OUR-CEE
Overcoming Underperforming Renovations in Central and Eastern Europe

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OUR-CEE

(Overcoming Underperforming Renovations in Central and Eastern Europe)

National baseline assessment on underperforming renovations

Bulgaria

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The opinions put forward in this study are the sole responsibility of the author(s) and do not necessarily reflect the views of the Federal Ministry for Economic Affairs and Climate Action (BMWK).

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1. EXECUTIVE SUMMARY

Bulgarian Long-Term National Strategy to Support the Renovation of the National Building Stock of Residential and Non-Residential Buildings by 2050 (LTRS) presents cost optimum analyses for four non-residential building categories: administrative buildings, schools, childcare facilities, and hospitals. The Sustainable Energy Development Agency (SEDA) manages the national registry of energy-audited buildings, providing detailed information on energy performance, recommended energy-saving measures, and estimated energy and monetary savings. The registry enables analysis to investigate potential underperforming renovations for the above-mentioned public building types.

Two types of analysis are conducted: comparing expected energy performance against national benchmarks for cost-optimal renovation and comparing average energy performance within a building type with estimated average energy performance for upgrading to the same energy class. The results confirm the prevalence of underperforming renovation in public buildings in Bulgaria. Energy auditors often suggest renovation to lower energy performance levels, and renovated buildings frequently exhibit poorer energy performance than initially recommended. This results in missed opportunities for energy savings and impedes progress towards climate neutrality in the public building sector.

The possible reasons behind underperforming renovations in public buildings are many, including: unambitious requirements of the regulatory framework; financing programs offering high grant rates against low energy efficiency requirements; superficial municipal energy planning; energy audit recommendations developed in accordance with the eligibility requirements in the financing programs; low-quality of execution of construction activities; insufficient control over the quality of execution of construction activities; lack of monitoring and verification of energy savings.

The LTRS outlines a comprehensive list of measures to achieve national building renovation goals. Implementing these measures can address underperforming renovations. An analysis of successful and unsuccessful implementations is crucial to prioritize measures and develop the National Building Renovation Work Plan (NBRP), which will replace LTRS and must be submitted by 2026. The plan must ensure the renovation of the entire national building stock to achieve a highly energy-efficient and decarbonized building stock by 2050. To reach this ambitious target, it is essential to include measures to avoid underperforming renovations and conduct detailed analyses of previously renovated buildings to enhance energy efficiency and meet the zero-emission building definition.

Specific attention should be given to the introduction of step-by-step building renovation approaches and Building Renovation Roadmaps (BRPs). Specialized training is required for the step-by-step renovation approach, EPCs, and BRPs. Collaboration with educational institutions is essential to create training materials and content. The scale of building renovation needs to be increased significantly, and new financial instruments must be provided to attract private funding. Encouraging the widespread participation of Energy Service Companies (ESCOs) in the building renovation sector is crucial. The creation of a National Decarbonisation Fund is the primary financial measure to promote deep renovation of buildings offering a range of financial instruments. Radical changes are needed in municipal energy planning, including setting long-

term goals for building renovation and creating roadmaps for achieving climate neutrality. The monitoring and verification of results should be made mandatory for funded projects, and incentives should be developed to encourage building owners to implement monitoring and control systems.

2. INTRODUCTION

Renovating both public and private buildings was singled out in the European Green Deal as a key initiative to drive energy efficiency in the sector and deliver on objectives. To pursue the dual ambition of energy gains and economic growth following the COVID-19 pandemic, the Commission published in 2020 the strategy "A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives" along with an action plan and a document presenting available EU funding. The Renovation Wave initiative builds on the national long-term building renovation strategies of Member States, other aspects of the Directive on Energy Performance of Buildings, and building-related aspects of each EU country's national energy and climate plans (NECPs). The Renovation Wave aims to at least double the EU's annual energy renovation rate by 2030.

Despite several good attempts to increase the energy performance of Europe's building stock, according to the BPIE's 2023 publication[1] "Buildings climate tracker – 2nd edition", the actions taken since 2015 have not been effective enough to decarbonize the EU building stock at the rate and depth required. In particular, countries in the Central and Eastern Europe (CEE) region are far from being on track; the region has gone backwards and requires a "better implementation of legislative requirements and more ambitious and inclusive strategies" (especially in view of the high share of people experiencing energy poverty) to decarbonize the building stock.

In order to meet 2050 decarbonization goal in the buildings sector and to catch the full speed of the renovation wave, the CEE region should learn from its previous experiences and mistakes. In particular, it is of utmost importance to manage underperforming energy renovations (i.e., renovations which have not resulted in their projected energy savings) and to identify the possible reasons behind them. The OUR-CEE project addresses the issue of underperforming renovations in public buildings and how to overcome it, focusing on four CEE countries traditionally challenged by low renovation ambitions and poor quality of the building stock. Public buildings, which are expected to lead the way in deep renovation, have been undergoing renovation for many years in CEE – but a significant proportion of this renovation is not achieving appropriate energy savings. The findings of the project will support the acceleration of deep renovation in CEE and achievement of the EU's energy efficiency targets.

This study is the first step of this project, aiming to provide insights into the magnitude of the problem of underperforming renovations in the OUR-CEE project countries, though national baseline studies as well as a regional study of CEE. At the same time, these studies will present the possible reasons that might be behind underperforming energy renovations. Finally, the baseline studies will offer a series of policy recommendations which, if implemented, can significantly improve the performance and impact of future public building renovations in CEE region. The main goal of baseline studies is thus to improve the understanding of underperforming renovations among decision-makers.

[1] BPIE, EU buildings climate tracker 2nd edition, 2023

3. OVERVIEW OF THE NATIONAL BUILDING STOCK AND RELATED POLICIES

There are no publicly available detailed statistics for the entire building stock in Bulgaria. While statistics on residential buildings can be found from the census results published by the *National Statistical Institute* (NSI), there are no aggregate statistics on non-residential buildings. *The Long-Term National Strategy to Support the Renovation of the National Building Stock of Residential and Non-Residential Buildings by 2050* (LTRS) provides information on the area of non-residential buildings by building type, with the source of information from the *Geodesy, Cartography and Cadastre Agency* (GCCA), but no information on the number of buildings is provided. For building energy performance information, the best source of data is the national register of building energy audits maintained by the *Sustainable Energy Development Agency* (SEDA).

3.1. Overview of the national building stock

According to the LTRS, the total floor area of non-residential buildings in Bulgaria is nearly 105 million. m^2. Non-residential buildings are summarized in 10 categories, one of which is "Others", and all other buildings are grouped in the category "Not classified". Buildings in the *Hotels and restaurants* category have the largest total floor area – around 18.9 million m^2. Information on non-residential buildings is presented in Table 1.

Table 1. Overview of non-residential building stock by building categories

Building categories of the non-residential building stock	**Total Floor Area, m^2**
Childcare establishments (kindergartens and crèches)	2 371 438
Others, incl. retirement homes, homes for orphaned and abandoned children, student dormitories, car repair centres	18 470 987
Healthcare establishments (hospitals, polyclinics, etc.)	9 685 995
Retail and wholesale outlets (supermarkets and shopping malls)	10 519 029
Education (schools, colleges and universities)	8 927 599
Public service buildings	14 878 947
Sport halls and facilities	1 793 216
Buildings of cultural and art institutions	2 296 810
Buildings in the transport sector (train stations, ports and airports)	2 803 990
Hotels and restaurants	18 898 840
Not classified	14 276 437
Total	**104 923 286**

Source: Ministry of Energy, LTRS, 2021

The LTRS also provides information on the ownership of non-residential buildings. The buildings owned by the central government and local authorities have a share of 29% of non-residential buildings and privately-owned buildings have a share of 56.6 %. The share of the non-residential buildings with mixed ownership (public-private) is 7.46% and the remaining buildings with a share of 6.9% are with an unclear ownership (not available information). This information is summarized in Table 2.

