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Long-term energy renovation strategy for 2050

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CONTENT

ABBREVIATIONS

ACEEE *American Council for an Energy-Efficient Economy*): US Energy Efficient Economy Council

AN RES 2010-2020: Renewable Energy Action Plan 2010-2020

AN HOUR 2020: Energy Efficiency Action Plan 2017-2020

CTN: Integrated territorial investments

SLIPS: Slovenian Infrastructure Agency

PSEPS 2050: Long-term energy renovation strategy for 2050

DSEPS: Long-term strategy to stimulate investment in energy renovation of buildings

EI: Energy performance certificate

EC *European Commission*: European Commission

Elena *European Local Energy Assistance*): European Local Energy Assistance

EU: European Union

Eurostat *Statistical office of the European Union*: Statistical Office of the European Union

EZ-1: Energy Act

JN: Procurement

PPP: Public-private partnership

LCA *Life Cycle Assessment*): Life cycle analysis

LCC *Life Cycle Costing*): Analysis of the cost of life

MF: Ministry of Finance of Slovenia

MGRT: Ministry of the Economy of the Republic of Slovenia

MJU: Ministry of Public Administration of the Republic of Slovenia

MNZ: The Ministry of the Interior of the Republic of Slovenia

MORS: Ministry of Defence

MP: Ministry of Justice of the Republic of Slovenia

SMES: SMEs

MZI DE: Ministry of Infrastructure of the Republic of Slovenia, Energy Directorate

Ministry of Infrastructure: Ministry of Infrastructure of the Republic of Slovenia

MFA: Ministry of Foreign Affairs of the Republic of Slovenia

NECPS: Integrated National Energy and Climate Plan of the Republic of Slovenia

PSO: Narrow public sector

EC OP 2014-2020: Operational programme for the Implementation of the European cohesion policy in the 2014-2020 period

OP GHG 2020: Operational programme of measures to reduce greenhouse gas emissions by 2020

RES: Renewable energy

PP-EPS: Project Office for Energy Renovation of Buildings

RHINE: Register of immovable property

RES: Court of Auditors of the Republic of Slovenia

RS: Republic of Slovenia

NZEBs: Nearly zero energy building

SVRK: Government Office for Development and European Cohesion Policy

SJS: Wider public sector

GHG: Greenhouse gases

HOURS Efficient use of energy

US: Constitutional Court of the Republic of Slovenia

Key messages from the long-term energy renovation strategy for 2050

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The overarching objectives of decarbonising the NECPs in the area of buildings by 2030, which are only feasible by reducing energy needs and increasing efficiency:

Reducing greenhouse gas (GHG) emissions in buildings by at least 70 % compared to 2005.
Renewable energy sources (RES) account for at least 2/3 of energy uses in buildings (share of RES use in final energy use excluding electricity and district heat).

Energy renovation of buildings shall be carried out taking into account the general constructional and functional condition of the building and therefore support a comprehensive renovation of buildings where necessary.
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The long-term energy renovation strategy for 2050 (DSEPS 2050) defines the approaches and policies for decarbonising the national building stock by 2050 and identifies measures supporting the building headline targets set in the National Energy and Climate Plan of the Republic of Slovenia (NEPN). The strategy thus identifies and builds on existing and new measures to achieve these objectives.

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The strategy must be implemented in line with the European Union’s commitment to the ‘energy efficiency first’ principle.
The objective of DSEPS 2050 is that by 2050 74 % of single-dwelling buildings and 91 % of multi-apartment buildings are energy renovated. This will reduce final energy consumption by 45 % and CO2 emissions by almost 75 per cent compared to 2005.
Increased investment in energy efficiency contributes to the recovery/development of the economy. In the short term, it contributes to increasing employment in sectors that supply products and services for the energy renovation of buildings and indirectly across the economy. In the longer term, they also contribute to the recovery or development of other sectors through the savings made.
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In order to achieve the headline targets set in the NECPs, high energy renovation rates, increased heating and preparation of domestic hot water from RES as well as more connections to district heating systems and a significant increase in the number of district heating systems are planned in areas where this is economically justified. The assumptions under the NECPs also include a gradual ban on the purchase of new fossil fuel heating installations, as it introduces a ban on the use of fuel oil in new buildings by 2021 and a ban on the sale and installation of new boilers on fuel oil by 2023.

In sparsely populated areas where we have unconcentrated heat demand, the production of heat for heating and the preparation of domestic hot water is channelled towards a decentralised supply of technologies such as, in particular, heat pumps and wood biomass boilers, which remains an important low-carbon resource in Slovenia. In areas where there is concentrated heat demand and in areas where remote systems already operate, priority shall be given to centralised heat supply.

At the time of the preparation of the SCEPS 2050, we are facing an economic crisis and green investments have proven to have a better impact than traditional ones, especially on jobs, in the past crisis. The country will invest significant resources in the recovery of the economy, and it is important that these funds are also used to combat climate change, as this reduces the associated adverse effects.

3

Most of today's buildings are expected to remain in use by 2050.

Two thirds of buildings are residential buildings for which DSEPS 2050 plans new financial instruments. With sustainable building renovation decisions, which take place around every 30 years, Slovenia will have a significant impact on resource efficiency through the implementation of DSEPS 2050.

Building renovation is a long-term task that will gradually cover the entire building stock in the coming years, while having a major impact on the quality of the indoor environment. More than 75 % of today's buildings are expected to remain in use by 2050. More investment in the renovation of an individual building can be expected in the light of new knowledge about the inadequacy of buildings' resilience combined with the danger of human lives in the event of damage caused by an ageing material or accidents (earthquake, flooding, landslides, etc.) and, under the normal scenario, only indicatively every 30 years (e.g. change of ownership, change of use, obsolescence and end-of-life). It is therefore necessary to better integrate resource efficiency and life-cycle thinking, i.e. environmental impact assessment throughout the life cycle of a building, into the renovation of buildings. More efficient resource and energy management over the life-cycle of a building is the key to a more competitive construction sector that will consume less raw materials and have lower environmental impacts.

4

The long-term objective of narrower public sector (PSS) buildings is the energy renovation of three per cent of the total floor area where minimum energy performance requirements are achieved in accordance with national legislation.

The PSO building register consists of 480 buildings and 32 parts of buildings with a total floor area of 890.899 m^2, of which:

- **25 % of buildings or parts of buildings do not yet have an energy performance certificate.**
- **39 % of buildings are officially protected as part of a protected environment or because of their special architectural or historical importance.**
- **23 per cent of assessed POTROG PSO buildings do not meet the required seismic resistance according to the 8-1 Eurocode. The list was updated in 2020 anda seismic risk analysis will have to be carried out for another 189 buildings.**

In order to achieve the short-term objective of an integrated energy renovation of 127.116 m^2 over the period 2014-2023, activities will need to be stepped up.

It was found that local communities were successfully organised to carry out energy renovations and submitted the largest number of projects, mainly due to the set of instruments. As a result, local communities have carried out or are carrying out energy renovation of 80 buildings and the investment value of renovations amounts to EUR39.9 million. Most of these projects are a public-private partnership with a two-year preparation cycle and have been co-financed by the EU Cohesion Fund. Project promoters (local energy agencies and competent services) and decision-makers played an important role in implementing the projects.

Local authorities have successfully implemented energy renovation projects for buildings mainly thanks to ELENA's technical assistance and financial incentives for energy contract projects for local communities, which have been successfully exploited by the municipalities of Ljubljana, Novo Mesto, Velenje and Kranj and 25 joint municipalities, mainly coastal municipalities.

5	**From the perspective of the worst-performing building stock, more than 40 per cent of one-apartment buildings, or some 100 000 households, are classified in energy classes F and G. These buildings were built mostly before 1980. The share indicates the volume of households with high heating energy use and associated costs. Such multi-apartment buildings account for almost 8 per cent, or around 24 000 households.** **DSEPS 2050 plans systemic measures in the field of energy poverty alleviation, including absorption of cohesion funds.**

One of the measures that will have the greatest impact in the field of energy poverty is the ZERO500 programme. The programme aims at alleviating growing energy poverty. This appropriation will be used to invest in energy efficiency measures (replacement of facades, windows, roof insulation, installation of ventilation and others). The programme will include 500 low-income households in single-dwelling buildings or apartments in double-dwelling buildings, which will receive 100 % of the grants to finance investments.

6	**In multi-apartment buildings, an instrument called building cards shall be introduced by 2024 at the latest. It defines the energy, fire and seismic aspects of renovation and provides guidance on recommended and required measures for gradually wider renovation.** **As much as 76 % of the floor area of the building stock belongs to buildings built before 1990. Therefore, when planning energy renovations in the period up to 2050, it is also necessary to regulate the systemic treatment of the wider renovation of buildings, including the seismic aspect**.

As part of the preparation of DSEPS 2050, an analysis of the seismic risk of PSO buildings was carried out. This showed that 61 buildings should be subject to a detailed anti-seismic analysis and, in the event of renovation, public funding should be made available in the range of EUR139.9-271.5 million. Co-owners in multi-apartment buildings will be obliged to display a so-called building certificate that defines the energy, fire and seismic aspects. It provides guidance for (progressive) wider renewal. It should be in place by 2024 and appropriate legislation and financial instruments should be put in place by that time. The purpose of the building card is to inform co-owners about the state of their building and possible long-term renovation measures.

7	**DSEPS 2050 focuses attention on the implementation of energy renovations from partial to integrated energy and NZEB renovations. It will be essential to reform the calls, scales and conditions of incentives for more favourable conditions for integrated renovations and energy renovations into NZEBs. The implementation of SCEPS 2050 requires either a pro rata increase in the contribution to energy efficiency or the provision of another suitable source of financing on an annual basis. Without additional resources from SCEPS 2050, the investment plan and the objectives of the NECPs will not be achieved.**

The objective of the NECPs to decarbonise buildings by 2030 will only be achieved by reducing energy needs and increasing the efficiency of heating systems. In recent years, most of the measures on buildings have been aimed at replacing heating systems or have involved partial energy renovations. Integrated energy renovations, which achieve greater environmental and energy impacts, have been rare.

The Renovation Plan is operationally complex and investment-intensive. The resources of the Eco-Fund stemming from the Climate Fund and the contribution to energy efficiency do not provide the scale of resources to achieve the dynamics of renovations under the EEDF.

1 Introduction

1.1 DSEPS 2050 Vision

The long-term energy renovation strategy for 2050 (hereinafter referred to as DSEPS 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 Integrated National Energy and Climate Plan of the Republic of Slovenia – NECPs(RS, 2020a):

- **Reducing greenhouse gas emissions in buildings by at least 70 % by 2030 compared to 2005.**
- **Renewable energy sources (RES) account for at least 2/3 of energy uses in buildings by 2030 (share of RES in final energy use excluding electricity and district heat).**

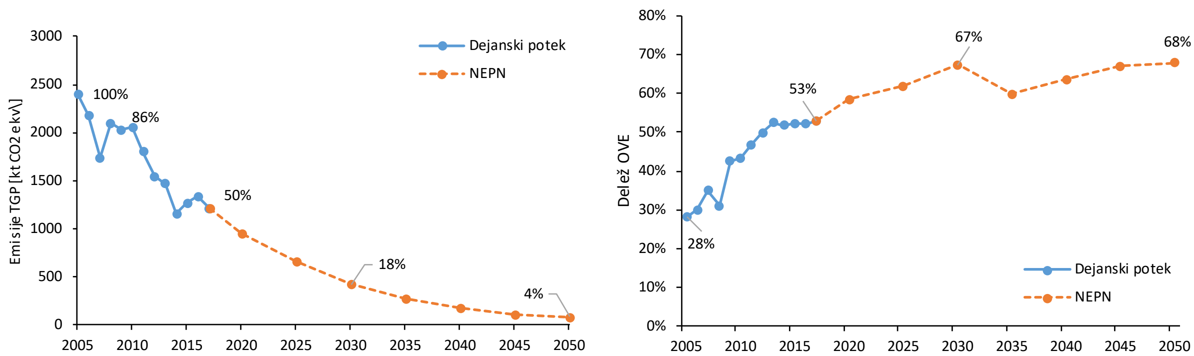


Figure1: Evolution of GHG emissions (left) and share of RES (right) in buildings 2005-2017 and scenario by 2050

DSEPS 2050 should be implemented in line with the European Union's commitment to the 'energy efficiency first' principle, which is the guiding policy principle in the formulation of energy policy(EC, 2015a). The 'efficiency first' principle gives priority to investment in sources of efficiency on the part of consumers (including energy efficiency and end-use response) where these would cost less or bring more value than investments in energy infrastructure, fuels and supply itself.

In 2015, the Government of the Republic of Slovenia adopted a Long-term strategy to promote investment (MzI, 2015a)in the energy renovation of buildings, which set important targets for reducing energy use in buildings. A follow-up to the long-term strategy to promote investments in the energy renovation of buildings (MzI, 2018a)was adopted in 2018, as the implementation of the strategy showed that some areas, such as quality management, the design of financial instruments and the moderate development of the energy contract market, needed more detailed consideration and upgrading.

The vision defined by PSEPS 2050 and also contained in the NECPs is to significantly improve energy efficiency and reduce greenhouse gas emissions in increasing the use of RES in buildings (Slika 1). This is towards net-zero emissions in the building sector by 2050, which will be achieved by maintaining the amount of energy renovation of buildings and switching to heating through RES technologies and a centralised RES heating system. Renovations and new constructions will be promoted by achieving near-zero life-cycle emissions, without neglecting other aspects of renovation (e.g. seismic and fire safety and the quality of the internal environment). This will also significantly reduce emissions of other harmful substances into the air. The aim is also to make Slovenia visible in the field of sustainable construction and renovation of buildings.

DSEPS 2050 sets out a roadmap with measures and country-level indicators to measure progress towards the long-term objective of reducing greenhouse gas emissions in the

European Union by 80-95 % by 2050 compared to 1990. The implementation of these measures will provide a highly energy efficient and decarbonised national building stock.

Preglednica 1 It sets out **the content of DSEPS 2050, which is laid down in Article 2** (EK, 2018) of Directive 2018/844 amending Directive 2010/31/EU on the energy performance of buildings (EK, 2010) and Directive 2012/27/EU on energy efficiency(EK, 2012). The European Commission mandates Member States to develop a long-term strategy for 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, promoting the cost-effective transformation of existing buildings into nearly zero energy buildings.

Table1: Structure of PSEPS 2050

Part	Content	Chapter V SEEPS 2050
a)	**An overview of the national building stock**, based on statistical sampling and the expected share of renovated buildings in 2020 and border years, as appropriate;	Chapter 2
b)	The**identification of cost-effective approaches to renovation** appropriate to the building type and climate zone, taking into account any critical trigger points, where relevant, during the life cycle of the building;	Chapter 3
C)	**Policies and measures to promote cost-effective integrated energy renovation of buildings**, including phased integrated renovation, and to support targeted cost-effective measures and renovations;	Chapters 3 and 4
D)	**An overview of policies and measures to address in a targeted manner the worst-performing parts of the national building stock,** the split incentive dilemma and market failures, and an outline of relevant national measures to reduce energy poverty;	Chapter 5
e)	**Policies and actions to target all public buildings**;	Chapter 4
F)	**An overview of national initiatives to promote advanced technologies and related buildings and communities**, as well as skills and education in the construction and energy efficiency sectors; and	Chapter 6
g)	Evidence-based **assessment of expected energy savings and wider benefits**, such as health, safety and air quality benefits.	Chapter 8

Energy renovation of buildings is an opportunity to innovate, drive economic growth and create new opportunities in the construction sector, making buildings more energy efficient and climate-friendly. This will also increase the quality of the living and working environment. To achieve this, determined and coordinated action by all parties involved is needed.

The energy renovation of buildings by 2030 will focus on: (1) roll-out of a gradual wider renovation of buildings, (2) more comprehensive energy renovations, (3) alleviation of energy poverty and (4) cost-effective solutions based on building characteristics. All of this will require the creation of an appropriate supporting environment at the legislative level, enabling the measures to be implemented and providing for adequate financial resources.

If the supporting environment is correctly planned and resources are properly distributed, the energy renovation of buildings will:

- boost local economies while supporting social cohesion and healthier living conditions;
- support the achievement of climate objectives and a just climate transition;
- create more and better jobs in the construction value chain and create new economic dynamism in supporting services and industry at regional and local level;
- improve the quality of buildings and internal space, help reduce health problems linked to poor building standards;
- create opportunities for long-term investment in real estate that provide people with better and healthier living and working conditions.

Wood biomass used for energy purposes in buildings should in principle use only wood which is not suitable for industrial processing into semi-finished or finished products and end-of-life wood. As regards the use of wood in buildings, the Decree on Green Public Procurement (Official Gazette of the Republic of Slovenia Nos 51/17 and 64/19) stipulates that the proportion of wood or wood-forming in buildings shall be at least 30 per cent of the volume of incorporated materials (without interior fittings, ground flooring plates and underneathing structures), unless the regulations or the intended use prohibit or prevent this, with a third of the wood content being lower if at least 10 per cent of construction products bearing the Type I or III Eco-label are installed in the building.

1.2 Objectives of SCEPS 2050

SCEPS 2050 takes into account the underlying objectives of the NECPs and defines them in more detail. It summarises and further defines a vision for the renovation of buildings by 2050, binding targets for 2030 and indicative targets for 2050. The objectives are in line with the orientations of decisions already taken at national and EU level. The analyses and models on the basis of which the objectives of the PSEPS 2050 and the NECPs have been established have been developed in the context of the LIFE Climate Road 2050 project[1].

The document defines indicators and milestones for 2030, 2040 and 2050. It shall also indicate milestones contributing to the achievement of the Union's energy efficiency targets under Directive 2012/27/EU.

2030 headline target

2030	**Reduce greenhouse gas emissions in buildings by at least 70 % compared to 2005.** **At least 2/3 of energy use in buildings from renewable energy sources (share of RES use in final energy use excluding electricity and district heat).**

A vision to 2050

2050	**Move towards net-zero emissions in the building sector by sustaining a large scale of energy renovation of buildings with low-carbon and**

[1] 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, Ljubljana, 2020.

	renewable materials and routing to heating through RES technologies and centralised RES heating systems. **Orienting new construction and energy renovation towards achieving near-zero emissions throughout the life cycle. Wider building renovations are encouraged to ensure the safety, health, well-being and productivity of users. Building construction and renovation will be a priority area for the transition to a low-carbon circular economy.**

Sectoral objectives for 2030

The sectoral targets are provided by three indicators supporting the headline targets of the NECPs and are given by reference to 2020.

HOUSEHOLDS (Chapter 2.1.2)	Indicator 1: **Final energy consumption is reduced by 25 %** **and CO2 emissions by** **45 %.** Indicator 2: **16.062 million m² m² one- and 7.271** **million m²** **multi-apartment** **buildings** **will be renovated.** Indicator 3: **Energy consumption will be reduced by 6.05 PJ or 26 %, with 36 per cent of NZEBs.**
PUBLIC BUILDINGS (Chapter 2.2.2)	Indicator 1: **Final energy consumption is reduced by 7 %** **and CO2 emissions by** **57 %.** Indicator 2: **2.3 million m² of** **public** **buildings will be renovated.** Indicator 3: **Energy consumption will be reduced by 0.7 PJ or 20 %, with 26 per cent of NZEBs.**
PRIVATE SERVICE SECTOR BUILDINGS (Chapter 2.3.2)	Indicator 1: **Energy end-use increases by % and CO2 emissions** **are** **reduced by 51 %.** Indicator 2: **4.1 million m² private service sector** **buildings** **will be renovated in energy.** Indicator 3: **Energy consumption will be reduced by 3.7 PJ or 16 %, with 24 per cent of NZEBs.**

1.3 Review of the achievement of the 2020 targets

For the period 2014-2020, measures in the field of energy renovation of buildings are detailed in the adopted implementing documents:

- The European Commission's OP 2014-2020 (RS, 2014a) defines funding from EU funds.
- An URE 2020 (MzI, 2017a) lists energy efficiency measures.
- An NZEB introduces (MzI, 2015b) the term 'nearly zero-energy building' into Slovenian territory.
- The draft RES 2010-2020 (MzI, 2017b) sets out measures in the field of renewable energy.
- OP GHG-2020(RS, 2014b).

For the period 2021-2030, the measures covered by the NEEAP, the draft RES, NZEB and OP GHG in the period 2014-2020 are now included in the NECPs.

In order to monitor the implementation of measures in buildings, the OP GHG defines indicators[2] with defined targets for 2020 for the public sector and the housing sector, as well as more general indicators of CO_2 intensity$_{in}$ service activities and the share of RES in widespread use. As the decomposition analysis has shown that replacing fuel with other energy sources and improving the energy efficiency of buildings have the greatest impact on reducing emissions in buildings, it is essential to promote the implementation of energy efficiency measures and the use of RES in order to achieve the objectives of the OP GHG and the NECPs in this area as well as in the future. In 2018, five indicators showed favourable developments in the building area, while the values of the four indicators were lagging behind the annual indicative targets (Table 1).

The EC OP also sets a specific **target for the energy renovation of central and/or sub-government buildings owned and occupied, representing a total of127 m² comprehensive energy renovated areas by 2023.**

The objectives set in the OP GHG for the public sector for the period 2013-2020 are: Increase the cumulative reduction of energy use by 300 GWh and the cumulative reduction of$_{CO2}$ emissions by 60 kt and the cumulative area value of comprehensive energy renovated public buildings by 1.73 million m².

The objectives set in the EC OP are to achieve a reduction of primary energy use in public buildings by 16.2 GWh, or a total of 116 GWh, and energy renovation of a total of 1.27 million m² of public sector buildings, through projects implemented with the support^{of} cohesion funds by 2023.

Table2: Overview of indicators and achievement of the objectives set and justification for the assessment of the projected achievement of the target in 2020 (summarised from the Hesscreen and others (2019))

Indicators	Indicator	Unit	Year observed	Background	Annual objectives	Objectives 2020	Achievement of indicative annual	Long-term emission management
PO 06	Leverage of incentives in the public sector	EUR/EUR	2018	0,38	0,39	0,33	☺	
PO 07	Reducing GHG emissions through public sector measures	Kt $CO2_{eq}$	2018	39	49	64	☹	
PO 07	Reducing final energy use through measures in the public sector	GWh	2018	160	235	310	☹	
PO 08	Surface area of energy-renovated buildings in the public sector	1000 m²	2018	1.515	1.388	1.795	☺	
PO 09	CO2 intensity$_{in\ the}$ commercial and institutional sector	T CO2/m$_{EUR1995}$	2018	30	36	32	☺	
PO 10	Improving energy efficiency in the housing sector – reducing GHG emissions	Kt $CO2_{eq}$	2018	165	212	268	☹	
PO 10	Improving energy efficiency in the housing sector – savings in final energy consumption	GWh	2018	1.234	1.125	1.401	☺	
PO 11	Specific GHG emissions in the residential sector	Kg $CO2_{eq}$ /m²	2018	9	10	9	☺	

[2] Http://kazalci.arso.gov.si/sl/themes/po-buildings

PO 12	Share of RES in the use of fuels in general use	%	2018	58	59	61	☹	

Table3: Key to qualitative assessment of the achievement of the indicative annual target and long-term emission control (summarised from the Hescreen Heart et al. (2019))

Qualitative assessment	**Explanation**
☺	Achievement of the annual target. Long-term management of the objective: All indicators point to the achievement of the target in 2020 and a good outlook for the future.
😐	Failure to achieve the annual target due to changes in methodology, etc. Long-term management of the objective: Some indicators suggest that the achievement of the target in 2020 could be jeopardised.
☹	Failure to achieve the annual target. Long-term management of the objective: A few indicators strongly or one indicator point very markedly to the achievement of the target in 2020 and beyond.

The targets set in the OP GHG are achieved in 2013-2020 through the implementation of energy efficiency and RES measures in the public sector, a cumulative reduction in energy use of 300 GWh and a cumulative reduction of60 kt in CO2 emissions and an increase in the cumulative area value of total energy-renovated public buildings by 1.73 million m².

The objectives set in the ERDF OP are to achieve a reduction in the use of primary energy in public buildings by 16.2 GWh or a total of 116 GWh by 2023 through projects supported by cohesion funds and to renovate a total of 1.27 million m² of theuseful area of public sector buildings.

Grants for reducing energy use in the public sector have been available since 2010, with the first projects completed in 2012. The number of programmes implementing energy efficiency and RES use measures in the public sector varies from year to year.

In 2018, energy consumption was reduced by 38 GWh and CO2 emissions by 11 kt in the public sector due to the implementation of energy efficiency measuresand the use of RES. In 2012-2018, this was the second largest impact achieved, representing 81 % of energy savings, or 46 %of the 2013 CO2 emission reduction, when the impacts achieved by projects in the previous financial period were highest. The savings were achieved through the implementation of energy renovation projects for public sector buildings from the Cohesion Fund under the ERDF OP, investments in the use of RES and increased energy efficiency of buildings owned by the public sector, as well as new investments in the construction of nearly zero-energy buildings of general interest in municipalities supported by Eco Fund grants, as well as through the mandatory achievement of end-use energy savings scheme for taxable persons. Cumulatively, a reduction in energy use of 160 GWh and a CO2 reduction of 39 kt CO2 were achievedby the end of 2018. The backlog of the indicative annual targets slightly decreased compared to 2017 at 32 % and 20 per cent respectively, compared with 38 per cent and 32 per cent the previous year (Slika 2).

According to the Project Office for Energy Renovation of Public Buildings, under the OP ECP, final energy savings from certified operations are estimated at a total of 57,7 GWh by the end of 2020and a reduction of CO2 emissions to 15,3 kt per year, meaning that the energy renovation of public buildings is carried out in accordance with the objectives set in the ERDF OP.

However, this will not be sufficient to achieve the objectives of the OP GHG. According to the first data for 2019, a cumulative reduction in energy use of 172 GWh and a reduction of 42 kt in CO_2 emissions were achieved in that year, bringing a further slight increase in the backlog of the two indicative annual targets. In 2020, for which a cumulative reduction in energy consumption is estimated at 199 GWh and a reduction in CO_2 emissions to 49 kt, there is a backlog of 36 % and 24 % respectively. In order to achieve the 2020 targets, public sector energy consumption should be reduced annually by 75 GWh and CO_2 emissions by 12 kt in 2019 and 2020. Such effects have never been achieved in the observed period 2012-2018.

In view of the current situation, we assume that the targets set out in the OP GHG for 2020 have not been achieved either. Nevertheless, the energy renovation of public buildings also requires adequate investment intensity to be ensured in order to achieve the objective set out in the ERDF OP. **In order to ensure the appropriate quality of the projects implemented and to promote green economic growth, it is necessary to ensure that investment is promoted as evenly and as predictable as possible**. In order to maximise long-term benefits through job creation, stable inflows to the public sector budget and economic growth, it is also important that investments are made as evenly as possible, without concentrating investment activity in individual years or shorter periods and declining activity in other periods. In the light of the good experience of this and the previous financial period (ECIP and OP ROPI), **co-financing with grants should continue to be provided in order to encourage investment in energy renovation of public buildings**.

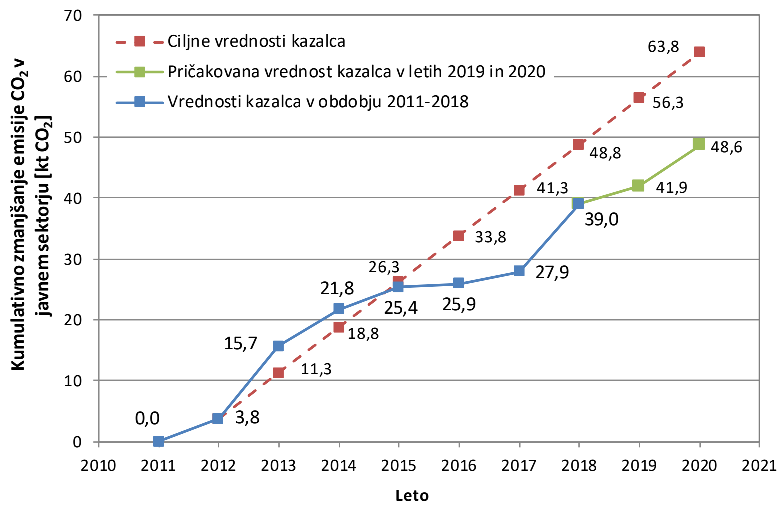


Figure2: Cumulative CO2 emission reduction through public sector measures 2011-2018, expected indicator value in 2019 and 2020 and its 2020 targets (Source: IJS-CEU)

The total value of the surface area of comprehensive energy-renovated buildings in the public sector amounted to 1.51 million m² at the end of 2018, above the indicative annual target of 9 per centSlika 3. In 2018, the refurbishment of over 250,000 m² areas was significantly higher than in 2017, but still lags behind the values of the annual renovated areas in the period 2013-2015. In order to reach the 2020 target, there is still a need for a comprehensive overhaul in 2019 and 2020. 140 m² public buildings per year. According to the first estimates, 146,000 m² were renovated in 2019 and 325,000 m² in 2020, totalling almost 1,99 million m² by 2020, which is 11 per cent above the indicative annual target value. The evolution of the indicator's value will thus remain favourable, but in order to achieve the sectoral GHG emission reduction target of the OP GHG Framework, it is essential to take into account, at the same time as this indicator, the findings of the indicators accompanying the reduction of CO_2 emissions and the end-use energy savings achieved by the implementation of public sector measures, which suggest that the **energy renovation of buildings should be directed more towards comprehensive renovations.**

Projects supported by cohesion funds are expected to refurbish over 700,000 m²areas by 2020 or reach 55 % of the 2023 target. This means that over 188 m² ofpublic buildings will have to be renovated each year in the period 2021-2023 to reach the target.

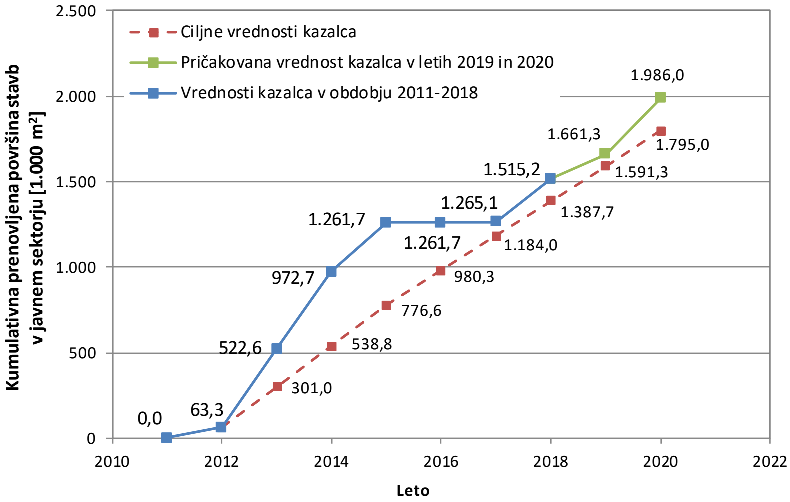


Figure3: Cumulative area of comprehensive energy renovated buildings in the public sector in 2012-2018, expected value of the indicator in 2019 and 2020 and its target values up to 2020 (Source: IJS-CEU)

In the case of energy renovation of PSO buildings, Slovenia's objectives are:

1. **Renovate each year three per cent of the total floor area of PSO buildings** that are heated and/or cooled, in such a way as to meet at least the minimum energy performance requirements (Article 5 of the Energy Efficiency Directive 2012/27/EC);
2. **To renovate 127,116 m² of the floorarea of PSO buildings during the period 2014-2023 (** Operational Programme for the Implementation of the European Cohesion Policy 2014-2020, hereinafter: EC OP 2014-2020).

DSEPS 2050 provides for the energy renovation of PSO buildings on the basis of a calculation of the total floor area of buildings owned and occupied by persons in the narrower public sector which have a total useful floor area of more than 250 m² and which, on 1 January of each year, do not comply with the national minimum energy performance requirements set in accordance with Article 4 of Directive 2010/31/EU.

According to the updated register of PSO buildings with a useful floor area greater than 250 m², the total area of PSOs is 887,648 m² (situation as at 1 October 2020). In view of the total surface area of PSO buildings, 26 m² of buildings'surfaces should therefore be renovated each year or during the period.
2014-2020 approximately 186.406 m², provided that all buildings are subject to energy renovations and without taking into account the renovations already carried out. The objective is indicative on the basis of the existing inventory, as it derives from the register of individual parts of buildings and the renovations will actually be carried out at the level of the individual building. The objective does not cover buildings for national defence purposes and covers individual accommodation or office buildings used by the Slovenian Army and the Ministry of Defence.

1.4 Terminology definition of renovation

Depending on the scale of energy renovation, a number of different types of renovation are distinguished. Directives and national and other documents provide different definitions, making it difficult to distinguish between them. Clear terminology is therefore crucial for communication in the context of applied professional and research work. ItV okviru priloge A Terminološka opredelitev prenose so navedeni vsi različni strokovni izrazi v zvezi s prenovo stavb in energijo, ki se uporabljajo v slovenskem in širšem tujem strokovnem okolju. Zaradi ustrezne in nedvoumne uporabe ustreznih opredelitev za potrebe energetske prenove v DSEPS 2050 so v okviru poglavja 1.4 Terminološka opredelitev prenove natančno opredeljeni izrazi, ki se uporabljajo za izvajanje energetske prenove v skladu z zakonodajo in drugimi ukrepi v Sloveniji.

V okviru te priloge so navedeni vsi različni izrazi, ki se uporabljajo v našem strokovnem prostoru. Namen je opisati in poenotiti ustrezno strokovno izrazoslovje v našem prostoru.

Preglednica 40 shows the collected terms describing the different types of renovation, the type of criterion (qualitative or quantitative) and the source from which it originates. A detailed explanation is given in Annex A.

DSEPS 2050 covers different types of renovation using the following terms:

- **Comprehensive energy renovation of a building** is renovation where energy efficiency measures are implemented on the building envelope and on building technical systems to meet the minimum energy performance requirements under Article 4 of Directive 2010/31/EU.
  For comprehensive energy renovations of existing public buildings, for the purpose of obtaining financial incentives, the requirements shall be verified at the level of minimum energy performance requirements (coefficient of specific transmission heat losses, annual heat demand for heating the building, minimum thermal transient value of the external surface elements of the building and partitioning elements of the building, and achievement of a minimum RES share of the total energy input for the operation of the building);
- **Nearly zero energy renovation** is an energy renovation of a building where the renovation meets the minimum energy performance requirements that are in line with the NZEB national definition;
- **Sustainable renovation** is the renovation of a building that takes into account sustainable construction criteria and indicators;
- **A wider renovation** is a 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.).

2 Energy renovation of buildings in Slovenia by 2050

The Slovenian building stock comprises 87.3^{million} m² floor areas, of which 76 % belong to buildings built before 1990. **Buildings are distinguished by function between residential** and **service sector buildings**, based on a common classification of types of buildings(UL RS 37/2018, n. d.).

The housing sector accounts for 73 % of the total building stock and is separated into single and multi-dwelling buildings, with a total floor area of 63.7 million$^{m^2}$ (,Slika 4)Preglednica 4.

Service sector buildings account for 23.4 million m^{2and} are differentiated according to the intended use and ownership of public buildings and the private service sector. Public buildings account for 41 % of all in the services sector and comprise buildings for specific social groups, public administration, culture and entertainment, museums and libraries, education and scientific research, healthcare and sport. **Public buildings consist of narrower and wider public sector buildings as well as municipal buildings or local communities.** Private service sector buildings are hotels, catering buildings, other administrative and office buildings and shops.

Table4: Useful area of the buildings covered by each group of the Uniform Classification of Facilities (CC-SI) in Slovenia, 2019 (source: IJS-CEU, GURS, SURS, IJS-CEU data)

Description of the actual use of the building or part thereof	Area [1.000 m²]
Residential buildings	**63.737**
One-dwelling buildings	46.823
Multi-dwelling buildings	16.914
Services sector: Public buildings	**9.707**
Residential buildings for specific social groups	1.117
Public administration buildings	1.049
Cultural and entertainment buildings	903
Museums and libraries	464
Educational and scientific research buildings	3.717
Healthcare buildings	1.220
Sports halls	1.238
Services sector: Private service sector buildings	**13.786**
Hotels	1.089
Catering buildings	1.245
Other administrative and office buildings	5.730
Shops	5.722

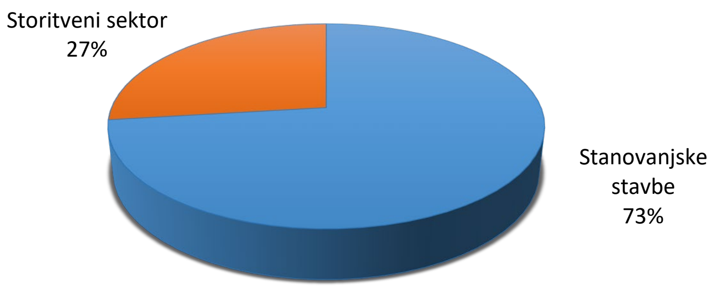


Figure4: Shares of building types in the total building sector

2.1 Residential buildings

2.1.1 Technical potential for energy renovation

The technical potential of buildings for deep energy renovation refers to buildings where at least two elements of the building's thermal envelope (wall, windows, roof) have already reached the expected lifetime of the element (30 years) and therefore need to be replaced. This means that we observe the age of the building and the structural elements of the building's thermal envelope during the period.

The technical energy renovation potential is modelled on the baseline state of the building from an energy point of view, i.e. whether, depending on the age of the building, any element of the building's thermal envelope has already been retrofitted (phase, roof) or replaced (window). A building that has not been renovated in the base year is eligible for a smaller, medium and deep or almost zero-energy renovation. The baseline situation is by default from the Real Estate Register (REN), where for the individual elements of the building envelope it is indicated if and when the element has been renovated in the past.

This potential is increasing in the observed period up to 2050, as new buildings requiring integrated energy renovations are added to the cumulative potential each year. On the other hand, according to the projected renovation schedule, the cumulative share of buildings eligible for comprehensive energy renovation is decreasing through annual renovations. In the past, therefore, due to relatively few renovations over the years, the total technical potential has increased cumulatively. The cumulative technical potential for energy renovation in single-apartment buildings is 44.6 million$^{m^2}$ and in multi-apartment buildings 16.4 million m² ().Slika 5

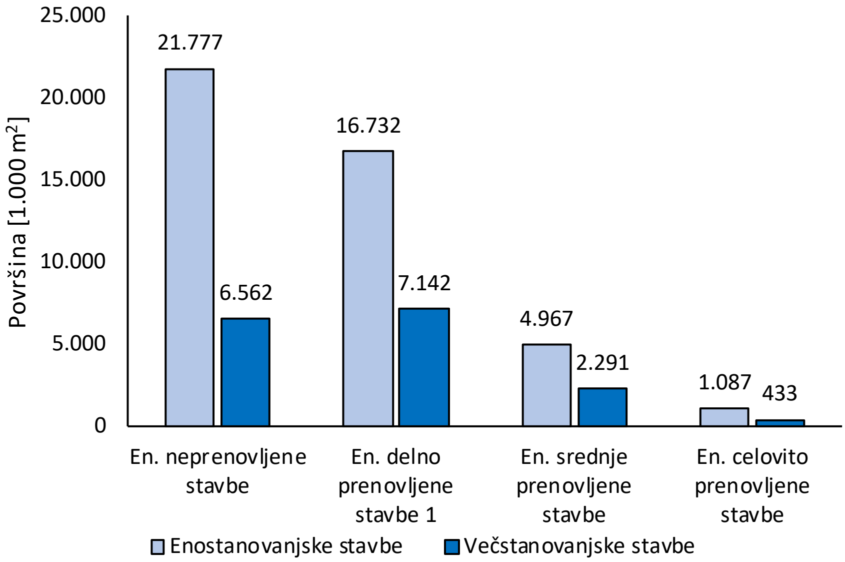


Figure5: Technical potential for energy renovation of residential buildings, given the extent of energy renovation of single and multi-apartment buildings already implemented

This potential shall be taken into account in the projected energy renovation of the existing housing stock, where the default number of renovations is in line with NECPs projections for analyses. The calculation of the number of renovations takes into account all forms of renovations, i.e. small, comprehensive and nearly zero-energy. Partial energy renovations are taken into account with a weight of 0.35 and integrated energy renovations, including NZEB renovations, with a weight of 1.0. The baseline annual renovation for single-apartment buildings in the period 2020-2050 is 3.5-4.0 per cent and 5.0-5.5 per cent for multi-apartment buildings. The challenging scale of energy renovations in order to reach the 2030 building targets and to reduce GHG in the long term by 2050 is reflected in a reduction in cumulative potential, leading to a gradual reduction of the model scale of renovations by 2050 (Slika 6).

In March 2020, an epidemic of the contagious COVID-19 disease caused by SARS-CoV-2 was declared in Slovenia(RS, 2020b). The announcement of the epidemic has halted or severely restricted not only social but also economic activity. As a result, economic growth will also be lower than initially projected in the NECPs.

In response[3]to the economic crisis caused by COVID-19, the European Union recommends that Member States base their actions on the European Green Deal as the cornerstone of the economic recovery plan. It defines economic recovery, ensuring resilience, creating jobs and protecting human well-being and health from further risks and adverse environmental impacts. Highlights the climate and environmental emergency and the fact that climate change and habitat loss increase the risk of emerging pathogens and pandemics, including the transmission of viruses from one species to another.

In the aftermath of the COVID-19 epidemic, economic growth is expected to be halted, which will also be reflected in households' investments in the energy renovation of buildings. Therefore, a projection of **"NECPs (covid-19)"** is prepared that takes into account the significantly reduced volume of investments in the energy renovation of buildings over the period 2020-2022, while still respecting the targets set out in the NECPs (Slika 6).

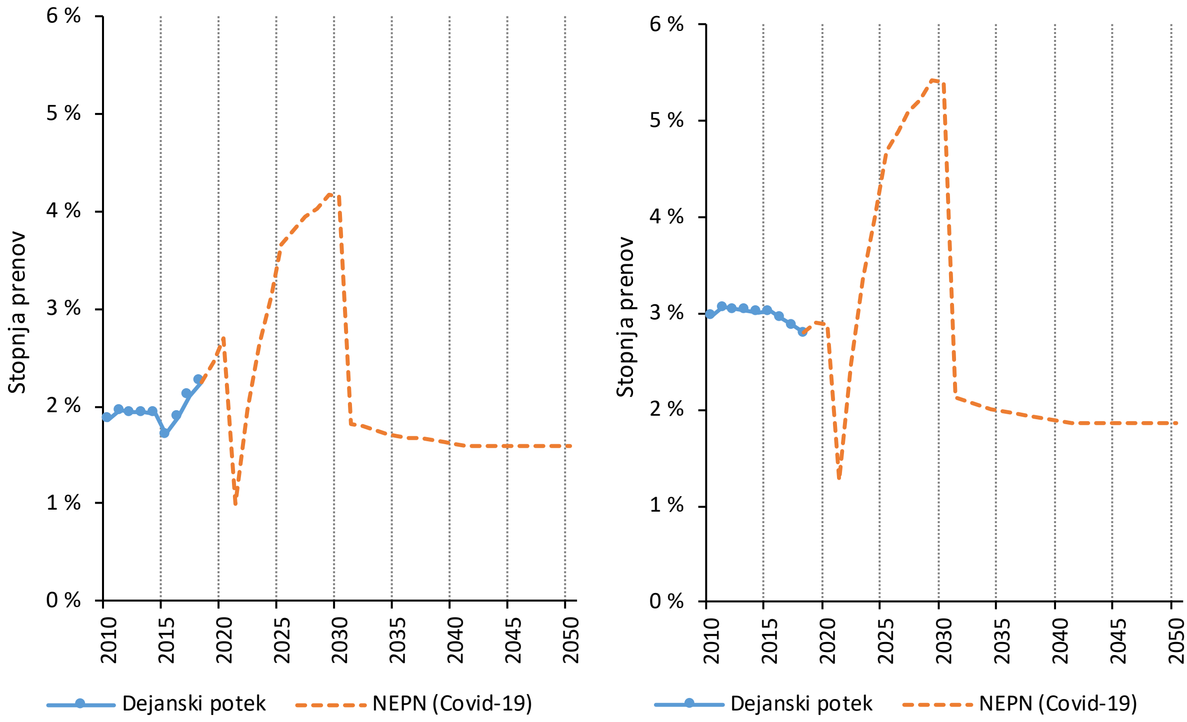


Figure6: Actual and projected weighted rate of energy renovation of single-apartment (left) and multi-apartment (right) buildings in the period 2017-2050

In order to achieve the objectives, SEEPS 2050 develops appropriate measures (chapter 7) to encourage more energy renovations in the period 2025-2030.

2.1.2 Indicators and milestones for monitoring energy renovation of residential buildings

Since the purpose of PSEPS 2050 is to set out a long-term vision for achieving the decarbonisation target by 2050, the Republic of Slovenia must go beyond existing measures (which ensure short-term effects) and ensure the long-term development of future policies and measures. The DSEPS 2050 roadmap supports the achievement of these objectives through indicators and milestones.

In this chapter, the roadmap sets milestones for monitoring energy renovations in 2030, 2040 and 2050 for the housing sector and defines the extent of the effects of energy renovations

[3] https://www.europarl.europa.eu/doceo/document/B-9-2020-0146_SL.html

that contribute to achieving the decarbonisation objectives of the Republic of Slovenia. The indicators for monitoring the energy renovation of residential buildings are:

1. Energy end-use savings and reduction of CO2 emissions,
2. share of the surface area of energy-renovated buildings,
3. energy savings and the role of nearly zero energy buildings.

Indicator 1: Energy end-use savings and reduction of CO2 emissions

In order to set milestones at the level of energy end-use savings and CO2 emission reductions in the residential sector, default assumptions ensuring the achievement of the 2030 targets are in line with the NECPs. The final energy balance is influenced by a number of policy factors set out in SEEPS 2050 and NECPs. Final energy use includes the use of energy for heating, cooling, domestic hot water preparation, lighting, ventilation, cooking and electricity for household appliances and other household needs.

As a result, many energy renovations, increased heating and preparation of domestic hot water from RES and more connections to district heating systems and a significant increase in the number of these in areas where this is economically viable are planned. In 2030, final energy consumption will decrease by 31.4 per cent compared to 2017 to 32.6 PJ, reducing CO2 emissions by 53.4 per cent. By 2050, final energy consumption will be reduced by 44.6 per cent to 26.03 PJ, with CO2 emissions reduced by 74.3 per centPreglednica 5.

The assumptions under the NECPs also include a gradual ban on the purchase of new fossil fuel heating installations, as it introduces a ban on the sale of new boilers from 2023 onwards. In sparsely populated areas, the production of heat for heating and the preparation of domestic hot water is channelled towards a decentralised supply of heat pumps and woody biomass boilers, which remains an important low-carbon resource in Slovenia. In addition, co-financing encourages the replacement of old combustion plants with new combustion plants. However, in concentrated parts of cities and areas where remote systems are already installed, NECPs favour centralised heat supply.

Table5: Energy end-use savings and CO2 emission reductions by 2050 in the residential sector (milestone 1)

Indicator	Unit	2020	2030	2040	2050
Energy savings					
Energy end-use	PJ	43,24	32,62	27,45	26,03
Reduction	%	—	25	37	40
Reduction of CO2 emissions					
CO2 emissions	MT	2,463	1,349	0,875	0,745
Reduction	%	—	45	64	70

Indicator 2: Share of energy-renovated buildings

Given the projected extent of energy renovations carried out, the time of construction and the energy renovation carried out per type of residential building, indicator 2 focuses on energy-renovated buildings (Preglednica 6). The scale of the energy renovation shall be taken into account in relation to the energy use indicator for heating and the energy refurbishment of each building carried out.

