REPUBLIKA SLOVENIJA
MINISTRSTVO ZA INFRASTRUKTURO

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA JAVNO UPRAVO

Long-Term Strategy for Mobilising Investments in the ENERGY RENOVATION OF BUILDINGS

October 2015

Table of contents

List of figures

List of tables

List of abbreviations

(AN sNES)	Action Plan for Nearly Zero-Energy Buildings
AN OVE 2010−2020	Renewable Energy Action Plan 2010–2020
AN URE 2020	National Energy Efficiency Action Plan 2014–2020
ARSO	Slovenian Environment Agency
GDP	Gross domestic product
BORZEN	Public utility service for electricity market organisation
CC-SI	Classification of building types (Decree on the Classification of Building Types and Buildings of National Importance, UL RS, No 109/11)
CC-SI	Uniform classification of building types
COSME 2020	Framework Competitiveness Programme for Small and Medium-Sized Enterprises 2014–2020
DB 2030	Long-Term Energy Balance of Slovenia up to 2030
Directive 2009/28/EC	Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
Directive 2010/31/EU	Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)
Directive 2012/27/EU	Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
EED	Energy Efficiency Directive (Directive 2012/27/EU)
EEIF	Energy Efficiency Industry Forum
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
EPC	Energy performance contracting
EPB	Energy performance of buildings (nearly zero-energy buildings)
ESCO	Energy service company
ERDF	European Regional Development Fund
ESF	European Social Fund
EU	European Union
EUR	Euro
EUROPE 2020	EU growth strategy for the coming decade
EZ-1	Energy Act
GEF	Global Environment Facility
GI ZRMK	Gradbeni inštitut ZRMK d.o.o.
GURS	Surveying and Mapping Authority of the Republic of Slovenia
IJS-CEU	Centre for Energy Efficiency (CEU) – Institut Jožef Stefan
INOP	Operational programme implementation plan
IPCC	Intergovernmental Panel on Climate Change
JSS	Non-residential building
JUS.U.J5.600	Technical conditions for the design and construction of buildings
PPP	Public-private partnership
CF	Cohesion Fund
LCA	Life-cycle assessment
LCC	Life-cycle costing
LS1	Public tender for the co-financing of operations for the energy renovation of buildings owned by local communities
LS2	Public tender for the co-financing of operations for the energy renovation of primary schools, nursery schools, health centres and libraries owned by local communities
MGRT	Ministry of Economic Development and Technology

MOP	Ministry of the Environment and Spatial Planning
SME	Small and medium-sized enterprises
MzI	Ministry of Infrastructure
Horizon 2020	EU Framework Programme for Research and Innovation 2014–2020
Decision 2009/406/EC	Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020
OP EKP 2014–2020	Operational Programme for the Implementation of European Cohesion Policy 2014–2020
OP PM10	Operational Programme for the Protection of Ambient Air Against Pollution Caused by PM10
OP TGP 2020	Operational Programme for Reducing Greenhouse Gas Emissions by 2020 with the Outlook to 2030
RES	Renewable energy sources
PM	Particulate matter (PM) is the expression used for dust particles present in the air over a specific period
PTZURES	Rules on Thermal Insulation and Efficient Energy Use in Buildings
PURES 2010	Rules on the Efficient Use of Energy in Buildings 2010
REN	Real estate register
REUS	Energy Efficiency Research Slovenia
REUS	Energy Efficiency Research Slovenia
SID	Slovenska izvozna in razvojna banka, d.d.
sNES	Nearly zero-energy buildings
CHP	Cogeneration of heat and power
SURS	Statistical Office of the Republic of Slovenia
GHG	Greenhouse gases
HT	Heat transfer
UNFCCC	United Nations Framework Convention on Climate Change
EE	Energy efficiency
VSS	Multi-apartment building

Summary

The existing building stock is the sector providing the greatest potential for achieving energy savings, as buildings account for just over one third of all energy consumed. Buildings are also key to achieving the target of an 80–95 % reduction in greenhouse gas emissions by 2050. The Energy Efficiency Directive therefore lays down that Member States should establish a long-term strategy for mobilising investments in the renovation of the national building stock in order to increase the rate of building renovation.

The strategic objective of this document is to achieve carbon-neutral energy use in buildings by 2050. This will be achieved by making considerable improvements in energy performance and by increasing the use of renewable energy sources in buildings. This will, in turn, significantly reduce emissions of other harmful substances into the atmosphere. A further objective is for Slovenia to become recognised for its activities in the field of sustainable construction.

Some 70 % of the total floor area of residential buildings and 60 % of the total floor area of non-residential buildings was constructed prior to 1985. This presents a very considerable potential for renovation.

The Strategy's basic scenario envisages a rate of complete energy renovation of residential buildings of 2 % (up to 2030 approx. 1.75 % of single-family houses and 2.5 % of multi-apartment buildings) and for buildings in the public sector 3 %.

The intermediate targets set out in the Long-Term Strategy for Mobilising Investments in the Renovation of Buildings up to 2030 are as follows:

- to reduce end-use energy consumption in buildings by 15 % by 2020 and 30 % by 2030 relative to 2005;
- to have at least two-thirds of energy in buildings produced from renewable energy sources;
- to reduce greenhouse gas emissions in buildings by 60 % by 2020 and at least 70 % by 2030 relative to 2005;
- to carry out energy renovation on at least 26 million m^2 of building floor area, or 1.3–1.7 million m^2 annually, with just over one third of this total renovated to nearly zero-energy building standard (AN sNES).

The Strategy's operational targets up to 2020 or 2030 are as follows:

- the renovation of 3 % of public buildings owned or occupied by central government each year (between 15 000 and 25 000 m^2);
- the renovation of 1.8 million m^2 of the floor area of buildings in the wider public sector between 2014 and 2023 (OP EKP);
- an improvement in the ratio between public funds invested and investment incentives in the public sector to 1: 3 (OP TGP 2020);
- the implementation of five energy renovation demonstration projects for different building types (OP EKP).

Investments in building renovation of approx. EUR 6.7 billion will be required to achieve these targets in the period leading up to 2030: three-quarters in the housing sector, 10 % in the public sector and 15 % in the private service sector. This means annual investments of between EUR 350 and 450 million: approx. EUR 300 million in the housing sector and EUR 100 million in the service sector (EUR 40 million in the public sector and EUR 60 million in the private sector).

In order to maximise the long-term benefits in terms of creating jobs, ensuring stable inflows into the public sector budget and contributing to economic growth, it is essential that these investments be spread as evenly as possible, without concentrating investment activities in individual years or over shorter periods.

The Energy Efficiency Directive establishes a number of measures, with the public sector playing a leading role. Buildings owned by public authorities account for around 10 % of the total building stock. After 2018 public sector organisations will only be able to purchase nearly zero-energy buildings when purchasing new buildings.

Three per cent of the floor area of buildings owned and occupied by central government which do not meet the minimum energy performance requirements from 1 January each year from 2014 onwards will have to be renovated annually.

Investments in the energy renovation of public sector buildings will average approx. EUR 40 million per year – on condition, however, that these investments are made in accordance with the energy performance contracting model, i.e. by including the private capital of enterprises that provide energy services. In order to meet the obligations that follow from the receipt of cohesion funds, i.e. the renovation of 1.8 million m^2 by 2023, the public sector will also have to provide a portion of the funds for financing of the investments, in tandem with grants.

Investments in the energy performance of buildings provide society with significant savings and with wider economic, social and environmental benefits.

ECONOMIC BENEFITS
Energy savings

It is estimated that the energy renovation of existing buildings will lead to savings of 10 % in the energy used for heating and hot water up to 2020 (25 % up to 2030). This means that without such measures, energy consumption in buildings will be over 10 % higher in 2020 and almost 25 % higher in 2030. The greatest energy savings will be seen within the structure of investments in the housing sector (85 % of all savings achieved by measures for the energy renovation of buildings).

The energy savings achieved as a result of the implementation of this Strategy will make a considerable contribution to achieving Slovenia's targets in the area of increasing energy efficiency; indeed, they will contribute over half of the indicative 2030 target (27 % increase in energy efficiency).

Energy efficiency measures and the replacement of fossil fuels with renewable energy sources will reduce dependence on imports. Slovenia is currently 100 % dependent on imports for its petroleum derivatives. The measures mean that there will be a halving in the consumption of fossil fuels in existing buildings by 2020, while by 2030 consumption will be a mere 20 % of the current level. This will lead to a significant reduction in Slovenia's imports of petroleum derivatives: a fall of 7 % in 2020 and 10 % in 2030 in comparison with the import levels that would be seen were the building-related measures not to be implemented. This constitutes an annual reduction of between EUR 100 and 200 million in imports of petroleum derivatives.

The impact will also be felt in electricity consumption, which will increase with the promotion of heat pumps. Demand for electricity will increase in the winter months. It would therefore be wise to promote the high-efficiency cogeneration of heat and power within district heating systems.

SOCIAL BENEFITS
Job creation

The increased volume of investment in energy efficiency also means increased demand in sectors whose products and services lead to improvements in the energy performance of buildings. This will have a direct impact on employment by increasing the numbers of people employed in those sectors that directly supply products and services for the energy renovation of buildings, e.g. construction, the manufacture of building fittings and heating systems, and the provision of energy services. There will also be an indirect impact from increased economic activity in these sectors.

Owing to the relatively high labour intensity of work connected with the energy renovation of buildings, investments in energy performance are, in comparison with many other sectors of the economy, a strong and important lever for the creation of new jobs.

We estimate, using the general equilibrium model, that additional investments in energy renovation will increase employment in Slovenia by between 0.36 and 0.58 % annually (between 3 000 and 4 600 new direct jobs created). We estimate that activities following on from the planned average annual volume of investments will create a total of around 7 000 jobs (indirect and direct). This will also have positive effects on economic growth and public revenues.

Reduction in fuel poverty
Fuel poverty occurs when a household is unable to secure sufficient warmth in its place of residence. High-quality energy renovation improves living comfort in buildings; this leads to greater productivity on the part of the people working there, reduces absence from work and lowers the number of incidences of allergic reaction.

ENVIRONMENTAL BENEFITS

Greenhouse gas emissions
By 2030 emissions of greenhouse gases and particulates from energy use in buildings will be half the current levels.

1 Introduction

Pursuant to Article 348 of the Energy Act (EZ-1), the Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings has been compiled in accordance with the structure required by the Energy Efficiency Directive[1] (hereinafter: Directive 2012/27/EU).

Particular emphasis is placed on buildings owned and occupied by central government, as Directive 2012/27/EU also requires the state, as from 1 January 2014, to renovate 3 % of the total useful floor area of heated and/or cooled buildings owned and occupied by central government each year in order that at least the minimum energy performance requirements under the Directive on the energy performance of buildings[2] (hereinafter: Directive 2010/31/EU) are met. The 3 % rate is calculated on the basis of the total floor area of buildings owned and occupied by central government and of administrative departments with a total useful floor area of over 500 m² or, from 9 July 2015, over 250 m² which do not meet the national minimum energy performance requirements on 1 January of each year set in accordance with Article 4 of Directive 2010/31/EU. Article 4 of Directive 2012/27/EU requires Member States to establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private. The Strategy contains:

- an overview of the national building stock based on statistical sampling;
- the identification of cost-effective approaches to renovation relevant to building type, location and climatic zone;
- policies and measures to stimulate the cost-effective renovation of buildings;
- perspectives to guide investment decisions of individuals, the construction industry and financial institutions;
- an estimate of the expected energy savings and wider benefits.

Under Article 348 of the Energy Act, the Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings shall include:

- determining those central government and wider public sector entities subject to renovation requirements, and determining the floor area of buildings owned and occupied by public sector entities;
- determining the share of renovation of the total floor area of buildings owned and occupied by central government;
- an overview of the national building stock;
- the identification of cost-effective approaches to renovation for different building types;
- measures to stimulate the cost-effective deep renovation of buildings;
- measures to guide the investment decisions of individuals, the construction industry and financial institutions.

Buildings protected in accordance with cultural heritage protection regulations are dealt with separately in the Strategy. Guidelines for the energy renovation of cultural heritage buildings are being compiled by the ministry responsible for energy and are likely to be completed by the end of November 2015. The guidelines will unify the professional standards that help project designers and cultural heritage protection organisations to determine the appropriate energy renovation measures to take in order to preserve protected elements of value. The Strategy takes account of all relevant programmes and action plans connected with the field. The Strategy shall be updated every three years.

Buildings are to be treated as whole units, i.e. including the building envelope, fittings, operation and maintenance, when major building renovation measures are being implemented. Where feasible in terms of cost and technology, priority in renovation must be given to buildings with the lowest energy performance. Buildings used for the following purposes are exempt from these measures:

- national defence, where such buildings do not contain individual residential or business units;
- worship or religious activities.

[1] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.

[2] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).

Through the long-term building renovation strategy, Slovenia is setting itself the objective of achieving substantial improvements in the energy performance of building stock. The Strategy also constitutes the expert basis for implementation of the Operational Programme for the Implementation of European Cohesion Policy 2014–2020 (OP EKP 2014–2020). The objectives are set out for the key years 2020/2023 (final year of implementation) and 2030, with an evaluation of the expected energy savings and the public funds and jobs required. For 2050 only the estimated energy savings have been calculated.

Methodological note

The Long-Term Strategy for Mobilising Investments in the Renovation of Buildings has also arisen on the basis of:

- national strategy documents (AN OVE 2010−2020, AN URE 2020, AN sNES, OP TGP 2020, OP EKP 2014−2020);
- national legislation (Energy Act EZ-1 and implementing regulations);
- European legislation (Directive 2010/31/EU recast, Directive 2012/27/EU);
- models of practice from other EU Member States.

2 Overview of the building stock and the potentials for renovation

Buildings are divided in terms of their purpose into residential and non-residential, with reference to the uniform classification of building types[3] (CC-SI). There were 775,204 apartments in 2012 (SURS), giving a total of over 63 million m^2 of floor area. This number accounted for 72 % of the total building stock (Table 1). Non-residential buildings are divided into public buildings and other service sector buildings. The public sector accounts for 38 % of the total floor area of non-residential buildings. This also includes buildings owned and operated by central government, which are subject to additional analysis in this report. In 2012 Slovenia's total building stock amounted to 88 million m^2, a figure which includes buildings actually heated. In terms of purpose of use, residential buildings predominate (and single-family houses predominate within this group), while buildings of social importance are the largest non-residential building category (Table 1); these include buildings for culture and entertainment, museums and libraries, buildings for education and scientific research, healthcare buildings and sports halls, which makes this group of buildings highly heterogeneous.

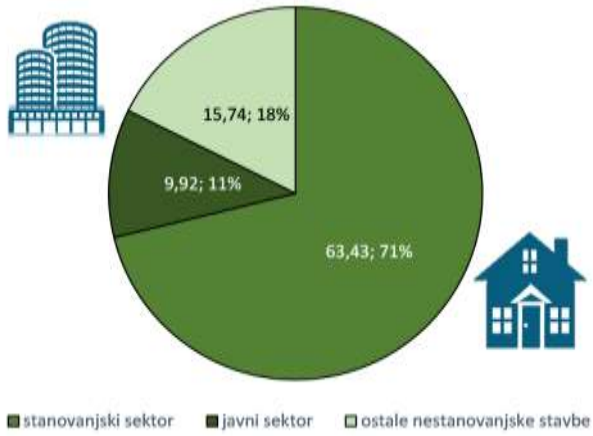
Table 1: Useful floor area by individual group of the single classification of buildings (CC-SI) in Slovenia, 2012 (Source: IJS-CEU, data from GURS, SURS, IJS-CEU)

CC-SI	**Description of actual use of a building or part of a building, aligned with the CC-SI classification**	**Floor area [1 000 m^2]**	**Proportion of the total building stock [%]**
111	Single-family houses	46 146	52
112	Multi-apartment buildings	17 291	19
113	Special-purpose residential buildings	1 008	1
121	Catering and hospitality buildings	3 008	3
122	Commercial and office buildings	7 409	8
123	Trade and other service activity buildings	6 415	7
126	Buildings of general social importance	7 817	9
TOTAL		89 094	100

Public buildings are buildings classified into sub-categories in the standard classification of buildings, or parts of buildings with the following code designations: CC-SI 113 Residential buildings for special purposes, CC-SI 12201 Public administration buildings and CC-SI 126 Buildings of general social importance.

[3] Decree on the Classification of Building Types and Buildings of National Importance (UL RS, 109/11).

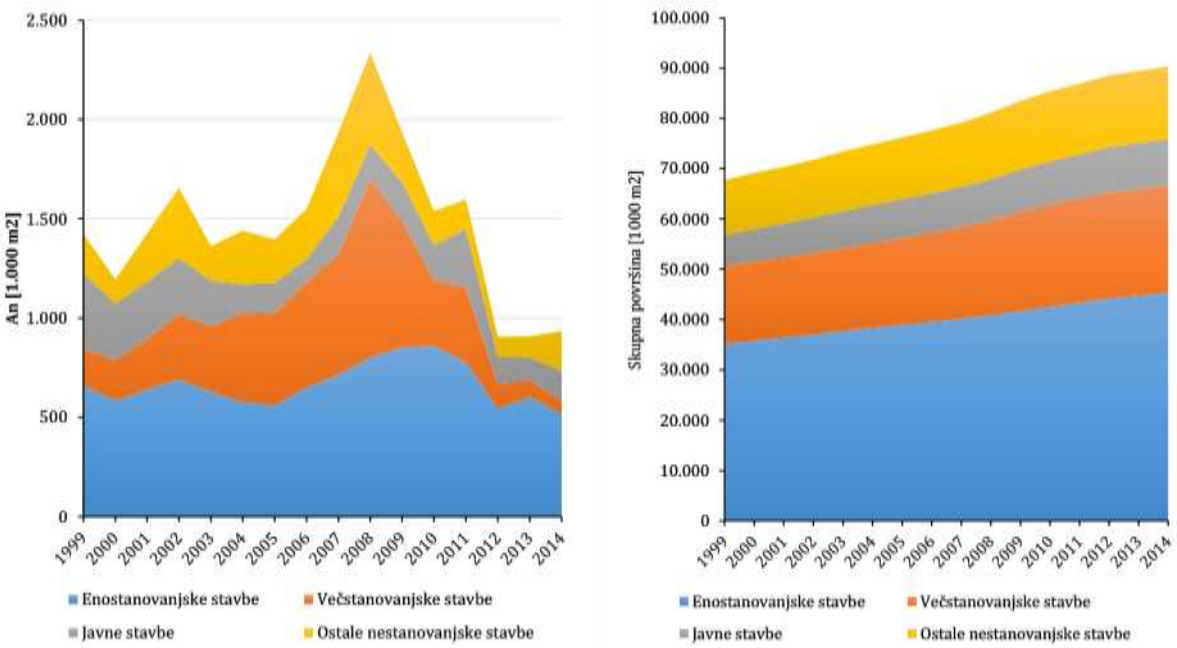
Other non-residential buildings are buildings classified into sub-categories in the standard classification of buildings, or parts of buildings with the following code designations: CC-SI 121 Catering and hospitality buildings, CC-SI 12202 Banks, post offices, insurance companies, CC-SI 12203 Other commercial buildings and CC-SI 123 Trade and other service activity buildings.



Key: Housing sector, Public sector, Other non-residential buildings

Figure 1: Total floor area of buildings by sector, 2012 (m^2 millions, share) (Source: SURS, IJS CEU)

The building stock is constantly increasing in size. In the most recent period, the highest number of new-builds occurred in 2008 (Figure 2). The numbers began to fall from the onset of the economic crisis and did not stabilise until 2013, which saw minimal growth in comparison with the year before.



Key: Total floor area

Single-family houses, Multi-apartment buildings, Public buildings, Other non-residential buildings

Figure 2: Total floor area of new-builds (left) and of building stock as a whole (right), 1999 to the present (Source: IJS-CEU, data: SURS, REN)

2.1 Definition of energy renovation

Energy renovation encompasses measures in buildings as a whole, thus including all building elements that affect energy use and building operation.

The energy renovation rate is defined, in relation to the expected primary energy savings, as renovation under an individual measure, partial renovation and complete energy renovation. The prescribed legislation on the minimum energy performance requirements of buildings also contains the category of 'nearly zero-energy renovation of a building'. The term 'complete energy renovation' denotes the coordinated implementation of energy efficiency measures on the building envelope (e.g. facade, roof, floor) and the building's technical systems (e.g. heating, ventilation, air-conditioning, hot water) in a way that exploits, as far as is technically possible, the entire economically justified potential for energy renovation. The main advantage of the complete approach is the possibility it provides for mutual optimisation of individual measures within a single, more extensive operation. Energy savings are therefore optimised – something which is not possible with partial energy renovation or the uncoordinated implementation of individual groups of measures. Gradual energy renovation is renovation in which the measures necessary to achieve total energy renovation are carried out in a phased manner. In general, the thermal envelope of a building is renovated first, followed by the technical systems within the building.

When projects are being selected, gradual complete and complete energy renovation are regarded as equal in terms of the due diligence applied and the cost-effectiveness of the energy efficiency measures already carried out. An energy audit confirms (or otherwise) whether an individual energy performance of buildings measure has been carried out successfully.

All energy renovation measures that would change, to an unacceptable degree, the character or appearance of a building which has distinctive structural elements, or which is protected as cultural heritage, are excluded from any complete energy renovation carried out on that building. The scope of complete energy renovation therefore also depends on the architectural and historical importance of a building, to which due regard must be paid. Where an individual measure referred to in an expanded energy audit cannot be carried out (is infeasible) or can be carried out only partly (is infeasible) because of the requirement to protect cultural heritage (therefore, that the measure cannot be carried out, or can be carried out only partly), under the Guidelines for the Energy Renovation of Cultural Heritage Buildings the measure shall be deemed to have been carried out and any energy renovation deemed to be complete energy renovation.

The measures most commonly taken in the course of the energy renovation of residential and non-residential buildings are as follows:

Building envelope measures

- Thermal insulation and renovation of the facade
- Replacement of existing and the installation of new energy-efficient windows/doors
- Thermal insulation of the ceiling abutting onto an unheated area
- Thermal insulation of the roof and renovation of the roof covering
- Thermal insulation of the cellar or floor and renovation of the floor
- Remediation of thermal bridges

Heating system measures

- Installation of efficient wood biomass heating appliances
- Installation of heat pumps for domestic hot water and/or central heating
- Installation of heating sub-stations or stations for connection to the district heating hot water system
- Installation of equipment for the high-efficiency cogeneration of heat and power
- Installation of a gas-fired condensing boiler
- Hydraulic balancing of the heating system
- Central regulation of the heating system
- Local regulation
- Thermal protection of the pipe system
- Replacement of worn-out heaters

- Improvements to ventilators and pumps
- Installation of frequency regulation

Ventilation and air-conditioning system measures

- Mechanical ventilation with heat recovery – central
- Mechanical ventilation with heat recovery – local
- Installation of equipment for transferring heat recovered from waste air
- Installation of a cooling generator and the upgrading of cooling systems
- Regulation of air-conditioning and ventilation

Domestic hot water measures

- Installation of heat pumps for domestic hot water and/or central heating
- Installation of heating sub-stations or stations for connection to the district heating hot water system
- Installation of a gas-fired condensing boiler
- Installation of efficient wood biomass heating appliances

Electricity use measures

- Energy-saving lighting
- Energy-saving electrical appliances
- Installation of equipment or construction of facilities for obtaining electricity from the sun, water or wind
- Installation of equipment for the high-efficiency cogeneration of heat and power

Electricity generation measures

- Installation of equipment or construction of facilities for obtaining electricity from the sun, water or wind
- Installation of equipment for the high-efficiency cogeneration of heat and power

2.2 Housing sector

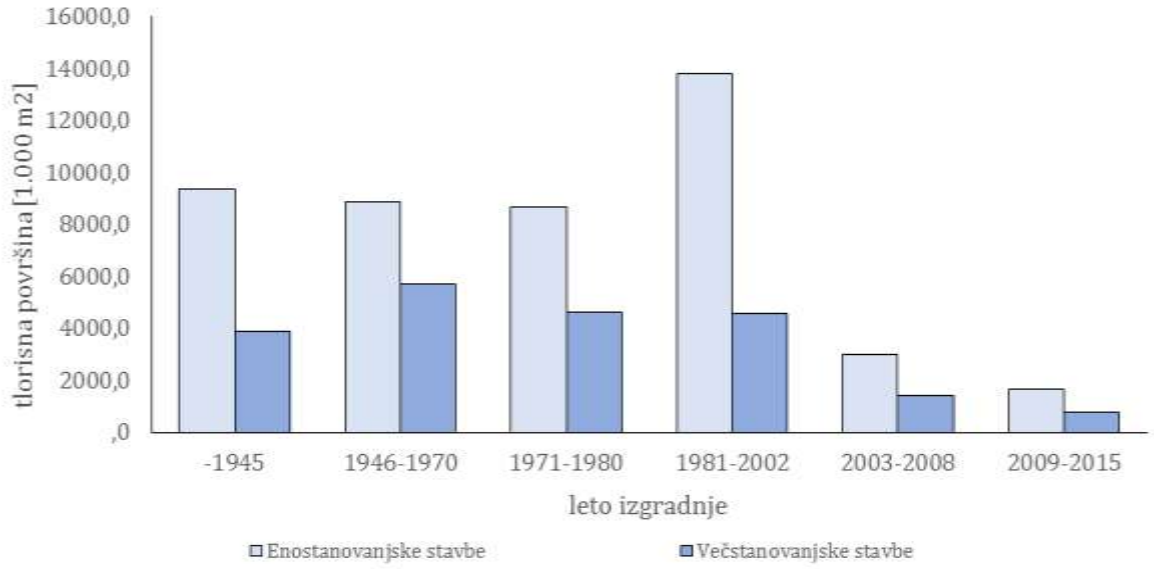
2.2.1 Status of building stock

In accordance with the classification of building types, residential buildings are divided into single-family houses (e.g. detached houses, villas, cottages, holiday homes, terraced houses or twin houses containing a single apartment unit), two-family houses (detached and terraced houses containing two apartment units), and multi-apartment buildings (other residential buildings containing three or more apartment units, e.g. apartment blocks and towers) (Table 2). In terms of useful floor area, the predominant building type is the single-family house (67 %). Residential buildings are categorised below into single-apartment single-family (SF), which includes single-and two-family buildings, and multi-apartment (MA) buildings. In 2012 there were 469 911 single-apartment single-family houses and 305 293 apartment units in multi-apartment buildings. Single apartment single-family houses account for a significantly higher share of total useful floor area (73 %).

Table 2: Useful floor area of residential buildings by individual group under the single classification of buildings (CC-SI) in Slovenia, 2012 (Source: IJS-CEU, data: GURS, SURS, IJS-CEU)

CC-SI	**Description of actual use of a building or part of a building, aligned with the CC-SI classification**	**Floor area [1 000 m^2]**	**Proportion [%]**
111	Single-family houses	46 146	72.7
112	Multi-apartment buildings (with two, three or more apartment units)	17 291	27.3
TOTAL		64 445	100

The life-cycle of an individual structural building element (facade, roof, windows) is approx. 30 years. This period is shorter for heating and other systems within a building. Around 71 % of the total floor area of residential buildings was constructed prior to 1985. This provides a very considerable potential for renovation. Figure 3 shows the total floor area of all categories of residential building by period of construction. Some of these buildings have already been renovated.



Key: Floor area

Year of construction

Single-family houses, Multi-apartment buildings

Figure 3: Structure of residential building stock by year of construction (Source: GI ZRMK, data: REN, 2014)

In future it will be possible to examine an assessment of the state of the building stock in the Register of Energy Performance Certificates. Figure 4 and Figure 5 show the percentage of buildings in each energy performance class (buildings for which energy performance certificates have been issued), broken down into age groups. Buildings constructed before 1945 account for the highest share of buildings in the lowest energy class. The share of newer buildings in this energy class is gradually falling in favour of classes A, B and C. One can infer that older buildings in classes A to C have already been renovated. Despite the small sample (1.2 % of SF and 4.9 % of MA), one can see that building construction has improved over time, as the share of buildings in a higher energy class increases the closer one gets to the present day.

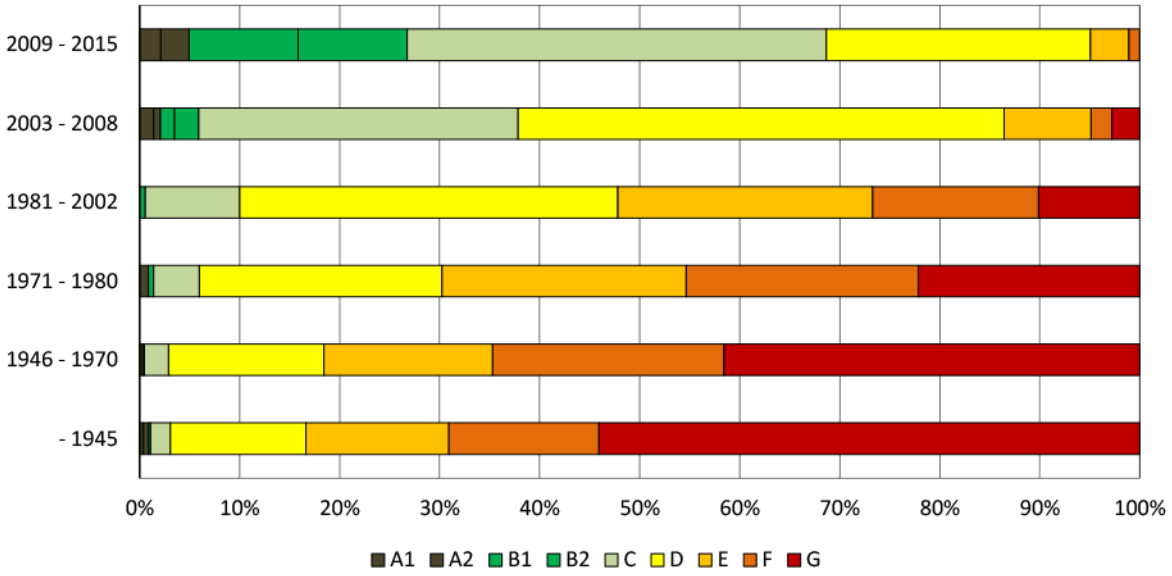


Figure 4: Distribution of single-family houses with energy performance certificates by year of construction and energy class (situation as at 19 April 2015, number of energy performance certificates = 3 296) (Source: GI ZRMK, data: Register of Energy Performance Certificates)

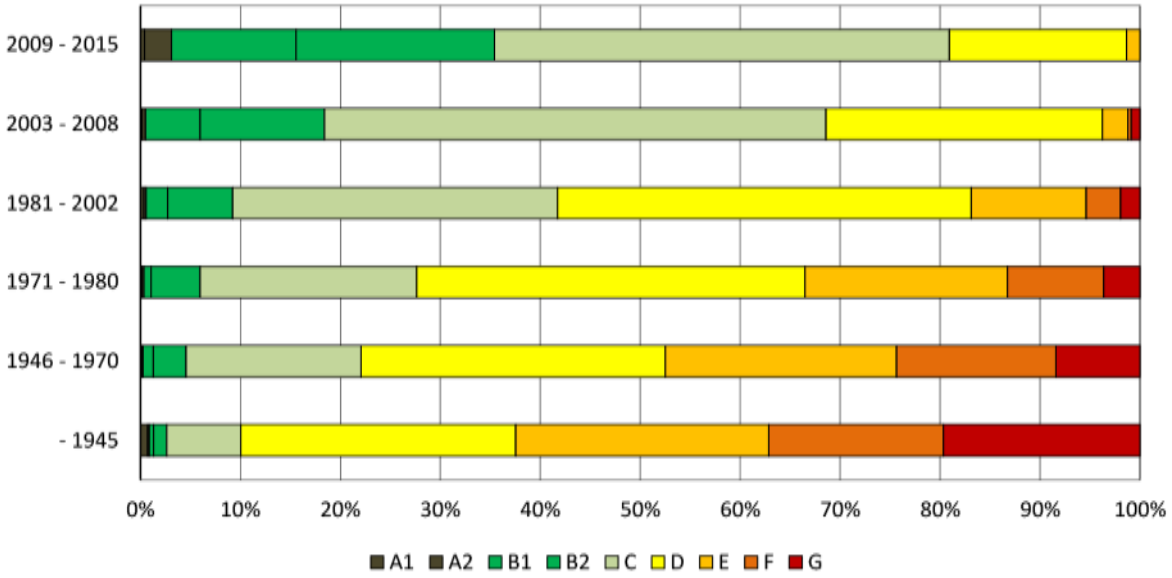
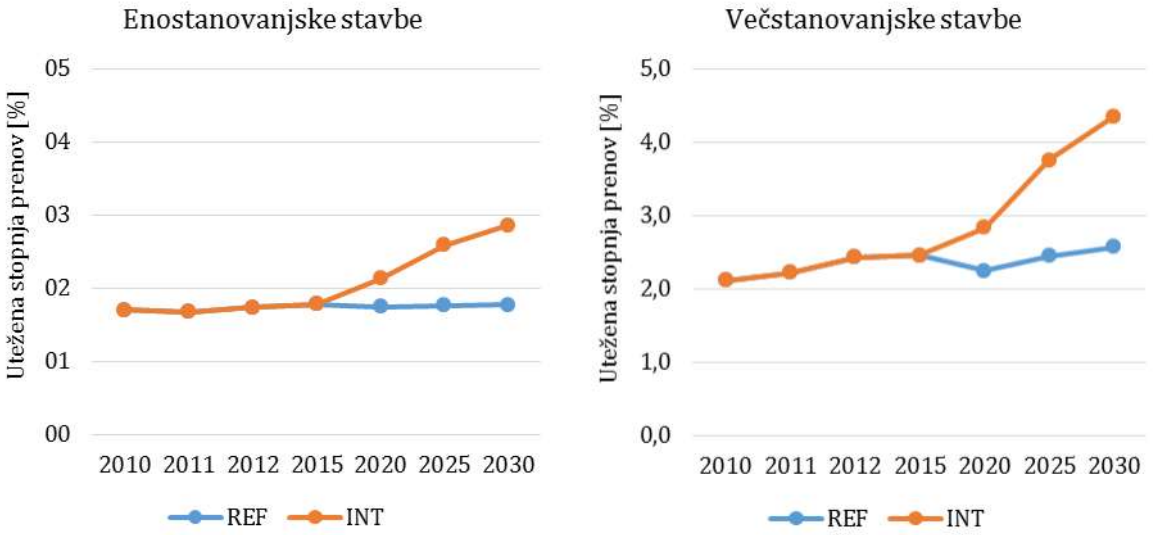


Figure 5: Distribution of number of multi-apartment buildings with energy performance certificates by year of construction and energy performance class (situation as at 19 April 2015, number of energy performance certificates = 4 982) (Source: GI ZRMK, data: Register of Energy Performance Certificates)

2.2.2 Renovation potential

The reference renovation rate (partial renovation has a weighting of 0.5 and complete energy renovation, which includes renovation to nearly zero-energy building standard, has a weighting of 1) was taken for the projection of renovations of the housing stock for the purposes of economic analysis (Sections 6 and 7), reference and

intensive scenarios, in accordance with the Long-Term Energy Balances.[4] Under the envisaged scenarios, the weighted renovation rate for single-family houses up to 2030 is around 1.75 %, while that of multi-apartment buildings is 2.5 %. Figure 6 shows the projection for the renovation of single-family houses and multi-apartment buildings up to 2030 for both scenarios.