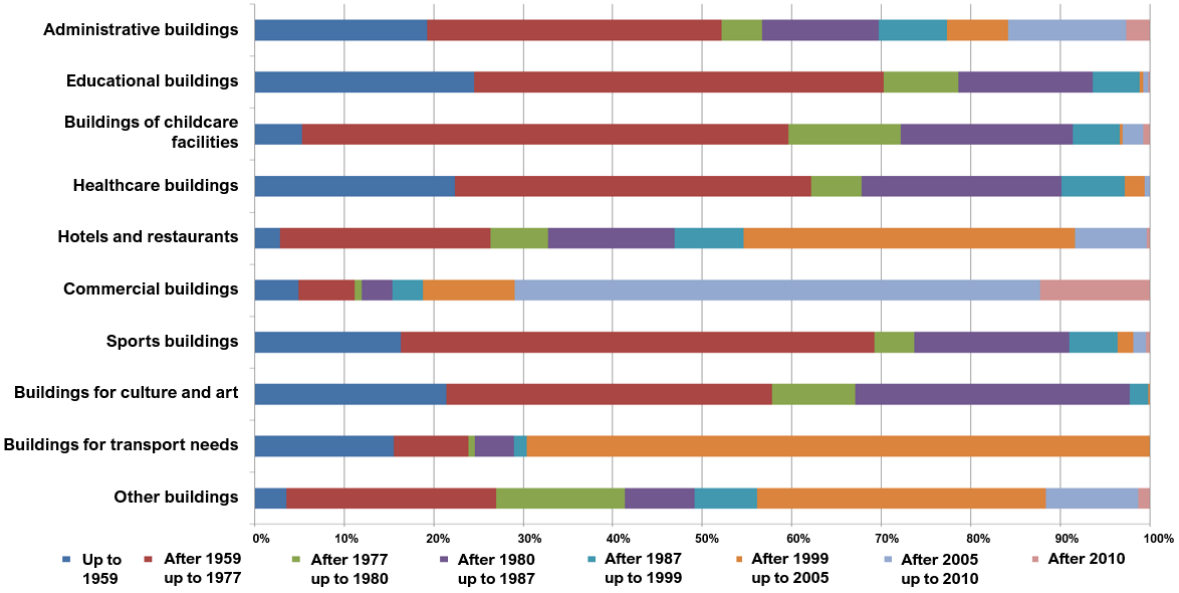
Table 2. Overview of buildings — breakdown per type of ownership

Ownership	Central government	Municipal	Private	Joint ownership	N/A	Total
Total floor area, m²	13 158 233	17 252 998	59 407 902	7 822 889	7 281 264	104 923 286
Share	12.54 %	16.44 %	56.62 %	7.46 %	6.94 %	100.00 %

Source: Ministry of Energy, LTRS, 2021

In the absence of accurate information, even on the number of buildings in the country, it is clear why there is no complete information on the distribution of buildings by year of construction. Such information is only available for residential buildings on the basis of census results provided by the NSI. For non-residential buildings, the LTRS presents data for a sample of buildings that have been entered into the SEDA database on energy audits, which are shown in Figure 1. The time periods over which the buildings are distributed correspond to the years in which there are regulatory changes about the required U-values of the building envelope components. For most categories of buildings, especially those that are predominantly publicly owned (education and science buildings, childcare buildings, healthcare buildings, sports buildings and arts and culture buildings), the majority of buildings were built between 1959 and 1977, when building envelope regulations were low. For buildings in the hospitality sector, commercial buildings and those buildings classified as 'Others', which are predominantly private, most of the audited buildings were built after 1999, when the implementation of thermal insulation was already mandatory.

Figure 2. Distribution of non-residential buildings by year of construction



Source: Ministry of Energy, LTRS, 2021

The information on dwellings in the LTRS is consistent with the 2011 Census results published by the NSI. In 2021, the latest census was carried out and there is new more up to date data. The total number of dwellings in the country is 2 123 142, with a 3% increase in the number of buildings recorded over the 10-year period since the previous census. A total of 87.5% of residential buildings are classified as houses and the share of multi-family residential buildings is 3.9% of all residential buildings. The total number of occupied residential buildings is 1 505 945 or 70.9% of all residential buildings. In terms of dwellings, the occupancy rate is even lower

at 61.1%. The data shows that 24.2% of dwellings are fully insulated and 7.7% are partially insulated. 38.9% of dwellings have energy efficient windows. The percentage of dwellings that have both insulation and efficient windows is 21.4%.

For residential buildings, the NSI provides the following information on the types of fuels used. Almost half of the occupied dwellings (47.7%) are heated with electricity, 36.3% - with wood, 13.3% - with heat from a central source (heating), 4.8% - with coal, 4.1% - with pellets, 2.5% - with natural gas from a central source. According to the national energy balances for 2021, also published by the NSI, the total final energy consumption of the household sector is 27935 GWh, with a predominance of electricity consumption - 42.8% and renewables and biofuels (practically mainly wood and some wooden pellets) - 31.8%. The data for the household sector (Table 3) mainly represent energy consumption in residential buildings.

Table 3. Household sector final energy consumption for 2021

Solid fossil fuels	1 608.2	5.8%
Oil and petroleum products	244.2	0.9%
Natural gas	1 318.6	4.7%
Renewables and biofuels	8 873.3	31.8%
Heat	3 939.6	14.1%
Electricity	11 951.3	42.8%
Total	**27 935.1**	**100.0%**

Source: NSI, Energy Balances 2021, National Statistical Institute, Sofia, 2023

The 2021 energy balances also provide information on final energy consumption in the Commercial and services sector. This consumption should largely overlap with the consumption of buildings in this sector, which are the majority of the non-residential buildings in the country. The data is presented in Table 4.

Table 4. Final energy consumption for the commercial and services sector in 2021

Solid fossil fuels	29.1	0.2%
Oil and petroleum products	436.1	2.9%
Natural gas	1 226.8	8.1%
Renewables and biofuels	3 536.1	23.4%
Heat	1 304.7	8.6%
Electricity	8 553.6	56.7%
Total	**15 086.2**	**100.0%**

Source: NSI, Energy Balances 2021, National Statistical Institute, Sofia, 2023

There is no published official information on the energy performance of different building types – residential and non-residential. An analysis of energy performance can only be made on the basis of the register of audited buildings maintained by SEDA, but for some individual building categories it does not contain sufficient data as no audits have been carried out. Section 4 of this document presents an analysis of the energy performance of buildings, focusing on the main types of public buildings.

Information on the number of nZEBs[2] is not available. The requirement for all new buildings in Bulgaria to meet the national nZEB definition is effective from 1 January 2024. The national register of audited buildings maintained by SEDA does not contain information on whether the registry included buildings meet the national nZEB definition. Considering that the requirement to apply the definition was introduced in Bulgaria with a long delay, it can be assumed that the number of nZEBs as of March 2024 is negligible.

3.2. Overview of the national public building stock

There is no separate statistical information on the area of public buildings in Bulgaria. However, an estimate can be made based on the LTRS data presented in Tables 1 and 2 above and expert judgement and some assumptions. An expert estimation[3] can indicate the types of non-residential buildings that are predominantly state or municipally owned. These are the building types presented in Table 5, below. Expert judgement has determined the proportion of publicly owned buildings for each building type so that their total area is consistent with the LTRS information presented in Table 2, above.

Table 5. Estimation about the public building stock in Bulgaria by building categories

Selected building categories of the non-residential building stock with prevailing public ownership	**Total Floor Area, m²**	**Assumed share of public ownership**	**Estimated Total Floor Area, m² of public or mixed ownership**
Childcare establishments (kindergartens and crèches)	2 371 438	0,95	2 252 866
Other, incl. retirement homes, homes for orphaned and abandoned children, student dormitories, car repair centres	18 470 987	0,45	8 311 944
Healthcare establishments (hospitals, polyclinics, etc.)	9 685 995	0,90	8 717 396
Education (schools, colleges and universities)	8 927 599	0,95	8 481 219
Public service buildings	14 878 947	0,25	3 719 737
Sport halls and facilities	1 793 216	0,98	1 757 352
Buildings of cultural and art institutions	2 296 810	0,98	2 250 874
Buildings in the transport sector (train stations, ports and airports)	2 803 990	0,98	2 747 910
Total	**61 228 982**		**38 239 297**

Source: Author's estimate based on data from Ministry of energy, LTRS, 2021

The LTRS sets out the targets for building stock renovation in Bulgaria summarised in a roadmap covering three periods: 2021-2030, 2031-2040 and 2041-2050 (Table 6). The area to be renovated, the final energy to be saved and the corresponding amount of carbon emissions reduced are defined. Targets are presented separately for residential and non-residential buildings, as well as for all buildings in total, but targets are not presented separately for public buildings. For non-residential buildings, only 17% of their total area is set to be renovated by 2050, which is justified by the fact that the area of public buildings is only 29% of the area of all non-residential buildings, and as it is stated in the LTRS "for the remaining buildings in this category the renovation process is driven by market mechanisms that cannot be predicted".

[2] Nearly Zero Energy Buildings – according to the Bulgarian national definition these are buildings with energy class A where 55% of the final energy for heating, cooling, ventilation, hot water, fans and pumps, and lighting is from renewable sources.

[3] Estimations by EnEffect based on experience with research and practice in renovating Bulgaria's building stock.

Based on this clarification, one can assume that the renovation targets set for non-residential buildings actually refer to the renovation of public buildings.

