measures.
- Further elaboration on milestones and intermediate targets to better monitoring the progress.
- Exploit synergies and improve cooperation at different policy levels.

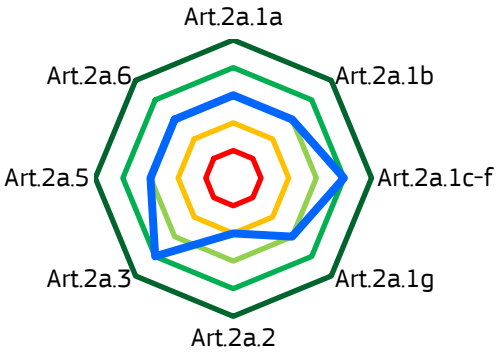
SWEDEN

1. EPBD Art.2a COMPLIANCE

Introduction: The Swedish LTRS was not part of the NECP of the latest year and was submitted in March 2020 as a separate document. Overall the SE LTRS is a fairly complete assessment being an evolution from the previous strategies.

The stand-alone document is structured by respecting the reporting guidelines, with an overview of the building stock and renovation needs and rates, a chapter on instruments and measures, other concerning the promotion of investments and taxation issues and a roadmap for the renovation of the building stock.

The annexes of the document are comprised of an overview of the implementation of the previous strategy, the report on the public consultation of the strategy and finally, an indication of the methodology used for the creation of the three renovation scenarios.



Legend: Y=Yes; N=No; P=Partly; U=Unclear

Clause	Requirement	Score (1-5)	
1a	**National Building Stock, and expected share of renovated building**	Y	3

The overview of the building stock presented in the Swedish Long Term Renovation Strategy is barely sufficient. It gives out information in critical areas, but it somehow lacks homogeneity within the document with data from different years, not clear indication of energy consumptions (only heat) and with different sources of data being presented.

The LTRS presents the number of buildings divided by Housing, Industry, Social function, Business, Agricultural buildings, complementary buildings and other buildings. It does not make a division regarding energy consumption, energy classes or ages under this disaggregation.

It gives out a general description of the energy consumption for heating and hot water, GHG emissions and energy classes per house, apartment building and non-residential premise.

As regards the current share of renovated buildings, a study (by the Rise Research Institutes of Sweden AB) on the potential renovation rates considering the age of the buildings is referred. It states that there is a 'renovation deficit' amongst Swedish apartment buildings.

		No. of buildings	No. of dwellings	Floor area (m^2)	Notes and sources
Residential	TOTAL	3 016 677	-	-	
	SFH	2 805 510	-	302 000 000	Around 93% of residential buildings; 302 million heated area of houses in 2016
	MFH	150 834	-	-	Around 5% of residential buildings, 27% of them owned by public housing sector)
Non resident	TOTAL	5 140 726	176 000 000	-	Industrial, social, business, agriculture, complementary and other buildings.
	PUBLIC	-	-	-	
	OFFICES	-	-	-	

1b	**Cost-effective approaches to renovations and trigger points identification**	Y	3

A systematic approach to identifying renovation needs and measures to improve the energy efficiency of apartment buildings is described: The Rekorderlig Renovering (Reliable Renovation) method is based on the principle of "measure-for-measure" and takes into account the financial circumstances of the property owner when determining cost-effective measures. This method has been applied in the Halvera Mera campaign, carrying out more than 60 apartment building renovation projects. The cost-effective energy efficiency measures in the packages calculated for the buildings in the study are presented in the strategy; The most numerous measures are technical measures such as the installation of an exhaust heat pump (FVP) or ventilation with heat recovery (FTX), measures aimed at the building envelope, adjustment and replacement of thermostatic valves, and measures relating to control and regulation systems. An analysis of the studies shows that properties with a high

annual energy consumption per square meter are more likely to be able to identify cost-effective measures relating to the building envelope, such as the replacement of windows or the additional insulation of attics and façades.

Trigger points are mentioned, e.g., non-energy building major renovations, change of property/tenancy, need to improve the indoor environment (chapter 3.2).

1c	**Policies and actions on deep renovations, including building renovation passports**	Y	**4**
1d	**Policies and actions to target worst-performing buildings, split incentive, market failures, and energy poverty**	P	
1e	**Policies and action on public buildings**	Y	
1f	**National initiatives to promote smart technologies and skills and education**	Y	

The LTRS outlines a set of measures that promote energy efficiency improvements in chapter 3. This is mainly a descriptive exercise without major information on the potential impact of such measures and the proposed timelines and budget. It is, however, a good evolution from both previous LTRS and NEEAP/NECP measures descriptions.