Key: Single-family houses, Multi-apartment buildings

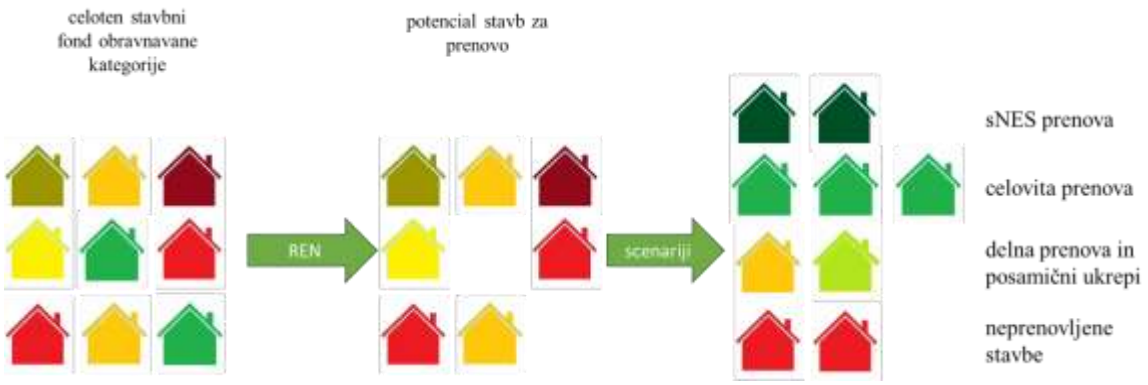
Weighted renovation rate

Figure 6: Weighted level for renovation within the period for single-family and multi-apartment buildings in the reference (REF) and intensive (INT) strategy (Source: IJS-CEU)

The overall technical potential for renovation is greater than that envisaged by the above renovation projections, and it is addressed using the procedure described below. The baseline state of the housing stock has been taken from the Property Register (REN). The renovation of elements of a building's thermal envelope is recorded in the REN. It states whether an individual element of a building's thermal envelope (facade, windows, roof) has already been renovated and when it was renovated. The technical potential of buildings for complete energy renovation[5] comprises buildings where at least two elements of the building's thermal envelope (walls, windows, roof) have already reached the end of their life-cycle and therefore require replacement. This potential will increase in the period up to 2030 because new buildings requiring complete energy renovation will join the cumulative potential every year. On the other hand, according to the envisaged renovation scenario the cumulative share of buildings that meet the conditions for complete energy renovation will fall as renovation work is carried out year on year. In the past, therefore, the overall technical potential cumulatively increased over the years because of the relatively low level of renovation.

[4] Long-Term Energy Balances up to 2030 and the Expert Foundations for Determining the National Energy Targets. IJS-CEU, 2014.

[5] AN sNES. Model of Building Stock, Source: GI ZRMK.



Key: Total building stock in the category addressed, Potential of buildings for renovation

REN, Scenarios

nZEB renovation, Complete renovation, Partial renovation and individual measures, Unrenovated buildings

Figure 7: Schematic presentation of the building stock renovation model (Source: AN sNES).

Owing to the requirement to take account of restrictions and obstacles, the technical potential for the complete energy renovation of buildings falls at the point where economic feasibility and social acceptability meet, which constitutes the pool of buildings for which the planning of the complete and nearly zero-energy renovation of existing buildings is possible. The following restrictions must be taken into account when determining the potential for the renovation of buildings: protection of built heritage, organisational obstacles (co-ownership of buildings, functionality – need to preserve continuity of operations), financial obstacles (financial mechanisms need to be established for more intensive renovation, along with stable sources of financing) and technical obstacles (emergence of innovative solutions for nearly zero-energy renovation, particularly for built heritage).

The potential for the renovation of residential buildings has been estimated, on the basis of a model, at 42 035 000 m^2 (17 968 000 m^2 for non-residential buildings).

Using the model, the potential for the complete and nearly zero-energy renovation of single-family houses was estimated in 2015 to be 30 453 million m^2, which is 64 % of the entire floor area of single-family houses. This is the potential for buildings to be renovated to a nearly zero-energy level of energy performance. Most of the remainder comprises buildings that can, owing to various restrictions, be renovated only partly. Two per cent of all buildings are already low-energy buildings.

The socially acceptable and financially feasible potential for the complete energy renovation of multi-apartment buildings so that they become nearly zero-energy buildings was estimated in 2015 to be 11 567 million m^2, which is 66 % of the total floor area. One per cent of the total floor area of buildings is low-energy, the remaining percentage comprising buildings which, owing to various restrictions, cannot undergo complete energy renovation.

The key measures supporting realisation of the targets set in relation to the renovation of existing single-family houses and multi-apartment buildings are, in particular: financial incentives, the provision of repayable funding for nearly zero-energy renovation (dedicated funds and funding from international financial institutions), the provision of information to building owners and managers, the development of a stimulative tax policy to encourage nearly zero-energy renovation, demonstration projects, a link to support schemes for the supply of heat from RES for optimisation of the operation of energy systems within the framework of the funding of the energy renovation of buildings, including the monitoring of the effects of renovation, financial aid to vulnerable population groups, the development of solutions for the energy renovation of cultural heritage buildings, with an emphasis on nearly zero-energy technologies, support for achieving the energy renovation targets within housing legislation, etc.

2.3 Public and other service sector

2.3.1 Status of building stock

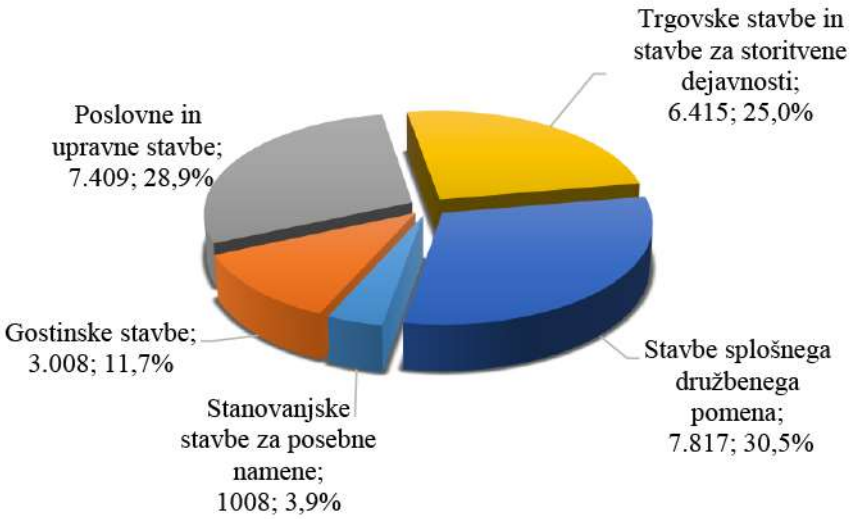
Non-residential buildings have a total of 25.66 million m^2 of useful floor area (2012, Table 3). A distinction is drawn between the public and other service sector. The largest public sector category comprises primary schools (2 million m^2), with other commercial and office buildings being the largest category within the other service sector (6 million m^2) (Figure 8).

Public buildings are buildings classified into sub-categories in the standard classification of buildings, or parts of buildings with the following code designations: CC-SI 113 Residential buildings for special purposes, CC-SI 12201 Public administration buildings and CC-SI 126 Buildings of general social importance.

Other non-residential buildings are buildings classified into sub-categories in the standard classification of buildings, or parts of buildings with the following code designations: CC-SI 121 Catering and hospitality buildings, CC-SI 12202 Banks, post offices, insurance companies, CC-SI 12203 Other commercial buildings and CC-SI 123 Trade and other service activity buildings.

Table 3: Non-residential building categories (Source: IJS-CEU, data: GURS, SURS, IJS-CEU)

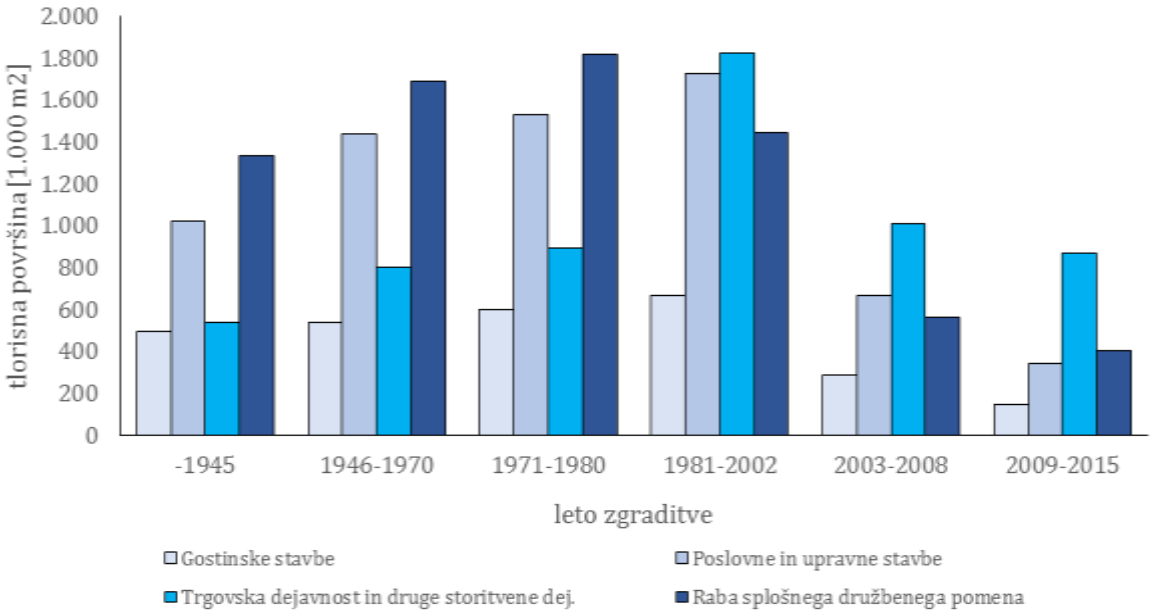
CC-SI	**Description of actual use of a part of a building, aligned with the CC-SI classification**		**Floor area [1 000 m^2]**	**Proportion [%]**
113	**Special-purpose residential buildings**		**1 008**	**3.9**
	Retirement homes		**461**	**1.8**
	Student and pupil dormitories		**305**	**1.2**
	Other		**242**	**0.9**
121	**Catering and hospitality buildings**		**3 008**	**11.7**
12111	**Hotels and similar short-stay accommodation buildings**		**1 661**	**6.5**
12112	**Inns, restaurants and bars**		**1 347**	**5.2**
12120	**Other short-stay accommodation buildings**			
122	**Commercial and office buildings**		**7 409**	**28.9**
12201	**Public administration buildings**		**1 096**	**4.3**
12202	**Banks, post offices, insurance companies**		**6 313**	**24.6**
12203	**Other commercial buildings**			
123	**Trade and other service activity buildings**		**6 415**	**25**
12301	**Trade buildings**		**6 415**	**25**
12302	**Market halls, exhibition grounds**			
12303	**Service stations**			
12304	**Service activity buildings**			
126	**Buildings of general social importance**		**7 817**	**30.5**
12610	**Buildings for public entertainment**		**1 227**	**4.8**
12620	**Museums and libraries**		**366**	**1.4**
12630	School, university and research buildings	Nursery schools	356	1.4
		Primary schools	2 017	7.9
		Secondary schools	794	3.1
		Other education buildings	798	3.1
12640	Hospitals and institutional care buildings	Hospitals	608	2.4
		Other healthcare buildings	734	2.9
12650	Sports halls		981	3.8
		TOTAL	**25 657**	**100**



Key: Commercial and office buildings (7 409), Trade and other service activity buildings (6 415), Buildings of general social importance, Special-purpose residential buildings, Catering and hospitality buildings

Figure 8: Proportion of floor area of buildings of various non-residential building categories (total floor area in 1 000 m^2, share, Source: IJS-CEU)

Sixty-one per cent of the total floor area of non-residential buildings was constructed prior to 1985. This provides a very considerable potential for renovation. Figure 9 shows the total floor area of all categories of non-residential building by period of construction. Some of these buildings have already been renovated.



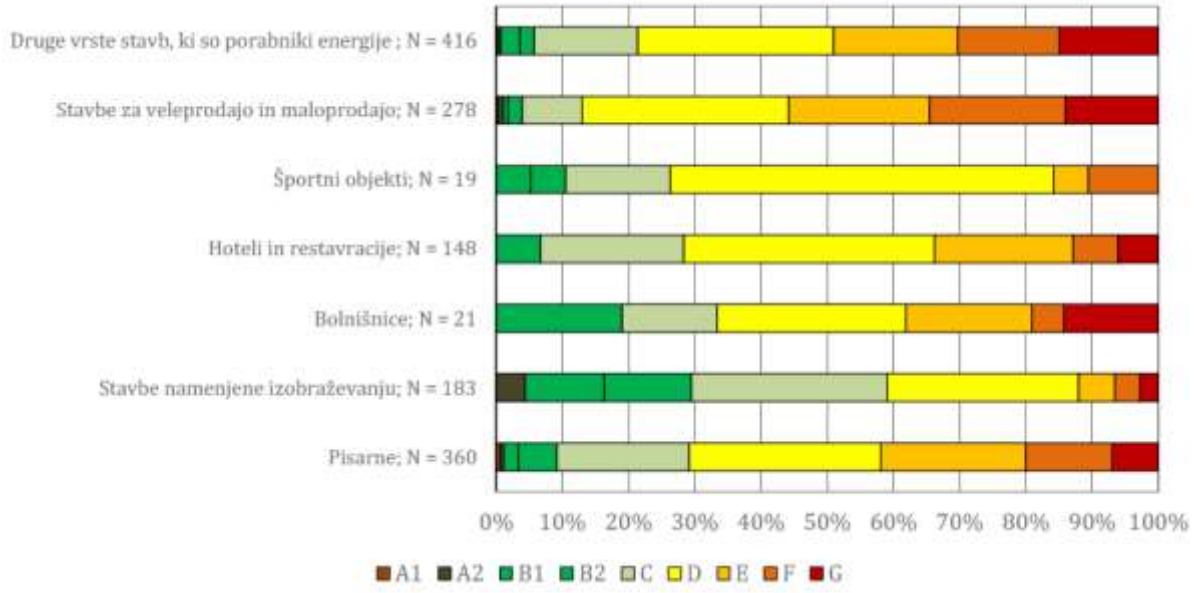
Key: Floor area

Year of construction

Catering and hospitality buildings, Commercial and office buildings, Trade and other service activity buildings, Buildings of general social importance

Figure 9: Structure of non-residential building stock by year of construction (Source: GI ZRMK, data: REN, 2014)

In assessing the state of the non-residential building stock, we noted the energy class in relation to the categorisation (Figure 10) as defined by Directive 2010/31/EU. It can be seen that over 50 % of all buildings in every category have an annual heating energy need of more than 60 kWh/m^{2}a. This share means that the potential for the renovation of existing buildings is great and will have to be reduced robustly in the years to come. Under the recast Directive 2010/31/EU, all public buildings will have to undergo nearly zero-energy renovation after 31 December 2018. This obligation begins for all other buildings after 31 December 2020.



Key: Other energy-using types of building, Wholesale and retail buildings, Sports halls, Hotels and restaurants, Hospitals, Education buildings, Offices

Figure 10: Distribution of non-residential buildings with energy performance certificates by building category (N = no of energy performance certificates, situation as at 19 April 2015) (Source: GI ZRMK, data: Register of Energy Performance Certificates)

2.3.2 Renovation potential

Renovation is divided into renovation following which non-residential buildings meet the requirements of a nearly zero-energy building during the period of renovation, and other renovation. Renovation restrictions are taken into account when determining the scope of complete and nearly zero-energy renovation, e.g. the protection of cultural heritage buildings, architectural restrictions, organisational obstacles (co-ownership of buildings, functionality – need to preserve continuity of operations), financial obstacles (financial mechanisms need to be established for more intensive renovation, along with stable sources of financing) and technical obstacles (emergence of innovative solutions for nearly zero-energy renovation, particularly for cultural heritage buildings), lack of organisation of property registers for buildings owned and occupied by central government (obligatory 3 % renovation each year), the time required for the design of projects and insufficient training of contracting authorities, planners and contractors of nearly zero-energy construction, as well as a lack of models, examples of good practice and demonstration projects from a technical standpoint and from the standpoint of the implementation of (green) public procurement in this area.

Projections for the energy renovation of existing non-residential buildings are made for three groups of buildings in the Strategy:

- public buildings owned and occupied by central government (with compulsory 3 % renovation each year in accordance with Directive 2012/27/EU);[6]
- other public buildings;
- other non-residential buildings (excluding the buildings referred to in the first and second indents above).

The potential for renovation in the service sector was estimated in 2015 at 11 111 million m^2 (68 % of the total floor area). Nearly zero-energy buildings account for 1 % of the total floor area, the remaining percentage comprising buildings which, owing to various restrictions, cannot undergo complete energy renovation.

The potential for renovation to nearly zero-energy building standard in public buildings was estimated in 2015 at 6 857 million m^2 (66 % of the total floor area of public buildings). Nearly zero-energy buildings account for 1 %, the remaining percentage comprising buildings which, owing to various restrictions, cannot undergo complete energy renovation.

At the outset the share of renovation after which a building may be treated as nearly zero-energy will be low. It is expected that renovation under nearly zero-energy building criteria will follow the model, i.e. the renovation of public buildings owned and occupied by central government, with a minor delay of course. It is envisaged that the share of renovation following which a building is deemed to meet the requirements of a nearly zero-energy building following renovation will gradually increase, and comprise the majority of all renovation by 2030.

The instruments supporting the plan set out to increase the number of buildings undergoing complete and nearly zero-energy renovation in the public sector, as part of the group comprising the 3 % of buildings owned and occupied by central government that must be renovated annually and in the other non-housing sector, are: financial incentives in the form of grants and repayable funding for the public sector, particularly central government buildings, cohesion funds, promotion of the introduction of energy performance contracting, private funds for the rest of the non-residential sector, financial resources from the dedicated funds and programmes of international financial institutions for the public sector and the rest of the non-residential sector, the re-routing of some financial incentives to promoting the provision of repayable funding, the training of contracting authorities, project designers, contractors and users of nearly zero-energy buildings, the development of solutions for the renovation of cultural heritage buildings and special building groups (type-specific solutions for non-residential and public buildings), a link to the support scheme for the supply of heat from RES, the legal foundations for target indicators for EE and RES in the public sector, the monitoring of the indicators achieved, promotion, and the implementation of measures to optimise the operation of energy systems as part of the financing of the energy renovation of buildings and for other buildings through financing via energy performance contracting.

2.4 Buildings owned and occupied by central government

Under Article 348 of the EZ-1, the Long-Term Strategy also includes a definition of central government:

Central government as defined by the Strategy comprises ministries, authorities affiliated with ministries, administrative units, government services, judicial authorities and other state authorities.

In accordance with the Strategy presented, the obligations under Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency relating to energy performance and the energy renovation of buildings owned and occupied by central government are obligations that refer to the energy efficiency and energy renovation of buildings owned and occupied by the core public sector . Slovenia is obliged to ensure, as from 1 January 2014, that 3 % of the total floor area of heated and/or cooled buildings owned and occupied by central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU. This obligation has been transposed into Slovenian law by Article 349[7] of the EZ-1. The total floor area of buildings or property in

[6] The 3 % rate is calculated on the basis of the total floor area of buildings owned and occupied by the central government bodies of the Member State with a total useful floor area of over 500 m² which do not meet the national minimum energy performance requirements on 1 January of each year set in accordance with Article 4 of Directive 2010/31/EU. The specified 500 m² threshold will be lowered to 250 m² from 9 July 2015.

[7] Article 349 (methodology for calculating the percentage of renovation)

the current Register of State-Owned Buildings Occupied by Central Government assumed not to meet the energy performance requirements stands at 708 296 m^2 (figure as at 18 April 2014). The current register will be updated, as outlined below.

The strategy for the energy renovation of buildings owned and occupied by central government will be accomplished by means of the following activities:

1. The establishment of a list of buildings owned and occupied by central government which do not meet the minimum energy performance requirements from 1 January each year from 2014 onwards.
2. Determination of the conditions for renovation
3. Financing of projects from the new financial perspective under the OP EKP 2014–2020
4. Implementation of pilot or demonstration projects
5. Monitoring of the targets (OP EKP 2014–2020 and more widely)

Slovenia has not yet decided whether to take an alternative approach as provided for by Article 5(6) of Directive 2012/27/EU, which allows the obligation to renovate a certain amount of floor area of state buildings to be replaced by other measures that would achieve the same energy savings in these buildings.

1. Establishment of a list of buildings owned and occupied by central government

By the end of the year, the ministry responsible for energy will compile a list of central government buildings, to include all data from the existing records (e-land register, GURS, CEN and other records maintained in accordance with the legislation). It will include buildings that do not meet the minimum energy performance requirements. The list will be updated on 1 January each year. This will enable renovation or new construction to be monitored continuously, a calculation to be made of the annual renovation rate for central government buildings and an annual calculation to be made of the total floor area of central government buildings, including any changes that affect the list. The list will be published on the website of the ministry responsible for energy.

2. Determination of the conditions for renovation

The conditions upon which the move towards the complete energy renovation of all central government buildings is based are:

- **Ownership by the state** (if the building is not wholly owned by the state, a full agreement on co-financing reached with the other owners is required).
- **Settled issue of management:** Where there are two or more managers, an agreement must be concluded on which of them will conduct the energy renovation, along with a financing plan.
- **Determination of the energy performance indicators:** A comprehensive energy audit of the building and an energy performance certificate, which must take sufficient account of the conditions relating to the location, the cultural protection conditions and any other relevant conditions.
- Investment documentation that specifies the upper limit on the return on investments made by a private partner.
- **Test of suitability for PPP:** Implementation of a preliminary procedure (Article 31 of the Public-Private Partnership Act) – a test is conducted to establish whether a building is suitable for public-private partnership (PPP) (implementation of a preliminary procedure under the Public-Private Partnership Act).

---

(1) For the purpose of calculating the percentage of renovation specified by the long-term strategy referred to in the preceding Article, the useful floor area of buildings exceeding 250 m^2 shall be taken into account when calculating the total floor area of buildings owned by the public sector.

(2) If the annual target for the renovation of the total floor area laid down by the long-term strategy referred to in the preceding Article is exceeded, the excess may be counted towards the targets for the following years. New buildings occupied and owned as replacements for specific central government buildings demolished in any of the two previous years, or buildings that have been sold, demolished or taken out of use in any of the two previous years due to the more intensive use of other buildings, may count towards the annual renovation rate of central government buildings.

(3) The ministry responsible for energy, in collaboration with the ministry responsible for the real estate management system shall compile an inventory of buildings owned and occupied by central government that includes details on the useful floor area and the energy performance indicators.

- **Specified proposal for the complete energy renovation of a building:** Set of measures for complete energy renovation in accordance with point 2.1.

The following premises must be taken into consideration after a decision is reached to move towards the energy renovation of a building:

- **Energy renovation project:** Project design documentation must be compiled before energy renovation is carried out. In the case of PPP, the project design documentation must be compiled by the private partner.
- **Implementation of other measures to improve the state of the building:** Other suitable measures to improve the state of buildings are also carried out alongside energy renovation, in accordance with the principles of due diligence.
- **Compliance of renovation with the principles of sustainable construction:** Pursuant to the sustainable construction guidelines being compiled by the ministry responsible for construction, which are likely to be completed by the end of 2017.

3. Financing of projects from the new financial perspective under the OP EKP 2014–2020

Financing of the OP EKP 2014–2020 is defined more precisely in the Decree on the Implementation of Procedures for the Use of European Cohesion Funds in the Republic of Slovenia in the 2014–2020 Programming Period for the 'Investments for Growth and Employment' Objective (UL RS, No 29/15) and in the associated managing authority instructions. Funds will be allocated under the direct approval process for projects for the energy renovation of central government buildings.

A priority list of buildings is expected to be compiled in December 2015 on the basis of the criteria for selecting and financing projects for the energy renovation of buildings, which are being drawn up by the ministry responsible for energy (criteria slated for completion by the end of November 2015). This list must be adhered to when the energy renovation of buildings is being undertaken. During the lifetime of the project, the criteria will be supplemented in response to the results of the energy renovation projects carried out. The priority list of buildings will be updated annually in response to the documentation produced and delivered (energy performance certificate, comprehensive energy audit, investment documentation).

4. Pilot or demonstration projects

Prior to the compiling of the list referred to in point 1 and to the commencement of implementation of energy renovation projects under point 3, pilot or demonstration projects may be commenced that involve the introduction of new knowledge and procedures for the implementation of renovation projects. The following assumptions must be followed during the selection of pilot projects, chiefly the state of readiness of the project, the location (temperature deficit), the feasibility of the nearly zero-energy building project, the compiling of the project in accordance with the model of ensuring energy savings, the group of projects, sustainable construction and pilot application of sustainable construction criteria, accessibility of the building, achievement of several targets from the OP with regard to urbanisation, substitute buildings and employment. Since achievement of the targets of the Strategy is based on private sector involvement, a pilot project involving the implementation of energy renovation in accordance with the model of contractual provision of energy savings must be carried out as a matter of priority, with priority given to the complete energy renovation of a group of buildings.

5. Monitoring of the targets (OP EKP 2014–2020)

The OP EKP 2014–2020 sets the targets that must be met, i.e. end-use energy savings in public sector buildings and the energy renovation of buildings owned and occupied by central government. The total floor area renovated in m^2, which is also the unit under which we will report to the EU regarding the 3 % renovation obligation, will form the basis for the monitoring of the achievement of the target. The list of buildings referred to in under point 1 will enable this monitoring to take place. Significantly, point 4 of Article 5 of Directive 2012/27/EU states that new buildings occupied and owned as replacements for specific central government buildings demolished in any of the two previous years, or buildings that have been sold, demolished or taken out

of use in any of the two previous years due to the more intensive use of other buildings, may count towards the annual renovation rate of central government buildings.

The method used to monitor the results of end-use energy saving measures will be set out in the Decree on the Energy Management System, which is being compiled and will be adopted in autumn 2015.

2.5 Buildings owned and occupied by the wider public sector

Under Article 348 of the EZ-1, the Long-Term Strategy also includes a definition of the wider public sector.

The wider public sector as defined by the proposed strategy comprises public institutes, public commercial institutes, public funds, public agencies and institutions founded by the state or by self-governing local authorities, and public institutes, public commercial institutes, public funds, public agencies and institutions founded by a municipality.

2.5.1 The strategy for the energy renovation of buildings owned and occupied by the wider public sector will be accomplished by means of the following activities:

1. Determination of the conditions for renovation
2. Financing of projects from the new financial perspective under the OP EKP 2014–2020
3. Implementation of pilot or demonstration projects

1. Determination of the conditions for renovation

The conditions upon which the move towards the complete energy renovation of all buildings of the wider public sector are:

- Ownership by a wider public sector entity (if the building is not wholly owned by a wider public sector entity, a full agreement on co-financing reached with the other owners is required).
- Settled issue of management: Where there are two or more managers, an agreement must be concluded on which of them will conduct the energy renovation, along with a financing plan.
- Determination of the energy performance indicators: A comprehensive energy audit of the building and an energy performance certificate, which must take sufficient account of the conditions relating to the location, the cultural protection conditions and any other relevant conditions.
- Investment documentation that specifies the upper limit on the return on investments made by a private partner.
- Test of suitability for PPP: Implementation of a preliminary procedure (Article 31 of the Public-Private Partnership Act) – a test is conducted to establish whether a building is suitable for public-private partnership (PPP) (implementation of a preliminary procedure under the Public-Private Partnership Act).
- Specified proposal for the complete energy renovation of a building: Set of measures for complete energy renovation in accordance with point 2.1.

The following premises must be taken into consideration after a decision is reached to move towards the energy renovation of a building:

- Energy renovation project: project design documentation for the energy renovation of a building must be compiled before energy renovation is carried out. In the case of PPP, the project design documentation must be compiled by the private partner.
- Implementation of other building improvement measures: other suitable measures to improve the state of a building are also carried out alongside energy renovation, in accordance with the principles of due diligence.
- Compliance of renovation with the principles of sustainable construction: Pursuant to the sustainable construction guidelines being compiled by the ministry responsible for construction, which are likely to be completed by the end of 2017.

2. Financing of projects from the new financial perspective under the OP EKP 2014–2020

Financing of the OP EKP 2014–2020 is defined more precisely in the Decree on the Implementation of Procedures for the Use of European Cohesion Funds in the Republic of Slovenia in the 2014–2020 Programming Period for the 'Investments for Growth and Employment' Objective (UL RS, No 29/15) and in the associated managing authority instructions. Funds will be allocated directly to wider public sector buildings (for buildings founded by the state) and via public tenders (for buildings founded by a municipality).

Wider public sector entities founded by the state: Calls to provide a list of energy renovation projects for buildings owned and occupied by wider public sector bodies founded by the state will be published every year in line with the funds available. Selection of the buildings and the level of approved funds will be drawn up on the basis of criteria for selecting and financing projects for the energy renovation of buildings, which are being compiled by the ministry responsible for energy (criteria slated for completion by the end of November 2015). The criteria will be supplemented in response to the results of the energy renovation projects carried out.

Wider public sector bodies founded by a municipality: The intermediate body will, annually and in line with the funds available, publish public tenders to which wider public sector bodies founded by a municipality may apply. Selection of the buildings and the level of approved funds will be determined on the basis of criteria for selecting and financing projects for the energy renovation of buildings, which are being compiled by the ministry responsible for energy (criteria slated for completion by the end of November 2015). During the lifetime of the project, the criteria will be supplemented in response to the results of the energy renovation projects carried out.

3. Implementation of pilot or demonstration projects

Prior to the implementation of energy renovation projects under point 3, pilot or demonstration projects may be commenced for wider public sector bodies that involve the introduction of new knowledge and procedures for the implementation of renovation projects. The assumptions referred to in point 4 of Section 2.4. must be followed in the procedure of selecting pilot projects.

3 Obstacles and opportunities in the monitoring of measures to increase energy performance – SWOT analysis

3.1 Housing sector

Technologies exist and are available on the market that increase energy performance and, consequently, lower energy use in residential buildings. With due regard to the costs and benefits throughout the entire life-cycle, investments in a large portion of the new technologies for improving energy performance are shown to be justifiable from an economic standpoint as well. Progress in increasing the energy performance of the housing sector is nevertheless relatively slow, with the main obstacles being:

- A **poor level of awareness**, which is the result of information asymmetry and a lack of information. There is a lack of awareness of the (financial and environmental) advantages of energy performance measures and a lack of availability of properly collated information on the technical and financial options to assist households. Information on energy performance is also asymmetrical, with a tendency towards the *ad hoc* use of material by those in possession of it. As a consequence, information on energy performance is relatively expensive, experts distribute it in limited quantities, and consumers frequently do not trust it because of their previous negative experiences with new technologies (OECD/IEA, 2007).
- Two further major obstacles in achieving greater energy performance in the housing sector are the **availability of financial resources** to support these types of project and **assessments of the return on investments** in energy efficiency projects which do not take account of future savings. As a result of the privatisation that took place in Slovenia in 1991, there is a high percentage of home ownership (90 % according to the 2011 census). The way in which housing was privatised (sale of formerly socially owned apartments at 10–30 % of their market value) led to an increase in ownership by the less well-off and, consequently, to the **problem of low-income owners** in the housing sector. Owing to their low incomes, they are unable to make an adequate contribution to maintenance and renovation, and therefore to improving the energy performance of residential buildings.
- The complexity of decision-making in multi-apartment buildings (owners with a range of very different interests and investment potentials within the same building, difficulty in achieving consensus among owners in the same residential building, percentage required for consent).
- **Inertia in consumer habits**, as major changes in consumer behaviour require a period in excess of ten years, while the time it typically takes for a new technology to penetrate is between three and four years (OECD/IEA, 2007).
- There is a **principal-agent problem** in the rented sector, where the owner of the apartment (who bears the costs of energy renovation) and the user of the apartment (who bears the costs of the energy consumed in the apartment, and therefore benefits from increased energy performance) are two different people. Consequently, the motivation to improve energy performance is very low. This applies equally to the private and non-profit rented sectors.

The main stakeholders in the energy renovation process are the owners of building stock, tenants, managers of multi-apartment buildings, building contractors, manufacturers and providers of EE products, equipment and services, project designers, energy suppliers, financial institutions, investors in the property market, energy advice network advisers, the state, municipalities and the Eco Fund.

Table 4: Matrix of strengths, weaknesses, opportunities and threats (SWOT) for investments in the increased energy performance of residential buildings

	Positive	Negative
Internal	STRENGTHS	WEAKNESSES
	• Spread of awareness of the advantages of increased energy performance of residential buildings • Energy advice network for citizens • Possibility of obtaining repayable funding and grants from the Eco Fund • Provision of information and incentives for increased energy performance by energy suppliers • Examples of good practice provide attractive models • With the introduction of individual metering, residents of multi-apartment buildings have an overview and control of their energy consumption • Reserve funds established in multi-apartment buildings • Reduction in levels of energy poverty among the population • Improvements to residents' living conditions • Lower energy costs	• Relatively poor level of awareness still present (chiefly of the organisational and implementational aspects of renovation) • Difficulties in reaching agreement in multi-apartment buildings • Lack of confidence in the managers of multi-apartment buildings • Lack of confidence in energy renovation providers • Problem of low-income owners • Lack of interest in energy renovation on the part of owners of rented flats • Too many partial rather than complete energy renovations • Implementation of the complete energy renovation of building envelopes without taking into account the changes to the requirement for users to behave in a certain way (e.g. deterioration in air quality in the absence of a ventilation system or no change in habits following the introduction of a recovery system) • Difficulties in acquiring funds for the renovation of multi-apartment buildings (no adequate loan instruments or the provision of loan instruments inhibited by legislation)
External	OPPORTUNITIES	THREATS
	• Rapid technological development • Use of European funds by owners of non-profit rented stock • Greater emphasis given to energy performance at the European level (incentives, tightening of requirements) • Establishment of a state guarantee scheme • Introduction of the possibility of dividing the benefits of energy efficiency measures between apartment owners and tenants	• Inadequate training of energy renovation providers • Extended period of relatively low fuel prices • Uncertainty regarding future energy prices • Instability of legislation • Inadequate conditions for the introduction of innovative energy performance services/energy performance contracting in the housing sector (contractual provision of energy supply and contractual provision of energy savings)

3.2 Buildings owned and occupied by central government

The public sector has a particularly important role to play in efforts to improve the energy performance of buildings, serving as a model for the renovation of building stock that improves energy performance. The following factors most frequently hinder the public sector from fulfilling this role:

- **Lack of funds and economic motivation** to improve the energy performance of public buildings. These types of investment are usually funded from budget funds allocated to a user annually. Alongside the austerity measures in place and the often restricted borrowing opportunities, this limits the possibility of undertaking the complete energy renovation of buildings, which requires considerable investment funds. As a result of this, renovations are often merely partial in nature. Moreover, managers in the public sector do not have an economic motive for improving the energy performance of their buildings. Investments in energy performance are usually low down the list of investment priorities.
- The most common critical organisational obstacle is the **lack of skills, information and reliable sources of data** in relation to the energy performance of buildings.
- **Complex and cumbersome public procurement procedures** for measures to improve the energy performance of buildings.
- Projects to improve energy performance also differ from traditional projects in terms of the method used to evaluate the return on investment, nor is the traditional cost-benefit analysis straightforward to use in these cases, chiefly because of difficulty in evaluating the positive side effects, such as improved feelings of well-being, healthier living conditions and so on. Investments in improving energy performance can also be understood as a form of insurance against the risks of unfavourable fluctuations in fuel prices, which from a strictly economic standpoint would also require the **application of a lower discount rate** when estimating the return on investment of a project.
- There are **restrictions on and a lack of a support environment for the use of non-budget funds**.

Lack of knowledge of and confidence in energy performance contracting as a non-budget source for the funding of energy renovation. The public sector often lacks the skills necessary to implement and manage such projects. The main stakeholders in the energy renovation of buildings owned and occupied by central government are the state as the joint owner of buildings, the state as legislator, the state as the administrator of public funds (EU funds, etc.), co-owners of buildings (with the state), state administration employees, building managers, building contractors, energy performance contracting providers (energy service enterprises or ESCO enterprises, etc.), energy suppliers, financial institutions and the EU.