Table 6. Renovation targets for the buildings in Bulgaria

Indicator	Dimension	2021-2030	2031-2040	2041-2050
Non-residential buildings	GWh/y	440	808	1 035
Non-residential buildings	m²	3 176 852	5 835 493	7 479 718

Source: Authors' extract from Ministry of Energy, LTRS, 2021

For public buildings, information on total energy consumption is not available. In contrast, the vast majority of public buildings have had energy audits carried out and there is very good information on their energy performance in the publicly accessible database maintained by SEDA. Analyses of energy performance in line with this study's main topic of *underperforming building renovations* are presented in Section 4.

3.3. Overview of the current state of related policies

Strategic policy documents

Integrated Energy and Climate Plan of the Republic of Bulgaria 2020-2030

In the field of energy and climate, there are three strategic documents that also affect the buildings sector. The lead document is the ***Integrated Energy and Climate Plan of the Republic of Bulgaria 2020-2030*** *(NECP)*. In the original version of the plan, which is still in force, policies and measures for renovation in the buildings sector are not highlighted as a top priority. The projections for the evolution of final energy consumption and the targets for energy efficiency and decarbonisation were set according to a computer model of the energy sector in which the assessment was carried out in a top-down manner and the assumptions underlying the model were not disclosed. Bottom-up sectoral modelling, which would have allowed a correct baseline to be established, different development scenarios to be developed and analysed based on long-term sectoral policies, the costs and benefits of the proposed measures to be assessed by sector, and, as a result, significantly more realistic target setting, has not been developed for the Plan.

At the end of February 2024, the Bulgarian government presented the **draft update of the NECP** to the European Commission (EC). The version presented was rather preliminary, as no model and forecast of the country's energy consumption and therefore GHG emissions was presented. The sectoral descriptions in the different dimensions of the plan were very unbalanced, often not distinguishing between policies and measures. The Commission's review concluded that there were key gaps in the draft plan, which led to 22 recommendations. Some of these recommendations, which are also directly relevant to the renovation of buildings, are as follows:

- Specify robust financing energy efficiency programmes and financial support schemes, able to mobilise private investments and additional co-financing in this regard.
- Include updated ambition levels to ensure a highly energy efficient and decarbonised national building stock and to transform existing buildings into zero-emission buildings by 2050, including intermediate milestones for 2030 and 2040 and a comparison with the most recent long-term renovation strategy. Support the targets for the

decarbonisation of buildings by providing further information on policies and measures including their costs and expected impact in energy savings, for the implementation of a coherent long-term renovation strategy.

- Specify the reforms and measures to mobilise the private investments needed to achieve the energy and climate targets. Improve and expand the analysis of investment needs to include a comprehensive and consistent overview of the public and private investment needs in aggregate and by sector.

Bulgarian Government should present the final NECP update by the end of June considering the recommendations by the EC.

Long-Term National Strategy to Support the Renovation of the National Building Stock of Residential and Non-Residential Buildings by 2050

The ***Long-Term National Strategy to Support the Renovation of the National Building Stock of Residential and Non-Residential Buildings by 2050*** *(*LTRS*)* is the leading document dedicated entirely to buildings. The strategy presents a roadmap for the renovation of the building stock up to 2050, with intermediate targets also presented up to 2030 and 2040. Unfortunately, the assessment of the area of buildings to be renovated and the potential savings from building renovation is again done in a top-down way, taking as a starting point the balance of the energy sector as modelled in the NECP. The renovation targets are split for non-residential and residential buildings (described above in Table 6), taking into account the results already achieved by 2020, before the document was designed.

The document contains a description of strategic objectives and priorities related to the implementation of the individual objectives. For each priority, existing barriers and specific policies and measures, the applicable financial instrument, and the timeframe and person responsible for implementing the measures are described. The list of measures is very detailed, and its successful implementation could contribute to a significant improvement in the volume and quality of building renovation. Table 7 summarises some of the proposed regulatory measures that are relevant to the main problem investigated in this report - underperforming building renovation of public buildings.

Table 7. Regulatory measures to improve building renovation proposed in LTRS

No.	Measure
1	Review and harmonisation of technical standards for energy efficiency of buildings. Examination of the possibility of raising the minimum requirements for all buildings to class B
2	Introduction of higher than minimum requirements for major renovation of buildings in publicly funded projects. Introduction of special provisions to ensure optimal performance of technical building installations.
3	Periodic review and alignment of energy efficiency standards and related building codes.
4	Establishment of criteria and methodologies for the assessment of products prepared from construction residues for re-use in construction
5	Introduction of relevant national norms and European standards for construction products such as Bulgarian State Standard
6	Specific provisions, timeframes and incentives for the transformation of existing buildings into high energy efficiency classes (Class B and above) and possibly achieving the nZEB requirement.
7	Promotion of the use of higher quality materials and new technologies in EE renovation.
8	Extension of the technical passport with an energy renovation planning section.

Source: Authors' extract from Ministry of Energy, LTRS, 2021

** The numbers of the measures are assigned for this document. The sequence of the measures does not correspond to the LTRS.*

Table 8 summarises some of the envisaged measures related to the expansion of financing opportunities for building renovation projects.

Table 8. Measures on financing building renovation proposed in LTRS

No.	Measure
9	Development of short- and medium-term plans, on the basis of which to plan budgets that will be available to finance support mechanisms (both from national and other financial sources).
10	Implementation of mandatory monitoring schemes of actual energy savings taking into account climatic conditions and indoor microclimate for different types - buildings, households and income groups (where applicable), for all building renovation support programmes
11	Enabling a combination of measures under different programmes to support the renovation of buildings, including clean air and social assistance programmes. Coordination should take place at local level.
12	Creation of a dedicated national fund to provide loan resources and bank guarantees for participating financial institutions.
13	Establish risk-sharing mechanisms between public institutions and commercial banks. Using IFI resources to structure the mechanisms.
14	Standardisation of processes and documents will support organisation and cost reduction opportunities for financing institutions.
15	Create platforms to aggregate similar projects at municipal or regional level.
16	Linking financial measures for energy efficiency improvements in building renovation to the targeted or achieved energy savings.
17	Development of the market for energy efficiency services under guaranteed outcome contracts. Provision of model energy performance contracts for the public sector.
18	Introduction of requirements for companies declaring themselves as ESCOs. Creation of a register of ESCOs, updating the code of ethics and model contracts

Source: Authors' extract from Ministry of Energy, LTRS, 2020

** The numbers of the measures are assigned for this document. The sequence of the measures does not correspond to the LTRS.*

Measures are also envisaged (Table 9) to improve information provision to ensure better renewal planning, and performance monitoring and control.

Table 9. Measures on improving data collection and analyses proposed in LTRS

No.	Measure
19	Establishing a system for collecting data and information on building renovation measures implemented. Annual monitoring of the implementation of strategies and programmes, publication and public presentation of monitoring reports with mandatory inclusion of optimisation measures.
20	Establishment of a single digital system for collecting information (database) on the existing building stock in the different categories of buildings at municipal level.
21	Ensuring connectivity between municipal databases and the various institutions collecting building data
22	Digitisation of technical passports and creation of municipal databases when systems are connected.
23	Systematisation of information, digitisation of typical design solutions for buildings constructed by industrial method by the municipalities.

Source: Authors' extract from Ministry of Energy, LTRS, 2020

** The numbers of the measures are assigned for this document. The sequence of the measures does not correspond to the LTRS.*

The strategy also contains a number of other measures that can contribute to improving the quality of building renovation implementation - measures related to training and improving the knowledge and skills of the different stakeholders from architects and engineers - designers, energy auditors and consultants, construction workers, inspection bodies, municipal officials, etc.

The LTRS offers an overview of all currently existing financial sources for building renovation as well as new possible sources, instruments and funding mechanisms, including at European and national level. The need to attract additional funding from the private sector has been identified, and the creation of a *National Decarbonisation Fund* (measure 13 in Table 8) has been identified as a key measure towards securing funding for building renovation.

National Recovery and Resilience Plan

The third important planning document that affects building renovation is the ***National Recovery and Resilience Plan*** (NRRP), formally adopted in 2022. The plan provides for a number of reforms and measures in a number of areas, with the leading dimension being 'Green Bulgaria'. There, the establishment of a *National Decarbonisation Fund* is recorded as Reform 1, but it seems that the envisaged deadlines will not be met. The Fund should support investments in low-carbon development through sustainable and targeted financing of a wide group of beneficiaries. It will be used to offer grants and technical assistance combined with financial instruments including credit lines and guarantees and/or a combination thereof. An information campaign to promote the fund is planned for Q3/2024, which obviously cannot take place before the fund itself is constructed.