In the period up to 2030, the volume of partial and improved renovations is still relatively high, as the technical constraints of buildings will largely make it impossible to renovate the NZEB to the level of NZEBs. The cumulative potential of such buildings will gradually decrease and such buildings will no longer undergo energy renovation by 2050 or will no longer meet the technical conditions for renovation. In the last years to 2050, the volume of renovations into NZEBs will increase, as buildings that have already been renovated previously energy-renovated will be renovated at that time. As a starting point, such a building is highly energy efficient and it will be possible to reach the level of NZEBs with a minimum additional measure (e.g. a building that was renovated in 2010 will meet the cumulative condition for renovation as soon as 2040 with a minimum additional measure to reach the level of the NZEB renovation).

Table6: Areas of energy renovation of single and multi-dwelling buildings by type of renovation by 2050

Construction period	**Period 2021-2030**	**Period 2031-2040**	**Period 2041-2050**
Single-dwelling buildings [1.000 m²]			
Partial refurbishment	1.558.0	37,5	0,0
Medium refurbishment	3.598.8	158,8	0,0
Comprehensive refurbishment	10.815.8	11.595.2	534,3
NZEB Refurbishment	89,6	996,9	3.164.1
Multi-dwelling buildings [1.000 m²]			
Partial refurbishment	854,5	0,0	0,0
Medium refurbishment	2.554.5	20,8	0,0
Comprehensive refurbishment	3.756.0	5.001.3	0,5
NZEB Refurbishment	52,6	539,0	1.145.5

Buildings that meet the technical conditions for renovation are being renovated energy-renovated and, as a result, older buildings are first renovated in the initial observation period and, gradually, those that were under construction or energy renovation after 2000. ih obdobjih energetske prenove.

Preglednica 7They Preglednica 8 show the shares of energy-renovated buildings by individual building periods and individual energy renovationperiods.

Table7: Share of energy renovation of single-apartment buildings by 2050.

Construction period	**Period 2021-2030**	**Period 2031-2040**	**Period 2041-2050**
Share of energy renovations within the construction period			
Construction before 1946	22 %	0 %	0 %
1946-1970	49 %	23 %	0 %
1971-1980	49 %	49 %	0 %
1981-2002	47 %	51 %	4 %
2003-2008	4 %	33 %	48 %
Construction after 2008	0 %	1 %	17 %
Share of energy renovations in the total building stock			

Construction before 1946	4,3 %	0,0 %	0,0 %
1946-1970	7,9 %	3,4 %	0,0 %
1971-1980	7,6 %	7,2 %	0,0 %
1981-2002	12,4 %	12,9 %	1,1 %
2003-2008	0,2 %	1,7 %	2,3 %
Construction after 2008	0,0 %	0,3 %	4,0 %

Table8: Share of energy renovation of multi-apartment buildings by 2050

Construction period	**Period 2021-2030**	**Period 2031-2040**	**Period 2041-2050**
Share of energy renovations in the construction period			
Construction before 1946	9 %	0 %	0 %
1946-1970	61 %	23 %	0 %
1971-1980	61 %	61 %	0 %
1981-2002	60 %	58 %	0 %
2003-2008	5 %	42 %	46 %
Construction after 2008	0 %	2 %	22 %
Share of energy renovations in the total building stock			
Construction before 1946	1,6 %	0,0 %	0,0 %
1946-1970	14,6 %	5,2 %	0,0 %
1971-1980	12,6 %	11,9 %	0,0 %
1981-2002	12,6 %	11,7 %	0,0 %
2003-2008	0,3 %	2,9 %	3,0 %
Construction after 2008	0,0 %	0,2 %	3,6 %

Indicator 3: Energy savings for heating and the role of nearly zero energy buildings

Indicator 3 focuses on the use of energy for heating separately in single and multi-apartment buildings and on the scope of NZEBs across the sector. The scope of the NZEBs is increasing until 2050 as a result of new constructions and the gradual increase in the volume of energy renovations to the level of NZEBs. Due to the demanding scale of renovation of single- and multi-apartment buildings, energy use for heating will be reduced by over 30 % by 2030 and by around 50 % by 2050 (Preglednica 9andPreglednica 10). The use of energy for heating is defined as the heat required to heat a building.

In line with the number of renovations, energy renovations carried out, the scale of the renovation and the age of the building stock is gradually becoming more energy efficient (and energy use is gradually decreasingSlika 7).

Table9: Energy savings for heating and the volume of nearly zero-energy single-dwelling buildings by 2050

Indicator	Unit	2020	2030	2040	2050
Energy use	PJ	18,16	13,39	10,73	9,91
Other buildings	PJ	17,68	11,37	7,04	5,83
NZEBs	PJ	0,48	2,02	3,68	4,08
Cumulative savings	%	—	26	41	45
Surface area of buildings	1 m²	47.624	49.676	50.084	50.494
Other buildings	1 m²	42.649	30.699	16.887	12.094
NZEBs	1 m²	4.975	18.977	33.198	38.400

Table10: Energy savings for heating and the volume of nearly zero-energy multi-apartment buildings by 2050

Indicator	Unit	2020	2030	2040	2050
Energy use	PJ	4,99	3,71	2,81	2,59
Other	PJ	4,90	3,24	1,82	1,49
NZEBs	PJ	0,08	0,46	0,99	1,10
Cumulative savings	%	—	26	44	48
Surface area of buildings	1 m²	17.023	17.295	17.383	17.471
Other	1 m²	15.986	11.767	5.783	4.204
NZEBs	1 m²	1.037	5.528	11.600	13.266

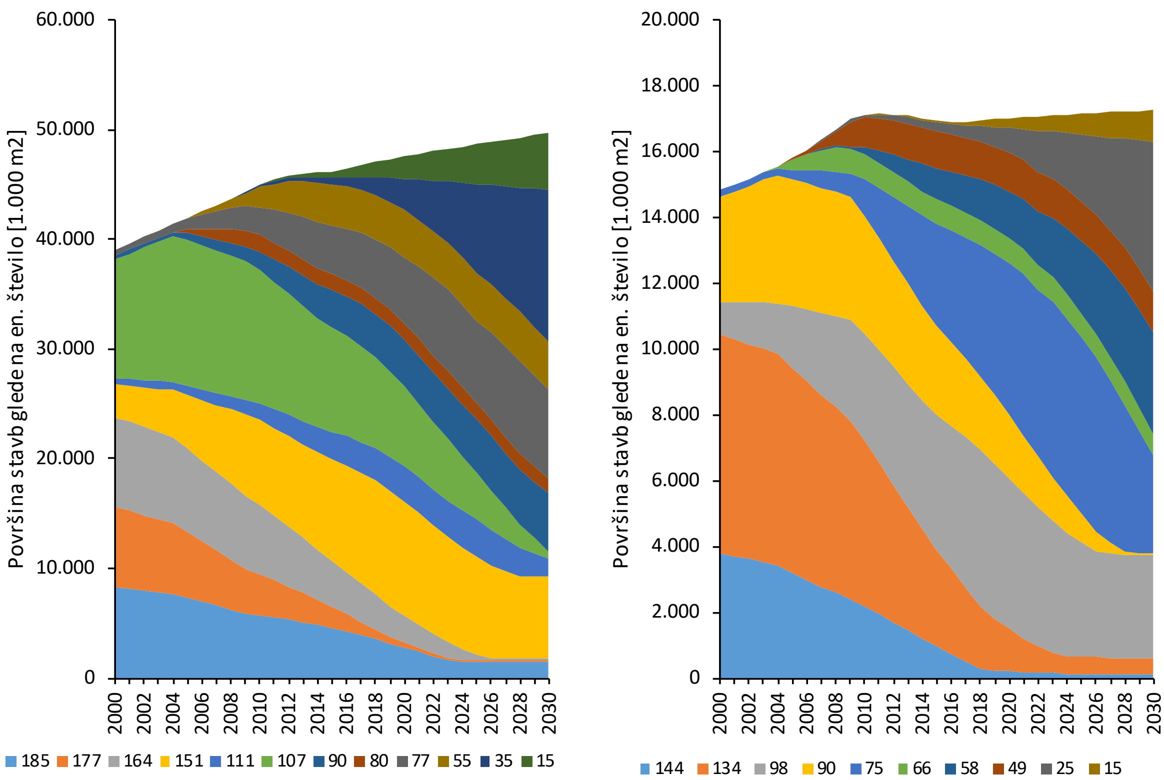


Figure7: Area of single-dwelling (left) and multi-apartment (right) buildings according to reference energy use 2000-2030

2.1.3 Barriers and opportunities to take energy renovation measures

The main participants in energy renovation in the housing sector are:

On the demand side:

- owners of housing stock: Individual owners of family houses, co-owners of multi-apartment buildings (mainly natural but also legal persons),
- housing funds: Public housing funds and non-profit housing organisations (non-profit housing[4]), major private and public housing owners (individuals, organisations and institutions);
- tenants of dwellings;
- managers of multi-apartment buildings.

On the supply side:

- repairers, repairers, housekeepers,
- energy consultants, energy advisory network advisors,
- opinion and consent (e.g. ZVKDS, energy suppliers, etc.)
- designers (architects, engineers), construction and other contractors, surveyors,
- manufacturers and providers of products, equipment and services to increase energy efficiency;
- energy contractors (energy service companies; ESCO),
- energy suppliers;

[4] Https://mss.si/ssvetovalnica-kdo/javni-stanovanjski-skladi/

- financial institutions (Eco-Fund, banks, others, such as municipal funds) and insurance companies;
- real estate market investors;
- government, municipalities.

Identification of **key barriers and challenges/opportunities** in the adoption of renovation measures

On the demand side:

- **Poor information** on renovation measures and expected effects also on the user's health and quality of stay and insufficient understanding of the technical options and their interactions.
- **Age structure** of natural persons – owners of buildings and apartments. Slovenia's population is ageing. Nowadays, 43 % of owners of buildings and apartments of retired people, i.e. older people, are in Slovenia and 48 % are owners of the working population[5]. Older owners find it harder to invest more in renovation, as they hamper financial capacity and (from their perspective) the long payback period of renovation, and older people are also less adaptable to the disruptions caused by renovation work. This often leaves decisions to the descendants.
- **Ownership structure and income differences**. In Slovenia, around 91 % of dwellings are privately owned and 81 % of dwellings are occupied by owners themselves[6]. Fragmented ownership can cause problems especially in multi-apartment buildings in order to ensure sufficient overall financial capacity (income weaker owners are unable to cover their share of the renovation costs).
- **Decision-making in multi-apartment buildings** combined with a fragmented ownership structure. Co-owners sometimes have a wide variety of short- and long-term interests. According to the Rules on the management of multi-dwelling buildings, (RS, 2013a) owners decide with more than three quarters of the shares (75 %) on all improvements that are not considered as maintenance and for which no building permit is required; This includes the energy renovation of a building. However, if energy renovation is part of a wider renovation involving improvements and construction works for which a building permit is required, a unanimous decision (100 per cent) is required. The same applies to the possible rental and repayment of a loan (for energy renovation) charged to the Reserve Fund.
- **Competence to take or validate technical decisions**. Owners in the housing sector often rely on providers rather than professionals to make technical choices or choose services (design, consultancy, supervision) in the (wrong) belief that costs are kept to a minimum; Implementation) on the basis of the principle of the lowest bid price without the requirement to meet a sufficiently high entry threshold (such as references and the tenderer's work and financial capacity), which is not a guarantee of a high quality of project implementation. In multi-apartment buildings, managers also do not always have a suitably qualified staff to manage or monitor the renovation project as a representative of co-owners in a sovereign manner. It makes great sense, therefore, to continue professional training programmes for managers of multi-apartment buildings that have already been successfully implemented in the past, which also have a good impact on the trust of co-owners in their managers.

[5] Https://www.stat.si/StatWeb/News/Index/8160

[6] Https://pxweb.stat.si/SiStatDb/pxweb/en/10_Dem_soc/10_Dem_soc__08_zivljenjska_raven__25_STANOVANJA__03_08612-stanovanja_REG/0861210s.px/

On the supply side:

- **Unpredictability in the labour market**. In Slovenia, the share of foreign labour in the construction sector is high, turnover is high and therefore the skills of this workforce are questionable.
- **Fragmentation of the construction sector**. The crisis in the construction sector since 2008, which has led to the collapse or collapse of large construction companies as well as design and engineering companies (often within the same umbrella company) with a long tradition and experience, is still affecting the structure of the construction sector and its overall ability to carry out major and professionally demanding projects. The bulk of the construction sector is now made up of craftsmen and smaller entrepreneurs, with questionable capacity to carry out large-scale and complex works and limited opportunities to acquire new skills.
- **Lack of diversity, flexibility and accessibility of sources of financing for energy renovation**. The already established system of financial support (subsidies and credit) offered to owners by the Eco Fund is excellent; These programmes should be maintained and further developed. The financing of energy renovation from own resources (equity financing) is limited to the few cases of wealthy owners. In multi-apartment buildings, the reserve fund may be used to cover investments, which, as a rule, represent only a minor part of the necessary funds, unless the owners agree to make substantially higher payments (in relation to the amounts required by law) over a longer period in which they are preparing to carry out the renovation. Debt financing, i.e. borrowing on the market, is mostly tied to offers from commercial banks, which are often less adapted to owners of multi-apartment buildings. The availability of credit may also be affected by measures such as macro-prudential restrictions on public credit. Debt financing by third parties, such as contractors, requires sufficient financial capacity and willingness to take on related business risks. At municipal level, there is scope for creating dedicated funds to encourage investment in the energy renovation of buildings, but these are very limited due to the very low degree of fiscal autonomy. Legislative changes in local fiscal policy could significantly improve the situation.
- **Energy prices**. Although there is some uncertainty about future developments in energy prices, they appear to be at acceptable and manageable levels, at least for most owners, and are therefore generally not an incentive to carry out energy renovations. In the future, this segment will also be closely linked to the increase in energy poverty and the effectiveness of tackling it at national level.
- Cultural**heritage protection regime**. In the case of buildings protected under the rules on the protection of cultural heritage, there may be important limitations in the scope and manner of energy renovation where it would interfere with protected values (external appearance, gabartes, original materials and building elements, etc.). The limited scope and thus the reduced effects of the renovation in terms of improving energy indicators may call into question the viability of the operation for owners regardless of its positive results, for example in the form of improvements in living comfort and reduced operating costs. Renovation costs may be higher compared to the renovation of a building which does not belong to the building heritage, if the use of specific (‘non-standard’, ‘historical’) materials or techniques to add, replace or renovate elements as close as possible to the original is required.

2.2 Public buildings

2.2.1 Technical potential for energy renovation

Public buildings comprise buildings of the narrower and wider public sector. The total surface area of public buildings comprises 9.7 million m^2, including 0.9 million m^2 the narrower public sector and 8.8 million m^2 the wider public sector.

The technical energy renovation potential is modelled on the baseline state of the building from an energy point of view, depending on the age of the building and the elements of the thermal envelope of the building. The baseline is the REN default situation where it is indicated for the individual elements of the building envelope whether the element has been renovated in the past and when. Two possible scales of renovation – partial and comprehensive energy renovation – were by default.

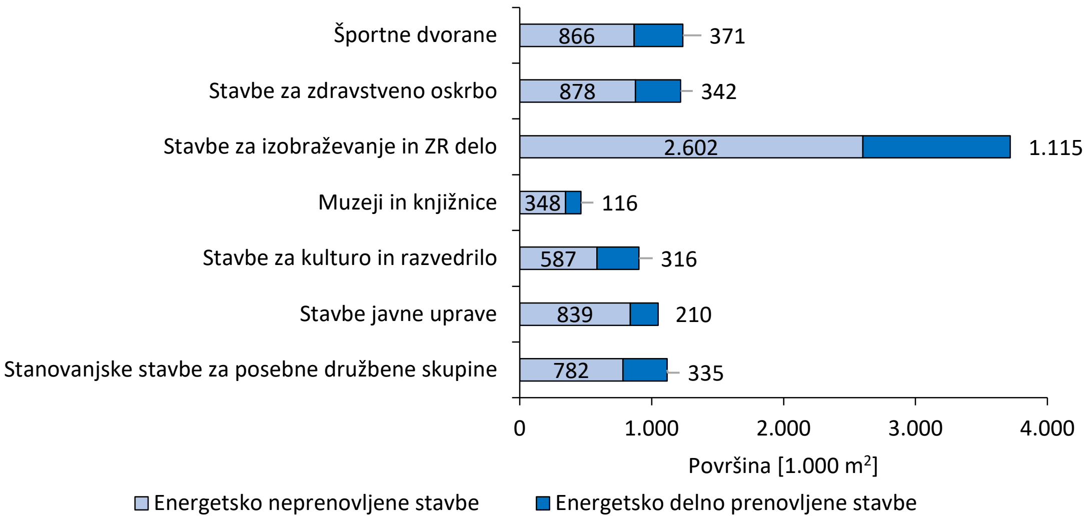


Figure8: Potential for energy renovation of service sector buildings, given the scale of energy renovations already implemented

The potential for a comprehensive energy renovation of buildings lies in buildings that have not yet been energy renovated. As a result, the technical potential for the integrated energy renovation of public buildings amounts to almost 8.08 million m^2, compared to 5.7 million m^2 for partial energy renovation. This potential shall be taken into account in the projection of energy renovations of the existing stock, where the default scope of renovations is in line with the NECPs forecast for analyses. The baseline for renovation of public buildings in the period 2020-2050 is 3.0-3.4 per cent.

In the context of this strategy, public sector entities capable of carrying out comprehensive energy renovation and representing a huge further scale of renovations are divided into narrower public sector entities and general public sector entities owned by the State and municipalities.

Buildings owned and occupied by the narrower public sector, which are subject to energy renovation of three per cent of the buildings per year, occupy a special place in the context of energy renovation.
In line with the commitments of the Energy Efficiency Directive, a list of the buildings covered by this building stock has been drawn up. Therefore, the technical potential for the future energy and wider renovation of these buildings is also further specified and will be crucial in the future.

For the wider public sector and local communities, such a list of buildings could not be drawn up in the context of the preparation of DSEPS 2050 due to its scale. However, this is defined as one of the specific activities of the SWF.

2.2.1.1 Buildings owned and occupied by close public sector entities

2.2.1.1.1 Building inventory

Article 5 of Directive 2012/27/EU provides that, from 1 January 2014, Member States are required to renovate energy annually three per cent of the total floor area of buildings owned and occupied by persons belonging to the narrower public sector where minimum energy performance requirements are met in accordance with national legislation.

The Republic of Slovenia has drawn up and published a list of buildings and parts of buildings owned and occupied by persons in the narrower public sector[7] (hereinafter PSO buildings).

The PSO building register consists of 480 buildings and 32 parts of buildings with a total floor area of 890.899 m²· The inventory covers buildings owned by the Republic of Slovenia or a legal person for which the managing body of state assets is registered in accordance with the Decree on the method of registration of real estate managers in the land register and in the cadastre of buildings (Official Gazette of the Republic of Slovenia Nos 121/06 and 104/13). According to the provisions of the Directive, only buildings for business use with an area of more than 250 m² are included in the register·

The list of PSO buildings must be updated annually with information on energy renovations carried out and buildings owned and occupied by the narrower public sector which have been or will be in real estate transactions (e.g. sale, purchase, letting). This will enable the ongoing monitoring of the energy renovations carried out and the annual calculation of the total floor area of buildings owned and occupied by close public sector entities, including changes.

2.2.1.1.2 Analysis of options for wider renovation

In line with the update of the list, an analysis shall also be carried out for a wider renovation which also takes into account other aspects of the renovation. In the interests of good governance and cost-effectiveness, energy renovations are directed towards buildings where energy renovation makes sense or where all the wider aspects of renovation are met in the long term, thus meeting the essential requirements for construction works under the Construction Act(Uradni list RS, 2020). These are:

1. mechanical resistance and stability,
2. fire safety,
3. hygiene and health protection and environmental protection,
4. safety of use,
5. noise protection,
6. energy economy and heat retention,
7. universal construction and use of a facility,
8. sustainable use of natural resources.

As part of the wider renovation of PSO buildings, minimum energy performance requirements, protection of cultural heritage and seismic and fire safety are set out.

Aspect 1: MINIMUM ENERGY EFFICIENCY

Minimum energy performance conditions are laid down in the Rules on the efficient use of energy(RS, 2010)in buildings (hereinafter referred to as PURES), which lay down requirements (detailed in chapter3.2):

- Specific transmission heat loss (HT)coefficient,
- The permitted annual heat required for heating the building (QNH);and
- minimum value of thermal permeability of the external surface elements of the building and the partitioning elements of the building (Annex C),

7 Https://www.energetika-portal.si/podrocja/energetika/energetska-prenova-javnih-stavb/evidenca-stavb-v-lasti-in-uporabi-oseb-ozjega-javnega-sektorja/

- achieving a minimum share of RES of the total energy input for the operation of the building in accordance with PURES.

A building is considered to be energy efficient if it meets the minimum requirements laid down in the PURES.

Article 336 of the Energy Act (EZ-1) lays down the requirement to issue an energy performance certificate (EI) for all buildings with a total useful floor area over 250 m² owned or occupied by the public sector. The volume of PSO buildings consists of 480 buildings and 32 parts of buildings in a total of eleven buildings. **Out of a total of 491 buildings, 25 % do not comply with the obligation to issue an energy performance certificate** (Preglednica 11).

Table11: Review of compliance with the requirement to produce an energy performance certificate in the register of buildings owned and occupied by close public sector entities

Operator	Number of buildings in the PSO register	Number of buildings in the PSO register with EI
Archives of the Republic of Slovenia	1	1
SLOVENIAN INFRASTRUCTURE AGENCY	4	0
National Assembly of the Republic of Slovenia	2	2
General Secretariat of the Government of the Republic of Slovenia	10	8
MPA	125	117
MNZ	105	100
MORS	145	47
MP	65	60
MINISTRY OF INFRASTRUCTURE	1	1
MFA	4	2
RS-RS	1	1
URSIKS	32	26
CP-RS	1	1

Aspect 2: PROTECTION OF CULTURAL HERITAGE

In Slovenia, 35 200 buildings or 12.5 million m²net floor areas are protected under cultural heritage regulations, of which approximately 16 000 are protected as building heritage and others are located in settlement areas. Of course, this building share is not crucial for the country’s overall energy balance, but there is room for improvement here too. If we achieve better energy efficiency in protected buildings by preserving their protected values, energy renovation will continue to contribute to better heritage conservation(Vendramin in drugi, 2016).

Gradual and comprehensive energy renovation shall be on an equal footing in the selection of projects, in line with good governance and cost-effectiveness of energy efficiency measures already implemented. The eligibility of each energy efficiency measure already implemented in a building shall be demonstrated in the context of the energy audit carried out.

For buildings with recognisable building elements or protected as cultural heritage, all energy renovation measures that would irreversibly alter the properties or appearance of the building shall be excluded from the integrated energy renovation. The scale of the integrated energy renovation therefore also depends on the architectural and historical importance of each building.

Before encroaching on cultural heritage or construction land within a registered archaeological site, cultural consent must be obtained from the competent regional unit of the Institute for the Protection of Cultural Heritage of Slovenia, subject to compliance with cultural protection conditions. Interventions are all works, maintenance and other works, activities and practices that alter the appearance, structure, internal relationships and use of cultural heritage.

An inspection of the buildings and parts of PSO buildings officially protected as part of a protected environment or because of their special architectural or historical importance showed that 186 buildings in the register are protected (Table 16). This means that the energy renovation of these buildings will require prior compliance with cultural protection conditions, but this does not necessarily have an impact on the envisaged scale of energy renovation.

Table12: Overview of the number of PSO buildings and parts officially protected as cultural heritage

Group	The nature of the heritage	Type of heritage	Regime	Number of parts of buildings in the PSO register
1	buildings	profane building heritage	monument	36
2	buildings	profane building heritage	heritage	37
3	settlements and parts thereof	settlement heritage	monument	97
4	settlements and parts thereof	settlement heritage	heritage	82

Energy renovation of cultural heritage buildings does not necessarily imply higher investment in renovation. An analysis of the energy renovation projects of public cultural heritage buildings, which were partly financed by cohesion funds, showed in a sample of 188 buildings that investments in energy renovation of facade envelopes and roofs are generally lower than for buildings not protected as cultural heritage and slightly higher investments in window replacement. The reasons for the lower investment in façade and higher in building furniture are technical, linked to the marginal conditions of the protection of cultural heritage. Final energy savings after the implementation of the measures were expected to be lower for cultural heritage buildings than for other buildings, but the difference was less than one quarter(Tomšič in drugi, 2019).

Aspect 3: SEISMIC SAFETY

The more seismicly vulnerable are older buildings built before the entry into force of the first seismic regulations. Among these facilities are older stones and bricks, with a few concrete buildings built after the Second World War. On the territory of Slovenia, a milestone was set by the 1963 Decree and the 1964 Rules (OJ SRS, No 18/63 and OJSC, No 39/64), but many of their provisions were not complied with in the design of the facilities until 1976(Lutman in drugi, 2015).

Only after the stronger earthquakes in Friuli and Montenegro, and the adoption of new regulations at that time, the designers became aware of the devastating power of earthquakes and their impact on construction structures. However, the most recent recommendations and knowledge of the profession are more comprehensively and more fully integrated into the European Standard Eurocode 8, which has been mandatory in Slovenia since 2008. As the requirements of these standards are much stricter than those of previous regulations, many pre-2008 facilities do not correspond to the current requirements.

In order to assess the potential for wider renovation of PSO buildings, a seismic risk assessment has been carried out(Lutman, 2020). As a result, we have identified the most at risk of being seismic among all the buildings assessed by the narrower government. These are those whose estimated seismic resistance is less than or equal to the required seismic resistance under the Eurocode 8-1.

As part of a specific task, 285 buildings owned and occupied by the narrower public sector were examined without taking into account the MORS buildings and a model assessment was carried out using the POTROG model developed for the Administration of the Republic of Slovenia for Protection and Disaster Relief(Lutman in drugi, 2013).

The**61 PSO buildings assessed do not reach 34 per cent of the required seismic resistance according to the Eurocode 8-1,** i.e. 21 % of the total of 285 buildings assessed**. It is essential for these buildings to require a detailed analysis of seismic resistance**.

Buildings for which a detailed seismic analysis will also confirm their high seismic risk and decide to undergo energy renovation and anti-seismic consolidation shall be subject to a detailed examination and examination of the supporting structure and its materials when designing and designing the anti-seismic consolidations, and a detailed analysis of the load capacity and seismic resistance using the method prescribed by the Eurocode 8-3 standard. A comparison of the assessed seismic resilience of the building in its current state with that required will serve as a basis for further decision-making. However, the final scope of the measures that will consolidate the structure in the most optimal way can be determined on the basis of a few versions analysed. In this context, it should be borne in mind that the scope for consolidation is not unlimited and that the requirements of the rules in force can often not be met. In such cases, the possibility of replacing the building with a new one should be considered. The anti-seismic renovations of these buildings analysed three counter-seismic consolidation options: The external reinforcement of the building, the internal reinforcement of the building and the construction of the building. The consolidation work took into account the costs of (1) consolidation work, (2) construction, artisanal and installation costs, (3) other costs and (4) costs of temporary eviction.

Table13: Review of the assessment of investments in the anti-seismic consolidation of the 61 seismic PSO buildings

How to reduce seismic risk to an acceptable level	Estimated investment
External reinforcement of the building	EUR 139.9 million
Internal consolidation of the building	EUR 264.3 million
Replacement construction	EUR 271.5 million

It should be borne in mind that it is not always possible to carry out external consolidation of a building on an individual building for spatial and other possible technical reasons. **If the country, as a good economy, wants to reduce to an acceptable level the seismic risk of those buildings that are among the most at risk of seismic risk, while ensuring their energy efficiency, it will have to provide funding in a range of at least EUR 139.9-271.5 million**, without taking into account the buildings where these analyses are still needed (Table 17). Irrespective of the analyses carried out, it is recommended that a seismic analysis be carried out prior to each energy renovation project of the building.
In the next phase, the seismic risk of all other buildings whose seismic resistance is 34-100 % required by the Eurocode 8-1 will have to be addressed in the same way.

Summary analysis of the potential for wider renovation

Gaps identified

25 % of buildings and parts of buildings owned and occupied by the narrower public sector do not have an energy performance certificate. For 189 buildings a seismic risk analysis must be carried out.
Orientations and proposals for upgrading
Managers of buildings and parts of buildings shall immediately order the production of energy performance certificates where they do not yet exist. For buildings at risk of earthquake, we propose that they be subject to a detailed seismic analysis. As a good manager, the state must not go to the energy renovation of a building without meeting eight essential requirements for construction works. In order to ensure energy-efficient and anti-seismic safe buildings, it will have to provide funds in the range of EUR 139.9-271.5 million for anti-seismic consolidation alone. This will require the provision of adequate resources and the creation of financial instruments. Irrespective of the model results of the analysis, it is recommended that all aspects of the renovation are always checked before energy renovations or that the essential requirements for construction works are checked.

Aspect 4: FIRE PROTECTION

Essential requirements for fire-resistant construction are set out in the construction technical guideline
TSG-1-001: Fire safety in buildings (MOP, 2019)prescribed by the Regulation on fire safety in buildings(RS, 2013). The requirements of TSG1-001 must be taken into account in the design and construction of new buildings and in the reconstruction and refurbishment of old buildings.

For the safe, efficient, economic and long-term renovation of buildings from the point of view of fire safety, it is necessary to develop a new technical guideline or to complement the existing technical guideline.
(TSG-1-001: Fire safety in buildings (MOP, 2019)).

Aspect 5: QUALITY OF THE INTERNAL ENVIRONMENT

Building renovations must offer users a healthy and work-friendly indoor environment. The refurbishment must ensure the quality of the indoor environment (adequate indoor temperature, humidity, air quality, acoustics, daily lighting) and monitor the quality of the indoor environment in terms of benefits for the user and society.

2.2.1.1.3 Designation of public buildings to carry out energy renovations

Each year, once the register of PSO buildings has been updated, groups of buildings are formed to show the actual state of the buildings in terms of wider renovation. Groups are distinguished from each other according to whether buildings have already been energy-renovated or are being renovated, as well as other aspects of wider renovation.

Groups of buildings are the starting point for building managers when deciding on energy renovation.

Out of a total of 491 buildings, 22 are already energy-efficient. This covers buildings that have either been built to the required minimum energy performance standards or are energy-renovated (group 1 in

Preglednica 14). This leaves a further 835 m² floor area of heated buildings for energy renovation.

Table 18 shows the potential for wider renovation, divided into seven groups, taking into account:

1. **achieving minimum energy efficiency,**
2. **the protection of cultural heritage; and**
3. **seismic risk.**

Groups 1 to 7 are groups according to the required scale of energy renovation and the obligation to take into account additional aspects of renovation, which is also linked to higher investments. A comprehensive overview by group and by building can be found in Annex B.

Under the EED, three per cent is calculated on the basis of the total floor area of PSO buildings which have a total useful floor area of more than 250 m² and which, on 1 January of each year, do not meet the national minimum energy performance requirements set in accordance with Article 4 of Directive 2010/31/EU. **Three per cent of the floor area for the energy renovation of PSO buildings in 2020 represents 25,069 m².**

Table14: Potential for wider renovation of PSO buildings

Groups of buildings	Minimum energy efficiency achieved	Taking cultural heritage into account	Taking into account seismic safety	Number of buildings and parts thereof	AU[m²]	Potential end-use energy savings [GWh/a]	Potential CO2 savings[kt/a]
1	yes	—	—	22	55.250		
2	No	No	No	166	263.986	20,85	5,85
3	No	yes	No	59	121.982	9,64	2,70
4	No	No	yes	21	47.723	3,77	1,06
5	No	yes	yes	34	81.539	6,44	1,81
6	No	yes	not Assessed	10	33.889	2,68	0,75
7	No	No	not Assessed	179	286.531	22,64	6,35
Total				491	890.899	66,02	18,52

The above-mentioned table of the group of buildings refers to the buildings listed in Annex B.

On the basis of the energy renovation projects already carried out in the period 2016-2019, potential final energy and CO_2 savings have been estimated. Buildings which do **not require additional treatment for the protection of cultural heritage and seismic risk prove to be the most likely savings potential**. The potential savings of these buildings are 20.85 GWh/a of final energy and 5.85 kt/a of CO_2 emissions.

If three percent of the floor area of PSO buildings is renovated only, the estimated investment is approximately six million euro per year. If the buildings were to be built up in an anti-seismic way, the investment would increase in the range of EUR 27.1-52.6 million.

Orientations for identifying the buildings to be renovated to meet the target of three per cent of the annual energy renovation:

1. From the list of buildings requiring only energy renovation, those to be renovated shall be identified in agreement with other building managers.
2. The principles of good management are taken into account, i.e. that all aspects of the wider renovation are examined.
3. Provision of programme funding for wider renewal.

2.2.1.2 Buildings owned and occupied by general public sector entities

According to Article 9 of the Energy Efficiency Act (Uradni list RS (UL RS; Official Gazette of the Republic of Slovenia) No 158/20), the long-term strategy for the energy renovation of buildings also includes the designation of general public sector entities for renovation and the determination of the surface area of buildings owned and occupied by public sector entities, which also includes the wider public sector.

“Persons of the wider public sector” means public institutes, public economic institutions, public funds, public agencies and institutions established by the State, as well as municipalities and public institutes, public economic institutes, public funds, public agencies and institutions established by the municipality. Entities in the general public sector are also autonomous institutions whose means of operation or whose working and development conditions are provided by the State, and the organisation, operation and financing of which are determined by an act of the State.

Although general public sector buildings do not fall within the three per cent refurbishment quota of public buildings under the Energy Efficiency Directive, they are exemplary as buildings of public authorities and at the same time have enormous renovation potential, and it is therefore also envisaged as a measure to draw up a list of buildings and parts of buildings owned and occupied by general public sector entities (hereinafter referred to as the ‘SJS building') by specifying the surface area of the buildings for renovation purposes. An analysis of the potential for wider renovation will also be prepared and priority public buildings will be identified to carry out the energy renovation. It is also envisaged to regularly update the list of ŠJS buildings with information on energy renovations carried out and other aspects of sustainable renovation. This will allow for the on-going monitoring of the energy renovations carried out and for the annual calculation of the total floor area of buildings owned and occupied by general public sector entities, including changes.

2.2.2 Indicators and milestones for monitoring energy renovation of public sector buildings

Since the purpose of DSEPS 2050 is to set out a long-term vision for meeting the decarbonisation target for 2050, the Republic of Slovenia must go beyond existing measures (which ensure short-term effects) and provide a long-term plan for the development of future policies and measures. The DSEPS 2050 roadmap, with defined indicators and milestones, supports the achievement of these objectives.

The roadmap in this chapter sets out milestones for 2030, 2040 and 2050 for the service building sector and indicates how these milestones contribute to the achievement of the objectives of the Republic of Slovenia and the European Union. The indicators for monitoring the energy renovation of residential buildings are:

1. Energy end-use savings and reduction of CO2 emissions,
2. share of energy-renovated buildings;
3. energy savings and the role of nearly zero energy buildings.

Indicator 1: Energy savings and reduction of CO2 emissions

In order to set milestones for energy end-use savings and CO2 reductions in the public sector, the default assumptions ensuring the achievement of the 2030 targets are in line with the NECPs. The final energy balance is influenced by a number of factors based on the guidance provided in SEEPS 2050 and the NECPs. Final energy use includes energy use for heating, cooling, hot water preparation, lighting and ventilation, and electricity.

The assumptions are similar to the housing sector (chapter2.1.1), with an even stronger focus on centralised heating systems, as 78 % of the heated floor area of the service sector buildings in Slovenia is located in densely populated areas. There are almost a hundred remote systems in Slovenia and will therefore play an important role in decarbonising the building stock by 2050.

In 2030, final energy consumption will decrease by 7 % compared to 2020 and will amount to 6.51 PJ, with a 57 % reduction in CO2 emissions. By 2050, final energy consumption will have a minimum increase of 0.02 per cent and 7.05 PJ, with a 92 % reduction in CO2 emissions. The increase in energy end-use stems from an increased number of new buildings and from the restructuring of heating installations (Table 11).

Table15: Energy end-use savings and CO2 emissions reduction by 2050 in public buildings

Indicator	Unit	2020	2030	2040	2050
Energy end-use savings					
Balance	PJ	7,03	6,51	6,64	7,05
Savings	PJ	—	0,52	0,39	—0,02
Reduction	%	—	7	6	0
CO2 savings					
Balance	Kt	105,0	45,3	17,8	8,2
Savings	Kt	—	59,7	87,2	96,9
Reduction	%	—	57	83	92

Indicator 2: Share of energy-renovated buildings

The analysis of the energy renovation of buildings takes into account two scales of energy renovations, partial and comprehensive energy renovation. For the latter, it is envisaged to cover measures that achieve the highest energy performance requirements of the building at the time of the renovation. Therefore, energy renovations planned after 2020 are considered nearly zero energy in line with the requirement of the EPBD.

In the period up to 2030, the volume of partial energy renovations will continue to grow slightly and then will be steady until 2050 due to the commitment to nearly zero-energy buildings and lower potential for such large-scale energy renovations. Buildings eligible for renovation are being renovated in energy terms, which means that older buildings are first renovated and then gradually built and energy-renovated since 2000.

Preglednica 16 It shows the share of buildings that have undergone energy renovation from the base year (2017) to the observed year. As the period analysed covered 33 years and this exceeds the technical life of the materials, for certain types of buildings some buildings may qualify for renovation at the beginning and end of the observation period and therefore some buildings can also undergo model energy renovation twice.

Table16: Share of energy renovation of public buildings by 2050

Year observed	2020	2030	2040	2050
Partial refurbishment				
Residential buildings for specific social groups	9,0 %	10,5 %	10,3 %	10,0 %
Public administration buildings	6,7 %	10,3 %	11,0 %	11,6 %
Cultural and entertainment buildings	2,3 %	3,4 %	3,5 %	3,5 %
Museums and libraries	4,5 %	6,7 %	6,8 %	6,8 %
Education and labour buildings	5,0 %	7,4 %	7,5 %	7,5 %
Healthcare buildings	3,4 %	4,8 %	4,8 %	4,8 %
Sports halls	3,8 %	5,6 %	5,7 %	5,6 %
Comprehensive refurbishment				
Residential buildings for specific social groups	5,1 %	21,7 %	38,6 %	54,6 %
Public administration buildings	3,8 %	32,9 %	64,0 %	95,2 %
Cultural and entertainment buildings	1,3 %	11,6 %	21,9 %	31,5 %
Museums and libraries	2,5 %	22,4 %	42,4 %	60,9 %
Education and labour buildings	2,8 %	24,7 %	46,6 %	66,6 %
Healthcare buildings	1,9 %	14,2 %	24,1 %	33,3 %
Sports halls	2,1 %	19,0 %	35,8 %	50,9 %

Indicator 3: Energy savings for heating and the role of nearly zero energy buildings

The energy use of the service stock in buildings is influenced by the reference energy use according to the type of building and the cumulative heated area of the buildings. The use of energy for heating is observed on the basis of the heat needed, which is gradually slightly reduced by 2030 as a result of increased building awareness in line with efficient energy use and with regard to atmospheric heating. According to the statistics on new buildings from 2010-2017, the heated area of buildings is also gradually increasing as a result of new constructions, which increase the cumulative surface area of buildings and the use of energy.

Energy consumption in 2020 amounted to 3.5 PJ (

Preglednica 17). It is gradually decreasing, decreasing by 20 % by 2030 and by 26 % by 2050, amounting to 2.6 PJ. In this context, the building stock of public buildings will represent 25 per cent of nearly zero-energy buildings in 2030 and 75 % in 2050.

Table17: Energy savings for heating and the volume of nearly zero-energy public buildings by 2050

Indicator	Unit	2020	2030	2040	2050
Energy use					
Public buildings	PJ	3,5	2,8	2,5	2,6
Cumulative savings	%	—	20	29	26
Share of NZEB					
Public sector	%	2,6	25,7	50,2	75,1

2.2.3 Analysis of the achievement of the objectives set

The financially challenging investments in the integrated energy renovation of PSO buildings, co-financed by cohesion funding under OP ECP 2014-2020, have not yet been implemented in 2014 and 2015 due to delays in the adoption of the PSEPS and the establishment of a project office for the energy renovation of buildings. 11.307 m² PSO buildings were renovated^{in} 2016 and 6.485 m² in 2017. In 2018, 3,276 m² was renewed and a further 7,714 m^{2in} 2019. These energy renovations of buildings were financed by the own resources of the Ministry of Defence of the Republic of Slovenia and the Ministry of the Interior of the Republic of Slovenia and other sources. However, there are other projects by operators which were not part of the co-financing under cohesion policy. Eko Fund grants were available for financially less demanding investments, which include a measure or several individual measures for the efficient use of energy and the use of renewable energy sources, and incentives for the energy renovation of the buildings of the Ministry of Defence of the Republic of Slovenia.

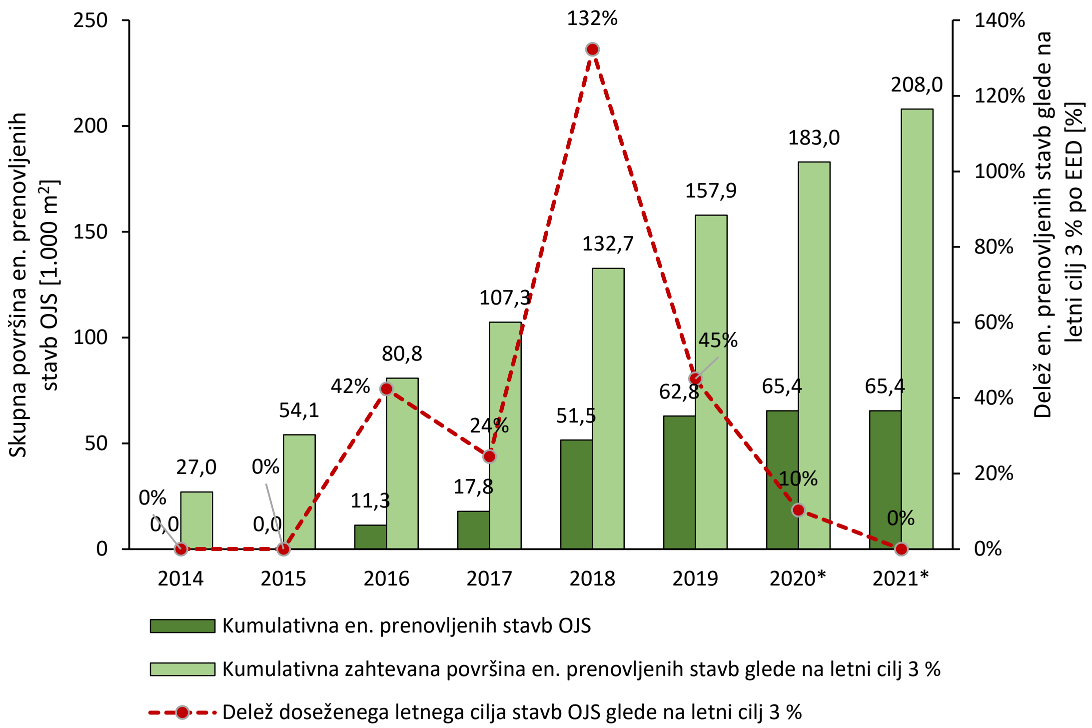
Project Office for Energy Renovation of Buildings (PP-EPS)

The energy renovation of buildings, co-financed by OP ECP 2014-2020, was launched with the establishment of a project office for the energy renovation of buildings (public sector) in 2015. An implementation framework for co-financing the integrated energy renovation of buildings of the narrower and wider public sector from OP ECP 2014-2020 funds is in place, allowing projects to be carried out either in the form of a public-private partnership (PPP) on the basis of the energy contract model or through a public procurement (JN) for energy renovation. The standardised processes and supporting environment for co-financing have been tested and optimised through the implementation of three pilot energy contract projects, as well as through twenty invitations and calls for tenders for cohesion funding in the 2014-

2020 period. Comprehensive energy renovation of the buildings of people in the narrower and wider public sector with co-financing from European cohesion policy funds is also possible for buildings for which individual measures or partial energy renovations by individual ministries (e.g. window change) have already been carried out in the past, provided that these buildings still fall short of the required energy performance levels and additional measures would achieve the prescribed levels of energy efficiency and renewable energy sources in accordance with the Rules on the efficient use of energy in buildings and other relevant guidance documents.

In 2018 and 2019, four projects were implemented, contributing 34,059 m² of the[renovated] areas of PSO buildings. Two projects are carried out on the basis of a PPP model of energy contract and two projects are carried out with public works contracts for the renovation of buildings. By the end of 2019, a total of 62,841 m² had been[refurbished]. Another project is planned to be implemented in 2020-2021, with an additional 2,595 m². Thus, in the context of OP ECP 2014-2020, the energy renovation of 36 m² PSO[buildings] will be carried out, according to data from operations already carried out and notified.

By 2021, a total of 65,436 m²[areas] of PSO buildings will be refurbished, taking into account the projects implemented in 2016 and 2017 and the implemented and declared operations of OP EAC 2014-2020 (Figure 1). It is expected that renovations financed by their own budgetary resources and individual actions by all ministries as part of a phased integrated renovation to meet the minimum energy performance requirements will also contribute to the three percent commitment. However, the extent of these renovations will only be known once the projects have been implemented and the achievement of the minimum requirements for the required energy performance of buildings has been confirmed.



* Approved projects for which the renovation is foreseen to be completed in 2020 and 2021.

Figure9: Energy renovation of narrower public sector buildings in the period 2014-2021 (source: PP-EPS)

Despite the fact that for the period 2014-2021 there is a marked increase in the annual volume of energy renovation of PSO buildings, the annual renovation target of three percent of the total floor area of these buildings will not be achieved by 2021 through existing measures. In the period 2014-2021, only 32 % of the target annual energy renovations for the whole period will be implemented cumulatively.

In addition, a significant decrease in the number of new energy renovation projects for buildings of the narrower and wider public sector was observed in 2019, with no single application for co-financing from FP ECP 2014-2020 from the narrower public sector. In view of this fact, the time needed to prepare and implement the new projects and the planned renovation of the 65 m² floor^area of PSO buildings by 2021Slika 9, it can be concluded that the energy renovation target of 127,116 m² of the floor^area of PSO buildings under OP ECP 2014-2020 will not be achieved. Under OP-ECP 2014-2020, Slovenia is committed to renovating 1.3 million m²^of buildings in the narrower and wider public sector.

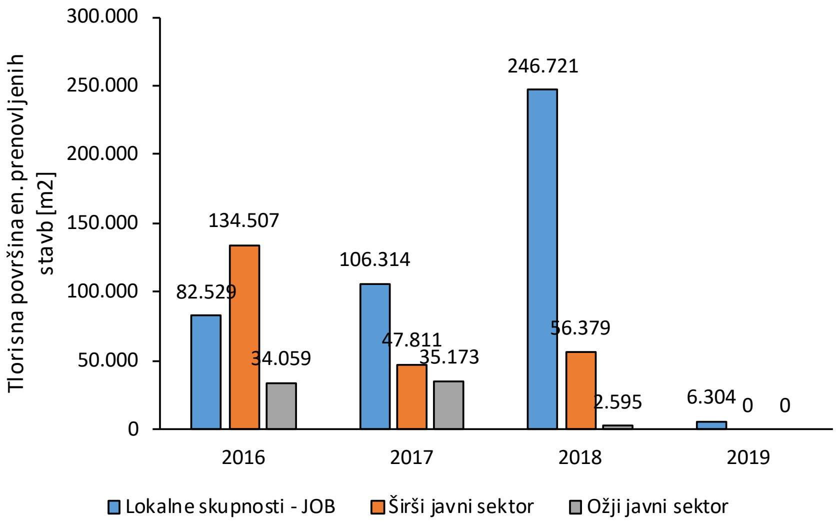


Figure10: Net floor area of declared energy renovations for co-financing by investor in the period 2016-2019 (source: PP-PPS)

In response to the necessary increases in the PSO's energy renovations, the Project Office has repeatedly removed the identified administrative obstacles in the context of the revision of the instructions for conducting energy renovation operations for buildings. One of the changes was made at the beginning of 2019, when the two-stage selection procedure for the direct approval of a government-owned operation of the narrower and wider public sector was simplified or improved, which significantly reduced the time between the issue of the eligibility decision and the issuance of the decision on support. The instructions were also amended as a result of amendments to the legislation on construction and spatial planning and the amendment of the provision of Article 61 of Regulation (EU) No 1303/2013, which had an impact on the calculation of the financing gap and thus on the determination of the amount of co-financing of energy renovation operations for public buildings by the Cohesion Fund. The Intermediate Bodies (Ministries) are specifically invited to submit applications for proposals for operations, with the possibility of submitting applications throughout the year, by means of annual invitations to tender. In 2017, ELENA's technical assistance was obtained for the preparation of project and investment documentation.