Regarding the **worst-performing buildings**, there is a mention of a new legal framework mentioning that (from 2021) the installation of individual meters will be mandatory, which may help boost the renovation of worst-performing buildings.

The LTRS does not address **renovation passports**.

Regarding **Energy Poverty**, Sweden does not consider energy poverty, but poverty in general. An overview of some initiatives to tackle the split incentive dilemma is given.

Chapter 3.7 gives out strategies regarding **public buildings**, namely the implementation of Environmental Management Systems, green procurement, the Energy Efficiency Council, the public properties Collaboration fund and Municipal Energy Planning.

Also, regarding **Public Buildings**, there are several measures outlined like green loans or state aids for schools refurbishments.

On **Smart technologies**, the SE LTRS outlines several research programmes that investigate the introduction of such technologies within buildings and cities.

1g	**Evidence-based estimate of expected energy-savings and wider benefits**	Y	**3**

In chapter 5 there are presented some scenarios with expected energy-savings and other benefits like the reduction of purchased electricity and heat for heating and hot water.

Chapter "5.2 Effects of energy efficiency improvements in a broader sense" list some of the potential benefits which can be positive effects that benefit residents but they do not pay and side effects in terms of external effects, which are impacts which are not priced or internalised in current market prices, and which represent an increased benefit or cost for third parties, in this case society at large.

A 2017 study is cited -"Anthesis Enveco's report Omvärldsbevakning – mervärden av energieffektivisering [External monitoring - added value of energy efficiency improvements] - but no quantification of wider benefits are outlined.

2	**Roadmap including measurable progress indicators and indicative milestones**	P	**2**

The strategy outlines building renovation generic milestones for 2030, 2040 and 2050. The indicators outlined are:

- Lower energy consumption per m^2 and building type than in the previous decade;
- A higher proportion of buildings in A-C and lower proportion of buildings in E-G than in the previous decade
- Fossil share of end energy use amongst the building stock;

From the information available in the LTRS, it is not possible to assess with all confidence whether the measures and the milestones proposed are achievable. There is a lack of quantification that can be used in future evaluations in terms of monitoring indicators.

2030	• 2030: fossil share of building stock end-use energy is 1%
2040	• 2040: 0% fossil share of end-energy use amongst the building stock
2050	• Every 10 years, the proportion of buildings in the A-C EPC class should be higher than in the previous reference year, and the proportion of buildings in the E-F EPC class should be lower than in the previous reference year. • Buildings built in the 1950s will be renovated in the next 20 years, buildings built from 1961-1975 will be renovated in the next 10 years. Other buildings have a renovation cycle of 40 years, meaning that buildings built after 1981 will start being renovated after 2020 • Expected energy savings by 2050 are around 10-15% (e.g. from 162 kWh/m^2/y in 2016 to 137 kWh/m^2/y in 2050)

To support investments mobilisation, facilitate access to appropriate mechanisms for:			
3a	**The aggregation of projects, and packaged solutions**	Y	**4**
3b	**Reduction of the perceived risk for investors**	Y	
3c	**Use of public funds to leverage private-sector investment or address specific market failures**	Y	
3d	**Guiding investments into an energy-efficient public building stock**	Y	
3e	**Accessible and transparent advisory tools (e.g., one-stop-shops)**	Y	

Chapter 4 of the LTRS addresses the provisions of Article 2a by outlining the efforts being made in the country regarding the mobilisation of investments to promote market introduction, technological development and innovation clusters, outlines risk mitigation measures for investors, the use of public funds to stimulate the private sector, guide the investments towards energy-efficient public buildings and shines a light on the existing advisory tools. A description of the instruments is given with the institutions responsible for the management of the programmes. Some of the tools being offered include Green Bonds, tax deductions for renovation, green loans, and state aid for the refurbishment of schools, for example.

Information on energy and climate advice are also big measures that have been being implemented for some time, like the Information Centre for Sustainable Construction of the Municipal Energy and Climate Advice.

Additional information

Summary results of the public consultation	Y	3

In Annex 2, the LTRS presents in detail the process of public consultation on the third strategy for energy-efficient renovation, carried out by the Swedish National Board of Housing, Building and Planning and the Swedish Energy Agency.