The NRRP has an investment measure to renovate public buildings. The investments are proposed to be 100% grants for implementation of energy-efficient renovation of public buildings, with the requirement that the renovation shall reduce on average at least 30% of primary energy consumption. The target is to renovate public buildings with 1.4 million m^2 floor area, 44% of the target for non-residential buildings in the LTRS (refer to Table 6), which we assume as a target for public buildings as explained above.

International documents analysing building renovation

In the period 2022-2023, first the *European Investment Bank* (EIB) and then the *World Bank* (WB) carried out market analyses related to the renovation of buildings in Bulgaria. Both institutions concluded that sufficient funds are available for the renovation of public buildings to meet the LTRS target for the period to 2030. This is not the case for residential buildings, where there is a significant shortfall in secured funds. According to the WB diagnostic report, which is based on the EIB analysis and complements it, only the secured funds. The WB report identifies a number of other shortcomings that hinder the successful implementation of the Renovation Wave in Bulgaria, such as insufficient number of construction companies, insufficient quality of energy audits, lack of training and training materials for energy auditors, inadequate monitoring of the implementation of energy efficiency measures, etc.

Regulatory framework

The renovation of buildings is regulated by the ***Energy Efficiency Act*** transposing the requirements of Energy Efficiency Directive and Energy Performance of Buildings Directive. It is complemented by several by-law regulations., the main ones being:

- ***Ordinance No E-RD-04-2 of 16.12.2022 on energy efficiency audit, certification, and evaluation of energy savings of buildings*** – The Ordinance establishes the procedure and rules for conducting of energy performance audits for buildings or parts of buildings in operation, including the documents that reflect the results of the audit; for the issuance of energy performance certificates for existing and new buildings; and for the preparation of energy savings assessments for buildings.
- ***Ordinance RD-02-20-3 of November 9, 2022 on the technical requirements for the energy performance of buildings*** – The ordinance specifies the minimum requirements for the energy performance of buildings. All existing buildings occupied by public bodies are required to be at least energy class "B". When carrying out an energy audit, it is mandatory to examine a package of measures that achieves an energy performance that complies with the national definition of nearly zero energy buildings. From the beginning of 2024, this definition is mandatory for all new buildings. This ordinance also presents the methodology for calculating the energy performance of buildings and the scales of the energy classes for different building types. The scales have changed and now contain ratings from *A* to *G*, as it is required in the *2024 Energy Performance of Buildings Directive Recast*. The ranges of the energy classes are specified for 11 different building types. Additionally, a methodology is presented to determine the energy class of any other building type, which does not have a specified scale, based on two comparisons of the existing energy performance to the energy performance when the norms active at the year of construction are applied and to the energy performance when the current norms are applied. Some sufficient changes were introduced in *Ordinance RD-02-20-3 of November 9, 2022,* compared to the previous one – new indicators for renewable and non-renewable energy were introduced as well as new primary energy factors and emission factors. The rules for the calculation of the final energy of the building when heat pumps are used for heating are also changed.

4. ASSESSMENT OF ENERGY PERFORMANCE OF RENOVATED PUBLIC BUILDINGS

The LTRS presents cost optimum analyses for the renovation of four main categories of non-residential buildings which are primarily owned and managed by the central government and the local authorities: administrative buildings, schools, childcare facilities (kindergartens and crèches) and hospitals. Different packages of measures are evaluated, and maximum, minimum, and average values are determined for the specific primary energy consumption of these building types. According to the national regulations, the specific primary non-renewable energy consumption is the parameter used to determine the energy class of the buildings. The following table presents the average cost optimal levels for these building categories:

Table 10. Cost-optimal renovation benchmarks for main public building types in Bulgaria

Building type	**Primary energy, kWh/m²**	**Energy class and range** (old scale)*	**Energy class and range** (new scale)**
Administrative buildings	140.31	A (70-140 kWh/m²)	B (134-268 kWh/m²)
Schools	43.97	A (25-50 kWh/m²)	B (35-70 kWh/m²)
Childcare facilities (kindergartens and crèches)	83.89	B (66-130 kWh/m²)	B (60-120 kWh/m²)
Hospitals	166.98	B (141-280 kWh/m²)	B (135-270 kWh/m²)

** Energy class and range according to the scale in the regulation active at the time when the LTRS was developed.*
*** Energy class and range according to the scale in the current regulation.*

The Sustainable Energy Development Agency (SEDA) manages the national registry of the energy audited buildings[4]. The database consists of detailed information about the buildings and their energy performance gathered during the energy audits, including also information about the recommended energy saving measures (ESM) and estimated energy and monetary savings and CO_2 emission reductions.

As of 25.03.2024, the register contains information on 11 352 audited buildings in operation with a total area of 43 965 256.5 m². Of the existing buildings, a total of 8 736 are non-residential, with a total area of 26 424 818.8 m². This means that the total area of the audited non-residential buildings is over 25% of the total area of all non-residential buildings. Regarding the four main public building types summarized in table 10 above, the register contains information on the following number of buildings (table 11):

Table 11. Number of buildings and total area of the audited buildings in the national registry

Building type	**Number of audited buildings**	**Total area of audit buildings**	**Share of the total area against all buildings of the respective type**
Public service buildings (administrative buildings)	1 386	3 792 140	25.5%
Educational buildings (schools, colleges, and universities)	1 746	7 729 039	86.6%
Childcare facilities (kindergartens and crèches)	1 140	1 789 953	75.5%

[4] https://portal.seea.government.bg/bg/IndustrialSystemsReport

Healthcare establishments (hospitals, polyclinics, etc.)	359	1 810 612	18.7%

As data in table 11 shows, for all four categories of buildings there is a large enough sample of data to make analyses that can be accepted as objective and indicative.

The information available in the register enables two types of analysis aimed at investigating potential underperforming renovations. Firstly, by comparing the expected energy performance resulting from the recommended renovation measures for buildings in the specified four categories against the national benchmarks for cost-optimal renovation in these building categories. This analysis helps assess the extent to which the energy audit recommendations may lead to insufficient levels of renovation. Secondly, one can compare the average energy performance of a specific energy class within a building type with the energy auditors' estimated average energy performance for buildings of the same type recommended for upgrading to the same energy class. This comparison provides insight into the deviation between the achieved renovation level and the recommended renovation level.

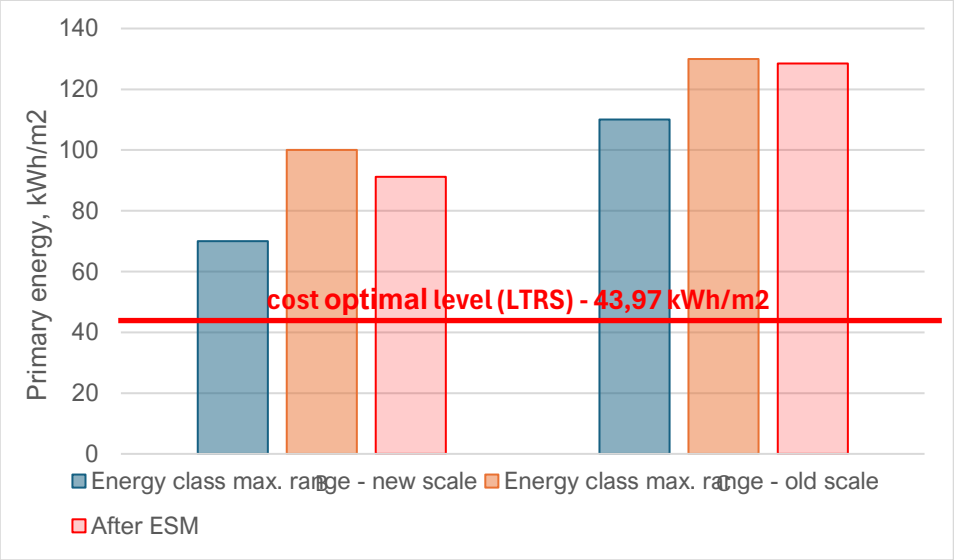
4.1. Analysis by comparing the expected energy performance resulting from recommended renovation measures to the national benchmarks for cost-optimal renovation

The results of **the first type of analysis** for the four main types of public buildings are shown graphically in the following four figures. The analyses were made according to the data in the SEDA register, as of 25.03.2024. The buildings for which it is recommended to achieve the corresponding energy class are included in the analyses only if they represent more than 10% of all registered buildings of the corresponding type.