The performance of the implementation of energy renovations is analysed from the point of view of the cost-effectiveness and energy efficiency of co-financed projects in the public sector. A comparison is made between the implementation of PPP projects in the form of a concession for the provision of energy-contracting services and the implementation of public procurement contracts. The data from certified operations show that PPPs under the energy savings contract model achieve better results than PPs, both in terms of final energy savings achieved (Slika 11left) and eligible costs (Figure 11 right), i.e. also in terms of co-financing.

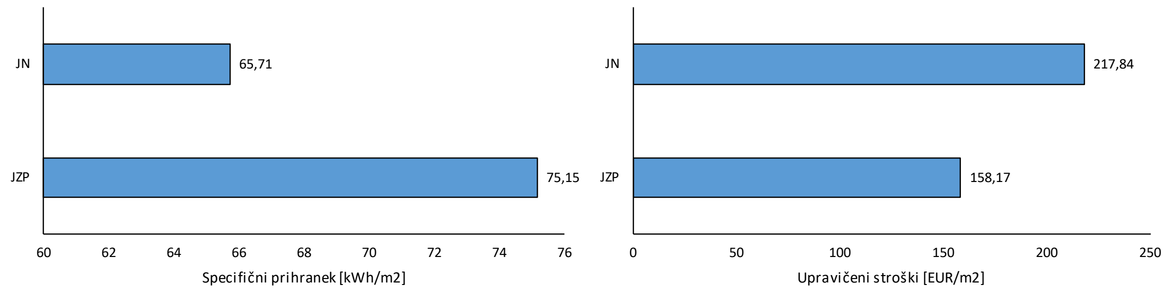


Figure11: Energy savings in public-private partnerships and public procurement (left) and eligible costs of energy renovation of buildings in public-private partnerships and public procurement (right) (source: PP-PPS)

It is noted that, due to its complexity, the implementation of the procedure for selecting a private partner following a PPP procedure requires, as a general rule, more time than the selection of contractors for PN operations. Data from the completed operations of the narrower public sector and the wider public sector show that the duration of the operations, from the decision on support to the implementation of all measures of integrated energy renovation of buildings according to the PPP (551 days) or (563 days) model, is approximately the same. With the exclusion of operations that significantly stand out in both models, the implementation time in the case of the PPP model is even shorter than the PPP model by 172 days or almost six months.

The organisational aspects of the implementation of the energy renovation of public sector buildings are analysed on the basis of a comparison of the size of the declared energy renovation operations of the narrower public sector, the general public sector and local communities for co-financing from OP ECP 2014-2020 funds (Preglednica 18:). By the end of 2019, a total of 75 operations were selected as eligible for co-financing (47 JR for co-financing by JOB municipalities and 28 operations selected with direct validation – NPO: ŠJS, PSO and pilots). Of which 42 in the form of JN operations (26 JOB + 16 NPO) and 33 in the form of PPP operations (21 JOB + 12 NPO). The eligible costs of operations eligible for co-financing amount to EUR137.4 million, the co-financing rate (EU + SLO) is EUR54.7 million and the EU co-financing is EUR46.5 million.

It is noted that local communities were successfully organised to carry out energy renovations and submitted the highest number of projects, mainly due to the provision of technical assistance by ELENA to the municipalities of Ljubljana, Novo Mesto, Velenje and Kranj and the 25 joint municipalities, mainly coastal municipalities. The latter have carried out or are carrying out energy refurbishment of 79 buildings and the investment value of renovations amounts to EUR39.9 million. Most of these projects are a public-private partnership with a two-year preparation cycle. Among the necessary measures to increase the scale of energy renovations in the public sector, negative trends make it necessary to define the appropriate form and scope of technical assistance to the public sector to allow for the continuous preparation and implementation of a larger number of projects.

Table18: Number of eligible projects for co-financing with OP ECP 2014-2020 with corresponding net floor area in the period 2016-2019. (source: EP-PPS)

Contracting authority for energy renovation	2016		2017		2018		2019		TOTAL	
	Number of projects	Area [m²]	Number of projects	Area [m²]	Number of projects	Area [m²]	Number of projects	Area [m²]	Number of projects	Area [m²]
Local community	14	82.529	13	106.314	18	246.721	2	6.304	**47**	**441.868**
Wider public sector	11	134.507	5	47.811	4	56.379	2	10.540	**22**	**249.237**
Narrow public sector	4	34.059	1	35.173	1	2.595	0	0	**6**	**71.827**

TOTAL	**29**	**251.095**	**19**	**189.298**	**23**	**305.695**	**4**	**16.844**	**75**	**762.932**

2.2.4 Barriers and opportunities to take renovation measures

2.2.4.1 Narrow public sector

The main **participants** in the energy renovation process in the public and other services sectors are:

On the demand side:

- government, municipalities, public and private sectors as owners of the building stock,
- co-owners of buildings (together with the State and the public and private service sectors),
- managers and managers,
- employees in the state and public administration and in the private service sector;
- tenants.

On the supply side:

- the State in its capacity as legislator,
- government as manager of public funds (EU funds and others);
- repairers, maintenance workers,
- energy consultants,
- opinion and consent (e.g. ZVKDS, energy suppliers, etc.)
- designers (architects, engineers), construction and other contractors, surveyors,
- manufacturers and providers of products, equipment and services to increase energy efficiency;
- energy suppliers;
- energy Contract Providers (ESCOs)
- local energy agencies (for community buildings),
- financial institutions and insurance companies;
- The European Union.

Identification of **key barriers and opportunities** in the adoption of renovation measures

On the demand side:

- **Poor information** on renovation measures and expected effects also on the user's health and quality of stay and insufficient understanding of the technical options and their interactions.
- **Lack of comprehensive information on comparator projects**, i.e. their investment value and the technical-energy and economic parameters of energy renovation, including systematic data on the results of energy management in the public sector.
- **Lack of awareness among building users** of the effects and benefits of energy renovation and thus inadequate adaptation to the situation after renovation (adaptation of behaviour, management of systems).
- **Low economic motivation** to carry out energy renovation. Lower energy costs after renovation is not a financial resource for owners/users to invest earmarkedly in other own needs. This type of investment is most often financed from the annual budget allocation of the user and ranks below the investment priorities. In the services sector, however, investment in the core business tends to take precedence over energy renovation projects for buildings.
- **Limited possibility of carrying out a comprehensive renovation of buildings** and thus increased investment. This is particularly noticeable in the context of various austerity measures and often limited borrowing opportunities. As a result, only partial renovations are common.

- **Lack of competence and professional competence to plan** and organise integrated energy renovation operations from a technical point of view and in terms of conducting public procurement procedures (for the public sector).
- **Ignorance and mistrust of (co-)financing mechanisms** for energy renovation projects, such as energy contracts or public-private partnerships; Lack of competence and professional competence to carry out such operations.

On the supply side:

- **Unpredictability in the labour market**. In Slovenia, the share of foreign labour in the construction sector is high, turnover is high and therefore the skills of this workforce are questionable.
- **Fragmentation of the construction sector**. The crisis in the construction sector since 2008, which has led to the collapse or collapse of large construction, design and engineering companies (often within the same umbrella company) with a long tradition and experience, still affecting the structure of the construction sector and its overall ability to carry out major and professionally demanding projects. The bulk of the construction sector is now made up of craftsmen and smaller entrepreneurs with questionable capacity to carry out large-scale and complex operations and limited opportunities to acquire new skills.
- **Demanding procurement procedures** in case of measures to increase the energy efficiency of buildings and, on the other hand, limitations and lack of supportive environment for the use of non-budget funds.
- **Barriers to the widespread deployment of energy contracts**. The small number of energy contract providers, the limited number of promoters of these projects, the legal complexity of implementation and the difficulty of obtaining financial resources for companies providing such services, all of which limit the scope for offering these transactions.
- **The uncertainty surrounding the legislative framework** reduces investment in the energy renovation of buildings. Investments in the energy renovation of buildings have a long return period and it is therefore important for investors' confidence that a robust, stable and coherent legislative framework defining energy renovation is important.
- **Method of assessing the profitability** of energy renovation projects in relation to other projects or investments. The traditional cost-benefit analysis is not easy to use due mainly to the difficulties in evaluating side-benefits, such as improved health and well-being, better quality living and working conditions, overall more favourable environmental impacts, etc.
- **Limited possibilities to create alternative sources of (co-)financing at local level**. At municipal level, there is scope for creating dedicated funds to encourage investment in the energy renovation of buildings, but these are very limited due to the very low degree of fiscal autonomy. Legislative changes in local fiscal policy could significantly improve the situation.
- **Energy prices**. Although there is some uncertainty about future developments in energy prices, at least for the majority of owners or users they are still at an acceptable and manageable level so that they are not an essential incentive to carry out energy renovation. Investments in energy efficiency are also an insurance against the risks of adverse fluctuations in energy prices, which would also require, from a strictly financial point of view, the use of a lower discount rate when assessing the profitability of the project.
- **The different wishes of the tenant and the owner**. In the services sector, a significant part of the building stock is rented. In principle, the tenant has an interest in investing in higher energy efficiency if this results in a marked reduction in the operating costs it pays and the owner has less interest in doing so, as he bears the cost of carrying out the energy renovation.

- **Staff restrictions**. There are many small and medium-sized enterprises in the services sector, which, due to their limited size, usually do not have enough human resources to deal with energy efficiency and use of RES and manage RES projects, including the search for external financial resources.
- Cultural**heritage protection regime**. In the case of buildings protected under the rules on the protection of cultural heritage, there may be significant limitations in the scope and manner of energy renovation where it would interfere with protected values (external appearance, gabarites, original materials and building elements, etc.). The limited scope and thus the reduced effects of the renovation in terms of improving energy indicators may call into question the viability of the operation, regardless of its positive effects, such as improving living and working comfort and reduced operating costs for owners. However, renovation costs may be higher compared to the renovation of a building which does not belong to the building heritage if the use of specific ('non-standard', 'historical') materials or techniques to add, replace or rebuild elements as close as possible to the original is required.

Obstacles to achieving the objectives

The long-term energy renovation target of three per cent of the total floor area of PSO buildings and the short-term objective of the integrated energy renovation of 127.116 m² of^{these} buildings will not be achieved in the period 2014-2023. The reasons for this are:

1. Insufficient dedicated public financial resources in the long term to carry out all necessary energy renovations in the public sector to ensure that at least minimum energy performance requirements are met.
2. Under-utilisation of 1,73 million EU technical assistance grants ELENA for 90 % co-financing for the preparation of technical and economic documentation in the period 2018-2020, despite the centralisation carried out in 2017 of the management of immovable property used for or in connection with tasks falling within its remit by certain government departments and ministries together with their constituent bodies.
3. The lack of competitiveness of the market of providers of energy efficiency services[8], which provide co-financing of only a limited number of energy renovations with proven sound financial performance indicators in longer preparation and implementation cycles of these projects.
4. Failure to provide highly specialised professional staff for the continuous preparation and implementation of the necessary increased scale of integrated energy renovations, including the implementation of complex PPP procedures over a longer period of up to two years.
5. Inadequate preparedness and organisation of the narrower public sector for the long-term implementation of the targeted, substantially increased scale of implementation of integrated energy renovations in a relatively short period of time, including co-financing of projects by private energy efficiency service providers and contracting of energy savings.
6. Administrative obstacles to classifying projects for the energy renovation of buildings in the plan for development programmes of the Republic of Slovenia's budget (NRP), which make it impossible to combine several buildings into a whole, with a comprehensive project or an understanding of a functionally completed whole. The coordination on how to prepare investment documentation and classify projects in the NRP has had a significant impact on the timetable of operations, leading to delays in the implementation of projects and in the absorption of OP ECP 2014-2020.

[8] Analysis of the Slovenian market for energy efficiency services and the quality of these services(https://qualitee.eu/si/wp-content/uploads/sites/5/QualitEE_2-04_CountryReport_SI_2018-04-14_rev1.pdf).

7. There are also obstacles to the provision of sufficient budgetary resources to cover that part of the investment costs that cannot be covered by cohesion policy or private sources of funding.

2.3 Private service sector buildings

2.3.1 Technical potential for energy renovation

The technical energy renovation potential is modelled on the baseline state of the building from an energy point of view based on the age of the building and elements of the thermal envelope of the building, as is the case for public buildings. The baseline is the REN default situation where it is indicated for the individual elements of the building envelope whether the element has been renovated in the past and when. Two possible scales of renovation – partial and comprehensive energy renovation – were by default.

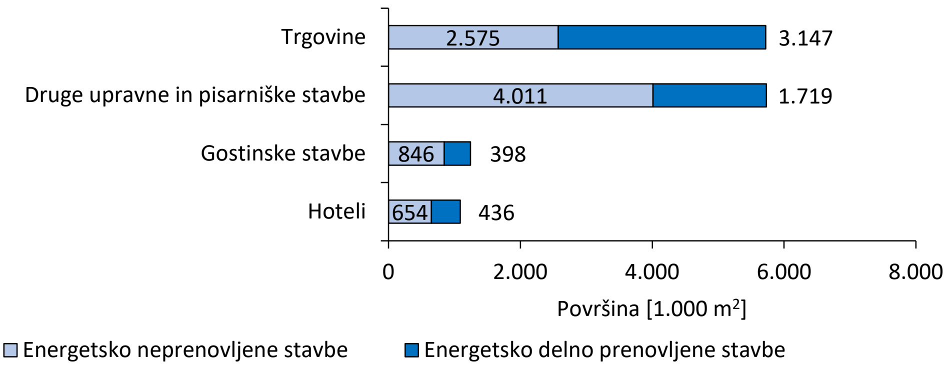


Figure12: The potential for energy renovation of service sector buildings, given the scale of energy renovations already implemented.

The technical potential for integrated energy renovation of private service sector buildings is 8.08 million m² and 5.7 million m²for partial energy renovation. Slika 2 This potential shall be taken into account in the forecast of energy renovations of the existing stock, where the default scope of renovations is in line with NECPs projections for analyses. The baseline scope of renovations for private service sector buildings in the period 2020-2050 is 3.1-3.3 per cent.

2.3.2 Indicators and milestones for monitoring energy renovation of buildings in the services sector

Since the purpose of DSEPS 2050 is to set out a long-term vision for meeting the decarbonisation target for 2050, the Republic of Slovenia must go beyond existing measures (which ensure short-term effects) and provide a long-term strategy for the development of future policies and measures. The DSEPS 2050 roadmap, with set indicators and milestones, supports the achievement of these objectives.

The roadmap in this chapter sets milestones for 2030, 2040 and 2050 for the service building sector and outlines how these milestones contribute to the achievement of the objectives of the Republic of Slovenia and the European Union. The indicators for monitoring the energy renovation of residential buildings are:

1. Energy end-use savings and reduction of CO2 emissions,
2. share of energy-renovated buildings;
3. energy savings and the role of nearly zero-energy buildings.

Indicator 1: Energy savings and reduction of CO2 emissions

In order to set milestones on energy end-use savings and CO2 emission reductions in private service sector buildings, default assumptions ensuring the achievement of the 2030 targets are in line with the NECPs. The final energy balance is influenced by a number of factors based on the guidance provided in SEEPS 2050 and the NECPs. Final energy use includes the use of energy for heating, cooling, hot water preparation, lighting and ventilation, and electricity.

In 2030, final energy consumption will increase by one percent compared to 2017 to 13.94 PJ, with a 51 % reduction in CO2 emissions. By 2050, final energy consumption will increase by 21 % to 16.75 PJ, with a 94 % reduction in CO2 emissions. The increase in energy end-use stems from an increase in the number of new buildings and from the restructuring of heating installations (Preglednica 19).

Table19: End-use energy savings and CO2 emission reductions by 2050 in private service sector buildings

Indicator	Unit	2020	2030	2040	2050
Energy end-use savings					
Balance	PJ	13,82	13,94	15,58	16,75
Savings	PJ	—	—0,13	—1,76	—2,93
Reduction	%	—	—1	—13	—21
CO2 savings					
Balance	Kt	108,8	53,4	19,7	6,4
Savings	Kt	—	55,3	89,0	102,3
Reduction	%	—	51	82	94

Indicator 2: Share of energy-renovated buildings

The analysis of the estimate of the share of energy-renovated buildings uses the same assumptions as for public buildings (subchapter2.2). Preglednica 20It shows the share of buildings that have undergone energy renovation from the base year (2020) to 2050.

Table20: Share of energy renovations of individual types of private service sector buildings by 2050

Year observed	2020	2030	2040	2050
Partial refurbishment				
Hotels	8,6 %	11,8 %	11,5 %	11,3 %
Catering buildings	3,6 %	5,3 %	5,4 %	5,4 %
Other administrative and office buildings	4,0 %	5,9 %	6,1 %	6,4 %
Shops	4,6 %	7,2 %	7,4 %	7,5 %
Comprehensive refurbishment				
Hotels	4,8 %	37,2 %	69,0 %	98,3 %
Catering buildings	2,0 %	18,7 %	36,1 %	52,1 %

Other administrative and office buildings	2,2 %	21,0 %	41,4 %	61,8 %
Shops	2,6 %	25,9 %	49,3 %	70,7 %

Indicator 3: Energy savings for heating and the role of nearly zero energy buildings

The energy use of the service stock in buildings is influenced by the reference energy use according to the type of building and the cumulative heated area of the buildings. The use of energy for heating is observed on the basis of the heat needed, which is gradually reduced by 2030 as a result of increased consumer awareness of efficient energy use and atmospheric heating. According to the statistics on new buildings from 2010-2017, the heated area of buildings is also gradually increasing as a result of new constructions, which increase the cumulative surface area of buildings and the use of energy.

Energy consumption in 2020 amounted to 3.5 PJ (Preglednica 21

Preglednica 17). It is gradually decreasing, decreasing by 20 % by 2030 and by 26 % by 2050, amounting to 2.6 PJ. In this context, the building stock of public buildings will represent 25 per cent of nearly zero-energy buildings in 2030 and 75 % in 2050.

Table21: Energy savings for heating and the volume of nearly zero-energy private service sector buildings by 2050

Indicator	Unit	2020	2030	2040	2050
Energy use					
Private service sector buildings	PJ	4,4	3,7	3,5	3,7
Cumulative savings	%	—	16	20	16
Share of NZEB					
Private service sector	%	2,7	24,4	48,4	72,4

2.3.3 Barriers and opportunities to take renovation measures

The main **participants** in energy renovation in the public and other services sectors are:

On the demand side:

- government, municipalities, public and private sectors as owners of the building stock,
- co-owners of buildings (together with the State and the public and private service sectors),
- managers and managers,
- employees in the state and public administration and in the private service sector;
- tenants.

On the supply side:

- the State in its capacity as legislator,
- State as manager of public funds (EU-funds and others),
- repairers, maintenance workers,
- energy consultants,

- opinion providers and consenters (e.g. ZVKDS, energy suppliers, etc.),
- designers (architects, engineers), construction and other contractors, surveyors,
- manufacturers and providers of products, equipment and services to increase energy efficiency;
- energy suppliers;
- energy Contract Providers (ESCOs)
- local energy agencies (for community buildings),
- financial institutions and insurance companies;
- The European Union.

The key barriers and challenges and opportunities in taking renovation measures on the demand and supply side are the same as for the public buildings described in sub-chapter2.2.4.

3 Cost-effective renovation

3.1 Premises

3.1.1 Building renovation principles

We are building buildings so that we can live and work in them of good quality. In addition to the functionality of the building, which makes it possible to carry out various activities by means of the layout of the premises, the building must also meet all the essential and other requirements as laid down in the Construction Act(Uradni list RS, 2020): 1. Mechanical Resistance and Stability, 2. Fire Safety, 3. Hygiene, Health and Environmental Protection, 4. Safety in use, 5. Noise Protection,
6. energy saving and heat conservation, 7. universal construction and use of facilities,
8. Sustainable use of natural resources.

These features must be guaranteed by the building throughout its life cycle, which requires maintenance, regular repairs and replacement of the individual elements of the building and its installations. As the lifestyle of users of buildings and activities and work processes in buildings also change over time, there is a need for modernisation during the lifetime of the building, involving construction interventions and technical improvements. These measures are linked to lower or greater investment in renovation and the eligibility of these investments is assessed in the light of the benefits and benefits of the measures and interventions. Often, the wider indirect benefits of building renovation, such as healthier and quality housing, higher performance of users, reduced environmental burdens and favourable economic impacts, outweigh the direct savings that can be achieved, for example, through energy renovation and directly measurable in monetary terms.

It shall ensure the proper functioning of the building through its design, structural elements, assemblies and systems providing adequate load capacity and safety, as well as a favourable living and working environment covering thermal, light, acoustic and psychophysical comfort, as well as indoor air quality. The built environment acts as an ‘ecosystem’ whose operation is defined by the triple nature of ‘building – environment-human’. The functioning of this system requires a flow of substances and energy, creating the conditions for changes and potential disruptions to the system and thus for system imbalances and threats to the environment and humans. Therefore, the renovation of the building stock must be comprehensive and sustainable. If, in the recent period, building renovations have been driven primarily by increasing energy efficiency, achieving near-zero energy performance and decarbonising as soon as possible, the principles of sustainable construction should also place emphasis on human health, safety, well-being and improved productivity.

Decisions to renovate buildings can have a major impact on resource efficiency[9]. The renovation of buildings should therefore include more resource efficiency and life-cycle thinking and environmental impact assessment throughout the life cycle of a building, from the design and manufacture of construction products, construction, maintenance, renovation and use of the building to the disposal of the building and the management and disposal of construction waste, the recycling of products or their re-use. More efficient resource and energy management throughout the life cycle of a building is the key to a more competitive construction sector that will consume less raw materials and have lower environmental impacts.

Since 2000, Slovenia has been successful in improving the energy efficiency of buildings, moving towards more environmentally friendly sources and thus effectively reducing greenhouse gas (GHG) emissions of buildings when using buildings(Petelin Visočnik et al., 2019). As a country, we have committed to ambitious climate energy targets and we are planning to decarbonise the building stock by 2050. Therefore, the building stock must be gradually renovated with energy, the renovation must be intensive in terms of scope and impact, and comprehensive in terms of optimising the planning of all interventions to preserve the essential features of the building.

Building renovation is a long-term task that will gradually cover the entire building stock in the coming years. It is estimated that around 75-90 % of today's buildings will still be in use by 2050(De Groote and Lefever, 2016). More investment in the renovation of an individual building can only be expected tentatively every 30 years; the renovation is influenced by change of ownership, change of use, obsolescence and consumption, damage caused by ageing or accidents (earthquake, flooding, avalanches, etc.). In order to avoid the so-called lock-in effect when investing in renovation, it is necessary to plan the renovation in the long term, to anticipate the use of modern technologies and to follow the guidelines of technological development.

In 2020, the NZEB criteria (NZEBs) for all new buildings are also applied to us. The action plan for the construction of nearly zero-energy buildings foresees, inter alia, the implementation of a significant proportion of the energy renovation of buildings in line with renovation criteria in the NZEBs, which, in addition to high energy efficiency, implies a necessary transition to renewable energy sources. Such a plan is not only a challenge for a particular building, but above all the task of national and local energy supply concepts. Operational criteria for the planning of renovations in NZEBs will have to be defined in the building legislation.

Comprehensive (energy) renovation and the introduction of renovations into NZEBs also increase the proportion of GHG emissions resulting from the construction of a building and conditional on the choice of building materials or products compared to GHG emissions generated during the operation of the building(Erhorn-Kluttig et al., 2019). Estimates show that by systematically monitoring the environmental performance of the materials used and choosing more environmentally friendly materials and products, we can reduce GHG emissions by a further 10 % compared to the way new buildings are built today or compared to the current renovation of buildings(Klaassens, 2014).

In practice, theenvironmental impact of material use is often assessed using the best possible proxy to reflect the actual environmental impact of the selected material, i.e. the indicator of carbon dioxide equivalent ($CO2_{eq}$.) determined by the LCA (*Life Cycle* Analyis) analysis "cradle-to-door". This approach captures the impacts from the extraction of raw materials to the finished construction product. Thus, while the focus may be on the choice of more environmentally friendly materials on the basis of transparent environmental criteria, the problem is of course much broader and requires consideration of the whole life cycle of a

[9]The Communication of the European Commission (EC) "Roadmap to a Resource Efficient Europe" (COM(2011) 571) states that better construction and use of buildings can lead to significant savings, as they can affect the current 42 % of final energy consumption and 35 % of greenhouse gas (GHG) emissions, as well as over 50 % of all extracted raw materials and save up to 30 % of water in some areas.

product (as well as buildings), including recycling and reuse and resource efficiency, as a cornerstone of the circular economy in the construction sector.

Finally, we will only be able to move towards the goals of a low-carbon, resource- and energy-efficient built environment if we deliver the technological breakthrough of low-carbon technologies in construction and buildings in a timely manner, and perhaps even more importantly if we transform the value chain in the construction sector in a timely manner and take advantage of the modern challenges for industry start-up. Technological innovations for sustainable buildings (e.g. super-insulating materials, dynamic glazing, built-in PV-technology, degradable and recyclable building parts, multifunctional thermal envelopes of a building, prefabricated components with built-in components such as solar power generation, ventilation, accumulation, ICT solutions enabling the transformation of the consumer into a proactive user integrated into the energy grid) will be a traditionally fragmented, craft market.

Therefore, if, until recently, we have been able to use conventional energy indicators to monitor progress in the sustainable transformation of the building stock and gradually upgrade them from the demonstration of heat demand into a more comprehensive way, such as the final use of energy for the operation of the building, primary energy and CO2 emissions in the building use phase, which also reflect the impact of a sustainable energy choice, then comprehensive “sustainable building criteria” should be applied by moving towards a low-carbon, resource and energy efficient and sustainable building sector(Level(s), DGNB, BREEAM, LEED in podobno).

In Slovenia, national criteria for the sustainable construction[10] and creation of a supportive environment for sustainable construction and renovation in the form of knowledge, databases and analytical tools are under development, which is of particular importance for contracting authorities. The criteria are based on Slovenian regulations and building practices, complemented by important environmental, economic and social aspects of building construction and a domestically recognised benchmark[11]. The building is judged throughout its life cycle, at all stages of construction, from conception to realisation. The national criteria shall refer to the European Level(s) system for assessing sustainability objectives in the field of buildings, covering energy, materials, water, health and comfort, climate change, life-long costs and the value of the building, and as a publicly available method that systematically leads the investor and the project team to manage those aspects of building construction and renovation that are critical to humans, the environment and the economy of investment and social advantages in relation to the built environment.

The above principles should also be included in the economic evaluation of the planned building renovation. In assessing the cost-effectiveness of the renovation, we take into account the principle of life-cycle costing or LCC (*Life Cycle Costing*) analysis, while looking for (cost-effective) solutions or methods of renovation that meet the current sustainability priorities and objectives of the built environment.

3.1.2 Energy renovation framework

Point 6 of the second paragraph of Article 15 of the Construction Act (essential and other requirements for buildings) lays down energy saving and heat conservation as one of the essential requirements.

[10]Life17 IPC/SI/00007 – LIFE IP CARE4CLIMATE, Action C4.4 Developing sustainable construction indicators (2019-2026). GI ZRMK, ZAG, MOP.

[11]Sustainable construction criteria will make it possible to monitor, for example, the carbon footprint of a building, the non-renewable energy used for the operation of the building and the production of the materials used, high-quality thermal comfort, indoor air quality by controlling pollutant and radon sources, checking the recyclability of the building and its components by ensuring ventilation, analysing how the building will respond to expected climate change in 2030 and 2050.

The Rules on the efficient use of energy in buildings – PURES (Official Gazette of the Republic of Slovenia Nos 52/10 and 61/17 – GZ) and Technical Guideline TSG-1-004:2010 – Energy efficiency provide minimum energy performance requirements in buildings.

Article 331 of the Energy Act imposes an obligation to adopt an action plan for nearly zero energy buildings. On 22 April 2015, the Government of the Republic of Slovenia adopted the 'Nearly Zero Energy Buildings Action Plan for the period to 2020' (NZEB), which defines a nearly zero-energy building for new buildings and renovation.

In accordance with Article 350 of the Energy Act, in 2014 Slovenia prepared the first EC report (MzI, 2014) on establishing cost-optimal levels of minimum performance requirements for buildings and building elements. Minor gaps have been identified between PURES 2010 and cost-optimal levels of minimum performance requirements for buildings and building elements. The update of the PURES Rules, which started in 2016 with the preparation of technical background documents, also took into account the closing of the identified gap and envisaged tightening the minimum energy performance requirements for building and building elements.

An updated EC report on setting cost-optimal levels of minimum requirements was produced in 2018(MzI, 2018b).

The results for 2018 for new constructions show that the macro-economic calculation gap between the applicable requirements and the cost-optimal level is -15 per cent. However, in the financial calculation chosen as the national benchmark, this gap shall not exceed -8 per cent, which is within the allowed gap between the applicable minimum energy performance requirements for the building and the cost-optimal level. The results of major renovations of existing buildings show that the macro-economic calculation gap between the applicable requirements and the cost-optimal level is + 1 % (beyond the cost-optimal level). However, in the financial calculation chosen as a national criterion, this gap amounts to + 17 per cent, which means that the tolerable gap criterion is not only met, but that the minimum requirements of the current regulation (PURES 2010) are even slightly stricter than the cost optimum.

The identified gap for building elements for existing buildings in the macroeconomic calculation is 10 %. In the financial calculation, the gap for building elements for existing buildings is -12 %, thus within the allowed gap between the applicable minimum energy performance requirements for the building and the cost-optimal level.

The analysis in 2018 therefore showed that the gap of 15 % between the applicable minimum energy performance requirements for a building under PURES 2010 and the cost-optimal level remains within the allowed gap.

The completion of the new PURES was foreseen in 2020. In addition to the regular harmonisation of minimum requirements for the energy performance of building elements, buildings and technical systems in buildings, a technically more detailed record of the requirements for the design of nearly zero-energy buildings in line with the existing NZEB definition for new buildings and renovation given in the NZEB and the update of the methodology for determining the energy performance of buildings in line with Annex I of Directive (EU) 2018/844 and EPB standards were envisaged.

3.2 Minimum energy performance requirements

3.2.1 The PURES Rules

The Rules on the efficient use of energy in buildings – PURES (Official Gazette of the Republic of Slovenia Nos 52/10 and 61/17 – GZ) (PURES 2010) and the Technical Guideline – Energy efficiency TSG-1-004:2010 set out requirements for the minimum energy performance of buildings for new construction and major renovation of existing buildings, as well as minimum requirements for maintenance and technical improvements (before the end of the useful life of a building element, system and subsystem). The PURES 2010 Rules lay down 10 % stricter requirements for all public buildings.

The PURES 2010 Regulation lays down strict minimum requirements for the thermal protection of the envelope (the opaque part and windows and doors) and the maximum annual heat required for heating the building, which is combined with the prescribed 25 % share of renewable energy in the total final energy for the operation of the systems in the building and the technical requirements for the systems (condensation gas boilers, the COP for heat pumps, the required efficiency of the recovery systems for ventilation, the mandatory preparation of domestic hot water with renewable systems) is a key part of its minimum requirements for energy efficiency.

According to the PURES and TSG-1-004, buildings must also meet other requirements in the area of housing comfort.

Here we refer to the requirements relating to the thermal permeability of the individual parts of the thermal envelope of the building, as well as the requirements dealing with the energy demand and its use in the building. In order to demonstrate the suitability of the planned construction or reconstruction of buildings, the required criteria shall be demonstrated in accordance with the standard SIST EN ISO 13790 Energy characteristics. buildings – Energy use account for space heating and cooling.

The minimum requirements for energy use in buildings are laid down in the PURES Rules in Article 7 (limit values for energy efficiency). The minimum requirements for energy use vary according to the intended use of the building in question.

The reformed PURES and TSG-1-004 will be adopted with the required significantly lower permitted energy consumption for the operation of technical building systems and a higher required RES content. The consideration of buildings shall take into account at least the requirements of the applicable rules and guidelines.

Three energy use indicators are prescribed for residential buildings, namely:

- The annual heat demand for heating QNH of $a_{building}$, calculated per unit of conditioned area Au, shall not exceed the value given by the equation[12]

  $QNH_{/}Au_{\leq}$ 45 + 60 f0 —$_{4,4}$ TL [kWh/$_{(}$ m2a)].
- The annual primary energy for the operation of the systems in the Qp building, calculated per unit heated area of the Au Building, $shall_{not}$ exceed the value given by the equation
  $QP_{/}Au_{=}$ 200 + 1,1 (60 f0 —$_{4,4}$ TL) [$_{kWh/}$(m2a)].
- The permitted annual cold demand for cooling QNC of $a_{building}$, calculated per unit of cooled area of A(u) building, shall not exceed the value of
  $QNC_{/}Au_{\leq}$ 50 kWh/(m2a).

For non-residential buildings, an energy use indicator is prescribed as follows:

- The annual heat demand for heating QNH of $a_{building}$, calculated per unit of conditioned volume Ve of the building, shall not exceed the value given by the equation
  $QNH_{/Ve}$ $\leq_{0,32}$ (45 + 60 f0-4,4_{TL}) [kWh/$_{(}$m3a)].

An energy use indicator is prescribed for public buildings, as follows:

- The annual heat demand for heating QNH of $a_{building}$, calculated per unit of conditioned volume Ve of the building, shall not exceed the value given by the equation
  $QNH_{/Ve}$ $\leq_{0,29}$ (45 + 60 f0-4,4_{TL}) [kWh/$_{(}$m3a)].

[12]F0: Shape factor; Ratio of the surface of the heat envelope of the building to the net heated volume of the building
TL: Average annual ambient air temperature.

The minimum thermal transient requirements for individual parts of the thermal envelope of a building are shown in Table 1 in point 3.1.1 of the Technical Guidelines for construction TSG-1-004 Efficiency of energy use. These values apply to all buildings regardless of their intended use. The minimum requirement for specific transmission heat losses through the surface of the heat envelope laid down in the PURES Rules in Article 7 (Efficient Energy Efficiency Limits) shall also apply to all buildings.

The PURES 2010 Regulation lays down the same minimum requirements for new constructions and reconstructions, where more than 25 % of the surface of the wrapper is refurbished and therefore a major renovation, which must be met in full (if technically feasible). Maintenance and technical improvements shall meet the minimum requirements of a particular part, system or subsystem.

The new PURES (in preparation already in 2020) is expected to significantly interfere with the methodology for calculating energy indicators and the criteria of minimum energy performance requirements for buildings, notably by laying down detailed technical requirements for the design of new nearly zero-energy buildings and by closing a small gap in cost-optimality of minimum requirements.

3.2.2 Definition of NZEB in NZEB

The NZEBs Action Plan (MzI, 2015b) defined the Slovenian NZEB criteria in 2015. According to these criteria, the term 'nearly zero-energy building' means a building with a very high energy performance, meaning that the building needs a very small amount of energy to operate, the energy required being mainly produced from renewable sources on site or nearby.

The NZEB definition covers:

A. definition of a building with very high energy performance,
B. very small amount of energy needed to operate the building,
C. the minimum share of renewable energy sources allowed, or the energy required is mostly produced from renewable sources on site or nearby.

A. Building with very high energy performance

The maximum heat required for heating the building must be less than or equal to:

- 25 kWh/m2a(energy classes A1, A2 and B1).

This value shall be adjusted mutatis mutandis in the regulation governing the efficient use of energy in buildings, taking into account[13] the climatic characteristics at the location of the building and the design factor of the building.

B. and C. Low amount of energy required for operation and minimum RES content

For a nearly zero-energy building, the following maximum permitted values for primary energy and minimum RES shares according to the type of building are defined (Table 22):

Table22: Maximum allowed values of primary energy NZEB per type of building (Source. An NZEB 2015)

Type of building	Maximum allowed value of primary energy Per unit conditioned# area per year [kWh/m2a]		Minimum RES share [%]
	Newly built	Major refurbishment[14] (reconstruction)	RER**
One-dwelling buildings	75	95	50
Multi-dwelling buildings	80	90	50
Non-residential buildings*	55	65	50

* Based on an analysis of cost-optimal levels for office buildings as the most strongly represented group of non-residential buildings; Exemptions for other types of non-residential buildings will be defined by a regulation regulating the efficient use of energy in buildings.

** RER is the share of renewables in total energy input.[15][16]

[13] I.e. at the time of the renewal of PURES (scheduled for 2021).

[14] As defined in EZ-1.

[15] As defined by REHVA (Federation of European Heating, Ventilation and Air Conditioning Association), Kurnitski, Jarek. 43rd International HVAC&R Congress and Exhibition, December 2012.

[16] REHVA nZEB technical definition and system boundaries for nearly zero energy building. 2013 revision for uniformed national implementation of EPBD recast prepared in cooperation with European standardisation organisation CEN. Report No 4, 2013.

Since the NZEB, which sets out the definition of NZEBs, is not a building regulation, it is envisaged to include the definition of NZEB when the PURES is amended (in 2021).

3.3 Cost-effectiveness of the renovation

When assessing the cost-effectiveness of the renovation, we take into account the principle of life-cycle costing or LCC analysis. Life Cycle Costing). The aim is to identify cost-effective solutions or methods of renovation that meet the current sustainability priorities and objectives of the built environment throughout their life cycle.

The LCC method is used to determine the net present value (NPV) of the total discounted costs over the expected lifetime of the building, comprising the investment in renovation, operating and energy costs, maintenance, repair and replacement costs of building parts and appliances, as well as end-of-life costs. The principles for the calculation of the cost of life (LCC analysis) for buildings and parts thereof are set out in ISO 15686-5(SIST ISO, 2017, slika 12).

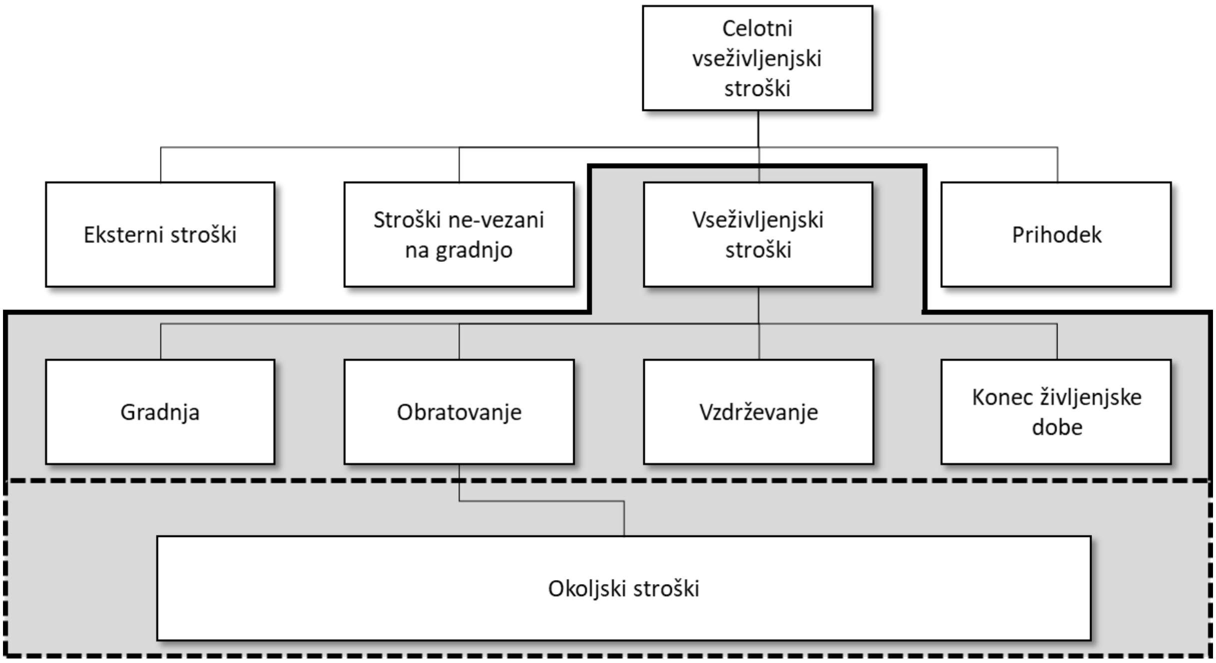


Figure13: Presentation of the life-cycle cost structure of a building (summarised according to ISO 15686-5)

A more detailed methodology for determining the cost of building renovation is laid down in Regulation (EU) (uredba EU, 2012) 244/2012 and its guidelines(smernice EU, 2012). In principle, the Regulation **prescribes a comprehensive cost approach** for new construction and major renovation works. This means that for each measure/package/variant assessed, all costs of construction (or major renovation) and subsequent use of the building have to be calculated. Since, in determining the cost-effectiveness of renovation variants, the focus of the calculation is on their comparison (and not on the estimation of the total costs for the investor and the building user), cost items that are the same in the versions, which do not have an impact on energy efficiency and additional costs, may be excluded from the calculation.

When comparing the lifetime costs of renovation from a macroeconomic point of view, we must also take into account the costs of environmental impact (carbon costs) and exempt taxes, whereas the financial aspect of the assessment of the cost-effectiveness of the renovation takes into account the costs paid by the user (i.e. we take into account the prices paid by the end-user, including taxes and subsidies, if applicable).

The cost-effectiveness of building renovations is assessed on the basis of the life-cycle costs calculated by the LCC analysis, comparing the individual versions with the cost of (maintaining) the baseline state of the building. **Cost-effective renovation is the one where the life-cycle cost of the renovated building is lower than that of the existing condition (Figure 13)**.

The cost-optimal level is the objective of the future reformed PURES. Nearly zero energy renovation is a refurbishment with such measures where the energy indicator (primary energy consumption) is significantly improved after renovation and the life-cycle costs of a renovated building (investment and any further operating costs) are still lower than the current situation. Cost-effective renovation of a building must meet the criterion of economic viability, but not necessarily the cheapest over its entire life cycle, but it represents a higher energy performance than the cost-optimal design (and at the same time meets the requirements of the regulation). While individual measures can be cost-effective, they provide less energy savings than full renovation; It is only after several measures have been implemented that a step-by-step renovation can significantly increase energy efficiency. The criterion is aimed at building owners and energy renovation planners in finding economically viable designs for the renovation of an existing building.

Figure14: Cost-effectiveness scheme for the energy renovation of an existing building (summarised by IEE REPUBLIC_ZEB[17])

3.4 Orientations for the replacement of technical systems

Role of the remote system and gas pipeline

The supply of a building with a district heating system in all three types coincides with the cost minimum. District heating with RES is undoubtedly the most appropriate way to supply thermal energy to buildings in urban agglomerations, provided that the price of heat is in competition with other systems. In Slovenian district heating systems, both conditions, RES and competitive energy price, can be met, and only one or none can be met.

Natural gas heating is close to cost-optimal for all three types of reference buildings under consideration, as investment in a gas boiler is relatively low, maintenance costs are low and the price of heat from natural gas is the lowest among fossil fuels. A key problem is natural gas heat as gas pipeline gas currently does not contain RES and as such does not meet the criteria for renovations in NZEBs.

The role of woody biomass

[17]IEE REPUBLIC_ZEB (http://www.republiczeb.org/).

Woody biomass in chips or pulverised form is one of the ways in which operating costs are reduced by 60-70 per cent compared to fuel oil. However, investment in the system is relatively high and management/maintenance is more demanding, reducing life-cycle costs by 10-15 per cent on average. A further restriction may be densely populated areas where particulate matter emission limits apply, as well as multi-apartment and non-residential buildings where noise and storage space limits for woody biomass apply. Woody biomass is of strategic importance for Slovenia, as it is a domestic renewable energy source that can shape its own pricing policy and must therefore always be seriously considered when refurbishing the building's thermal energy supply system.

Role of heat pumps

Life-cycle cost analysis and primary energy use place heat pumps prominently among the systems in the cost-effective renovation of single-apartment, multi-apartment and non-residential buildings, especially after the energy renovation of the heat envelope, where the lower required temperature regime does not require intervention in heating bodies and can easily replace the boiler. In older buildings there is no floor or wall distribution of heat to rooms, and in some cases there is no central heating system. In the latter case, the only option is to install air/air heat pumps, which affects the parameters of the accommodation comfort. If, despite the energy renovation of the heat envelope, the required radiator temperature is higher than 60 °C, the designer may select a heat pump, in this case a two-step heat-water temperature at the grade of the combustion boiler. The most common air/water heat pumps in Slovenia use 77-82 per cent of renewable energy sources for their operation, and operating costs are 50-55 % lower compared to fuel oil. When investing in a new heating system for multi-apartment buildings with a heat pump, the relatively advantageous price and the uncomplicated management/maintenance result in a life-long cost of around 25 per cent compared to the fuel oil system. As with woody biomass, there is no restriction on heat pumps, but the comfort they bring should not be ignored. In combination with a solar power plant installed in accordance with the Decree on self-consumption of electricity from renewable energy sources (Official Gazette of the Republic of Slovenia No 17/19) and in combination with the financial mechanisms available for residential buildings, the cost and environmental advantage of heat pumps over other systems is further increased.

Role of ventilation systems

Mechanical ventilation systems significantly increase the cost of life for all three types of buildings analysed, most significantly for non-residential buildings. The proportion of ventilation energy compared to the total energy use of the building is expected to increase as requirements and standards for higher energy performance and lower transmission losses are tightened, while ventilation standards recommend more intensive ventilation to improve indoor air quality. At the same time, the building regulations (PURES 2010) introduce criteria for the air-tightness of buildings, which will have a significant impact on higher indoor air quality, health and productivity of people in buildings. In general, high air quality in accommodation spaces can only be permanently ensured by mechanical ventilation systems. The use of heat recovery/regeneration devices is essential for low- and nearly zero-energy buildings.

Air quality in accommodations can be permanently ensured by different ventilation systems (mechanical, natural, hybrid), choosing the appropriate system according to the architectural design of the building, the location, the technical systems used in the building and the like. The advantages of mechanical ventilation are the control of ventilation, the possibility of filtering air and the recovery of waste heat. Natural ventilation has the advantage of ensuring a higher air flow where necessary, especially during space overcrowding and without electricity consumption for the operation of mechanical fans. During the summer period, increased airflows with natural ventilation can be used to cool the building without using energy for the operation of air conditioning systems.

4 Policies and measures to promote energy-efficient renovations

4.1 PSEPS 2050 framework – legal and strategic basis for setting objectives

Through a number of documents and decision-making processes at EU level, and in particular the EU 2020 Strategy, Slovenia has committed itself to achieving the objectives of sustainable growth. The EUROPE 2020 strategy (EC, 2010) for smart, sustainable and inclusive growth is the vision of Europe’s social market economy for the 21st century, which contains three priority elements that interlink, complement and reinforce each other, namely:

- **Smart growth**: Developing an economy based on knowledge and innovation;
- **Sustainable growth**: Promoting a more competitive, resource-efficient, green and low-carbon economy;
- **Inclusive growth**: Consolidating a high-employment economy that strengthens social and territorial cohesion.