Table 5: Matrix of strengths, weaknesses, opportunities and threats (SWOT) for investments in the increased energy performance of buildings owned and occupied by central government

	Positive	Negative
Internal	STRENGTHS	WEAKNESSES
	• Mandatory energy performance certificate showing the possible scale of savings • Legally stipulated obligation to introduce energy management systems • As a reliable payer, the state is a relatively low-risk client and is therefore attractive for energy performance contracting models • Promotion of energy accounting within energy management systems • Improved levels of information and awareness of the cost-effective options for saving energy in buildings • Improvements to the quality of the working environment	• Lack of economic motivation to improve the energy performance of buildings • Lack of awareness of the scale of energy use in buildings (also the consequence of a lack of data on energy supply and use) and the possibilities for reducing energy use • Lack of funds • The protracted period of tight fiscal frameworks resulting from unstable macroeconomic conditions and the deficit and debt reduction procedure, which will make the use of state funds for investments in the energy performance of buildings more difficult • Lack of information, human and organisational resources specialised in implementing the energy renovation of buildings

	• Examples of good practice provide attractive models • Lower energy expenditure in the long term	and measures relating to energy efficiency in buildings • Delays in introducing energy management systems in the public sector.
		• Fragmentary nature of knowledge, experience and skills • Reaching agreement and gaining consent for the renovation of buildings not 100 % owned by the state • High discount rate for public investments (7 %) • Investments often limited to those with a relatively quick return • Limited borrowing opportunities • Lack of knowledge, understanding and confidence regarding the concept of energy performance contracting • Lack of skills in the commissioning of energy performance contracting projects • Legal complications regarding the implementation of energy performance contracting • Lack of a support environment for the implementation of energy performance contracting projects • Partial energy renovation instead of complete renovation • Implementation of the complete energy renovation of building envelopes without taking into account the changes to the requirement for users to behave in a certain way (e.g. deterioration in air quality in the absence of a ventilation system or no change in habits following the introduction of a recovery system) • High proportion of protected buildings that require special treatment, absence of guidelines
External	OPPORTUNITIES	THREATS
	• The EU requirement for the mandatory renovation of 3 % of the total floor area of buildings owned and occupied by central government each year • Rapid technological development • Energy performance contracting possibilities • Use of European funds for technical support and the funding of the renovation of buildings owned and occupied by central government. • Greater emphasis given to energy performance at the European level (incentives, tightening of requirements) • The planned overhaul of the methodology for implementing energy audits in buildings in order to support the preparation of tenders for energy	• Too little emphasis placed on government support for energy-efficient investments in the public sector • Limited range of financial instruments for financing the energy renovation of public buildings • The problem in acquiring financial resources faced by enterprises that provide energy performance contracting services limits the potential scope of provision of these services • Inadequate training of energy renovation providers • Low number of energy performance contracting providers and the limited number of promoters of energy performance contracting projects • Extended period of relatively low fuel prices • Uncertainty regarding future energy prices

	performance contracting • Accessibility of innovative energy performance services/energy performance contracting (contractual provision of energy supply and contractual provision of energy savings)	

3.3 Public and private service sector

Wider public sector buildings (i.e. excluding buildings owned and occupied by central government) and commercial buildings in the service sector are classified as part of the public and private service sector. Both types of building have similar characteristics (size, energy intensity, relatively concentrated ownership, usually professional management); however, the barriers to investment in energy performance differ somewhat within the group.

The main barriers for the public sector are similar to those encountered by central government: lack of funds and economic motivation, lack of skills, complex and cumbersome public procurement procedures, a high discount rate required that does not take account of the public benefit, lack of confidence in and knowledge of energy performance contracting).

One important factor when opting for the energy renovation of buildings in the private service sector is that these investments have an explicit economic benefit for the investor. The most important barriers that arise here are:

- Investments in energy renovation have a long period of return on investment; a robust, stable and consistent regulatory framework defining the field of energy renovation is therefore important for investor confidence. **Uncertainty regarding the regulatory framework** reduces investments in the energy renovation of buildings.
- The most common critical organisational obstacle is the **lack of skills** in the field of the energy performance of buildings and a **lack of information and of reliable sources of data** for estimating savings.
- A considerable portion of buildings in the service sector are rented. This means that, once again, the **principal-agent problem** has to be addressed (i.e. the fact that the interests and motives of tenants and owners are different).
- Investors often give **priority to investments with a quicker rate of return**, therefore to partial renovation rather than investments in the complete energy renovation of buildings and in energy systems within buildings. Similarly, investments in improving the energy performance of buildings in the commercial sector can also be seen as a form of insurance against the risks of unfavourable fluctuations in fuel prices, which from a strictly economic standpoint also requires the application of a lower discount rate when estimating the return on investment of a project. However, lower discount rates are seldom applied. Consequently, investments in an enterprise's core activity take priority over projects for the energy renovation of buildings
- There are a large number of small and medium-sized enterprises in the service sector which, owing to their size, usually do not have enough staff able to deal with EE and the use of RES, or to manage projects in this field. Even though there are some public funds available for investments, uptake is slow.

The main stakeholders in the energy renovation of buildings in the public and private service sectors are the public and private sectors as owners of buildings, the state as legislator, municipalities, co-owners of buildings (co-owned with the public and private service sectors), state administration employees and employees in the private service sector, building managers, building contractors, energy performance contracting providers (energy service enterprises or ESCO enterprises, etc.), energy suppliers, local energy agencies (for local community buildings), financial institutions and the EU.

Table 6: Matrix of strengths, weaknesses, opportunities and threats (SWOT) for investments in the increased energy performance of buildings in the public and private service sector

	Positive	Negative
Internal	STRENGTHS	WEAKNESSES

	• Mandatory energy performance certificate for buildings under a long-term lease showing the possible scale of savings[8] • Mandatory local sustainable energy action plan that also includes measures for the energy renovation of buildings • As a reliable payer, the state is a relatively low-risk client and is therefore	• Lack of economic motivation to improve the energy performance of public buildings • Lack of awareness of the scale of energy use in buildings (also the consequence of a lack of data on energy supply and use) and the possibilities for reducing energy use • Lack of funds
	• attractive for energy performance contracting models • Energy audits improve awareness of the cost-effective options for saving energy in buildings • Improved levels of information and awareness of the cost-effective options for saving energy in buildings • Promotion of energy accounting • Improvements to the quality of the working environment • Lower energy expenditure in the long term	• Lack of information, human and organisational resources specialised in implementing the energy renovation of buildings and measures relating to energy efficiency in buildings • The protracted period of tight fiscal frameworks resulting from unstable macroeconomic conditions and the deficit and debt reduction procedure, which will make the use of state funds for investments in the energy performance of public sector buildings more difficult • Lack of interest in energy renovation on the part of tenants • Reaching agreement and gaining consent for the renovation of buildings not 100 % owned by one owner • High discount rate for public investments (7 %) • Limited opportunities for borrowing by the public sector and weak lending activities on the part of banks in providing loans to the private sector • Lack of knowledge, understanding and confidence regarding the concept of energy performance contracting • Lack of a support environment for the implementation of energy performance contracting projects • Legal complications regarding the implementation of energy performance contracting • Poorly developed local energy agencies in some places • Partial instead of complete energy renovation – Investments in the private sector often limited to those with a relatively quick return • Implementation of the complete energy renovation of building envelopes without taking into account the changes to the requirement for users to behave in a certain way (e.g. deterioration in air quality in the absence of a ventilation system or no change in habits

[8] Mandatory for all buildings with a total useful floor area of over 250 m^2 owned or occupied by the public sector, and for buildings in the private service sector when sold or placed under a long-term lease.

		following the introduction of a recovery system)
External	OPPORTUNITIES	THREATS
	• Rapid technological development • Energy performance contracting possibilities • Financial incentive grants for technical support and the financing of building renovation • Greater emphasis given to energy performance at the European level (incentives, tightening of requirements) • The planned overhaul of the methodology for implementing energy audits in buildings in order to support the preparation of tenders for energy performance contracting • Standardisation of energy performance contracting procedures	• Too little emphasis placed on government support for energy-efficient investments in the public sector • Limited range of financial instruments for financing the energy renovation of public buildings • The problem in acquiring financial resources faced by enterprises that provide energy performance contracting services limits the potential scope of provision of these services • Inadequate training of energy renovation providers • Too few providers of energy performance contracting • Extended period of relatively low fuel prices • Uncertainty regarding future energy prices

4 Cost-effective approaches to building renovation

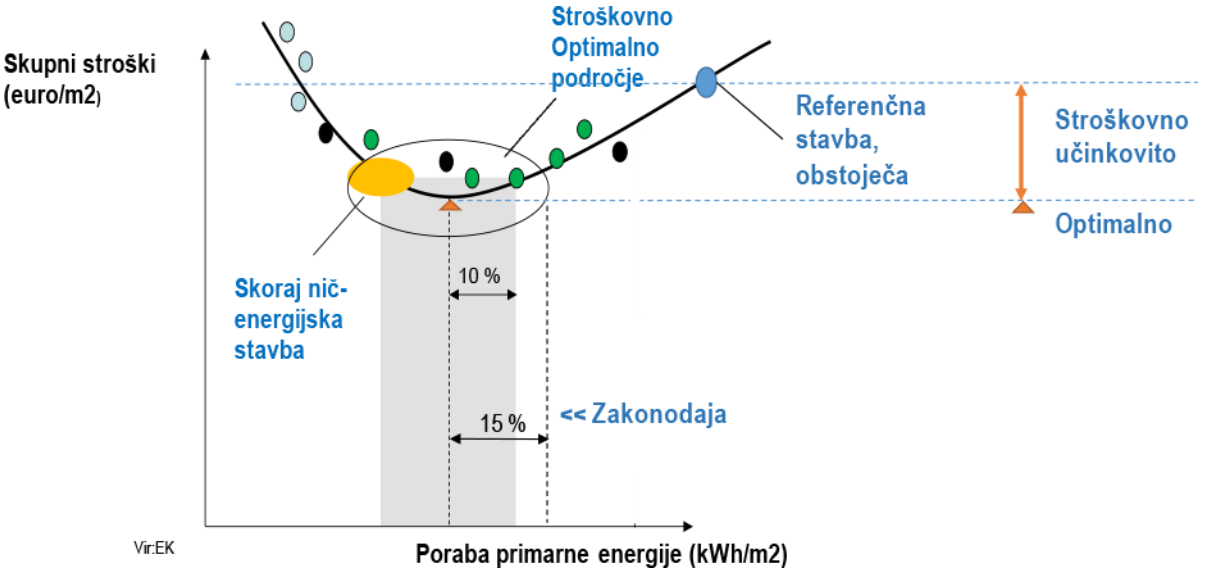
4.1 Premises

An energy-efficient measure for the energy renovation of a building is a measure in which the period of return on investment is shorter than the life-cycle of the measure. Since the energy renovation of a building usually comprises a group of measures, the economic efficiency of the building renovation energy design is evaluated comparatively, relative to the baseline energy design for the reference building. In this case the reference building is a building with an energy design based on legislation and construction practice during the planning or construction phase.

As the economic criterion for assessing the energy design of a building, Directive 2010/31/EU has introduced lifetime or global costs within the envisaged life-cycle of a building, where the key indicator by which we describe the energy design of a building is its primary energy consumption.

The criteria for cost-effective and cost-optimal design must first be defined at the national level in order to determine the appropriate design of the complete energy renovation of a building (Figure 11). We proceed from a reference (unrenovated) building with high energy consumption as well as high lifetime costs within the life-cycle resulting from inefficient design. Each renovation scenario that is able to demonstrate, on the basis of an analysis (energy properties of the building and LCC/costs of investment, maintenance, replacement and operation) lower global costs and lower energy consumption than the reference building is cost-effective. However, the most optimal is the one with the lowest total costs in terms of net current value.

Under European legislation, the minimum requirements for energy-efficient new buildings in the complete energy renovation of existing buildings must be formulated in accordance with the established cost-optimal minimum level. A deviation of no more than 15 % from the cost-optimal level is permitted. On the other hand, the principle applies, for the nearly zero-energy design of a new building or the renovation of a building, that those costs connected with up to 10 % lower energy consumption than the cost-optimal level are still acceptable. When nearly zero-energy construction becomes mandatory by the end of 2018 or 2020, the economics will be closer to the optimal. The definition of a nearly zero-energy building, expressed in Slovenia using the highest permitted primary energy use, is supplemented by the requirement for at least 50 % coverage of energy supply by renewable sources.



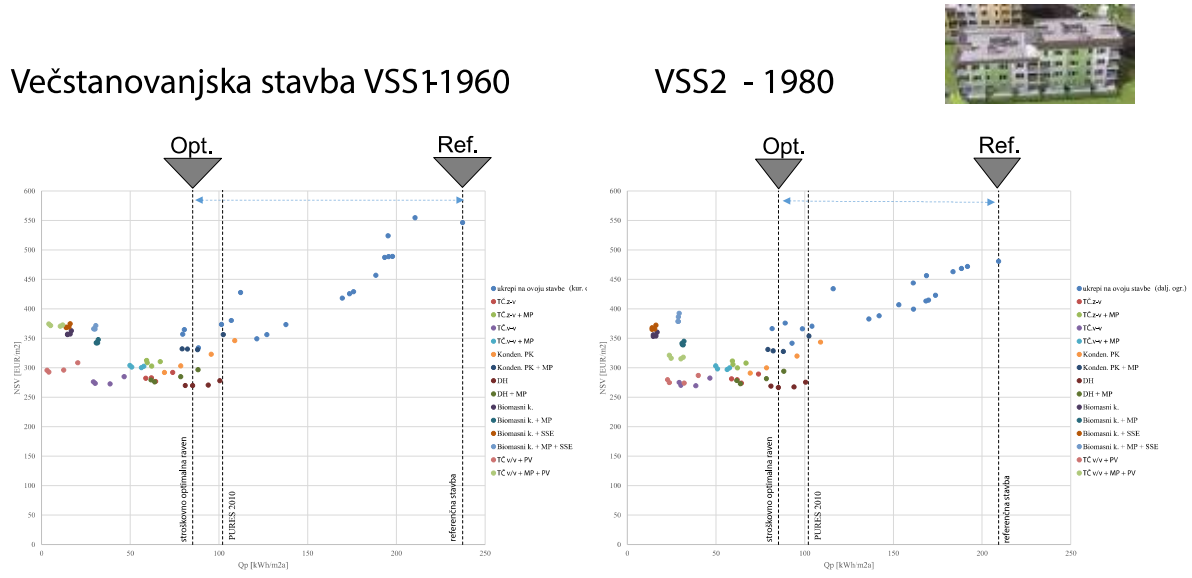
Key: Total costs (EUR/m2), Cost-optimal area, Reference building (existing), Cost-effective, Optimal, Nearly

zero-energy building, Legislation, Primary energy consumption, Source: European Commission

Figure 11: Schematic presentation of cost-effective and cost-optimal energy renovation (Source: EC, GI ZRMK)

The characteristics of building envelopes, energy designs and the systems typically used in buildings are defined for the purposes of typologising buildings in Slovenia. On this basis, we then record the appropriate cost-effective energy renovation measures that can be carried out gradually or as a package of measures; however, in both cases the final objective must be the complete energy renovation of a building in accordance with the principles outlined above.

The national analysis of the cost-optimal minimum requirements for new buildings and the renovation of existing buildings shows a comparative assessment of the economic justifiability of different building renovation energy designs for each individual typology of existing buildings. Figure 12 determines the cost-optimal level of energy design of a building undergoing energy renovation: reference multi-apartment building with the energy characteristics of 1960, VSS1 (left) and the characteristics of 1980, VSS2 (right). The optimal design requires energy indicators that are slightly better than those contained in PURES 2010; however, the deviation is within the still-acceptable tolerances for the compliance of Slovenian legislation and the minimum energy performance requirements with Directive 2010/31/EU.



Key: Multi-apartment building

Optimal, Reference

Strokošno … = Cost-optimal level, Referenčna … = Reference building

Ukrepi … = Building envelope measures (heating oil), Heat pump (air/water), Heat pump (air/water + mechanical ventilation), Heat pump (water/water), Heat pump (water/water + mechanical ventilation), Gas-fired condensing boiler, Gas-fired condensing boiler + mechanical ventilation, District heating, District heating + mechanical ventilation, Biomass boiler, Biomass boiler + mechanical ventilation, Biomass boiler + solar collectors, Biomass boiler + mechanical ventilation + solar collectors, Heat pump (water/water) + solar photovoltaic, Heat pump (water/water) + mechanical ventilation + solar photovoltaic

Figure 12: Determination of the cost-optimal level of energy design of a building undergoing energy renovation: reference multi-apartment building with the energy characteristics of 1960, VSS1 (left) and the characteristics of 1980, VSS2 (right).

We can therefore establish that complete energy renovation must be implemented to a level of complexity that means that the renovated building complies with PURES 2010, with an awareness that the regulation is likely to

be tightened in 2015, where the recent tightening of the minimum requirement regarding the permitted required heat for the heating of a building (in force since 1 January 2015, Article 7 of PURES 2010) will be supplemented in a way that removes the gap between the primary energy use of the cost-optimal energy design of a building and the design of a building constructed under PURES 2010.

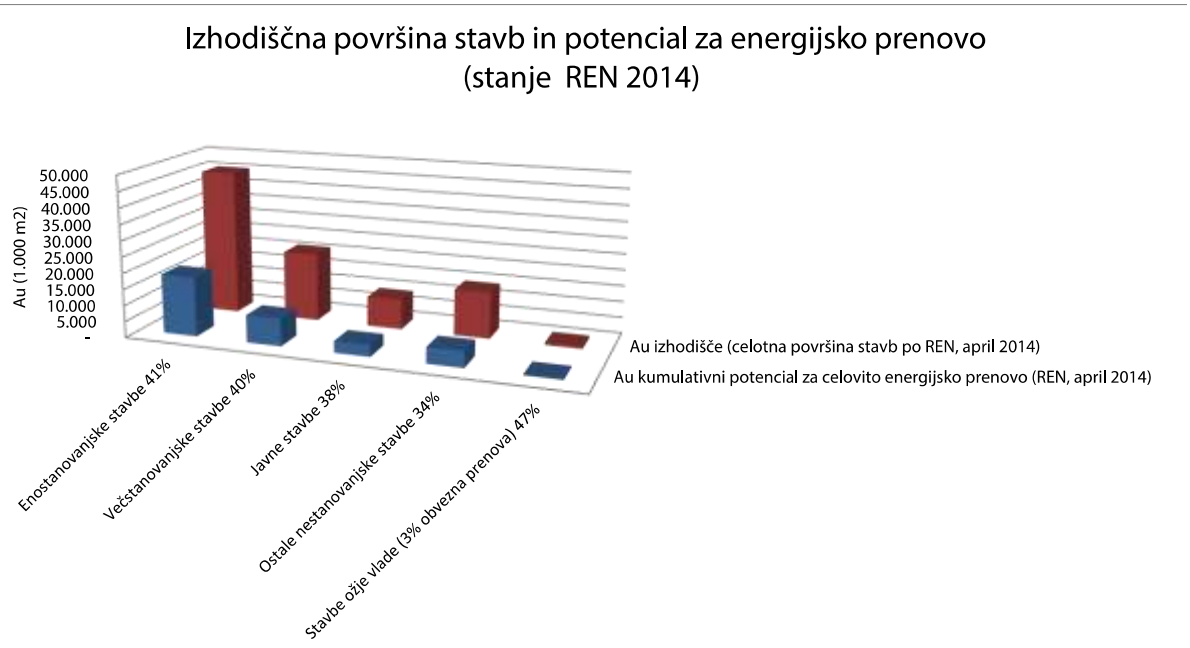
The nearly zero-energy renovation of a building is a more demanding process than the complete energy renovation of a building. Primary energy use in a nearly zero-energy building must be lower than the cost optimum, which is otherwise the target value for the minimum requirements in the regulations. The nearly zero-energy renovation of a building must have further explicit and stricter requirements regarding the low heat needs or requirements for high energy performance, as well as a requirement for substantial coverage of energy needs using renewable sources in the building or in its vicinity. Meeting these requirements in relation to the nearly zero-energy renovation of existing buildings, as stated in the Action Plan for Nearly Zero-Energy Buildings (AN sNES) with regard to the technical requirements and the target volume, is a particular challenge in all sectors and for all types of building. Nevertheless, public buildings and some of the more forward-looking investors and building owners will be among the first to meet the requirements applying to the nearly zero-energy renovation of buildings in the next few years.

The nearly zero-energy renovation of buildings to a superior standard is already a challenge to technological development in the field of new construction materials and renewable energy source technologies, as well as to the development of sustainable construction and renovation, which require the integrated planning and implementation of the complete energy renovation of building stock. We require models and examples of good practice in this area. These must be supported by sustainable construction guidelines as well as by the demonstration projects envisaged within the OP EKP 2014–2020.

4.2 Technical potential for the implementation of cost-effective measures

The technical potential for the complete energy renovation of existing buildings has been assessed in percentages relative to the overall baseline floor area of buildings within individual categories, with information on the renovation status of individual elements of the building envelope (external walls, roof, windows) obtained from REN (2014):

- single-family houses 41 %
- multi-apartment buildings 40 %
- public sector buildings 38 %
- other non-residential buildings 34 %
- central government buildings (mandatory 3 % renovation) 47 %



	Enostanovanjske stavbe 41%	Večstanovanjske stavbe 40%	Javne stavbe 38%	Ostale nestanovanjske stavbe 34%	Stavbe ožje vlade (3% obvezna prenova) 47%
Au kumulativni potencial za celovito energijsko prenovo (REN, april 2014)	18.540	8.481	3.578	4.949	336
Au izhodišče (celotna površina stavb po REN, april 2014)	45.352	21.287	9.300	14.387	708

Key: Baseline floor area of buildings and potential for energy renovation (REN 2014 data)

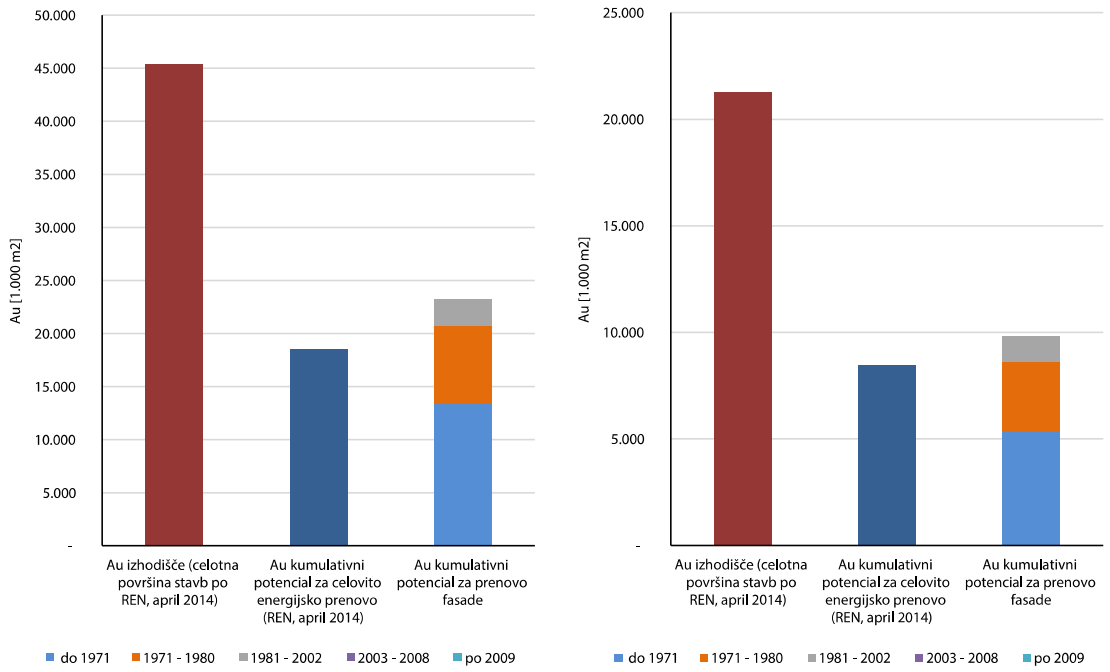
Enostanovanjske … = Single-family houses, Multi-apartment buildings, Public buildings, Other non-residential buildings, Central government buildings (3 % renovation)

Au izhodišče = Au baseline (total floor area under REN, April 2014), Au cumulative potential for complete energy renovation (REN, 2014)

Figure 13: Baseline technical potential for the implementation of the complete energy renovation of building envelopes relative to the total useful floor area of a specific group of buildings (Source: GI ZRMK, data: REN, 2014)

The technical potential for energy renovation is estimated on the basis of the age of the elements of the envelope (end of the life-cycle of an individual element, e.g. walls, roof, windows), which is affected by the age of the building itself as well as by any previous renovation (Figure 13). The baseline technical potential for complete energy renovation comprises buildings where at least two elements of the building's thermal envelope (walls, windows, roof) have already reached the end of their life-cycle and therefore require replacement.

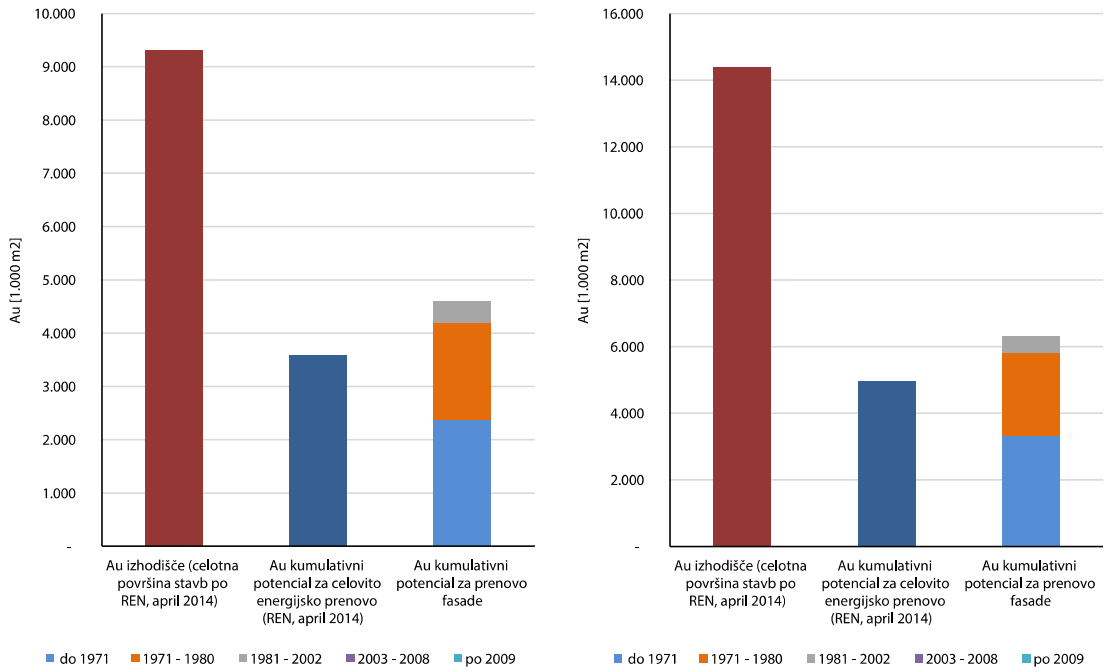
Figures 14 and 15 (public and other non-residential buildings) provide a comparison between the total floor area of buildings within a specific category in the baseline year 2014 with the cumulative technical potential for complete energy renovation (assuming that at least two elements of the envelope have reached the end of their life-cycle) and the potential for the renovation of the external walls/facade (assuming that the life-cycle of the facade has come to an end).



Key: Au baseline (total floor area of buildings, REN, 2014), Au cumulative potential for complete energy renovation (REN, April 2014), Au cumulative potential for facade renovation

do 1971 = up to 1971 … po 2009 = after 2009

Figure 14: Total floor area of buildings, cumulative potential for complete energy renovation and the renovation of the facade (with reference to the age of the building) in the baseline year 2014, based on information from REN 2014, for single-family houses (left) and multi-apartment buildings (right) (Source: GI ZRMK).

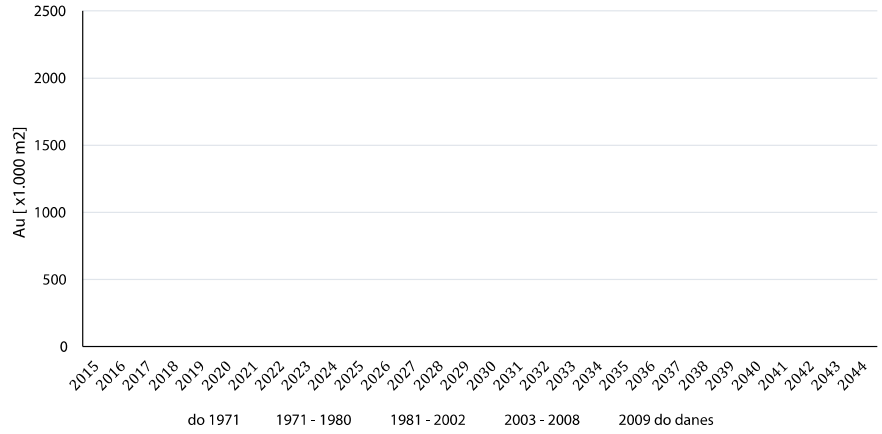


Key: Au baseline (total floor area of buildings, REN, 2014), Au cumulative potential for complete energy renovation (REN, April 2014), Au cumulative potential for facade renovation

do 1971 = up to 1971 … po 2009 = after 2009

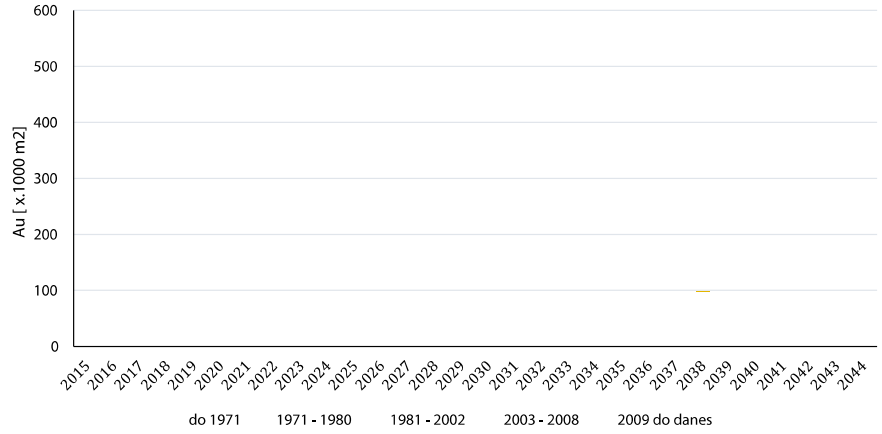
Figure 15: Total floor area of buildings, cumulative potential for complete energy renovation and the renovation of the facade (with reference to the age of the building) in the baseline year 2014, based on information from REN 2014, for public buildings (excluding buildings owned and occupied by central government, left) and other non-residential buildings (right) (Source: GI ZRMK).

This potential will increase annually in the period under observation (up to 2030 or up to 2050) because new buildings requiring complete energy renovation will join the cumulative potential every year. The annual growth in the potential of buildings with facades ready for replacement is shown in Figures 16 to 19. The suitability of an energy renovation measure depends on the architectural, physical construction and technical construction properties of the building. The analysis shows that over half the facades of the envelopes of buildings constructed before 1971 are within the existing potential (buildings without or with very little insulation). In the years up to 2030, the existing potential for the renovation of facades will increase on account of buildings constructed between 1981 and 2002.



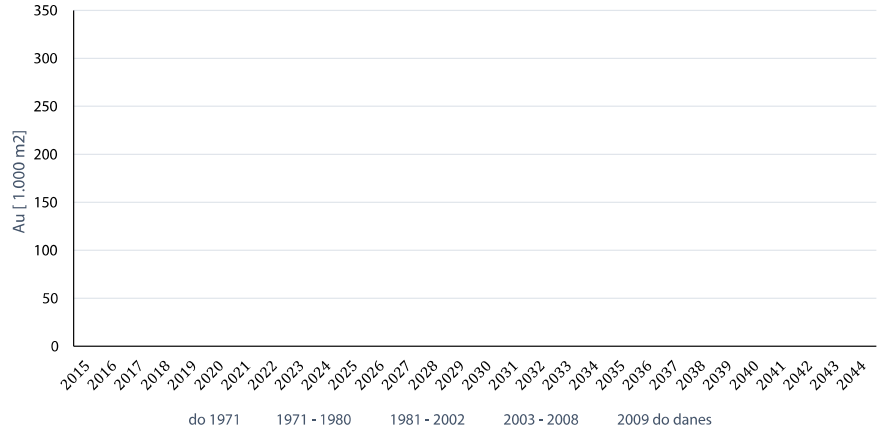
Key: do 1971 = up to 1971 … 2009 do danes = 2009 to present day

Figure 16: Example of the annual growth of technical potential for renovation of the facades of single-family houses, broken down according to the age of building stock that meets the age condition for renovation (Source: GI ZRMK).



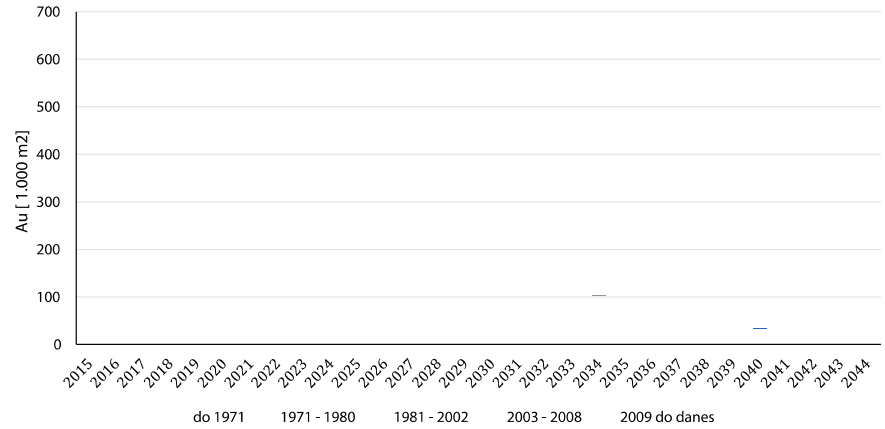
Key: do 1971 = up to 1971 … 2009 do danes = 2009 to present day

Figure 17: Example of the annual growth of technical potential for renovation of the facades of multi-apartment buildings, broken down according to the age of building stock that meets the age condition for renovation (Source: GI ZRMK).



Key: do 1971 = up to 1971 … 2009 do danes = 2009 to present day

Figure 18: Example of the annual growth of technical potential for renovation of the facades of public buildings (excluding buildings owned and occupied by central government), broken down according to the age of building stock that meets the age condition for renovation (Source: GI ZRMK).



Key: do 1971 = up to 1971 … 2009 do danes = 2009 to present day

Figure 19: Example of the annual growth of technical potential for renovation of the facades of other non-residential buildings, broken down according to the age of building stock that meets the age condition for renovation (Source: GI ZRMK).

4.3 Characteristics of building construction, broken down by period

Despite the ostensible diversity of buildings, it is possible to define common characteristics and to classify them by period (Table 7). An overview of the physical construction properties of the existing building stock by period tells us which measures would be possible and worthwhile on individual buildings as part of the complete energy renovation of residential and non-residential buildings.

Table 7: Characteristics of individual age groups of buildings and the recommended cost-effective measures

Residential and non-residential buildings	
	Up to 1945 – period prior to the Second World War
Status	Residential and non-residential buildings from the **pre-war period** (up to 1945) are of solid construction. The external walls are of above-average thickness and made of brick, the ceilings are generally of wood (beam construction), and the cellars are vaulted and made of stone. The roofs and loft spaces are not insulated unless architectural and energy renovation work has already been carried out on them. If the loft spaces are occupied and used, the roofs have mostly already been renovated and insulated (the insulation is generally too thin for today's heating requirements) and the covering has been replaced. The windows are small and made of wood. Buildings are in general poorly maintained and, because of their age, require complete energy renovation, encompassing architectural and construction renovation in addition to energy renovation. Buildings may also be subject to monument protection regulations. This means that all the measures planned must be examined and approved in advance by those required to give their consent.
	1946 – 1971 – 1980
	The quality of construction of housing and non-residential building stock built between the **initial post-war period** and the mid-1970s is poorer, or at best equal to

	the quality of construction of buildings erected prior to 1945. This is largely the result of the lack of building material at the time, or the need to save on building material. The walls were reduced in thickness to 30 cm because of the introduction of modular brick construction. Insulation materials did not exist at that time. The majority of residential buildings were constructed using modular brick. Concrete tiles (insufficient heat insulation), bricks from slag and electrofilter ash were subsequently also used. The buildings are generally in need of deep energy and construction renovation, with the replacement of windows and other maintenance measures.
	The building stock requiring most critical renovation is from this period, led by single-family houses (mostly self-builds) and followed by multi-apartment buildings and, lastly, apartment blocks of all types. Renovation is also required on almost all non-residential building stock.
	1981–2002
	A period of intensive construction of larger housing complexes began in the **1980s**. The first somewhat stricter regulations (JUS.U.J5.600) required greater supervision of the construction of multi-storey apartment buildings (particularly towers). Construction was either solid, with an additional layer of thermal insulation, or skeleton-framed (filled in with masonry facades). The predominant material used in the construction of multi-storey buildings was concrete, including tiles, in all panelling systems. Private apartment stock was built in an uncontrolled manner, chiefly of brick, houses had larger floor areas and were of masonry, some without thermal insulation, others already with thermal insulation and some with inadequate 'thermal insulation' for which siporex, porolite and air were used. Problems and inconsistencies in execution (joints, seals, leaks) have arisen as a result of new materials and self-builds. During this period windows were large, aluminium- or wood-framed and generally energy-inefficient (single-glazing used in places and windows most frequently with inefficient insulated glazing (Thermopane). Non-residential building stock saw a similar intensity of construction and similar construction. Energy renovation chiefly includes the replacement of inadequate building fixtures and work on the building envelope, which must be based on additional thermal insulation, chiefly the roof and ceilings, and the remediation of major thermal bridges. In the **1990s** construction became very diverse, with a fall in the intensity of growth in the construction of concrete housing complexes. Light prefabricated construction, particularly for single-family houses, appeared alongside brick-based construction. There were fewer concrete-based structures and exposed thermal bridges, while the proportion of brick-based construction featuring the thermal insulation of all structural elements increased. On average, houses from this period have better thermal insulation than those from the 1980s, and the windows installed in these houses are of wood, aluminium and PVC. Double-glazing (Thermopan) is predominant everywhere. The 1990s was also marked by the preparation of new legislation; in the meantime, the rules of the profession in force at the time were applied to energy design. In the second half of the 1990s, the first opportunities arose for obtaining grants for energy improvements to building envelopes (loft insulation, installation of gas-filled low-emission glazing, installation of oil-fired boilers).
	2003–2008
	We believe that buildings constructed **between 2002 and 2008** already have better thermal insulation; it therefore makes sense to insulate them further only when

	individual structural elements are damaged or are slated for replacement (frequently for functional and aesthetic reasons, e.g. windows). It also makes sense to insulate only sloping roofs above a heated loft area. In 2002 the first national rules (PTZURES) were issued. These introduced the principles of the original Directive and outlined the development of this field.