Figure 2 presents the results of the analysis for **school buildings**. Considering the limitation described above, only buildings of classes B and C fall within the scope of the analysis. A total of 84.7% of all energy audits of schools have recommended renovation of the buildings to the level of energy class B or C and therefore included within the scope of this analysis. The graph shows the maximum energy performance of the building for the respective class according to the regulations valid until 2022 and according to the current regulations, which is compared to the average energy performance recommended by the energy auditors. The red line shows the cost-optimal national benchmark for school buildings in accordance with the LTRS. As the number of audited buildings under the current regulations is much smaller compared to those audited before, the average energy performance of the buildings after the recommended measures is sufficiently higher than the maximum energy performance for the corresponding class according to the current regulations.

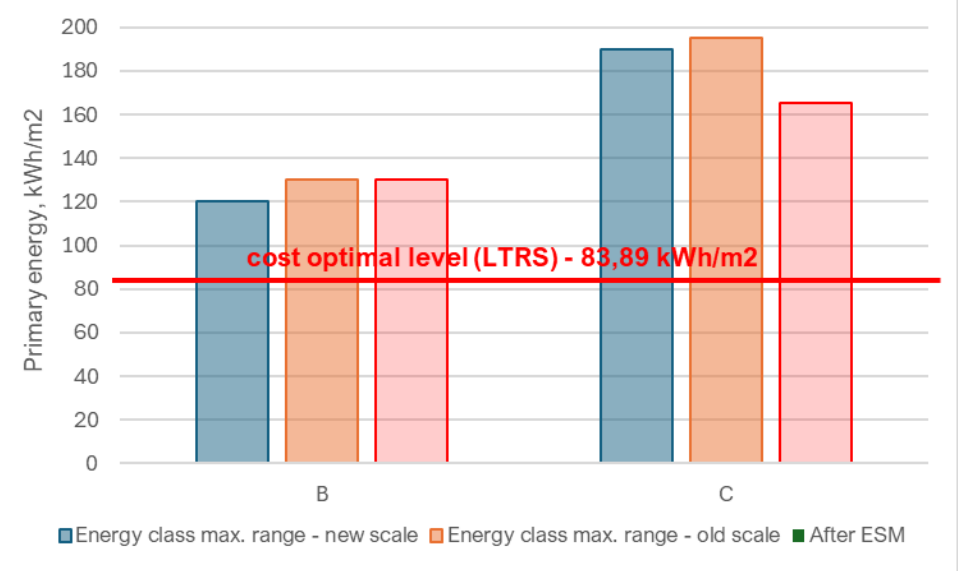
Despite the above, it is very clear that after the recommended measures, the average energy performance of the buildings is close to the maximum energy performance for the energy class. The average energy performance after measures, for the buildings for which it is recommended to achieve energy class B is 91.19 kWh/m^2 (with an upper limit according to the old norms of 100 kWh/m^2), and for the buildings for which it is recommended to achieve energy class C – respectively 128.48 kWh/m^2 (with an upper limit according to the old norms of 130 kWh/m^2). In the buildings with recommended class B, the excess of the average energy performance compared to the cost-optimal renovation benchmark in LTRS is 47.22 kWh/m^2 (more than double), and in the buildings with recommended class C the excess is 84.51 kWh/m^2 (nearly 4 times above the cost-optimal level).

Figure 2. Average recommended renovation level for school buildings versus cost-effective renovation benchmark in LTRS



The results of the analysis for **children's facilities** are presented in figure 3. For this building category, only the buildings with recommended energy class B or C, which are 83.9% of all cases, were included in the scope of the analysis.

Figure 3. Average recommended renovation level for childcare facilities versus cost-effective renovation benchmark in LTRS

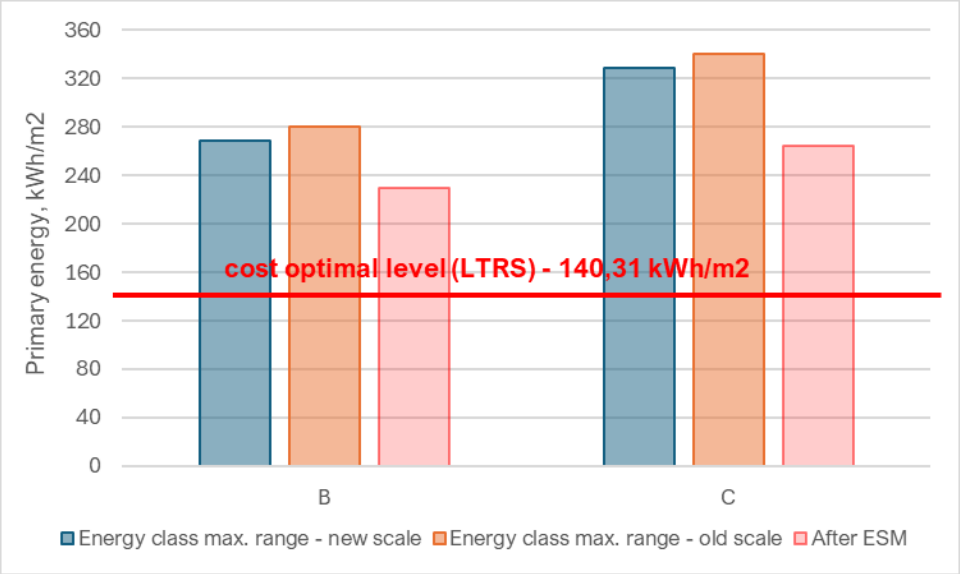


As for the school buildings, for childcare facilities the average energy performance after the recommended measures is close to the maximum energy performance for the energy class. The average energy performance after measures, for the buildings for which it is recommended to achieve energy class B, is at the upper limit according to the old norms - 130 kWh/m^2, and for the buildings for which it is recommended to achieve energy class C - respectively 165.16 kWh/m^2 (with an upper limit according to old standards of 195 kWh/m^2). For buildings with recommended class B, the excess of the average energy performance compared to the cost-optimal renovation benchmark in LTRS is 46.11 kWh/m^2 (more than 1.5 times), and for buildings with recommended class C the excess is 81, 27 kWh/m^2 (nearly 2 times).

Kindergartens were among the first buildings to undergo renovation in all Bulgarian municipalities. Consequently, the data in the registry pertaining to the recommended renovation levels is based on older energy audits. As a result, the graph above clearly illustrates that when an upgrade to Class B was advised, the energy auditors were aiming for the upper end of the scale within that class.

The third category of buildings for which this analysis was performed is **public service buildings** (administrative buildings). The results are presented in Figure 4. Again, only buildings with recommended energy class B or C were included in the analysis, which are a total of 68.8% of all registered buildings of this type. In the registry, there is also a large number of public service buildings recommended to be renovated to energy class A (in total 23% of all buildings in the category), but the buildings of the same category that have already been renovated to class A are a low number, therefore cannot be included in the scope.

Figure 4. Average recommended renovation level for public service buildings versus cost-effective benchmark in LTRS



As one can see on the graph, in the case of public service buildings, again the average energy performance after the measures is much higher than the cost-optimal renovation benchmark defined in the LTRS for this type of building (140.31 kWh/m^2). For buildings with recommended energy class B, the average excess is 89.65 kWh/m^2 (over 63%), and for buildings with recommended energy class C, the excess is 124.02 kWh/m^2 (over 88%).

In contrast to the previous two building categories, the average energy performance recommended in energy audits for public service buildings is significantly lower than the maximum values for both energy classes B and C, in both the old and new class scales. This difference can be attributed to the delayed commencement of renovation projects for public service buildings compared to schools and childcare facilities. Consequently, many energy audits for public service buildings were conducted later, incorporating stricter regulatory requirements. This is likely the reason that considerable number of buildings in this category have been recommended for renovation to energy class A, as previously mentioned.

The final category of buildings analysed is **healthcare establishments (hospitals, polyclinics, etc.)**. Similar to other buildings, only those certified as energy class B or C, and those recommended to achieve the same classes, have a significant enough representation of data

to be included in the sample for analysis. In this category, a total of 80.9% of all buildings have recommended renovation measures to reach class B or C.

Figure 5. Average recommended renovation level for buildings of healthcare establishments compared to cost-effective benchmark in LTRS

Similar to public service buildings and for buildings of healthcare establishments, the average energy performance recommended in the energy audits is notably lower than the maximum energy performance of energy classes B and C on both the old and the new scales. However, another key factor to consider in this case is the national methodology for calculating the energy characteristics of buildings. This methodology takes into account the energy consumption of various electrical appliances within the building that are not part of the building systems when determining the building's energy class. Furthermore, healthcare establishments are evaluated on a single building scale, encompassing hospitals, polyclinics, and other smaller health centers. As a result, polyclinics and small health centers, which may lack the equipment found in hospitals, can achieve significantly better energy performance when implementing similar measures. This leads to an overall improvement in the average energy performance within the general category that includes polyclinics alongside hospitals.