The strategy supports the transition to an economy that is resource-efficient, fully decoupling economic growth from resource and energy use and environmental impacts, reducing greenhouse gas emissions, improving competitiveness through efficiency and innovation, and promoting greater security of energy supply. Slovenia implements the vision of the Europe 2020 strategy through its policies. It has identified the area of sustainable energy as one of the priority axes of the Operational Programme for the implementation of the European cohesion policy for the period 2014-2020 and has allocated the highest funding in this context to the building sector.

As an EU Member State, Slovenia has committed to honour its commitments under the Paris Agreement to keep the increase in global temperature below 2 °C by reducing greenhouse gas emissions and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. The Paris Agreement was ratified by Slovenia in 2016(RS, 2016). Already in March 2010, the European Council took a political decision to reduce greenhouse gas emissions by 80-95 % by 2050 compared to 1990, such reductions will, according to the Intergovernmental Panel on Climate Change (IPCC), be necessary in developed countries to achieve this goal. For 2030, the following policy decisions were already taken in 2014 and were further tightened in 2018 in the field of renewables and energy efficiency(EC, 2018):

- reducing GHG emissions by 40 % at EU level as a whole compared to 1990. Member States’ contributions to this target will be legally binding. They will be set in such a way that they are properly balanced in terms of fairness and solidarity (based on relative GDP per capita). All Member States will contribute to the overall EU emission reductions in 2030, with targets of 0-43 % compared to 2005;
- the share of renewable energy consumed in the EU in 2030 is expected to be at least 32 %. This target will be binding at EU level;
- to improve energy efficiency in 2030 compared to projected future energy consumption on the basis of existing criteria, an indicative EU-wide target of at least 32.5 per cent is set. The national targets are set by the Member States themselves.

The EU’s Roadmap for achieving a low-carbon economy by 2050 identified orientations for the EU’s sectorial targets for 2050 and the necessary interim targets. The need to reduce GHG emissions in the household and service sectors (buildings area) by 88-91 % compared to 1990 was identified.

In March 2020, the European Commission put forward **a proposal for a first European Climate Law** (EC, 2020) with the aim of enshrining the European Green Deal's goal of **making Europe's economy and society climate neutral by 2050**.

This means **achieving net-zero greenhouse gas emissions for the EU countries as a whole**, notably by reducing emissions, investing in green technologies and protecting the natural environment. The aim of the law is to ensure that all EU policies contribute to this objective and that all sectors of the economy and society are involved. The key binding documents are:

The Energy Act(RS, 2019), which defines the starting points of Slovenia's energy policy. For the period up to 2020, Slovenia has made a number of international commitments. Among them, the following are of particular importance in the field of buildings:

- Directive 2012/27/EU on energy efficiency;
- Directive 2010/31/EU on the energy performance of buildings;
- Directive 2009/28/EC on the promotion of the use of energy from renewable sources;
- Decision 2009/406/EC on the effort of Member States to reduce their greenhouse gas emissions;
- revision of the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

The national objectives resulting from the above-mentioned documents, to which actions in the building sector will make a significant contribution, are:

- improving energy efficiency by 2020;
- mandatory share of renovation of buildings owned and occupied by close public sector entities;
- nearly zero-energy building commitments;
- a mandatory 25 % share of RES in gross final energy consumption in 2020;
- GHG emission targets (GHG emissions should be below the trajectory target in the period up to 2020);
- air protection targets, the most important of which is the reduction of particulate matter emissions in the building sector.

Implementation programmes. A number of implementation plans already adopted and under preparation, which detail the contributions of specific areas to the achievement of national targets, are also essential for the development of the strategy – the documents set indicative targets for sectors or areas. The implementation programmes relevant for the building sector are:

- Energy Efficiency Action Plan 2014-2020 (AN URE 2014-2020);
- Renewable Energy Action Plan 2010-2020 (AN RES 2010-2020), revision under preparation;
- Operational Programme for the Implementation of European Cohesion Policy 2014-2020 (ECP 2014-2020);
- Operational programme of measures to reduce GHG emissions by 2020 (OP GHG—2020);
- Operational programme for protection of ambient air against PM10 pollution (OP PM10) and orders on air quality plans.

The objectives of the Climate and Energy Package (EE, RES and GHG) are not addressed separately and in detail here. Two Energy Efficiency Directives (2010/31/EU and 2012/27/EU) also set specific national targets relating only to buildings and are described in the sub-chapters of Annex A (Nearly Zero Energy Buildings Objectives, Obligation for Closer Public Sector Buildings). As they are less known, a separate chapter lists air protection objectives (air protection).

4.2 Development measures

4.2.1 Horizontal actions

4.2.1.1 Regulations on the energy performance of buildings

The rules for the energy performance of buildings (hereinafter referred to as PURES) will be upgraded in 2021 by introducing more stringent requirements for the energy performance of buildings, in line with the results of the national study on cost-optimal minimum requirements. The update of the regulation will also include an update of the minimum energy performance requirements for new technical building systems, as well as for their replacement and upgrade where technically, economically and functionally feasible. **A major innovation in PURES will be the creation of a so-called 'nearly zero-energy building** '(NZEB).

The upgrading of energy efficiency rules also includes upgrading the minimum requirements for the renovation of existing buildings with more detailed criteria for the nearly zero-energy construction and renovation of existing buildings. The upgrading of regulations will interfere with the energy performance of the building and systems and the achievement of a targeted coverage of the building's needs by renewable energy sources or energy efficient energy supply systems.

In the long term, it is envisaged to upgrade the rules for reducing GHG emissions over the life cycle of a building (for example, introducing life-cycle environmental impact assessments with the aim of implementing lower-emission materials) either as part of the upgrading of the Rules on efficient energy use in buildings, or in the context of the modernisation of green public procurement rules in the field of buildings, or as part of a specific regulation in the field of sustainable buildings.

4.2.1.2 Cultural heritage buildings

The proportion of buildings protected under the rules on the protection of cultural heritage is very high and this share is particularly high in the case of state buildings. This group of buildings, as a bearer of Slovenian identity and because of its economic importance, needs special treatment. Due to their specificities, the renovation of cultural heritage buildings usually requires higher investment and some deviations from the required renovation parameters applicable to other buildings and therefore often the conditions for obtaining available public funding for energy efficiency and exploitation of RES cannot be met for these buildings as well.

Guidelines for the energy renovation of cultural heritage buildings were adopted in 2016(Vendramin in drugi, 2016). The guidelines provide the following orientations:

- Criteria are developed **for the architectural-structural aspect of energy renovation** so that the energy renovation of cultural heritage buildings takes place in such a way that the protected features of cultural heritage are not affected or even destroyed at the time of renovation;
- **Positive discrimination criteria** are developed to be used in calls for tenders to promote the energy renovation of buildings ('the heritage factor'), which will enable the level of incentives and the way in which cultural heritage protection to be promoted to be adapted; The requirements for the energy performance of buildings protected under the rules on the protection of cultural heritage shall be adapted to the protected values, in particular as regards correction factors;
- During the implementation phase, there is a **pilot or demonstration project** for the energy renovation of five general public sector buildings[18]created by the Republic of

[18]Https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2017007500006/javni-razpis-za-podelitev-koncesije-za-izvedbo-projekta-energetsko-pogodbenistvo-v-dolocenih-objektih-ministrstva-za-kulturo-ob-369417

Slovenia and officially protected as part of a protected environment or because of their special architectural or historical importance.

For this group of buildings, a comprehensive set of measures will need to be developed in the future, taking into account the following orientations:

- a comprehensive study of cultural heritage buildings in need of energy renovation;
- provision of funding for the renovation of cultural heritage buildings;
- changes in local fiscal legislation: Greater autonomy of the local self-governing community in the creation or management of sources of fiscal revenue for the possibility of creating a fund for financial incentives for private owners of cultural heritage buildings for their energy renovation;
- complementing the guidelines for the energy renovation of cultural heritage buildings with innovations and changes in legislation and strategic documents, upgrading the technical content, developing the recommended phases of the project for the integrated energy renovation of cultural heritage buildings, describing examples of good practices and transferring lessons from tenders to co-finance energy renovation of buildings from cohesion funds; and
- training of operators.

These measures require a specific and timely preparation and appropriate organisation of the key actors and participants for the qualitative implementation of the actions.

4.2.1.3 Systemic treatment of wider building renovations

With DSEPS 2050, Slovenia sets the objective of achieving a significant improvement in the energy performance of the building stock and of achieving the headline targets in the field of buildings. Energy renovations of older buildings also need to address other challenges at the same time or take into account different boundary conditions, such as the protection of cultural heritage. For sheltered buildings, it is necessary to obtain cultural protection conditions before energy renovation and then to adapt the interventions accordingly.

Slovenia is a seismic country and the renovation of buildings makes sense to pay particular attention to the construction and its resilience to the earthquake. This is particularly the case for older buildings, as knowledge of anti-seismically secure construction has grown and upgraded over time. Earthquakes have revealed a lack of construction at certain times, and the ageing of materials must also be taken into account, so that the assessment of the seismic resilience of buildings becomes necessary under new standards and regulations, even though it is not binding. **As much as 76 % of the floor area of the building stock belongs to buildings built before 1990. Therefore, when planning energy renovations in the period up to 2050, it is also necessary to regulate the systemic treatment of the wider renovation of buildings, including the seismic aspect**.

At European level, the Republic of Slovenia, together with the other Member States, will endeavour to make the renovation of buildings a priority for the future of the EU, also from a broader perspective, since the renovation of buildings from a broader perspective is necessary in the long term and can only in this way satisfy all the criteria of the sustainable development of society.

The problems of simultaneous energy and static renovation are addressed through various innovative approaches (e.g. by adding a useful volume on or adjacent to a building in parallel with energy renovation, thereby increasing the useful surface area of the building, increasing the value of existing buildings or creating additional spaces).

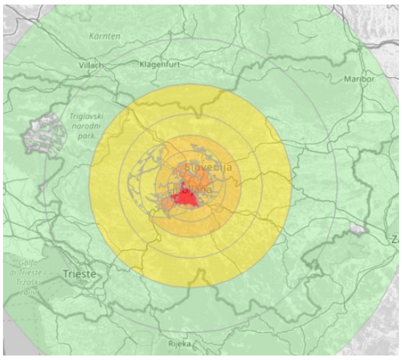
As part of the preparation of DSEPS 2050, a preliminary model analysis of the seismic risk of buildings owned and occupied by the narrower public sector was carried out. It has shown that

61 buildings are placed in the group of the most exposed buildings with a seismic resistance of less than 34 per cent currently prescribed. Addressing this situation as a matter of priority would require a detailed seismic analysis of these buildings and would require funding in the range of EUR 139.9-264.3 million for their anti-seismic consolidation. Investment in replacement construction is estimated at EUR271 million.

Slovenia as a whole is in a seismic area, in particular Ljubljana, where earthquakes have already been catastrophic in the past. Only in 20. There were 15 earthquakes in Slovenia with an intensity of at least Stage VII of the EMS (European seismic scale or European macro-seismic scale). **If an earthquake of VIII-IX, such as the devastating earthquake in 1895, were to take place in Ljubljana today, its consequences would be disastrous** for buildings and, above all, for people. More than 1265 buildings would be demolished or seriously injured (Slika 15). These buildings have a permanent residence of almost 28 000 people and are home to 34 000 people during the day. This leads to the conclusion that many buildings in schools, health centres, halls and various offices, which are empty at night and many people are present in the day, are more vulnerable to earthquakes. In the event of an earthquake at night, more than 2000 people could lose their lives and an earthquake in the day would endanger the lives of almost 2500 people. The cost of replacing demolished or severely damaged buildings alone would be estimated at EUR2-5 billion. As much as 10 to 15 times, the estimated cost of rehabilitating and consolidating more than 18 thousand buildings would be medium damaged by the earthquake.

For this group of buildings, a comprehensive set of measures will need to be developed in the future, taking into account the following orientations:

- a comprehensive study of buildings suitable for wider renovation,
- the introduction of an information tool for owners on energy efficiency, seismic and fire safety;
- providing funding sources for the wider renovation of buildings; and
- training of operators.



Uporabnost stavb	Ocenjeno število stavb	Ocenjeno število ljudi		
		Nočni scenarij	Dnevni scenarij med tednom *	Dnevni scenarij vikend *
Neuporabne	1265 (0%)	27.636 (3%)	34.141 (3%)	17.199 (3%)
Začasno neuporabne	18.020 (4%)	103.551 (11%)	105.944 (12%)	60.392 (12%)
Uporabne	268.424 (59%)	601.258 (67%)	397.253 (46%)	290.060 (59%)
Neocenjene	160.415 (35%)	161.688 (18%)	317.819 (37%)	116.039 (23%)
Skupaj	448.124 (100%)	894.133 (100%)	855.157 (100%)	483.690 (100%)

Figure15: Modelled effects of the effects of an earthquake of intensity VIII-IX EMS-98 with an epicentre in Ljubljana (left) and an assessment of the consequences of the earthquake in terms of threats to buildings and people (right) (POTROG, 2020)

4.2.2 Residential buildings

Channelling subsidies into integrated energy and neighbourhood renovations

The continuation of the promotion policy through investment financial incentives (EcoF incentives) is envisaged. In the future, these incentives will be more targeted, the level of incentives will give more impetus to the integrated energy renovation of buildings (the highest co-financing rate will be given to the integrated energy renovation of buildings and the lowest to the implementation of the individual measure). Subsidies must also be linked to quality checks on performance. Instruments to promote the renovation of neighbourhoods will also be examined.

Provision should also be made for legal bases to facilitate borrowing from the reserve fund and/or the building by way of on-bill financing.

The upgrading of financial assistance to vulnerable population groups is foreseen in the adopted strategy papers and identifies specific measures for energy renovation in households facing energy poverty. The measures will focus on investment, as well as on advice and behavioural change measures. Advice and other implementation assistance will address the obstacles faced by this target group (access to information, skills to implement the measures, etc.) and will take utmost account of experience in providing assistance to this target group in other areas. Operators of a not-for-profit housing stock should also be encouraged to carry out a comprehensive energy renovation of buildings through appropriate regulation of the non-profit rental system.

4.2.3 Public buildings

Two strategic issues are crucial for the public sector:

- organisation of implementation enabling timely and comprehensive renovation of buildings in such a way as to allow for the best impact on public finances, including effects on economic growth, employment and other wider societal benefits;
- ensuring greater refurbishment of public buildings with limited public resources through the establishment of energy contracts.

The strategic impacts will depend directly on the implementation activities at the beginning of the new financial period, therefore we also address some implementation issues in this chapter. The instruments supporting the planned plan to increase the number of comprehensive and nearly zero-energy renovations of buildings in the public sector are:

- financial incentives in the form of grants and reimbursable grants;
- promoting the deployment of energy contracts;
- private funding for the private non-residential sector;
- the financial resources of dedicated funds and IFI programmes for the public and private non-residential sectors and the targeting of part of the incentives to encourage the supply of reflows;
- training of procurers, designers, contractors and users of nearly zero energy buildings;
- development of solutions for the renovation of the building cultural heritage and other specific groups of buildings (typical solutions for non-residential and public buildings),
- link to support schemes for the supply of RES heat,
- legal bases for energy efficiency and RES target indicators in the public sector;
- monitoring of achieved indicators and promotion,
- implementation of measures to optimise the operation of energy systems in the context of financing the energy renovation of buildings and for other buildings through energy contract financing.

Incentives, including grants, will target the public sector in the broadest sense in terms of both the ownership and the purpose of the use of buildings. Priority will be given to actions aimed at achieving the obligation to renovate three percent of the total floor area of the buildings of persons in the narrower public sector which, on 1 January of each year, do not meet the minimum energy performance requirements.

In line with the direction that the buildings of public bodies should lead by example, Slovenia has set ambitious energy renovation targets for buildings owned and occupied by the narrower public sector that are heated or cooled. At the same time, account will have to be taken of the provisions of the Green Public Procurement Regulation, which stipulate that the proportion of wood or wood components in buildings must be at least 30 per cent of the volume of materials installed.

In order to remove obstacles to the long-term energy renovation target of narrower public sector buildings, the existing instruments for the public sector (Preglednica 27) are being upgraded and new instruments are proposed (an analysis of the narrower public sector buildings carried out clearly shows that in order to achieve the country's binding renovation targets of three percent of PSO buildings, more stable financial resources must be provided to implement these investments. The very poor implementation of the energy renovation of buildings in the PSO so far is mainly due to the lack of budgetary resources and, at the same time, the dispersion of these resources within the budgetary rights of individual ministries. In order to accelerate the energy renovation of these buildings, it is necessary to ensure a stable and sufficient source of funding and an appropriate list of priority ministry buildings suitable for energy renovation, which, according to the Government of the Republic of Slovenia, must be renovated. One option is to provide funding by creating a system-based financial resource dedicated to the energy renovation of PSO buildings.

Consideration should be given to options for a systemic financial resource for energy renovations by providing different financial resources (restrictions on individual ministries' budgets within the adopted budget, cohesion funding and other EU grants, possibilities to use funds generated by energy savings or lower energy costs). To this end, the legal, technical and economic aspects of setting up such a financial resource should be examined in cooperation with the relevant authorities. To this end, legislative and incentive instruments along the lines of the rest of the world (so-called 'revolving funds') should be examined.

The examination should explore the possibility of using initial start-up funding through the payment of European cohesion funds.

4.2.4 Private service sector buildings

Hours and exploitation of RES enable small and medium-sized enterprises, in particular, to reduce their energy costs and thus their operations. Due to their limited size, these companies usually do not have enough human resources to deal with the energy efficiency and exploitation of RES and manage RES projects, although some public funding is already available for this purpose (Eco-Fund, programmes of energy suppliers). It would therefore be worthwhile for this target group to set up a specific programme to overcome these obstacles, the preparation and implementation of which would require, in particular, the involvement of MzI and MGRT, as well as the Eco Fund and local energy agencies. This programme should encourage the creation of service packages targeting this target group.

This will also be needed to support investment incentives and other forms of financial incentives to improve energy and material efficiency (measures to promote energy efficiency and RES in SMEs) funded by the European Regional Development Fund (ECDP 2014-2020), where incentives for thousands of projects are planned.

4.2.5 Complementary policies

Measures and **policies for district heating systems that take into account the vision of the DSEPS 2050 are also essential in order to achieve the targets and** impacts on emission reductions. A detailed strategy for this sector will be defined in the NECPs.

At the same time, building renovation measures relate to **air quality**, significantly reducing the overall cost of achieving the objectives of several policies. Full compliance with air quality legislation and programmes is essential when implementing the energy renovation of buildings. The strategy further guides the delivery of air quality objectives in line with the orientations adopted during the FP GHG-2020 which are:

- incentives for wood biomass combustion plants for heating buildings or settlements, whether publicly funded or encouraged under the obligation of energy suppliers to achieve end-use energy savings, shall only be given to the best available techniques;
- individual heating systems shall not be encouraged if they replace heating with heat from district heating systems;
- individual heating systems shall not be encouraged in areas with the adoption of an Air Quality Plan Decree where district heating is a preferred way of heating buildings by means of municipal acts or a local energy plan. If the use of natural gas is chosen as the preferred heating mode, the replacement of gas-fired combustion plants with new woody biomass combustion plants shall not be encouraged;
- when creating incentives for heating in buildings and settlements, the following priority of heat supply according to the energy source shall be taken into account:
  - district heating systems using RES in cogeneration of heat and electricity, RES under separate production, high-efficiency natural gas in CHP or waste heat;
  - individual RES heat supply;
  - individual natural gas supply;
  - other sources.

With the measures outlined in this strategy in the area of energy efficiency in buildings, the total use of woody biomass for heating (in absolute quantity) will be lower in 2030 than would have been the case without these measures, while at the same time the share of buildings where this energy product will be exploited in modern high-efficiency installations will be higher.

4.3 Overview of policies and measures in the area of wider renovation

4.3.1 Promoting energy efficiency and renewable energy use in buildings in general

Table23: Overview of the implementation of existing measures in buildings in general and necessary upgrade measures

RENEWED ACTIONS	
MEASURE S-1	**Amendments to the rules for the energy performance of buildings**
Responsibility	MOP, MzI DE
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	law
Necessary measures for continuation, upgrading of implementation and deadlines	Already adopted in NECPs: • Adoption of a new PURES. Deadline: 2021 Additional activities: • PURES should be regularly updated in accordance with the requirements of the EPBD and KED Directives.
MEASURE S-2	**Renovation of cultural heritage buildings and other specific groups of buildings**
Responsibility	MIC DE, MK
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS, OP ECP; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	set of instruments

RENEWED ACTIONS	
Necessary measures for continuation, upgrading of implementation and deadlines	• Develop criteria for determining the eligible costs for the sustainable energy renovation of public buildings. Deadline: 2021. • Provide co-financing tailored to these target groups in the context of cohesion. Deadline: 2022. • Changes in local fiscal legislation: Greater autonomy of the local self-governing community in the creation or management of sources of fiscal revenue for the possibility of creating a fund for financial incentives to private owners of cultural heritage buildings for their energy renovation. Deadline: 2022 • Complement the guidelines for the energy renovation of cultural heritage buildings with innovations and changes in legislation and strategic documents, upgrading technical content, developing the recommended phases of the project for the integrated energy renovation of cultural heritage buildings, describing examples of good practices and transferring lessons from tenders to co-finance energy renovation of buildings from cohesion funds. Deadline: 2023.
MEASURE S-3	**Energy Contracts**
Responsibility	MZI DE
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS, OP ECP; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic

Necessary measures for continuation, upgrading of implementation and deadlines	• Design appropriate financial products for EPO service providers
	• Support the development of the EPO through appropriate support measures, such as:
	  o training,
	  o additional technical and technical assistance in project preparation,
	  o the EPO project quality assurance programme,
	  o development of tools for the evaluation of EPO projects, etc.
	• Extend the instrument from the public sector to other sectors, in particular housing.
	• Establish a mechanism to encourage the emergence of ESCOs, with special attention for SMEs (SID Bank and others).
	Deadline: 2023

MEASURE S-4	**Development of sustainability criteria for buildings**
Responsibility	MOP, MzI DE
Strategic bases and their validity	AN HOUR, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	planning
Necessary measures for continuation, upgrading of implementation and deadlines	• The LIFE IP CARE4CLIMATE project foresees testing the first version of the sustainability indicator system in 2020, including the establishment of a supportive environment and the development of criteria for the evaluation of indicators. Training of experts involved in testing will also be provided. Deadline: 2021. • It foresees the creation of a supportive environment for the sustainable valuation of buildings (establishment of the system, certification scheme, training, system maintenance, financing), the preparation of the basis for the promotion and financing of sustainable renovations and the extension of the promotion to sustainable building renovations, the implementation of model

RENEWED ACTIONS	
	sustainable renovation projects for public buildings. Deadline: 2023.
MEASURE S-5	**Legal ban on the use of fossil fuels for heating in buildings**
Responsibility	MZI DE
Strategic bases and their validity	NECPS; Validity until 2030
Duration	2030
Type of instrument	law
Necessary measures for continuation, upgrading of implementation and deadlines	• Prohibit fuel oil by 2021 in new buildings and sell and install new heating oil boilers in 2023. Deadline: 2021. • Develop an assessment of the potential for efficient heating and cooling. Deadline: 2020. • Define priority orientations for heating and cooling sources and technologies at the next update of the NECPs in accordance with the assessment of the potential for efficient heating and cooling. Deadline: 2024.
MEASURE S-6	**Establishment of an energy and emission cadastral of buildings**
Responsibility	MZI DE
Strategic bases and their validity	NECPS; Validity until 2030
Extended validity of the measure	2030
Type of instrument	Other (information platform)
Necessary measures for continuation, upgrading of implementation and deadlines	• Establish a building energy performance portal based on all available data, including emission data, which will provide a comprehensive spatial view of the state and emissions of buildings and allow for quality planning of measures. The portal should also enable the monitoring of emissions of particulate matter (PM10 and PM2,5) and ensure air quality. Deadline: 2024
MEASURE S-7	**Drawing up a financing plan for the wider renovation of buildings**
Responsibility	MZI DE
Strategic bases and their validity	NECPS; Validity until 2030
Extended validity of the measure	2030
Type of instrument	planning
Necessary measures for continuation, upgrading of implementation and deadlines	• The name of the instrument from the NECPs is renamed from 'Developing a Sustainable Building Renovation Financing Plan' to 'Developing a financing plan for wider building renovations', in order to ensure the consistency of the designation of the renovation in LIFE IP CARE4CLIMATE, under which the plan will be drawn up, and DSEPS 2050.

Table24: Overview of new measures in buildings in general.

NEW MEASURES	
MEASURE S-8	**Ensure sufficient resources to implement financial incentives for energy efficiency and RES use in residential buildings**
Responsibility	MZI DE
Strategic bases and their validity	AN HOUR, NECPS; Validity until 2030
Duration	2030

NEW MEASURES	
Type of instrument	Law
Necessary measures for continuation, upgrading of implementation and deadlines	• A pro-rata increase in the contribution to energy efficiency by 2030 each year (a threefold increase in the energy efficiency contribution until 2030 (0.25 CEUR/kWh) Deadline: start 2021
MEASURE S-9	**Obligations of suppliers**
Responsibility	MZI DE
Strategic bases and their validity	NECPS; Validity until 2030
Duration	2030
Type of instrument	Law
Necessary measures for continuation, upgrading of implementation and deadlines	• Increasing the obligations of liable parties to achieve mandatory energy savings for electricity and natural gas suppliers at a level of 1 % of the energy sold annually • Preparation of the technical background for the preparation of a new proposal for a regulation on securing energy savings in order to promote energy contract services in the field of buildings. Deadline: start 2021

Justification of the need to provide sufficient resources to implement financial incentives for energy efficiency and RES use in residential buildings

The objective of the NECPs in decarbonising buildings by 2030 will only be achieved by reducing energy needs and increasing the efficiency of heating systems. In recent years, most of the measures on buildings have been directed towards replacing heating systems or have involved partial energy renovations. Integrated energy renovations, which achieve greater environmental and energy impacts, have been rare. Instead of partial renovations, DSEPS supports the implementation of integrated energy and nearly zero energy renovations. DSEPS is also intensifying the scale of energy renovations of buildings. The Renovation Plan shall be implemented in a comprehensive and investment-intensive manner. Over the next ten years, the Eco Fund will need to further focus its action on promoting comprehensive renovations and renovations into NZEBs. It will be essential to reform the calls, scales and conditions of incentives for more favourable conditions for integrated and energy renovations of NZEBs. On average, by 2030, the DSEPS requires an increase of more than double the annual absorption of grants for energy renovations of buildings compared to the amount of drawdowns in 2018. The resources of the Eco-Fund stemming from the Climate Fund and the contribution to energy efficiency do not provide the scale of resources needed to achieve the envisaged scale of renewal of the DSEPS. The implementation of the DSEPS requires either a pro rata increase in the contribution to energy efficiency each year (needed threefold increase in the contribution by 2030 (or 0.25 CEUR/kWh by 2030)) or the provision of another appropriate source of financing. Without additional resources, the investment plan and the objectives of the NECPs will not be achieved.

Justification for introducing new obligations on suppliers subject to energy savings

Energy suppliers with their energy saving programmes can also make a significant contribution to achieving the scale of renovations. Under the legislation in force, taxable persons must achieve savings equivalent to 0.75 % of the energy sold in the previous year in the current calendar year. Taxpayers can also achieve energy savings by investing in energy efficiency measures, providing energy services and contractually providing energy savings or by other means. The implementation of the DSEPS requires a major shift in the development of energy services and the contractual delivery of energy savings in the building sector by energy suppliers. The regulation increases the level of energy savings required under Article 7 of the recast Energy Efficiency Directive. In parallel, the Savings Sharing Protocol regulates the sharing of the savings achieved between Eco Fund and energy suppliers for energy renovation projects in buildings, where the implementation of the energy renovation was simultaneously financed by contractual provision of savings by energy suppliers and Eko Fund funds.

4.3.2 Promoting energy efficiency and renewable energy use in buildings in households

Table25: Overview of the implementation of existing measures in households and necessary measures to upgrade

RENEWED ACTIONS	
ACTION G-1	**Aid scheme for energy efficiency in households for vulnerable population groups**
Responsibility	MoI DE, Eco Fund, ENSVET, MOP, MDDSZ
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS, OP ECP; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic (financial incentives) and support activities
Necessary measures for continuation, upgrading of implementation and deadlines	• Implementing the ZERO500 programme and supporting 500 households facing energy poverty and spending cohesion funds for this purpose until 2023. Deadline: 2023. • The Energy Poverty Scoreboard (chapter 7.4) showed that more than 40 % of single-apartment buildings have high heating costs. In order to ensure the continued implementation of the ZERO500, a financial envelope of EUR 7 million shall be made available for the new Multiannual Financial Framework 2021-2027. 2021-2027
ACTION G-2	**Financial incentives for energy efficiency and RES use in residential buildings**
Responsibility	MZI DE, MOP, Eko Fund, MKGP, MK
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS, OP ECP, AN RES; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic (financial incentives)
Necessary measures for continuation, upgrading of implementation and deadlines	• Drawing up a financial plan to promote measures in households, including the identification of sources of financing, incentive mechanisms and measures to remove key barriers, and organising the promotion and provision of one-stop-shop assistance. Deadline: 2022. • In order to target renovations and achieve the targets in 2030, a separate call for partial and integrated renovations shall be introduced, with at least 70 % of the foreseen resources dedicated to financial incentives for energy efficiency and the use of RES in residential buildings to be allocated to integrated energy and renovations in NZEBs, while also increasing leverage. Deadline: 2022. • In order to increase the efficiency of operations, the eco-fund shall analyse options for energy efficiency and RES measures, available through incentive mechanisms, and develop new financial instruments for the housing sector in cooperation with the Ministry of Infrastructure and other institutions (financial, ESCO). Deadline: 2022
ACTION G-3	**Financing instruments for renovation in multi-owner buildings**
Responsibility	Eco Fund, MESI DE, MOP

RENEWED ACTIONS	
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic, regulatory
Necessary measures for continuation, upgrading of implementation and deadlines	Legislation governing energy efficiency: • Consideration shall be given to the possibility of redrafting the legislation defining the amount of the required commitment of borrowing at the expense of the reserve fund or considering the creation of a specific fund to enable and encourage the implementation of integrated energy or renovation projects in the NZEB. The examination shall take into account the possibility of neutralising the increase in payments to the debt recovery reserve with a guaranteed reduction in energy costs due to energy renovation. • The field of energy contracts and energy services is qualitatively regulated. Deadline: 2020
ACTION G-4	**Mandatory sharing and accounting of heat costs in multi-apartment buildings**
Responsibility	MZI DE
Strategic bases and their validity	OP GHG, AN HOUR; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	law
Necessary measures for continuation, upgrading of implementation and deadlines	• Building on the current Regulation. Deadline: 2022.
ACTION G-5	**Energy advisory network for citizens – ENSVET**
Responsibility	MoI DE, Eco Fund, MOP
Strategic bases and their validity	OP GHG, AN HOUR, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	information/awareness raising
Necessary measures for continuation, upgrading of implementation and deadlines	• Strengthen professional support to co-owners in planning energy renovations of multi-apartment buildings as independent expert support for decisions to increase the energy efficiency of the building. • Train independent energy consultants to prepare the relevant content on the building certificate. • Strengthening the functioning of the ENSVET network, expanding into new municipalities, expanding advisory activities. Deadline: 2023.
ACTION G-6	**Reflow schemes for energy efficiency in households: Eco-Fund loans and incentives from other providers of green loans for the housing sector**
Responsibility	Eco Fund, MOP, commercial banks
Strategic bases and their validity	OP GHG, AN HOUR; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic

RENEWED ACTIONS	
Necessary measures for continuation, upgrading of implementation and deadlines	• Creation of new financial instruments, in particular first loss-absorbing schemes to absorb losses from green loan providers • A first loss-absorbing scheme is being developed for financial institutions for a pre-agreed amount of green loans. Deadline: 2022
ACTION G-7	**Sharing incentives between owners and tenants in multi-apartment buildings**
Responsibility	Ministry of Infrastructure: DE, MOP
Strategic bases and their validity	AN HOUR, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	Regulation, inducements
Necessary measures for continuation, upgrading of implementation and deadlines	• Consideration of the sharing of incentives between owners and tenants shall identify options for establishing an appropriate model for financing energy renovations by energy suppliers. • In the case of such a model, technical development support is provided to energy suppliers, a review of regulatory barriers is prepared and a pilot project is carried out. Deadline: 2022
ACTION G-8	**Establishment of a guarantee scheme**
Responsibility	Eco Fund, MESI DE, MOP
Strategic bases and their validity	AN HOUR, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic (financial incentives)
Necessary measures for continuation, upgrading of implementation and deadlines	Consideration shall be given to whether there is a possibility of creating a guarantee facility that would provide individual guarantees to borrowers or reserve funds on borrowing from the reserve fund. Deadline: 2022

Table26: Proposals for new measures for households

NEW MEASURES	
ACTION G-9	**Study on precise knowledge of the wider renovation of residential and non-residential buildings in Slovenia**
Responsibility	Ministry DE, MOP, MORS
Strategic bases and their validity	DSEPS 2050
Deadline for transposition	2023
Type of instrument	support activities
Necessary measures for continuation, upgrading of implementation and deadlines	A project to provide information on seismic risks to the building stock in Slovenia and to prepare the basis for a financial incentive scheme for building cards and wider renovations is being prepared as a technical basis for addressing the wider renovation of buildings in the legislation.
ACTION G-10	**Building card**
Responsibility	Ministry DE, MOP, MORS
Strategic bases and their validity	DSEPS 2050
Deadline for transposition	2024
Type of instrument	Technical assistance

NEW MEASURES	
Necessary measures for continuation, upgrading of implementation and deadlines	Legally oblige co-owners of multi-apartment buildings to have a building card. The components of this are as follows: Part 1: Analysis of energy efficiency Part 2: Fire safety analysis Part 3: Seismic risk analysis Part 4: List of recommended and required measures for a gradual wider renewal Part 5: Assessment of the condition of the building
ACTION G-11	**Establishment of a project office for the preparation of energy renovation projects for multi-apartment buildings**
Responsibility	MZI DE, Eco Fund
Strategic bases and their validity	DSEPS 2050
Deadline for transposition	2021
Type of instrument	Technical assistance
Necessary measures for continuation, upgrading of implementation and deadlines	A project office shall be set up for the energy renovation of multi-apartment buildings. The Project Office shall comprise the provision of adequate staff and financial conditions for the implementation of the tasks of supporting the preparation of energy renovation projects for multi-apartment buildings. The operation of the Project Office focuses on the preparation of energy renovation projects for residential buildings and operates on a one-stop-shop basis and as a platform between investors (owners), managers, refurbishment contractors, eco-funds, energy suppliers, ESCO-companies. Deadline: 2021
ACTION G-12	**Pilot projects**
Responsibility	MZI DE, Eco Fund
Strategic bases and their validity	DSEPS 2050
Deadline for transposition	2022
Type of instrument	Technical assistance, economic
Necessary measures for continuation, upgrading of implementation and deadlines	Implementation of three pilot projects testing the operation of new financial instruments and new financing models for energy renovation of multi-apartment buildings. Pilot projects shall adequately address diffuse ownership, sharing of incentives, NZEBs and wider renovation of buildings.

Justification for the need to introduce a building badge

The consideration of wider building renovations in the chapter 4.2.1.3 shows that, when planning energy renovations in the period up to 2050, there is also a need to regulate the systemic treatment of wider building renovations, which also covers the seismic aspect. Recent studies of PSO housing and buildings prove this.

At European level, the EU's financial framework for 2014-2020 has made the energy renovation of the building stock a priority. The financing of the anti-seismic consolidation of the building stock is not expected in the future, so Slovenia will have to define the modalities for the wider renovation of buildings and the design of financial instruments.

Although the first regulations on seismic safety dates back to 1963, many buildings from the 70s, 80s and even 90s have recently proved to be seismicly dangerous. The building card is primarily intended to protect home buyers and owners, as the availability of correct data on the seismic risk of the building is of great importance.

The building certificate is intended to provide a comprehensive picture of the actual state of the building, and therefore the possibility of taking into account the functional obsolescence of the building (e.g. provision of the necessary infrastructure for advanced operation of the building, lack of parking spaces, lifts, provision of adequate electric mobility infrastructure, etc.) should be considered when setting up the instrument, as well as architectural design renovation of buildings.

Justification for the need to set up a project office for the preparation of energy renovation projects for residential buildings

In practice, the implementation of the planned scale of more demanding energy renovations of residential buildings by 2030 means, on average, the implementation of three times the scale of the implementation of such projects so far. In particular for multi-apartment buildings, a large number of barriers and limiting factors have been identified that make it difficult for spontaneous decision-making for energy renovation. The main obstacles are dispersed ownership, the demographic structure of owners, energy poverty, the sharing of incentives between owners and tenants, the non-motivation of owners and the growing need for fundamental renovations of buildings. The energy renovations of buildings so far have been carried out in those multi-apartment buildings where such problems have not been strongly reflected. However, the planned energy renovation of multi-apartment buildings in the period 2021-2030 covers almost all buildings, including those where the obstacles and problems identified are very pronounced and therefore energy renovation cannot be expected to take place without external support.

The establishment of an Energy Office for the energy renovation of multi-apartment buildings could effectively address these problems. The project would provide technical assistance and provide funding for the following activities: Identification of energy renovation projects for multi-apartment buildings (VSS), preparation of energy renovation projects (PEP), carrying out extended energy audits and building performance certificates, assessing the scope of renovations, gathering information on consents and structural problems arising from the ownership of buildings, drawing up RZIs. ELENA could be used for the operation of the project office and the project office would be partly financed from the Ministry of Infrastructure, cohesion funds, housing owners' funds. Around 90 % of the cost of producing PEP for VSS could be financed by the Project Office.

In order to ensure greater implementation of the energy renovations of the VSS, coordinated action will be required between (a) the founder of the project office, (b) the eco-fund, which adapts the public call for a comprehensive renovation of multi-apartment buildings on the basis of the energy contract model and tests new financial instruments and energy contract models in the VSS through pilot projects, (c) energy service providers that also extend their energy services to energy renovation projects for residential buildings, and (c) building managers. The coordinated setting up of a project office will allow for the preparation and implementation of a larger number of projects at the same time.

Justification of the necessity to carry out pilot projects

Implementation of three pilot projects testing the operation of new financial instruments and new financing models for the energy reform of the VSS. Pilot projects shall be carried out by the Eco Fund in cooperation with MzI and other actors (financial institutions, energy suppliers, ESCO-companies, housing funds, etc.).

Pilot projects shall adequately describe the procedures for carrying out the energy renovation of the VSS, paying particular attention to solving the problems of dispersed ownership, the sharing of incentives between owners and occupants, the implementation of renovations in NZEBs and the wider renovation of buildings. The pilot project for renovations in the NZEB and the wider renovation will also require the involvement of the Republican or municipal housing funds, since such renovations require the expatriation of residents for the duration of the renovations.

4.3.3 Promotion of energy efficiency and renewable energy use in public buildings

DSEPS 2050 foresees the upgrading of the role of the Project Office in the energy renovation of buildings, which:

- build on the already existing guidance and model documentation relating to the implementation of energy renovation projects for public buildings;
- accelerate the preparation of integrated energy renovation projects by providing expert support for the identification of priority projects, the preparation of these projects, the definition of the delivery model, the monitoring and verification of energy savings and other activities;
- will actively develop and promote new financial models to encourage the renovation of public buildings and the contractual delivery of energy savings (e.g. exploring an additional energy contract model following a public procurement procedure; Examination of an additional model of energy renovation of PSO buildings by the in-house contractor of the country (public-public partnership);
- will ensure the establishment of a quality system for energy renovation projects for public buildings by educating qualified energy efficiency service providers and integrating quality criteria into standardised processes and documentation for the implementation of energy renovation projects.

Table27: Review of the implementation of existing measures in public buildings and necessary upgrade measures

Renewed actions	
ACTION J-1	**Energy management in the public sector**
Responsibility	MZI DE, MJU, MP
Strategic bases and their validity	AN HOUR, OP GHG; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	other (monitoring, reporting and support activities)
Necessary measures for continuation, upgrading of implementation and deadlines	• In line with the EZ-1 requirements, continuous monitoring of energy use and the implementation of measures in the public sector shall be ensured, including setting energy efficiency targets for public buildings or institutions. Deadline: 2021. • It will set ambitious targets for the use of RES in public buildings and provide the necessary incentives to accelerate its development (financial incentives, energy contracts, etc.). Deadline: 2021. Programme to be drawn up (deadline: 2021) for the long-term implementation of energy renovations in the narrow public sector, which defines: • energy efficiency targets by public sector entity; • priority implementation of categorised energy renovation projects by people in the narrower public sector, • the volume of investment and the necessary financial resources, • timetable for the implementation of energy management projects and activities, • opportunities for joint projects, • organisational aspects of energy management and implementation of energy renovations, • support environment and tools for project implementation and necessary support for carrying out extended energy audits and project preparation,

RENEWED ACTIONS	
	• performance indicators on the implementation of the programme, • targeted indicator monitoring and reporting; and • implementation of soft measures (schooling, knowledge base, information, introduction of standard energy management).
ACTION J-2	**Reflow schemes for energy efficiency in the public sector**
Responsibility	Eco Fund, MOP, MzI DE
Strategic bases and their validity	AN HOUR, OP GHG; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic
Necessary measures for continuation, upgrading of implementation and deadlines	• The Integrated National Energy and Climate Plan (NECP) of the Republic of Slovenia (NECP) plans for 2023 to improve the monitoring of the effects of investments receiving loans in order to reduce energy use and GHG emissions and increase energy production from RES. • Targeted towards a wider non-state-owned public sector.
ACTION J-3	**Non-repayable investment incentives for the energy renovation of buildings in the public sector aimed at increasing the share of projects carried out by means of energy contracts**
Responsibility	MZI DE, Eco Fund
Strategic bases and their validity	AN HOUR, OP GHG, OP ECP; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	economic (financial incentives)
Necessary measures for continuation, upgrading of implementation and deadlines	Promoting energy renovation of public sector buildings through cohesion funds for this purpose by 2023. Deadline: 2023. In order to achieve a wider range of energy renovations along the model: • actively develop and promote new financial models to encourage the contractual delivery of energy savings (e.g. exploring an additional energy contract model following a public procurement procedure); • provide financial incentives for the preparation of energy contract projects as part of the support programme for promoters of such projects, • establish a system of education and training for those responsible for energy renovation at all stages of the preparation and implementation of the EPO project (contracting authorities, service providers, project promoters, providers of measurement and verification of savings, etc.). Deadline: 2021.
ACTION J-4	**Quality assurance of energy renovation projects in the public sector**
Responsibility	MZI DE, PP-EPS
Strategic bases and their validity	AN HOUR, OP GHG, DSEPS; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	set of instruments

RENEWED ACTIONS	
Necessary measures for continuation, upgrading of implementation and deadlines	The NECPs already foresee the following activities: • Under LIFE IP CARE4CLIMATE, Activity C4.1, an analysis of the energy renovation projects of public buildings co-financed by cohesion funds will be carried out and a system will be put in place to monitor the achievement of the objectives of ensuring the quality of energy renovation of public buildings in mid-2022. Guidelines for BIM design and a procurement procedure with BIM will be developed in 2021. • The LIFE IP CARE4CLIMATE project, activity C4.1, will also build on the Construction Quality Label scheme (ZKG) with a view to promoting a higher quality of the energy renovation of buildings. Under the LIFE IP CARE4CLIMATE project, the UK will be upgraded with new assessment teams, including processes, services, renovated buildings and/or specific products and systems that are key to successful energy renovation and greener and more sustainable buildings. • From 2021 onwards, it is planned to upgrade the quality assurance system for energy renovation of buildings as part of a structured process of participation of participants, certification of contractors and processes, education/training of stakeholders, and ensuring public sector leadership by enforcing a quality system for energy renovation projects for buildings in the public sector.
ACTION J-5	**Project Office for Energy Renovation of Public Buildings**
Responsibility	MZI DE
Strategic bases and their validity	AN HOUR, OP GHG, OP ECP; Validity until 2020 NECPS; Validity until 2030
Duration	2030
Type of instrument	other (organisational measure)
Necessary measures for continuation, upgrading of implementation and deadlines	The Project Office shall ensure that the following tasks are carried out: • build on the existing guidance and model documentation relating to the implementation of energy renovation projects for public buildings; • speed up the preparation of integrated energy renovation projects for public buildings by providing expert support for the identification of priority projects, the preparation of such projects, the definition of the delivery model, the monitoring and verification of energy savings and other activities; • actively develop and promote new financial models to encourage the renovation of public buildings and the contractual delivery of energy savings (e.g. exploring an additional energy contract model following a public procurement procedure; Examination of an additional model of energy renovation of PSO buildings by the in-house contractor of the country (public-public partnership); • ensure the establishment of a quality system for energy renovation projects for public buildings by educating qualified energy efficiency service providers and integrating quality criteria into standardised processes and documentation for the implementation of energy renovation projects. • In order to carry out the tasks of promoting the preparation and implementation of priority energy renovations or to assume the role of system accelerator of projects and the quality programme administrator, the Project Office shall be reinforced in terms of staffing. Deadline: 2021.
ACTION J-6	**Establishment and annual updating of the list of priority energy renovations of the general public sector**

RENEWED ACTIONS	
Responsibility	MZI (participant GVR, MF)
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	organisational
Necessary measures for continuation, upgrading of implementation and deadlines	Establishment and annual update (1) of the list of general public sector buildings, (2) analysis of technical options for wider renovation and (3) identification of energy renovation projects by a decision of the Government of the Republic of Slovenia on the basis of the Decree on energy management in the public sector. Deadline: 2022 and annual update

4.3.3.1 Policies and measures to promote energy renovation of buildings owned and occupied by the narrower public sector

Table28: Proposals for new instruments for buildings owned and occupied by the narrower public sector

NEW MEASURES	
PSO-1 ACTION	**Energy efficiency programme**
Responsibility	MINISTRY OF INFRASTRUCTURE
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	Programme
Necessary measures for continuation, upgrading of implementation and deadlines	An energy efficiency programme in the core public sector will be drawn up, comprising the setting of targets, the definition of the implementation framework and activities, including the introduction of energy management, the creation of support mechanisms for project preparation and implementation, and the establishment of an impact monitoring and reporting system. (Additional explanation of the measure is given at the end of the sub-chapter) Deadline: 2021
PSO-2 ACTION	**Upgrading of the project office for the energy renovation of public buildings**
Responsibility	MINISTRY OF INFRASTRUCTURE
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	Organisational
Necessary measures for continuation, upgrading of implementation and deadlines	The activities of the Project Office shall be extended to the following tasks: Identification of investment projects, expert support for the design of the implementation model of each project, expert support to participants in project preparation, implementation of a programme of monitoring and evaluation of the effects of implemented projects and quality assurance programme. In order to assume the role of system promoter of projects and as administrator of the quality programme, the project office needs to be staffed accordingly. Deadline: 2021
PSO-3 ACTION	**Extension of the implementation framework of energy contracts**
Responsibility	MINISTRY OF INFRASTRUCTURE, PP-EPS
Strategic bases and their validity	DSEPS 2050

NEW MEASURES	
Duration	2030
Type of instrument	Implementing
Necessary measures for continuation, upgrading of implementation and deadlines	In order to increase the energy renovation of PSO buildings, additional activities shall be undertaken to develop new financial instruments to support the promotion of energy renovation of buildings (e.g. examination of an additional energy contract model following a public procurement procedure with energy savings assurance, a system of measurement and verification of savings and energy management, examination of an additional model of energy renovation of PSO buildings by the in-house contractor of the country (public-public partnership)). As part of the development of an additional energy contract model, the legislative, technical and economic aspects of this implementation framework shall be examined and standardised documentation, tools and procedures for implementation shall be developed accordingly. Within the scope of the DSEPS, the Project Office is continuously actively developing and promoting new financial models to encourage the renovation of public buildings and the contractual delivery of energy savings. Deadline: 2021
PSO-4 ACTION	**A systemic financial resource for the implementation of priority energy renovations**
Responsibility	MZI (participant GVR and MF)
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	economic
Necessary measures for continuation, upgrading of implementation and deadlines	Exploring the potential of a system-based financial resource for priority energy renovations (Additional explanation of the measure is given at the end of the sub-chapter) Deadline: 2022
PSO-5 ACTION	**Update of the list of energy renovation buildings owned and occupied by the narrower public sector**
Responsibility	MZI (participant MF, GOVK)
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	organisational
Necessary measures for continuation, upgrading of implementation and deadlines	Updating (1) the list of buildings owned and occupied by the narrower public sector, (2) analysing the technical options for wider renovation and (3) identifying energy renovation projects by means of a decision of the Government of the Republic of Slovenia on the basis of the Decree on energy management in the public sector. Deadline: Annual update

Energy efficiency programme

The programme will set out a structured and standardised approach to energy management across the sector, regardless of the volume of energy use of each programme provider. The key points of the programme are:

(i) **Commitment to implement**: The definition of programme targets and programme implementers, the setting of energy and environmental performance targets at the level of the individual contractor, the establishment of the programme implementation structure and the identification of responsible persons and their tasks;

(ii) **Identification of needs**: Defining procedures for defining the necessary energy efficiency measures and projects at the level of each contractor and a plan for their implementation, taking into account a standardised system for the prioritisation of renovations, based on defined targets and systematic monitoring of relevant indicators of energy efficiency, use of renewable energy sources, sustainable mobility and carbon footprint;

(iii) **Programming**: Building capacity for energy management in the sector, establishing indicators and mechanisms for setting annual targets and evaluating the impacts achieved, strategic planning and implementation of investments, identification of the necessary financial and human resources and allocation of financial resources;

(iv) **Implementation**: Establishing a standardised implementation framework for preparing, implementing and monitoring energy efficiency investments, including quality criteria;

(v) **Monitoring**: Upgrading the energy monitoring system by digitising the process, reporting and evaluating energy management indicators in the sector.