Implementation details of latest LTRS	Y	3

Annex 1 of the LTRS presents an overview of the implementation of the previous strategy; the status of implementation (ended/ongoing/dormant) of 2017 LTRS 8 instrument/measures are reported.

Fire safety and intense seismic activity risks (optional)	N

2. General assessment: Ambitions, strengths, and weaknesses

Summary

The Swedish Long Term Renovation Strategy is a well-structured document that respects the general guidelines of reporting of the LTRS. Overall, the strategy checks almost all the marks regarding the minimum reporting requirements and is a good evolution from the previous strategies from 2014 and 2017. This time, the LTRS is presented as a stand-alone document and presents a more holistic approach to the building renovation sphere. However, losing some of the elements that were presented before, like the quantification of energy-savings and the cost-effectiveness associated with measures, in a general way this is a good step forward on the country's framework policies in the buildings sector.

The measures presented in the strategy are a continuation of previously established measures plus the addition of others since the last reporting. Generally, the measures presented in the LTRS along with the ones outlined in the NECP, give good coverage of energy efficiency measures in the buildings' ecosystem besides the traditional umbrella energy and carbon tax.

Some points to be improved could be the definition of a strategy to tackle energy poverty and worst-performing buildings since these are barely mentioned.

Level of details/ Appropriateness/ Comprehensiveness

The description of the building stock could be more comprehensive and have the different types of buildings sub-divided per category, age and give an overview of the energy consumption for all the energy carriers.

The policies and measures outlined actions and planned measures cover a broad range of policy instruments: Regulatory, voluntary, economic, fiscal and awareness-raising.

The quantification of each of the measures proposed in Chapters 3 (technical measures) and 4 (financial measures) could be more developed. Budget information, responsible entities, and the energy-savings impact of the measures are not always indicated and could be useful to assess whether these measures may be enough to achieve the proposed targets.

Good practices:

Regulatory measures:
Energy Performance Certificate Act obliges that for every "transaction", an Energy declaration should be emitted. Energy Performance Certificates are widely used throughout the country and are expected to increase in the coming years. With an

increase in renovations due to the age of the buildings, EPCs are a tool that serves as an indicator of the renovation rate of the Swedish Building stock.

Other regulatory measures outlined in the NECP that suit the LTRS purposes are the National Board of Housing, Building and Planning Building Regulations (BBR), the use of Environmental management systems in central government and green procurement by the purchases of energy-efficient products, services and buildings by authorities.

Tools and mechanisms to support the mobilisation of finance:
Some of the interesting tools being used to support the renovations through finance are the Urban Environment Agreement, The Offentliga fastigheter Collaboration Fund, Green Bonds and the Tax deductions for ROT (Repairs, Conversions and Extensions).

Public sector:
The Offentliga fastigheter Collaboration Fund (Public Properties) is one of the most noteworthy initiatives to be identified. It is a collaboration fund between the Swedish Association of Local Authorities and Regions and state property managers. At the present time, there are a number of energy-related focus areas, such as the lighting in public premises, renovation involving energy efficiency measures, energy-efficient schools, and low-energy construction in the state, municipality and county council sectors.

Another initiative was the State aid for the refurbishment of school premises: during the period 2015-2018, it was possible to apply for a state grant for the refurbishment of school premises in order to improve the learning and working environment and reduce the impact on the environment.

Tackling worst-performing buildings and energy poverty:
Energy poverty and social housing are not tackled in the LTRS.

Chapter 3.3 mentions a legislative change that may lead to apartment buildings with the worst energy performance being renovated and upgraded in terms of their energy efficiency due to the installation of individual meters. However, this measure is not explained in detail.

Other measures:
n/a

Strengths and Innovative approaches

The use of fiscal measures is the stand-out measure that has always been present in Swedish Energy Efficiency Policies. The use of green bonds and green leases are some of the most interesting ones that are now in place and that have been presented for the first time in this LTRS, even if having started during the previous reporting periods.

Recommendations

The following aspects could be improved in the next revision of the strategy:

- Uptake of NZEBs
- Although Sweden only considers poverty issues in general and not energy poverty as an issue, it would be interesting to see the country's strategy on this subject.
- Quantification of the expected impact of all the measures. This way, it would be possible to monitor and verify the progress being made in order to assess the targets and measures suitability.