An overview of the maximum permitted heat transfer of building envelope elements is shown by period of construction in Table 8.

Table 8: Overview of the maximum permitted heat transfer of building envelope elements [W/(m^{2}K)]

Structural element	1970 regulation	JUS – III. c. 1980	2002 regulation	2010 regulation
External wall	1.28–1.68	0.8	0.6	0.28
Floor abutting onto the ground	0.93	0.65	0.45	0.3
Wall abutting onto the ground	no requirement	0.8	0.7	0.35
Ceiling above an unheated cellar	1.04	0.5	0.5	0.35
Ceiling abutting an unheated loft	1.16	0.7	0.35	0.2
Gently sloping roof above an unheated area	0.93	0.35	0.2	0.2
Windows	3	3	1.4–1.6	1.3

4.4 Technical/economic aspect of the energy renovation of a building

4.4.1 Establishment of reference buildings

The following categories of reference buildings have been established in Slovenia for the purpose of the cost-optimal methodology:

1. single-family houses;
2. apartment blocks and multi-apartment buildings;
3. public buildings and other non-residential building categories.

The building stock within individual building categories is shown in relation to reference buildings.[9]

The reference building and the baseline properties typical of construction in 1960 are shown below for each category of existing building. The effects of cost-effective measures on the energy renovation of buildings are analysed in relation to the reference buildings. Building geometry was taken from the typology for residential buildings, or else a new virtual building (for public and other non-residential buildings) designed. The thermal envelope and systems for heating, cooling, ventilation, etc. were prescribed for the reference buildings with

[9] 'Cost-optimal levels of minimum energy performance requirements for buildings in Slovenia', Analysis of results, GI ZRMK, December 2014.

regard to statistical data (SURS,[10] REUS[11]). Individual measures and groups of measures that form various energy renovation scenarios are analysed below in relation to three reference buildings.

Measures were defined and primary energy use and global costs in terms of net present value were calculated for the energy renovation design examples addressed.

[10] Statistical Office of the Republic of Slovenia (figures for 2010–2014).
[11] Energy Efficiency Research Slovenia (REUS).

Table 9: Reference single-family house for existing buildings (1960, major renovation)

Existing single-family house (ESS1)	Geometry of the building	Shares of window area on building envelope and windows with no solar access	Floor area in m^2, as used in the building code
	A / V = 0.87 m^{-1} 47/41/39/ surface area of facade N / W / S / E = 28 m^2 surface area of roof = 107 m^2 floor area = 76 m^2 orientation: south	ratio of surface area of windows to facade 3.2 / 2.3 / 9.5 / 16.0	148
Description of the building	**Description of the average building technology**	**Average energy performance (kWh/m2a) before investment**	**Requirement per level of component (typical value)**
type of use: residential thermal capacity: 48 MJ/K year of construction: 1960	heating: ELHO boiler cooling: / domestic hot water: in combination with ELHO boiler ventilation: natural	340	$HT_{ext.wall}$ = 1.20 W/m²K HT_{roof} = 1.20 W/m²K $HT_{floor\ in\ contact\ with\ ground}$ = 1.16 W/m²K $HT_{windows}$ = 2.30 W/m²K H_t' = 1 349 W/m²K

Permitted energy efficiency limit values under the PURES 2010 rules

coefficient of specific transmission losses	0.393	W/(m²K)	→ requirement not met
Q_{nh}/A_u	43.5	kWh/(m²a)	→ requirement not met
Q_p/A_u	198.3	kWh/(m²a)	→ requirement not met
Domestic hot water provided by RES			→ requirement not met

Table 10: Reference multi-apartment building for existing buildings (1960, major renovation)

Existing single-family house (VSS1)	Geometry of the building	Shares of window area on building envelope and windows with no solar access	Floor area in m^2, as used in the building code
	A / V = 0.41 m^{-1} surface area of facade N / W / S / E =337/172/172/106 m^2 surface area of roof = 470 m^2 floor area = 470 m^2 orientation: south	ratio of surface area of windows to facade 107 / 24 / 159 / 15	1 596
Description of the building	**Description of the average building technology**	**Average energy performance (kWh/m2a) before investment**	**Requirement per level of component (typical value)**

type of use: residential year of construction: 1980 thermal capacity: 479 MJ/K	heating: ELHO boiler cooling: / domestic hot water: in combination with ELHO boiler ventilation: natural	237	$HT_{ext.wall}$ = 0.80 W/m²K HT_{roof} = 0.60 W/m²K $HT_{floor\ in\ contact\ with\ ground}$ = 0.93 W/m²K $HT_{windows}$ = 2.70 W/m²K H_t' = 1.423 W/m²K

Permitted energy efficiency limit values under the PURES 2010 rules

coefficient of specific transmission losses	0.467	W/(m²K)	→ requirement not met
Q_{nh}/A_u	22.8	kWh/(m²a)	→ requirement not met
Q_p/A_u	175.5	kWh/(m²a)	→ requirement not met
Domestic hot water provided by RES			→ requirement not met

Table 11: Reference building for existing public and other non-residential buildings (1960, major renovation)

Existing single-family house (JS1)	Geometry of the building	Shares of window area on building envelope and windows with no solar access	Floor area in m², as used in the building code
	A / V = 0.39 m.[1] surface area of facade N / W / S / E =231/123/237/109 m² surface area of roof = 520 m² floor area = 520 m² orientation: south	ratio of surface area of windows to facade 33 / 43 / 27 / 27	1 298
Description of the building	**Description of the average building technology**	**Average energy performance (kWh/m2a) before investment**	**Requirement per level of component (typical value)**
type of use: residential year of construction: 1960 thermal capacity: 608 MJ/K	heating: ELHO boiler cooling: / domestic hot water: central boiler ventilation: natural	165	$HT_{ext.wall}$ = 0.80 W/m²K HT_{roof} = 0.60 W/m²K $HT_{floor\ in\ contact\ with\ ground}$ = 0.93 W/m²K $HT_{windows}$ = 2.70 W/m²K H_t' = 1.332 W/m²K

Permitted energy efficiency limit values under the PURES 2010 rules

coefficient of specific transmission losses	0.442	W/(m²K)	→ requirement not met
Q_{nh}/V_e	7.5	kWh/(m³a)	→ requirement not met
Q_p/A_u	176.2	kWh/(m²a)	→ requirement not met
Domestic hot water provided by RES			→ requirement not met

4.4.2 Definition of measures and scenarios

The analysis of the setting of the cost-optimal level of minimum requirements[12] has formulated the set of energy performance measures to be used for the reference buildings. The measures included in the calculation include the technologies indicated in Article 6 of Directive 2010/31/EU and repeated in Article 7, i.e. district heating and

[12] 'Cost-optimal levels of minimum energy performance requirements for buildings in Slovenia', Analysis of results, GI ZRMK, December 2014.

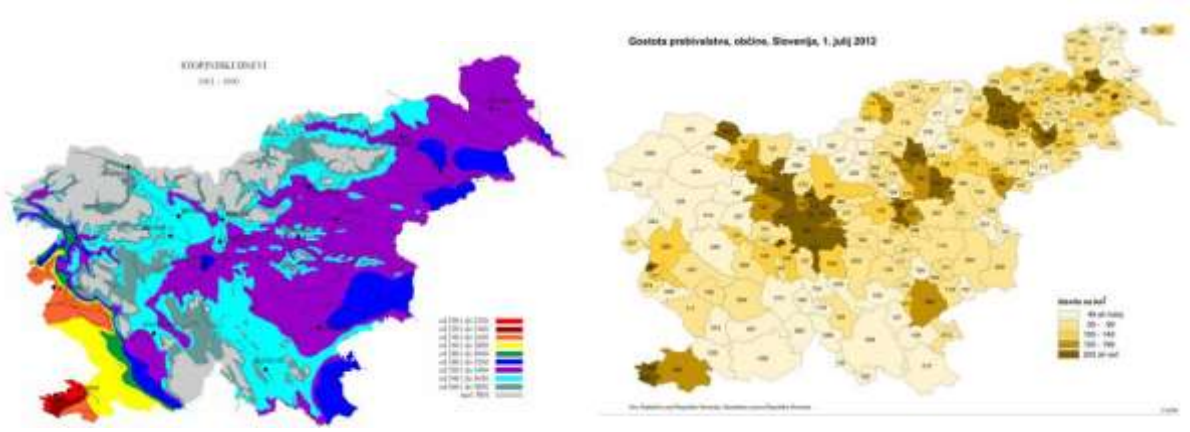
cooling, heat pumps, etc. In accordance with the third paragraph of Annex I(2) to the Regulation,[13] Slovenia also included measures based on renewable energy sources in the calculation.

Due regard was paid to the fact that measures implemented in one system can affect the energy performance of another system, e.g. the level of insulation of the envelope affects the capacity and dimension of building systems. This interaction between different measures is taken into account when defining the variants. The measures are in compliance with the levels of air quality and internal comfort under the CEN 15251 standard on air quality in closed premises.

The purpose of the cost-optimal methodology is to facilitate various technologies, where this is not limited to a calculation of the global costs of established and proven variants. The selected technologies and fuels for heating and domestic hot water systems represent the basic range of options which an investor can find on the market before the introduction of an energy performance improvement measure.

Table 12 first sets out the individual measures for improving the energy performance of buildings (their gradual implementation leads to complete energy renovation), followed by the variants of the complete energy renovation measures. Individual measures are determined for all the components of the thermal envelope (four measures for external walls, three measures for the roof structure and two measures for windows) for different heat transfer values. Combinations of complete energy renovations that include measures involving building systems are presented in Table 13.

Most buildings in Slovenia are constructed within a temperature deficit range of 2 800–3 600 K/day. Less than 10 % of the population lives in south-west Slovenia, where the temperature deficit is between 2 100 and 2 800 K/day. Work on the building stock is therefore focused on the other, cooler parts of Slovenia.



Key: DEGREE DAYS

od = from, do = to, nad = over

Population density, municipalities, Slovenia, 1 July 2012

Population per km2, ali manj = or fewer, ali več = or more

Sources: Statistical Office of the Republic of Slovenia, Surveying and Mapping Authority of the Republic of Slovenia

Figure 20: Annual temperature deficit (left) and population density (right) in Slovenia (Source: ARSO, SURS)

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

Table 12: List of measures/variants (P1–P17, major renovation, 1960)

MEASURE/VARIANT	Wall (1960)	Wall (1980)	Wall structure 1	Wall structure 2	Wall structure 3	Wall structure 4	Roof (1960)	Roof (1980)	Roof structure 1	Roof structure 2	Roof structure 3	Window (1960)	Window (1980)	Double-glazed window	Triple-glazed window	HP (air/water)	HP (water/water)	Gas-fired condensing boiler	Biomass boiler	District heating	Mechanical ventilation	Solar collectors	Solar photovoltaic
INDEX	1.2	0.8	0.28	0.2	0.15	0.1	1.2	0.6	0.2	0.15	0.1	2.3	2.7	1.3	0.7								
P1	☐	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	_	_	_					
P2	☐	☐		☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	_	_	_					
P3	☐	☐	☐	☐	☑		☑	☐	☐	☐	☐	☑	☐	☐	☐	_	_	_					
P4	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐	☑	☐	☐	☐	_	_	_					
P5	☑	☐	☐	☐	☐	☐	☐	☐	☑		☐	☑	☐	☐	☐	_	_	_					
P6	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	_	_	_					
P7	☑	☐	☐	☐	☐	☐	☐	☐	☐		☑	☑	☐	☐	☐	_	_	_					
P8	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑		_	_	_					
P9	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐		☑	_	_	_					
P10	☐		☐	☑	☐	☐	☐	☐	☑		☐	☑	☐	☐	☐	_	_	_					
P11	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	_	_	_					
P12	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☑		_	_	_					
P13	☐	☐	☐	☐	☑	☐		☐	☐	☑	☐	☐	☐		☑	_	_	_					
P14	☐	☐	☐	☐		☑	☐	☐	☐	☐	☑	☑	☐	☐	☐	_	_	_					
P15	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑		_	_	_					
P16	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	_	_	_					
P17	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑		☐	☑		_	_	_					
P18	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☑	_	_	_					

Table 13: List of measures/variants (P19–P74, major renovation, 1960, 1980)

VARIANT	Wall (1960)	Wall (1980)	Wall structure 1	Wall structure 2	Wall structure 3	Wall structure 4	Roof (1960)	Roof (1980)	Roof structure 1	Roof structure 2	Roof structure 3	Window (1960)	Window (1980)	Double-glazed window	Triple-glazed window	HP (air/water)	HP (water/water)	Gas-fired condensing boiler	Biomass boiler	District heating	Mechanical ventilation	Solar collectors	Solar photovoltaic
INDEX	1.2	0.8	0.28	0.2	0.15	0.1	1.2	0.6	0.2	0.15	0.1	2.3	2.7	1.3	0.7								
P19			☑						☑					☑		☑					☑		
P20				☑					☑					☑		☑							
P21					☑					☑					☑	☑							
P22						☑					☑				☑	☑							
P23			☑						☑					☑		☑					☑		
P24				☑					☑					☑		☑					☑		
P25					☑					☑					☑	☑					☑		
P26						☑					☑				☑	☑					☑		
P27			☑						☑					☑			☑						
P28				☑					☑					☑			☑						
P29					☑					☑					☑		☑						
P30						☑					☑				☑		☑						
P31			☑						☑					☑			☑				☑		
P32				☑					☑					☑			☑				☑		
P33					☑					☑					☑		☑				☑		
P34						☑					☑				☑		☑				☑		
P35			☑						☑					☑				☑					
P36				☑					☑					☑				☑					
P37					☑					☑					☑			☑					
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				☑					☑				☑	☑					☑		☑

4.5 Calculation of primary energy use

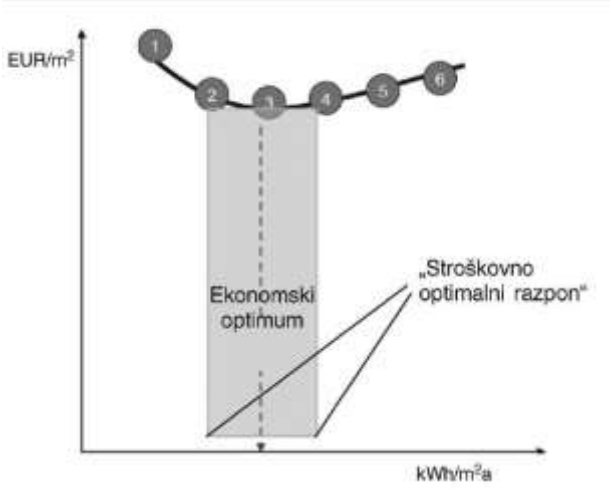
In accordance with the EN ISO 13790 standard and with regard to CEN standards and the requirements of the calculation of the cost-optimal level, an accurate hourly dynamic method was chosen for the primary energy calculation. A comprehensive approach was chosen for the reciprocal effects of the building and its systems, where in the calculation of energy for heating and cooling the effect of all heat gains connected with the building and its technical systems was taken into account. The heat needed to heat and cool a building has been calculated using the monthly quasi-stationary method, in accordance with PURES 2010 and the technical guideline TSG-1-004:2010 Efficient Use of Energy.

In accordance with the Guideline, the calculated primary energy includes energy used for heating, cooling, ventilation, hot water and lighting. The main reference for this is Annex I to Directive 2010/31/EU, which is also applied in full for the cost-optimal framework methodology. The tables show the value of total input energy for the operation of the building offset by the total renewable portion of energy that is consumed in the building. Since in some cases heat pumps are taken as a monovalent system, in places the energy consumption for DHW is equal to zero. This means that this portion was fully covered via energy produced from, for example, ambient heat.

Annex B presents calculations of heating or cooling need, energy use by structure and resource, primary energy use and primary energy savings relative to the baseline status of the reference buildings for the measures and variants described.

4.6 Cost-effective renovation

On the basis of the primary energy use and global cost calculations connected to the different variants defined for the reference buildings, graphs have been drawn for selected cases which show primary energy use and global costs in terms of net present value. The calculation of the global costs takes account of the initial investments, the total annual costs for each year, the final value and, where appropriate, the costs of removal, where the values are compared with the initial year. The result of the global cost calculations is the net present value of costs incurred in the specific period of the calculation, taking into account residual values of equipment with a longer life-cycle. Forecasts of energy costs and interest rates are limited to the period of the calculation. The combination of measures or variants with the lowest costs is the lowest point of the curve (Variant 3 in Figure 21). Its position on the X axis represents the cost-optimal level of the minimum energy performance requirements. Annex I(6)(2) to the Directive provides that if packages are linked to the same or very similar costs, the definition of the cost-optimal level should, if possible, be based on the variant with the lower use of primary energy (the left-hand side of the cost-optimal range).



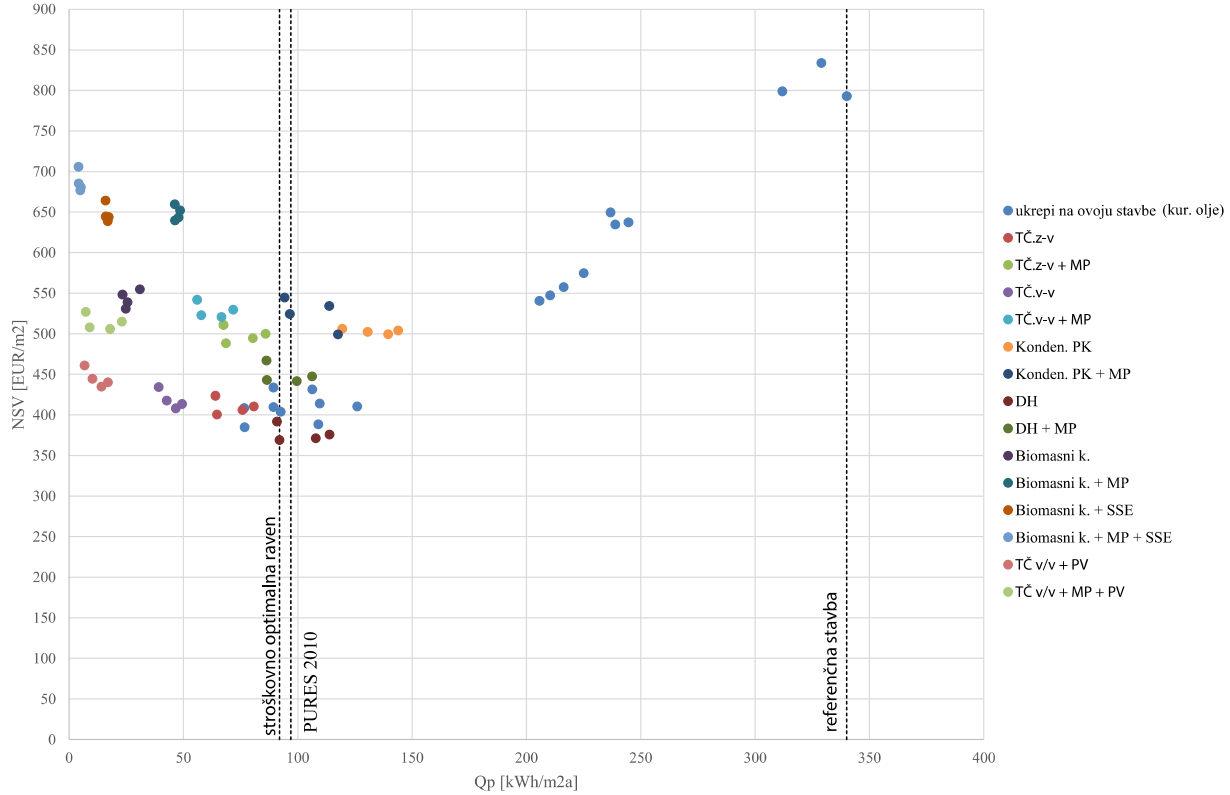
Key: Economic optimum, Cost-optimal range

Figure 21: Different variants and the position of the cost-optimal range[14] (Source: Guideline)

Primary energy use and lifetime costs (investment, maintenance, replacement and operation, including energy costs) are shown for the reference buildings in terms of the net current value, assuming a 30-year lifetime, with a financial calculation containing a 3 % discount rate and with due regard to increases in energy prices.

[14] Boermans, Bettgenhäuser et al., 2011: Cost-optimal building performance requirements – Calculation methodology for reporting on national energy performance requirements on the basis of cost optimality. Under the Directive on the Energy Performance of Buildings, ECEEE (Cost-optimal building performance requirements – Calculation methodology for reporting on national energy performance requirements on the basis of cost optimality within the framework of the EPBD, ECEEE).

- **Single-family house**



Key: Strokošno … = Cost-optimal level, Referenčna … = Reference building

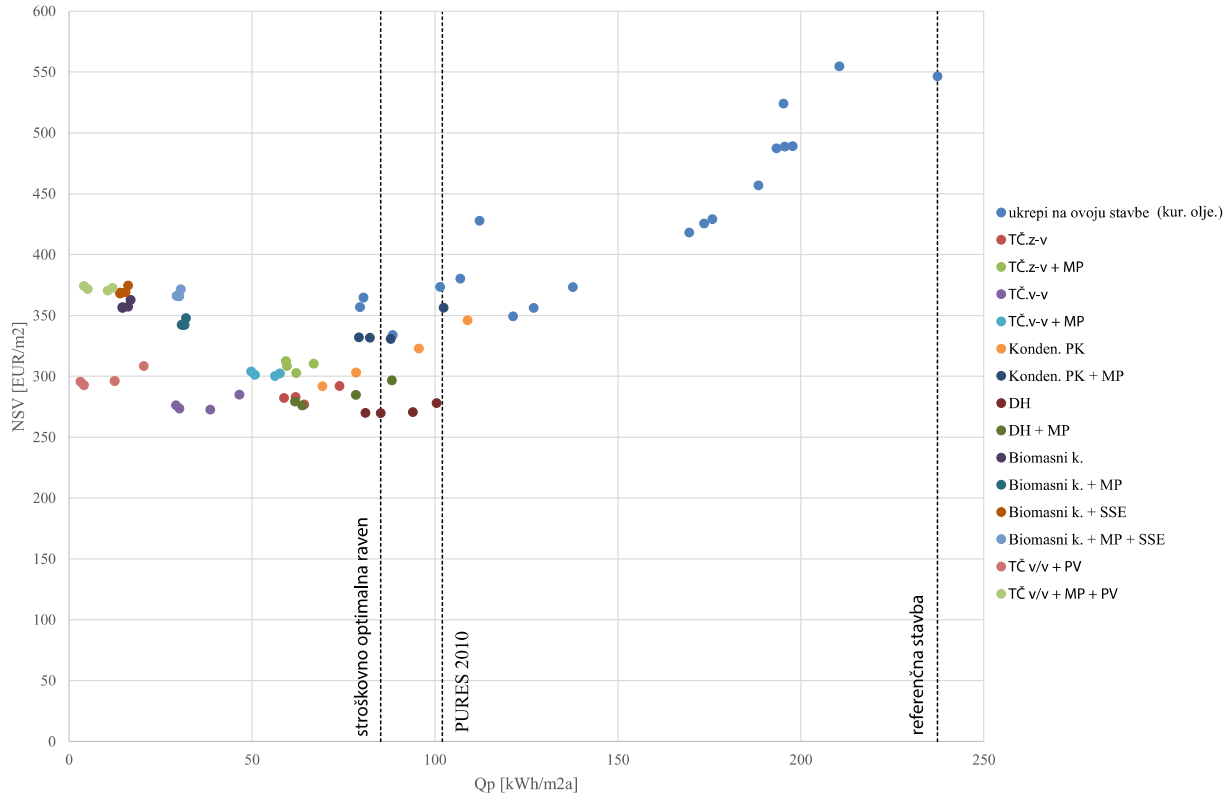
Ukrepi … = Building envelope measures (heating oil), Heat pump (air/water), Heat pump (air/water + mechanical ventilation), Heat pump (water/water), Heat pump (water/water + mechanical ventilation), Gas-fired condensing boiler, Gas-fired condensing boiler + mechanical ventilation, District heating, District heating + mechanical ventilation, Biomass boiler, Biomass boiler + mechanical ventilation, Biomass boiler + solar collectors, Biomass boiler + mechanical ventilation + solar collectors, Heat pump (water/water) + solar photovoltaic, Heat pump (water/water) + mechanical ventilation + solar photovoltaic

Figure 22: Investment costs in relation to primary energy use: single-family house ESS1 – major renovation (1960) (financial analysis, discount rate 3 %, high energy price) (Source: GI ZRMK).

In the case observed, the primary energy use value for the economic optimum and the reference building is shown in the table below. In accordance with the procedures described in the previous sections, a building destined for major renovation that meets the current minimum energy performance requirements as defined by PURES 2010 is also indicated.

Observed level	*Primary energy [kWh/m^{2}a]*
Nearly zero-energy renovation	**95 (+ at least Class B1 + 50 % RES)**
Cost-optimal level (framework value)	**93**
Minimum requirement currently in force (PURES 2010)	**97**
Reference building	**340**

- **Multi-apartment building**



Key: Strokošno … = Cost-optimal level, Referenčna … = Reference building

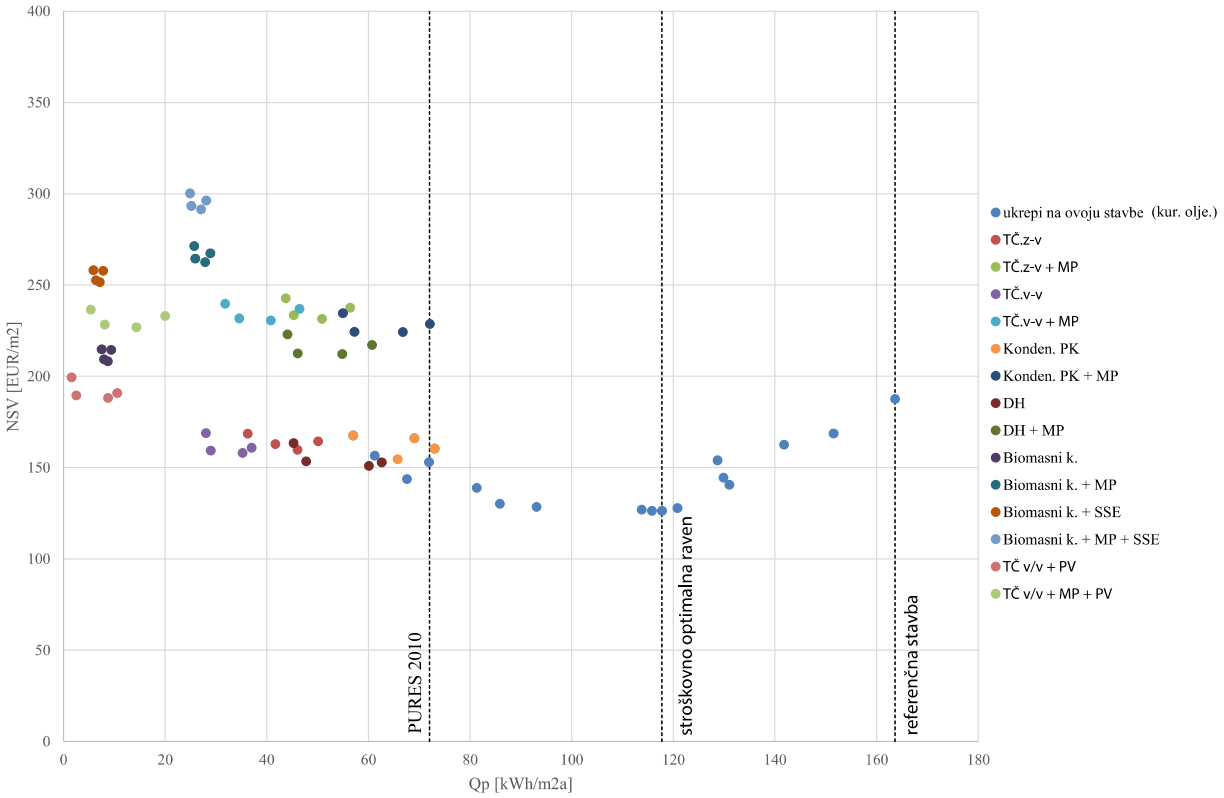
Ukrepi … = Building envelope measures (heating …), Heat pump (air/water), Heat pump (air/water + mechanical ventilation), Heat pump (water/water), Heat pump (water/water + mechanical ventilation), Gas-fired condensing boiler, Gas-fired condensing boiler + mechanical ventilation, District heating, District heating + mechanical ventilation, Biomass boiler, Biomass boiler + mechanical ventilation, Biomass boiler + solar collectors, Biomass boiler + mechanical ventilation + solar collectors, Heat pump (water/water) + solar photovoltaic, Heat pump (water/water) + mechanical ventilation + solar photovoltaic

Figure 23: Investment costs in relation to primary energy use: multi-apartment building VSS1 – major renovation (1960) (financial analysis, discount rate 3 %, high energy price) (Source: GI ZRMK).

In the case observed, the primary energy use value for the economic optimum and the reference building is shown in the table below. In accordance with the procedures described in the previous sections, a building destined for major renovation that meets the current minimum energy performance requirements as defined by PURES 2010 is also indicated.

Observed level	*Primary energy [kWh/m^{2}a]*
Nearly zero-energy renovation	**90 (+ at least Class B1 + 50 % RES)**
Cost-optimal level (framework value)	**86**
Minimum requirement currently in force (PURES 2010)	**102**
Reference building	**237**

- **Public building**



Key: Strokošno … = Cost-optimal level, Referenčna … = Reference building

Ukrepi … = Building envelope measures (heating …), Heat pump (air/water), Heat pump (air/water + mechanical ventilation), Heat pump (water/water), Heat pump (water/water + mechanical ventilation), Gas-fired condensing boiler, Gas-fired condensing boiler + mechanical ventilation, District heating, District heating + mechanical ventilation, Biomass boiler, Biomass boiler + mechanical ventilation, Biomass boiler + solar collectors, Biomass boiler + mechanical ventilation + solar collectors, Heat pump (water/water) + solar photovoltaic, Heat pump (water/water) + mechanical ventilation + solar photovoltaic

Figure 24: Investment costs in relation to primary energy use: non-residential building JSS1 – major renovation (1960) (financial analysis, discount rate 3 %, high energy price) (Source: GI ZRMK).

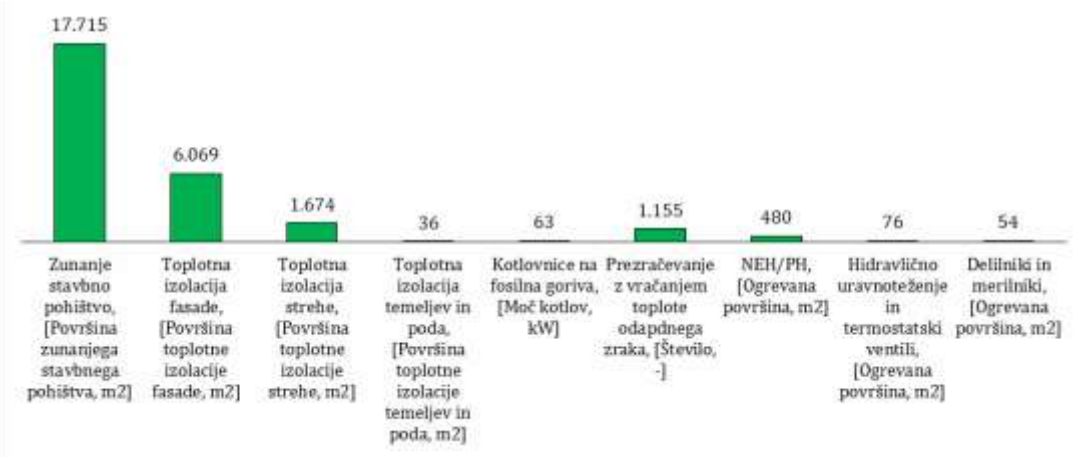
In the case observed, the primary energy use value for the economic optimum and the reference building is shown in the table below. In accordance with the procedures described in the previous sections, a building destined for major renovation that meets the current minimum energy performance requirements as defined by PURES 2010 is also indicated.

Observed level	*Primary energy [kWh/m^{2}a]*
Nearly zero-energy renovation	**65 (+ at least Class B1 + 50 % RES)**
Cost-optimal level (framework value)	**119**
Minimum requirement currently in force (PURES 2010)	**72**
Reference building	**165**

4.7 Details of energy renovations carried out

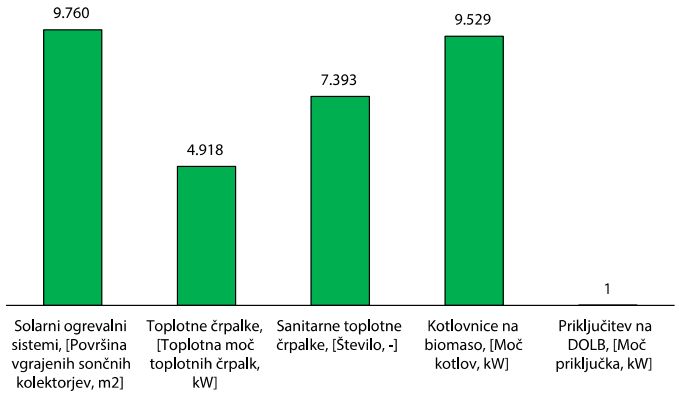
According to figures from the SURS,[15] most of the energy consumed in households in 2013 went towards heating rooms: 29.524 TJ or approx. 61 %. Twenty per cent of the energy was consumed for domestic hot water, almost 14 % for lighting and electrical devices, almost 5 % for cooking and less than 1 % for the cooling of rooms.

The Eco Fund allocated 31 606 RES incentives and 27 321 EE incentives between 2008 and 2013. An analysis identifying the effectiveness and rate of renovation of residential buildings following the disbursement of incentives is currently under way. Complete energy renovation means the implementation of several measures at a single location.



Key: External building fixtures [Surface area of external building fixtures, m2], Thermal insulation of facade [Surface area of thermal insulation of facade, m2], Thermal insulation of roof [Surface area of thermal insulation of roof, m2], Thermal insulation of foundations and ground [Surface area of thermal insulation of foundations and ground, m2], Fossil fuels boilers [Power of boilers, kW], Ventilation with recovery of waste heat [Number, -], NEH/PH [Heated floor area, m2], Hydraulic balancing and thermostat valves [Heated floor area, m2], Dividers and meters [Heated floor area, m2]

Figure 25: Number of incentives disbursed: Total EE measures



Key: Solar heating systems [Surface area of installed solar collectors, m2], Heat pumps [Thermal power of

[15] Statistical Office of the Republic of Slovenia (SURS), final figures for energy and fuel consumption in households in 2013.