Establishment of a system-based financial resource to achieve three per cent of the energy renovation of PSOs buildings

The analysis of the narrower public sector buildings carried out clearly shows that, in order to achieve the country’s binding renovation targets of three percent of PSO buildings, more stable financial resources must be made available to carry out these investments. The very poor implementation of the energy renovation of buildings in the PSO so far is mainly due to the lack of budgetary resources and, at the same time, the dispersion of these resources within the budgetary rights of individual ministries. In order to accelerate the energy renovation of these buildings, it is necessary to ensure a stable and sufficient source of funding and an appropriate list of priority ministry buildings suitable for energy renovation, which, according to the Government of the Republic of Slovenia, must be renovated. One option is to ensure the establishment of a systemic financial resource for the energy renovation of PSO buildings.

Consideration should be given to establishing a systemic financial resource for energy renovations by providing different financial resources (restrictions on individual ministries’ budgets within the adopted budget, cohesion funding and other EU grants, use of funds generated by energy savings or lower energy costs). To this end, the legal, technical and economic aspects of setting up such a financial resource should be examined in cooperation with the relevant authorities. Legislative and incentive instruments like the rest of the world (so-called ‘revolving funds’) should also be examined.

The examination should identify the possibilities for initial start-up funding through the payment of European cohesion funds.

The table below gives an overview of the activities in the field of energy renovation of PSO buildings in terms of financing, where intensity increases by 2030 with a view to reaching an annual average target of 3 % energy renovation. It shows the necessary investments in energy renovation and sources of financing.

Table29: Financing structure of the renewable financial source to achieve 3 per cent of the energy renovation of PSO buildings

		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	SKUPAJ
Izvedene en. prenove od leta 2014	**m^2**	**65.436**	**100.609**	**124.623**	**148.220**	**170.918**	**192.743**	**213.658**	**233.627**	**252.550**	**270.458**	**287.382**	**287.382**
Stavbe potrebne enenergetske prenove	m^2	835.649	810.580	786.565	756.586	727.507	697.172	665.620	630.760	596.946	564.147	532.331	7.603.863
Energetska prenova 3% stavb	**m^2**	**35.173**	**24.014**	**23.597**	**22.698**	**21.825**	**20.915**	**19.969**	**18.923**	**17.908**	**16.924**	**15.970**	**237.916**
Investicije v energetsko prenovo 3% stavb z DDV	**mio EUR**	**9,44**	**6,45**	**6,33**	**6,09**	**5,86**	**5,61**	**5,36**	**5,08**	**4,81**	**4,54**	**4,29**	**63,86**
Investicije v energetsko prenovo 3% stavb	mio EUR	7,74	5,28	5,19	4,99	4,80	4,60	4,39	4,16	3,94	3,72	3,51	52,34
DDV	mio EUR	1,70	1,16	1,14	1,10	1,06	1,01	0,97	0,92	0,87	0,82	0,77	11,52
Upravičeni stroški investicij v energetsko prenovo 3% stavb	**mio EUR**	**8,12**	**5,54**	**5,45**	**5,24**	**5,04**	**4,83**	**4,61**	**4,37**	**4,13**	**3,91**	**3,69**	**54,92**
Dodatne energetske prenove 1,5% stavb (nedoseganje cilja 2014-2020)	**m^2**	**0**	**0**	**6.382**	**6.382**	**8.509**	**10.637**	**14.891**	**14.891**	**14.891**	**14.891**	**14.891**	**106.367**
Energetska prenova 4,5% stavb	**m^2**	**35.173**	**24.014**	**29.979**	**29.080**	**30.335**	**31.552**	**34.860**	**33.814**	**32.800**	**31.816**	**30.861**	**344.283**
Investicije v energetsko prenovo dodatnih 1,5% stavb z DDV	**mio EUR**	**0,00**	**0,00**	**1,71**	**1,71**	**2,28**	**2,85**	**4,00**	**4,00**	**4,00**	**4,00**	**4,00**	**28,55**
Investicije v energetsko prenovo dodatnih 1,5% stavb	mio EUR	0,00	0,00	1,40	1,40	1,87	2,34	3,28	3,28	3,28	3,28	3,28	23,40
DDV	mio EUR	0,00	0,00	0,31	0,31	0,41	0,51	0,72	0,72	0,72	0,72	0,72	5,15
Investicije v energetsko prenovo 4,5% stavb z DDV	**mio EUR**	**9,44**	**6,45**	**8,05**	**7,80**	**8,14**	**8,47**	**9,36**	**9,08**	**8,80**	**8,54**	**8,28**	**92,41**
Investicije v energetsko prenovo 4,5% stavb	mio EUR	7,74	5,28	6,60	6,40	6,67	6,94	7,67	7,44	7,22	7,00	6,79	75,74
DDV	mio EUR	1,70	1,16	1,45	1,41	1,47	1,53	1,69	1,64	1,59	1,54	1,49	16,66
Investicije z garancijo prihrankov energije (energetsko pogodbeništvo)	**mio EUR**	6,14	4,19	**7,24**	**7,02**	**7,33**	**7,62**	**8,42**	**8,17**	**7,92**	**7,69**	**7,45**	79,20
Investicije brez garancije prihrankov	**mio EUR**	3,30	2,25	**0,80**	**0,78**	**0,81**	**0,85**	**0,94**	**0,91**	**0,88**	**0,85**	**0,83**	**13,21**
KOHEZIJA SKUPAJ (2014-2020)	**mio EUR**	**4,29**	**2,93**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**7,22**
KOHEZIJA (nepovratna sredstva JZP)	mio EUR	2,59	1,77	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,35
KOHEZIJA (nepovratna sredstva JN)	mio EUR	1,70	1,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,87
LASTNA SREDSTVA MINISTRSTEV	**mio EUR**	**2,02**	**1,38**	**0,80**	**0,78**	**0,81**	**0,85**	**0,94**	**0,91**	**0,88**	**0,85**	**0,83**	**11,05**
ZASEBNI PARTNERJI (JZP)	**mio EUR**	**3,13**	**2,14**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**5,27**
PRORAČUNSKI VIRI (povratna sredstva, garantirani prihranki, JN)	**mio EUR**	**0,00**	**0,00**	**7,24**	**7,02**	**7,33**	**7,62**	**8,42**	**8,17**	**7,92**	**7,69**	**7,45**	**68,87**
Sklad za okrevanje in odpornost - RRF	mio EUR	0,00	0,00	2,50	2,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,00
KOHEZIJA (2021-2027)	mio EUR	0,00	0,00	4,74	4,52	7,33	7,62	8,42	8,17	7,92	7,69	7,45	63,87

5 Overview of policies and measures for worst-performing buildings and for alleviating energy poverty

5.1 Energy poverty in Slovenia and the EU

Energy poverty is becoming a growing problem that requires adequate and effective treatment. It is estimated that in 2018 around 50 million people in the EU lived in energy poverty(Gangale and Mengolini, 2019). There is no uniform definition in Slovenia to determine the share of households in energy poverty, and there are different definitions of energy poverty elsewhere.

According to the Official Journal of the EU we speak of energy poverty when a household is unable or difficult to provide adequate heating at an affordable price and has no access to affordable energy-related services (Official Journal of the EU, 2011/C 44/09). One definition states that energy-poor households are those that spend more than ten percent of their income on the provision of warm housing and other energy services. Energy poverty is influenced by incomes, energy prices and consumption, which depends on household behaviour and the energy efficiency of buildings. Almost everywhere in Europe, the most vulnerable are pensioners, single parents, large families, families with few active members, etc. The occurrence of energy poverty is directly linked to the worsening micro-climatic conditions and its consequences in living quarters (mould, cold home). International studies also show that the deepening of energy poverty is directly linked to social exclusion and poor health(Hills, 2012).

Addressing energy poverty is important not only from a social point of view, but also from the point of view of efficient energy use in buildings and ensuring climate objectives.

According to EU-SILC, in 2015 5.6 per cent of households unable to provide a suitably heated dwelling in Slovenia were 3.9 per cent (Eurostat, 2018)in 2017, and 3.3 per cent one year later(Eurostat, 2019). However, SURS data show that households in the first quintile (20 % with the lowest incomes) are on average in 2015 17,7 % of all available funds are earmarked for electricity, gas or other fuels. Compared to 2000, the share of expenditure on energy products increased most in the first income quintile from 13.1 per cent to 17.7 per cent of the total available funds(SURS, 2015). However, according to Eurostat's SILC survey data, as many as 27 % of the Slovenian population in 2015 lived in a dwelling where they left the roof, were humid walls, foundations or floors, were hard window frames or floors. For the low-income population, this share is even higher by ten percentage points.

In Slovenia, the share of people living in owner-occupied dwellings is higher than the European average, as stated in the 2018 climate mirror, but just over 50 % of people with a low income live in owner-occupied (Cirman et al., 2018b)dwellings, which is an obstacle to investment in energy renovations. An analysis of factors related to the financial capacity of (Cirman et al., 2018a)households showed that in Slovenia around 68 per cent of households are able to finance investment in the energy renovation of a property (without changing the combustion plant) with a bank loan, with Eko Fund's grant not playing an essential role in the ability to repay a 20-year loan. This percentage shall be reduced to around 60 per cent. The analysis estimates that, despite the subsidy, 19.5 per cent of households are unable to carry out energy renovation due to credit inability, but this percentage is likely to be even higher due to other loans or indebtedness, while around 20 per cent of households in Slovenia are unable to invest themselves in energy renovation, as the initial investment costs are too high for them.

The analysis also showed that credit capacity is higher in densely populated areas than in sparsely populated areas where as many as 23 per cent of households cannot obtain credit. Higher credit incapacity is found in households with pensioners, below the average number of active persons, below the average number of household members, and an above-average share of such households lives in single-family houses, among which houses are energy inefficient. The analysis carried out also confirms that it would be more sensible to target income weaker as their share is significant.

5.2 Existing policies and measures

Slovenia started tackling energy poverty through an efficient energy use scheme for low-income households, which was part of the National Energy Efficiency Action Plan 2008-2016. Over a six-year period, 18,000 households, or 20 per cent of all low-income households, are expected to participate in the scheme. The first public call was launched by the Eco Fund in 2010 to promote investment in multi-apartment buildings for socially disadvantaged citizens, with an incentive of 100 per cent of the recognised investment costs. The Eco Fund is also now implementing most energy poverty measures in Slovenia, including ZERO and ZERO500. Non-governmental organisations are also active in the field of energy poverty, notably Focus, which was among the first involved in various projects, and continues to do so now.

One of the biggest actions that will have the greatest impact is the ZERO500 programme, where the Cohesion Fund will contribute EUR5.9 million. The programme of non-reimbursable financial incentives aims at alleviating growing energy poverty. This appropriation will be used to invest in energy efficiency measures (replacement of facades, windows, roof insulation, installation of ventilation and others). The programme implemented by the Eco Fund will include 500 low-income households in single-dwelling buildings or apartments in two-dwelling buildings.

The eco-fund also offers non-repayable financial incentives for socially disadvantaged citizens to replace old solid fuel combustion plants at 100 % of recognised investment costs and non-repayable financial incentives to socially weak owners for new joint investments in higher energy efficiency in older residential buildings amounting to 100 % of the recognised costs.

16 investments were made in 2017 for the replacement of combustion plants, the amount of incentives was EUR 55,128 in 2018 12, with energy savings estimated at 82,3 MWh and 14,6 t/CO2 respectively. Since 2010, % of the subsidy to co-owners of the Eco Fund has been made possible by the fund, covering both the renovation of boiler rooms and investments in energy efficiency. The eco-fund also implements the ZERO project (reducing the energy poverty of citizens), where members of the public apply for free home visits. In addition to advice on reducing energy and water consumption, the energy advisor provides them with a package of appliances that can reduce their energy and water consumption, saving around one hundred euros a year. In total, 195 such visits were carried out in 2019 (i.e. % of the activities of ENSVET consultants); 224 visits were carried out in 2018 and only 104 visits in 2017. The objective of the ZERO project is to achieve an indicative home visit of three hundreds a year.

An analysis of the measures (Climate mirror 2018, Volume 4) showed that the Eco Fund measures are common to weak effectiveness as demand for measures is low. The biggest obstacle is access to the target population. In order to maximise their impact, measures need to be systematically integrated into and coordinated with social policy, and access to the target group through social work centres should be regulated in a uniform manner.

Table30: Overview of policies and measures for worst-performing buildings and for alleviating energy poverty

Instrument name	Type of instrument	Responsibility for implementation	Description of the instrument	Implementation
Operational Programme for the Implementation of Cohesion Policy 2014-2020: Subsidising energy efficiency measures in single- and double-dwelling buildings – ZERO500 programme	economic (financial incentives)	Ecological Fund	The measure provides investment support and guidance for energy-poor households to improve energy efficiency. In addition, this measure also provides financial assistance for investments in the energy efficiency of residential buildings.	Launched in 2020
Vulnerable customers and emergency supply	law	Electricity distributor	It shall be prohibited to exclude vulnerable households from electricity supply in circumstances where disconnection could lead to life-threatening or serious health problems.	Yes
Non-repayable financial incentives for socially disadvantaged citizens to invest in the renovation of boiler rooms and increase energy efficiency in multi-apartment buildings	economic (financial incentives)	Ecological Fund	The measure reimburses recipients of regular cash social assistance who are co-owners the full cost of their share of the investment in improving the energy efficiency of buildings with three or more works and in the renovation of common boiler rooms.	Yes
Non-repayable financial incentives for socially weak citizens to replace old solid fuel combustion plants with new wood biomass combustion plants	economic (financial incentives)	Ecological Fund	The measure provides investment support for vulnerable households to replace old solid fuel boilers with biomass boilers. The measure is targeted at specific municipalities.	Yes
Reducing the energy poverty of citizens (ZERO)	information and awareness	Ecological Fund	The measure offers independent energy advice to households on energy efficiency and renewable energy sources.	Yes.

5.3 Buildings with the lowest energy performance

Policies and measures for households (Preglednica 25) and for worst-performing buildings (Preglednica 27) contribute to the gradual improvement of the condition of buildings from an energy perspective and reduce the number of households at risk of energy poverty. As energy poverty is not yet defined in Slovenia, it can only be monitored indirectly by means of an indicator of buildings with the lowest energy efficiency.

The energy indicator, which allows buildings to be classified into energy classes, is defined by the Rules on the methodology for producing and issuing energy performance certificates for buildings (Official Gazette of the Republic of Slovenia Nos 92/14 and 47/19). The energy classes are classified according to the annual heat demand for heating the building per unit of conditioned surface. For the lowest energy classes, the indicator is capped above 150 kWh/^{m2a} $_{\text{and up to and}}$including 210 kWh/m2a for F energy$^{\text{class}}$and with values above 210 kWh/m2a for G energy class.

Preglednica 31 Shows the shares of buildings in energy classes F and G in the total building stock, separately for single- and multi-apartment buildings. The analysis was made on the basis of a heat map for heating(IJS-CEU, 2020). This includes publicly available data on buildings (real estate register databases, energy performance certificates and Eco Fund) and a model assessment of energy use in buildings.

In terms of surface area and number, the cumulative maximum share (more than 40 per cent) of single-dwelling buildings in energy class F is less than one per cent. These buildings were mainly built before 1980. This means that more than 23 million m²heated areas of single-apartment buildings or households have a high use of energy for heating and associated costs. Such multi-apartment buildings account for almost eight per cent. Taking into account the average size of housing in multi-apartment buildings in Slovenia (60 m²), more than 24 000 households are at risk of energy poverty.

Table31: Shares of buildings in the lowest energy classes in terms of construction period and number and area of housing stock

Construction period	**Energy class F**		**Energy class G**	
Share of all buildings in classrooms	Number	Area [m²]	Number	Area [m²]
One-dwelling buildings				
before 1946	19,6 %	17,1 %	0,6 %	0,3 %
1946-1970	17,9 %	16,9 %	0,3 %	0,2 %
1971-1980	10,8 %	11,0 %	0,2 %	0,1 %
1981-2002	0,1 %	0,1 %	0,2 %	0,1 %
2003-2008	0,0 %	0,0 %	0,0 %	0,0 %
after 2008	0,0 %	0,0 %	0,0 %	0,0 %
Multi-dwelling buildings				
before 1946	1,1 %	1,2 %	0,8 %	0,8 %
1946-1970	3,6 %	4,0 %	0,7 %	0,7 %
1971-1980	0,7 %	0,7 %	0,3 %	0,4 %
1981-2002	0,3 %	0,3 %	0,1 %	0,1 %
2003-2008	0,0 %	0,0 %	0,0 %	0,0 %
after 2008	0,0 %	0,0 %	0,0 %	0,0 %

According to the envisaged measures based on the projections set out in the NECPs, the energy performance of these buildings will gradually improve (Preglednica 32). In order to achieve the set building targets, most of these buildings will undergo energy renovation in the period up to 2030. Despite the implementation of energy renovations, part of the building stock will remain unrenovated due to technical constraints.

Table32: Share of reduction in the number of buildings in the lowest energy classes compared to 2020

Milestone	2030		2050	
Type of building	Energy class F	Energy class G	Energy class F	Energy class G
One-dwelling buildings	43 %	62 %	59 %	63 %
Multi-dwelling buildings	66 %	54 %	66 %	55 %

5.4 Energy poverty targets

Slovenia addresses energy poverty for the period 2020-2030 in the NECPs, where Slovenia set itself the 2030 target to alleviate and reduce energy poverty by speeding up the implementation of (1) social policy measures, (2) general housing measures and (3) existing targeted measures.

On the basis of international comparisons, the NECPs conclude that energy poverty in Slovenia is not significant, but that the transition to a low-carbon economy must be accompanied by measures to prevent the most vulnerable sections of the population from being affected by the planned measures. With SEEPS 2050 and NECPs in the area of energy poverty, Slovenia commits to:

- a legal definition of energy poverty by 2021;
- identify and analyse in detail how to measure energy poverty by 2022;
- establish by 2023 target indicators for energy poverty for Slovenia by 2030;
- carry out research (CRP) on precise knowledge of the habits and needs of the most vulnerable part of the population in Slovenia;
- by 2023, draw up an action plan to combat energy poverty in Slovenia, setting out measures to achieve the target indicators for energy poverty in Slovenia.

Responsibility for measures to alleviate energy poverty is shared between the ministry responsible for social affairs, energy and the environment and the Government's development and cohesion policy department.

It will ensure effective implementation for already existing energy poverty reduction measures. As mentioned above, the biggest obstacle is access to the target population. The target group will be accessed through the Social Work Centres, which are already in contact with the target group, know their needs and have the necessary competences to communicate with them. This will improve the flow of information to the target population. Social work centres will be strengthened by specialised external promoters who will take over the implementing parts of the measures. Continuity of implementation will be ensured for the measures already in place and the ZERO project will be upgraded/linked to investment assets in the future. If necessary, they will allocate additional resources from the URE bonus to ensure continuity of implementation. Local communities will also be involved in awareness-raising and promotion activities.

Regular coordination will be established between the ministry responsible for energy, the ministry responsible for labour, family and social affairs and the Eco Fund, where progress in the implementation of existing measures will be monitored on a monthly basis. The roles (competences and duties) of each institution involved in the field of energy poverty will also be specified. Coordination will be led by MzI.

The transition to a low-carbon society needs to be in line with climate justice and therefore special attention should be paid to the most vulnerable population groups, as well as adequate and timely implementation of energy poverty measures. Slovenia will actively integrate energy poverty reduction measures into social policies and set them in parallel with other social policies (pension, housing, etc.). New measures on energy poverty will also aim to improve air quality, mitigate climate change and improve health. Particular attention will also be paid to the energy renovation of social housing.

Table33: New measures for worst-performing buildings and to reduce energy poverty

NEW MEASURES	
MEASURE ER-1	**Collective purchase of electricity**
Responsibility	MDDSZEM, MzI, MOP
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	organisational
Necessary measures for continuation, upgrading of implementation and deadlines	After the definition of energy poverty, collective electricity purchases are organised for these vulnerable groups in order to secure the best electricity price.

NEW MEASURES	
MEASURE ER-2	**CDE project on precise knowledge of the habits and needs of the most vulnerable population in Slovenia**
Responsibility	MDDSZEM, MzI, MOP
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	technical assistance
Necessary measures for continuation, upgrading of implementation and deadlines	The CDE is implemented to better understand the habits and needs of the most vulnerable sections of the population in Slovenia and to prepare the background documents for the action plan to combat energy poverty.
MEASURE ER-3	**Action plan to combat energy poverty in Slovenia**
Responsibility	MDDSZEM, MzI, MOP
Strategic bases and their validity	DSEPS 2050
Duration	2030
Type of instrument	law
Necessary measures for continuation, upgrading of implementation and deadlines	An action plan against energy poverty in Slovenia will be drawn up, setting out indicators and measures to achieve the indicators for energy poverty in Slovenia and including a financial incentive scheme. Deadline: 2023.

6 Incentives for the use of advanced technologies

So-called 'smart or advanced buildings' are an essential part of a decarbonised and more dynamic renewable energy system geared towards achieving the EU's 2030 targets on energy efficiency and renewable energy and on a decarbonised building stock by 2050. Slovenia has already established instruments (Preglednica 34) with advanced technologies to achieve high energy efficiency by improving the performance of the building and facilitating the management of technical building systems. This ensures the quality of the indoor environment tailored to the users of buildings so that they can effectively influence the performance of buildings, either by appropriate settings or by their behaviour in the building, the impact of which can be monitored by advanced devices.

Incentives for community self-sufficiency are a prime example of building well-connected buildings and advanced communities supporting solutions for advanced communities and cities.

Table34: Overview of national initiatives to promote advanced technologies and well-connected buildings and communities

Instrument name	Type of instrument	Responsibility for implementation	Description of the instrument
Non-repayable investment incentives for the energy renovation of buildings in the public sector aimed at increasing the share of projects carried out by means of energy contracts	economic (financial incentives)	MZI DE, Eco Fund	In order to demonstrate the energy savings achieved and the reduction of GHG emissions, regular monitoring of energy use after energy renovation is mandatory. Non-reimbursable financial incentives shall promote the deployment of advanced information technologies for the purpose of monitoring energy use and optimising the operation of energy systems. They are therefore considered to be an eligible cost in obtaining a grant.

Instrument name	Type of instrument	Responsibility for implementation	Description of the instrument
Financial incentives for energy efficiency and RES use in residential buildings	economic (financial incentives)	MZI DE, Eco Fund, MKGP	Advanced electrical and machine installations for the operation and control of the system and the start-up of the system in both energy renovations and new buildings shall also be considered eligible costs for the award of grants for actions in households.
Mandatory sharing and accounting of heat costs in multi-apartment buildings	law	MZI DE	The installation of advanced heat meters for the whole building, which is a condition for cost-sharing in a building with several individual parts, and the installation of allocators or calorometers in apartments, is required.
Promotion of solar power plants for stand-alone and collective investment	economic (financial incentives)	MZI DE, Eco Fund	Self-supply and the installation of advanced devices in single-dwelling buildings and community self-handling in multi-apartment buildings shall be encouraged, with multi-apartment buildings, office-dwelling, residential and commercial buildings.

Table35: Overview of national initiatives to promote skills and education in the construction and energy efficiency sectors in the field of advanced technologies

Initiative	Duration	Description and outcome of the initiative
Life IP Care4Climate project, activities C2.2: Carrying out training courses and C6.2: Upgrading energy management in the public sector	2019-2026	Draw up instructions for the implementation of energy accounting, including instructions for appropriate reporting by liable parties on energy use, the implementation of energy efficiency measures and associated costs.

In 2017, the Government of the Republic of Slovenia established Strategic Development and Innovation Partnerships (SRIPs) to achieve nine strategic development priorities for the country, including advanced cities and (advanced) communities (PMiS). With the help of related partners, which are key in the field of advanced cities and communities, the government financially supports and guides the above-mentioned development priority with the aim of accelerating economic development in particular. In the field of energy, the aim is to make energy generation, demand, storage and conversion more flexible and to improve the management of the energy and water distribution network(MGRT, 2017). Key areas are:

- demand Response and Demand Side Management;
- the visibility, management and automaticity of the distribution network (distribution management system);
- energy Management System (EMS).

In the new financial period, Slovenia will continue to support advanced cities and communities.

7 Financing of the implementation of the measures

7.1 Sources of funding for energy renovation of buildings 2021-2030

In order to achieve the NECPs targets for the energy performance of buildings, investments in energy renovations of EUR 8 540 million (excluding VAT) are needed in the period 2021-2030. Energy renovation in the housing sector is planned for investment (excluding VAT) of EUR 6 634 million (77.7 per cent), in the public sector of EUR 825 million (9.7 per cent) and in the private services sector of EUR 1.081 million (12.6 per cent).

Both grants and grants will be made available to finance the necessary investments for the energy renovation of buildings. The development of several financial instruments is necessary to realise the investments. Investments and sources of financing by sector are listed below[19].

In addition to the existing instruments, new instruments are planned to finance building renovation measures for the period up to 2030, which are listed in Chapter 7, in order to achieve the challenging objectives of the NECPs.

7.1.1 Residential buildings

In the housing sector, EUR 7 264 million (including VAT) must be invested in order to achieve the targets set out in the NECPs for the period 2021-2030. Due to the impact of COVID-19 on the economy, investment in energy renovation of housing is expected to be much lower in 2021 and 2022 than in other years.

The main source for promoting energy renovation in the housing sector is the contribution to energy efficiency (EEEE), which is awarded through the Eco Fund in the form of grants. In order to achieve the objectives of the NECPs, renovations in NZEBs and integrated renovations, which are expected to be less likely to be carried out spontaneously due to lower economic viability, high specific costs and the integrity of the renovation, will be encouraged. Thus, in order to achieve the objectives of the NECPs in the housing sector, it is estimated that 725,6 million grants will have to be provided in the period 2021-2030. Thus, in order to ensure sufficient grants, a gradual increase in the contribution to URE is foreseen from EUR 0,08c/kWh to EUR 0,27c/kWh in 2030. For the energy renovation of buildings in the housing sector by 2030, the energy efficiency contribution is planned to: EUR565.7 million.

A Climate Change Fund grant is also available through the Eco Fund to replace old combustion plants with new wood biomass combustion plants or heat pumps[20]. EUR135 million will be made available from the Climate Change Fund for the energy renovation of buildings in the housing sector by 2030.

Despite the foreseen increase in the contribution to energy efficiency, the planned scale of energy renovation also requires additional European cohesion policy grants under the Multiannual Financial Framework (MFF) for the period 2021-2027 of EUR8.2 million (including the Slovenian part) for the energy renovation of multi-apartment buildings[21]. In addition, a

[19] The expert bases for the assessment of sources of funding have been developed in the framework of the LIFE IP CARE4CLIMATE project (LIFE17 IPC/SI/000007).

[20] The Climate ChangeFund has a spending programme only until 2023. The level of funding after 2023 will be determined by the adoption of the Climate Change Fund's spending programme. In the future, it will be so important that the use of the Climate Change Fund for energy renovation purposes is in line with the NECPs' energy renovation target.

[21] At the time when the strategy was drawn up, the level of funding per objective or programme had not yet been fixed, so we assume that funds will only be available in 2023 to meet the needs of the housing sector.

further five million euros of grants are planned under the Recovery and Resilience Fund (RRF)[22].

Under OP ECP 2014-2020, the ZERO500 programme for alleviating energy poverty of EUR5.8 million by 2023 is also ongoing. The programme will allow 500 low-income households to invest in energy renovation. After this period, the EGDC foresees the continuation of the energy poverty reduction programme to the same extent.

Taking into account levers, total grants of

EUR725.6 million leveraged EUR2 399.1 million of investments over the period under examination. The use of grants in individual years may deviate from what is foreseen and it is therefore important that unused grants be carried over to subsequent years exclusively for the energy renovation of buildings, as this is the only way to ensure sufficient grants over the whole period.

On the other hand, households invest in the energy renovation of their homes, even without a grant. A significant proportion of households have already carried out energy renovations in the past without Eko Fund subsidies. The survey on household energy and fuel consumption (APEGG, 2019) thus estimates that spontaneous renovations amount to approximately EUR510 million annually. The survey also shows that spontaneous renovations in the past were mostly partial energy renovations. The PSEPS also foresees that the bulk of the investment in energy renovation will be carried out by spontaneous refurbishment by 2030, i.e. EUR 4 864.9 million on average, or EUR486.5 million a year on average. Spontaneous renovations will be carried out on a slightly smaller scale compared to previous years, as energy renovations will focus on integrated and grant —driven NZEBs.

Eko Fund grants and commercial bank loans are also available to support investments in the energy renovation of residential buildings. To a lesser extent, programmes of energy suppliers and energy service companies (ESCOs) are also available.

Table36: Volume of investments and sources of financing for energy renovation of buildings in the housing sector 2021-2030

		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	SKUPAJ
Investicije v energetsko prenovo SS	mio EUR	221,65	412,95	551,48	638,55	726,94	759,92	792,90	812,69	838,55	878,11	6633,74
Investicije v energetsko prenovo SS (z DDV)[1]	**mio EUR**	**242,70**	**452,18**	**603,87**	**699,21**	**796,00**	**832,11**	**868,23**	**889,90**	**918,21**	**961,53**	**7263,95**
Struktura financiranja investicij												
Nepovratna sredstva - Skupaj	**mio EUR**	**51,94**	**51,41**	**56,72**	**61,74**	**68,13**	**74,05**	**79,14**	**86,48**	**93,48**	**102,57**	**725,65**
Prispevek URE (energetska prenova)	mio EUR	32,17	36,15	40,62	45,64	51,27	57,19	63,78	71,13	79,30	88,40	565,65
Sklad za podnebne spremembe	mio EUR	18,00	13,00	13,00	13,00	13,00	13,00	13,00	13,00	13,00	13,00	135,00
VFO 2021-2027 (KS EU - 85 %)[2]	mio EUR			1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	8,00
VFO 2021-2027 (KS SI -15 %)	mio EUR			0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	1,41
Viri v okviru RRF	mio EUR		0,50	0,75	0,75	1,50	1,50					5,00
ZERO500/nov ukrep (KS EU - 85 %)	mio EUR	1,50	1,50	1,00	1,00	1,00	1,00	1,00	1,00	0,00	0,00	9,00
ZERO500/nov ukrep (KS SI - 15 %)	mio EUR	0,26	0,26	0,18	0,18	0,18	0,18	0,18	0,18	0,00	0,00	1,59
Spodbujene naložbe z nepovratnimi sredstvi	mio EUR	170,18	167,24	185,85	202,70	222,37	242,24	262,87	287,51	313,77	344,31	2399,05
Sredstva gospodinjstev - Skupaj	**mio EUR**	**190,77**	**400,76**	**547,15**	**637,47**	**727,87**	**758,07**	**789,09**	**803,42**	**824,74**	**858,96**	**6538,30**
Financiranje subvencioniranih naložb	mio EUR	118,24	115,83	129,13	140,96	154,25	168,20	183,73	201,03	220,30	241,74	1673,40
Spontana prenova	mio EUR	72,53	284,94	418,02	496,51	573,62	589,87	605,36	602,39	604,44	617,22	4864,90
Povratna sredstva - Eko sklad[3]	mio EUR	2,70	2,70	2,70	2,70	2,70	2,70	2,70	2,70	2,70	2,70	27,00
Finančni viri- Skupaj	**mio EUR**	**242,70**	**452,18**	**603,87**	**699,21**	**796,00**	**832,11**	**868,23**	**889,90**	**918,21**	**961,53**	**7263,95**

Notes:
1 Eligible costs represent 80 per cent of investments.
2 Appropriations from the MFF 2021-2027 will be possible by the end of 2029 and are therefore programmed under the MFF for 2030.
3 Eko Fund grants are intended to finance subsidised investments and spontaneous renovations. They are not added to the sources of financing in order to avoid double counting.

[22] At the time of the strategy, the National Recovery and Resilience Plan, which will be the basis for mobilising the Recovery and Resilience Fund (RRF), has not yet been adopted.

Demonstration of sources of financing for energy renovation of buildings in the housing sector

V stanovanjskem sektorju je za doseganje ciljev iz NEPN v obdobju 2021–2030 treba investirati 7.264 milijonov evrov (z DDV). Zaradi posledic vpliva bolezni COVID-19 na gospodarstvo se v letih 2021 in 2022 pričakuje precej manjši obseg naložb v energetsko prenovo stanovanj kakor v drugih letih.

Glavni vir za spodbujanje energetskih prenov v stanovanjskem sektorju so sredstva iz prispevka za učinkovito rabo energije (URE), ki se v obliki nepovratnih sredstev dodeljujejo prek Eko sklada. Za doseganje ciljev v okviru NEPN se bodo spodbujale predvsem prenove v sNES in celovite prenove, za katere se pričakuje, da je zaradi manjše ekonomske upravičenosti, visokih posebnih stroškov in celovitosti izvedbe prenove njihova spontana izvedba manj verjetna. Tako je za doseganje ciljev iz NEPN na področju stanovanjskega sektorja ocenjeno, da bo v obdobju 2021–2030 treba zagotoviti 725,6 milijonov nepovratnih subvencij. Za zagotovitev zadostnih nepovratnih sredstev je tako predvideno postopno zvišanje prispevka za URE z 0,08 €c/kWh na 0,27 €c/kWh v letu 2030. Za energetsko prenovo stavb v stanovanjskem sektorju do leta 2030 je tako iz prispevka URE načrtovanih 565,7 milijona evrov.

Prek Eko sklada so na voljo tudi nepovratna sredstva sklada za podnebne spremembe za zamenjavo starih kurilnih naprav z novimi kurilnimi napravami na lesno biomaso ali s toplotnimi črpalkami. Za energetsko prenovo stavb v stanovanjskem sektorju do leta 2030 se iz sklada za podnebne spremembe zagotovi 135 milijonov evrov.

Kljub predvidenemu zvišanju prispevka za URE so za načrtovani obseg energetskih prenov potrebna tudi dodatna nepovratna sredstva evropske kohezijske politike v okviru večletnega finančnega okvira (VFO) za obdobje 2021–2027 v višini 8,2 milijona evrov (vključno s slovenskim delom) za namene energetske prenove večstanovanjskih stavb. Poleg tega je iz sklada za okrevanje in odpornost (RRF) načrtovanih še pet milijonov evrov nepovratnih sredstev.

V okviru OP EKP 2014–2020 poteka tudi program ZERO500 za zmanjševanje energetske revščine v višini 5,8 milijona evrov do leta 2023. Program bo omogočil 500 gospodinjstvom z nizkimi prihodki naložbe v energetsko prenovo. Po tem obdobju DSEPS predvideva nadaljevanje programa zmanjševanja energetske revščine v enakem obsegu.

Ob upoštevanju vzvodov se pričakuje, da bodo skupna nepovratna sredstva v višini

725,6 milijona evrov v preučevanem obdobju spodbudila 2.399,1 milijona evrov naložb. Poraba nepovratnih sredstev v posameznih letih lahko odstopa od predvidene, zato je pomembno, da se neporabljena nepovratna sredstva namensko prenesejo v naslednja leta izključno za energetsko prenovo stavb, saj bo le tako zagotovljeno dovolj nepovratnih sredstev v celotnem obdobju.

Po drugi strani gospodinjstva investirajo v energetsko prenovo stanovanj tudi brez nepovratnih sredstev. Večji delež gospodinjstev je že v preteklosti energetske prenove izvedel brez subvencij Eko sklada. Na podlagi ankete o porabi energije in goriv v gospodinjstvih (APEGG, 2019) je tako ocenjeno, da spontane prenove na letni ravni znašajo okvirno 510 milijonov evrov. Iz ankete je tudi razvidno, da je šlo pri spontanih prenovah v preteklosti večinoma za delne energetske prenove. Tudi DSEPS predvideva, da bo večji del naložb v energetsko prenovo do leta 2030 izveden s spontanimi prenovami, in sicer 4.864,9 milijona evrov oziroma v povprečju 486,5 milijona evrov letno. Spontane prenove bodo izvedene v nekoliko manjšem obsegu glede na pretekla leta, saj bodo energetske prenove usmerjene v celovite in prenove v sNES, spodbujene z nepovratnimi sredstvi.

Za podporo naložbam v energetsko prenovo stanovanjskih stavb so na voljo tudi povratna sredstva Eko sklada in posojila poslovnih bank. V manjšem obsegu so na voljo tudi programi dobaviteljev energije in podjetij za energetske storitve (ESCO).

Preglednica 36 All assumptions show that a sufficient amount of grants is provided for the implementation of renovations under the PSEPS and for the achievement of the NECPs' objectives in the area of residential buildings. In order to achieve the NECPs, other organisational and supportive conditions, in addition to non-repayable incentives, need to be met, as only if they are met will allow for the envisaged scale of energy renovations.

7.1.2 Public buildings

In the public sector, EUR825 million (excluding VAT) has to be invested in the period 2021-2030 to achieve the NECPs targets. Moreover, as the target of three percent of the energy renovation of buildings in the narrow public sector (PSS) is not achieved, an additional EUR 23.4 million (excluding VAT) has to be invested in the pastPreglednica 37.

The main non-repayable source of funding for energy renovation of buildings in the public sector is European cohesion policy funding. At the beginning of the period under examination, the absorption of the remaining grants for integrated energy renovations of buildings in the public sector under OP ECP 2014-2020 is foreseen until 2023. A further EUR68.2 million of European spending grants are available under cohesion policy until the end of 2023. The share of EU grant funding, including Slovenia's own participation, will be 49 %[23].

The remaining 51 % of cohesion policy investments will be financed from various sources. Thus, in the case of integrated energy renovations of buildings in the wider public sector (SPS), further promotion of public-private partnerships based on the principle of energy contracts (PPPs) is envisaged. The PPP model has proved to be more effective in the past compared to the procurement model (JN). Based on previous approved operations, it is assumed that the PPP model will be applied to 75 % of the investments. Continuing the promotion of a high share of PPPs will make an important contribution to mobilising private funds in the renovation of public buildings and decongesting the budget. In the event of energy renovation under the PPP model, ESCOs contribute 51 % of the funds (own funds, loans and financial instruments). The specificities of the financing of the implementation of the energy renovation of buildings in the narrow public sector (PSS) on the basis of the energy contract model, including the establishment of a renewable financial source, are illustrated in Preglednica 37 and in Chapters 3.9, 8.2 and 7.3.3.

Since 2024, European cohesion funding under the new Multiannual Financial Framework (MFF 2021-2027) of EUR59.8 million has also been planned for the comprehensive energy renovation of buildings in the public sector[24]. In this context, it is planned to continue the financial scheme from the previous period. Thus, the share of EU grant funding, including Slovenia's own participation, will be 49 per cent of the investment (EU share of 85 %, Slovenia's share of 15 per cent) and the remaining 60 % will be financed from private and own

[23] As a temporary measure to mitigate the impact of COVID-19, an increase in the co-financing rate of European cohesion policy funds from 40 % to 49 % for operations for integrated energy renovation of buildings owned and occupied by the Republic of Slovenia and municipalities was adopted.

[24] TheMFF 2021-2027 has not yet been adopted at EU level. As a result, the amount of funds allocated to Slovenia is not yet known. The level of funding per objective or programme is not yet available. The 2021-2027 MFF is expected to be able to draw on by the end of 2029, so resources from the MFF are planned for 2030. The way in which objectives and indicators are to be financed and monitored is not yet specified.

resources. In addition to the new Multiannual Financial Framework, funds are also programmed under the Recovery and Resilience Plan (hereafter: RRF) with[25] an estimated amount of EUR 86 million. Measures will be taken to increase the energy efficiency of buildings through the sustainable renovation of existing buildings or the construction of new ones.

These include:

a) buildings of exceptional administrative importance due to the COVID-19 epidemic;
b) buildings of major importance for society due to the COVID-19 epidemic;
c) buildings requiring individual upgrading of technical building systems (specifically targeting ventilation, air conditioning technologies),
d) residential buildings (energy renovation of multi-apartment buildings according to the needs and scarcity of housing funds); and
e) creating a renewable financial resource for the energy renovation of buildings of the narrower public sector.

EUR258.7 million of European cohesion funding is planned for the whole period, which, together with Slovenia's participation (EUR45.7 million), will leverage EUR621.1 million. (excluding VAT) investment in the comprehensive energy renovation of buildings in the public sector. In addition, a further EUR38 million grant is planned under the Recovery and Resilience Fund (RRF)[26].

In addition to cohesion grants, EUR38.5 million is available in EC OP 2014-2020 for the comprehensive renovation of buildings in the public sector. 62,5 % of the funds are provided under cohesion policy and 37,5 % was provided in addition by SID Banka, through which loans are also provided. The funds shall be made available to both PSO and PSOs and ESCOs. Half of the funds are expected to be used by 2021 and the other half by the end of 2023. After the expiry of the EC OP 2014-2020, they are under the MFF 2021-2027 the planned reimbursable cohesion funding of EUR37.5 million and the corresponding share of SID Banka[27]. A total of EUR50 million of cohesion return funding is planned for the whole period.

For the energy renovation of buildings in the public sector, a planned grant of EUR11.1 million is available from the URE contribution under the Eco Fund. In addition, a grant of EUR11 million from the Climate Change Fund (CSF) is available[28]. In this context, the PCA is earmarked primarily for those energy renovations of public buildings which are not feasible under cohesion policy, PPPs and the like. Eko Fund grants are also available to finance energy renovations in the public sector. Reimbursable funds are also available under the programmes of SID Banka and Commercial Banks. To a lesser extent, energy suppliers' programmes are also available.

[25] TheRRF is not yet adopted at EU level and is under preparation. As a result, the amount of funds allocated to Slovenia is not yet known. The level of funding per objective or programme is not yet available. The disbursement of RRF funds is expected to be possible by the end of 2026. The way in which objectives and indicators are to be financed and monitored is not yet specified.

[26] At the time of the strategy, the National Recovery and Resilience Plan, which will be the basis for mobilising the Recovery and Resilience Fund (RRF), has not yet been adopted.

[27] Under the 2021-2027 MFF, implementation foresees the use of financial instruments or a combination of financial instruments (FIs) with one form of grant in line with the EC recommendations. The use of financial instruments and/or a combination of FI with non-repayable support will be envisaged in line with the gap analysis carried out, possibly also as access to repayable forms of financing for private partners in the case of a PPP.

[28] The Climate ChangeFund has a spending programme only until 2023. The level of funding after 2023 will be determined by the adoption of the Climate Change Fund's spending programme. In the future, it will be so important that the use of the Climate Change Fund (CSF) for energy renovation purposes is in line with the NECPs' energy renovation targets.

Table37: Volume of investment and sources of financing for energy renovation of buildings in the public sector over the period 2021-2030

		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	SKUPAJ
Investicije v energetsko prenovo JS	mio EUR	69,62	71,93	76,40	83,40	83,40	83,40	83,40	83,40	83,40	83,40	801,74
Dodatne investicije JS zaradi doseganja 3 % po EED	mio EUR	0,00	1,40	1,40	1,87	2,34	3,28	3,28	3,28	3,28	3,28	23,40
Investicije v energetsko prenovo JS- Skupaj	**mio EUR**	**69,62**	**73,34**	**77,81**	**85,27**	**85,74**	**86,67**	**86,67**	**86,67**	**86,67**	**86,67**	**825,14**
Upravičeni stroški [1]	mio EUR	59,87	63,07	66,92	73,33	73,73	74,54	74,54	74,54	74,54	74,54	709,62
Investicije v energetsko prenovo JS- Skupaj (z DDV)[2]	**mio EUR**	**75,06**	**79,07**	**83,88**	**91,93**	**92,43**	**93,44**	**93,44**	**93,44**	**93,44**	**93,44**	**889,59**
Struktura financiranja investicij												
Viri v okviru kohezije - Skupaj	**mio EUR**	**54,55**	**54,55**	**54,55**	**71,23**	**71,23**	**71,23**	**71,23**	**71,23**	**71,23**	**30,01**	**621,05**
Kohezijska sredstva -Skupaj (49%)	mio EUR	26,73	26,73	26,73	34,90	34,90	34,90	34,90	34,90	34,90	14,71	304,31
Kohezijska sredstva EU (85%)	mio EUR	22,72	22,72	22,72	29,67	29,67	29,67	29,67	29,67	29,67	12,50	258,67
Kohezijska sredstva - slovenska udeležba (15%)	mio EUR	4,01	4,01	4,01	5,24	5,24	5,24	5,24	5,24	5,24	2,21	45,65
JZP (ESCO - 51 %)	mio EUR	20,87	20,87	20,87	27,24	27,24	27,24	27,24	27,24	27,24	11,48	237,55
JN (proračun in/ali FI - 51%)	mio EUR	6,96	6,96	6,96	9,08	9,08	9,08	9,08	9,08	9,08	3,83	79,18
Viri financiranja neupravičenih stroškov in DDV	**mio EUR**	**14,89**	**15,53**	**16,29**	**18,48**	**18,56**	**18,72**	**18,72**	**18,72**	**18,72**	**16,45**	**175,09**
Proračun -DDV pri JN	mio EUR	3,00	3,00	3,00	3,92	3,92	3,92	3,92	3,92	3,92	1,65	34,16
Proračun - neupravičeni stroški z DDV	mio EUR	11,89	12,53	13,29	14,56	14,64	14,80	14,80	14,80	14,80	14,80	140,93
Viri v okviru spodbujenih naložb z URE in SPS	**mio EUR**	**4,53**	**3,84**	**4,19**	**4,58**	**5,03**	**5,49**	**6,01**	**6,59**	**7,23**	**7,94**	**55,42**
Sklad za podnebne spremembe (SPS)	mio EUR	2,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	11,00
Prispevek URE (energetska prenova)	mio EUR	0,63	0,71	0,80	0,90	1,01	1,12	1,25	1,40	1,56	1,74	11,11
Finanaciranje spodbujenih naložb iz URE in SBS - proračun in/ali FI	mio EUR	1,89	2,13	2,39	2,69	3,02	3,37	3,76	4,19	4,67	5,21	33,32
Viri v okviru RRF	**mio EUR**	**0,56**	**5,36**	**9,40**	**11,40**	**9,05**	**2,25**	**0,00**	**0,00**	**0,00**	**0,00**	**38,03**
Nepovratna sredstva - Skupaj	**mio EUR**	**29,93**	**33,80**	**37,93**	**48,20**	**45,96**	**39,27**	**37,15**	**37,30**	**37,46**	**17,44**	**364,44**
Povratna sredstva (FI) - Skupaj[3]	**mio EUR**	**10,5**	**10,5**	**0,5**	**10,5**	**10,5**	**10,5**	**10,5**	**10,5**	**10,5**	**0,5**	**85**
Povratna sredstva (kohezija)	mio EUR	6,25	6,25	0	6,25	6,25	6,25	6,25	6,25	6,25	0	50,00
Povratna sredstva (kohezija, delež SID banke)	mio EUR	3,75	3,75	0	3,75	3,75	3,75	3,75	3,75	3,75	0	30
Povratna sredstva - Eko sklad	mio EUR	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	5,00
Povratna sredstva - RRF	mio EUR	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Finančni viri- Skupaj[4]	**mio EUR**	**74,53**	**79,28**	**84,43**	**105,69**	**103,87**	**97,69**	**95,96**	**96,54**	**97,18**	**54,41**	**889,58**

Notes:
1 Eligible costs represent 86 per cent of investments.
2 For PPPs, VAT is recoverable and is not taken into account.
3 The grant is intended to finance subsidised investments under cohesion policy, URE and the PCA. They are not added to the sources of financing in order to avoid double counting.
4 In individual years, although there is a slight discrepancy between the level of investment and the financial resources, these are balanced over the whole period.