ANNEX C – EPBD Art.2a notifications' evaluation template

Compliance and general assessment

			2020 LTRS		
		Country	Member State name		
		Introduction and Document Information (Is the full LTRS submitted as part of the final NECP?)			
			EPBD Art.2a Compliance	Comment/details	Score (0-5)
Section 1 - Art.2a.1		Overview of the National Building Stock, including expected share of renovated buildings in 2020 - Art 2a.1a	Yes/no/partly		
		Cost-effectiveness approaches of renovations, **including trigger points identification** - Art.2a.1b	Yes/no/partly		
		Policies and actions on deep renovations of building, including staged deep renovation and building renovation passports - Art.2a.1c	Yes/no/partly		
		Policies and action on worst-performing buildings and **energy poverty** - Art.2a.1d Overview of: a) worst performing segment of the national building stock b) split-incentive dilemma; c) market failures; d) alleviation of energy poverty	Yes/no/partly		
		Policies and action on public buildings - Art.2a.1e	Yes/no/partly		
		Overview of national initiatives to promote (Art.2a.1f): a) smart technologies and b) skills and education in the construction and energy efficiency sector	Yes/no/partly		
		Evidence-based estimate of expected energy savings and wider benefits - Art.2a.1g	Yes/no/partly		
Section 2 - Roadmap including measurable progress indicators and indicative milestones - Art.2a.2		Are there indicative building renovation milestones determined for 2030, 2040, and 2050? How they contribute to achieving the Union's energy efficiency targets? Are there progress indicators determined? (e.g. energy saving, CO2 emission reduction, number or % of building retrofitted, number or % of NZEB, etc.)?	Yes/no/partly		
Section 3 - Mobilisation of investments; Member States shall facilitate access to appropriate mechanisms for:		the aggregation of projects, to enable investor access as well as packaged solutions for potential clients - Art.2a.3a	Yes/no/partly		
		the reduction of the perceived risk - Art.2a.3b	Yes/no/partly		
		the use of public funding to leverage additional private-sector investment or address specific market failures;- Art.2a.3c	Yes/no/partly		
		guiding investments into an energy efficient public building stock, in line with Eurostat guidance - Art.2a.3d	Yes/no/partly		
		accessible and transparent advisory tools, such as one-stop-shops for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments - Art.2a.3e	Yes/no/partly		
Section 5 - Public consultation (LTRS Annex 1)		Each MS shall carry out a public consultation on its LTRS prior to submitting it to the EC: Is a summary of the results of its public consultation included as an Annex? - Art.2a.5	Yes/no/partly		
Section 6 - 2017 LTRS monitoring (LTRS Annex 2)		Each MS shall annex the details on the implementation of its 2017 LTRS, including the planned policies and actions - Art.2a.6	Yes/no/partly		
Section 7 - Safety issues		Each MS **MAY** use its LTRS to address fire safety and risks related to intense seismic activity; Are these optional information reported?- Art.2a.7	Yes/no/partly		
Summary					
level of details/ Appropriateness/ Comprehensiveness					
Good practices (e.g. measures with high impact, high efficiency (results/public expenditure), energy poverty, educational/healthcare buildings)	Regulatory measures (e.g. mandatory renovation works, Energy Performance Certificates, NZEB,				
	Tools and mechanism to support the mobilisation of finance (e.g. Innovative grants, tax incentives, EPC, Adapted VAT rates, green loans etc) See a full catalogue in the				
	Public sector as a model for energy efficient renovation (**with a focus on Schools, Hospitals and defence sector**)				
	Tackling worst-performing buildings and energy poverty and Fostering energy-efficient renovation of social housing				
	Other measures				
Strengths and Innovative approaches					
Recommendations					

ANNEX D – Policies and measures to address energy poverty identified in the 2020 LTRS