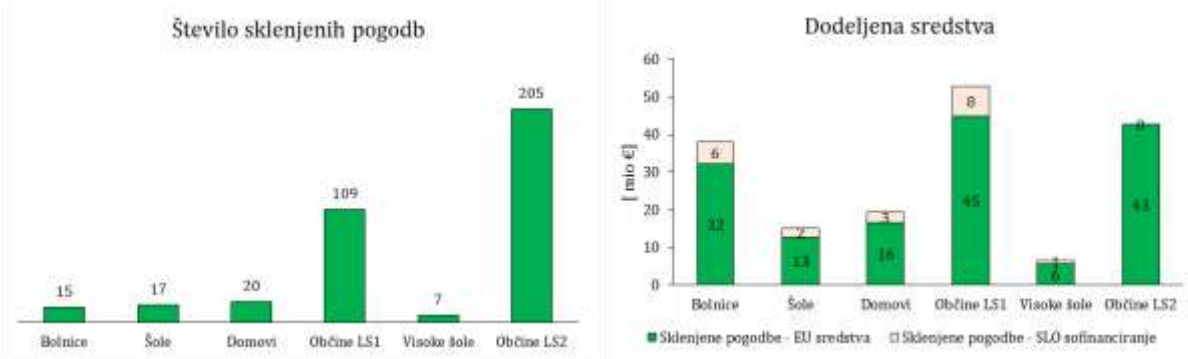
heat pumps, kW], Heat pumps for domestic hot water [Number, -], Biomass boilers [Power of boilers, kW], Connection to wood biomass district heating [Power of connection, kW]

Figure 26: Number of incentives disbursed Total RES measures

We are able to reach conclusions on the energy quality of renovations of buildings in the service sector on the basis of experiences gleaned from the allocation of grants for the energy renovation of buildings from the Cohesion Fund in the 2007–2013 period. In that period the ministry published the following tenders:

- the energy renovation of buildings of legal entities of public law in the field of healthcare founded by the Republic of Slovenia and under the responsibility of the Ministry of Health;
- public tender for the energy renovation of buildings occupied by public schooling and education institutes founded by the Republic of Slovenia and under the responsibility of the Ministry of Education and Sport;
- the energy renovation of retirement homes founded by the Republic of Slovenia, under the responsibility of the Ministry of Labour, Family and Social Affairs and engaged in social services activities;
- public tender for the co-financing of operations for the energy renovation of buildings owned by local communities (LS1);
- public tender for the co-financing of operations for the energy renovation of primary schools, nursery schools, health centres and libraries owned by local communities (LS2);
- public tender for the allocation of grants for the energy renovation of public institutes in the area of higher education and science.

The ministry signed 374 contracts (Figure 27, Figure 28) for which EU funds amounting to EUR 155 million were disbursed (Slovenia's co-financing contribution for these projects was EUR 20 million). The total floor area of renovated buildings amounts to 1 262 790 m^2, with energy renovation under public tender LS2 accounting for most of this figure (Figure 28). The highest energy savings were achieved at healthcare institutions (Figure 28).



Key: Number of contracts signed

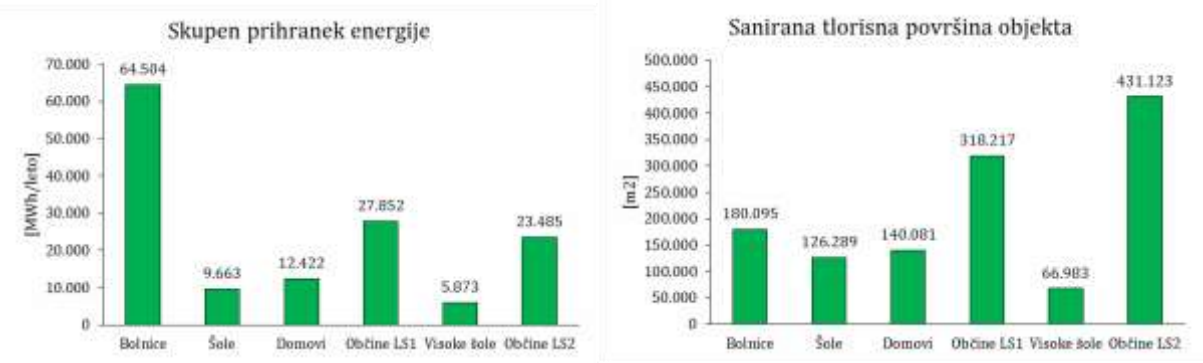
Hospitals, Schools, Homes, Municipalities (LS1), Higher education establishments, Municipalities (LS2)

Funds allocated

Contracts signed – EU funds, Contracts signed – national co-financing

mio = millions

Figure 27: Number of contracts signed under individual tenders and the level of funds allocated for these projects



Key: Total energy savings

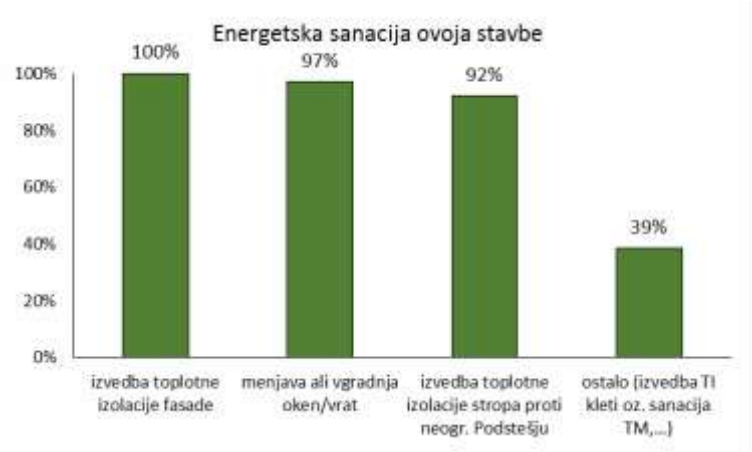
Hospitals, Schools, Homes, Municipalities (LS1), Higher education establishments, Municipalities (LS2)

Renovated floor area of buildings

leto = Year

Figure 28: Total annual energy savings under individual tenders and the floor area of buildings undergoing energy renovation

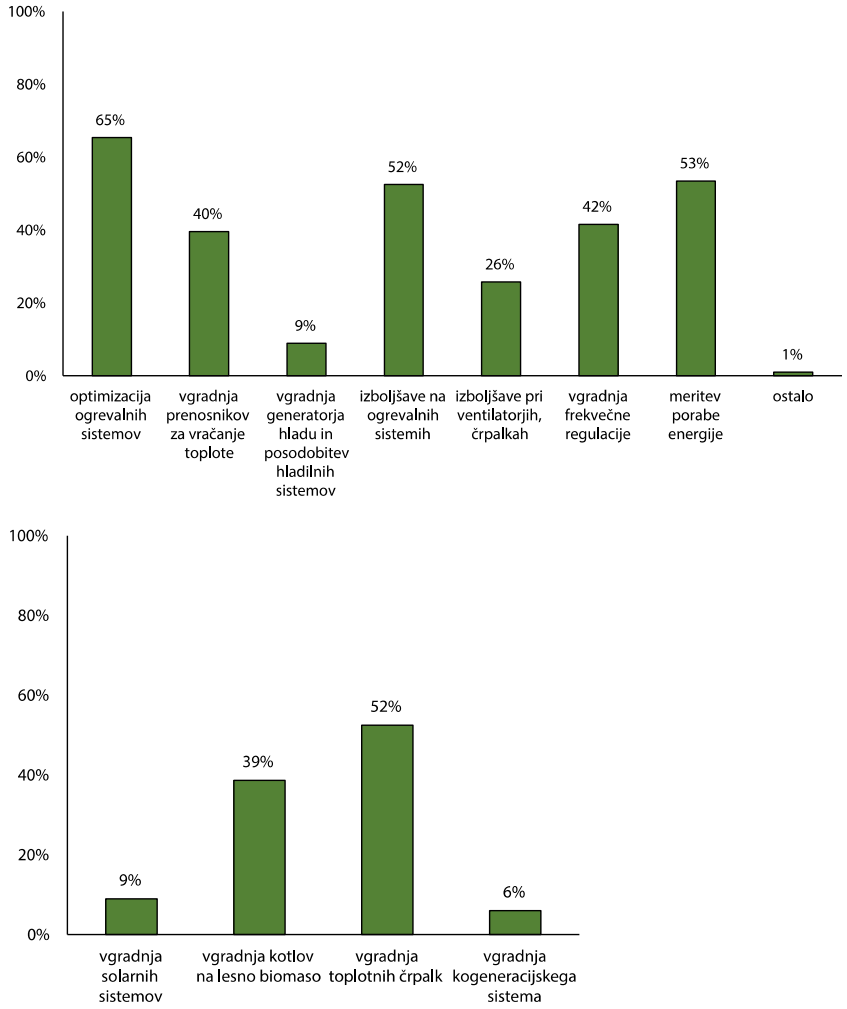
A total of 109 operations were included in the public tender for the co-financing of operations for the energy renovation of buildings owned by local communities (LS1). A single operation could include several buildings for which eligible costs were granted for the energy renovation of the thermal envelope, energy-efficient heating, cooling and ventilation systems, the use of renewable energy sources and the installation of a cogeneration system. Figure 29 shows that the complete energy renovation of the building envelope took place in the majority (over 90 %) of these buildings, as these were measures taking place on several elements of the building envelope (replacement of windows, additional thermal insulation of the facade and roof or loft space).



Key: Energy renovation of building envelope

Thermal insulation of facade, Replacement or installation of windows/doors, Thermal insulation of roof abutting an unheated loft area, Other (thermal insulation of cellar or remediation of thermal bridges, etc.)

Figure 29: Overview of energy renovation measures carried out on building envelopes under LS1

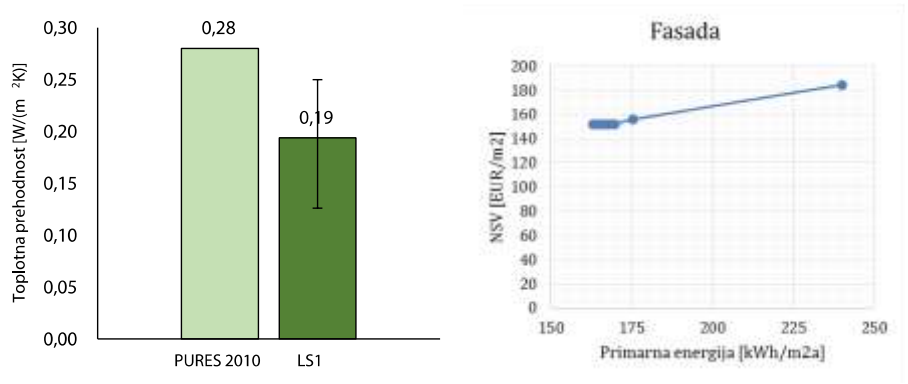


Key: Optimisation of heating systems, Installation of equipment for transferring heat recovered from waste air, Installation of a cooling generator and the upgrading of cooling systems, Improvements to heating systems, Improvements to ventilators, pumps, Installation of frequency regulation, Other

Installation of solar systems, Installation of wood biomass boilers, Installation of heat pumps, Installation of a cogeneration system

Figure 30: Use of energy-efficient heating, cooling and ventilation systems (lower) and use of RES technologies and cogeneration (upper)

A wood biomass boiler and heat pump was used in 92 cases as the heat generator for heating and/or preparation of domestic hot water. A wood biomass boiler was used in 32 cases of the replacement of extra-light heating oil as the heating fuel, and a heat pump in six cases. Natural gas was replaced by a wood biomass boiler in three cases and by a heat pump in nine cases. In over half the operations, the contracting authorities invested in energy accounting, thereby committing themselves to efficient energy use through the monitoring of consumption. In over half the instances of energy renovation, existing heating systems were optimised and improvements made to heating systems (Figure 30).



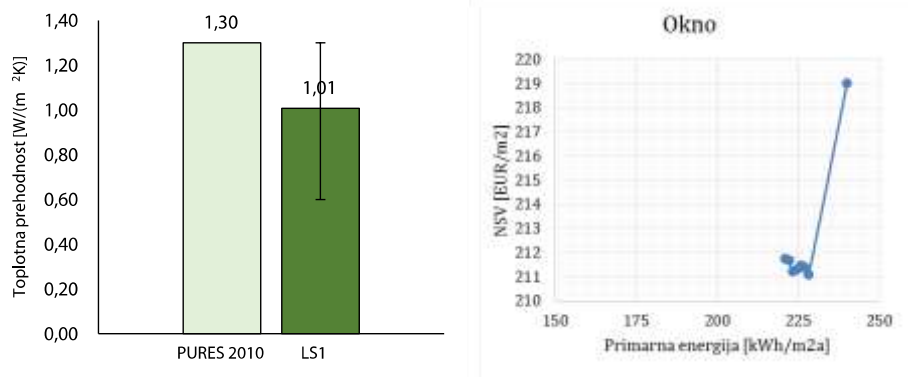
Key: Heat transfer

Facade

Primary energy

Figure 31: Average heat transfer of a facade wall following a measure carried out under LS1 with both borderline cases (left) and an analysis of the cost-optimal level of individual measures on a facade wall (right) (Source: GI ZRMK).

The analysis showed the average heat transfer of an individual component (wall insulation, replacement of windows, roof or loft insulation) after completion of the measure (Figure 31, Figure 32, Figure 33) for all buildings granted the costs of renovating the thermal envelope as part of LS1 projects. The comparison showed that, on average, installation or insulation exceeded the minimum requirements set out in PURES 2010. The most advanced thermal insulation of an envelope gives heat transfer that is 50 % better than that prescribed ($HT_{facade,\ min,\ LS1}$ = 0.12 W/(m^2K), $HT_{windows,\ min,\ LS1}$ = 0.60 W/(m^2K), $HT_{roof,\ min,\ LS1}$ = 0.086 W/(m^2K)).



Key: Heat transfer

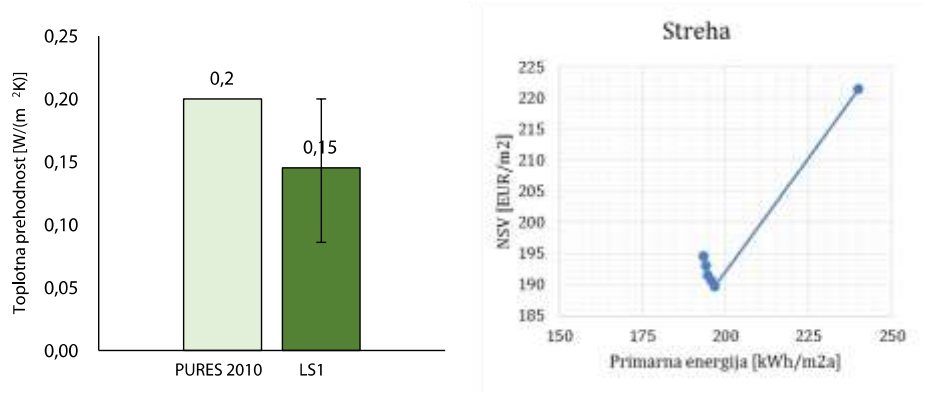
Window

Primary energy

Figure 32: Average heat transfer of windows following a measure carried out under LS1 with both borderline cases (left) and an analysis of the cost-optimal level of individual measures of window replacement (right) (Source: GI ZRMK).

The cost-effectiveness of an individual measure in terms of the net current value derived from an analysis of the cost-effective level of the minimum requirements regarding energy performance in Slovenia is shown alongside

the quality of the rate of renovations of individual elements of the thermal envelope of a building.[16] A non-residential office building constructed c. 1960 is taken as the baseline. Implementing various individual energy performance measures allows us to see where we will achieve the optimum over a 30-year period. The calculation of the global costs in terms of net current value takes account of the initial investments, the total annual costs for each year, the final value and, where appropriate, the costs of removal, where the values are compared with the initial year. The result of the global cost calculations is the net present value of costs incurred in the specific period of the calculation, taking into account residual values of equipment with a longer life-cycle. Forecasts of energy costs and interest rates are limited to the period of the calculation.



Key: Heat transfer

Roof

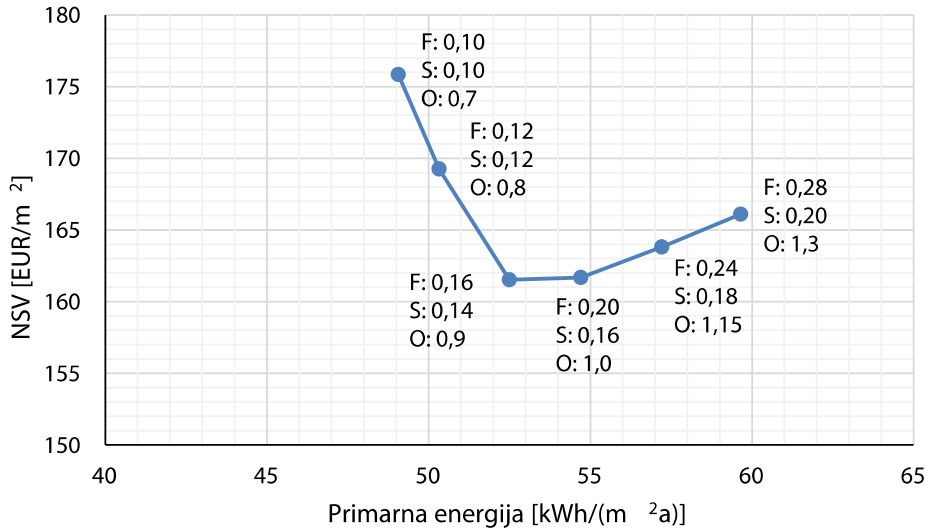
Primary energy

Figure 33: Average heat transfer of a roof following a measure carried out under LS1 with both borderline cases (left) and an analysis of the cost-optimal level of individual measures on a roof (right) (Source: GI ZRMK).

An analysis of LS1 operations has shown that the energy renovation of public buildings is being carried out in a complete and comprehensive manner, i.e. that roofs and facades have been insulated and windows replaced with better, more energy-efficient models (Figure 29). In several cases the heating system has been replaced and a transition made to renewable energy sources in place of an existing boiler running on extra-light heating oil or natural gas (Figure 30).

We have compiled an analysis based on the reference building referred to in Section 4.3.1 in order to verify that complete energy renovation measures on building envelopes are being carried out effectively or even cost-optimally. Figure 34 presents an example of the complete energy renovation of a building using various thermal envelope combinations (different heat transfer values for the facade, roof and windows), whereby the heating and domestic hot water system was replaced by an air/water heat pump. We are able to note that the combination of the average values for the heat transfer of elements of a building's thermal envelope given in Figures 31–33, where HT_{facade} = 0.19 W/(m^2K), $HT_{windows}$ = 1.01 W/(m^2K) and HT_{roof} = 0.15 W/(m^2K), lies within the cost-optimal range, which is close to the economic optimum. This means that the renovation of public buildings (as part of LS1 projects) has already exceeded the cost-effective and is within the range of the local cost optimum for renovation of the thermal envelope.

[16] 'Cost-optimal levels of minimum energy performance requirements for buildings in Slovenia', Analysis of results, GI ZRMK, December 2014.



Key: Primary energy

Figure 34: Analysis of cost-optimal level of the building envelope (F – facade, R – roof, W – windows, with the appurtenant heat transfer value) (Source: GI ZRMK).

5 Policies and measures to promote energy renovation

5.1 Framework of the Strategy – legal and strategic foundations for the formulation of targets

Slovenia has undertaken to realise the objectives of sustainable growth set out in numerous documents and decision-making processes at the EU level, particularly the Europe 2020 strategy. 'Europe 2020:[17] A Strategy for Smart, Sustainable and Inclusive Growth' sets out a vision of Europe's social market economy for the 21st century and contains three mutually reinforcing priorities:

- Smart growth: developing an economy based on knowledge and innovation.
- Sustainable growth: promoting a more competitive, resource-efficient, greener low-carbon economy.
- Inclusive growth: fostering a high-employment economy that strengthens social and territorial cohesion.

The Strategy supports a move to an economy that uses all resources efficiently, separates economic growth completely from the use of resources and energy, and from their environmental impacts, reduces GHG emissions, improves competitiveness through efficiency and innovation, and promotes greater security of energy supply. Slovenia will realise the vision set out in the Europe 2020 strategy in its national policies. Sustainable energy use has been classified as one of the priority axes of the Operational Programme for the Implementation of European Cohesion Policy 2014–2020 (OP EKP 2014–2020), with most of the funds under this programme going to the building sector.

Climate and energy policy and targets for the post-2020 period are still being formulated at the EU level. Slovenia actively supports the common vision of preventing the adverse effects of climate change and keeping the rise in global temperatures below 2 °C, and its implementation through EU-wide climate-change policy, the agreements reached at the UNFCCC (from Copenhagen and Cancun), and national climate-change policies and measures. A political decision to reduce GHG emissions by 80–95 % by 2050 relative to 1990 was taken by the European Council back in March 2010. According to the findings of the Intergovernmental Panel on Climate Change, this is the reduction required in developed countries if the target is to be reached. Discussions on EU-level sectoral targets up to 2050 are taking place as part of the EU plan for a competitive low-carbon economy by 2050.[18] The EU Council resolutions of 23–24 October 2014 define the intermediate medium-term climate-change and energy targets of the EU as a whole up to 2030. The EU-level intermediate targets for the period up to 2040 and the national targets up to 2030 are still in the process of being formulated. The following political decisions (EU Council resolutions) have been reached for 2030. It is envisaged that they will be transferred into EU law in 2015:

- a 40 % reduction in total GHG emissions at the EU level relative to 1990. Member States' contributions to achieving this target will be legally binding. They will be determined in a balanced way in terms of justice and solidarity (based on relative per-capita GDP). All Member States will contribute to jointly reducing the EU's emissions up to 2030. Their targets will range from 0 to -40 % relative to 2005;
- the share of energy from renewable energy sources to be consumed in the EU in 2030 should be at least 27 %. This target will be binding at the EU level;
- an EU-level indicative target of at least 27 % has been set on the basis of the applicable criteria to improve energy efficiency in 2030 in comparison with the forecast consumption of energy in the future. Member States shall determine their own national targets.

Guidelines on the EU sectoral targets up to 2050 and the necessary intermediate targets have been defined as part of the EU plan for a competitive low-carbon economy by 2050.[19] It has been determined that GHG emissions must be reduced in the household and service sectors (in relation to buildings) by between 88 and 91 % of emissions relative to 1990.

The key document defining the premises of Slovenia's energy policy is the Energy Act (EZ-1).[20] Both the Strategy and EZ-1 also include the drafting of other strategic documents: Analysis of the Financing Models for

[17] COM(2010) 2020 final.
[18] Roadmap for Moving to a Competitive Low-Carbon Economy in 2050, COM (2011) 112.
[19] Roadmap for Moving to a Competitive Low-Carbon Economy in 2050, COM (2011) 112.

the Renovation of Public Buildings, with an Emphasis on Mobilising Private Sector Investments, the Criteria for Allocating Grants and Repayable Funding for the Inclusion of Private Capital, Expert Foundations and Technical Guidelines for the Energy Renovation of Public Buildings, supplements to the Guidelines for the Implementation of Energy Performance Contracting in the Public Sector, Manual of Eligible Costs in the Energy Renovation of Buildings, and Technical Guidelines for the Energy Renovation of Cultural Heritage Buildings.

The above strategic documents will be compiled by the ministry responsible for energy. The ministry responsible for energy will also, on the basis of the strategic documents and, it is expected, by the end of 2015, compile and make public the instructions for the work of intermediate and implementing bodies. The bases of Slovenia's sustainable energy policy are determined by the targets that Slovenia has adopted and to which it is committed by its international obligations, and by a number of operational programmes aimed at implementing the adopted international obligations, in addition to the EZ-1.

Slovenia has adopted several international obligations for the period leading up to 2020. The most important of these in relation to buildings are:

- Directive 2012/27/EU on energy efficiency;[21]
- Directive 2010/31/EU on the energy performance of buildings;[22]
- Directive 2009/28/EC on the promotion of the use of energy from renewable sources;[23]
- Decision No 2009/406/EC on the effort of Member States to reduce their greenhouse gas emissions;[24]
- Revised Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.[25]

The **national targets** derived from the above-mentioned documents and to which the building-related measures will make a significant contribution are:[26]

- improvements in energy efficiency by 2020;
- the mandatory percentage of buildings owned and occupied by central government that are to undergo renovation;
- obligations regarding nearly zero-energy buildings;
- a mandatory 25 % share of RES in gross end-use energy consumption in 2020;
- GHG emission targets (GHG emissions must be below the target trajectory in the period leading up to 2020);
- air protection targets, the most important of which, for the building sector, are the national targets for reducing particle emissions.

Implementing programmes The series of implementing plans and plans under preparation and listed above, which define in more detail the contributions to be made by individual areas to meeting the national targets by setting the indicative targets[27] for sectors or areas are also essential to the formulation of the Strategy. The implementing programmes of importance to the building sector are:

- Energy Efficiency Action Plan 2014–2020 (AN URE 2014−2020);
- Renewable Energy Action Plan 2010−2020 (AN OVE 2010−2020), revision under preparation;
- Operational Programme for the Implementation of European Cohesion Policy 2014–2020 (OP EKP 2014–2020);[28]

---

20 Energy Act (UL RS, No 17/14).

21 Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.

22 Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).

23 Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

24 Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

25 www.unece.org/env/lrtap/multi_h1.html

26 These targets are presented in more detail in Annex B and summarised in Table 2, where the international acts that lay down these obligations are specified and a detailed definition of these targets given: target years, target values and the targets defined in the national implementing documents.

27 The indicative targets from the operational programmes and action plans relevant to the building sector are presented in more detail in Annex B and summarised in Table 3.

28 Government of the Republic of Slovenia, November 2014.

- Operational Programme for Reducing Greenhouse Gas Emissions by 2020[29] (OP TGP 2020[30]);
- Operational Programme for the Protection of Ambient Air Against Pollution Caused by PM_{10} (OP PM_{10}) and ordinances on air-quality plans.

The climate and energy package targets (energy efficiency, renewable energy sources and greenhouse gases) are not presented separately and in detail here. The specific national targets relating solely to the building sector and described in the sub-sections of Annex A ('Targets for nearly zero-energy buildings', 'Obligation for buildings owned and occupied by central government') are also set in two energy efficiency directives (2010/31/EU and 2012/27/EU). Since they are less well-known, the air-protection targets are set out in a separate section ('Air protection').

5.2 Vision, targets and timetable of the Long-Term Strategy for Mobilising Investments in the Renovation of Buildings

The Long-Term Strategy for Mobilising Investments in the Renovation of Buildings incorporates and supplements the vision set out for the sector up to 2050, the indicative targets up to 2030 and the operational targets up to 2020 of importance for the building sector and compliant with the guidelines contained in the decisions already taken at national and EU level.

Vision up to 2050

2050	***This vision up to 2050 is for almost carbon-neutral energy use in the building sector, to be achieved by making considerable improvements in energy performance and increasing the use of renewable energy sources in buildings. This will, in turn, significantly reduce emissions of other harmful substances into the atmosphere.*** ***A further objective is for Slovenia to become recognised for its activities in the field of sustainable construction.***

The vision refers to an increase in the direct and indirect use of renewable energy sources in buildings, including via efficient district heating systems.

Indicative and operational targets of the Strategy

The indicative targets for 2030 and the operational targets for 2020 have been put forward on the basis of the targets set in documents that have already been adopted and documents under preparation. An assessment will also be made in the second phase of the project of how the building sector is to contribute to achieving the legally binding national targets in accordance with the obligations and the decisions already taken.

2030	***The indicative targets that provide the framework for the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings up to 2030 are:*** • ***to reduce end-use energy consumption in buildings by 30 % relative to 2005;*** • ***to have at least two-thirds of energy in buildings produced by renewable energy sources;***[31] • ***to reduce GHG emissions in buildings by at least 70 % relative to 2005;*** • ***to reduce particle emissions from energy use in buildings by 50 % in the 2015–2030 period.***

[29] Government of the Republic of Slovenia, November 2014.
[30] Report on the Assessment of the Monitoring of the Implementation and Effectiveness of OP TGP 2020 Measures, final project report, IJS-DP-11681, 2014.
[31] Share of use of RES in end-use energy excluding electricity and district heating.

	Anticipated results of the programme: • ***the renovation of 9 million m^2 of residential buildings and 3.5 million m^2 of buildings in the service sector to the nearly zero-energy building standard (AN sNES);*** • ***use of energy for heating and domestic hot water at a level of less than 27 PJ in residential buildings and less than 7.5 PJ in the public and service sectors.***
2020	***The operational targets set out in the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings up to 2020 are as follows:*** • ***a reduction of at least 16 % in end-use energy consumption in buildings relative to 2005;*** • ***at least 60 % of energy use in buildings produced from RES;***[32] • ***a 58 % reduction in GHG emissions relative to 2005;*** • ***a 20 % reduction in particle emissions from energy use in buildings in the 2015–2020 period;*** • ***the renovation of 3 % of the total floor area of buildings owned and occupied by central government that do not meet the minimum energy performance requirements from 1 January each year.***[32]
	Anticipated results of the programme: • ***the renovation of 2.9 million m^2 of residential buildings by 2020 and 333 000 m^2 of buildings in the service sector by 2018 to nearly zero-energy building standard (AN sNES);*** • ***use of energy for heating and domestic hot water at a level of less than 34.5 PJ in residential buildings and less than 9 PJ in the public and service sectors;*** • ***the renovation of 1.8 m^2 of floor area in buildings in the wider public sector between 2014 and 2023 (OP EKP 2014–2020);*** • ***an improvement in the ratio between public funds invested and investment incentives in the public sector to 1: 3 (OP TGP 2020);*** • ***primary energy savings of 1.6 TWh/year in 2020 in existing buildings;*** • ***the implementation of five pilot/demonstration projects for the energy renovation of different building types.***

[32] The target value will change from year to year; therefore, it is not expressed in m^2 of the floor area of renovated buildings. More detailed monitoring of the achievement of the target using this method is also envisaged as part of the monitoring of the implementation of the DSEPS.

5.3 Measures

Slovenia is carrying out a series of measures to promote, regulate and coordinate the energy renovation of buildings field that provide the points of departure for the measures to be taken in future. The key measures are:

- incentives in the form of grants to reduce energy use in the housing sector, which have been allocated since 1991 and saw a significant increase between 2008 and 2014;
- grants to reduce energy use in the public sector have been allocated since 2010;
- regulations on the energy performance of buildings (see Section 4.3): the regulations brought into force comply with the criteria applying to nearly zero-energy building requirements.

Activities have already been planned in relation to the following measures, although they are not yet fully under way:

- enhancing the effects and effectiveness of incentives:
    - promoting the energy services market,
    - ensuring a stable support environment,
    - quality management;
- promoting measures for special target groups:
    - vulnerable households,
    - buildings in the business sector, particularly SMEs,
    - cultural heritage buildings;
- coordinating policies and measures, and coordination with development policy in particular:
    - implementation of demonstration projects,
    - incentives aimed at earlier phases of the development of technologies.

For the 2015–2020 period, measures are defined in detail in the adopted implementing documents, OP EKP 2014–2020 (financing from EU funds), AN URE 2020 (energy efficiency measures), AN OVE 2010–2020 (renewable energy source measures) and OP TGP 2020 (development measures).

A detailed overview of the implementation of OP TGP 2020 measures from 2014 in the building sector shows that these measures were carried out successfully, with the exception of the 'financial levers for incentives in the public sector' indicator, which is worsening. In order to improve the ratio between grants and investment incentives in the public sector, implementing activities must be accelerated and improved in this area in accordance with the plans set out in AN URE 2014–2020 and OP EKP 2014–2020.

Table 14: Overview of indicators and achievement of the targets set in OP TGP 2020 (Source: IJS-CEU)[33]

No	Indicator	Unit	Status (year)	Target value (year)	OP TGP 2020 target	Target met
3	Financial lever for investments in the public sector	EUR/EUR	0.74 (2013)	0.53 (2013)	0.33	☹
4	Reducing GHG emissions by means of measures in the public sector	kt CO_2 equivalent	15.9 (2013)	11.3 (2013)	64.4	☺
5	Floor area of public sector buildings that have undergone energy renovation	1 000 m^2	513 (2013)	301 (2013)	1 772	
6	CO_2 intensity in the commercial and institutional sectors	t CO_2/ EUR $millions_{1995}$	46.5 (2012)	44.7 (2013)	31.7	☺
7	Improving energy performance in the housing sector	GWh	487.2 (2013)	433.8 (2013)	1 408	☺

[33] IJS-CEU: Report on the Assessment of the Monitoring of the Implementation and Effectiveness of OP TGP 2020 Measures, final project report, IJS-DP-11681, 2014.

8	Specific GHG emissions in the housing sector	kg CO_2 equivalent/ m^2	15.8 (2012)	15.1 (2013)	10	☺
9	Share of heat from RES in use of heat in general consumption[34]	%	53 % (2013)	51.8 % (2013)	61 %	☺

5.3.1 5.3.1. Overview of measures in existing implementing documents

1. All buildings

Table 15: Overview of measures adopted in implementing documents (horizontal for all buildings)

Instrument/measure	Reference document	Status
Regulations on the energy performance of buildings	AN URE 2020, AN sNES, Measure V.1 OP TGP 2020, Measure NS-1	Existing measure with additions
	Link with SWOT analysis – Instability of housing sector legislation – Too little emphasis placed on government support for energy-efficient investments in the public sector – Partial instead of complete energy renovations in the public and private service sectors	
	Strategic guidelines[35] – Tightening of requirements for the introduction of nearly zero-energy buildings – Compulsory energy renovation of public buildings – Tightening of requirements for the use of renewable energy sources in new and renovated buildings – Upgrades to reduce GHG emissions within the life-cycle	
Energy performance contracting	AN URE 2020, AN sNES, Measure H.1 OP TGP 2020, Measure OS-11 OP EKP 2014–2020, Measure 4iii/1	Existing measure with additions
	Link with SWOT analysis – Lack of funds – Limited range of financial instruments for financing the energy renovation of public buildings – The problem in acquiring financial resources faced by enterprises that provide energy performance contracting services limits the potential scope of provision of these services – Low number of energy performance contracting providers and the limited number of promoters of energy performance contracting projects	

[34] Share of RES relative to end-use energy consumption in general consumption (excluding use of electricity and district heating).

[35] Strategic guidelines as defined in the reference documents.