7.1.3 Buildings owned by the Republic of Slovenia and the use of close public sector persons

Due to the lack of budgetary resources and at the same time the dispersion of these resources within the framework of budgetary rights of consumption, the energy renovation of buildings of the narrow public sector requires the provision of a stable and sufficient source of funding and an appropriate list of priority ministry buildings suitable for energy renovation, which, according to the Government of the Republic of Slovenia, must be renovated with energy.

The list of public buildings for renovation and construction will be drawn up and adopted on the basis of the Decree on the management of energy in the public sector (Official Gazette of the Republic of Slovenia Nos 52/16, 116/20 and 158/20 – Zure).

The energy renovation strategy for buildings owned by the Republic of Slovenia and the use of persons in the narrower public sector will be implemented through the following actions:

1. Setting conditions for integrated energy renovation
2. The financing of projects under the new Multiannual Financial Framework (MFF 2021-2027) and the Recovery and Resilience Plan (RRF) following the procedure for direct approval of the operation on the basis of the list of public buildings to be refurbished under the direction of the Government of the Republic of Slovenia (POS-5 measure).
3. Monitoring of objectives (MFF 2021-2027, RRF and others).

1. Setting conditions for integrated energy renovation

The necessary conditions for the energy renovation of a building, which apply to all buildings in the wider public sector, are:

- Ownership of the Republic of Slovenia, however, if the building is not wholly owned by the Republic of Slovenia, requires an agreement on co-financing with other owners.

- Establishment of energy efficiency indicators: An expanded energy audit of the building and an energy performance certificate must be drawn up, taking due account of any decisive conditions that may influence the design and implementation of investment measures (e.g. location information, cultural heritage protection requirements, etc.).
- Investment treatment of the project – Investment documentation must be drawn up, including verification of the PPP implementation variants of the operation.
- Suitability test for a public-private partnership – conduct of the pre-litigation procedure in accordance with the provisions of the ZJZP.
- A proposal for a comprehensive energy renovation of a building – measures must be drawn up that meet the requirements and conditions relating to a prescribed level of efficient energy use and renewable energy sources, which should also take into account the provision of a high-quality indoor environment envisaged after the completion of the energy renovation.

Following the decision to renovate a building, the following starting points should be taken into account:

- Development of project documentation for energy renovation: If the project is carried out in the context of a public procurement procedure (JN), the project documentation for the energy renovation of the building must be drawn up. In the case of a public-private partnership (PPP), the project documentation shall be produced by the private partner.
- Simultaneous implementation of other measures to improve the condition of the building: Energy renovation shall also be accompanied by other reasonable measures to improve the condition of the building and to ensure the health and quality of the living of users, in accordance with the principles of good management.
- Taking into account, as far as possible, the principle of sustainable construction.

2. Financing of projects under the new Multiannual Financial Framework (MFF 2021-2027) and the Recovery and Resilience Plan (RRF)

The selection of operations will be carried out by means of a procedure for direct approval of the operation according to the means available and on the basis of the list of buildings to be renovated as instructed by the Government of the Republic of Slovenia. The selection of buildings and the level of appropriations will be made on the basis of the criteria for the selection and financing of energy renovation projects for buildings drawn up by the ministry responsible for energy. The criteria will be supplemented on the basis of the results of the energy renovation projects carried out.

3. Monitoring of objectives (MFF 2021-2027, RRF and others)

The relevant programming documents will set out objectives and how to monitor the achievement of these objectives, including indicators. This will take into account common indicators at EU level (e.g. for Cohesion and European Regional Development Funds and others) and selected indicators from chapter 2.2.2 of this document.

7.1.4 Buildings owned by the Republic of Slovenia and the use of general public sector entities

Given the lack of budgetary resources and at the same time the dispersion of these resources in the context of budgetary spending rights, it is also necessary to provide a stable and sufficient source of funding for the energy renovation of general public sector buildings. The establishment of an appropriate list of buildings suitable for energy renovation is envisaged as a starting point and the establishment of a list of general public sector buildings is envisaged as one of the measures under this strategy.

The energy renovation strategy for buildings owned and occupied by general public sector entities will be implemented through the following actions:

1. Setting the conditions for integrated energy renovation.
2. Financing projects under the new Multiannual Financial Framework (MFF 2021-2027) and the Recovery and Resilience Plan (RRF):
    - 2A. The selection of projects through a procedure for the direct approval of an operation in the context of the implementation of the European cohesion policy for buildings owned and occupied by general public sector entities established by the Republic of Slovenia,
    - 2B. Selection of projects following a public tender procedure in the context of the implementation of the European cohesion policy for buildings owned and occupied by municipalities.
3. Monitoring of objectives (MFF 2021-2027, RRF and others).

More specifically:

1. <u>Defining the conditions for renewal</u>

The necessary conditions for the energy renovation of a building, which apply to all buildings in the wider public sector, are:

- Organised ownership of the public partner (state, municipalities) or co-financing agreement concluded with other co-owners.
- Establishment of energy efficiency indicators: An expanded energy audit of the building and an energy performance certificate must be drawn up, taking due account of any decisive conditions that may influence the design and implementation of investment measures (e.g. location information, cultural heritage protection requirements, etc.).
- Investment treatment of the project – Investment documentation must be drawn up, including verification of the PPP implementation variants of the operation.
- Suitability test for a public-private partnership – conduct of the pre-litigation procedure in accordance with the provisions of the ZJZP.
- A proposal for a comprehensive energy renovation of a building – measures must be drawn up that meet the requirements and conditions relating to a prescribed level of efficient energy use and renewable energy sources, which should also take into account the provision of a high-quality indoor environment envisaged after the completion of the energy renovation.

Following the decision to renovate a building, the following starting points should be taken into account:

- Development of project documentation for energy renovation: If the project is carried out in the context of a public procurement procedure (JN), the project documentation for the energy renovation of the building must be drawn up. In the case of a public-private partnership (PPP), the project documentation shall be produced by the private partner.
- Simultaneous implementation of other measures to improve the condition of the building: Energy renovation shall also be accompanied by other reasonable measures to improve the condition of the building and to ensure the health and quality of the living of users, in accordance with the principles of good management.
- Taking into account, as far as possible, the principle of sustainable construction.

<u>2. Financing of projects under the new Multiannual Financial Framework (MFF 2021-2027) and the Recovery and Resilience Plan (RRF)</u>

Funds will be allocated directly to general public sector buildings (for buildings of general public sector entities created by the state) and on the basis of public tenders (for buildings owned and occupied by municipalities). Consideration will also be given to the possibility or feasibility of drawing up a list of general public sector buildings created by the Republic of Slovenia suitable for energy renovation.

A. Persons of the wider public sector established by the State: The invitations to submit proposals for energy renovation projects for buildings owned and occupied by general public sector entities founded by the state are expected to be published annually, subject to available funding. The submission of a proposal is conditional on the inclusion of the building on the list of buildings of priority energy renovations (measure J-6). The buildings will be selected and the amount of the appropriations will be determined on the basis of the criteria for the selection and financing of energy renovation projects for buildings drawn up by the ministry responsible for energy. The criteria will be supplemented on the basis of the results of the energy renovation projects carried out.

B. Municipalities: Depending on the available funds, the intermediate body will annually issue calls for tender to which municipalities will be able to apply. The selection of buildings and the level of appropriations will be determined on the basis of the criteria for the selection and financing of energy renovation projects for buildings drawn up by the ministry responsible for energy. The criteria will be updated over the lifetime of the project on the basis of the results of the energy renovation projects carried out.

3. Monitoring of objectives (MFF 2021-2027, RRF and others)

The relevant programming documents will set out objectives and how to monitor the achievement of these objectives, including indicators. This will take into account common indicators at EU level (e.g. for Cohesion and European Regional Development Funds) and selected indicators from chapter 2.2.2 of this document.

7.1.5 Private service sector buildings

In the private service sector, EUR 1 081 million (excluding VAT) must be invested in the period 2021-2030 in order to achieve the targets set out in the NECPsPreglednica 38. In the private sector, buildings are an integral part of the assets of the companies with which they operate, i.e. they will invest their own assets where they have a higher return and a shorter return period. Grants for the energy renovation of buildings thus improve the economy of investments.

The main source of grants for the energy renovation of buildings in the private sector is the contribution of URE of EUR44.39 million. Under the EC OP 2014-2020, funding will be made available in 2021 and 2022 to support tourism micro, small and medium-sized enterprises to increase their material and energy efficiency by an estimated EUR7.49 million[29]. A total of EUR 51.9 million is planned over the whole period, which will leverage investments of EUR 231,7 million[30].

The planned investments in energy renovation can only be made if companies provide adequate funding and/or financial resources of EUR 1 029 million. Companies can finance energy renovations of buildings from their own funds, Eko Fund loans, SID Bank loans and other commercial banks. On the other hand, they may also use partnerships with ESCO-companies to finance the energy renovation of buildings or cooperate with energy suppliers' programmes.

[29] The estimated funding relates only to the part of the grant that is expected to be dedicated to the energy renovation of buildings. The level of co-financing varies from region to region and may be up to 70 % or up to 75 % of eligible costs.
[30] The projections foresee that 30 per cent of the investment in energy renovation will be stimulated by grants of 20 %.

Table38: Volume of investment and sources of financing for energy renovation of buildings in the private sector over the period 2021-2030

		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	SKUPAJ
Investicije v energetsko prenovo ZS[1]	**mio EUR**	**106,43**	**106,48**	**106,78**	**107,39**	**108,31**	**105,92**	**107,34**	**108,96**	**110,70**	**112,47**	**1080,78**
Struktura financiranja investicij												
Nepovratna sredstva - Skupaj	**mio EUR**	**7,91**	**4,94**	**3,19**	**3,58**	**4,02**	**4,49**	**5,01**	**5,58**	**6,22**	**6,94**	**51,88**
Prispevek URE (energetska prenova)	mio EUR	2,52	2,84	3,19	3,58	4,02	4,49	5,01	5,58	6,22	6,94	44,39
Kohezijska sredstva - ESRR	mio EUR	5,39	2,10									7,49
Spodbujene naložbe URE in ESRR -Skupaj	mio EUR	19,63	16,91	15,94	17,91	20,12	22,44	25,03	27,91	31,12	34,69	231,69
Sredstva/finančni viri podjetij	**mio EUR**	**98,51**	**101,54**	**103,60**	**103,81**	**104,29**	**101,43**	**102,33**	**103,38**	**104,48**	**105,53**	**1.028,90**
Povratna sredstva - Eko sklad[2]	mio EUR	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	5,00
Finančni viri - Skupaj	**mio EUR**	**106,43**	**106,48**	**106,78**	**107,39**	**108,31**	**105,92**	**107,34**	**108,96**	**110,70**	**112,47**	**1080,78**

Notes:
1 Eligible costs represent 80 per cent of investments.
2 Eko Fund grants are intended to finance subsidised investments and spontaneous company renewals. They are not added to the sources of financing in order to avoid double counting.

7.2 Proposal for new instruments to finance building renovation in the period up to 2030

Achieving the EU's ambitious energy efficiency targets will require major investments in most buildings we use today for housing, business, education, recreation and other needs. EU Member States encourage investment through a variety of incentives. The most common form of financial incentives in the residential, commercial and public buildings sector is still incentives in the form of **grants** (Economidou in drugi, 2019) used by all Member States, according to the Accelerating energy renovation investments in buildings – financial and fiscal instruments across the EU. Their use is particularly widespread in the area of housing (used by all countries), most of them also in the commercial buildings sector, and to a lesser extent in public buildings (Table 41). In the area of residential buildings, the use of **reversible financial instruments** (different forms of soft loans) is also widespread, and to a lesser extent for commercial and public buildings. A similar situation exists with regard to the use of **fiscal instruments**, which are generally somewhat less widespread.

Although the findings of the European Commission study (Economidou in drugi, 2019) show that EU countries spend around EUR15 billion annually on promoting investment in the energy efficiency of residential, commercial and public buildings, this amount is far too low to achieve the EU's objectives, which will require a lot of private funding in addition to public funding. It is precisely in the area of buildings that the European Commission estimates that one of the biggest gaps in the scale of investment needed is(EC, 2015b). This gap and the current fiscal pressures on public finances of the economic and health crisis will require changes in the promotion of energy efficiency in buildings by making public funds more sustainable and more reversible and with higher leverage of private funds.

Such changes will need to be reflected in a move away from today's most widespread sunk incentives and a greater use of reversible diversified financial instruments, such as guarantee schemes, the creation of revolving funds, debt purchase and the like, aimed at ensuring more predictable cash flows, reducing risks, increasing the value of assets, increasing business opportunities and the possibility of refinancing energy efficiency investments. On the other hand, better targeting of grants on vulnerable and hard-to-reach groups of real estate users, closing specific market gaps and promoting the development and use of innovative mechanisms will be necessary.

Table39: Number of EU28 countries using financial and fiscal instruments by sector of buildings (shaded fields show which groups of instruments are also available in Slovenia)

	Non-repayable subsidies	**Reimbursable subsidies (favourable loans)**	**Tax relief(s)**
Residential buildings	28	20	11
Commercial buildings	17	9	8
Public buildings	16	8	5

Source: Data taken from Economidou et al., 2019.

In Slovenia, non-repayable and reimbursable subsidies (partly also from cohesion funds under CTN for publicly owned multi-apartment buildings) are available mainly through the Ecofund for the residential sector. A reduced VAT rate of 9.5 % for the construction, renovation and repair of dwellings can also be considered a tax credit for the energy renovation of residential buildings. Reimbursable grants and grants for commercial and public buildings are also available from the Cohesion Fund and the Eco Fund offer.

In order to promote investment in energy renovation, Slovenia uses mainly **non-reimbursable subsidies**, which are already partially targeted, mainly in the housing sector, taking into account the difficulties in deciding on the energy renovation of multi-apartment buildings, promoting integrated renovations and eradicating energy poverty. In particular for the target group of the energy poor, it is essential that the **delivery instrument for energy-efficient renovations for the energy poor** becomes one of the permanent instruments under the Eco Fund measures and, in cooperation with general poverty prevention measures, mitigates the impact of measures stemming from the NECPs.

In line with the objectives and orientations set out above, a number of possible new financial measures are identified in the remainder of this strategy, mainly on the basis of foreign experience. On the basis of this strategy, it will be possible to examine the individual measures in more detail. Only after a detailed examination of the individual measures will it be possible to identify all the activities and modalities for their implementation and to justify the appropriateness of the measure. The purpose of the definition of the measure is to examine it first and then to implement further possible solutions and activities. Each measure is identified and proposed on the basis of experience and best practices from abroad. With regard to the measures, it should be noted that this is the 2050 strategy, which sets orientations and not all implementing solutions.

For example, as regards **reversible financial instruments**, we propose to extend the existing portfolio of predominantly concessional loans and repayments in the context of energy contracts by introducing a guarantee scheme for residential buildings; (b) energy bills schemes for residential, commercial and public buildings; (c) debt purchase schemes from energy contract providers.

a) Residential buildings guarantee fund

The guarantee scheme reduces the risk of unreliable payments and non-payments to the reserve fund of multi-apartment buildings, which may make repayments unreliable and even lead to default on energy contract providers (ESCOs) or creditors where energy efficiency investments have been made through debt to the reserve fund. In line with the experience of the rest of the world, the guarantees provide coverage of defaults from the reserve fund towards ESCO companies, energy renovation providers and commercial banks in the event of borrowing from the reserve fund. The guarantees are granted for the duration of the contract between ESCO and the owners of the residential building and are charged on a one-off basis to all building owners individually as a deductible amount from the corresponding non-refundable incentive for the energy renovation of the building. The implementing body of the measure may be an institution, e.g. Eco Fund. The guarantee would ensure:

- alleviating difficulties in borrowing against the reserve fund;
- reducing the risks of creditors;
- promoting energy contracts in multi-apartment buildings;
- alleviating individuals’ borrowing difficulties, as the renovation would be carried out through indebtedness at the expense of the reserve fund.

b) First loss relief

The first loss absorbing instrument reduces the risks of commercial banks in financing energy efficiency investments by companies. It operates in a similar way to a portfolio guarantee for banks, except that this instrument provides a commercial bank with cover for the entire loss of principal credit due to an inability to pay by the company. The total first loss absorption volume is defined as a proportion of the pre-defined target investment volume that the commercial bank undertakes to make. The first loss absorbing instrument reduces the risk of commercial banks to finance investments in the energy renovation of buildings and the energy efficiency of companies. With the use of the instrument, commercial banks become more inclined to finance investments in the energy efficiency of companies, in particular with regard to market gaps: Longer maturities, lower ratings, deferrals. The price of financing by commercial banks also becomes lower due to the transfer of the first loss cover advantage to the final beneficiary of the loan.

c) Establishment of a system resource to finance the renovation of the buildings of the narrower public sector

An explanation is given in section 4.3.3.1.

d) Schemes based on energy bills

Schemes based on energy bills or so-called on-bill financial schemes are schemes where energy efficiency investments made are compensated by payments to the energy supplier. The energy supplier or a third party implements energy efficiency measures, which are then paid off against unchanged bills for the energy supplied and the energy supplier pays back the investment from the energy consumption savings resulting from the measures implemented. The measure can be effectively implemented in all three building sectors – residential, commercial and public.

There are various forms of financial schemes with payments on energy services bills. US Energy Efficient Economy Council The American Council for an Energy-Efficient Economy, ACEEE) distinguishes three models(ACEEE, 2020; Rieke Boll in drugi, 2019):

- Energy**bill payment schemes where the energy supplier finances energy efficiency measures (OBF)**. Such schemes are the most common in the US and are implemented autonomously by energy suppliers.
- Account-based repayment schemes where the funder**of the measures implemented is a third party that is remunerated by energy bills (OBR)**. Under this model, the energy supplier only offers the infrastructure for repayment when billing, while the funds come from an external (often private) financer. In this context, the three most common versions are in use:
    - The initial financing of the measure is on the side of the energy supplier, which then sells the claim to a third party.
    - The energy supplier offers the initial financing of the measure, which is provided by the financial market (e.g. by issuing bonds) in advance and is then remunerated by energy bills.
    - It is only an energy supplier as an intermediary between external financing providers and consumers and facilitates the use of energy billing infrastructure.

  Under this version, there are also various public forms of guarantee for repayment of the commitments entered into.
- Payment schemes with special tariffs where the implementation of the measure is linked to a change in the tariff at which energy is paid after the measure has been implemented and is linked to the energy meter in the building. The revised tariff is then a source of financing for the reimbursement**of implemented measures (TOB**). The advantage of this version is that the remuneration is linked to the building and its respective owners, not just to the current building owners.

Some payments are made under OBR energy bills payment schemes in Slovenia, while other forms (OBF and OBT) are not widespread. Funding for such schemes may come from different titles, and in Slovenia, a combination of EF reflows (which would provide an incentive to enforce the instrument) and funds from obligated liabilities under the Decree on Energy

Savings should be considered. Schemes are also attractive because they do not need to change excessively the way and scope of operations of the supplier companies. However, it would be essential to examine which of the schemes and their variants would be the most appropriate in the context of our legislation and the users of the proposed instrument.

The attractiveness of these schemes also stems from the fact that the design of the programme makes it possible to overcome relatively effectively certain obstacles to the financing of energy efficiency measures:

- address the reluctance of financial institutions and ESCO-companies to finance low-value projects.
- It can successfully address the problems of shared incentives in rental relationships, in particular where repayment is made under a scheme with different tariffs.
- Eliminates high initial inputs.
- It is appropriate for building owners who intend to move soon, as the obligation to repay the outstanding part of the liability is transferred to the new owner.

It is not linked to the assessment of creditworthiness, in particular in the case of TOB, it is linked only to the building.

A very interesting example of the use of such a scheme in Denmark is the promotion of the installation of heat pumps, and the business model for heat pumps emulates the business model known in conventional district heating in urban areas. Energy companies install, finance, maintain and operate a heat pump, and consumers pay a fixed amount for a single connection, a regular monthly fee and a cost for the heat supplied(Economidou in drugi., 2019).

e) Debt Purchase Scheme from Energy Contract Providers

The expansion of energy contract schemes, particularly in smaller markets such as Slovenia, where there are few energy contract service providers, is very limited by the ability to finance these providers. Their balance sheets are growing rapidly on the back of investments, which typically have long repayment terms, and hence the cumulative indebtedness and exposure of ESCO companies(ABRACADABRA, 2019; Núñez Ferrer, 2019). These restrictions relate to **factoring schemes** where ESCO offers long-term energy contract receivables (energy renovation savings) at a discount to a specialised factoring company. The purchase of a claim covers only the part of the liability of the community of owners of the renovated building which is not linked to the maintenance obligation and operating costs and is contractually charged to ESCO. A successful model of this kind is the Latvian LABEEF, set up as a EUR30 million fund to promote the comprehensive renovation of the Soviet-period buildings.

The functioning of the Facility shall be as follows:

- ESCO shall agree with building owners a comprehensive renovation (between 45 % and 65 per cent of energy savings) for twenty years.
- ESCO shall carry out a comprehensive renovation of the building.
- The building manager charges owners the same energy cost as before the renovation.
- The building manager pays actual (reduced energy costs) to the energy supplier and the difference to previous costs (savings) to ESCO.
- Once the refurbishment has been carried out and the savings have been demonstrated, ESCO sells at a discount the LABEEF savings receivable less the maintenance and operating costs still borne by ESCO.

A similar instrument was introduced in 2019 for public buildings in Ukraine under the auspices of the GEF-UNDP project “Removing Barriers to Increase Investment in Energy Efficiency in Public Buildings in Ukraine through the ESCO Modality in Small and Medium Sized Cities”(Medium.com, 2019).

The European Energy Efficiency Fund (EEEF Eligible Investments, 2019). Such claims could be bought from us by Eko Fund and SID Banka.

In Slovenia, there is a reduced value added tax rate (9.5 per cent) in the context of **fiscal instruments to promote energy-efficient renovations** in the housing sector. Given the strong regressiveness of fiscal instruments, in particular those linked to personal income tax, the existing instrument is appropriate and sufficient. The potential incentives for energy-efficient renovations in the context of personal taxation, which are known in some European countries, benefit those with the highest income, so the effectiveness of such instruments is low and the granting of incentives is inadequate.

According to the basic definition of a building, building furniture, building envelopes and permanently installed installations and installations in a building intended for the operation of a building are also an integral part of a building. It follows from that definition that an integral part of a building is also the built-in equipment, fittings and technological installations intended for the operation of the building and/or the various accessories to be installed in the building which are directly connected with the building and necessary for its normal operation. The person liable for such installations and installations which are functionally intended for the operation of the building may not benefit from the investment allowance provided for by the legislation in force. In this context, in order to encourage investment in the energy renovation of commercial buildings, it would make sense to allow investment in the increased energy performance of a building that achieves a certain energy efficiency class and is demonstrated by an energy performance certificate to be included in the 40 % investment allowance.

Tax incentives can support other policies. Taxable persons in the business sector may benefit from other advantages under the applicable corporate tax law, from a comparatively lower standard tax rate to all general deductions and other institutions for reducing the tax base which affect the amount of their tax liability and the tax saving. The introduction of tax incentives is a technical and political issue, but their implementation needs to be carefully considered in the light of the objectives and purposes of tax policy and other policies and the impact on budget revenue. However, if advantages or rules refer to specific, narrower areas, their effects under EU rules and their administrative aspect still need to be analysed and assessed.

The current method of taxing real estate by means of compensation for the use of building land and homes and business premises owned by natural persons by means of property tax under the Citizens' Tax Act contains certain instruments that encourage the new construction and renovation of buildings, but these are outdated and too vague in the light of the objectives of the strategy. It is therefore necessary to ensure that, in the context of the reform of property taxation, which is necessary in view of the current legal situation of property levies (the legal basis for which has already been repealed and can only be applied), real estate taxation is regulated in such a way as to promote the renovation of buildings both in terms of energy efficiency and the preservation of architectural and cultural heritage.

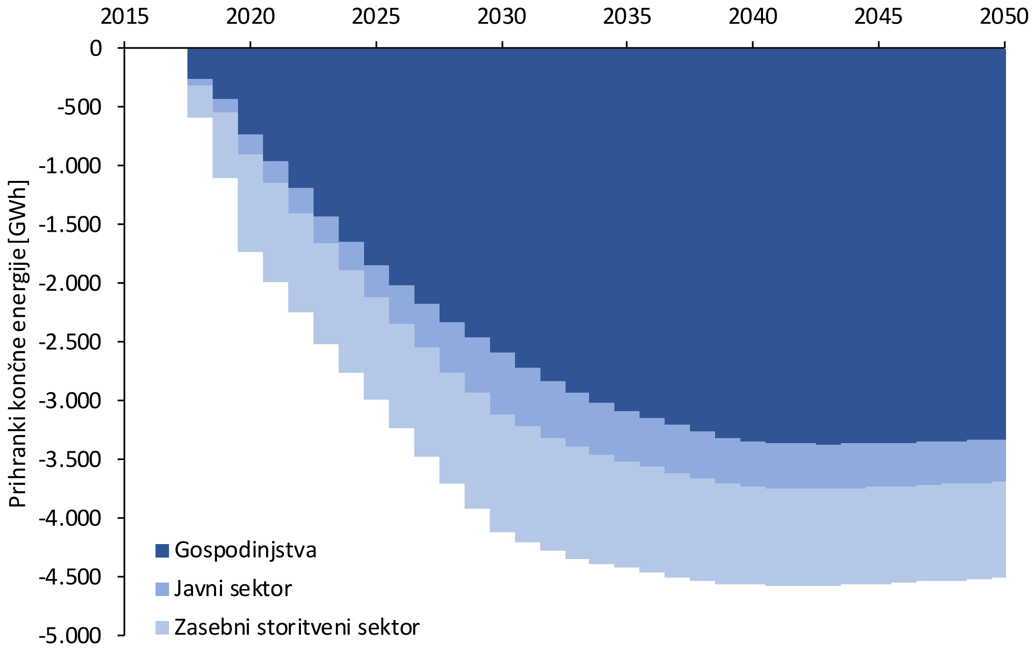
8 Assessment of energy savings and wider benefits

Investments in the energy efficiency of buildings bring significant savings to society and wider benefits, which can be grouped into economic, social, environmental and energy system benefits.

8.1 Economic benefits

Energy savings

A dynamic model was used to forecast energy use in buildings until 2050. The model estimated final energy savings for heating and hot water preparation due to the implementation of energy renovation measures for existing buildings. Savings have been estimated compared to 2017. In 2020, final energy savings amount to 1.732 GWh (6.24 PJ), increase to 4.115 GWh (14.81 PJ) by 2030, and 4.502 GWh (16,21 PJ) by 2050.



The largest share of final energy savings is expected in the housing sector – 63 % in 2030 and 74 % in 2050 through building renovation measures. The savings achieved as a result of the implementation of this strategy will greatly contribute to achieving Slovenia's energy efficiency targets.

Additional investments

Increasing the energy efficiency of the building stock generates a significant amount of investment. Over the period 2015-2030, the total investment needed (excluding VAT) is estimated at EUR6.71 billion, while the additional investment (excluding the investments that would be required by regular building maintenance) is estimated at EUR5.48 billion. In order to maximise the long-term economic benefits in terms of job creation, stable inflows to the public sector budget and contribution to the growth of the economy, it is crucial that these investments are carried out as evenly as possible and without concentrating investment activity in individual years or shorter periods. The impact of additional investment on employment, budgetary inflows and GDP growth has been estimated by means of a recovery dynamic general equilibrium model comprising 25 sectors of activity and 25 goods and services.

Additional posts

Increased investment in energy efficiency also implies increased demand in sectors that make buildings more energy efficient through their products and services. Employment effects are direct, i.e. an increase in employment in sectors directly supplying products and services for the energy renovation of buildings, such as the construction industry, the manufacture of building furniture, heating systems, ECSO-industry, and indirect developments in the economy as a whole in response to increased economic activity in the other sectors involved.

Due to the relatively high work intensity of works related to the energy renovation of buildings compared to many other sectors of the economy, investments in energy efficiency represent an important and powerful lever for the creation of new jobs.

In its study (EEIF, 2020) for the period up to 2020, the Energy Efficiency Industry Forum estimates that EUR million of investment in the energy efficiency of buildings in Europe supports 19 new jobs (jobs are defined as one person for one year). In Slovenia, the planned average annual volume of additional investment of EUR500-700 million would support 9.500-13.300 jobs (indirect and direct).

Increased value of real estate

Growing research worldwide points to the positive impact of increased energy efficiency on the value of real estate. A UK study (Fuerst in drugi, 2013) shows that apartments with energy class A/B are on average 14 % higher on the market than those in the lowest energy class. Similar results are provided for residential real estate in Ireland, where A-grade real estate is sold at a premium of 11 %, while the rental market premium is much lower at only two per cent. Increased energy efficiency also contributes to increasing value in commercial buildings. In the case of French real estate, it has been found that the energy efficiency of the building is also capitalised in the value and rent of commercial, office and industrial real estate, with the effects in the real estate service sector being stronger than in the industrial real estate sector.

In Slovenia, it has also become mandatory to indicate the energy performance indicators of a building or of an individual part of it from an energy performance certificate for one or more years in advertisements for the sale of a building or a specific part thereof and when renting it for one or more years. The obligation was imposed on us by the Energy Act EZ-1, implemented on 22 March 2014. It can be expected that this will also reflect the different energy efficiency of buildings in real estate prices.

Incentives for R & D, industrial competitiveness and increased exports

Promoting energy-efficient building renovation in the national economy also has an important incentive effect for the development of R & D activities related to energy-efficient technologies. In Slovenia, important emphasis is also given to this area under the first and third priority axes of the OP ECOC, which, through various instruments, promote and pursue the objective of increasing the competitiveness of the economy for green growth and job creation.

8.2 Societal Benefits

Reduced energy poverty

Although there is no official definition of energy poverty, it can be inferred from the cost of energy for households, the payment of these costs and the ability of households to afford a suitable warm housing. According to the household consumption survey, in 2012 households spent on average seven percent of all their available funds for electricity, gas, other fuels and steam in Slovenia. The distribution of households by income quintile shows that expenditure on electricity, gas, other fuels and steam in the first quintile (with the 20 % of households with the lowest incomes) amounted to 15.3 per cent of total available assets, 9.4 per cent in the second quintile, 7.6 per cent in the third quintile, 6.0 per cent in the fourth quintile and the last quintile 4.5 per cent.

According to the Income and Living Conditions Survey, 93.6 per cent of households (78 per cent of households in the first quintile of incomes) could afford a suitable warm housing in Slovenia in 2012, while 16.9 per cent of households have occasional problems paying their energy and water costs (23.8 per cent of households in the first quintile by income), and 31.1 per cent of households live in dwellings facing dipping, humid walls and frustrated occes. Evidence shows that there are increasing numbers of households that cannot afford a properly warm dwelling.

Impact on health, improved housing comfort and higher productivity

Comprehensive energy-efficient renovation has a significant impact on improving the quality parameters of housing conditions, such as room temperature, air quality, lighting, acousticity and humidity. The UK study on the impact of energy poverty and insufficiently heated housing on human health clearly shows an increased risk of health problems in energy poor households (death due to low temperatures in winter months, respiratory problems, mental health impact, incidence of cold conditions, worsening rheumatism and arthritis, etc.). A qualitatively implemented energy renovation improves the housing situation of households facing energy poverty and poor housing conditions and is also reflected in other households and businesses. Many studies[31] demonstrate advantages such as increased productivity, less absenteeism, less stress and less allergic reactions.

In addition to the societal benefits mentioned above, an adequate comprehensive energy renovation also contributes positively to strengthening cultural and tourism opportunities.

8.3 Environmental benefits

Reduction of greenhouse gas emissions

Total GHG emissions from the combustion of fuels in the building sector amounted to 1210 kt CO2 equivalent in 2017, representing 6.9 % of total national GHG emissions. Energy use in the building sector, which is divided into households and service sector buildings, accounted for 33 % of total energy consumption in 2017 and is thus one of the main sources of CO2 emissions. Between 2005 and 2017, emissions in the service sector buildings decreased by 44 % and by 35 % in households.

The reduction in GHG emissions is due to various factors, notably environmental commitments, the implementation of energy efficiency measures, the use of renewable technologies and the increase of centralised heating systems in densely populated areas. Between 2005 and 2017, emissions in buildings decreased mainly due to investments in energy efficiency measures and measures to replace more efficient technologies and other energy sources (most of which was the replacement of heating oil). In reducing household GHG emissions, a financial instrument of grants has been established, while public buildings have been renovated almost exclusively by cohesion funding, with municipalities particularly successful.

The objective is to achieve net-zero GHG emissions by 2050. Intermediate targets are to reduce emissions by 82 % by 2030 and 85-95 % by 2040 compared to 2005Slika 1.

[31] A summary of such studies is published at: Http://www.institutebe.com/Building-Performance-Management/Productivity-Gains-from-Energy-Efficiency.aspx

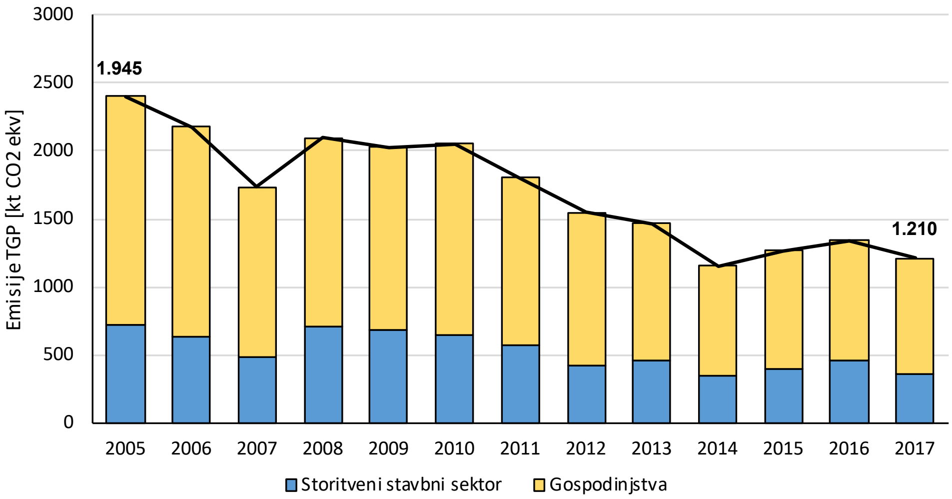


Figure16: Reducing greenhouse gas emissions from the building sector in the period 2005-2017

Reduced air pollution

The expected effects of the planned energy renovation measures for buildings up to 2030 and 2050 on the reduction of air pollution compared to 2015 are estimated. Emission reductions are expected:

- sulphur dioxide by 431 t and 69 % by 2030 and by 539 t and 86 % respectively by 2050;
- nitrogen oxides by 2,060 t and 61 % respectively by 2030 and by 2,721 t and 80 per cent respectively by 2050;
- all dust particles of 5,754 t and 65 per cent respectively by 2030 (primary particles of less than 2,5 µm (PM2,5), for 5,394 t and primary particles of less than 10 µm (PM10) for 5.518 t) and for 7.498 t and 84 per cent respectively by 2050 (primary particles of less than 2.5 µm (PM2,5) for 7.025 t and primary particles of less than 10 µm (PM10) for 7.187 t);
- volatile organic substances (VOCs) for 3 062 tonnes and 57 % respectively by 2030 and 5 t and 78 per cent respectively by 2050.

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Annex A Terminological definition of renovation

Annex A Terminological definition of transfers lists all the different technical terms relating to the renovation of buildings and energy used in the Slovenian and wider foreign professional environment. As a result of the proper and unambiguous application of the relevant definitions for the purposes of energy renovation in PSEPS 2050, Chapter 1.4 of the Terminological Definition of Renovation specifies the terms used to carry out energy renovation in accordance with legislation and other measures in Slovenia.

This annex lists all the different terms used in our professional space. The aim is to describe and harmonise the relevant professional terminology in our area.

Table40: Overview of the most important terms for the different types of renovation

Slovenian term	The English term	Qaval criterion	Yardstick	Additional description	Source
Partial	**Partial**	✔		Implementation of only part of the actions (two or more).	DSEPS
Staged	**Step-by-step**	✔		Implementation of all measures in stages.	DSEPS
Wider	**Mr Wider**	✔		Various building improvements; Possible integration of energy efficiency and RES measures.	Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings
Extensive	**Substantial**		✔	The costs exceed 50 % of the value of the investment for a new comparable production installation.	Energy Act (EZ-1; Official Gazette of the Republic of Slovenia No 60/19 – official consolidated text)
Greater	**Major**		✔	More than 25 % of the surface area of the building envelope shall be renovated.	Energy Act (EZ-1; Official Gazette of the Republic of Slovenia No 60/19 – official consolidated text)
Minor	**Light**		✔	Primary energy savings are less than 30 %.	Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings
Medium	**Medium**		✔	Primary energy savings range from 30 % to 60 %.	Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings
Thorough	**Deep**		✔	Primary energy savings are greater than 60 %.	Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings
Comprehensive	**Bulk**	✔	✔	Refers to (large) primary energy savings.	DSEPS
Nearly zero energy	**Nearly zero-energy**		✔	The achieved indicators are in line with the national definition of nearly zero energy buildings.	DSEPS
Sustainable	**Sustainable**	✔	✔	Compliance with sustainable construction criteria and indicators.	National legislation under preparation

A.1st Refurbishment (Ms: *Renovation*)

The term ***renovation*** is not defined in the construction and energy legislation, although it is used on its own and in many combinations.

The construction Act (PGI-1 NPB-16), which defined the maintenance of the facility, was most closely aligned with the definition or positioning of the *renovation* in the legislative terminology framework:

‘On the date of entry into force of this Law, the terms’adaptation‘,’refurbishment‘,’maintenance work‘,’regular maintenance work‘and’investment maintenance work‘shall be deemed to mean’maintenance of a building‘in accordance with the provisions of this Law.’

As the terminology used in practice, as well as in the regulations, has been somewhat looser and not always completely uniform (which is still not completely eliminated), the *alterations* and *renewals* mentioned in the above quote can also be cited as a *refurbishment*.

The maintenance of the building is defined by the ZGO-1 as the performance of works that keep the building in good condition and allow its use, and includes regular maintenance and maintenance work for the public benefit.

The refurbishment of the PGI-1 would therefore entail the implementation of measures to maintain the good condition and usability of the facility.

The Construction Act (Uradni List RS (UL RS; Official Gazette of the Republic of Slovenia) Nos 61/17 and 72/17 – corr.) then defined and extended the term ‘maintenance’ as works designed to preserve the usability and value of the building, and improvements that take account of the progress of the technique, the replacement of individual expired structural and other elements and penetrations for the installation.

This definition (works, improvements, replacements) can also include the term’ *refurbishment* ‘, as understood and used in particular with regard to improving the energy performance of buildings.

For these reasons, the **term *renovation*, especially in extended forms such as major renovation or deep renovation, is commonly used as a synonym for the improvement of the energy performance of a building, including the use of renewable energy sources**.

For these extended formats, qualitative and quantitative descriptions are helpful, or we use a variety of indicators (geometrics, energy, financial and others) for classification and evaluation where appropriate.

They apply the principle in a number of other countries, in particular the EU, on the basis of the transposition of European directives into national legal orders. For example, the Global Buildings Performance Network (GBPN) notes this in its 2013 technical report ‘What is a deep renovation definition’.

A1.1 Specificity of cultural heritage buildings

In the field of cultural heritage, the term’ *renewal* ‘has a particular meaning.

Under the Cultural Heritage Protection Act (Uradni List RS (UL RS; Official Gazette of the Republic of Slovenia) Nos 16/08, 123/08, 8/11 – ORZVKD39, 90/12, 111/13, 32/16 and 21/18 – ZNOrg), ***reform*** is a set of various activities in the economic, social and cultural spheres that ensure the preservation and revitalisation of the heritage through appropriate spatial planning.

It is considered to be integrated conservation, which is a set of measures to ensure the continued existence and enrichment of the heritage, its maintenance, restoration, refurbishment, use and regeneration.

A1.2 English language terms

In the academic literature in English, as well as in English translations of individual national legislative documents, there is a relatively uncoordinated reference to individual terms which are increasingly or less understood (or translated) as ***refurbishment*** when they relate to the efficient use of energy in buildings.

The use of different terms for the same concept also occurs in other languages. By way of example, reference is made to the English term *rehabilitation* (see below), for which, inter alia, the terms Rehabilitierung*, Sanierung, Instandhaltung* and *Erneuerung* are used in the official German translations.

Renovation is a term of *renewal* that has been established in the EU and is used in European directives.

In the US and in countries where US terminology is summarised, this term is mainly, but not exclusively, used for measures to improve the energy performance of the building envelope.

One of the many interpretations of this term is that the result is in fact a building, which is new, but that it is based on an old building, that is to say, it is not just a very repaired old building.

Retrofit is an expression that has already been markedly withdrawn from practice in the EU, at least from the literary language. In the US and the countries where US terminology is summarised, it is mainly, but not exclusively, used to replace building systems (heating, cooling, ventilation, hot water preparation, lighting, installation of appliances) with more energy efficient ones.

Like retrofit, Refurbishment *is* not widely used in the EU today. It describes the return of the building to its original good condition, including improvements in energy use.

Rehabilitation is a term that is also used in academic literature, but nowadays mostly as a perhaps less suitable translation of the term' *renewal* 'from national languages into English when considering (only) the energy aspect. The definition of this term also differs from one geographical area to another. In the USA, for example, the term *rehabilitation indicates* a smaller scope of measures than *renovation*.

A.2nd Action (Ms: *Measure*; Also: *Step*)

In relation to *renovation*, a ***measure*** is**an** action designed or implemented **to improve the energy performance of a building, including the use of renewable energy sources.**

The measure may cover what is done, such as the installation of additional thermal protection, the sealing of the building furniture or the upgrading of the heating system, resulting in a direct physical modification of the building or part thereof.

The measure may consist of something to be concluded (i.e. a decision), e.g. adapting local fiscal policy to create a fund to increase the energy efficiency of buildings.

In practice, the *measure* can be understood **as an improvement** in (or a step towards) energy efficiency in the broadest sense.

A2. 1 Specificity in cultural heritage buildings

In the field of cultural heritage, the term' ***intervention' is*** used.

According to the Cultural Heritage Protection Act, the term 'introduction to heritage' includes all works, activities and practices which *in* any way alter the appearance, structure, internal relations and use of the heritage, or which destroy, degrade or alter its location, and in particular any alterations of heritage which are regarded as construction in accordance with regulations on the construction of buildings, work in the maintenance and use of the heritage, the transfer of heritage or parts thereof, activities and conduct carried out in connection with or directly with the heritage, and the search for other archaeological and heritage research.

According to this definition, when dealing with the energy performance of buildings, the term' *measure* 'can be understood as synonymous with the *intervention* when it comes to a building heritage.

A.3rd Standard refurbishment (Modernisation: Standard renovation)

The term' ***standard renovation*** 'is rarely used in our area. Conceptually, it may correspond to the description *of* ***the refurbishment in accordance with the minimum requirements of the regulations***.

The above-mentioned Global Buildings Performance Network report identifies a standard renovation as the one that delivers the minimum possible (NB: Obviously meant as minimum) energy **savings**. The report estimates these to be 20 % or 30 %, sometimes even less.

A.4th Partial refurbishment (Ms: *Partial renovation*)

In the case of ***partial renovation***, only part of the measures (two or more) which otherwise constitute a coherent complete set of technically feasible and cost-effective measures for the energy renovation of a specific building shall be implemented.

The provisions of the applicable technical regulation, now Article 2 of the Rules on the efficient use of energy in buildings (Official Gazette of the Republic of Slovenia Nos 52/10 and 61/17 – GZ), are complied with.

The effect of the partial renovation in terms of improving the energy indicators of the building is correspondingly worse and depends on the scope or number of measures.

Partial renovation is most justified if its actions are a phase of gradual renovation of the building.

A.5 Progressive renovation (Man: Step-by-step renovation; Also: Gradual renovation)

A gradual overhaul has already been identified in DSEPS 2015 as an overhaul in which the necessary measures to achieve a comprehensive energy renovation are implemented in a phased **manner**. As a general rule, the thermal envelope of the building is renovated first and then the technical systems in the building.

The gradual refurbishment thus consists of **successive partial renovations**, which must be carefully coordinated with each other.

A.6 Broad renovation (MS: *Wider renovation*)

Wider renovation is not necessarily linked to the improvement of the energy performance of a building or its energy renovation. As stated in Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings, wider renovation can be a **trigger** point **for energy renovation**.

It includes, for example, improving accessibility for persons with reduced mobility, improving the safety of the building (against fire, floods, earthquakes and risks related to defective electrical installations) or removing asbestos.

A.7 Substantial renovation (Ministry: *Substantial renovation*)

The concept of a ***major overhaul*** was introduced by the EED Directive (2012/27/EU). It applies mutatis mutandis (in particular) to installations. In the USA, it is mostly referred to as *retrofit*.

Under the Energy Act (EZ-1; Uradni list RS (UL RS; Official Gazette of the Republic of Slovenia) No 60/19 – official consolidated text) means renovation whose **costs exceed 50 % of the investment value for a new comparable production plant**.

A wide-ranging refurbishment is also used as a descriptive term for the ‘physical scope’ of the measures or for the ‘volume of renovation activities’, for example at national level.

The eco-fund has sometimes used this term in its calls for proposals to cover a certain total number of energy renovation measures.