MS	Building-related policies and measures on energy poverty included in the LTRS
Austria	Leverage factor with EEO scheme (1.5) attributed to energy savings achieved with energy poor households. Various information and support schemes operating at regional and local level.
Belgium Brussels	'Measure "Strengthening the exemplary nature of the public authorities": action 2 - Improving the energy performance of social housing buildings: Any major renovation — carried out by a social housing company (SIISP) or the SLRB — must make it possible to meet the final target set for the type to which the building belongs (in accordance with Module 6 'Energy performance requirements and obligations'). Measure "Revise the energy bonus mechanism" in order to include vulnerable households; Measure "Revision of the Brussels green loan" foresee a 0 % loan rate for a vulnerable target audience; Measure "Set up a single entry point to accompany the individuals" - free information/coaching support is available to vulnerable households (for example through 'pro deo' architects); Measure "Collect data and develop indicators" - More accurate data on vulnerable and vulnerable households, and in particular on precarious owners
Belgium Flanders	An "Emergency fund" was set up for certain target groups who do not have sufficient financial resources to make their home energy-efficient (Decree of the Flemish Government of 17 May 2019). An interest-free loan with deferred repayment amounting to up to EUR 25 000 can be granted to the buyers in duress, poor owners who purchase poor quality housing from necessity. Only when the dwelling is sold, or at the latest after 20 years, must the loan be repaid. A first call (EUR 15.5 million, providing 625 loans) was launched by the Minister for Energy at the beginning of 2020. Vulnerable groups qualify for a free energy scan of their homes; over 20 000 such scans are being carried out every year. The rental and insulation premium (previously known as Social Energy Efficiency Projects) for dwellings inhabited by vulnerable private tenants. In addition to a flat-rate contribution of EUR 200, which the project promoter receives per work carried out for the use of route guidance, the owner — lessor receives: EUR 20 per m 2 mounted roof or roof insulation; EUR 12 per m^2 cavity wall insulated; EUR 85 per m^2 of high efficiency glazing. The Flemish energy loan. Interest-free energy loan for the priority target group: EUR 15 000 and duration of 10 years. Since 2010, 21.000 energy loans have been granted for a total of EUR 175 million. Increased energy premiums for protected customers (beneficiaries of the social price caps). The Flemish Region provides financial support to all those who invest in energy saving in the form of a premium paid by the distribution system operator. For protected customers, who usually have much less financial resources, the regulation provides for increased amounts for energy contributions (e.g. 50 % increase in energy premiums). From the Flemish Climate Fund, EUR 20 million was foreseen every year in the period 2016-2019 to further invest in the energy renovation of social rented housing. In 2018, a total of EUR 16 million was added to the energy renovation of social rented housing. These funds are used to subsidise energy measures in the renovation and replacement construction of existing dwellings, such as the installation of high-efficiency glass, insulation outer skin and technical provisions including heat pump, condensing boilers or solar water heaters. Energy scan for free. An adviser in the home is looking for energy savings. The residents receive energy-saving tips that can be applied at the outset. Where useful, the energy scanner places free energy saving materials (energy-saving shower head, energy-saving light bulbs, radiator foil, pipe insulation).
Belgium Wallonia	Wallonia grants a subsidy to low-income households (owner-occupiers or tenants) to carry out work in their dwellings that will enable them to use energy more efficiently. The planned activities include Improving conditions for support of renovation in disadvantaged households, including designing new support mechanisms (credits), social missions, specifying energy poverty conditions, etc. Measure 27 stimulating and facilitating the energy renovation of housing managed by social real estate agencies. The planned actions include the use of rent management by social real estate agencies to encourage renovation without an excessive increase in the overall cost (rent + energy costs), encouraging the social security agencies to improve the energy efficiency of the buildings they manage by consistently integrating energy performance criteria into the renovation of the assets, ensure more resources for SSA to promote energy renovations of dwellings that they rent, analyse the possibilities of adapting the rent of dwellings managed by SSA to the proven energy performance of the dwelling and encourage monitoring of energy consumption after renovation in social housing companies.
Bulgaria	Bulgaria is currently implementing a support scheme for persons who meet certain income-tested and property-based criteria for poverty, granting heating allowances to eligible recipients via the social assistance system throughout the heating period. Full electricity liberalisation is in progress and it will be accomplished once a mechanism for protection of vulnerable households is in place. In the long term, measures to improve the energy efficiency of the homes of energy poor consumers in order to lower their energy costs and improve their living comfort will be implemented. The renovation of multi-family residential buildings with a view to upgrading them to energy class C will lower the average monthly cost of heating homes and may result in low-income households being able to improve their living conditions sufficiently to be dropped from the category of households at risk of energy poverty. Moreover, improving energy efficiency by complementing the national target under Article 7 of Directive 2012/27/EU through a requirement for the implementation of measures, as a matter of priority, to improve energy efficiency for the benefit of vulnerable clients, including households affected by energy poverty and, when appropriate, in buildings used for social housing.
Croatia	Energy renovation programme for multi-family buildings – renovations costs are reimbursed to citizens at risk of energy poverty; Energy renovation programme for single family houses also covers a segment for energy poverty; Adoption and implementation of the energy poverty programme – citizens at risk of energy poverty will be informed through