When comparing the average energy performance recommended in the energy audits to the cost-optimal renovation benchmark set in the LTRS for this building category (166.98 kWh/m^2), significantly higher values are once again observed. Buildings with a recommended energy class B show an average excess of 51.55 kWh/m^2 (over 30%), while buildings with a recommended energy class C exhibit an excess of 103.83 kWh/m^2 (over 62%). The relatively smaller excess compared to other analysed building categories is attributed to the inclusion of hospitals and polyclinics in one and the same category and the methodological requirement to consider the energy consumption for all equipment within these buildings into determining the energy class.

Based on the analyses conducted for the four categories of buildings, the following conclusions can be drawn:

- Energy auditors typically recommend achieving energy performance levels post-renovation that are close to the minimum required (around the upper limit of the respective energy class range). This tendency can be attributed to the fact that

municipalities often request energy audits to qualify for funding under various grant schemes. Auditors are thus compelled to align their recommendations with the minimum requirements of the funding program which are linked to the minimum regulatory requirements.

- The average energy performance levels recommended in energy audits significantly surpass the energy performance corresponding to the cost-optimal renovation benchmark outlined in the LTRS for the respective building type.
- Based on the aforementioned conclusions, it is evident that the initial stage of the building renovation process, specifically the conduct of an energy audit, sets the stage for shallow renovations. This practice significantly hinders the feasibility of transitioning these buildings to climate-neutral status.

4.2. Analysis by comparing the average actual energy performance with the average recommended energy performance in energy audits

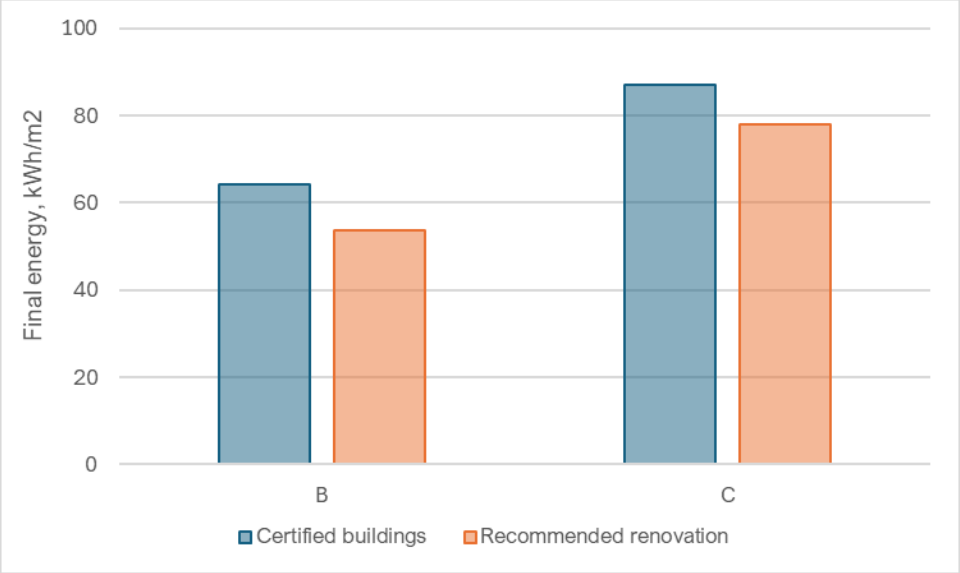
The following four graphs display the outcomes of the second type of analysis for the four primary categories of public buildings. Once more, the analyses were conducted using data from the SEDA register as of 25.03.2024. Again, only buildings within the respective energy class are included if they constitute more than 10% of all buildings within the corresponding category listed in the register. By comparing the average energy performance of a specific energy class within a building type with the energy auditors' estimated average energy performance for buildings of the same type recommended for upgrading to the same energy class the deviation between the achieved renovation level and the recommended renovation level are determined.[5]

Figure 6 illustrates the results of a comparative analysis between the average energy performance of renovated **school buildings** and the recommended energy performance levels outlined in energy audits when targeting the same energy class. The analysis includes only buildings within energy classes that have a significant number of registered buildings (over 10% of all buildings of the relevant type). This encompasses both buildings certified within the specified energy class and those for which measures have been recommended to reach the same energy class.

Due to this criterion, the analysis for school buildings is limited to energy classes B and C. The average actual energy performance for all schools certified within energy class B is 64.12 kWh/m^2. In contrast, the average recommended energy performance for achieving energy class B is 53.27 kWh/m^2 post-implementation. For energy class C school buildings, the respective values are 87.1 kWh/m^2 for certified buildings and 78.0 kWh/m^2 after implementing the recommended measures to reach energy class C. The comparison reveals that renovated school buildings exhibit an average specific consumption between 10% and 16% more than the energy consumption calculated by the energy auditors for the same type of building when prescribing measures to achieve the respective energy class.

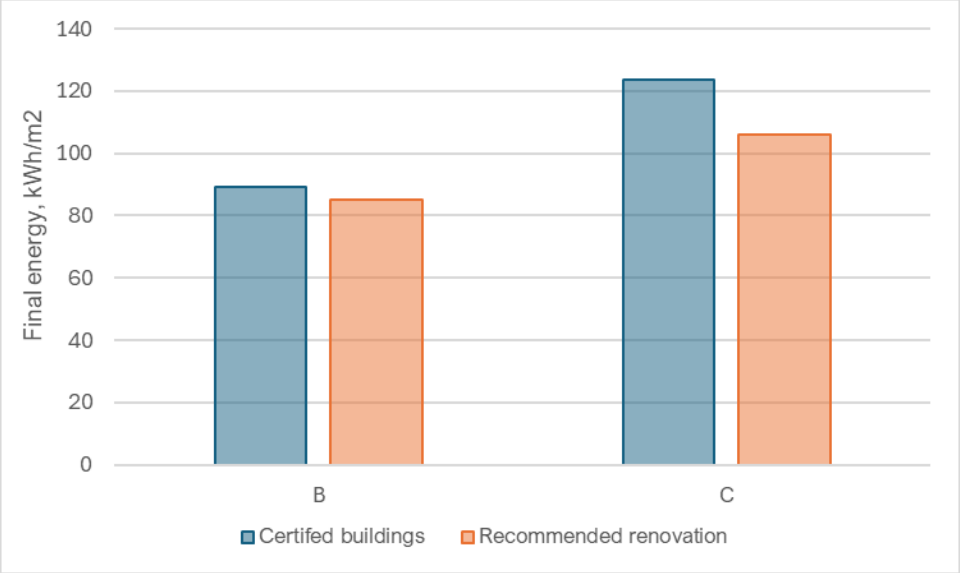
[5] To ensure clarity in the text in this chapter the comparison is between the average recommended energy performance and the average actual energy performance.

Figure 6. Average energy performance of renovated school buildings by energy class compared to recommended average energy performance for the same energy class



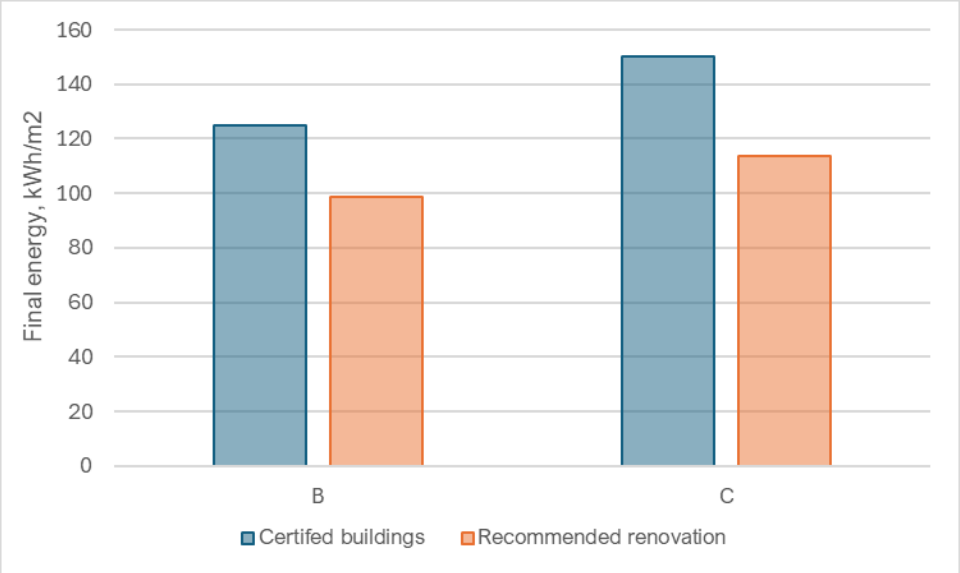
The findings are consistent for the **buildings of childcare facilities**, as depicted in Figure 7. Once again, only buildings classified as energy class B and C are included in the analysis. The average actual energy performance for all buildings of childcare facilities certified as class B is 89.12 kWh/m^2. In contrast, the average recommended energy performance in the energy audits targeting achieving class B is 85.26 kWh/m^2 post-renovation. For energy class C childcare facilities, the respective values are 123.63 kWh/m^2 for already certified buildings and 106.17 kWh/m^2 based on recommendations in energy audits to achieve energy class C. The comparison reveals that renovated childcare facility buildings exhibit an average specific consumption between 4% and 14% higher than the energy auditors' calculated consumption for childcare facilities slated for renovation to the corresponding classes.