Instrument/measure	Reference document	Status
	– Limited opportunities for borrowing by the public sector and weak lending activities on the part of banks in providing loans to the private sector – Lack of knowledge, understanding and confidence regarding the concept of energy performance contracting – Lack of skills in the commissioning of energy performance contracting projects – Legal complications regarding the implementation of energy performance contracting – Lack of a support environment for the implementation of energy performance contracting projects – Inadequate conditions for the introduction of innovative energy performance services/energy performance contracting in the housing sector	
	Strategic guidelines – Ensuring clear and unambiguous legislation – Active support of the Slovenian government and line ministries in the enforcement of this instrument – Technical assistance (establishment of technical offices) for the implementation of projects by direct budget users – Energy renovation of public sector buildings as part of energy performance contracting – Link between energy performance contracting and grants for the renovation of building envelopes – Financial incentives from commercial banks and SID banka (subsidies and guarantee schemes) – Provision of funds for energy performance contracting incentives from EU Cohesion Fund resources – Implementation of demonstration/pilot projects – Training of entities at all levels – Energy performance contracting in the housing sector	
Energy performance as part of sustainable spatial planning	AN URE 2020, AN sNES, Measure H.6, OP EKP 2014–2020 CTN OP TGP 2020, Measure OS-1	Existing measure
	Link with SWOT analysis – No direct link	
	Strategic guidelines – Comprehensive planning of buildings, neighbourhoods and housing complexes (new and alongside renovation), with due regard to energy performance and the use of renewable energy sources	
Financial incentives for energy-efficient heating systems (repayable funding and grant schemes, demonstration projects, support scheme for supply of heat from RES)	AN URE 2020, AN sNES, Measure G.2 OP TGP 2020, Measure OS-4 (only support scheme for the generation of heat from RES) OP EKP 2014–2020, Measures 4i/1 and 3a/2	Existing measure (upgraded)
	Link with SWOT analysis – Too many partial rather than complete energy renovations	

Instrument/measure	Reference document	Status
	– Lack of funds – Limited opportunities for borrowing by the public sector and weak lending activities on the part of banks in providing loans to the private sector	
	Strategic guidelines – Establishment of a support scheme for the supply of heat from RES	
Support scheme for electricity generated from renewable energy sources and high-efficiency CHP	AN URE 2020, AN sNES, Measure V.3 OP TGP 2020, Measure OS-5	Existing measure
	Link with SWOT analysis – No direct link	
	Strategic guidelines – Operation of a stable and economically sustainable scheme, featuring adequate alignment with conditions on the market	
Information and awareness-raising activities	AN URE 2020, AN sNES, Measure H.3 OP TGP 2020, Measure OS-15 OP EKP 2014–2020, Measure 4iii/1, 2	Existing measure
	Link with SWOT analysis – Relatively poor level of awareness still present (chiefly of the organisational and implementational aspects of renovation) – Too many partial rather than complete energy renovations – Implementation of the complete energy renovation of building envelopes without taking into account the changes to the requirement for users to behave in a certain way (e.g. deterioration in air quality in the absence of a ventilation system or no change in habits following the introduction of a recovery system) – Lack of information, models and examples of good practice, and human and organisational resources specialised in implementing the energy renovation of buildings and measures relating to energy efficiency in buildings – Lack of knowledge, understanding and confidence regarding the concept of energy performance contracting	
	Strategic guidelines – Coordinated awareness-raising, information and promotion in the area of EE, the use of RES and energy services	
Training programmes	AN URE 2020, AN sNES, Measure H.4 OP TGP 2020, Measure OS-14 OP EKP 2014–2020, Measure 4iii/1, 2	Existing measure
	Link with SWOT analysis – Lack of confidence in energy renovation providers	

Instrument/measure	Reference document	Status
	– Inadequate training of energy renovation providers, planners and works supervisors – Lack of information, human and organisational resources specialised in implementing the energy renovation of buildings and measures relating to energy efficiency in buildings – Lack of skills in the commissioning of energy performance contracting projects – Low number of energy performance contracting providers and the limited number of promoters of energy performance contracting projects	
	Strategic guidelines – Informal and formal education and training of energy renovation providers – Training of providers, project designers and supervisors of nearly zero-energy renovation and new construction – Training of entities at all levels of energy performance contracting projects, particularly central government (providing a role model for the rest of the public sector and to the private sector)	
Support scheme for the renovation of built cultural heritage and other special building groups	AN URE 2020, Measure J.6 (AN sNES, buildings, new Measure-1) OP TGP 2020, Measure NS-6 OP EKP 2014–2020, Measure 4iii/1	Measure not yet implemented
	Link with SWOT analysis – High proportion of protected buildings that require special treatment, absence of guidelines	
	Strategic guidelines: – Development of renovation criteria, demonstration projects, development and introduction of technologies, financial support scheme	
Promoting EE and RES	OP TGP 2020, Measure OS-2	Existing measure
	Link with SWOT analysis – Lack of economic motivation to improve the energy performance of buildings	
	Strategic guidelines – Energy performance of buildings as a criterion for possible reliefs within the new property tax system	
Excise duty on heating fuels	OP TGP 2020, Measure OS-3	Existing measure
	Link with SWOT analysis – Lack of economic motivation to improve the energy performance of buildings	
	Strategic guidelines – Excise policy that will ensure the competitiveness of biomass and biofuels over fossil fuels for heating	

2. Residential buildings

Table 16: Overview of measures adopted in implementing documents for residential buildings

Instrument/measure	Reference document	Status
Financial incentives for the energy-efficient renovation and sustainable construction of residential buildings (repayable funding and grant schemes, demonstration projects)	AN URE 2020, AN sNES, Measure G.1 OP TGP 2020, Measures OS-7 and NS-2a OP EKP 2014–2020, Measure 4iii/2	Existing measure (upgraded)
	Link with SWOT analysis – No direct link, e.g. lack of funds	
	Strategic guidelines Green loan schemes, grants – Demonstration projects for the energy renovation of multi-apartment buildings in the private and public sectors (e.g. workers' hostels, apartments provided by housing funds, etc.) within the context of energy-performance contracting – Demonstration projects for the complete energy renovation of multi-apartment buildings under nearly zero-energy renovation criteria – Energy renovation of buildings, with the involvement of housing cooperatives, to be implemented as part of integrated territorial investments (ITI) in selected urban areas	
Aid scheme for energy renovation for vulnerable population groups	AN URE 2020, AN sNES, Measure G.3 OP TGP 2020, Measure OS-6 OP EKP 2014–2020, Measure 4iii/2	Existing measure (upgraded)
	Link with SWOT analysis – Problem of low-income owners	
	Strategic guidelines – Investments, advice and measures to change patterns of behaviour	
Compulsory division and billing of heating costs in multi-apartment and other buildings according to actual consumption	AN URE 2020, AN sNES, Measure G.4 OP TGP 2020, Measure OS-9	Existing measure
	Link with SWOT analysis – No direct link, e.g. a lack of economic motivation to increase the energy performance of buildings	
	Strategic guidelines – Prompt resolution of problems	

Instrument/measure	Reference document	Status
Energy advice network for citizens	AN URE 2020, AN sNES, Measure G.5 OP TGP 2020, Measure OS-10	Existing measure (upgraded)
	Link with SWOT analysis – Relatively poor level of awareness still present (chiefly of the organisational and implementational aspects of renovation)	
	Strategic guidelines – Coordinated awareness-raising, information and promotion in the area of EE, the use of RES and energy services	
Instruments for financing renovation in buildings with multiple owners	AN URE 2020, Measure H.7 (AN sNES, Measure H.5) OP TGP 2020, Measure OS-8	Measure not yet implemented
	Link with SWOT analysis – Difficulties in reaching agreement in multi-apartment buildings	
	Strategic guidelines – Improvements to housing legislation (consent of owners, reserve funds, energy performance contracting in multi-apartment buildings)	
Distribution of incentives among owners and tenants in multi-apartment buildings	AN URE 2020, Measure H.8 (AN sNES, Measure H.6)	Measure not yet implemented
	Link with SWOT analysis – Lack of interest in energy renovation on the part of owners of rented flats	
	Strategic guidelines – Division of the benefits of energy performance measures between owners and tenants in multi-apartment buildings	
Establishment of a guarantee scheme	AN URE 2020, Measure H.9 (AN sNES, Measure H.7)	Measure not yet implemented
	Link with SWOT analysis – Difficulties in acquiring funds for the renovation of multi-apartment buildings (no adequate loan instruments or the provision of loan instruments inhibited by legislation)	
	Strategic guidelines – Support for the acquisition of funds for the energy renovation of multi-apartment buildings by means of loan security	

3. Public sector buildings

Table 17: Overview of measures adopted in implementing documents (horizontal public sector buildings)

Instrument/measure	Reference document	Status
Green public procurement	AN URE 2020, AN sNES, Measure J.1	Existing measure
	OP TGP 2020, Measure OS-13	
	Link with SWOT analysis – No direct link	
	Strategic guidelines – Inclusion of energy efficiency and the use of renewable energy sources as criteria in public procurement processes	
Financial incentives for the energy-efficient renovation and sustainable construction of buildings in the public sector (funding with an emphasis on central government buildings, ensuring project quality, promoting the optimisation of operation of energy systems, demonstration projects)	AN URE 2020, AN sNES, Measure J.2	Existing measure (upgraded)
	OP TGP 2020, Measures NS-2b, NS-3 and NS-4	
	OP EKP 2014–2020, Measures 4iii/1 and 6e/1	
	Link with SWOT analysis – Lack of funds – Lack of information, human and organisational resources specialised in implementing the energy renovation of buildings and measures relating to energy efficiency in buildings – Partial energy renovation instead of complete renovation	
	Strategic guidelines – The financing and promotion of complete energy renovation that includes the use of RES and energy renovation measures, where possible in combination with energy performance contracting (by 2020 80 % of all financial support for the energy renovation of public buildings will be directed towards promoting energy performance contracting) – Project office for the energy renovation of buildings as the coordinating body for project implementation – Financial incentives for the drafting of investment projects – Promotion of the implementation of measures to optimise the operation of energy systems – Pilot or demonstration energy renovation projects in the public sector as part of energy performance contracting – Complete energy renovation pilot or demonstration projects that take account of the following assumptions, chiefly the state of readiness of the project, the location (temperature deficit), the feasibility of the nearly zero-energy building	

	project, the compiling of the project in accordance with the model of ensuring energy savings, the group of projects, sustainable construction and the pilot application of sustainable construction criteria, the accessibility of the building, achievement of several targets from the OP with regard to urbanisation, substitute buildings and employment.	
Introducing an energy management system in the public sector	AN URE 2020, AN sNES, Measure J.3 OP TGP 2020, Measure OS-12	Existing measure
	Link with SWOT analysis – Lack of awareness of the scale of energy use in buildings (also the consequence of a lack of data on energy supply and use) and the possibilities for reducing energy use – Delays in introducing energy management systems in the public sector	
	Strategic guidelines – Introduction of energy accounting and energy management systems – Introduction and management of collective energy accounting at the municipal and national levels – Upgrading of the methodology for energy audits in such a way as to promote energy performance contracting – Implementation of energy audits	
MEASURES SPECIFIC TO BUILDINGS OWNED AND OCCUPIED BY CENTRAL GOVERNMENT		
Establishment of a project office	AN URE 2020, AN sNES, Measure J.5 OP EKP 2014–2020, Measure 4iii/1	Existing measure
	Link with SWOT analysis – Lack of information and the fragmentary nature of that information, lack of human and organisational resources specialised in managing projects for the energy renovation of buildings and measures relating to energy efficiency in buildings, and energy performance contracting projects – Fragmentary nature of knowledge, experience and skills	
	Strategic guidelines – Implementation of projects for the energy renovation of central government buildings within the context of energy performance contracting (where justified) or in combination with grants, including the establishment of a record of central government buildings for energy renovation purposes	

4. Overview of future challenges

There are several obstacles that have not yet been addressed:

- **Housing sector**
  - Lack of confidence in the managers of multi-apartment buildings
  - Uncertainty regarding future energy prices
- **Central government buildings**
  - The protracted period of tight fiscal frameworks resulting from unstable macroeconomic conditions and the deficit and debt reduction procedure, which will make the use of state funds for investments in the energy performance of buildings more difficult
  - Reaching agreement and gaining consent for the renovation of buildings not 100 % owned by the state
  - High discount rate for public investments (7 %)
  - Investments often limited to those with a relatively quick return
  - Uncertainty regarding future energy prices
- **Public and private service sector**
  - The protracted period of tight fiscal frameworks resulting from unstable macroeconomic conditions and the deficit and debt reduction procedure, which will make the use of state funds for investments in the energy performance of buildings more difficult
  - Lack of interest in energy renovation on the part of tenants
  - Reaching agreement and gaining consent for the renovation of buildings not 100 % owned by the state
  - High discount rate for public investments (7 %)
  - Poorly developed local energy agencies in some places
  - Investments in the private sector often limited to those with a relatively quick return
  - Uncertainty regarding future energy prices

5.4 Summary and upgrading of the strategic guidelines for mobilising investments in the renovation of buildings

5.4.1 Development measures

Mobilising investments in the renovation of buildings has great business importance and will contribute to greater competitiveness. To allow these measures to foster the creation of new, stable and internationally competitive green jobs with high added value, special attention must be paid to the following:

- stability of the support environment;
- quality management;
- incentives also directed towards earlier phases of the development of green technologies, products and services (only in this way will it be possible to exploit the benefits of investments in the renovation of buildings to the full).

Stability and predictability of the support structure. A support environment that reduces risk and fosters the gradual development of a range of products and services on the market is a precondition for growth and development. Steps must be taken to ensure that financial incentives for measures for the energy renovation of buildings do not introduce additional risks that would hinder the development of the market, e.g. by creating pronounced fluctuations in demand for products and services. It is therefore particularly important that tenders for financial incentives or tenders directly allocated (to the public sector) follow these guidelines:

- they enable the high-quality design and implementation of projects and pay due regard to the specifics of those individual target groups for which more time is required for project design and implementation (sufficiently long deadlines, information provided on time, etc.);

- they do not create peaks in demand, enable the entire construction season to be used (tenders published in good time) and direct the volume of investments evenly or via gradual increments across a multi-annual time period, which is essential if the objective of developing jobs is to be realised;
- they indicate the instruments/models to be used, with the tenders for incentives associated with them being published in good time;
- they support the long-term nature of support institutions' plans.

Quality management. So that investments in the energy renovation of buildings create better macroeconomic effects and higher added value within the sector, thereby supporting more complex jobs and increasing development and export opportunities for enterprises, a quality management model must be introduced at all levels of the design and implementation of energy renovation projects. Key to this is the introduction of instruments such as: the provision of public procurement quality criteria, the introduction of an energy management system within the public and private sectors, training programmes, the enforcement of national or international quality standards for equipment installed (for installers and assemblers as well), the development of quality standards for services (e.g. energy performance contracting), and the introduction of certification for providers and processes. The exemplary role of the public sector is crucial in this respect. Activities to enforce quality standards oriented towards specific areas relating to the energy renovation of buildings (e.g. quality of the energy renovation of schools through training activities, an analysis of the quality of projects already completed, demonstration projects, recommendations, etc.) will also be carried out where required.

Demonstration projects in the area of the energy renovation of buildings have been implemented individually in Slovenia and seldom in support of a more extensive implementation programme. The GEF project, under which seven investment projects have been carried out with all the necessary support activities, is a positive example of this practice. It has been continued with a more extensive programme to promote wood biomass as part of 2007–2013 cohesion policy. The funds earmarked for demonstration projects under the OP EKP 2014–2020 and intended for the following could also represent a breakthrough in this area:

- the implementation of demonstration projects featuring the complete energy renovation of different types of public sector building under nearly zero-energy building criteria, where possible (central government and cultural heritage buildings) using the latest technologies, which have a demonstration effect;
- the implementation of demonstration projects featuring the complete energy renovation of multi-apartment buildings under nearly zero-energy building criteria. The funds are earmarked for the use of the latest technologies, which have a demonstration effect.

The purpose of demonstration projects is to showcase new technologies that realise the objectives of energy efficiency and air protection, as well as other objectives linked to the energy renovation of buildings such as the efficient management of natural resources, reducing GHG emissions within the life-cycle of buildings, protecting cultural heritage, financing anti-earthquake renovation, etc. At the same time, demonstration projects are aimed at showcasing the use of energy performance contracting in public buildings. Demonstration projects are also an important instrument for upgrading the quality management system for building renovation.

Focused incentives for the development of services and products. Priority areas are defined within the Slovenian Industrial Policy, with the development of environmental technologies (EE technologies, RES technologies, technologies for increasing materials efficiency) ranked at the top of the priority areas for economic development. In line with this, emphasis is placed on two support sectors: sustainable construction and manufacturing industries (chiefly wood manufacturing, metals, electricity and electronics).

It is crucial to the development and production of new sustainable products and services that the development incentives for SMEs are targeted, in accordance with the Slovenian Industrial Policy adopted in 2013 and the draft Smart Specialisation Strategy of the Republic of Slovenia, at the following technological areas:

- energy efficiency technologies (insulation materials, technologies for efficient energy and water consumption);
- technologies for the production of energy from renewable energy sources (solar collectors, devices for the exploitation of energy from biomass);
- technologies for the systemic management of energy from RES (diffuse sources) and the integration of these sources into the energy system (intelligent networks), and for energy supply systems featuring consumption management by users themselves;
- technologies for energy-efficient building solutions in new construction and building renovation.

Slovenia has a range of development incentives that are not targeted at specific areas. Owing to major investment activities in relation to the energy renovation of buildings in the years to come, it would make sense at the same time to promote commercial development projects relating to energy-efficient products, production processes and services, i.e. to provide comprehensive support to the commercial sector (industry and the service sector) through the promotion of research, development, demonstration projects and the market penetration of technologies, products, materials and services that affect energy use. Such activities are of key importance because they link the implementation of the programme for the energy renovation of buildings founded on energy policy targets to the objectives of technological development, economic growth and employment.

Irrespective of the absence of targeted and integrated incentives, in various EE segments Slovenia possesses top-class knowledge and competitive, globally oriented enterprises that are capable of developing technologies, new concepts, systems and services in the field of energy efficiency. Slovenia's key opportunities and skills lie in the development of integrated systems.

Specific activities in support of development in this field are being pursued as part of the promotion of centres of excellence and competence centres. Other instruments intended to promote innovation and the purchase of technological equipment, and other incentives for the development of small and medium-sized enterprises, generally do not define priority areas, nor do they stimulate additional objectives such as those relating to the environment. Considerable funds have also been directed towards development of the field from European programmes (Horizon 2020, which is the EU's framework programme for research and innovation, and COSME 2020, the framework programme for the competitiveness of SMEs). It is particularly important to provide SMEs with support that allows them to become involved in these programmes. SMEs are an important part of the economy as far as development of this field is concerned – as energy performance contracting providers as well. Public innovation contracts can also be an important form of incentive.

As an incentive to establish a green innovations market, the following types of project/activity are being supported by cohesion funds in Slovenia in the 2014–2020 period (these projects/activities will also have to be exploited to the full for the purposes of developing the complete energy renovation of buildings):

- development activities and technological investments for the production of new or substantially improved products;
- technological and non-technological innovations (e.g. design) with market potential;
- the networking of enterprises with higher education, research, consulting and international institutions for the purposes of exchanging knowledge and experiences and carrying out joint development projects;
- eco-innovations and the development of new green products, services, processes and business models that will enable Slovenia to move towards a low-carbon society that manages resources efficiently;
- support for projects to commercialise products that have been developed and for the entry of new technologies on the market in order to obtain references, e.g. through innovative public contracts (pre-commercial procurement) and demonstration projects.

OP EKP 2014–2020 measures relating to the promotion of innovations relevant to the building sector:

1. Priority Axis: 'Promoting Investments by Enterprises in Innovation and Research, and Establishing Links and Synergies Between Enterprises, Research and Development Centres and Higher Education':
   - 002 Research and innovation processes in large enterprises
   - 003 Productive investment in large enterprises linked to the low-carbon economy
   - 062 Technology transfer and cooperation between universities and enterprises, primarily to the benefit of SMEs
   - 063 Support for clusters and business networks, primarily to the benefit of SMEs
   - 064 Research and innovative processes in SMEs (including the voucher system and process design services and social innovations)
   - 065 Research and innovation infrastructure, processes, technology transfer and cooperation in enterprises, with an emphasis on a low-carbon economy
2. Priority Axis: 'Dynamic and Competitive Businesses for Green Economic Growth':
   - Promoting entrepreneurship, particularly by facilitating the commercial application of new ideas and encouraging the establishment of new enterprises, including business incubators:
   - 068 Energy efficiency and demonstration projects in SMEs and supporting measures
   - 069 Support to environment-friendly production processes and resource efficiency in SMEs
   - 071 Development and provision of incentives to enterprises specialising in services that contribute to a low-carbon economy and resistance to climate change (including support for such services)

5.4.2 Horizontal measures

Regulations relating to the energy performance of buildings will be upgraded[36] so that stricter requirements are introduced for the energy performance of buildings in line with the results of the national study of the cost-optimal minimum requirements. The updating of the regulation will also include, as required, the updating of the minimum energy performance requirements for new technical building systems. These requirements will also be applied to the replacement and upgrading of the systems where this is technically, economically and functionally feasible. Energy performance regulations will be updated with a more detailed technical definition of the criteria for nearly zero-energy buildings no later than by the end of 2018 (for new buildings occupied by public authorities as owners) or the end of 2020 (for all other new buildings). The updating of energy performance regulations also includes the upgrading of the minimum requirements for the renovation of existing buildings with a more detailed definition of the criteria for the nearly zero-energy renovation of existing buildings. The upgrading of the regulations will affect the energy performance of buildings and systems and achievement of the target coverage of the energy needs of buildings with renewable energy sources or energy-efficient energy supply systems.

The updating of regulations for reducing GHG emissions during the life-cycle of a building, e.g. the introduction of environmental impact assessments for buildings during their life-cycle (LCA, life-cycle assessment) with the aim of establishing the use of low-emission materials, is planned over the long term as part of the upgrading of rules relating to energy efficiency in buildings, the updating of green public procurement regulations for the building sector or within a special sustainable buildings regulation.

Cultural heritage buildings. The proportion of buildings protected under cultural heritage protection regulations is very high, particularly as regards buildings owned and occupied by the state. Owing to their contribution to national identity and their economic importance, this group of buildings requires special attention. Because of their particular features, the renovation of cultural heritage buildings usually requires higher levels of investment and a certain deviation from the renovation parameters required of other buildings; they are therefore frequently unable to meet the conditions for obtaining public funds for EE and the use of RES.

[36] Updating of the Rules on the Efficient Use of Energy in Buildings (PURES, UL RS, No 52/10) is planned for 2015.

A comprehensive set of measures for this special group of buildings is under preparation and will take into account the following guidelines:

- the formulation of criteria for the architectural/design aspect of energy renovation so that measures for the energy renovation of cultural heritage buildings do not damage or even destroy the protected elements of cultural heritage (AN URE 2020);
- the formulation of 'positive discrimination' criteria that will be applied in tenders for promoting the energy renovation of buildings ('heritage factor') and will enable the level of the incentives to be aligned with the method by which cultural heritage protection is promoted (AN URE 2020); requirements for the energy performance of buildings protected under cultural heritage protection regulations shall be aligned with the assets being protected, chiefly in terms of correction factors;
- the implementation of pilot or demonstration projects for the complete energy renovation of different types of public sector building and different forms of renovation (cultural heritage buildings among others) by using the latest technologies (OP EKP 2014–2020); the development and introduction of technologies;
- the provision of financing sources for the renovation of cultural heritage buildings;
- the training of providers.

These measures require special and timely preparation; they also require the key players and shareholders to be properly organised if the measures are to be implemented to the requisite level of quality.

5.4.3 Public sector

The following two strategic issues are of key importance to the public sector:

- a level of organisation for implementation that allows buildings to be renovated on time, extensively and in a manner that has the best possible impact on the public purse, including effects on economic growth and employment and other wider social benefits;
- the provision of a greater scope of renovation of public buildings using limited public funds and the enforcement of energy performance contracting.

The strategic effects will depend directly on the activities performed at the start of the new financial perspective; we are therefore also highlighting a number of implementation issues in this section.

The instruments supporting the plan set out to increase the number of buildings undergoing complete and nearly zero-energy renovation in the public sector are: financial incentives in the form of grants and repayable funding, promotion of the introduction of energy performance contracting, private funds for the rest of the non-residential sector, financial resources from the dedicated funds and programmes of international financial institutions for the public sector and the rest of the non-residential sector, the re-routing of some financial incentives to promoting the provision of repayable funding, the training of contracting authorities, project designers, contractors and users of nearly zero-energy buildings, the development of solutions for the renovation of cultural heritage buildings and special building groups (type-specific solutions for non-residential and public buildings), a link to the support scheme for the supply of heat from RES, the legal foundations for target indicators for EE and RES in the public sector, the monitoring of the indicators achieved, promotion, and the implementation of measures to optimise the operation of energy systems as part of the financing of the energy renovation of buildings and for other buildings through financing via energy performance contracting.

Incentives, including grants, will be directed towards the public sector in the widest sense with reference to the ownership as well as the purpose of use of buildings. Priority will be given to activities directed towards achieving the obligation to renovate 3 % of the total floor area of buildings owned and occupied by central government that do not meet the minimum energy performance requirements from 1 January each year.

Project office for the energy renovation of buildings. A coordinating body needs to be established whose aim would be to concentrate knowledge and experience for the implementation of investments in the energy renovation of state-owned buildings, with special emphasis on the energy performance contracting model (OP EKP 2014–2020 and AN URE 2014–2020 measure). It will provide an expert team to assist in designing invitations to tender, conducting public-private partnership procedures, evaluating tenders, overseeing the implementation of measures, overseeing the implementation of the contract on the provision of energy savings, and transferring knowledge and good practice to the entire public sector and other sectors. The project office for the energy renovation of buildings is primarily intended to provide technical assistance for the energy renovation

of state-owned buildings (indirect and direct budget users). Funding of the office is partly planned under technical assistance within the context of OP EKP 2014–2020.

Project office for the energy renovation of buildings. The tasks of the office are:

- to manage and ensure the systematic preparation of a set of projects to meet the targets set in relation to the renovation of state-owned buildings;
- to support the implementation of energy performance contracting projects:
  - an active role in establishing an energy performance contracting model (including the preparation of procedures and documents for the standardised implementation of projects) and in removing administrative barriers,
  - the speeding-up of the preparation of projects (speeding-up of compliance with obligations regarding the certification of buildings, preparation of expanded energy audits and project documentation),
  - the systematic preparation of joint tenders to lower project costs (geographical criteria, links between projects on the basis of economic parameters, etc.),
  - the provision of ongoing support for the implementation of energy performance contracting projects (assistance in the designing of tenders and the evaluation of bids, procedures, negotiations, the organisation of appropriate support for the implementation of investments, the organisation of supervision of the implementation of the contract on the provision of energy savings, etc.);
- to provide support for quality assurance in the field of energy efficiency in central government buildings:
  - an active role in establishing a system for assuring the quality of preparation and implementation of projects for the energy renovation of buildings in the public sector,
  - the provision of ongoing technical assistance in the preparation and implementation of projects, and oversight of those projects,
  - the introduction of an energy management system for all central government buildings,
  - the preparation and introduction of a scheme for optimising the operation of energy systems ('re-commissioning') with subsequent implementation for projects already carried out and within new investment projects,
  - analyses of the quality of projects already carried out;
- to provide information and participate in the training of all important entities in these fields;
- to transfer knowledge and experiences relating to investments in the renovation of buildings between different segments of public administration (with entities such as local energy agencies, etc.), and transfer international knowledge and experiences to other sectors (e.g. SMEs, housing sector);
- to support the transfer of knowledge and experiences in the field of the energy renovation of cultural heritage buildings;
- to manage demonstration project records (the role of the project office will be to ensure the demonstration effects by making the appropriate selection of projects and solutions and by monitoring them, disseminating the results, etc.);
- to retain and maintain records of central government buildings for energy renovation requirements;
- to systematically monitor projects in order to optimise the process of preparing and selecting projects, allocating funds and providing for comparative evaluation;

to concentrate and link together knowledge and experience in the public sector in relation to investments in energy renovation and the implementation of energy performance contracting projects.

Energy performance contracting. The use of energy performance contracting (EPC) increases the scale of investments using less public funding for the complete energy renovation of public buildings. It contributes to achieving the annual dynamics of renovation of public buildings required under the Directive on Energy Efficiency[37] (EED), as well as giving the economy a kick start, as greater demand for energy performance contracting has contributed to the development of the market for energy services that improve energy efficiency.

[37] Directive 2012/27/EU.

A number of energy performance contracting projects have already been carried out in Slovenia (the first was in 2002), particularly in the public sector, for different EE and RES measures and different investment volumes, etc. Several projects have also been carried out as part of suppliers' obligations to ensure energy savings by final customers. While this is a good basis, projects are still encountering a series of obstacles and unresolved administrative issues. It should be pointed out that energy performance contracting projects in the public sector have so far been carried out at the local community level, while central government is only encountering these projects in the new financial perspective.

Using a project-based approach and in order to ensure the successful enforcement of energy performance contracting, an extensive scheme must be introduced for the renovation of public buildings as part of energy performance contracting projects. The key strategic decision involves the financing model. It would be best to test it out first on a smaller number of projects so that the strengths and weaknesses and the practical aspects of implementation can be finally verified. The model must correspond and, where required, be adapted to the availability of financial resources, above all the use of cohesion funds and possible additional funding sources (e.g. from international sources). Use of the energy performance contracting model in the public sector is also addressed in Section 6.2.2.

Using a project-based approach and in order to ensure the successful enforcement of energy performance contracting, an extensive scheme must be introduced for the renovation of public buildings as part of energy performance contracting projects. The following tasks are of key importance here:

- establishing a financing model using energy performance contracting;
- ensuring the systematic preparation and selection of energy renovation projects using energy performance contracting;
- regulating the issue of the financing of the preparation of projects and, where required, acquiring additional resources for technical assistance;
- ensuring that projects are linked into joint projects to achieve better economic effects for the public purse (lowest costs possible within the life-cycle of measures);
- making improvements that provide for the unambiguous interpretation of legislation regarding issues such as: accounting standards, borrowing by municipalities when the repayment of investments from savings made in energy costs is involved, interpretation of the Public Procurement Act and the Public-Private Partnership Act in relation to energy performance contracting projects, etc.;
- ensuring the systematic production of support material for energy performance contracting so as to enable projects to be designed to a higher level of quality, more swiftly and more cheaply. Support material encompasses standard contracts, instructions relating to tender implementation procedures, project implementation and supervision of the implementation of contracts on the provision of energy savings (monitoring of the effects, reporting and verification of savings), the supplementing of the methodology for conducting energy audits in the public sector so that it supports the preparation of energy performance contracting tenders, etc.;
- legally regulating the field for the introduction of new approaches such as 'financing through an energy account';
- testing the regulation using demonstration projects;
- providing publicly accessible information in support of energy performance contracting within the energy management system;
- providing concerted and constant information and awareness-raising for target groups regarding EE energy services (promotional campaign), including the promotion of model examples, providing information to financial institutions on EE energy services, encouraging financial institutions to offer favourable loans to enterprises for energy services to implement energy performance contracting projects, and incorporating content into the single sustainable energy information portal (BORZEN);
- training potential contracting authorities, particularly from the public sector, in the design and management of energy performance contracting projects;
- supporting contracting authorities, particularly in the public sector, in energy performance contracting projects (see the 'Project office for the energy renovation of buildings' section) and providing support to other segments of the public sector (e.g. local energy agencies could, in accordance with the EZ-1, assume the role of project promoters on behalf of municipalities);
- enforcing the European Code of Conduct for Energy Performance Contracting;
- enforcing quality standards for energy performance contracting;
- training entities at all levels;
- providing ongoing support to responsible persons within institutions in relation to removing barriers;
- monitoring projects systematically (labour costs and individual activities), ensuring comparative evaluation, and optimising the processes of selecting projects and allocating funds.

Development of public procurement and other decision-making or procurement procedures in the public sector. The criterion of lowest life-cycle costs will have to be adhered to consistently in order to increase the impact on the energy performance of buildings. This is a developmental task (the criteria will be enforced incrementally). The aim is to enforce the principle in all segments (as this involves the use of public funds for measures for the energy renovation of buildings), including the allocation of incentives to the private sector. As

mentioned above, quality criteria must be adhered to in public procurement and green public procurement, and eco-innovations promoted through public procurement, in order to enhance developmental effects. AN URE 2014–2020 addresses the energy efficiency aspects of green public procurement in more detail. The development of other decision-making or procurement procedures in the public sector is also necessary, particularly in relation to PPP or energy performance contracting.

5.4.4 Residential buildings

Targeting of subsidies towards complete energy renovation and the renovation of residential areas. Continuation of the policy of promotion through financial investment incentives (Eco Fund incentives) is planned. These incentives will be more targeted in future and the level of the incentives will provide greater encouragement for the complete energy renovation of buildings (the highest level of co-financing will be given to the measures for the complete energy renovation of buildings and the lowest to the implementation of an individual measure). Subsidies must also be linked to verification of the quality of implementation. Instruments for promoting the renovation of residential areas will also be studied.

The legal foundations for decision-making in multi-apartment buildings must be regulated in favour of the energy renovation of buildings. This regulation will be based on the principle that 50 % consent is sufficient for an energy renovation decision to be taken if a substantial improvement in energy performance is involved, where the investment will be returned in the form of savings in energy costs.

The legal foundations must also be regulated so as to **make it easier for the reserve fund or the building to take on borrowing**, also on the basis of 'on-bill financing'.

Vulnerable population groups. The enhancement of financial assistance for vulnerable population groups is planned within the strategic documents adopted. Special measures are defined for energy renovation in households faced with fuel poverty. The measures will be aimed at investments, advice and measures to change patterns of behaviour. Advice and other practical assistance will be aimed at overcoming the obstacles encountered by this target group (access to information, skills to implement measures, etc.), and will rely to the greatest possible extent on experiences in providing assistance to this target group in other areas. EE measures for vulnerable population groups are addressed in AN URE 2014–2020.

Managers of non-profit housing stock must also be encouraged to engage in the complete energy renovation of buildings through appropriate regulation of the system of non-profit rents.

5.4.5 Buildings in the private service sector

Small and medium-sized enterprises. Energy efficiency and the use of renewable energy sources for SMEs constitutes, above all, an opportunity to reduce energy and therefore operating costs. Owing to their size, these enterprises often do not have enough staff able to deal with EE and the use of RES or to manage projects in this field, even though there are some public funds already available for this purpose (Eco Fund, energy suppliers' programmes). It would make sense to formulate a special programme for this target group that overcomes this obstacle. The cooperation, above all, of the MzI and the MGRT, as well as the Eco Fund and local energy agencies, would be required in the design and implementation of this programme. The programme should promote the formation of a package of measures aimed at this target group.

This would also be required as support for investment incentives and other forms of financial incentive to improve energy and materials efficiency (measures to promote EE and RES in SMEs) financed by the European Regional Development Fund (OP EKP 2014–2020), where incentives for 1 000 projects are planned.

5.4.6 Complementary policies

Efficient district heating systems. Measures and policies for district heating systems that pursue the vision set out in this Strategy are also required if the targets are to be reached and emissions reduced. A detailed strategy for this sector will be outlined in the Energy Concept of Slovenia.

Air protection. Building renovation measures also relate to the issue of air quality, whereby they considerably reduce the global costs of achieving the targets of several policy areas at the same time. Consistent adherence to air quality legislation and programmes is of essential importance when undertaking the energy renovation of buildings. The Strategy is additionally oriented towards achieving air-quality targets in accordance with the guidelines adopted in the OP TGP 2020, which are:

- incentives for wood biomass heating installations for the heating of buildings or residential complexes that are financed by public funds or promoted as part of energy suppliers' obligations to achieve end-use energy savings are intended solely for the best available technologies;
- incentives are not given to individual heating systems if they replace heating from district heating systems;
- incentives are not given to individual heating systems in areas that have adopted an ordinance on an air-quality plan if municipal acts or a local sustainable energy action plan have given priority to district heating for the heating of buildings. If natural gas is given priority in heating, incentives are not given to the replacement of heating installations using gas with new heating installations using wood biomass;
- due regard is paid to the following order of precedence for energy sources for the supply of heat when designing incentives relating to the heating of buildings and residential complexes:
    - district heating systems that use RES for the cogeneration of heat and power, RES in separate generation, natural gas in high-efficiency CHP or waste heat;
    - individual supply of heat from RES;
    - individual natural gas supply;
    - other sources.

Total consumption of wood biomass for heating will be lower (in absolute terms) in 2030 as a result of the measures for energy efficiency in buildings incorporated into this Strategy than they would be without these measures; at the same time, the proportion of buildings using this fuel in modern high-efficiency installations will be higher.

Internalisation of the external costs of environmental pollution can have an important effect on increasing the cost-competitiveness of projects for the energy renovation of buildings and, at the same time, on public finance revenues for achieving the climate and energy targets. New policies should help to adjust the prices of resources which are not adequately evaluated on the market. For the building sector, these are, in particular, water, clean air and climate. An appropriate system of environmental levies could also coordinate efforts towards fiscal consolidation by promoting the restructuring of the economy into one that manages resources efficiently.

5.5 Measurability of targets – linking targets with an assessment of the effects and with measures to monitor the effects

One very important aspect of target-setting is the measurability of those targets, and the quality and costs of monitoring the implementation of the Strategy.

Under Directive 2012/27/EU, targets can be set using one or more sets of indicators:

A. energy savings, renovated floor area, emissions reduction, an increase in the share of RES, where only building renovation and new construction promoted by means of subsidies are taken into account;
B. energy savings, renovated floor area, emissions reduction, an increase in the share of RES, where all building renovation and new construction are taken into account;
C. end-use energy consumption in buildings, total emissions, share of RES, use of RES, specific use of energy in buildings;
D. primary energy use in buildings, total emissions, share of RES, specific emissions.

From the point of view of the measurability of the targets, it is very important that the decision on the framework of the Strategy accords as closely as possible to the categorisation of sectors within the national statistics. The Strategy covers energy use in all buildings, with the exception of buildings in manufacturing industry. This means that all energy use in buildings from the statistical sectors of households and other use, which includes service activities (public and commercial), and energy use at agricultural holdings (but excluding energy use for agricultural machinery) are taken into account.

The useful floor area of occupied apartment units and the useful floor area of service sector buildings are taken into account when monitoring the floor area of buildings. The obligations imposed by Article 5 of the EED are also monitored in relation to the useful floor area of buildings.