MS	Building-related policies and measures on energy poverty included in the LTRS
	local centre on energy renovation and co-financing actions; Energy Poverty Programme including the use of renewable energy in residential buildings in assisted regions and areas of special care.
Cyprus	- the right to apply for special household electricity tariff, which is about 20 % lower than the normal tariff; - inclusion of a legal provision which foresees continuation or reconnection of electricity supply in critical periods for vulnerable consumers who face serious health problems; - financial incentives for the installation of a residential photovoltaic system using the 'net-metering' method; - higher grant rates for residential energy upgrades offered by the 'Save & Upgrade' financial incentives (75 % instead of 50 % for other consumers) and support for installation of individual energy saving measures.
Denmark	Heat supplement: allowances/subsidies are given to the economically weakest part of the pensioners; Aid by municipalities on an individual basis to pay particularly high heating bill for a person who has been affected by changes in his or her circumstances (e.g. unemployment or sickness). Traffic, Construction and Housing Authority has launched an analysis of the renovation needs of the whole social housing sector, which will serve as a basis for the political negotiations on the size of the renovation framework in a future housing agreement. As part of the analysis, an overall potential for energy efficiency improvements in the social housing sector is also identified. Persons who fulfil specific vulnerable conditions and which have high housing costs or a high dependency ratio may receive special support if the need for assistance cannot be met through other benefits. Special support is not paid as a lump sum, but as a starting point calculated as the difference between what the applicant itself assumes to be able to pay in housing costs (limit value) and the net balance of the recipient's network costs, including water, heating, gas, electricity. In the case of public housing, a pilot scheme is in place to enable public housing organisations to carry out tests on so-called dynamic heat accounts, where the heat cost is billed on the basis of indoor air quality (indoor temperature, humidity and CO_2 content) as an alternative to traditional heat consumption measurement.
Estonia	Energy poverty is not seen a real issue in Estonia. In any case a Task Force on Accessibility has been launched at the State Chancellery to ensure that renovation of buildings is accessible to all groups of the population (parents with children, the elderly and people with disabilities).
Finland	An Energy poverty housing allowance and social assistance, allowances for housing costs, such as water and heating expenses. The social assistance will cover their basic expenses, such as the rent or maintenance charge of their home, the heating costs of their house, or water or household electricity expenses. There is also a subsidy for financial consulting services for tenants.
France	- The EEO Scheme include some specific measures for low income families; - Tax credits: Crédit d'impôt pour la transition énergétique (CITE); - Free energy audits for low income households; - Package of measures to combat energy poverty.
Germany	- Federal support for energy advice from consumer centres; - Energy saving Check Active; - Housing allowance (part of the overall social welfare payments).
Greece	The LTRS does not give extended details on energy poverty measures but it mentions that targeted energy upgrades in buildings occupied by energy vulnerable households are included in the past plan on energy poverty. It also specifies that in the new programming period, the successful financial schemes on residential energy efficiency will be modified to streamline incentives with a view of maximizing energy benefits and to support economically vulnerable and energy vulnerable households.
Hungary	Energy poverty of vulnerable households is mainly tackled through various measures concerning energy tariffs. Among energy efficiency related actions, the energy efficiency obligation scheme is specifically expected to support vulnerable consumers. The "increased use of decentralised heating solutions and electricity production penetration" are expected to help the decrease of energy poverty. Awareness-raising, information and consulting campaigns should promote low-cost energy efficiency investments that can be implemented by homeowners themselves, "resulting in substantial savings".
Ireland	Social housing upgrades measure: it is a programme of insulation retrofitting of the least energy efficient social homes to improve the energy efficiency and comfort levels; The Warmth and Wellbeing Pilot Scheme is an existing measure that provides energy efficiency improvements to the homes of older people and children suffering from chronic respiratory conditions, improving the living conditions of vulnerable people living in energy poverty (the average Building Energy Rating of participating homes improved from a D2 to a B3 with carbon emissions reducing by on average 2.2 tCO_2/year; The Better energy communities schemes supports community-based partnerships to improve the energy efficiency of the building stock in homes, schools community and business buildings and energy poor homes with a wider use of BER ratings, wider promotion of audits.
Italy	The Ecobonus is the main measure identified to tackle the energy poverty: within the Ecobonus tax rebate incentive, it is possible, for low income families, to transfer the credit to a financial institution, in order to reduce/annul the upfront cost of energy renovation interventions; The "Superbonus 110%" extend this possibility to all the subjects. The ecobonus can also be used to improve the energy performance of the social houses stock; Training and information campaigns to promote behavioural changes and increase the rate of renovation; Development of maps to identify the "energy poverty" risks, integrating data from energy modelling and the "revenue agency" database