Figure 7. Average energy performance of renovated buildings of children's facilities by energy class compared to recommended average energy performance for the same energy class



The results of the analysis for the third category of buildings - ***public service buildings*** are presented in Figure 8. Again, in accordance with the aforementioned criteria, only buildings of energy classes B and C are included the scope of the analysis.

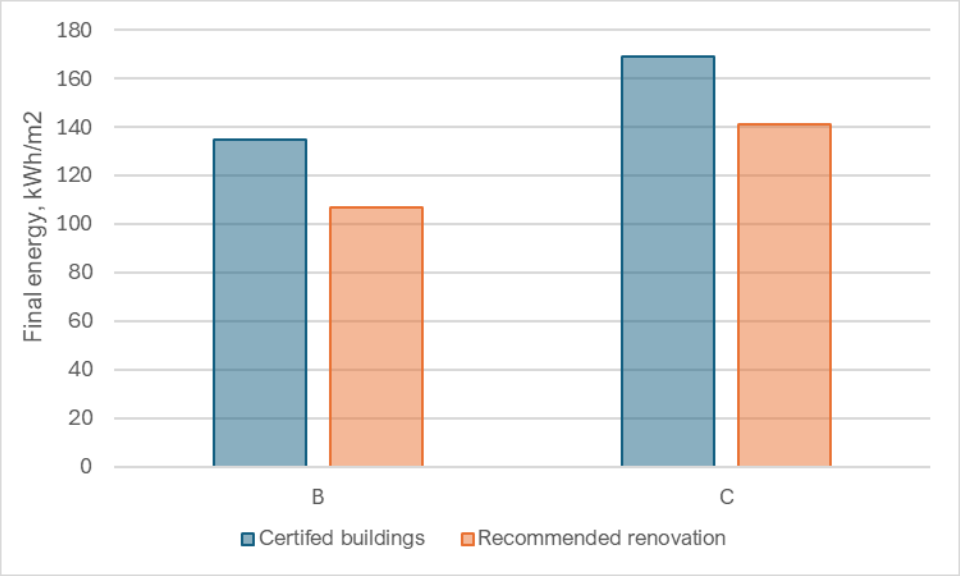
Figure 8. Average energy performance of renovated public service buildings by class compared to recommended average energy performance for the same energy class



The average actual energy performance for all public service buildings certified with class B is 125.00 kWh/m^2, and for those certified with class C – 150.09 kWh/m^2, respectively. The average recommended energy performance for all public service buildings aiming at energy class B is 98.74 kWh/m^2 post-implementation and, accordingly, it is 113.82 kWh /m^2 post-implementation for the buildings aiming at energy class C are recommended. When comparing these values, renovated public service buildings have on average between 26 and 32% higher specific energy consumption than the expected average energy consumption of the buildings in the energy audits targeting achieving the same energy class.

The last analysis, the results of which are presented in Figure 9, refers to the **buildings of healthcare establishments (hospitals, polyclinics, etc.)**.

Figure 9. Average energy performance of renovated buildings of healthcare establishments by classes compared to recommended average energy performance for the same energy class



Class B certified buildings in this category have an average actual energy performance of 134.87 kWh/m^2, while the expected average energy performance as recommended in the energy audits pursuing energy class B is 106.94 kWh/m^2 post-implementation, which is a 26% lower value. The results are similar when comparing energy class C level. Buildings already certified with this class have an average actual energy performance value of 169.12 kWh/m^2. Buildings prescribed to be renovated to class C have an average recommended energy performance of 140.95 kWh/m^2 post-implementation. The recorded deviation is 20%.

The following key conclusions can be drawn from the second type of analysis for the four building categories:

- Across all building categories, buildings that are already certified up to a certain class exhibit poorer energy performance than what energy auditors predict when recommending renovation measures to achieve the same energy class.
- The likelihood that the above conclusion is a result of inaccurate forecasts by energy auditors is low, given the analysis's consideration of a sufficiently large sample of buildings and the consistent methodology applied in assessing energy performance pre- and post-energy-saving measures.
- Assuming that the behaviour of building occupants remains consistent before and after renovation, the primary reason for not attaining the expected energy performance post-renovation can be attributed to the quality of the implementation of the prescribed measures.

In conclusion, it can be summarised that the results of both types of analysis, utilizing extensive statistical data from energy audits, unequivocally confirm the prevalence of ***underperforming renovation in public buildings*** in Bulgaria. Energy auditors often suggest renovation to energy performance levels that fall significantly short of what can be achieved through cost- optimal building renovation. Furthermore, renovated buildings frequently exhibit poorer energy performance than what was initially recommended in the energy audits. These factors collectively result in missed opportunities for energy savings and impede progress towards achieving climate neutrality in the public building sector.

5. IDENTIFICATION OF POSSIBLE REASONS BEHIND UNDERPERFORMING RENOVATIONS IN PUBLIC BUILDINGS

The possible reasons behind underperforming renovations in public buildings are many. In this section, we have summarised the most important reasons that we believe have the greatest impact on this problem.

5.1. Unambitious requirements of the regulatory framework

For years, the low ambition for energy efficiency was a main feature of the regulatory framework regarding the building stock in Bulgaria. Even after the first introduction of energy classes into national legislation in 2009, achieving energy class C was deemed sufficient to meet the requirement for energy efficiency in building renovations. This requirement remained in force until the end of 2022, when *Ordinance RD-02-20-3 on the technical requirements for the energy performance of buildings* was adopted. This requirement was not changed even once during this long period, despite the changing EU regulations and the ever-higher goals of European policies, even when the main emphasis in the EU was placed on the deep renovation of buildings, or the introduction of the requirement that buildings are renovated at cost-optimal levels. Although the first national analysis to determine cost-optimal levels for building renovation found that these levels are achieved when renovating different building types to energy performance corresponding to energy class B, the energy efficiency requirement for building renovation was retained as class C.

In addition, there were and continue to be no incentives for deep renovation of buildings and achieving the highest energy classes. Instead, the Local Taxes and Charges Act has had texts for more than 15 years that allow building owners to be exempted from local tax if they renovate their buildings to modest levels such as energy class C and even class D. If someone who owns a building renovates it to energy class A or according to the national definition of nZEB, the tax credit they can get is the same as if they renovated it to energy class C. This, of course, does not apply to the renovation of public buildings, but it is indicative of the political impasse when considering the renovation of the buildings.

In the new Ordinance *RD-02-20-3* of November 2022, however, the requirements regarding the energy efficiency of buildings were increased. At least energy class B is required for all existing buildings occupied by public bodies. A requirement has been added that all energy audits propose and assess a package of measures that leads to results consistent with the national definition of nZEB, and this package of measures should be executed as a priority if it aligns with the best cost-efficiency compared to the other evaluated packages of measures.

5.2. Financing programs offering high grants rates against low energy efficiency requirements

EU-funded programmes managed at the national level have been the main source of funding for the renovation of public buildings in Bulgaria. Most of these programmes offered grants with a very high grant rate of 100% or close to 100%. Against this background, all other financial instruments, such as credit financing or ESCO find episodic and very limited application. Municipalities would naturally opt for the generous grant, given their very limited financial possibilities and reliance on subsidies from the state budget, furthermore, they are also legally limited regarding the possibilities of taking loans.

Of course, the conditions of the financing programmes are determined in accordance with the national regulatory framework. The minimum requirement for renovation of buildings to energy class C was set for many years in the conditions for funding, as a result of which most renovated buildings correspond to this energy class. This shallow renovation of the buildings is causing the so-called lock-in effect. Since the implemented basic measures on the buildings, for example thermal insulation of the enclosing elements, have a long-life cycle, it is unprofitable to redo them. Some municipalities have renovated almost all their buildings under such conditions, and some types of buildings such as schools and kindergartens have already been renovated in almost all municipalities.

Some change in the conditions of funding programs has been observed in the period since the publication of the LTRS. The programs include requirements to achieve higher energy efficiency classes, in some cases even energy class A.