A.8 Major renovation (Modern renewal: *Major renovation*)

The Energy Act defines ***major renovation*** as the reconstruction or maintenance of a building where the total cost of the renovation of the building envelope or technical building systems exceeds 25 per cent of the value of the building, excluding the value of the land on which it stands, or where more than 25 % of the surface area of the building envelope is renovated.

In so doing, it takes into account the wording of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast), which provides alternative options for a national definition of this term, namely the renovation of a building where (a) the total cost of the renovation of the building envelope or technical building systems exceeds 25 per cent of the value of the building’s value, excluding the value of the land on which it stands, or (b) more than 25 % of the surface area of the building envelope is renovated.

National requirements for minimum energy performance of buildings are linked to major renovations.

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 further specifies that major building renovations should **take into account** highly efficient alternative systems, where technically, functionally and economically feasible, and **address** the issues of healthy indoor climate conditions, fire safety and risks related to heavy seismic activity.

A.9 Minor refurbishment (MS: *Light renovation*)

On the basis of analyses prepared by the EU Building Stock Observatory, the Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings identifies ***a minor renovation*** than that where **primary energy savings are less than 30 %**.

A.10 Medium refurbishment (Modernisation: *Medium renovation*)

On the basis of analyses prepared by the EU Building Stock Observatory, Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings ***defines 'medium renovation*** ‘as one which accounts for **30-60 % of primary energy savings**.

A.11 Fundamental refurbishment (MS: *Deep renovation*)

On the basis of analyses prepared by the EU Building Stock Observatory, the Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings defines ***deep renovation*** as one where **more than 60 %** of**primary energy savings** are made.

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 lists deep renovation as a catalyst for the transformation of existing buildings into nearly zero-energy buildings (NZEBs).

Note: The term *comprehensive renovation* from some EU documents has also been translated in the past as *a radical overhaul*.

A.12 Comprehensive refurbishment (an equivalent: *Comprehensive renovation*, *integral renovation*)

The term *"comprehensive renovation* "refers to expected (large) primary energy savings and is already defined in SEEPS 2015:

Comprehensive energy renovation of a building is renovation where energy efficiency measures are implemented on the building envelope and on building technical systems in order to meet the minimum energy performance requirements set in application of Article 4 of Directive 2010/31/EU.

For comprehensive energy renovations of existing public buildings, in order to obtain financial incentives, the requirements shall be verified at the level of minimum energy performance requirements (coefficient of specific transmission heat losses, annual heat demand for heating the building, minimum thermal transient value of the external surface elements of the building and partitioning elements of the building, and achievement of a minimum RES share of the total energy input for the operation of the building).

Note:

The term' *comprehensive renovation* 'is sometimes used in the sense of a *wider renovation* (see above), which *also includes an aspect of energy* efficiency, i.e. in qualitative terms all measures to ensure a safe, healthy and comfortable living in a building in a cost-effective way, to address its construction and energy shortcomings, to reduce operating and maintenance costs and to extend the lifetime of the building.

A12.1 Specificity of cultural heritage buildings

Under the Cultural Heritage Protection Act (Uradni List RS (UL RS; Official Gazette of the Republic of Slovenia) Nos 16/08, 123/08, 8/11 – ORZVKD39, 90/12, 111/13, 32/16 and 21/18 – ZNOrg), the ***comprehensive renovation of cultural heritage buildings*** is a multidisciplinary activity involving experts in spatial sciences, architecture, construction, engineering and other engineering, conservation and restoration, including psychologists and economists, and others who ensure their tasks and operation and compliance with the measures to ensure its continued existence, restoration and restoration, including psychologists and economists.

In particular, the Guidelines for the Energy Renovation of Cultural Heritage Buildings define the ***comprehensive energy renovation of cultural heritage buildings***:

"buildings with recognisable building elements or protected as cultural heritage cannot normally be fully renovated in a way that does not adversely affect protected values. Therefore, this term designates the specificity of integrated energy renovation, excluding all measures that would unacceptably change the character or appearance of the building. The scope of the integrated energy renovation therefore depends on the architectural and historical importance of buildings, which must be taken into account."

In simplified terms, the comprehensive energy renovation of cultural heritage buildings includes only cultural protection conditions and/or cultural protection measures that have been validated to improve energy efficiency.

A12.2 Specificity in spatial planning

The term' *comprehensive renovation* 'is also used in spatial planning, but is indirectly linked to the area of energy efficiency and does not refer specifically to buildings.

The Spatial Planning Act (Uradni list RS (UL RS; Official Gazette of the Republic of Slovenia) No 61/17) lays down the principles and rules for spatial planning, the parties working in this field, the types of spatial planning documents, their content and interrelationships, the procedures for their preparation, adoption and implementation, and the combined planning and authorisation procedure. That law also defines 'area refurbishment', meaning various activities aimed at revitalising the degraded area, in order to ensure, through spatial planning and land policy instruments and other measures, the preservation of high-quality structures and the improvement of functional, technical, spatial and structural, residential, economic, social, cultural and environmental conditions.

A.13 Integrated renovation

The term' *comprehensive renovation* 'is sometimes used in practice in the sense of wider renovation, which also includes an aspect of energy efficiency.

In the national documents, it is used in the 2017 Supplement to the PSEPS in the title of two demonstration projects.

A.14 Low energy renovation (MS: *LOW-energy renovation*)

There is no definition of low energy renovation in the legislation.

According to the energy indicators achieved, it is classified as a standard and nearly zero energy renovation level, closer to the latter.

Taking into account the requirements of 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 as a catalyst for the transformation of existing buildings into nearly zero-energy buildings (SNES), the concept of low-energy renovation would correspond to a ***mean renovation*** which, in line with Commission Recommendation (EU) 2019/786 of 8 May 2019 on the renovation of buildings, is one of which amounts to 30-60 percent of primary energy savings.

A.15 Nearly zero energy renovation (see: *Nearly zero-energy renovation*)

The ***Nearly Zero Energy Refurbishment*** was introduced by DSEPS 2015:

"According to the prescribed legislation on minimum energy performance requirements in a building, there is still almost zero-energy renovation of the building."

It therefore refers specifically to the **renovation** that brings the building to **nearly zero energy levels in accordance** with **national legislation**.

In the above-mentioned report, the Global Buildings Performance Network explains that nearly zero energy renovation is a fundamental refurbishment where energy is fully supplied from renewable sources on site.

A.16 Sustainable renewal (Sustainable renewal: *Sustainable renovation*)

The term" ***sustainable renovation*** "describes renovation measures that take equal account of environmental, economic and social criteria.

The above-mentioned requirements of 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 also partly guide the content of ***major renovations*** along these principles.

In practice, assessment and assessment of sustainable renovations are linked to the use of dedicated methods and tools to evaluate building sustainability indicators. A system of sustainable construction indicators is also under preparation in Slovenia under LIFE IP CARE4CLIMATE.

A.16.1 Specificity of cultural heritage buildings

The standard SIST EN 16883:2017, Preservation of cultural heritage – Guidelines for improving the energy performance of historical buildings, adds fourth to the three fundamental aspects or pillars of the assessment of the sustainability of the renovation. This is a ***cultural aspect***, which states that the management of a cultural heritage building must preserve the cultural historical importance of the building for present and future generations.

Annex B List of PSO buildings for the implementation of the energy renovation of buildings

Legend:

SP group of buildings (Table 14)

PSO No serial number of the building or part of the building from the PSO building register

ESA the building has already been renovated in energy

KD **Z**: Cultural considerations must be taken into account
NZ: Cultural considerations are not required to be taken into account

PA a detailed study of the building's anti-seismic consolidation is needed
D: A modelling or actual seismic study has been carried out and the results show that the building achieves the required seismic resistance. Nevertheless, before carrying out an energy renovation, it is recommended that the seismic resilience of the building be examined in detail and that appropriate solutions be found for the integrity of the building's treatment.
ND: A modelling or actual seismic study has been carried out and the results show that the building does not meet the required seismic resistance, and it is therefore recommended that the seismic resistance of the building is examined in detail and appropriate solutions are found for the integrity of the building before carrying out the energy renovation.
NO: Model assessment not yet carried out

Table41: List of PSO building groups for energy refurbishment of buildings according to different aspects

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
1	7	General Secretariat of the Government of the Republic of Slovenia	1721	39	1898	9000,7	PSO buildings already renovated		D
1	8	General Secretariat of the Government of the Republic of Slovenia	1721	135	1930	2415,0			D
1	10	General Secretariat of the Government of the Republic of Slovenia	1721	147	1950	571,4			D
1	11	General Secretariat of the Government of the Republic of Slovenia	1721	166	1950	1593,2			D
1	53	MPA	2392	799	1960	1031,0			D
1	64	MPA	2175	3180	2011	639,0			D
1	72	MPA	166	1039	1969	1541,0			D
1	112	MPA	1200	444	1980	1483,6			D
1	187	MNZ	1738	1245	1992	3276,0			D
1	212	MNZ	2631	7002	2010	2549,6			D
1	227	MNZ	1200	444	1980	1121,8			D
1	233	MNZ	2477	256	2007	3124,0			D
1	281	MORS	2642	0	2010				D
1	350	MORS	2490	348	1920	4100,0			D
1	351	MORS	2490	1421	1967	2773,0			D
1	353	MORS	2490	1422	1969	2279,0			D

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
1	354	MORS	2490	350	1972	2008,0			D
1	357	MORS	2490	1709	1975	654,0			D
1	397	MP	1077	1672	1962	5311,2			D
1	441	MP	105	5935 (new 10460)	1911	5317,0			D
1	457	MP	850	458	1974	3448,5			D
1	477	MP	1200	444	1980	1013,2			D
2	3	General Secretariat of the Government of the Republic of Slovenia	2110	464	1287	1198,7	No	NZ	D
2	5	General Secretariat of the Government of the Republic of Slovenia	2103	651	2007	7434,1	No	NZ	D
2	13	MPA	1300	469	1974	826,0	No	NZ	D
2	14	MPA	1082	405	1971	1634,0	No	NZ	D
2	16	MPA	840	1	1980	1233,4	No	NZ	D
2	17	MPA	829	844	1997	1072,0	No	NZ	D
2	18	MPA	1783	1355	1980	423,0	No	NZ	D
2	19	MPA	1855	706	1982	2013,0	No	NZ	D
2	20	MPA	2175	53	1991	1261,8	No	NZ	D
2	22	MPA	2605	1640 (parts of the building 1,2,3)	1982	1509,9	No	NZ	D
2	23	MPA	2605	1647	1974	1095,5	No	NZ	D
2	24	MPA	2605	1161	1967	724,4	No	NZ	D
2	25	MPA	1730	4111	1968	2020,7	No	NZ	D
2	26	MPA	2706	140	1995	12691,5	No	NZ	D
2	27	MPA	1739	6087	1930	1231,1	No	NZ	D
2	31	MPA	2636	2780	1974	1138,0	No	NZ	D
2	35	MPA	108	15	1988	620,0	No	NZ	D
2	39	MPA	1456	10321	1980	2245,7	No	NZ	D
2	41	MPA	2455	190	1960	934,0	No	NZ	D
2	42	MPA	2455	460	1976	1357,0	No	NZ	D
2	43	MPA	753	2160	1975	262,9	No	NZ	D
2	46	MPA	1077	493	1960	432,5	No	NZ	D
2	56	MPA	1308	1283	2004	1130,1	No	NZ	D
2	60	MPA	1535	1474	1995	1023,2	No	NZ	D
2	61	MPA	1758	388	2009	383,3	No	NZ	D
2	62	MPA	184	922	1972	260,1	No	NZ	D
2	63	MPA	2626	3646	2005	711,0	No	NZ	D
2	65	MPA	2172	19	1960	622,1	No	NZ	D
2	73	MPA	1838	186	1993	411,0	No	NZ	D
2	81	MPA	2679	1381	1982	1265,2	No	NZ	D
2	82	MPA	1725	195	1980	661,0	No	NZ	D
2	83	MPA	1730	1386	1974	709,9	No	NZ	D
2	92	MPA	2016	1365	2009	661,0	No	NZ	D

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
2	93	MPA	2604	4946	2004	621,5	No	NZ	D
2	96	MPA	657	1110	1959	254,0	No	NZ	D
2	98	MPA	1515	970	1990	677,3	No	NZ	D
2	104	MPA	1308	193	1981	950,5	No	NZ	D
2	105	MPA	606	795	2009	846,8	No	NZ	D
2	106	MPA	2631	5463 (part of building 27)	2000	918,1	No	NZ	D
2	108	MPA	665	2219	2008	1057,7	No	NZ	D
2	109	MPA	2455	955	2000	863,5	No	NZ	D
2	113	MPA	2248	1306	2004	441,0	No	NZ	D
2	116	MPA	2001	31	1960	657,5	No	NZ	D
2	119	MFA	1725	64	1907	3251,0	No	NZ	D
2	128	MPA	2099	265	1999	251,8	No	NZ	D
2	130	MPA	2490	217	1920	440,8	No	NZ	D
2	131	MNZ	2392	159	1960	443,1	No	NZ	D
2	132	MNZ	2191	102	1979	900,4	No	NZ	D
2	133	MNZ	2207	1573	2000	659,7	No	NZ	D
2	134	MNZ	1300	778	1976	684,0	No	NZ	D
2	135	MNZ	1300	779	1976	3136,0	No	NZ	D
2	136	MNZ	1077	1714	1979	3887,6	No	NZ	D
2	137	MNZ	2118	1555	2008	2215,4	No	NZ	D
2	138	MNZ	1676	553	1981	2413,2	No	NZ	D
2	139	MNZ	1536	238	1993	912,7	No	NZ	D
2	140	MNZ	829	1270	1937	896,7	No	NZ	D
2	141	MNZ	407	676	2008	1485,6	No	NZ	D
2	153	MNZ	1783	1324 (part of building 101)	1969	526,4	No	NZ	D
2	154	MNZ	2555	21	1963	616,0	No	NZ	D
2	155	MNZ	2560	228	1963	676,0	No	NZ	D
2	156	MNZ	2357	1326	1985	1048,0	No	NZ	D
2	157	MNZ	2524	636	1980	522,0	No	NZ	D
2	158	MNZ	1577	430	2008	3681,6	No	NZ	D
2	159	MNZ	2605	405	1934	610,0	No	NZ	D
2	160	MNZ	2605	1389	1972	984,0	No	NZ	D
2	161	MNZ	2100	1064	1991	6010,0	No	NZ	D
2	162	MNZ	2169	92	1980	782,0	No	NZ	D
2	163	MNZ	1322	708	1978	907,0	No	NZ	D
2	164	MNZ	157	596	1987	692,7	No	NZ	D
2	165	MNZ	166	225	1950	623,1	No	NZ	D
2	166	MNZ	166	227	1975	450,0	No	NZ	D
2	167	MNZ	1725	68	1894	3026,0	No	NZ	D
2	168	MNZ	1725	305	1894	284,0	No	NZ	D
2	170	MNZ	1739	3110	1920	1335,0	No	NZ	D

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
2	172	MNZ	1725	358	1938	7852,0	No	NZ	D
2	176	MNZ	1737	364 (part of building 1-9)	1970	3290,0	No	NZ	D
2	177	MNZ	1775	597	1970	588,0	No	NZ	D
2	178	MNZ	1725	72	1984	603,6	No	NZ	D
2	179	MNZ	1772	1132 (part of building 6,10)	1980	701,9	No	NZ	D
2	180	MNZ	2636	727	1979	1906,1	No	NZ	D
2	181	MNZ	2636	275	1980	1457,0	No	NZ	D
2	182	MNZ	2636	298	1960	922,0	No	NZ	D
2	184	MNZ	1738	1270	1982	5996,8	No	NZ	D
2	185	MNZ	1738	1277	1984	797,9	No	NZ	D
2	186	MNZ	2683	53	1986	2526,7	No	NZ	D
2	188	MNZ	1730	4106	2005	6468,0	No	NZ	D
2	189	MNZ	1994	2712	2008	1361,6	No	NZ	D
2	196	MNZ	259	319	1982	999,3	No	NZ	D
2	197	MNZ	657	885	1905	1689,1	No	NZ	D
2	198	MNZ	658	44	1937	889,2	No	NZ	D
2	199	MNZ	658	855	1964	1241,6	No	NZ	D
2	200	MNZ	680	1210	1977	783,5	No	NZ	D
2	201	MNZ	1973	112	1979	774,3	No	NZ	D
2	202	MNZ	1515	1972	2007	2271,3	No	NZ	D
2	203	MNZ	920	400	1963	311,1	No	NZ	D
2	204	MNZ	105	2804	1981	2001,4	No	NZ	D
2	205	MNZ	105	9896	2005	3020,2	No	NZ	D
2	206	MNZ	2304	748	1980	2103,0	No	NZ	D
2	207	MNZ	2304	749	1980	318,0	No	NZ	D
2	208	MNZ	2304	750	1980	309,0	No	NZ	D
2	209	MNZ	2304	753	1980	1671,3	No	NZ	D
2	210	MNZ	1455	10206	1998	23573,0	No	NZ	D
2	211	MNZ	332	261	2007	506,4	No	NZ	D
2	213	MNZ	457	382	2007	1429,6	No	NZ	D
2	214	MNZ	2490	913	1986	1003,7	No	NZ	D
2	215	MNZ	400	3119	2002	1839,7	No	NZ	D
2	216	MNZ	2156	761	1964	507,0	No	NZ	D
2	217	MNZ	883	240	1965	505,2	No	NZ	D
2	218	MNZ	2635	1803	2008	2325,0	No	NZ	D
2	220	MNZ	2455	307	1971	566,6	No	NZ	D
2	221	MNZ	850	425	1984	753,1	No	NZ	D
2	222	MNZ	753	1587	1990	540,1	No	NZ	D
2	223	MNZ	1115	484	1976	702,4	No	NZ	D
2	224	MNZ	2315	1025	1960	338,0	No	NZ	D
2	225	MNZ	1476	3848	2005	1091,3	No	NZ	D

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
2	226	MNZ	2029	303	2002	1430,5	No	NZ	D
2	228	MNZ	121	1	2007	367,1	No	NZ	D
2	229	MNZ	2248	571 (part of building 6 and part of building 10)	1980	2775,5	No	NZ	D
2	230	MNZ	1871	820	1978	946,1	No	NZ	D
2	231	MNZ	2144	380	1995	976,0	No	NZ	D
2	232	MNZ	964	3701	1986	1116,0	No	NZ	D
2	234	MNZ	1886	102	1977	365,7	No	NZ	D
2	235	MNZ	997	949	1995	499,8	No	NZ	D
2	236	MPA	2120	910	1980	455,0	No	NZ	D
2	238	MPA	2636	1677	1988	346,1	No	NZ	D
2	241	MPA	2156	436	1995	342,8	No	NZ	D
2	242	MPA	850	424	1994	692,5	No	NZ	D
2	401	MP	1676	685	2000	895,3	No	NZ	D
2	403	MP	1959	5575 (part of the building 81,83,91)	1982	733,9	No	NZ	D
2	405	MP	1783	1344	1980	701,5	No	NZ	D
2	408	URSIKS	1700	646	1947	371,0	No	NZ	D
2	409	URSIKS	1700	479	1977	626,6	No	NZ	D
2	415	MP	2605	1199	1980	593,9	No	NZ	D
2	416	MP	2605	1981	1987	5416,1	No	NZ	D
2	418	URSIKS	2605	1986	2003	6226,2	No	NZ	D
2	419	MP	2100	862	1966	3019,0	No	NZ	D
2	426	MP	1838	54	1981	362,5	No	NZ	D
2	429	MP	1737	782	1991	1371,7	No	NZ	D
2	433	MP	1737	1919	1998	2920,9	No	NZ	D
2	434	URSIKS	1727	45	1965	2039,6	No	NZ	D
2	436	URSIKS	657	1929	1896	2283,0	No	NZ	D
2	437	MP	657	2168	1995	1547,7	No	NZ	D
2	438	MP	657	2700	2008	8491,4	No	NZ	D
2	440	URSIKS	105	3932	1900	863,1	No	NZ	D
2	442	MP	105	3953	1995	662,4	No	NZ	D
2	447	MP	1456	8	1999	265,9	No	NZ	D
2	448	MP	332	1115	2003	598,7	No	NZ	D
2	451	MP	400	4371	1995	1619,9	No	NZ	D
2	454	URSIKS	694	29	1915	1020,5	No	NZ	D
2	456	MP	2455	308	1960	1382,4	No	NZ	D
2	460	URSIKS	1398	127	1955	561,1	No	NZ	D
2	461	URSIKS	1400	18	1963	319,9	No	NZ	D
2	462	URSIKS	1400	17	1975	797,5	No	NZ	D
2	463	URSIKS	1400	16	1975	1596,7	No	NZ	D
2	476	MP	2035	1316	1928	1448,6	No	NZ	D

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
2	479	MP	1871	2098	1960	1284,1	No	NZ	D
2	480	URSIKS	1409	107	1920	405,5	No	NZ	D
2	482	MP	964	3590	1975	1531,9	No	NZ	D
2	485	MPA	1725	378	1933	2508,0	No	NZ	D
2	486	MPA	1722	696	1975	275,5	No	NZ	D
2	487	MINISTRY OF INFRASTRUCTURE	1737	221	1938	5512,8	No	NZ	D
2	488	SLOVENIAN INFRASTRUCTURE AGENCY	2168	17	1974	461,1	No	NZ	D
2	489	SLOVENIAN INFRASTRUCTURE AGENCY	338	1114	1995	296,0	No	NZ	D
2	490	SLOVENIAN INFRASTRUCTURE AGENCY	2205	27	1960	371,3	No	NZ	D
2	491	SLOVENIAN INFRASTRUCTURE AGENCY	2076	145	2002	360,0	No	NZ	D
2	492	RS-RS	1725	286	1966	2082,1	No	NZ	D
3	2	National Assembly of the Republic of Slovenia	1725	67	1959	7500,0	No	Z	D
3	12	General Secretariat of the Government of the Republic of Slovenia	1723	2875	1949	1367,0	No	Z	D
3	21	MPA	1577	101	1957	495,1	No	Z	D
3	28	MPA	1725	367	1953	4567,0	No	Z	D
3	29	MPA	1725	34	1980	908,0	No	Z	D
3	32	MPA	679	9	1980	2310,9	No	Z	D
3	33	MPA	657	2318	1992	6412,0	No	Z	D
3	34	MPA	105	10144	2002	795,6	No	Z	D
3	36	MPA	105	1886	1976	558,2	No	Z	D
3	37	MPA	2304	337	1975	2677,0	No	Z	D
3	38	MPA	1483	473	1980	2595,0	No	Z	D
3	40	MPA	400	2880	1979	1058,2	No	Z	D
3	49	MPA	1737	480	1993	9778,7	No	Z	D
3	51	MPA	657	852	1990	1256,9	No	Z	D
3	52	MPA	1737	989	2002	3929,2	No	Z	D
3	54	MPA	2392	244	1910	290,0	No	Z	D
3	55	MPA	2392	80 (part of the building 6,7,8)	1925	264,3	No	Z	D
3	66	MPA	1577	120	1910	1044,0	No	Z	D
3	74	MPA	1737	209	1980	3812,4	No	Z	D
3	76	MPA	1725	414	1874	572,6	No	Z	D
3	78	MPA	1721	190	1950	677,0	No	Z	D
3	85	MPA	1725	36	1980	8038,7	No	Z	D
3	91	MPA	1720	10	1980	842,4	No	Z	D
3	94	MPA	657	1746	1973	3645,3	No	Z	D
3	95	MPA	657	866	1966	1364,3	No	Z	D

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
3	97	MPA	2605	1020	1713	371,0	No	Z	D
3	99	MPA	105	504	1995	299,3	No	Z	D
3	100	MPA	105	1882	1929	1173,2	No	Z	D
3	102	MPA	2304	448	1970	477,8	No	Z	D
3	103	MPA	1456	85	2006	1146,0	No	Z	D
3	110	MPA	1115	1023	1904	724,3	No	Z	D
3	111	MPA	1115	1074	1982	1393,5	No	Z	D
3	114	MPA	964	3522	1997	1553,5	No	Z	D
3	115	MPA	964	4732 (part of building 4,6,8,12,15)	2009	1740,0	No	Z	D
3	117	MPA	1886	161	1850	699,8	No	Z	D
3	125	MPA	1077	3286	1990	263,5	No	Z	D
3	126	MPA	2605	124	1993	280,0	No	Z	D
3	240	MPA	2636	2845	1965	3087,0	No	Z	D
3	393	MP	2392	244	1910	559,8	No	Z	D
3	394	MP	1300	279	1909	2196,4	No	Z	D
3	395	MP	1077	3118	2004	522,0	No	Z	D
3	396	MP	1077	3286	1990	3071,2	No	Z	D
3	400	URSIKS	1077	1735	1968	862,1	No	Z	D
3	404	MP	184	516	1978	1744,0	No	Z	D
3	412	MP	2175	487	1930	2047,8	No	Z	D
3	414	MP	1577	120	1910	432,2	No	Z	D
3	422	MP	1322	780	2007	576,9	No	Z	D
3	425	MP	166	1090	1904	931,4	No	Z	D
3	428	MP	1737	466	1974	319,0	No	Z	D
3	439	MP	657	1715	1897	10897,2	No	Z	D
3	443	MP	2304	447	2008	3028,9	No	Z	D
3	444	MP	2304	761	1963	2885,7	No	Z	D
3	449	MP	2630	162	1910	1247,3	No	Z	D
3	452	MP	400	1154	1250	1768,1	No	Z	D
3	453	MP	2156	653	1905	1374,0	No	Z	D
3	455	MP	1379	298	1948	581,0	No	Z	D
3	458	MP	753	1960	1904	515,7	No	Z	D
3	493	CP-RS	1725	438	1882	2093,4	No	Z	D
4	15	MPA	1959	5573 (part of building 57)	1982	762,8	No	NZ	ND
4	59	MPA	1676	1577	1970	339,0	No	NZ	ND
4	75	MPA	1721	73	1920	691,2	No	NZ	ND
4	79	MPA	2679	950	2002	737,5	No	NZ	ND
4	80	MPA	2679	824	1980	469,0	No	NZ	ND
4	84	MPA	1725	434	1905	1972,8	No	NZ	ND
4	88	MPA	2679	559	1980	683,5	No	NZ	ND

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
4	90	MPA	2679	957	1980	21381,4	No	NZ	ND
4	118	MPA	996	1518	1960	306,9	No	NZ	ND
4	120	MFA	1725	66	1907	7527,0	No	NZ	ND
4	121	MFA	1725	60	1940	605,7	No	NZ	ND
4	122	MFA	1940	210	1268	3087,6	No	NZ	ND
4	169	MNZ	1751	64	1900	790,9	No	NZ	ND
4	171	MNZ	1739	3107	1920	746,0	No	NZ	ND
4	173	MNZ	1739	3111	1940	1299,5	No	NZ	ND
4	174	MNZ	1727	129	1980	940,0	No	NZ	ND
4	175	MNZ	1737	410	1965	897,9	No	NZ	ND
4	183	MNZ	1722	912	1981	1386,0	No	NZ	ND
4	219	MNZ	1379	1563	1945	640,7	No	NZ	ND
4	424	MP	532	907	1950	631,2	No	NZ	ND
4	430	MP	1723	5537	2006	1826,2	No	NZ	ND
5	1	National Assembly of the Republic of Slovenia	1725	451	1879	4670,0	No	Z	ND
5	4	General Secretariat of the Government of the Republic of Slovenia	2103	52	1510	3692,0	No	Z	ND
5	9	General Secretariat of the Government of the Republic of Slovenia	1721	143	1950	5267,0	No	Z	ND
5	30	MPA	2636	7812	1962	783,7	No	Z	ND
5	45	MPA	996	1414	1936	786,4	No	Z	ND
5	48	MPA	1737	470	1950	1980,0	No	Z	ND
5	50	MPA	1728	481	1910	824,9	No	Z	ND
5	57	MPA	1077	1439	1896	2152,5	No	Z	ND
5	68	MPA	2100	823	1963	718,0	No	Z	ND
5	70	MPA	1322	831	1908	268,6	No	Z	ND
5	77	MPA	1728	443	1947	4546,0	No	Z	ND
5	87	MPA	1725	368	1964	5726,5	No	Z	ND
5	89	MPA	1725	382	1960	2042,0	No	Z	ND
5	107	MPA	2490	73	1938	1366,8	No	Z	ND
5	124	MPA	1737	222	2003	3597,6	No	Z	ND
5	239	MPA	1727	808	1975	2118,0	No	Z	ND
5	399	URSIKS	1077	1340	1810	4124,8	No	Z	ND
5	402	MP	1535	231	1958	820,5	No	Z	ND
5	406	MP	2357	1725	1900	648,3	No	Z	ND
5	407	MP	2357	588	1955	310,9	No	Z	ND
5	410	URSIKS	1700	854	1650	3007,7	No	Z	ND
5	411	MP	2525	227	1850	946,4	No	Z	ND
5	413	MP	1911	527	1890	679,4	No	Z	ND
5	420	MP	2100	823	1963	750,0	No	Z	ND
5	423	MP	1322	840	1890	1916,5	No	Z	ND
5	427	MP	1737	703	1922	1055,8	No	Z	ND
5	431	MP	1737	516	1963	512,1	No	Z	ND

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
5	432	MP	1737	354	1902	15550,3	No	Z	ND
5	435	MP	259	610 (part of building 1,2)	1960	1166,5	No	Z	ND
5	446	MP	1456	683	1899	6082,8	No	Z	ND
5	450	MP	2490	136	1905	398,1	No	Z	ND
5	478	MP	2248	609	1700	762,1	No	Z	ND
5	483	MP	2002	650	1554	836,2	No	Z	ND
5	484	MP	996	1365	1961	855,0	No	Z	ND
6	6	General Secretariat of the Government of the Republic of Slovenia	2103	53	1974	8200,0	No	Z	NO
6	44	MPA	2316	1857, 1859	1980	1898,0	No	Z	NO
6	44	MPA	2316	1857, 1859	1980	1898,0	No	Z	NO
6	47	MPA	1074	3317 and 3617	2006	442,5	No	Z	NO
6	47	MPA	1074	3317 and 3617	2006	442,5	No	Z	NO
6	58	MPA	1077	3098, 3086	2003	2470,5	No	Z	NO
6	58	MPA	1077	3098, 3086	2003	2470,5	No	Z	NO
6	67	MPA	2605	1411	1995	259,0	No	Z	NO
6	71	MPA	1322	705, 704	1980	406,6	No	Z	NO
6	71	MPA	1322	705, 704	1980	406,6	No	Z	NO
6	86	MPA	2636	2735	1960	4875,0	No	Z	NO
6	101	MPA	105	3959	1995	1543,0	No	Z	NO
6	142	MNZ	1583	81	1965	523,3	No	Z	NO
6	143	MNZ	1583	76	1955	346,6	No	Z	NO
6	144	MNZ	1583	73	1910	525,0	No	Z	NO
6	145	MNZ	1583	65	1965	378,4	No	Z	NO
6	146	MNZ	1583	63	1991	259,2	No	Z	NO
6	147	MNZ	1583	59	1964	431,4	No	Z	NO
6	148	MNZ	1583	58	1910	514,7	No	Z	NO
6	149	MNZ	1583	45	1963	388,0	No	Z	NO
6	150	MNZ	1583	38	1920	252,3	No	Z	NO
6	151	MNZ	1583	27	1920	145,3	No	Z	NO
6	152	MNZ	1583	23	1971	195,4	No	Z	NO
6	190	MNZ	1751	845	1970	4389,2	No	Z	NO
6	191	MNZ	1751	79	1976	1825,7	No	Z	NO
6	192	MNZ	1751	67	1985	1657,6	No	Z	NO
6	193	MNZ	1751	54	1900	3178,7	No	Z	NO
6	194	MNZ	1751	59	1971	4401,4	No	Z	NO
6	195	MNZ	1751	53	1970	2803,7	No	Z	NO
6	237	MPA	2636	2706, 2599	1980	4834,6	No	Z	NO
6	237	MPA	2636	2706, 2599	1980	4834,6	No	Z	NO
6	243	MORS	2306	5	1960	467,0	No	Z	NO
6	244	MORS	2306	712	1960	331,0	No	Z	NO

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
6	245	MORS	2306	713	1979	418,0	No	Z	NO
6	246	MORS	2306	6	1994	1950,0	No	Z	NO
6	249	MORS	2194	374	1988	2040,0	No	Z	NO
6	250	MORS	2194	370	1992	2200,0	No	Z	NO
6	251	MORS	2194	372	1930	1310,0	No	Z	NO
6	252	MORS	2194	373	1930	1310,0	No	Z	NO
6	253	MORS	2194	627	1930	810,0	No	Z	NO
6	254	MORS	2194	632	1930	630,0	No	Z	NO
6	255	MORS	2194	631	1930	540,0	No	Z	NO
6	256	MORS	2194	313	1988	456,0	No	Z	NO
6	257	MORS	2194	626	1930	338,0	No	Z	NO
6	258	MORS	2194	628	1930	560,0	No	Z	NO
6	259	MORS	1077	965	1895	9480,0	No	Z	NO
6	260	MORS	1077	858	1965	886,0	No	Z	NO
6	261	MORS	1077	2133	1934	2967,0	No	Z	NO
6	262	MORS	1077	950	1930	2100,0	No	Z	NO
6	263	MORS	1077	854	1895	1116,0	No	Z	NO
6	264	MORS	1077	848	1895	904,0	No	Z	NO
6	265	MORS	1077	855	1965	264,0	No	Z	NO
6	266	MORS	3102	792	1955	1939,0	No	Z	NO
6	267	MORS	1302	732	1957	1438,0	No	Z	NO
6	268	MORS	1302	920	1948	1358,0	No	Z	NO
6	269	MORS	1302	914	1948	1358,0	No	Z	NO
6	270	MORS	1302	915	1950	1483,0	No	Z	NO
6	271	MORS	1302	921	1948	1335,0	No	Z	NO
6	272	MORS	1302	919	1948	1358,0	No	Z	NO
6	273	MORS	1302	918	1948	1358,0	No	Z	NO
6	274	MORS	1302	916	1948	1358,0	No	Z	NO
6	275	MORS	1302	917	1972	776,0	No	Z	NO
6	276	MORS	1301	1787	1969	259,0	No	Z	NO
6	277	MORS	1301	683	1963	259,0	No	Z	NO
6	278	MORS	1302	948	1962	428,0	No	Z	NO
6	279	MORS	1302	867	1969	324,0	No	Z	NO
6	280	MORS	2642	432	1975	809,0	No	Z	NO
6	282	MORS	699	129	1960	407,0	No	Z	NO
6	283	MORS	1700	120	1961	420,0	No	Z	NO
6	284	MORS	1706	482	1980	257,0	No	Z	NO
6	285	MORS	2101	317	1974	640,0	No	Z	NO
6	286	MORS	2101	371	1964	2428,0	No	Z	NO
6	287	MORS	2101	340	1975	1842,0	No	Z	NO
6	288	MORS	2101	303	1960	3410,0	No	Z	NO
6	289	MORS	2101	307	1974	651,0	No	Z	NO
6	290	MORS	2134	224	1976	800,0	No	Z	NO

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
6	291	MORS	2101	313	1939	520,0	No	Z	NO
6	292	MORS	2101	339	1975	386,0	No	Z	NO
6	293	MORS	2101	304	1940	506,0	No	Z	NO
6	294	MORS	2101	353	1975	1428,0	No	Z	NO
6	295	MORS	2101	343	1975	270,0	No	Z	NO
6	296	MORS	1754	1292	1985	3872,0	No	Z	NO
6	297	MORS	1730	2298	1976	3805,0	No	Z	NO
6	298	MORS	1730	2330	1976	3805,0	No	Z	NO
6	299	MORS	1730	2333	1976	3653,0	No	Z	NO
6	300	MORS	1730	2331	1976	3805,0	No	Z	NO
6	301	MORS	1730	1415	1995	14437,0	No	Z	NO
6	302	MORS	1736	1267	1980	7926,0	No	Z	NO
6	303	MORS	1736	1276	1980	2982,0	No	Z	NO
6	304	MORS	1736	1275	1980	2999,0	No	Z	NO
6	305	MORS	2636	628	1974	3920,0	No	Z	NO
6	306	MORS	1759	796	1982	704,0	No	Z	NO
6	307	MORS	1730	2085	1976	718,0	No	Z	NO
6	308	MORS	1730	2297	1976	484,0	No	Z	NO
6	309	MORS	1730	2297	1976	484,0	No	Z	NO
6	310	MORS	1754	254	1978	443,0	No	Z	NO
6	311	MORS	1730	4090	1077	455,0	No	Z	NO
6	312	MORS	1754	230	1900	308,0	No	Z	NO
6	313	MORS	1736	1303	1980	796,0	No	Z	NO
6	314	MORS	1754	225	1939	308,0	No	Z	NO
6	316	MORS	659	1918	1985	4581,0	No	Z	NO
6	317	MORS	659	1978	1986	3600,0	No	Z	NO
6	318	MORS	676	1320	1980	2787,0	No	Z	NO
6	319	MORS	1077	965	1895	9480,0	No	Z	NO
6	320	MORS	659	2338	1974	1250,0	No	Z	NO
6	321	MORS	657	2576	1989	1074,0	No	Z	NO
6	324	MORS	659	1871	1969	556,0	No	Z	NO
6	325	MORS	659	2430	1974	392,0	No	Z	NO
6	326	MORS	659	1694	1986	374,0	No	Z	NO
6	328	MORS	659	1789	1969	360,0	No	Z	NO
6	331	MORS	2003	1291	1980	760,0	No	Z	NO
6	332	MORS	105	216	1948	978,0	No	Z	NO
6	333	MORS	105	226	1995	1136,0	No	Z	NO
6	334	MORS	105	230	1948	330,0	No	Z	NO
6	335	MORS	105	228	1948	338,0	No	Z	NO
6	336	MORS	105	229	1948	337,0	No	Z	NO
6	337	MORS	1455	1045	1950	3895,0	No	Z	NO
6	338	MORS	1455	948	1950	3015,0	No	Z	NO
6	339	MORS	1455	982	1950	3015,0	No	Z	NO

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
6	340	MORS	1455	981	1950	3015,0	No	Z	NO
6	341	MORS	1455	978	1976	1098,0	No	Z	NO
6	342	MORS	1455	1047	1974	616,0	No	Z	NO
6	343	MORS	1455	944	1965	529,0	No	Z	NO
6	344	MORS	1456	667	1949	271,0	No	Z	NO
6	345	MORS	1455	984	1975	255,0	No	Z	NO
6	346	MORS	676	1320	1980	2787,0	No	Z	NO
6	347	MORS	2151	53	1980	2765,0	No	Z	NO
6	348	MORS	2151	52	1981	1650,0	No	Z	NO
6	359	MORS	2490	1441	1995	958,0	No	Z	NO
6	360	MORS	2490	220	1960	406,0	No	Z	NO
6	361	MORS	2490	218	1950	296,0	No	Z	NO
6	362	MORS	753	2472	1978	2959,0	No	Z	NO
6	363	MORS	753	2465	1978	2084,0	No	Z	NO
6	364	MORS	753	2471	1907	1347,0	No	Z	NO
6	365	MORS	753	2466	1978	281,0	No	Z	NO
6	366	MORS	1706	482	1980	257,0	No	Z	NO
6	367	MORS	2134	224	1976	800,0	No	Z	NO
6	368	MORS	2401	625	1920	9680,0	No	Z	NO
6	369	MORS	2401	624	1960	1304,0	No	Z	NO
6	370	MORS	2401	632	1960	913,0	No	Z	NO
6	371	MORS	2401	631	1960	421,0	No	Z	NO
6	372	MORS	2401	107	1960	300,0	No	Z	NO
6	373	MORS	2001	48	1980	4050,0	No	Z	NO
6	374	MORS	2001	46	1979	2167,0	No	Z	NO
6	375	MORS	2001	45	1970	870,0	No	Z	NO
6	376	MORS	2002	3124	1978	751,0	No	Z	NO
6	377	MORS	2002	2528	1775	528,0	No	Z	NO
6	378	MORS	2002	2533	1975	550,0	No	Z	NO
6	379	MORS	2002	2523	1975	480,0	No	Z	NO
6	380	MORS	2002	2526	1975	479,0	No	Z	NO
6	381	MORS	2002	2527	1972	478,0	No	Z	NO
6	382	MORS	2002	2529	1975	478,0	No	Z	NO
6	383	MORS	2002	2543	1975	481,0	No	Z	NO
6	384	MORS	2002	2525	1975	485,0	No	Z	NO
6	385	MORS	2002	2524	1975	483,0	No	Z	NO
6	386	MORS	2002	2317	1975	462,0	No	Z	NO
6	387	MORS	2002	2532	1975	397,0	No	Z	NO
6	388	MORS	2001	39	1972	411,0	No	Z	NO
6	389	MORS	2001	536	1972	339,0	No	Z	NO
6	390	MORS	2001	534	1972	293,0	No	Z	NO
6	391	MORS	2002	1291	1980	760,0	No	Z	NO
6	392	MORS	2002	2531	1975	614,0	No	Z	NO

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
6	417	MP	2605	1411	1995	2164,7	No	Z	NO
6	421	MP	2100	515	2003	685,0	No	Z	NO
6	445	MP	2304	448	1970	431,1	No	Z	NO
6	459	MP	1138	816	1890	524,5	No	Z	NO
6	464	URSIKS	1400	27	1963	2607,7	No	Z	NO
6	465	URSIKS	1400	24	1963	1329,0	No	Z	NO
6	466	URSIKS	1400	23	1963	1325,0	No	Z	NO
6	467	URSIKS	1400	22	1963	1332,0	No	Z	NO
6	468	URSIKS	1400	20	1963	1088,0	No	Z	NO
6	469	URSIKS	1400	76	1963	844,0	No	Z	NO
6	470	URSIKS	1400	36	1982	2192,0	No	Z	NO
6	471	URSIKS	1400	34	1975	4598,0	No	Z	NO
6	472	URSIKS	1400	49	1963	1468,0	No	Z	NO
6	473	URSIKS	1400	43	1985	1351,0	No	Z	NO
6	474	URSIKS	1400	45	1965	683,0	No	Z	NO
6	475	URSIKS	1400	39	1963	971,8	No	Z	NO
6	481	MP	1422	760	1989	329,2	No	Z	NO
7	69	MPA	1322	826	1956	424,0	No	NZ	NO
7	247	MORS	2594	140	1907	4555,0	No	NZ	NO
7	248	MORS	2594	491	1950	800,0	No	NZ	NO
7	315	MORS	659	1536	1857	16148,0	No	NZ	NO
7	349	MORS	2490	1418	1920	5820,0	No	NZ	NO
7	352	MORS	2490	1902	1920	2718,0	No	NZ	NO
7	355	MORS	2490	1903	1967	1380,0	No	NZ	NO
7	356	MORS	2490	1708	1920	752,0	No	NZ	NO
7	358	MORS	2490	1423	1969	354,0	No	NZ	NO
7	398	MP	1077	1331	1960	938,0	No	NZ	NO
7	494	MP	1737	303	1928	779,5	No	NZ	NO
7	495	MP	1737	364	1970	1530	No	NZ	NO
7	496	MP	1725	472	1963	2.381.60	No	NZ	NO
7	497	MP	657	1746	1973	479,30	No	NZ	NO
7	498	MP	850	643	1997	337,00	No	NZ	NO
7	499	MP	1115	1244	1961	320,80	No	NZ	NO
7	500	MK	1737	226	1849	2.050.70	No	Z	NO
7	501	Archives of the Republic of Slovenia	1728	367	1774	3.098.00	No	Z	NO
7	502	Archives of the Republic of Slovenia	1728	367	1978	1.458.00	No	NZ	NO
7	503	Archives of the Republic of Slovenia	1727	594	1891	3.799.90	No	Z	NO
7	504	MK	384	2	1900	8.412.00	No	Z	NO
7	505	MK	1331	774	1234	6.731.00	No	Z	NO
7	506	MK	462	1, 94	13rd chair	2.833.50	No	Z	NO
7	507	MK	2181	515	1856	223,30	No	Z	NO

SP	PSO No	Operator	K.o. No.	Building number	Year Built	AU [m²]	ESA	KD	PA
7	508	MK	2181	218	1888	281,50	No	Z	NO
7	509	MK	208	397	1612	1.384.40	No	Z	NO
7	510	MK	1711	1949	1520	1.600.00	No	Z	NO
7	511	MK	632	201, 195, 667, 214	1885	2.484.10	No	Z	NO
7	512	MK	2598	19	1924	269	No	Z	NO
7	513	MK	1518	252, 282	1870	2.738.56	No	Z	NO
7	514	MK	1321	1845	1580	2.739.20	No	Z	NO
7	515	MK	1535	1316	1954	1.148.50	No	Z	NO
7	516	MK	1648	73, 74, 75, 217	1863	2.590	No	Z	NO
7	517	MK	1648	77	1700	187,30	No	Z	NO
7	518	MK	2474	101	1850	369,00	No	Z	NO
7	519	MK	1253	350	1730	1.822.80	No	Z	NO
7	520	MK	1986	373	1550	148,7	No	Z	NO

- the MC buildings are not taken into account in the context of the analysis of the narrow public sector.

Annex C C Cost-effective energy renovation

C.1 Characteristics of the building stock and triggers for energy renovation

Despite the diversity of buildings, it is possible to identify common characteristics of older buildings and to classify them according to periods of construction (Preglednica 42). An overview of the basic construction-physical characteristics of the existing building stock by period shows which measures would be possible and meaningful for individual buildings in the context of an integrated energy renovation of residential and non-residential buildings.

Table42: Characteristics of each age group of buildings

Until 1945 (period before World War II)
Pre-war buildings (until 1945) are solidly built. The external walls are above average thickness, brick, ceilings are mostly wooden, trams, cellar and stones. Roofs and sunsets are not isolated if architectural and energy renovation measures have not yet been implemented. The roofs are largely renovated and insulated (as a general rule too small for today's requirements), if the undergrounds are housed and exploited, and the cover is replaced. Windows are small, wooden. Buildings are mostly poorly maintained and, due to their age, require a comprehensive renovation that includes not only energy renovation but also architectural and construction renovation. The weakness of the buildings during this period is their seismic resistance. Systems and installations in buildings from this period have, as a general rule, been modernised in the past. Mechanical ventilation is not frequent in these buildings. Due to mass construction and high thermal accumulation in these buildings, cooling systems are not common, even for non-residential use. Buildings may also be subject to site protection, so all planned measures must be subject to prior checking and approved by the consenting authorities. **The most important triggers for the renovation of buildings from this period are**: The sale of the building to the new owner and therefore the different needs of the user, the planned wider renovation in other areas, as well as the recovery of the consequences of natural disasters (in the context of post-earthquake reconstruction[32] or flood recovery).
1946-1980
The housing stock of the first post-war period up to the mid-s is mostly built inferior or, at most, the same quality as buildings built up up to 1945, mainly due to the scarcity and saving of building materials and later due to new construction technologies where energy use has not yet been a major factor. The walls are reduced to 30 cm due to the entry into force of modular bricks and insulation materials are not yet present during this period. Most residential buildings are built with modular bricks. Otherwise, cast concrete with insufficient thermal insulation, slag bricks, filter ash bricks are subsequently used under construction. Buildings are mostly in need of thorough energy and construction renovation, window replacement and other maintenance measures. Non-residential buildings were often built **in different prefabricated technologies during the second half of this period**, which is the case for both the construction system and the

[32] For example, the post-earthquake renovation of Poso buildings, which also included energy efficiency.

envelope. The poor air-tightness of the building envelope and the poor thermal protection of the envelope are therefore a major problem for these buildings, especially for increasing glazed surfaces, often without efficient shading, which are also unfavourable due to the summer overheating of the rooms. Commercial buildings from the second half of this period often have built-in ventilation and cooling systems.