MS	Building-related policies and measures on energy poverty included in the LTRS
Latvia	'The 'warmer living' measure is an agreement signed between stakeholders in the public and private sectors to contribute to the reduction of energy poverty by working together and providing information to households. Within the support mechanisms for energy efficiency buildings of NAP2027, Task [351] aims to improve access to housing for people in difficulty and disadvantaged by developing mechanisms to provide financial support (i.e.: ad-hoc grant based on the number of children in the family, developing a system for calculating a single-apartment benefit that takes into account housing costs, identify disincentives for access to quality rental/purchasing of houses. NAP2027 Task [349] also foresees the renovation and the increase of social housing and the creation of a tool for housing support for disadvantaged people to change residence in order to facilitate participation in the labour market.
Lithuania	Energy policy measures focused on cost reduction and increasing energy efficiency; Targeted measures on energy poverty: socio-economic measure (heating aid for low-income people), measures targeting a particular housing segment (multi-apartment renovation programme), energy specific measure (usage of specific type of energy) and measures targeting specific areas/regions; Obligations for energy suppliers to prevent energy poverty.
Luxemburg	Allocation "de vie chere" – is a subsidy scheme in place to combat energy poverty; Checklist on energy poverty for social services provided by MyEnergy agency.
Malta	The energy benefit scheme is the main and longest standing instrument to tackle energy poverty in Malta. It aims to decrease the energy cost burden of low-income and vulnerable households. Approximately €4-5 million are budgeted by the Maltese government (Ministry of Social Policy). In 2017, 20 488 consumers received the energy benefit.2 The Energy Incentives Advice Scheme for Vulnerable Households was set up by EWA in 2018 aiming at reducing the energy and water consumption through the replacement of old and inefficient appliances, specifically targeting vulnerable households. This scheme is executed in collaboration with LEAP and funded with €200 000 annually. Based on 470 home visits, EWA identified 277 households that needed a replacement of a fridge-freezer, washing machine and AC unit as these are considered high energy consumers. The Energy Efficiency in Low Income Households in the Mediterranean (ELIH MED) project works towards the identification of cost-effective solutions and innovative public and private financing mechanisms to foster energy efficiency investment in low income households. Initiated and co-funded by the EU, this project has a total budget of €250 000 to be used for 35 households in Malta between 2014-2025. The Consumer empowerments in a smart meter world (SMART-UP) is a European Horizon 2020 project partnering with local organisations and national ministries to fight energy poverty in 5 EU Member States, i.e. Spain, Italy, France, the UK and Malta. The project focused on increasing the awareness of vulnerable households to their energy consumption and to help them adopt new energy efficient consumption patterns by providing educational and practical means 2. The project has been delivered by the Maltese partner Project in Motion (PiM) in collaboration with the Ministry for the Family, Children's Rights and Social Solidarity and LEAP. The Eco-reduction scheme under which households that consume either: (i) less than 2 000 kWh per year in a single household; or (ii) less than 1 750 kWh per person in a two or more-person household, receive a direct rebate on 15-25% of their electricity bills. This policy incentivises efficiency and lower consumption, while also having a positive effect on the bills of low-income households who fall within the consumption limit. The provision of professional advice, free-of-charge, by the Energy and Water Agency to vulnerable and low-income households on energy efficient appliances and behaviour.
NL	Obligation for landlords to improve residential properties up to the 'standard' aiming to protect tenants from high energy costs.
Poland	The 'Stop Smog' programme targets energy poor people living in single-family homes. The scheme is addressed to all municipalities that can demonstrate poor air quality on their territory, i.e. concentrations of air pollutants exceeding EU standards. The programme covers the implementation in these households of projects consisting of: • replacement of heating equipment or systems with low-carbon standards, • decommissioning of heating equipment or systems and connection to district heating, electricity or gas networks, • thermomodernisation of the building.
Portugal	The LTRS is giving a full dedicate Action Axis to Energy Poverty for the first time (EA5 – Combate à Pobreza Energética). Energy poverty is omnipresent in the document and thermal comfort is studied and the improvement of this indicator is seen as essential in the strategy. Building renovation is seen as fundamental into complying with energy and climate objectives, but also energy poverty and economy relaunch after Covid-19 The two policies tackling Energy Poverty are: Provision of financing and tax benefits for those who rehabilitate and Increased comfort conditions.
Romania	A list of actions to improve social protection for vulnerable categories of energy poverty are listed. They comprehend the extension of the definition of vulnerable groups, preparation of an action plan for energy poverty, define responsibilities for specific programmes targeting vulnerable users and resource requirement, streamlining of existing heating aid and developing and implementing buildings renovation programmes with measures aiming at ensuring access to finance for socially vulnerable groups. Additional support for the implementation of the renovation measures for socially vulnerable people in buildings with the lowest energy performance would be to reduce the burden of energy costs by compensating all or part of the investment costs for the vulnerable owners. Such an intervention would require a budget of around 40 to EUR 200 million per year over the next 10 years. This budgetary estimate has been determined on the basis that 40 % of the investments will be reimbursed by the residential owners and about 30 % of building owners will be socially vulnerable groups, which will need additional support for