A number of implementing documents (OP TGP 2020 and OP EKP 2014–2020) also set detailed operational targets aimed at increasing the effectiveness of the implementation of programmes and the monitoring of the effects of the implementation of these programmes. Systems of indicators have also been developed for the requirements of these programmes. Some of them are specifically tailored towards the monitoring of measures in the building sector. The indicators used to monitor the results of the OP TGP 2020 and OP EKP 2014–2020 are presented in the tables in Annex A.

The system for the monitoring of the effects of the implementation of the Strategy will be linked as closely as possible to the systems of indicators already approved.

Proposed main indicators for the monitoring of the achievement of the national targets:

- energy use;
- share of renewable energy sources;
- greenhouse gas emissions from the sector;
- floor area of nearly zero-energy buildings;
- share of central government buildings that have been renovated.

The following indicators are proposed for the monitoring of the effects and costs of incentives:

- floor area of buildings that have been renovated on the basis of incentives;
- savings in energy costs;
- reductions in GHG emissions, increase in the use of energy from RES, energy savings;
- volume of investments;
- costs for incentives;
- jobs created (within the framework of the data available). Indicators are also required for assessing the effectiveness of the measures:
- the ratio between the values of incentives and investments;
- the ratio between savings in energy costs and the costs of the measures;
- the specific costs of incentives per unit of energy saved;
- the specific costs of incentives per unit of emissions reduced.

The national statistics for energy and construction will also have to be upgraded if achievement of the targets of the Strategy is to be monitored effectively; this particularly applies to the monitoring of the overall scale of building renovation (including independent renovation) in the private sector. Monitoring of energy use, the energy performance of buildings and building renovation in the public sector will be based, in particular, on mandatory energy management and building certification systems.

6 Future-oriented perspectives for guiding investment decisions

6.1 Estimate of the investment volumes required

According to projections for 2016–2023, the value of investments in the renovation of buildings will amount to EUR 3 166 million: 72.7 % for the renovation of buildings in the housing sector, 10.7 % for buildings in the public sector and 16.6 % for buildings in the private service sector. The value of investments in the 2024–2030 period is estimated to be EUR 3 137 million, giving a total for 2016–2030 of EUR 6 304 million: 73.6 % for the housing sector, 10.3 % for buildings for the public sector and 16.1 % for buildings in the private service sector.

Table 18: Total volume of investments in the energy renovation of buildings, by sector (value excl. VAT) (Source: IJS-CEU)[38]

(EUR million)	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Investments required (excl. VAT)									
Residential buildings	246	261	274	286	296	303	309	327	2 302
Public sector	42	42	42	42	42	43	43	43	340
Private service sector	64	64	64	64	64	68	68	68	525
Total overall investments	**353**	**367**	**380**	**392**	**402**	**414**	**420**	**438**	**3 166**
Additional investments required (excl. VAT)									
Residential buildings	197	211	223	235	243	249	253	269	1 879
Public sector	36	36	36	36	36	37	37	37	289
Private service sector	55	55	55	55	55	57	57	57	446
Total additional investments	**287**	**301**	**314**	**325**	**334**	**343**	**347**	**363**	**2 614**

In order to assess the macroeconomic effects of the Strategy, an assessment must be made of the share of investments that would be made in each case, in addition to the overall value of the investments, i.e. excluding measures for promoting the energy renovation of buildings (financial incentives, regulations, information-provision measures, etc.). This share is estimated to be 17.5 % and includes only the most urgent investments in heating systems at the end of the life-cycle. The difference to the full value of the investments in the energy renovation of buildings (82.5 %) is referred to as 'additional investments'. These are the result of the implementation of this Strategy. The value of the additional investments in the 2016–2023 period is EUR 2 614 million (EUR 5 154 million in 2016–2030). For more detailed explanations, see also Section 8.

6.2 Funding sources

To achieve the targets set in relation to the energy performance of buildings, a set of financial indicators is planned that ensures a sufficient volume of repayable funds and grants for implementation of the required investment volumes. The instruments supporting the plan set out to increase the number of buildings undergoing complete and nearly zero-energy renovation in the public sector, as part of the group comprising the 3 % of buildings owned and occupied by central government and in the other non-housing sector are: financial incentives in the form of grants and repayable funding for the public sector, particularly central government buildings, cohesion funds, promotion of the introduction of energy performance contracting, private funds for the rest of the non-residential sector, financial resources from the dedicated funds and programmes of international financial institutions for the public sector and the rest of the non-residential sector, the re-routing of some financial incentives to promoting the provision of repayable funding, the training of contracting authorities, project designers, contractors and users of nearly zero-energy buildings, the development of solutions for the renovation of cultural heritage buildings and special building groups (type-specific solutions for non-residential and public buildings), a link to the support scheme for the supply of heat from RES, the legal foundations for target indicators for EE and RES in the public sector, the monitoring of the indicators achieved, promotion, and the implementation of measures to optimise the operation of energy systems as part of the financing of the energy renovation of buildings and for other buildings through financing via energy performance contracting. The sources of funding are defined more precisely for the period from 2016 to 2023 (from the beginning to the

[38] The values are stated without VAT. In future assessments of the effect, it will be taken into account as required for a specific indicator, differently by sector: costs for an investor, costs to public finances and for the required subsidies, necessary financial resources, etc.

anticipated end of the use of cohesion funds from the 2014–2020 financial perspective), where those sources that may be taken into account over a longer period are also shown.

6.2.1 Housing sector

By 2023 Slovenia will need to invest EUR 2.533 billion in the housing sector in order to achieve the targets set in the AN URE and the European commitments adopted by Slovenia. The main source of financial incentives for promoting and supporting the implementation of investments in the energy performance of residential buildings in Slovenia comprises repayable and grant funding provided systemically and on a long-term basis by the Eco Fund.

Funds are earmarked from the energy efficiency contribution via the Eco Fund and partly from resources from the Climate Change Fund of the Republic of Slovenia to support investments in the energy performance of buildings in the housing sector. Both sources of funding are aimed at investors in the form of grant-based incentives. Up to 25 % of the recognised costs may be co-financed in incentives deriving from the energy efficiency contribution. Otherwise, a grant-based incentive accounts, on average, for one-sixth of the overall investment. Incentives disbursed from resources from the Climate Change Fund are intended for areas blighted by air pollution. The level of co-financing is therefore higher (up to 50 % of the recognised costs). Taking the lever that grant-based incentives have on investments in energy efficiency into account, we can expect that grants earmarked for investments in the housing sector will activate just over EUR 200 million of investments annually between 2015 and 2023. Systemic funding for the energy-efficient renovation of the housing sector is not linked to the period of use of cohesion funds (it is envisaged to continue after 2023).

Owners of housing property are investing in energy-efficient renovation even without making use of grants. The ratio between subsidised and spontaneous renovation is estimated to be 1:2[39] (the 2012 estimate for spontaneous renovation was EUR 270 million annually). Investments are also supported by the Eco Fund, which provides favourable loans (EUR 8 million annually from the dedicated property fund for individuals), by commercial banks (with the support of SID banka as well) and, to a less extent, by energy suppliers' programmes.

Table 19: Total volume of investments in the energy renovation of residential buildings and total funding sources 2015–2023

EUR million	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Investments required in the energy renovation of residential buildings (excl. VAT)	**231**	**246**	**261**	**274**	**286**	**296**	**303**	**309**	**327**	**2 533**
Investments required in the energy renovation of residential buildings (incl. 9.5 % VAT)	**253**	**269**	**286**	**300**	**313**	**324**	**332**	**338**	**358**	**2 774**
EE grants earmarked for energy-efficient renovation	30	28	28	28	28	28	28	28	28	254
Grants from the Climate Change Fund*	8	13	16	16	16	16	16	16	16	133
Grants TOTAL	38	41	44	44	44	44	44	44	44	387
Volume of grants of activated investments	**204**	**207**	**214**	**218**	**217**	**217**	**217**	**217**	**217**	**1 927**
Spontaneous renovation	49	62	72	82	96	107	115	121	141	846
Total activated renovation funds	**253**	**269**	**286**	**300**	**313**	**324**	**332**	**338**	**358**	**2 774**
Eco Fund grants	8	8	8	8	8	8	8	8	8	72

*The level of funding from the Climate Change Fund from 2016 onwards will be determined when the Programme for the Use of Funds from the Climate Change Fund is adopted by the Slovenian government.

Table 19 sets out the investments and the financial resources required to fund the investments. It is clear that the planned volume of systemic funds, with the assumption of equal financial levers, makes available a volume of

[39] Estimates derived from the Survey of Household Consumption and the REUS survey.

funds sufficient for realisation of the targets set. A smaller volume of spontaneous renovation will have to be engaged as a residual source of funds for renovation than was realised in 2012 if the targets set are to be achieved; in addition, such renovation is also supported by favourable repayable funds from the Eco Fund, banks, etc.

If the planned funds are to be activated successfully and the expected results achieved, it is important for the utilisation of funds to be supported by appropriate support measures as well:

- The provision of a volume of funds for renovation that is predictable and stable over the long term (predictable tenders), as this enables the long-term planning of investments on the part of owners of residential buildings and an even distribution of renovation projects over time.
- The progressive targeting of grant-based subsidies at the complete energy renovation of buildings, and less at the financing of individual partial measures.
- The removal of bottlenecks in renovation resulting from the inability of lower-income apartment owners to finance renovation. An instrument has already been designed at the Eco Fund to eliminate fuel poverty and the inability to pay for renovation (included under grants in Table 19). Grants of EUR 5 million from the Cohesion Fund are also envisaged.
- The removal of barriers to decision-making on energy renovation in multi-apartment buildings. Two major obstacles are the securing of the required majority in favour of energy renovation in multi-apartment buildings and the possibility of using debt-based financial instruments in multi-apartment buildings (whether in the form of loans or through 'on-bill financing').
- The taxing of property in a way that does not slow the pace of energy renovation.

6.2.2 Public sector

Directive 2012/27/EU obliges Slovenia to ensure that 3 % of the total floor area of heated and/or cooled buildings owned and occupied by central government that do not meet the energy performance requirements is renovated each year. Under the Operational Programme for the Implementation of European Cohesion Policy 2014–2020, Slovenia has also undertaken to renovate 1.8 million m^2 of floor area across the entire public sector (the obligation relating to central government buildings is included in this figure) by the end of the period of use of cohesion funds in the target year of 2023. In order to achieve the target set, an annual volume of investment of between EUR 51 and 53 million (or a total of EUR 415 million for the whole period, including 22 % VAT) will have to be made during the period of use of cohesion funds (2016–2023).

Investments in the public sector (central government and the wider public sector) will be financed from EU funds, financial instruments that act as a suitable lever for EU funding resources, Slovenia's own funds and private sources. EUR 115 million in grants and EUR 50 million in repayable funds (which, with the EUR 20.3 million (15 %) of own funds which Slovenia is obliged to provide, gives a total of EUR 185.3 million in cohesion fund grants for the energy renovation of public sector buildings up to 2023) are available under the 'Sustainable energy' priority investment of the OP EKP 2014–2020.

There are plans to bring forward the start-up of the energy performance contracting mechanism, which also attracts private capital to the renovation of public sector buildings, in order to enhance the effects of public funds. Financial instruments that would enable risks to be spread and provide suitable financial leverage for the funding of public-private partnership projects are being formulated to support the full introduction of energy performance contracting. The financial instruments scheme is based on a combination of cohesion funds and other public and private financial resources (financial lever 2.5). Up to EUR 50 million of repayable OP EKP 2014–2020 funds will be invested in this scheme.

Table 20: Total volume of investments in the energy renovation of public sector buildings and possible funding sources 2016–2023

EUR million	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Public sector investments required									
Total investments (excl. VAT)	42	42	42	42	42	43.4	43.4	43.4	340

VAT	9.2	9.2	9.2	9.2	9.2	9.5	9.5	9.5	74.8
Total required volume of funding (investment + VAT)	51.2	51.2	51.2	51.2	51.2	52.9	52.9	52.9	414.8
Structure of funding of investments									
Funds from financial instruments (incl. EUR 50 million in repayable funding from cohesion sources)*	15.4	15.4	15.4	15.4	15.4	15.9	15.9	15.9	125
Cohesion grants	14.2	14.2	14.2	14.2	14.2	14.7	14.7	14.7	115
State's own contribution to cohesion grants	2.5	2.5	2.5	2.5	2.5	2.6	2.6	2.6	20.3
ESCO providers' own funds (30 % of investment)	15.4	15.4	15.4	15.4	15.4	15.9	15.9	15.9	124.4
Amount of funds required from the integral budget	3.7	3.7	3.7	3.7	3.7	3.8	3.8	3.8	30.1
Total	**51.2**	**51.2**	**51.2**	**51.2**	**51.2**	**52.9**	**52.9**	**52.9**	**414.8**

*The forms of the financial instruments for energy efficiency based on a prior assessment of the financial instruments: loans to public and private owners, risk-spreading instrument (guarantee instrument) and equity financing for ESCO enterprises.

The average share of funding from state grants, including the state's own contribution, is 40 %, while the average share of funding from other funds (ESCO funds and financial instruments) is 60 %. Since the above-mentioned illustration indicates only the possible sources of funding, the Analysis of the Financing Models for the Renovation of Public Buildings, with an Emphasis on Mobilising Private Sector Investments, which is under preparation at the ministry responsible for energy and is slated for completion by the end of November 2015, will give a more precise breakdown. This analysis will separately deal with and regulate cases of the funding of the energy renovation of public sector buildings for which a preliminary procedure as laid down in Article 34 of the Public-Private Partnership Act (ZJZP) is not possible, with the exception of selected pilot or demonstration projects.

If the planned funds are to be activated successfully and the expected results achieved, it is important for the utilisation of funds to be supported by appropriate support measures:

- the management of projects by the project office in a way that ensures that the flow of projects suitable for energy performance contracting is efficient, predictable and stable over the long term;
- provisions for the rapid commencement of project design that will ensure stable demand for funds and energy performance contracting services and a stable volume of investments throughout the entire period, and will also therefore have the greatest impact on the national economy. Rapid commencement will also help to create good practice and the transfer of knowledge to others;
- the targeting of energy performance contracting grants specifically towards those projects of interest to energy performance contracting;
- the determination of projects in accordance with a priority list (priority given to projects in which the investments have the greatest impact);
- the formation of appropriate practice on the part of contracting authorities in relation to requirements for ESCO enterprise guarantees for the implementation of works, which can, on account of the lack of depth of the ESCO services market, slow the expansion of energy performance contracting.

6.2.3 Private service sector

In the private service sector, buildings are an integral part of the assets used by enterprises to carry out their business and ensure that they are competitive on the market. Investments in the energy performance of buildings in the private service sector are included in the wider set of investments in improving energy and materials efficiency. The required investments in the energy performance of buildings in the private service sector is estimated to be EUR 525 million in the 2016–2023 period, or between EUR 64 and 68 million per year. It is essential that the promotion of energy performance and the provision of funds to improve energy performance in the private service sector does not involve support for individual measures – rather, that general instruments are used to encourage enterprises to invest in that part of the their process in which they are able to achieve the

greatest energy savings. Promoting improvements to the energy performance of buildings on their own could have undesirable distorting effects and therefore an unfavourable impact on the competitiveness of the private service sector.

The following dedicated funding sources are available/envisaged for increasing energy and materials efficiency, in addition to enterprises' own funds, in the 2016–2023 period:

- Funds disbursed under the OP EKP 2014–2020 (Priority Axis 3), which has earmarked EUR 91 million for the promotion of energy efficiency, environment-friendly measures and efficient resource use in the 2016–2023 period.
- It is proposed that a loan fund be established that includes repayable funds and grants from the OP EKP (Priority Axis 3) and that the risks be spread for the period of implementation of the OP EKP.
- It is expected that those liable under the Decree Ensuring Energy Savings will focus a large part of their obligations to ensure energy savings on larger energy users in the private service sector. It is expected that energy suppliers, taking into account the costs of achieving energy savings specific to them and in light of their obligations, will implement incentives for investments in energy efficiency of between EUR 5 and 15 million annually. These measures will provide incentives for further investments of between EUR 20 and 40 million; these will mainly increase energy efficiency in enterprises, leading in the long term to energy savings and making an important contribution to securing the competitiveness of industry and the private service sector.
- The private service sector is also of interest to energy performance contracting, which can be an important lever for increasing energy performance in this sector as well.
- Dedicated long-term bank financing.

7 Estimate of savings and wider benefits

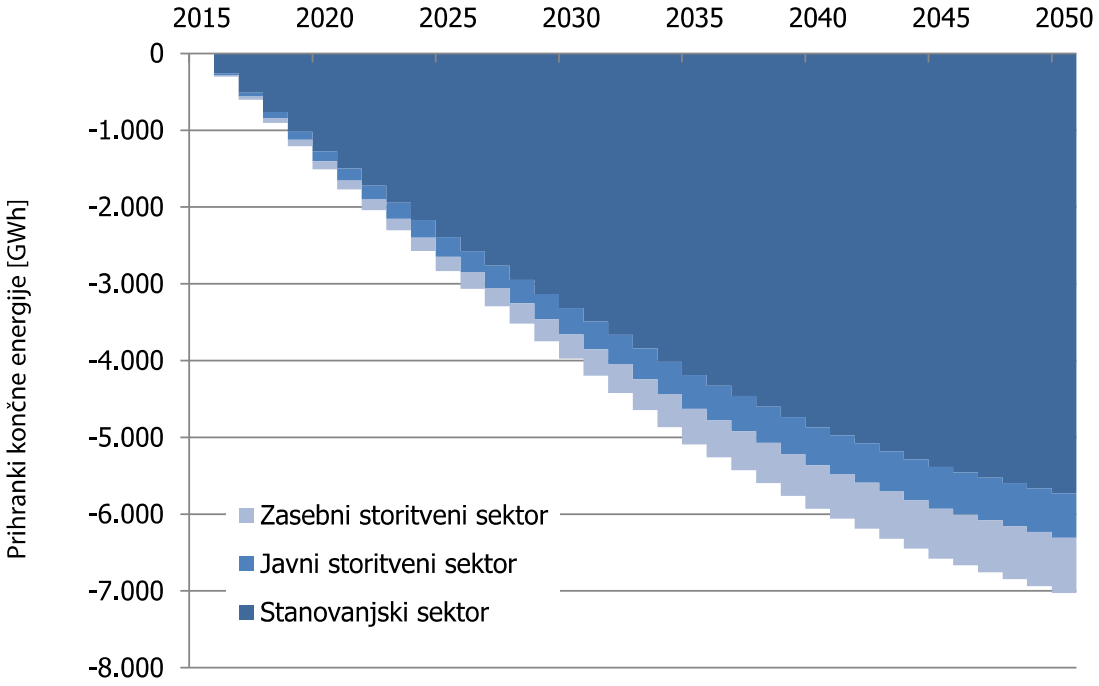
Investments in the energy performance of buildings provide society with significant savings and with wider economic, social and environmental benefits, as well as benefits accruing to the energy system.

7.1 Economic benefits

7.1.1 Energy savings

As part of the task, a model for projecting energy use in buildings up to 2050 was developed and put into service for the first time.

Savings in end-use and primary energy for heating and domestic hot water resulting from the implementation of measures for the energy renovation of existing buildings were estimated relative to 2015. End-use energy savings will amount to 1 509 GWh (5.4 PJ) in 2020, and will increase to 3 976 GWh (14.3 PJ) by 2030 and to 7 029 GWh (25.3 PJ) by 2050. Primary energy savings will be higher, as 1 kWh of electricity or district heating saved means over 2 kWh or 1.3 kWh of primary energy saved. Primary energy savings will amount to 1 624 GWh (5.8 PJ) in 2020, 4 323 GWh (15.6 PJ) in 2030 and
7 852 GWh (28.3 PJ) in 2050.



Key: End-use energy savings

Private service sector, Public service sector, Housing sector

Figure 35: Projection of primary energy savings resulting from the implementation of measures for the energy renovation of existing buildings up to 2050 (Source: IJS-CEU)

We anticipate the housing sector to account for the highest share of end-use energy savings: in 2020 85 % of all savings achieved as a result of building renovation measures (in 2030 83 %).

The energy savings achieved as a result of the implementation of this Strategy will make a considerable contribution to achieving Slovenia's targets in the area of improving energy efficiency. A comparison with the PRIMES scenario,[40] which was used to determine the indicative 2020 energy efficiency target and which sees energy efficiency improve by 20 %, shows that primary and end-use energy will be 27 % lower in 2030 under the long-term balances. The building renovation resulting from the implementation of this Strategy will achieve a 12 % reduction in primary energy use and a 16 % reduction in end-use energy. Therefore, primary energy savings from building renovation account for 42 % of total savings and end-use energy savings from building renovation account for 58 % of total savings.

Additional investments

Increasing the energy performance of building stock entails a substantial volume of investments. In the 2015–2030 period, the total value of the investments required (excluding VAT) is estimated at EUR 6.71 billion, and the value of additional investments (i.e. excluding investments required by regular building maintenance) at EUR 5.48 billion. In order to maximise the long-term economic benefits in terms of creating jobs, ensuring stable inflows into the public sector budget and contributing to economic growth, it is essential that these

[40] Calculation dated November 2007, published in 'European energy and transport. Trends to 2030'. Update 2007. http://ec.europa.eu/dgs/energy_transport/figures/trends_2030_update_2007/energy_transport_trends_2030_update_2007_en.pdf

investments be made as evenly as possible, without concentrating investment activities in individual years or over shorter periods.

The impact of the additional investments on employment, budget inflows and GDP growth has been estimated using a SAM-based recursive-dynamic model of general equilibrium containing 25 sectors of activity and 25 commodities and services.[41]

Additional employment

The increased volume of investment in energy efficiency also means increased demand in sectors whose products and services lead to improvements in the energy performance of buildings. This will have a direct impact on employment by increasing the numbers of people employed in those sectors that directly supply products and services for the energy renovation of buildings, e.g. construction, the manufacture of building fittings and heating systems, and the ESCO sector. There will also be an indirect impact across the whole economy in response to increased economic activity in the other sectors involved.

Owing to the relatively high labour intensity of work connected with the energy renovation of buildings, investments in energy performance are a strong and important lever for the creation of new jobs in comparison with many other sectors of the economy.

We estimate, using the general equilibrium model, that additional investments in energy renovation will give rise to a direct growth in employment in Slovenia of between 0.36 % and 0.58 % annually (or the annual creation of between 3 000 and 4 600 new jobs).

In its study of the period leading up to 2020, the Energy Efficiency Industry Forum (EEIF)[42] estimates that investments of EUR 1 million in the energy performance of buildings in Europe supports 19 new jobs (a job is defined as the employment of one person for one year). This means that the planned average annual volume of additional investments of between EUR 300 and 400 million in Slovenia would support between 5 700 and 7 700 jobs (indirect and direct).

Increased GDP

The Copenhagen Economics Report on the effects of energy-efficient building renovation emphasises that in economic conditions of relatively high unemployment and free capacity in the national economy, investments can also have a considerable effect on increasing GDP, as additional investments increase economic activity and create new jobs in the sectors directly involved, as well as having a positive indirect effect on other parts of the economy. The additional funds used for investments in the energy renovation of buildings should, given the economic conditions without these investments, generate an increase in GDP of 0.89 % per year relative to the baseline scenario, and an increase of 1.98 % in domestic sales and 1 % in domestic production. Private consumption should also increase by 0.93 % and state consumption by up to 0.04 %.

Public finance benefits

Investments in improvements to the energy performance of buildings reduce state expenditure on energy and, at the same time, bolster public finance revenues as a result of increased investment and economic activity. The positive effects are indirect as well as direct, as healthcare expenditure and the funds required for subsidies will fall as a result of the reduction in fuel poverty and the improvements to health brought about by improved living conditions. Increased energy efficiency also enables the state to realise its 2020 commitments. An estimate of the

---

41 MAJCEN, Boris et al., Nadgradnja rekurzivnega dinamičnega modela splošnega ravnotežja slovenskega gospodarstva v obdobju 2007–2009 (Upgrading of the recursive-dynamic model of general equilibrium of the Slovenian economy 2007–2009). Ljubljana: Inštitut za ekonomska raziskovanja (Institute for Economic Research), 2011. 324 pp.

42 http://www.eeif.eu/the-european-energy-efficiency-industries-call-for-a-fundamental-change-in-europes-approach-towards-energy-supply-and-use/#section-H.
http://www.google.si/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB4QFjAA&url=http%3A%2F%2Fwww.e
uroace.org%2FPublicDocumentDownload.aspx%3FCommand%3DCore_Download%26EntryId%3D433&ei=w0RfVeyR KcONsAGE64DoDg&usg=AFQjCNEu_5aWmvsQqM1ydycT7EHeOs6mjQ&bvm=bv.93990622,d.bGg

public finance effects for Slovenia using the general equilibrium model shows a positive effect on the state budget (the deficit should be reduced by 0.46 percentage points relative to the baseline scenario).

Increased property values

An increasing number of studies around the world show that increased energy performance has a positive effect on property value. A British study[43] indicates that property with an A/B energy class achieves values that are, on average, 14 % higher than those achieved by property in the lowest energy class. Property research carried out in Ireland gives similar results; there, property in energy class A sells for an 11 % premium, while the premium in the rented market is much lower (2 %). Increased energy performance contributes to increasing the value of commercial buildings as well. In the case of France,[44] the energy performance of a building is also reflected in the sale value of and rents for commercial, office and industrial property, where the effects are stronger in service sector property than in industrial property.

It has become mandatory in Slovenia as well for the energy performance indicators of a building or part of a building as indicated in the energy performance certificate to be stated when advertising the sale of a building or a part thereof, or its renting-out for a period of one year or more. This obligation has been laid down in the Slovenian Energy Act (EZ-1) and came into force on 22 March 2014. We can expect this to result in price differences being more pronounced between different energy performance levels.

Incentives for research and development, industry competitiveness and export growth

Promoting the energy-efficient renovation of buildings within the national economy also has an important incentivising effect on the development of research and development activities connected with energy-efficient technologies. Significant emphasis is also given to this field in Slovenia under the first and third priority axes of the OP EKP, which uses various instruments to promote and realise the target of increasing competitiveness for green economic growth and the creation of new jobs.

7.2 Social benefits

Reduced fuel poverty

Although there is no official definition of fuel poverty, we can infer it from the energy costs borne by households, the payment of these costs, and the ability of households to afford to heat their residence to an adequate level of warmth. According to the Household Consumption Survey, an average of 7 % of Slovenian household income went towards electricity, gas, other fuels and domestic hot water in 2012. The division of households into income quintiles shows that expenditure on electricity, gas, other fuels and domestic hot water accounted for 15.3 % of all available income in the first quintile (the 20 % of households with the lowest income), 9.4 % in the second quintile, 7.6 % in the third quintile, 6 % in the fourth quintile and 4.5 % in the last quintile.

According to figures from the Research into Income and Living Conditions, in Slovenia 93.6 % of households could afford to heat their residence to an adequate level of warmth in 2012 (78 % of households in the first income quintile), 16.9 % of households had occasional difficulty paying energy and water costs (23.8 % of households in the first income quintile), and 31.1 % of households lived in apartments affected by leaks, damp walls and worn-out windows or floors. The figures show that the number of households unable to afford to heat their residence adequately is on the rise.

Effect on health, improved living comfort and higher productivity

[43] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/207196/20130613_-_Hedonic_Pricing_study_-_DECC_template 2_.pdf

[44] Nappi-Choulet, I. and Décamps, A. (2013) Capitalization of energy efficiency on corporate real estate portfolio value. Journal of Corporate Real Estate, 15(1): 35–52.

Complete energy-efficient renovation has a significant effect on improving the parameters of quality of living conditions such as temperature of rooms, air quality, lighting, acoustics and humidity. A British study that looked at the effect of energy poverty and insufficiently heated housing on human health[45] pointed out increased exposure to health problems in those households suffering from energy poverty (death from low temperatures in the winter months, respiratory complaints, mental health, frequency of colds and flu, worsening of rheumatic and arthritic conditions, etc.). High-quality energy renovation does most to improve living conditions for those households faced with energy poverty and poor living conditions, and is also reflected in other households and in enterprises. Many studies[46] point to the advantages of such renovation, including increased productivity, reduced levels of absence from work, lower levels of stress and fewer incidences of allergic reaction.

In addition to the above social benefits, proper complete energy renovation also makes a positive contribution to the development of cultural and tourist potentials.

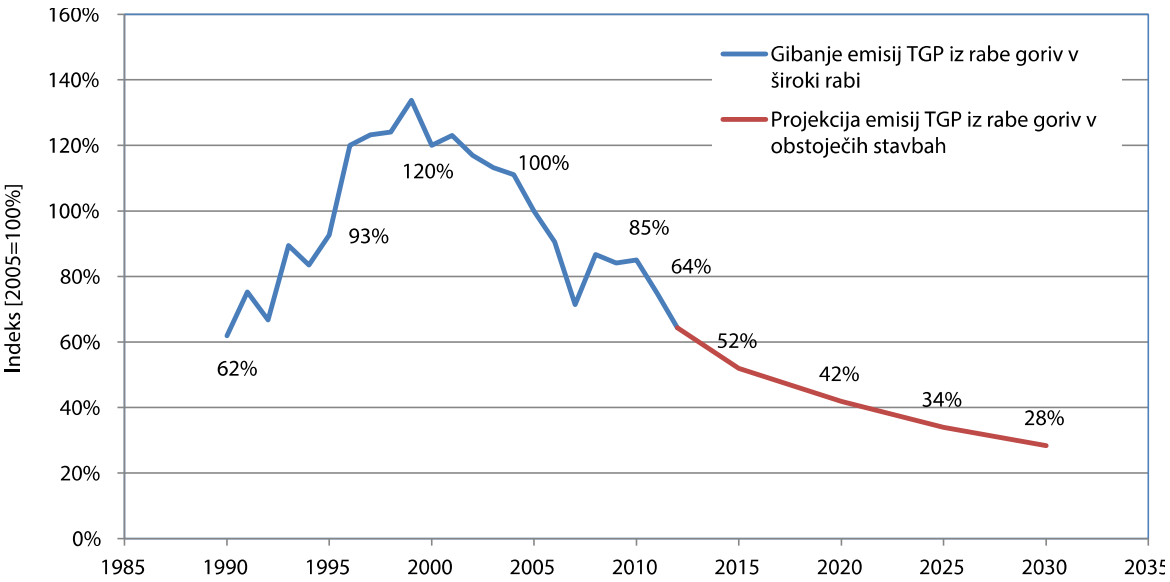
7.3 Environmental benefits

Long-term projections for the renovation of building stock have been produced and the environmental impact of policies and measures assessed for the period leading up to 2030. This analysis contains the first projection of GHG emissions for Slovenia in accordance with the new IPCC methodology. This contains the modified emission and greenhouse potential factors from the fourth IPCC assessment report, which entered into use for international reporting purposes in 2015.

Reduced greenhouse gas emissions

Emissions from existing buildings amounted to 1 208 kt CO_2 equivalent in 2015. These will fall to 971 kt CO_2 equivalent by 2020 and to 657 kt CO_2 equivalent by 2030. This means that emissions will be 58 % lower in 2020 and 72 % lower in 2030 relative to the baseline year of 2005. Total emissions from existing and new buildings are slightly higher, estimated to be 681 kt in 2030 (a 71 % reduction relative to emissions in 2005).

The projection is lower than the indicative sectoral target set in the OP TGP 2020, as a result of the fact that the additional measures set out in the AN sNES had not yet been taken into account in the preparation of the OP TGP 2020.



[45] http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty.

[46] A summary of similar types of study is available from: www.institutebe.com/Building-Performance-Management/Productivity- Gains-from-Energy-Efficiency.aspx

Key: Index

Trend in GHG emissions from the use of fuels in general consumption, Projected GHG emissions from the use of fuels in existing buildings

Figure 36: Trend in GHG emissions from the use of fuels in existing buildings and the projection for the period leading up to 2030 (Source: IJS-CEU)

The effects of the planned measures for the energy renovation of existing buildings in the period leading up to 2030 will be considerable, with GHG emissions falling by 551 kt CO_2 equivalent (46 %) relative to 2015.

Reduced air pollution

An assessment has been made of the anticipated effects of the planned measures for the energy renovation of buildings on reducing air pollution levels in the period leading up to 2030 relative to 2015. A reduction in emissions of the following is expected:

- sulphur dioxide – reduction of 572 t (59 %);
- nitrogen oxides – reduction of 1 293 t (43 %);
- all particles – reduction of 5 043 t, or 53 % (reduction of 4 745 t of primary particles smaller than 2.5 µm ($P_{2.5}$) and of 4 766 t of primary particles smaller than 10 µm (PM_{10});
- volatile organic substances – reduction of 3 995 t (39 %).

7.4 Benefits for the energy system

Energy efficiency measures and the replacement of fossil fuels with renewable energy sources will reduce dependence on imports. The indicator of dependence on imports will, as a result of measures for the energy renovation of buildings, improve by 1.3 percentage points in 2020 and by 2.9 percentage points in 2030.

Slovenia is currently 100 % dependent on imports for its petroleum derivatives. The measures mean that there will be a 49.5 % reduction in the use of fossil fuels in existing buildings by 2020, and an 82 % reduction by 2030. This will lead to a reduction in Slovenia's imports of petroleum derivatives: a fall of 7 % in 2020 and of 10 % in 2030 in comparison with the import levels that would be seen were the building-related measures not to be implemented.

Impact on the electricity consumption diagram. Encouraging the installation of heat pumps will change the need for additional electricity supply capacities and increase demand for electricity in the winter months; it would therefore be wise to promote the high-efficiency cogeneration of heat and power in district heating systems at the same time. There could be an additional increase in pressure on peak-time electricity consumption during periods of very low temperatures.

If one also takes into account the development of intelligent networks, including meters, increased electricity consumption in transport, both rail and personal transport, and the adjustment of energy systems and energy supply this requires, we are faced with further challenges to which we will attempt to find answers within the Energy Concept currently being drawn up.

8 ASSUMPTIONS AND METHODOLOGY

The projected energy use, the estimate of environmental effects and energy savings, and the values of investments are based on an analysis of the Long-Term Energy Balance of Slovenia up to 2030 (DB 2030),[47] which has been updated for the purpose of compiling this Strategy: (i) a new base year of 2012 has been taken into account, with partial calibration for 2013 as well, (ii) the assumptions regarding transitions between energy efficiency classes have been aligned with the AN sNES analysis and (iii) the calculation period has been extended to 2050. The reference scenario from the DB 2030, which is also the basis for the AN URE 2014–2020, has been selected as the scenario in the Strategy. The preliminary analyses contain a detailed description of the overall methodology used to design the projections. Additional explanations of the methodology for calculating the renovation rate and for assessing the value of investments, as well as a number of assumptions associated with this, are given in this section.

The task involved the following activities:

- a model for projecting energy use in Slovenia in buildings up to 2050 was developed and put into service for the first time;
- the first projection was compiled of GHG emissions for Slovenia in accordance with the new IPCC methodology. This contains the modified emission and greenhouse potential factors from the fourth IPCC assessment report, which entered into use for international reporting in 2015.

8.1 Renovation rate

The calculations that formed the basis for designing the Strategy assumed an average annual renovation rate of 1.7 % for residential buildings in the 2016–2020 period (1.8 % in 2021–2030, 2.3 % in 2013–2040 and 1.9 % in 2041–2050). This is the weighted annual renovation rate. Energy savings from transitions between energy classes relative to the maximum reductions for an individual type of building were used for the weightings. The maximum reduction in energy use is achieved in the course of a transition from the lowest energy class to the low-energy level. This weighting was used for all transitions between energy classes, except for transitions to the low-energy level. A weighting of 1 was assumed for all transitions to the low-energy level from any energy class. Older residential buildings can move between four energy classes in the course of energy renovation, while newer buildings can move between three.

The weighted average annual renovation rate for buildings in the wider public sector was 1.4 % in the 2016–2020 and 2021–2030 periods, rising to 1.5 % in 2031–2040 and 2041–2050. In the service sector, the renovation rate in the 2016–2020 period is, at 1.3 %, slightly lower than in the public sector. In the 2021–2030 period it is the same as the public sector rate (1.4 %), rising to 1.6 % in 2031–2040, and falling back to 1.4 % again in 2041–2050.