5.3. Superficial municipal energy planning

The Energy Efficiency Act imposes an obligation on municipal administrations to develop short-term and long-term programs for energy efficiency and to report annually to SEDA the implementation of these programmes. Unfortunately, this legal obligation is fulfilled by most municipalities as an absolute formality. A 2021 study[6] covering the programs of all 265 municipalities in Bulgaria found that only 1/5 of Bulgarian municipalities have set quantitative energy efficiency targets in the period of their programs and only 30% of the programs have an available financial framework or financial valuation of activities.

Buildings are the major energy consumer in municipalities and accordingly occupy a leading place in these plans. The main prerequisite for the formal approach to municipal planning is precisely the way of financing energy efficiency projects, and particularly the renovation of public buildings. The high grant-in-aid predetermines municipalities to focus entirely on this method of financing. Accordingly, the municipalities wait for the financial programmes and financing conditions to be announced and then start preparing their projects, in accordance with the announced terms and conditions. On the other hand, it is typical for these programs to lack accurate, clear and predictable long-term information about the conditions for granting funds.

5.4. Recommendations in energy audits according to the criteria of the financing program

Since most of the municipalities rely solely on the financing programmes with high grant rates for the implementation of projects for the renovation of their buildings, the conditions of these programmes become leading criteria already in the preparation of project proposals. It is typical for energy audits to be requested with the task to recommend measures meeting the application conditions and collecting the maximum number of points possible according to the evaluation criteria. As we have already noted above, the energy efficiency requirements in the programs have for many years been linked to the achievement of the minimum energy efficiency requirement according to national legislation. As a result, energy audits are generally

[6] Manolova, Maria. The role of energy efficiency plans and their contribution to climate change mitigation policies. Climateka.bg, 2021
https://www.climateka.bg/planove-energiyna-efektivnost-prinos-klimatichni-promeni/

performed with low quality, without considering different packages of measures and without looking for a cost-optimal solutions.

5.5. Quality of execution of construction activities

The quality of execution of the construction and installation activities in the renovation of the buildings is key to achieving the expected results. The first prerequisites for bad construction quality are poor-quality energy audits and technical project design, which do not describe in detail the prescribed energy-saving measures, and often the valuation of the investment for the measures is made based on aggregated indicators. The main reason, which in many cases leads to poor performance, is that almost in any case in tender procedures for the selection of contractors, the leading criterion for selection is "lowest price". This results in the input of cheaper, lower-quality or insufficient materials and the use by contractors of cheaper and less skilled workers.

5.6. Control over the quality of execution of construction activities

Control over the quality of execution of construction activities is also very often not performed well enough, either by the supervising company or by the municipality and when it is relevant by the managing authority of the financial program, as well. This affects both the quality of the construction and, from there, the results that are achieved, namely underperforming renovations. Leading reasons for the poor control are again the leading selection criterion "lowest price" in the procedures for selecting contractors, as well as the lack of specific requirements and criteria regarding the technical characteristics of the materials used and specifics and details in the energy audits and technical project design documentation. The lack of sufficient human resources in many municipalities, especially in the smaller ones, is also important detriment.

5.7. Lack of monitoring and verification of energy savings

It is a common feature of many, if not all, energy efficiency projects that monitoring and verification of the energy savings achieved are neither mandatory nor carried out. While the financing programs conduct thorough checks on the financial and construction documentation, as well as the accurate execution of cost-of-quantity accounts, they fail to verify whether and to what extent energy savings have been realised. This lack of attention to the significance of the achieved energy savings shifts the focus of project implementation from achieving actual energy savings to meeting deadlines and bureaucratic requirements, typically resulting in underperforming renovations.

6. POLICY RECOMMENDATIONS TO OVERCOME THE ISSUE OF UNDERPERFORMING RENOVATIONS IN PUBLIC BUILDINGS

In the *Long-Term National Strategy to Support the Renovation of the National Building Stock of Residential and Non-Residential Buildings by 2050* (LTRS), a comprehensive list of measures aimed at achieving the established national goals for building renovation is outlined. The implementation of many of these measures can also significantly contribute to addressing the common issue of renovating buildings without achieving the expected levels of deep renovation. Therefore, it is crucial to conduct an analysis of both successfully and unsuccessfully implemented measures by LTRS, identify challenges related to their implementation, prioritize measures based on importance and expected outcomes, and develop a more effective plan for their execution. This will ensure that these measures do not merely remain theoretical, as has been the case with many similar measures in the past, but are actively implemented,

An excellent opportunity to accomplish these actions is through the upcoming ***National Building Renovation Work Plan*** (NBRP), which will replace the LTRS and must be submitted by the Bulgarian government to the European Commission in 2026. The plan must ensure the renovation of the entire national building stock to achieve a **highly energy-efficient and decarbonized building stock by 2050**, with the aim of converting existing buildings into **zero-emission buildings**. To reach this ambitious target, it is essential to include measures regarding the following:

1. *Implementing measures to avoid underperforming building renovations for all building slated for renovation as soon as possible.*
2. *Conducting detailed analyses of all previously renovated buildings to determine the necessary actions and timelines for enhancing their energy efficiency, ensuring they meet the zero-emission building definition by 2050.*

The step-by-step renovation of buildings is an approach has not yet been implemented in Bulgaria but is highly suitable when aiming to achieve ambitious long-term renovation objectives. This approach should be advocated for and enforced in building renovation practice. The key principle of the step-by-step renovation approach is that the best technologies and the measures with the highest possible energy efficiency must be applied in each renovation step. The number of measures included in each step depends on the building specifics and the available financial resources, but in general each step should contribute to achieving the long-term renovation goal. The consequence of the implementation of the measures should be planned in a way to avoid lock-in effects against the implementation of further measures.

One useful tool for encouraging step-by-step renovation are Building Renovation Roadmaps **Building Renovation Roadmaps (BRPs)** serving as a tool that recommends measures for the implementation of long-term, stepwise building renovation strategies aimed at achieving a final long-term goal. In addition to energy-saving measures, BRPs offer guidance to building owners on enhancing microclimate parameters within the building and provide recommendations for potential financing sources. As per the EPBD recast, by the end of May 2026, all Member States are required to introduce voluntary BRP schemes. It may be prudent to consider making such schemes mandatory, in addition to the **next generation of energy performance certificates**.

The entire process and mandatory documentation should be revamped to ensure that the **combined energy consulting service for building owners** is of high quality without a significant increase in cost. The realization of anticipated savings largely depends on human behaviour and the operational practices adopted post-implementation of the measures. The new integrated consulting service for building owners should encompass education and training for end users post-renovation, to be facilitated by energy consultants.

The implementation of significant changes to the traditional building renovation process necessitates that all involved parties prepare for the successful adoption of these innovations. **Specialized training** is required for the step-by-step renovation approach, as well as for the development and the efficient use of Energy Performance Certificates (EPCs), Building Renovation Passports (BRPs), and new building performance indicators. These training programs should cater to various stakeholders, starting with **energy auditors and designers** and extending to **construction firms, financial institutions, municipal authorities, and property owners**. Training sessions can be facilitated through regional and municipal **one-stop shops** (OSSs), which are already being established in different areas across the country. Collaboration with **specialized educational institutions** is essential, as they should be engaged in creating training materials, designing training content, and when it is applicable incorporating relevant training modules into their curricula.

There is a need to significantly enhance the scale of building renovation. To achieve this in practice, it is essential to **introduce new financial mechanisms that can attract private funding** for renovation purposes. Encouraging the widespread participation of **Energy Service Companies (ESCOs)** in the building renovation sector is crucial. The establishment of a ***National Decarbonisation Fund*** is the primary financial measure outlined in the LTRS and in the Recovery and Resilience Plan (RRP). This fund should offer a range of financial instruments to the market to promote deep renovation of buildings in alignment with long-term renovation strategies, leading to their transformation into zero-emission structures.

It is very important to radically change the approach and attitude towards **long-term energy planning at the municipal level**. The new municipal energy plans should set the same long-term goals for the renovation of the municipal building stock as in the NBRP and contain roadmaps for achieving climate neutrality of the local building stock. For this purpose, new instructions and methodologies should be developed and specialised trainings should be organized for municipal administrations. **A municipal energy management platform**[7] should be created, in which municipalities can collect, store, monitor and analyze the energy consumption of their buildings and through which they can report to SEDA on the implementation of their projects, programs and plans.

The monitoring and verification of results in terms of achieved energy savings, renewable energy consumption and reduced CO_2 emissions should be made a mandatory requirement for every project that receives funding under the specialized financial instruments, and incentives should be developed and offered to all building owners to implement monitoring and control in their buildings.

[7] An example of such a platform is ***municipalenergy.net*** developed under *the Municipal energy management systems* (MEMS) project , funded by the *European Climate Initiative* (EUKI). https://municipalenergy.net/Identity/Account/Login?ReturnUrl=%2F

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