MS	Building-related policies and measures on energy poverty included in the LTRS
	the redemption of investments. Such interventions are expected to improve living conditions for the most vulnerable, who have very limited access to financing and reimbursement capacity and can reduce the number of vulnerable persons and relevant grants by more than 30 %. • Provision of non-financial support to low-income vulnerable consumers through the possibility of payment by instalments (payment of electricity bills in instalments); • Implementation of the National Social Assistance Information System; • Romania grants relief to domestic heating under Government Emergency Ordinance No 70/2011, repealed and replaced by Law No 196/2016, which should take effect on 1 April 2021.
Spain	A whole National Strategy to alleviate Energy Poverty is developed and reported in the strategy. Main building-related actions includes: Agile and low-cost refurbishments available to vulnerable households; increase in the number of social housing renovations through public intervention; specific provisions for vulnerable households in grant allocation for building renovations.
Slovenia	Non-repayable financial incentives for socially disadvantaged citizens to invest in the renovation of boiler rooms and increase energy efficiency in multi-apartment buildings Non-repayable financial incentives for socially weak citizens to replace old solid fuel combustion plants with new wood biomass combustion plants Reducing the energy poverty of citizens (ZERO); MEASURE ER-1 Collective purchase of electricity; MEASURE ER-2 Project on precise knowledge of the habits and needs of the most vulnerable population in Slovenia MEASURE ER-3 Action plan to combat energy poverty in Slovenia
Slovakia	The Slovak Republic considers energy poverty as part of poverty itself: A number of measures have been adopted so far in this area (e.g. National framework strategy for promoting social inclusion and combating poverty, an "housing allowance" to cover part of the cost of housing, including energy); Moreover, the NECP (section 3.4.4) includes energy poverty related measures. From those, the Act No 443/2013 on the State Housing Development Fund is targeting energy efficiency in buildings. Other acts are targeted generally at provision and financing of housing without a clear link to energy efficiency. They include Act No 443/2010 on housing and social housing subsidies providing subsidies for the removal of system failures in multi-apartment buildings, Act No 417/2013 on aid in material need, and decrees on energy prices. The other measures included in the section target poverty and social issues in more general, rather than energy poverty specifically (such as procedures for payment schemes in case of inability of the household to pay for energy, update of housing benefits, and other). In the field of housing, the targeted form of support is housing benefit (Section 14 of Act No 417/2013), which is intended to cover part of the cost of housing, including energy. The allowance is granted as part of a benefit in material need pursuant to Act No 417/2013 on assistance in material need and amending certain acts. The housing allowance accounts for a significant part of the eligible income for the most deprived and amounts to EUR 55.80 per month in the case of a household with a single household member, or EUR 89.20 per month for a household with more than one household member, or for the rental of an apartment by more than one tenant.
Sweden	'Sweden has declared that "makes no distinction between energy poverty and general poverty" The issue is managed within the context of social policy and there are no instruments in place which are specifically aimed at energy poverty.

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