The most critical building stock to be refurbished is precisely that period, mainly single-family houses, mainly self-building houses, then multi-dwelling houses and ultimately apartment blocks of all kinds.

Non-residential buildings from this period pose a major technical and financial challenge in refurbishment, as they require comprehensive functional, static and anti-seismic renovation with an otherwise deep energy renovation. Another problem from the point of view of renovation is the fact that many of these buildings are architectural heritage and therefore, especially when renovating the envelope, account must be taken of the provisions relating to the protection of cultural heritage buildings.

The most important triggers for the renovation of buildings from this period are: Change of ownership, change in the way it is used, planned wider renovation with technical upgrades and financial incentives adapted to the buildings of the period (in particular housing).

1981-2002

In the **eighties** there has been a period of intensive construction of large residential and business areas. The first somewhat stricter regulations (JUS.U.J5.600) required greater controls on the construction of multi-storey residential buildings (mainly towers). The construction is either massive with an additional layer of thermal insulation or skeletal with bricked facade fillers. The predominant material for the construction of multi-storey structures is concrete, even cast, in all shutting systems. The private housing stock is built in a style, mainly from bricks, houses are large floor areas and bricks, some without thermal protection, others already thermally insulated, as well as those with inadequate "thermal insulation", using, for example, siporex, porolite, air. New materials and self-building blocks create problems and inconsistencies in the implementation (fume, sealing, sealing). The windows are large during this period, aluminium or wood frames and mostly energy-inadequate (single-layer glazing is used, and most often an inefficient insulating glazing (thermopan)*insulating*windows).

The energy renovation of these buildings was initially mainly based on the replacement of unsuitable building furniture and additional thermal insulation – mainly roofs and ceilings and the rehabilitation of major thermal bridges – and the development of energy efficiency over the last two decades is undergoing comprehensive renovation, most often in conjunction with a wider renovation which also includes other technical improvements and architectural adaptations, most often in the event of a change of ownership.

Over the **ninety** years, construction becomes very diverse and the intensity of construction of concrete settlements is decreasing. Light prefabricated construction is carried out on brick-and-mortar construction, mainly in single-family houses. Concrete bricks and exposed thermal bridges are reduced and the proportion of brick outs is increased by thermal insulation of all structural assemblies. Houses are on average better thermally insulated than in the eighties, and built-in windows are wooden, aluminium and PVC. Everywhere, two-layered insulating (*thermopan*) glazing prevails.

New legislation was drawn up in the nineties and, in the meantime, the design of buildings took into account the current rules of the profession.

In the second half of the nineties, grants for energy improvements on the wrapping (surface insulation, installation of low-emission gas-filled glazing, setting of oil burners) are being

made available for the first time, energy audits are being introduced for non-residential buildings and the first energy renovations are being carried out. **The most important triggers for the renovation of buildings from this period are**: Change of ownership, change in the way it is used, planned wider renovation with technical upgrades and financial incentives adapted to the buildings of the period.
2003-2008
We consider that buildings built in the **period after 2002 to 2008** are already better thermally insulated, so it makes sense to insulate the building with additional thermal insulation only when individual structural components are damaged or are intended to be replaced, often for functional and aesthetic reasons (e.g. windows). In addition, it makes sense to isolate only the inclined roof above the heated understress. The systems in the buildings from this period are slowly over-exploited and, to a large extent, no replacements have taken place so far. In 2002, the first national PTZURES Rules were issued, which introduced the requirements of the original Directive 2002/91/EC in the field of energy performance of buildings and outlined rapid developments in this area, thus making the construction of buildings more energy efficient compared to previous periods.

The most common measures for the energy renovation of residential buildings are:

Measures on the building envelope

- carrying out the thermal insulation of the facade
- replacement of existing and installation of new energy efficient windows/doors
- construction of thermal insulation of the ceiling against unheated space
- thermal insulation of the cellar or floor
- remediation of thermal bridges

Measures on heating system

- installation of efficient wood biomass combustion plants
- installation of a heat pump for domestic hot water preparation and/or central heating
- installation of heat substations or stations to connect to the heat-water district heating network
- installation of high-efficiency combined heat and power plants
- installation of a condensing gas boiler
- hydraulic balancing of the heating system
- central control of the heating system
- local regulation
- thermal protection of the drainage network
- replacement of end-of-life heating products
- improvements in fans, pumps
- installation of frequency control

Measures on the ventilation and air conditioning system

- mechanical ventilation with heat recovery of discarded air – central
- mechanical ventilation with heat recovery of discarded air – local
- installation of waste air heat return transferors
- installation of a cold generator and modernisation of cooling systems

Measures for the use of sanitation

- installation of a heat pump for domestic hot water preparation and/or central heating

- installation of heat substations or stations to connect to the heat-water district heating network
- installation of a condensing gas boiler
- installation of efficient wood biomass combustion plants

Measures concerning the use of electricity

- energy-saving lighting
- energy-saving electrical appliances
- installation of installations or construction of power generating facilities from solar, water or wind energy
- installation of high-efficiency combined heat and power plants

Measures for electricity generation

- installation of installations or construction of power generating facilities from solar, water or wind energy
- installation of high-efficiency combined heat and power plants

An overview of the maximum permissible thermal transient of building envelope elements by typical age periods of construction is shown inPreglednica 43.

Table43: Overview of the maximum permissible thermal transient of envelope elements [W/(m2K)]

Structural assembly	Regulation 1970	Jus – III.c. 1980	Regulation 2002	Regulation 2010
External wall	1.28-1.68	0,80	0,60	0,28
Soil on the ground	0,93	0,65	0,45	0,30
Wall towards terrain	No request	0,80	0,70	0,35
Ceiling above a non-heated cellar	1,04	0,50	0,50	0,35
Ceiling against unheated understress	1,16	0,70	0,35	0,20
Light inclined roof over heated space	0,93	0,35	0,20	0,20
Windows	3,00	3,00	1.4-1.6	1,30

C.2 Calculation of cost-optimal levels

Establishment of reference buildings

In Slovenia, for the purpose of a cost-optimal methodology, reference buildings have been identified for the following types of buildings:

- one-dwelling residential buildings;
- apartment blocks and multi-dwelling buildings;
- public buildings and other types of non-residential buildings.

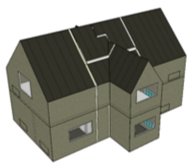
The determination of the reference building shows the building stock within each type of building[33].

For each type of existing building, the following is a reference building determined within the cost-optimal levels of minimum energy performance requirements in accordance with the

[33] Reporting by the Republic of Slovenia to the European Commission on the establishment of 'cost-optimal levels of minimum performance requirements for buildings and building elements', June 2018.

requirements of the EPBD (Article 3 2010/31/EU) with baseline characteristics for the 1960 construction year. On reference buildings, the effects of cost-effective measures and groups of measures for the energy renovation of buildings are analysed. The geometry of the building was taken from the typology of the tabula for residential buildings, or a new virtual building for public and other non-residential buildings was created. The heat envelope and systems for heating, cooling, ventilation and others were attributed to the reference buildings according to statistical data (SURS[34], REUS[35]). In the three reference buildings, the individual measures and groups of measures that shape the different types of energy renovation are analysed below. They were identified in the[36] cost optimum analysis for the primary energy use and the life-cycle cost (net present value) for each type of energy renovation of the building. Tables 9 to 11 give the architectural and construction-physical characteristics of the reference buildings, the baseline systems and technologies and the limit values for energy efficiency based on compliance with the minimum requirements of the PURES 2010 Regulation for each type of reference building.

Table44: Reference single-dwelling building for existing buildings (1960; Major refurbishment)

Obstoječa enostanovanjska stavba (ESS1)	Geometrija stavbe	Deleži površine oken na ovoju stavbe in oken brez dostopa sonca	Tlorisna površina v m^2, kot se uporablja v grad. pred.
	A / V = 0,87 m^{-1} površina fasade S / Z / J / V = 47 / 41 / 39 / 28 m^2 površina strehe = 107 m^2 površina tal = 76 m^2 usmeritev: jug	razmerja površin oken na fasadi 3.2 / 2.3 / 9.5 / 16.0	148
Opis stavbe	Opis povprečne gradbene tehnologije	Povprečna energetska učinkovitost (kWh/m2a), pred naložbo	Zahteve glede ravni komponent (tipična vrednost)
tip rabe: stanovanjska toplotna kapaciteta: 48 MJ/K leto izgradnje: 1960	ogrevanje: kotel na ELKO hlajenje: / priprava sanitarne tople vode: v komb. s kotlom na ELKO prezračevanje: naravno	340	$U_{zun.stena}$ = 1,20 W/m²K U_{streha} =1,20 W/m²K $U_{tla\ na\ terenu}$ = 1,16 W/m²K U_{okna} = 2,30 W/m²K H_t' = 1,349 W/m²K

Limit values for efficient energy use according to the PURES Regulation 2010

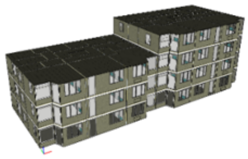
specific transmission loss coefficient	0,393	W/(m2K)	→ Requirement not fulfilled
QNH/Au	43,5	KWh/(m2a)	→ Requirement not fulfilled
As/mk	198,3	KWh/(m2a)	→ Requirement not fulfilled
Hot water preparation is provided using RES			→ Requirement not fulfilled

[34] Statistical Office of the Republic of Slovenia (data 2010-2014).

[35] Energy Efficiency Survey of Slovenia (REUS).

[36] Commission Delegated Regulation (EU) No 244/2012 supplementing Directive 2010/31/EU.

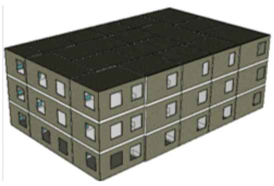
Table45: Reference multi-dwelling building for existing buildings (1960; Major refurbishment)

Obstoječa večstanovanjska stavba (VSS1)	Geometrija stavbe	Deleži površine oken na ovoju stavbe in oken brez dostopa sonca	Tlorisna površina v m², kot se uporablja v grad. pred.
	A / V = 0,41 m^{-1} površina fasade S / Z / J / V = 337/172/172/106 m^2 površina strehe = 470 m^2 površina tal = 470 m^2 usmeritev: jug	razmerja površin oken na fasadi 107 / 24 / 159 / 15	1596
Opis stavbe	**Opis povprečne gradbene tehnologije**	**Povprečna energetska učinkovitost (kWh/m2a), pred naložbo**	**Zahteve glede ravni komponent (tipična vrednost)**
tip rabe: stanovanjska leto izgradnje: 1980 toplotna kapaciteta: 749 MJ/K	ogrevanje: kotel na ELKO hlajenje: / priprava sanitarne tople vode: lokalni bojler prezračevanje: naravno	237	$U_{zun.stena}$ = 0,80 W/m²K U_{streha} =0,60 W/m²K $U_{tla\ na\ terenu}$ = 0,93 W/m²K U_{okna} = 2,70 W/m²K H_t' = 1,423 W/m²K

Limit values for efficient energy use according to the PURES Regulation 2010

specific transmission loss coefficient	0,467	W/(m2K)	→ Requirement not fulfilled
QNH/Au	22,8	KWh/(m2a)	→ Requirement not fulfilled
As/mk	175,5	KWh/(m2a)	→ Requirement not fulfilled
Hot water preparation is provided using RES			→ Requirement not fulfilled

Table46: A reference building within cost-optimal levels of minimum energy performance requirements in accordance with the requirements of the EPBD (Article 3 2010/31/EU) for existing public and other non-residential buildings (1960; Major refurbishment)

Obstoječa javna stavba (JS1)	Geometrija stavbe	Deleži površine oken na ovoju stavbe in oken brez dostopa sonca	Tlorisna površina v m², kot se uporablja v grad. pred.
	A / V = 0,39 m^{-1} površina fasade S / Z / J / V = 231/123/237/109 m^2 površina strehe = 520 m^2 površina tal = 520 m^2 usmeritev: jug	razmerja površin oken na fasadi 33 / 43 / 27 / 27	1298
Opis stavbe	**Opis povprečne gradbene tehnologije**	**Povprečna energetska učinkovitost (kWh/m2a), pred naložbo**	**Zahteve glede ravni komponent (tipična vrednost)**
tip rabe: poslovna stavba leto izgradnje: 1960 toplotna kapaciteta: 608 MJ/K	ogrevanje: kotel na ELKO hlajenje: / priprava sanitarne tople vode: centralni bojler prezračevanje: naravno	165	$U_{zun.stena}$ = 0,80 W/m²K U_{streha} =0,60 W/m²K $U_{tla\ na\ terenu}$ = 0,93 W/m²K U_{okna} = 2,70 W/m²K H_t' = 1,332 W/m²K

Limit values for efficient energy use according to the PURES Regulation 2010

specific transmission loss coefficient	0,442	W/(m2K)	→ Requirement not fulfilled
QNH/Ve	7,5	KWh/(m3a)	→ Requirement not fulfilled
As/mk	176,2	KWh/(m2a)	→ Requirement not fulfilled
Hot water preparation is provided using RES			→ Requirement not fulfilled

Definition of measures and envisaged renovations

In the analysis of setting cost-optimal levels of minimum requirements, energy efficiency measures applicable to the identified reference buildings have been developed. The measures included in the calculation shall include envelope technologies and various systems for supplying buildings with energy for heating, cooling and ventilation; Supply by district heating, heat pump, condensing gas boiler and other; Measures for the production of energy from renewable sources on or near the building were also included in the calculation.

The selected technologies and energy products for the heating and hot water preparation system are the basic options available to the investor on the market prior to the implementation of the energy efficiency improvement measure.

Table 45 first shows the individual measures to improve the energy performance of the building (P1-P18; Their gradual implementation leads to a comprehensive renovation), followed by versions of the integrated energy renovation measures. Individual measures are laid down for all parts of the thermal envelope, namely four measures for the outer wall, three measures for roof construction and two measures for windows, for different thermal transient values of the structure. Combinations of measures within the envisaged comprehensive renovations (P19-P74) involving measures with building systems are shown in Table 46.

Most of the buildings in Slovenia are built in the 2800-3600 Kdan temperature deficit range. In the area of south-west Slovenia with a temperature deficit of 2100-2800, Kdan lives less than ten per cent of the total population of Slovenia, so the centre of gravity of the treatment on the building stock is in the rest of the colder part of Slovenia (Slika 17).

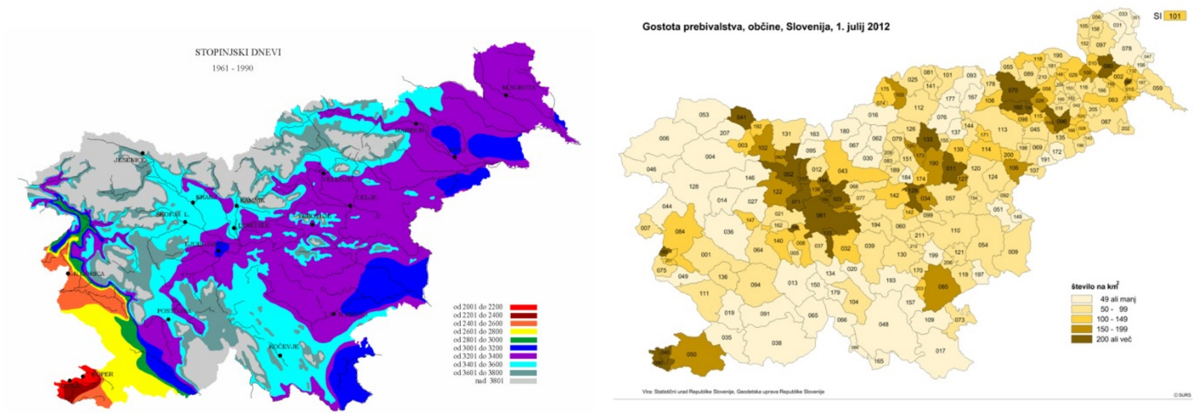


Figure17: Annual temperature deficit (left) and population density (right) in Slovenia (source: ARSO, SURS)

Table47: List of measures on the energy renovation envelope/variant (P1-P18; Major refurbishment; 1960)

MEASURE/VERSION	Wall (1960)	Wall (1980)	Wall construction 1	Wall construction 2	Wall construction 3	Wall construction 4	Roof (1960)	Roof (1980)	Roof construction 1	Roof construction 2	Roof construction 3	Window (1960)	Window (1980)	Double glazing window	Triple glazing window	Point air – water	Point water – water	Condensing gas boiler	Biomass boiler	District heating	Mechanical ventilation	Solar receivers	Solar Photovoltaic
INDEX	1,20	0,80	0,28	0,20	0,15	0,10	1,20	0,60	0,20	0,15	0,10	2,30	2,70	1,30	0,70								
P1			□				□					□											
P2				□			□					□											
P3					□		□					□											
P4						□	□					□											
P5	□								□			□											
P6	□									□		□											
P7	□										□	□											
P8	□						□							□									
P9	□						□								□								
P10			□						□			□											
P11					□					□		□											
P12					□					□				□									
P13					□					□					□								
P14						□					□	□											
P15			□						□					□									
P16			□						□						□								
P17						□					□			□									
P18						□					□				□								

Table48: List of energy renovation measures/variations (P19-P74; Major refurbishment; 1960)

VERSION	Wall (1960)	Wall (1980)	Wall construction 1	Wall construction 2	Wall construction 3	Wall construction 4	Roof (1960)	Roof (1980)	Roof construction 1	Roof construction 2	Roof construction 3	Window (1960)	Window (1980)	Double glazing window	Triple glazing window	Point air – water	Point water – water	Condensing gas boiler	Biomass boiler	District heating	Mechanical ventilation	Solar receivers	Solar Photovoltaic
INDEX	1,20	0,80	0,28	0,20	0,15	0,10	1,20	0,60	0,20	0,15	0,10	2,30	2,70	1,30	0,70								
P19			□						□					□		□							
P20				□					□					□		□							
P21					□					□					□	□							
P22						□					□				□	□							
P23			□						□					□		□					□		
P24				□					□					□		□					□		
P25					□					□					□	□					□		
P26						□					□				□	□					□		
P27			□						□					□			□						
P28				□					□					□			□						
P29					□					□					□		□						
P30						□					□				□		□						
P31			□						□					□			□				□		
P32				□					□					□			□				□		
P33					□					□					□		□				□		
P34						□					□				□		□				□		
P35			□						□					□				□					
P36				□					□					□				□					
P37					□					□					□			□					

VERSION	Wall (1960)	Wall (1980)	Wall construction 1	Wall construction 2	Wall construction 3	Wall construction 4	Roof (1960)	Roof (1980)	Roof construction 1	Roof construction 2	Roof construction 3	Window (1960)	Window (1980)	Double glazing window	Triple glazing window	Point air – water	Point water – water	Condensing gas boiler	Biomass boiler	District heating	Mechanical ventilation	Solar receivers	Solar Photovoltaic
INDEX	1,20	0,80	0,28	0,20	0,15	0,10	1,20	0,60	0,20	0,15	0,10	2,30	2,70	1,30	0,70								
P38						□					□				□			□					
P39			□						□					□				□			□		
P40				□					□					□				□			□		
P41					□					□					□			□			□		
P42						□					□				□			□			□		
P43			□						□					□						□			
P44				□					□					□						□			
P45					□					□					□					□			
P46						□					□				□					□			
P47			□						□					□						□	□		
P48				□					□					□						□	□		
P49					□					□					□					□	□		
P50						□					□				□					□	□		
P51			□						□					□					□				
P52				□					□					□					□				
P53					□					□					□				□				
P54						□					□				□				□				
P55			□						□					□					□		□		
P56				□					□					□					□		□		
P57					□					□					□				□		□		
P58						□					□				□				□		□		
P59			□						□					□					□			□	
P60				□					□					□					□			□	
P61					□					□					□				□			□	
P62						□					□				□				□			□	
P63			□						□					□					□		□	□	
P64				□					□					□					□		□	□	
P65					□					□					□				□		□	□	
P66						□					□				□				□		□	□	
P67			□						□					□		□							□
P68				□					□					□		□							□
P69					□					□					□	□							□
P70						□					□				□	□							□
P71			□						□					□		□					□		□
P72				□					□					□		□					□		□
P73					□					□					□	□					□		□
P74						□					□				□	□					□		□

C.3 Examples of renovation of reference buildings

C.3.1. Accession

In the context of Slovenia's reporting to the European Commission in 2018 (second revised report) on the establishment of 'cost-optimal levels of minimum performance requirements for buildings and building elements', the cost aspect of the renovation of existing buildings was also considered. The analysis identified the reference buildings by function, characteristic geometry and characteristic characteristics of the thermal envelope of the building for each construction period. For reference buildings, measures/packages/types of renovation have been identified and, on the basis of the LCC, their cost-effectiveness and cost-optimal level of minimum energy performance requirements for buildings and their parts have been analysed.

In line with EN ISO 13790 and in line with CEN EPB standards and the requirements for calculating cost-optimal levels, the hourly dynamic method was chosen for the calculation of primary energy. An integrated approach has been chosen for interaction between the building and its systems, where the effect of all thermal winnings related to the building and its technical systems is taken into account in the calculation of energy for heating and cooling. The heat required for heating and cooling of the building was calculated using a monthly quasi-stationary method in accordance with the PURES Rules 2010 and technical guideline TSG-1-004:2010 Effective energy use. According to the guidelines, the primary energy calculated includes the use of energy for heating, cooling, ventilation, hot water and lighting. The main basis for this is Annex I to Directive 2010/31/EU, which is also fully applicable to the cost-optimal framework methodology.

In Slovenia, for the purpose of a cost-optimal methodology, reference buildings have been identified for the following types of buildings:

- one-dwelling residential buildings;
- apartment blocks and multi-dwelling buildings;
- public buildings and other types of non-residential buildings.

Annex C describes in detail the reference buildings with architectural and construction-physical characteristics and systems and shows, for the measures and types of renovation described, calculations for heat and cold requirements, energy use by structure and resources, primary energy use and primary energy savings in relation to the baseline state of the characteristics of the reference building.

Table49: Energy efficiency measures for existing buildings on the building envelope

Versions of the measures	**External wall**	Wall construction 1	Wall construction 2	Wall construction 3	Wall construction 4	**Roof**	Roof construction 1	Roof construction 2	Roof construction 3	**Window**	Double glazing window	Triple glazing window	Air tightness
U [W/m2K]		**0,28**	**0,20**	**0,15**	**0,10**		**0,20**	**0,15**	**0,10**		**1,30**	**0,70**	N50
1		×					×				×		3,0
2			×				×				×		2,0
3				×				×				×	1,0
4					×				×			×	0,6

Table50: Energy efficiency measures for existing buildings on systems

Heat-heating device	Code	Operation	Heaters	Source for domestic hot water
Air heat pump water	**MP/vm**	continuous operation, controlled room temperature	radiators/flood heating	same as for heating, monovalent operation
Water heat pump	**V/v**	continuous operation, controlled room temperature	radiators/flood heating	same as for heating, monovalent operation
Condensing gas boiler	**Konden. PK**	continuous operation, controlled room temperature	radiators/flood heating	same as for heating, monovalent operation
Biomass boiler	**Biomass k.**	continuous operation, controlled room temperature	radiators/flood heating	(1) same as for heating (2) SSE support
District heating	**DH**	continuous operation, controlled room temperature	radiators/flood heating	same as for heating, monovalent operation

System	Code
Mechanical ventilation with recovery	**MP**
Solar receivers	**SSE**
Photovoltaic power plant	**PV**

For each type of existing building, the results of the cost-effectiveness analysis of the variants and packages of measures are shown below, by way of example, in relation to the baseline situation of reference buildings with characteristics specific to the construction year 1960 (bases for the versions of the measures are presented inPreglednica 50). The cost optimum analysis determined the primary energy use and the life-cycle cost (net present value) for each type of energy renovation of the building.

The measures included in the calculation shall include envelope technologies and various systems for supplying buildings with energy for heating, cooling and ventilation purposes; Supply by district heating, heat pump, condensing gas boiler and other; Measures for the production of energy from renewable sources on or near the building were also included in the calculation. The selected technologies and energy products for the heating and hot water preparation system are the basic options available to the investor on the market prior to the implementation of the energy efficiency improvement measure (Preglednica 49, 50 and 25).

C.3.2. Results

The cost-effectiveness of renovation variants is checked by calculating the primary energy use and determining the total life-cycle cost of the building for selected renovation variants that have been identified for the reference buildings in question. Primary energy use was determined by an hourly dynamic simulation. The calculation of total costs took into account the initial investment, the sum of the discounted annual costs (for energy and maintenance and the periodic replacement of elements) for each year and the terminal value, where applicable. The total cost calculations result in the net present cost value over the considered lifetime of the building, taking into account other values of equipment with a longer lifetime. All variants of the combination of renovation measures that have lower total life costs than the unnovated reference building are cost-effective, determined to meet the needs of cost-optimal levels of minimum energy performance requirements in accordance with the requirements of the EPBD (Article 3 2010/31/EU). The cost-optimal version of the renovation with the lowest cost of life is.

The introduction of individual measures on the packaging reduces primary energy use and reduces life-cycle costs. If these are lower than the baseline, such refurbishment shall be cost-effective. Individual measures are laid down for all parts of the thermal envelope, namely four measures for the outer wall, three measures for roof construction and two measures for windows, for different thermal transient values of the structure.

Furthermore, the cost-effectiveness of the envisaged renovation is increasing in the combination of measures as part of comprehensive renovations, including measures with building systems. Renovations with different systems are shown for four different levels of envelope thermal protection each time.

The types of energy renovation of the reference buildings under consideration show different primary energy savings according to the baseline state of the reference building and thus lead to so-called:

- small renovations (primary energy savings of up to 30 per cent),
- medium renovations (savings of 30-60 per cent) or up to
- deep renovations (reduction of primary energy use by at least 60 per cent).

Therefore, **the implementation of individual energy renovation measures on reference buildings results in an indicative primary energy saving of up to a maximum of 30 % and only a small renovation**.

Deep renovation, thus achieving at least 60 per cent of primary energy savings in all versions of the energy renovation of the reference buildings, requires linking the measures on the envelope to measures on building systems and, as a rule, the use of RES or the production of energy from RES on the building, leading to even greater savings from nearly zero energy renovation.

Measures on the thermal envelope of a building offer significant energy savings and must, as a rule, be implemented in the event of thorough energy renovation. The measures on the wrapping are unquestionably cost-effective if they are implemented at the end of the life of the envelope. In that case, the cost (after the design or selection of materials) of the more complex facades is a replacement of building elements.

For construction-physical reasons and in order to achieve thermal comfort, we aim to achieve as uniform a level as possible of the thermal protection of the building envelope. The total thermal protection quality of the parts of the thermal envelope of the building can be described by the specific transmission loss ratio *Ht'(* W/m2K), which takes into account, in addition to the thermal transient of the individual parts of the envelope, the size of the outer surfaces of the envelope parts. If, on the basis of balanced combinations of casing renovation measures, we analyse the life-cycle costs depending on the primary energy achieved, we can determine the local cost optimum where, notwithstanding some differences in reference buildings, the thermal transition of *U* outdoor walls and roofs is around 0.2 W/m2K and windows 1.3 W/m2K in all cases under consideration.

Single-residential building

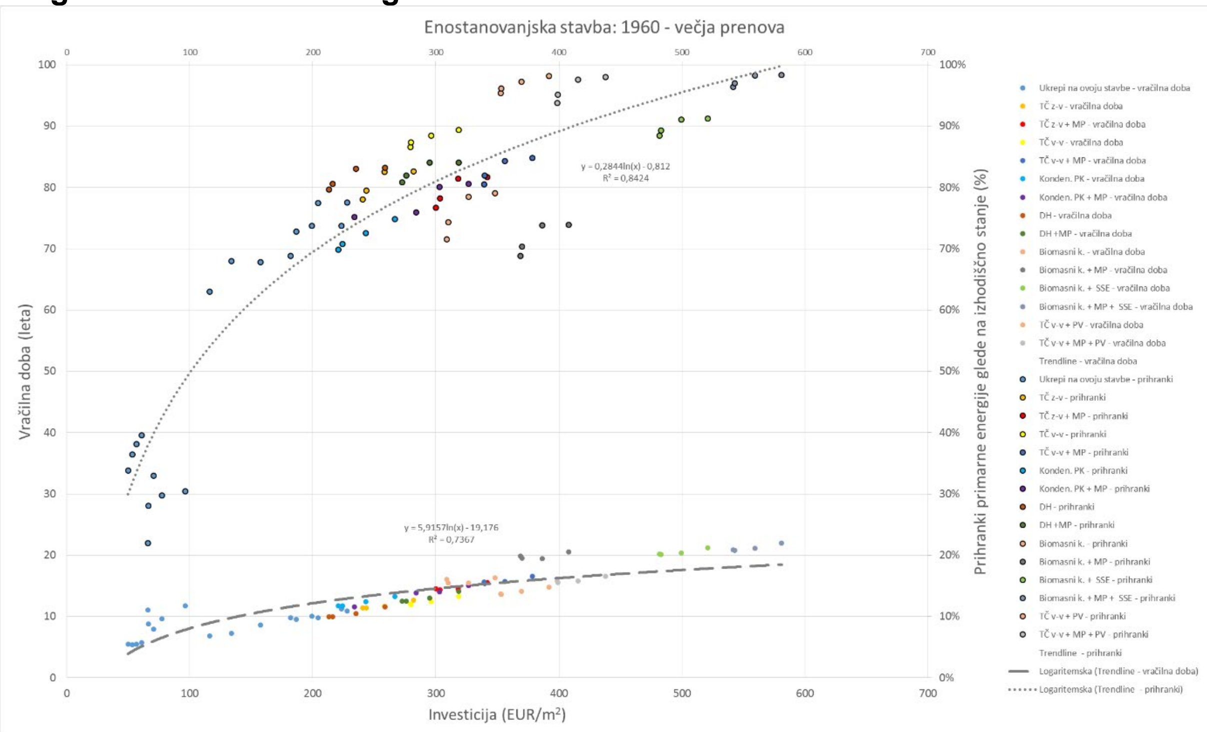


Figure18: Simple payback period of investment in the energy renovation of a building and primary energy savings (percentage of baseline) depending on the level of investment in energy renovation for different types of renovation: Single dwelling ESS1 – major renovation (year of construction 1960) (source: GI ZRMK)

The figures (Slika 19 andSlika 20) showSlika 18, for the selected reference buildings, a simple payback period for the investment in the energy renovation of a building and primary energy savings in relation to the baseline situation of the unfurbished building, both depending on the amount of the renovation investment, taking into account all costs inherent to energy renovation (so-called eligible energy renovation costs). The payback period is determined by the energy cost savings needed to ensure the desired level of thermal comfort and covers heating, cooling, ventilation, air conditioning, hot water preparation and lighting (excluding energy costs for the operation of other technical equipment and installations in the building). The payback period of the investment in energy renovation varies for the reference buildings in question, mainly due to differences in geometric form, timing of use and indoor thermal sources. Overall, therefore, the payback period is slightly lower for non-residential buildings than for single-family houses and slightly higher for non-residential/public buildings than for multi-apartment buildings.

Multi-dwelling building

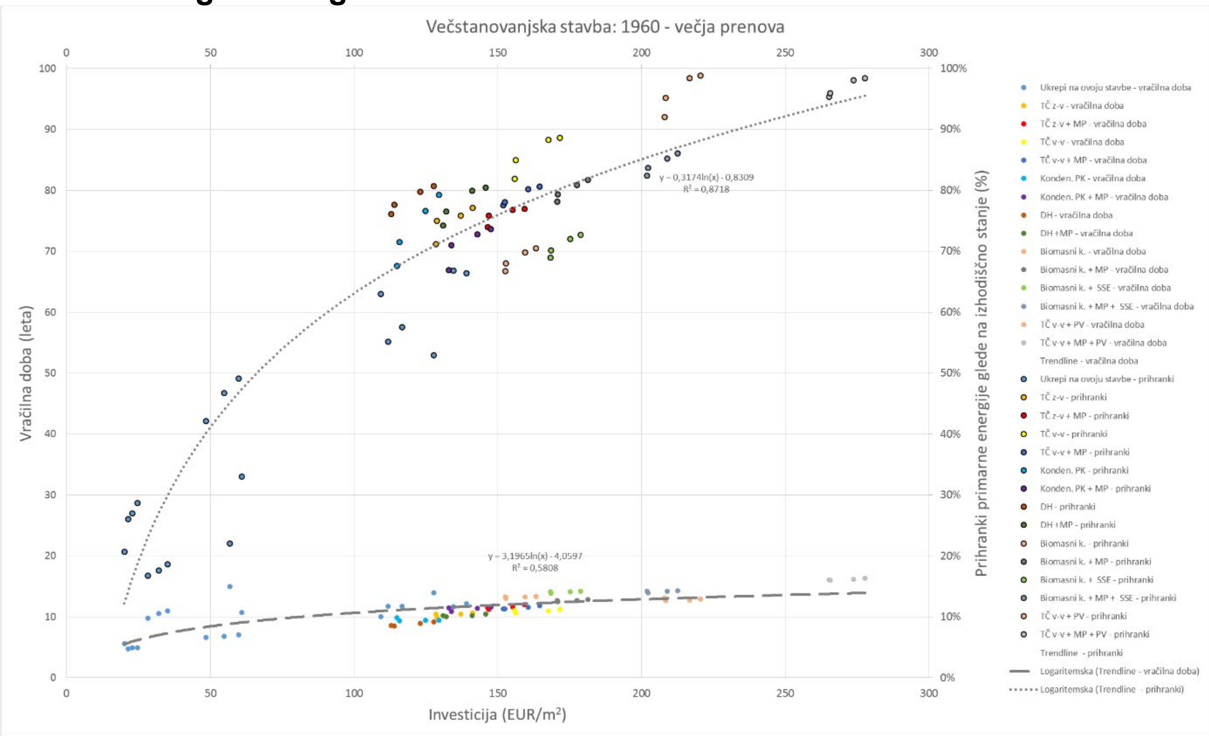


Figure19: Simple payback period of investment in the energy renovation of a building and primary energy savings (percentage of baseline) depending on the level of investment in energy renovation for different types of renovation: VSS1 multi-apartment building – major renovation (year of construction 1960) (source: GI ZRMK)

Public building

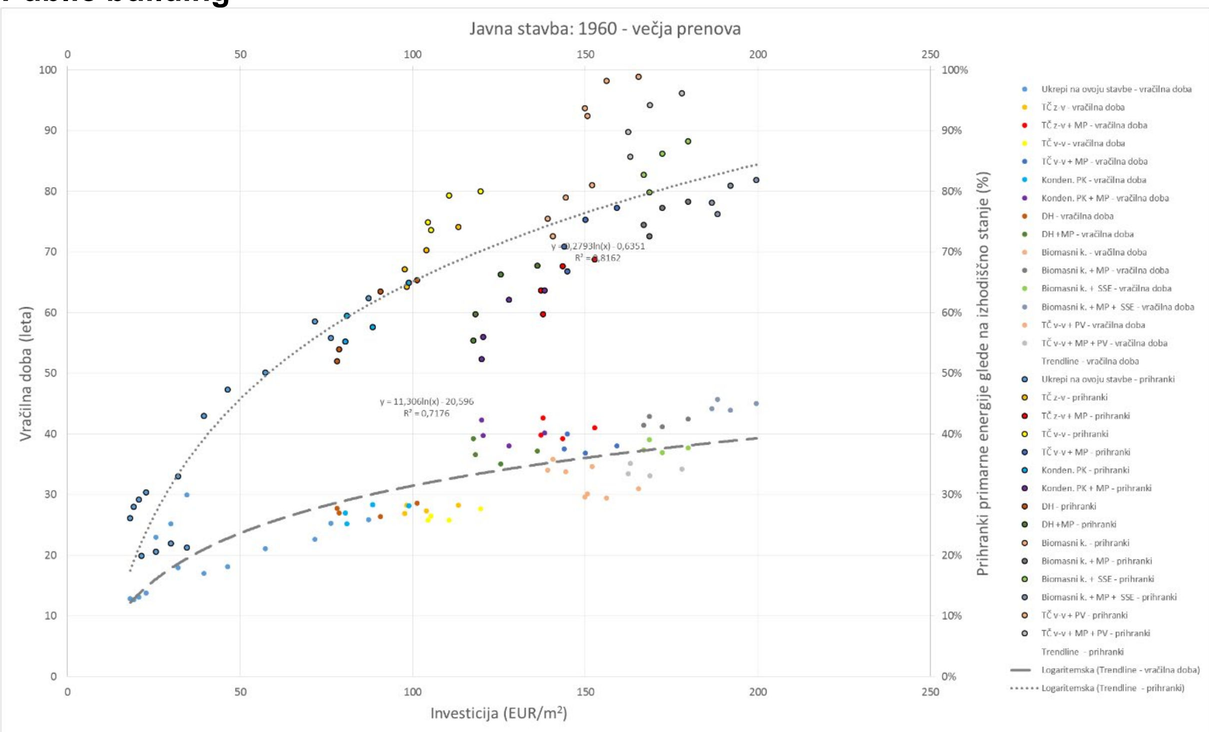


Figure20: Simple payback period of investment in the energy renovation of a building and primary energy savings (percentage of baseline) depending on the level of investment in energy renovation for different types of renovation: Public building JSS1 – major renovation (year of construction 1960) (source: GI ZRMK)

The choice of heat source and energy supply system plays an important role in the cost-effective renovation of buildings. In selecting a cost-effective source of heat, the price of the unit of heat is an important factor. By putting different sources on the same denominator, the unit of thermal energy in MWh, we can compare the price of MWh of heat from different space and sanitary water heating systems. NA Slika 21 compares the price of one MWh of thermal energy from fuels/systems most commonly used in Slovenia for space and sanitary water heating. The comparison is presented for the period from July 2007 to the end of 2018 and clearly shows the difference between the price stability of some (mainly domestic) energy products compared to the fluctuation of other fossil fuels.

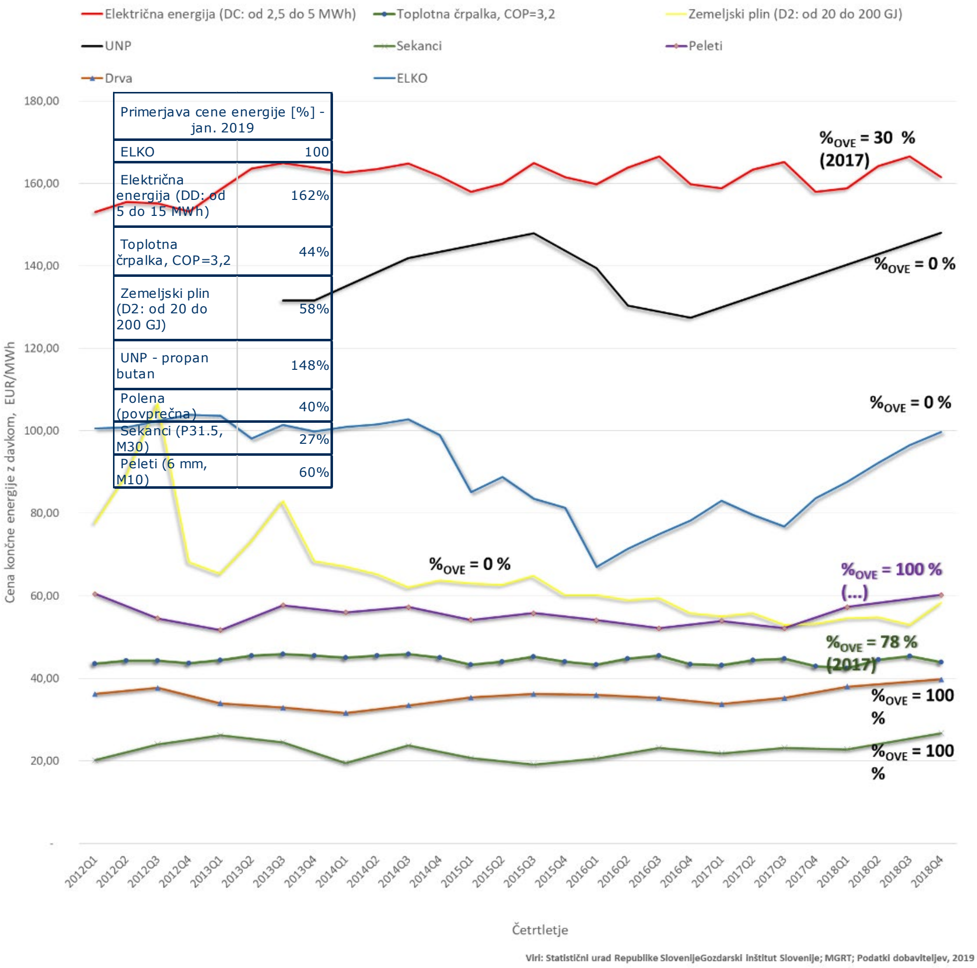


Figure21: Comparison of unit price of heat from different energy products/systems

An analysis of the data Slika 21 shows that, from the point of view of the price of the energy product, the cost-efficiency of all comparable renewable heating systems (RES-wood, heat pumps, and in many cases district heating systems) significantly outstrips fossil fuel systems (ELK, natural gas, liquefied petroleum gas (LPG)). In the case of a fuel boiler, the cost of fuel is 40 per cent, and in the case of a heat pump air-water with an annual average heating number COP = 3.2, it is only 44 per cent of the costs to be paid for the ELKO boiler (January 2019 data). When comparing the environmental performance, i.e. primary energy equivalent and standard CO_2 emissions, heat pumps surpass other systems, with the exception of the woody biomass system, which, in the case of unfiltered flue-gases in individual combustion plants, leads to an increase in the concentration of solid particles in the atmosphere and therefore the wood biomass is more sustainablely suitable for conversion into heat and electricity in larger district heating systems with controlled emissions.

Building renovation and sustainable energy supply are inextricably linked works that must be addressed comprehensively, in a cost-optimal, environmentally friendly and socially responsible way. The NZEB standards require a higher level of performance while carefully analysing the cost-optimal alternative energy supply systems available on/close to the area of the building/sachine, without prejudice to the quality of residence of occupants(Zavrl in drugi, 2015). The NZEB criteria provide for 50 % RES supply on or near the building. The share of energy for the preparation of domestic hot water compared to the energy sufficient for space heating is decreasing and it is therefore reasonable to check whether the same energy source or different energy sources are used for these two needs.

It is expected Slika 22 that life-cycle costs are highest if a building is heated by LPG or electric resistive heaters of all forms, regardless of the fact that the cost of investing in such heating systems is generally the lowest. ELKO remains an expensive energy product with an unpredictable future price, which has shown an upward trend in recent years (regardless of the current decline due to the epidemiological crisis). Despite the relatively low investment costs, ELKO heating will continue to be expensive and we expect a further phase-out of its use for household heating for economic, but above all environmental, reasons. The same applies to natural gas, which, although more favourable in terms of life-cycle costs, is a fossil fuel and does not meet the criteria of the NZEB on the share of RES in the energy supply of the building.

On the other hand, they are heat pumps which are an environmentally friendly way of heating buildings with the lowest life costs. In addition to economic efficiency, in Slovenia (data for 2017) between 78 % (air – water) and 85 % (water) of RES are used in their operations, thus fulfilling and exceeding the NZEB criteria. Heat pumps are used to heat buildings in an environmentally and human-friendly way, and as the population ages, comfortable and uncomplicated management of the heating system will become an increasingly important factor.

The high life costs of wood biomass systems (first and pellets) are due to high investment and partly maintenance costs. We consider a comprehensive overhaul of the system and not often temporary solutions with a cheap boiler or even simply replacing the burner in the old oil boiler. The life-cycle costs of refurbishment of the wood biomass boiler system under the conditions considered reach and exceed the lifetime costs of the boiler on ELKO (Slika 22). In the case of polishing boilers, this is due to a relatively high investment (which must include a sufficiently large heat supply for optimal operation) and, in the case of pellets, a relatively high price of the energy product with a slightly lower investment. Nevertheless, woody biomass as a domestic renewable source should always be taken into account when weighing on the choice of a new heating system. Low-value wood is mainly used for heating by combustion in individual combustion sites and is the predominant energy product in Slovenian households and plays a certain role in the fight against energy poverty. It is a local RES and a relatively cheap fuel, but we need to pay attention to the quality of the boiler choice, which makes it possible to reduce some undesirable local effects, which are particularly reflected in emissions and increased concentrations of solid particles in the atmosphere.

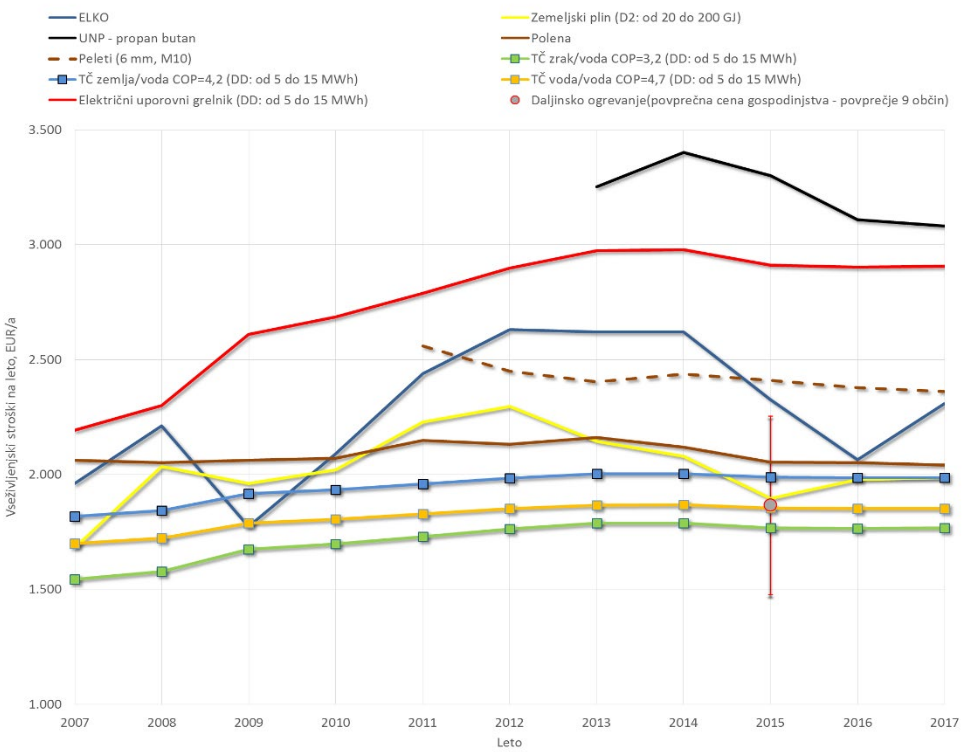


Figure22: Comparison of life costs of different energy products/systems

In finding a more appropriate way of exploiting the great potential of woody biomass in energy terms, the evolving and some of the commercially available innovative technologies (e.g. gasification) appear to be a step in the right direction. This is particularly true in Slovenia in combination with district heating systems, local energy self-supply and an increase in the share of RES in the national electricity system. We included in our analysis nine district heating systems in Slovenia, which are a good way of supplying sustainable energy to homes, especially in urban centres. Larger systems make it easier to control and exploit different RES with less harmful emissions than in individual combustion areas, so district heating systems are one of the important factors on Slovenia's sustainable path to a self-sufficient and low-carbon community. However, operators of certain district heating systems should be encouraged to take energy efficiency measures to modernise their systems, manage them more proactively (i.e. less retroactively) and reduce the heat losses charged to consumers. This will ensure that the price of their heat is competitive with other energy products, as it Slika 22 shows a large range of the price of district heat. The competitive price brings new consumers, which in itself again leads to lower prices and thus to happy and environmentally friendly heating.