The model places central government entities within building category 12201 (Public administration buildings). The weighted annual renovation rate for these buildings was 2.3 % in the 2016–2020 and 2021–2030 periods, 2.6 % in 2031–2040 and a mere 0.9 % in 2041–2050 (since all buildings in this sector will have been renovated in this period). Rates lower than 3 % are the result of the fact that for various reasons it is not possible to renovate all buildings to a low-energy level. Because of this, they receive a weighting lower than 1 in the calculation of the weighted rate even though the renovations comply with the requirements of the Directive. The unweighted renovation rate in this sector is 3 % up to 2040.

A summary of the volume of renovation in the residential sector and the public and private service sectors is given in figures and tables (Table 20, Table 21, Figure 40, Figure 41).

[47] Long-Term Energy Balances up to 2030 and the Expert Foundations for Determining the National Energy Targets. IJS-CEU, 2014. (http://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/dolgorocno-nacrtovanje-energetske-politike/)

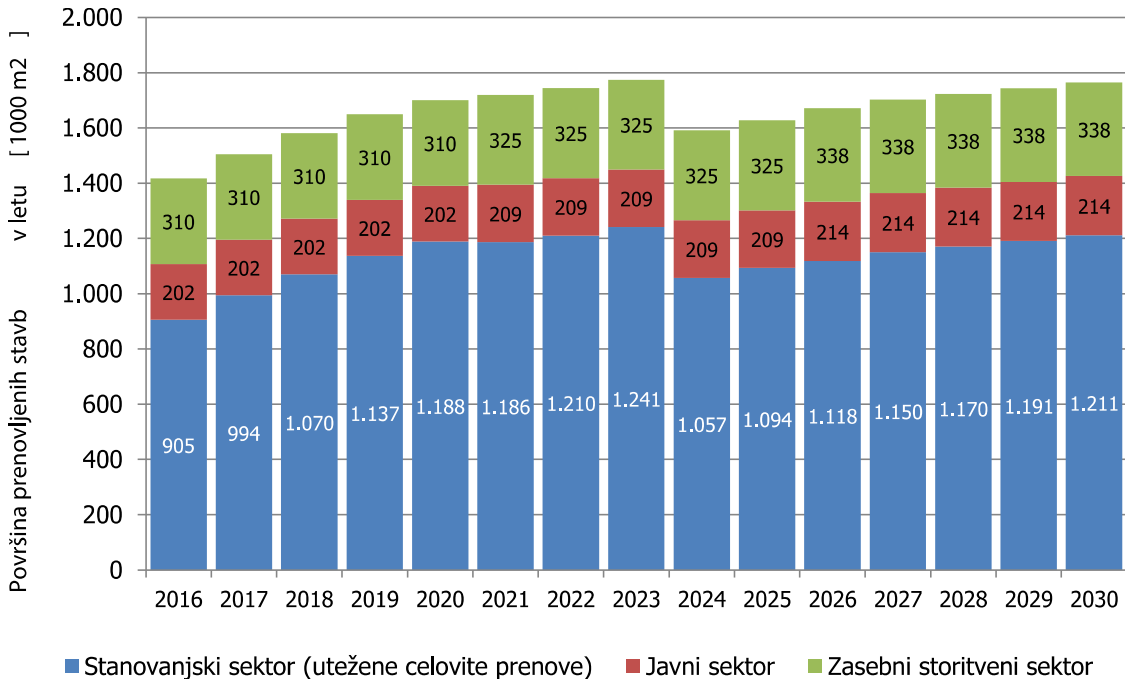
Table 21: Floor area of renovated buildings in the housing sector 2016–2030 – summary (Source: IJS-CEU)

	Floor area of buildings renovated in the housing sector [1000]															
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	*2016–2030*
Single-family houses																
Renovations	1 393	1 363	1 323	1 282	1 241	1 248	1 256	1 224	993	978	985	992	999	1 005	1 012	***17 295***
Of which: complete energy renovations	229	338	439	533	620	637	653	735	550	608	659	734	764	794	824	***9 117***
Partial renovations	1 165	1 025	884	749	620	612	603	489	443	370	326	258	235	212	188	***8 178***
Weighted partial renovations	402	377	350	324	299	301	304	254	236	201	173	128	116	105	93	***3 662***
Total equivalent to complete energy renovations (complete and weighted partial renovations)	**630**	**715**	**789**	**857**	**919**	**938**	**957**	**989**	**786**	**809**	**832**	**862**	**880**	**899**	**918**	***12 779***
Multi-apartment buildings																
Renovations	758	719	680	641	585	511	496	482	482	483	483	483	483	483	483	***8 253***
Of which: complete energy renovations	73	88	101	112	117	122	130	153	195	211	212	213	214	215	217	***2 370***
Partial renovations	685	631	580	530	468	389	366	329	288	272	271	270	269	268	267	***5 883***
Weighted partial renovations	203	191	180	169	152	126	123	99	77	74	75	76	76	77	77	***1 774***
Total equivalent to complete energy renovations (complete and weighted partial renovations)	***275***	***279***	***280***	***280***	***269***	***248***	***253***	***252***	***272***	***285***	***287***	***288***	***290***	***292***	***294***	***4 144***
Residential **buildings** total (single-family houses and multi-apartment buildings)																
Renovations	2 151	2 083	2 003	1 924	1 825	1 759	1 752	1 706	1 475	1 461	1 468	1 475	1 482	1 489	1 496	***25 548***
Of which: complete energy renovations	301	426	540	645	737	758	783	888	744	819	871	947	978	1 009	1 041	***11 487***
Partial renovations	1 850	1 657	1 463	1 279	1 088	1 001	969	817	731	642	597	528	504	480	455	***14 061***
Weighted partial renovations	604	568	530	492	451	428	427	353	313	275	248	203	192	181	170	***5 436***
Total equivalent to complete energy renovations (complete and weighted partial renovations)	**905**	**994**	**1 070**	**1 137**	**1 188**	**1 186**	**1 210**	**1 241**	**1 057**	**1 094**	**1 118**	**1 150**	**1 170**	**1 191**	**1 211**	***16 923***

Table 22: Floor area of renovated buildings in the public and private service sector 2016–2030 – summary (Source: IJS-CEU)

Floor area of renovated buildings in the public and private service sector [1000]	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2016-2030
Public sector																
Total renovations	202	202	202	202	202	209	209	209	209	209	214	214	214	214	214	***3 123***
Private service sector																
Total renovations	310	310	310	310	310	325	325	325	325	325	338	338	338	338	338	***4 866***
Total service sector	**512**	**512**	**512**	**512**	**512**	**534**	**534**	**534**	**534**	**534**	**553**	**553**	**553**	**553**	**553**	***7 995***

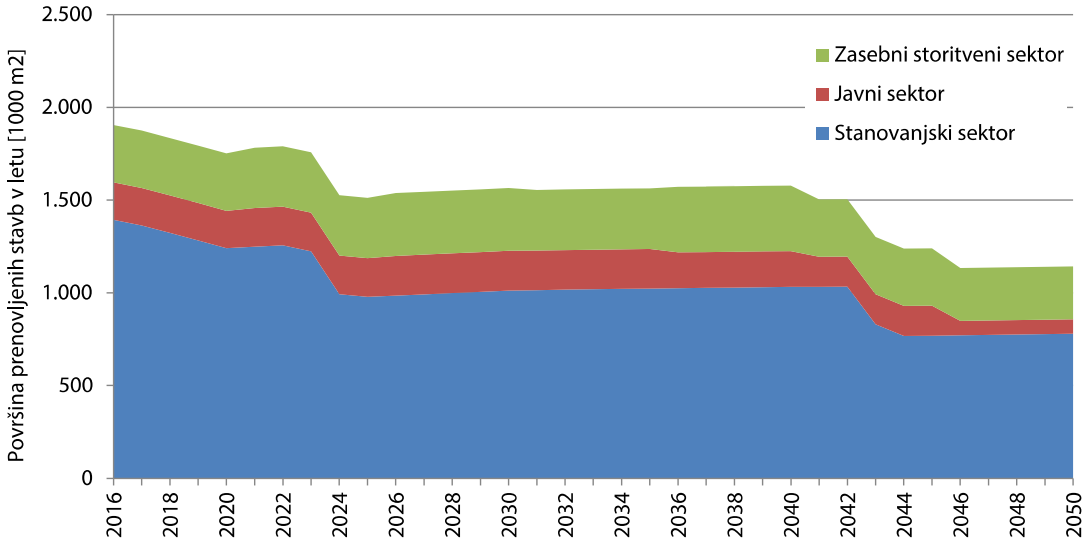
Note: The floor area of buildings to be renovated in 2016 has been assessed very approximately. If realisation falls short of the target, the shortfall will have to be made up in the years following.



Key: Floor area of renovated buildings, In year

Housing sector (weighted complete renovation), Public sector, Private service sector

Figure 37: Floor area of renovated buildings in the residential and the public and private service sectors in the 2016–2030 period (equivalent complete energy renovations of buildings are shown for the housing sector) (Source: IJS-CEU)



Key: Floor area of renovated buildings in year

Private service sector, Public sector, Housing sector

Figure 38: Floor area of renovated buildings in the residential and the public and private service sectors in the 2016–2050 period (the total floor area undergoing partial or complete energy renovation is shown; floor areas partly renovated can be renovated several times) (Source: IJS-CEU)

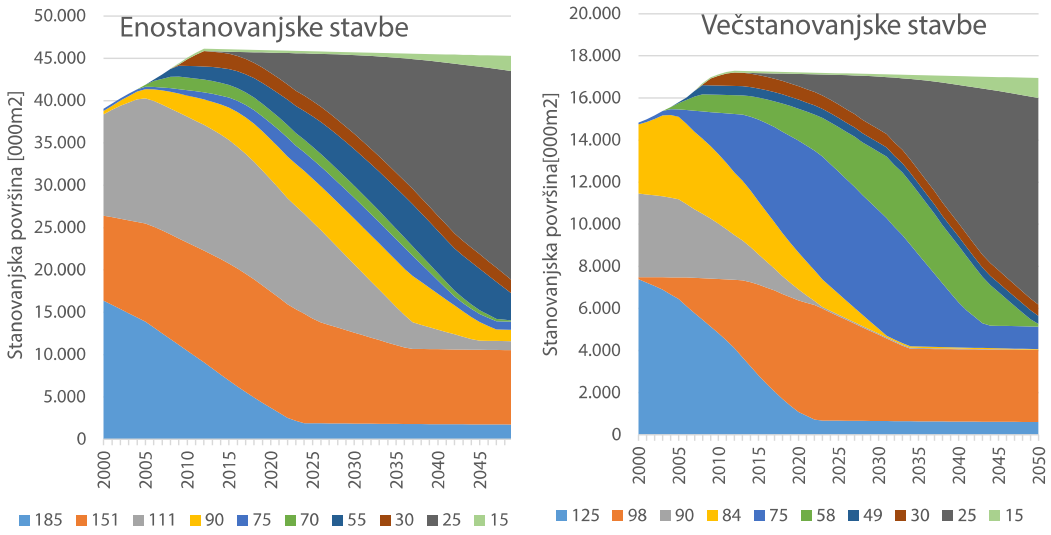
8.2 Estimated value of investments

Methodology for assessing investments.[48] An estimate of the investments required and the effects of those investments is based on projected energy use by sector (households, public service activities, private service activities), which is dependent in particular on: (i) the structure of the building stock in terms of the energy performance of the building envelope and of the heating and domestic hot water systems. The user behaviour factor is taken into account in the energy savings evaluation. In the model the housing stock is divided into energy efficiency classes determined on the basis of period of construction and the type of renovation already carried out, which in turn is determined by the thickness of the insulation of the building envelope and the heat transfer of the fittings, separately for single-family houses and multi-apartment buildings. A detailed projection of the changes to the structure of building stock in terms of the energy classes of existing buildings in the housing sector (built up to and in 2012) is shown in the graph for single-family houses and multi-apartment buildings (Figure 39). The investments necessary for transitions between energy classes were evaluated, and the assumptions regarding specific investment costs are based on the AN sNES analysis and additional ZRMK analyses. The values of investments in heating and domestic hot water systems were evaluated separately. The structure of heating appliances was modelled using a simulation of the purchase of new appliances, which facilitates an analysis of the different measures that influence the purchase of new appliances and the replacement of existing appliances before the end of their life-cycle (Figure 40). The share of district heating is modelled separately. Buildings are additionally divided into buildings in built-up and sparsely populated areas, with multi-apartment buildings further being divided into those with central heating for the whole building and those with central heating for separate floors. A special module simulates the equipment intended exclusively for the preparation of domestic hot water. The number and power of new appliances for heating and domestic hot water have been assessed by energy source and technology. The investment value of new appliances has been assessed on the basis of an analysis of Eco Fund data. The investment value of measures in the service sector has been assessed slightly differently. The building stock model is based on REN data, supplemented with data from the Statistical Office of the Republic of Slovenia, and is divided into 18 sectors or sub-sectors based on the CC-SI building classification. The energy parameters prior to and after renovation were set for the buildings within an individual sector (Figure 41) and a projection of

[48] For a more detailed description of the methodology, see the previous analyses: 'Long-term energy balances for the national energy programme: Part 1: Premises, Part 2: Results, IJS-CEU. 2011. Long-Term Energy Balances up to 2030 and the Expert Foundations for Determining the National Energy Targets. IJS-CEU, 2014.

the volume of renovated floor area drawn up. The value of the investments in the renovation of buildings and of heating and domestic hot water systems has been evaluated on the basis of an estimate of the average investment costs for measures in the public sector forming part of tenders for the energy renovation of buildings for the implementation of EU cohesion policy in the 2007–2013 period.

The average value of investments (excluding VAT) is EUR 208/m2 in the service sector and EUR 204.7/ m2 in the housing sector in the 2016–2030 period. This includes total investments in the building envelope and in heating and domestic hot water systems, and is the average of the complete and partial energy renovations of single-family houses and multi-apartment buildings. The investment value has been calculated as stated above.

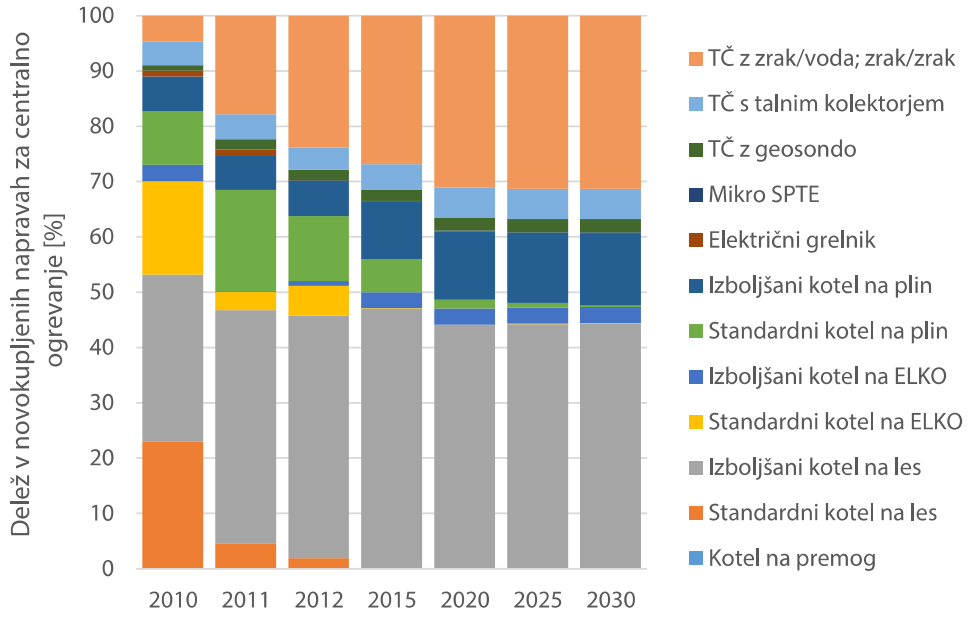


Key: Residential floor area

Single-family buildings

Multi-apartment buildings

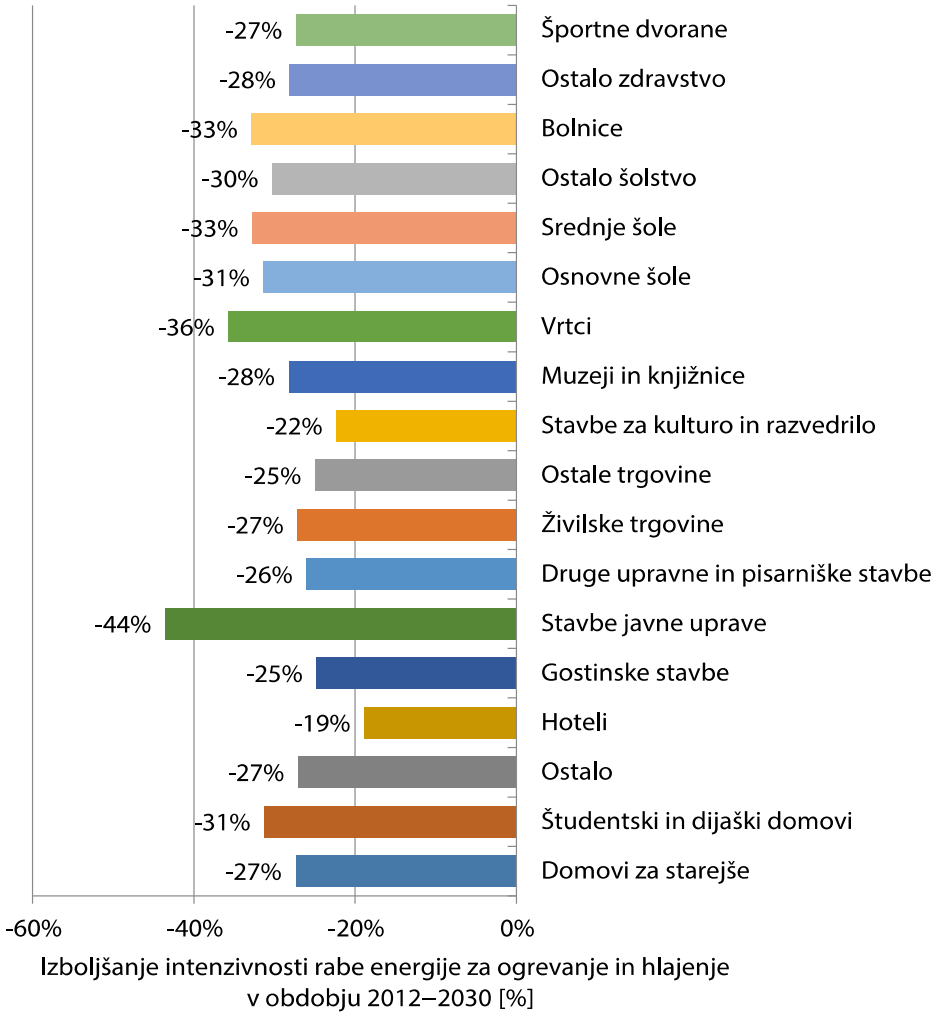
Figure 39: Projected structure of building stock in single-family houses and multi-apartment buildings in relation to the energy performance of buildings (with regard to the specific consumption of useful energy for heating, expressed in kWh/year) for existing buildings (Source: IJS-CEU)



Key: Share of newly purchased central heating appliances

Heat pump (air/water, air/air), Heat pump with ground collector, Heat pump with geoprobe, Micro CHP, Electric heater, Improved gas boiler, Standard gas boiler, Improved ELHO boiler, Standard ELHO boiler, Improved wood boiler, Standard wood boiler, Coal boiler

Figure 40: Projected structure of newly purchased boilers within the heating systems of existing residential buildings in relation to energy source and type of device (single-family houses and multi-apartment buildings together) (Source: IJS-CEU)



Key: Sports halls, Other healthcare, Hospitals, Other education, Secondary schools, Primary schools, Nursery schools, Museums and libraries, Cultural and entertainment buildings, Other shops, Food shops, Other administrative and office buildings, Public administration buildings, Catering and hospitality buildings, Hotels, Other, Student and pupil dormitories, Retirement homes

Improvements to energy-use intensity for heating and cooling 2012–2030

Figure 41: Projected improvement in energy-use intensity in service activities 2012–2030 (Source: IJS-CEU)

Calculation of the value of additional investments. In order to assess the macroeconomic effects of the Strategy, an assessment must be made of the share of investments that would be made in each case, in addition to the overall value of the investments, i.e. excluding measures for the energy renovation of buildings. Additional investments account for the difference to the full value of the investments in the energy renovation of buildings. The value of the additional investments has been assessed in the form of a comparison between the reference scenario and the 'no measures' scenario, which takes the following assumptions into account: (i) that investments would be made in heating systems at the end of the life-cycle, but that final customers would opt for appliances with low investment costs and (ii) that the renovation of building envelopes would not be carried out.

Estimate of the share of investments in the public sector that could be made using energy performance contracting. The share is estimated for two scenarios. The first scenario takes account of the criterion under which investments in heating systems are made by means of energy performance contracting and investments in building envelopes by means of the public sector's own funds. In this case the ratio between public and private funds would be 59: 41. The second scenario takes into account the fact that total investments in the complete energy renovation of buildings are made using a combination of private and public funds, i.e. project packages are formulated that allow for an adequate return on the private funds invested. We have checked the scenarios against the data available on public sector projects forming part of the tenders for the energy renovation of buildings for the

implementation of EU cohesion policy in the 2007–2013 period. In this case, a grant funding level of 66 % would be required and the entire savings in the energy costs ascribed to the contractual partner. With the appropriate project selection (energy performance before renovation, value of the energy savings/energy price before renovation, occupancy level of buildings, etc.) and the optimisation of investments, it would be possible to achieve a ratio between public and private funds of 60:40.

SOURCES:

– Expert Foundations for the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings (MzI, 2015, compiled for the MzI by GI ZRMK d.o.o. in collaboration with IJS-CEU and EF)

Annex A Premises for formulating the Strategy's targets (Annex to Section 5.1)

A1.1. Summary of the national targets and the targets under preparation

The annex contains a more detailed description of the national targets already adopted and that provide the framework for formulating the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings, and provides additional explanations of the content of Section 5.1.

The national building-related targets from the international obligations previously adopted by Slovenia and to which the building-related measures will make a significant contribution are summarised in Table A 1.

The following are given for each individual target: the international acts that lay down the obligations, the target year or years, the indicator used to monitor the target, and the unit, target value and reference national implementing document. The implementation plan defines in more detail the contributions made by individual areas to meeting the national targets by setting the indicative targets for sectors or areas, with the building sector being presented in detail in Table A 2.

The climate and energy package targets (energy efficiency, renewable energy sources and greenhouse gases) are not presented separately and in detail here, as they are given extensive explanations in the action plans (AN URE 2014−2020, AN OVE 2010−2020, OP TGP 2020). The specific national targets relating solely to buildings are set by two energy efficiency directives (2010/31/EU and 2012/27/EU). These targets and the above-mentioned implementing documents are summarised in sub-sections ('Targets for nearly zero-energy buildings', 'Obligation for buildings owned and occupied by central government'). Since they are less well-known, the air-protection targets are set out in a separate section ('Air protection'). These are very important for the formulation of the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings.

Table A 1: Summary of the operational national targets deriving from international obligations and important for the housing sector

Target	**Obligation**	**Indicator**	**Target year**	**Target value**	**Comments regarding the role of buildings in achieving compliance with the target[49]**	**Source**
Energy efficiency						
National RES targets	Article 3 of the EED and the draft AN URE 2014−2020	Primary energy consumption	in 2020	7 125 Mtoe	End-use energy consumption in buildings accounted for 17 % of primary energy use in 2012	AN URE 2014−2020
Obligation to renovate buildings owned and occupied by central government	Article 5 of the EED	Annual proportion of buildings renovated relative to total floor area Floor area of buildings renovated	Annually up to 2020	3 %/year	The target in the 2014–2020 period relates to 21 % of the floor area of central government buildings, 1.7 % of all public sector buildings and 0.17 % of all buildings in Slovenia.	AN URE 2014−2020
National targets in relation to nearly zero-energy buildings	Article 9 of the EPB Directive and the AN sNES	Nearly zero-energy buildings as a proportion of all new construction and renovated buildings – intermediate national targets in the period leading up to 2020 Targets by sector (m^2)	after 2020 after 2018 2015 2018	100 % 100 % and public sector 3 and 4		AN sNES
Renewable energy sources						
National RES targets	Directive 2009/28/EC	Share of RES in gross end-use energy consumption	in 2020	25 %	Buildings account for 19 % of gross end-use energy consumption and 49 % of RES consumption	AN OVE 2010−2020 revision
Greenhouse gas emissions						
National GHG emission reduction targets	Decision 2009/406/EC	GHG emissions in the year – linear target trajectory 2013–2020	in 2020 in 2015	12 117 kt CO_2equivalent 11 988 kt CO_2equivale	Buildings account for 17 % of non-ETS emissions (2011)	OP TGP 2020

[49] Source: IJS-CEU.

Target	Obligation	Indicator	Target year	Target value	Comments regarding the role of buildings in achieving compliance with the target[49]	Source
				nt		
Air protection						
National air protection targets	Revised Gothenburg Protocol (2012)	Reduction in emissions of $PM_{2.5}$	by 2020 relative to 2005	-15 %	Small heating plants account for 79.4 % of emissions of $PM_{2.5}$ and 66.3 % of emissions of PM_{10} (2011)	

Table A 2: Summary of indicative building-related targets in the adopted national documents and documents under preparation

Target	Obligation	Indicator	Target year	Target value	Comments regarding the role of buildings in achieving compliance with the target	Source
Energy efficiency						
Long-term indicative sectoral target	Contribution to the national EE target in 2030	Reduction in end-use energy consumption	by 2030 relative to 2005	-15 %		Draft AN URE 2014−2020
Renewable energy sources						
Sectoral RES target in relation to heating and cooling	Contribution to the national RES target	Share of RES in gross end-use energy consumption for heating and cooling	in 2020 and 2030	30.8 %[50]	Buildings account for 56 % of gross end-use energy consumption for heating and cooling and 91 % **Napaka! Zaznamek ni definiran.** of RES use for this purpose	Revised AN OVE 2010−2020, revision under preparation
Greenhouse gas emissions						
Long-term indicative sectoral target	Contribution to achieving the national target for reducing GHG emissions	Reduction of GHG emissions in general consumption	up to 2020 up to 2030 relative to 2005 up to 2050	-53 % -66 % almost carbon-neutral energy	The targets relate to all buildings in general consumption	OP TGP 2020

[50] AN OVE 2010−2020, Government of the Republic of Slovenia, July 2010. A new version of the AN OVE is currently being drafted.

Target	Obligation	Indicator	Target year	Target value	Comments regarding the role of buildings in achieving compliance with the target	Source
				use		
Air protection						
Air protection ordinances	Achievement of the limit values for PM_{10} concentrations in the ambient air	Reduction in emissions of PM_{10}				

A1.2. Targets in relation to nearly zero-energy buildings

In accordance with the target referred to in Article 9 of Directive 2010/31/EU, all new buildings will have to be nearly zero-energy from 2020 (from the end of 2018 in the public sector). Member States are also obliged to design policies and measures and to set targets for the renovation of existing buildings to nearly zero-energy standard. The AN sNES defines the national targets in the area of nearly zero-energy buildings in the intermediate 2014–2020 period. The intermediate targets for nearly zero-energy new construction are set out in Table (3), while the targets for renovation to nearly zero-energy standard are set out in Table (4). They shall apply until complete implementation of the provisions of Article 330 of the EZ-1.

Table A 3: Intermediate targets for new nearly zero-energy buildings under the AN sNES

		2014	**2015**	**2018**	**2020**
Single-family houses	m^2	51 740	76 850		267 500
Multi-apartment buildings	m^2	6 440	9 753		73 650
Public buildings	m^2	30 470	53 320	84 126	
Other non-residential buildings	m^2	20 010	50 030	115 970	

Table A 4: Intermediate targets for the nearly zero-energy renovation of buildings in the residential and non-residential sectors, including the public sector, under the AN sNES

		2014	**2015**	**2018**	**2020**
Single-family houses	m^2		231 680		2 257 000
Multi-apartment buildings	m^2	53 350	107 000		649 000
Public buildings	m^2			123 000	
Other non-residential buildings	m^2			190 000	
Buildings owned and occupied by central government (3 % under the EED)	m^2		2 000	20 000	

A1.3. Obligation for buildings owned and occupied by central government

Article 5 of Directive 2012/27/EU obliges Member States to renovate 3 % of the total floor area of buildings owned and occupied by central government every year. AN URE 2014−2020 details how the 3 % renovation obligation will be quantified in detail. Therefore, AN URE 2014–2020:

- reproduces the published record of buildings owned and occupied by central government (property register as at 18 April 2014), according to which the total floor area of buildings stands at 708 296 m^2. The obligation for the state to renovate 3 % of the total floor area every year means that 21 249 m^2 of floor area has to be renovated every year;
- states that the target is a framework target based on the existing record, since it is derived from the register of individual parts of buildings, while it is individual buildings themselves that will actually be renovated;
- states that the record of buildings owned and occupied by central government (property register as at 18 April 2014) will be updated in response to the expected supplements;
- states that the ministry responsible for state-owned property intends in the next year to take data on buildings owned by the state from GURS records and the Land Register, and to update and reformulate it so that it is able to serve energy renovation and other requirements. This data on buildings will replace the existing record of buildings owned and occupied by central government;

- states that the data will be collected for all state-owned buildings regardless of useful floor area, making it possible to use it as the basis for an inventory of buildings with a useful floor area greater than 500 m^2 as well as buildings with a useful floor area greater than 250 m^2. The list of buildings will thereby comply with the requirements of Directive 2012/27/EU after July 2015 as well;
- states that buildings will be treated within this framework as whole units that include the building envelope, fittings, operation and maintenance. Cultural heritage buildings are the exception.

AN URE 2014–2020 also states that the ministry will compile the priority list determining which buildings will have priority in terms of ensuring greater energy savings on the basis of the Long-Term Strategy for Mobilising Investments in the Renovation of Buildings. Bases for determining the priority list will be drawn up on the basis of this Strategy.

A1.4. Air protection

Consistent adherence to air quality legislation and programmes is important when planning building-related targets. Small heating plants are a significant source of emissions of harmful substances into the air, particularly dust particles, as they account for 66.3 % of total PM_{10} emissions in Slovenia, along with 79.4 % of $PM_{2,5}$ emissions (**Napaka! Vira sklicevanja ni bilo mogoče najti.**). It is therefore of great importance that air protection targets be addressed in the Strategy alongside the climate and energy package targets. Only in this way will it be possible to reduce overall costs and enhance the benefits of both policies. This issue has already been given emphasis within OP TGP 2020's comprehensive environmental impact assessment procedure and an 'Air quality and reduction of GHG emissions' section compiled on the basis of this. Due regard will be given to these guidelines when formulating the strategy.

Table A 5: Share of emissions of particles from general consumption in 2011 (Source: ARSO environmental indicators)

		TSP	**PM_{10}**	**$PM_{2.5}$**
Emissions of particles from the use of fuel in remaining consumption as a share of total emissions of particles	%	55.7	66.3	79.4

Detailed figures are available from the ARSO website ('Environmental indicators'). The last published figures refer to 2011.

A.2. Overview of strategic foundations at the EU level

Slovenia has undertaken to realise the objectives of sustainable growth set out in numerous documents and decision-making processes at the EU level, particularly the Europe 2020 strategy. 'Europe 2020:[51] A Strategy for Smart, Sustainable and Inclusive Growth' sets out a vision of Europe's social market economy for the 21st century and contains three mutually reinforcing priorities:

- Smart growth: developing an economy based on knowledge and innovation.
- Sustainable growth: promoting a more competitive, resource-efficient, greener low-carbon economy.
- Inclusive growth: fostering a high-employment economy that strengthens social and territorial cohesion.

The Strategy supports a move to an economy that uses all resources efficiently, separates economic growth completely from the use of resources and energy, and from their environmental impacts, reduces GHG emissions, improves competitiveness through efficiency and innovation, and promotes greater security of energy supply. Slovenia will realise the vision set out in the Europe 2020 strategy in its national policies. Slovenia has classified sustainable energy use as one of the priority axes of the OP EKP 2014–2020, with most of the funds under this programme going to the building sector.

Climate and energy policy and targets for the post-2020 period are still being formulated at the EU level. Slovenia actively supports the common vision of preventing the adverse effects of climate change and keeping

[51] COM(2010) 2020, final.

the rise in global temperatures below 2 °C, and its implementation through EU-wide climate-change policy, the agreements reached at the UNFCCC (from Copenhagen and Cancun), and national climate-change policies and measures. A political decision to reduce GHG emissions by 80–95 % by 2050 relative to 1990 was taken by the European Council back in March 2010. According to the findings of the Intergovernmental Panel on Climate Change, this is the reduction required in developed countries if the target is to be reached. Discussions on EU-level sectoral targets up to 2050 are taking place as part of the EU Plan for a Competitive Low-Carbon Economy by 2050.[52] The EU Council resolutions of 23–24 October 2014 define the intermediate medium-term climate-change and energy targets of the EU as a whole up to 2030. The EU-level intermediate targets for the period up to 2040 and the national targets up to 2030 are still in the process of being formulated. The following political decisions (EU Council resolutions) have been reached for 2030. It is envisaged that they will be transferred into EU law in 2015:

- a 40 % reduction in total GHG emissions at the EU level relative to 1990. Member States' contributions to achieving this target will be legally binding. They will be determined in a balanced way in terms of justice and solidarity (based on relative per-capita GDP). All Member States will contribute to jointly reducing the EU's emissions up to 2030. Their targets will range from 0 to -40 % relative to 2005;
- the share of energy from renewable energy sources to be consumed in the EU in 2030 should be at least 27 %. This target will be binding at the EU level. An EU-level indicative target of at least 27 % has been set on the basis of the applicable criteria to improve energy efficiency in 2030 in comparison with the forecast consumption of energy in the future. Member States shall determine their own national targets.

Discussions on EU-level sectoral targets up to 2050 and the necessary intermediate targets are taking place as part of the EU Plan for a Competitive Low-Carbon Economy by 2050.[53] A reduction in GHG emissions is envisaged in the household and service sectors (in relation to buildings) by between 88 and 91 % relative to 1990.

Table A 6: Required reduction in GHG emissions by sector from the Roadmap for Moving to a Competitive Low-Carbon Economy in 2050

Reduction in GHG emissions relative to 1990	**2005**	**2030**	**2050**
	[%]		
Total for all sectors and gases	-7	-40 to -44	-79 to -82
Transformation − CO_2	-7	-54 to -68	-93 to 99
Industry − CO_2	-20	-34 to -40	-83 to -87
Transport (including maritime transport and aviation)	+30	+20 to -9	-88 to -91
Households and service activities – CO_2	-12	-37 to 53	-88 to -91
Agriculture − GHG excl. CO_2	-20	-36 to -37	-42 to -49
Other emissions − GHG excl. CO_2	-30	-72 to -73	-70 to -78

A.3. Overview of strategic foundations in Slovenia

Slovenia does not have an overarching development strategy, nor does it have an overarching strategic or programme document for the field of energy. A number of operational programmes have been adopted aimed at implementing the international obligations assumed by Slovenia.

A3.1.1. AN URE 2014–2020

[52] Roadmap for Moving to a Competitive Low-Carbon Economy in 2050, COM (2011) 112.
[53] Roadmap for Moving to a Competitive Low-Carbon Economy in 2050, COM (2011) 112.

The National Energy Efficiency Action Plan up to 2020 is the country's basic implementing document for energy efficiency. It is aimed chiefly at ensuring implementation of obligations under Directive 2012/27/EC and is an update of a document that has already been adopted.[54] AN URE 2014−2020, which was adopted by the government on 21 May 2015, sets out the following objectives in relation to buildings:

- **The 2020 national energy efficiency target (target under Article 3 of Directive 2012/27/EU):** *'In accordance with Article 3 of Directive 2012/27/EU, Slovenia has set a target for improving energy efficiency by 2020 such that primary energy consumption will not exceed 7 125 million toe (82.86 TWh) in 2020. The national 2020 target is derived from the long-term energy consumption projections up to 2030, which were produced in 2014. This target does not include the non-energy consumption of fuels and has been based on national energy consumption statistics compiled using the EUROSTAT methodology.'*
- **The national targets in relation to nearly zero-energy buildings** (target under Article 9 of the Directive 2010/31/EU): these targets are defined in detail in the AN sNES (see Section A1.2 for more details).
- **Energy renovation targets** under Article 5 of Directive 2012/27/EU (see Section A1.3 for more details).
- Long-term indicative targets for reducing GHG emissions and improving the energy in performance of buildings. AN URE 2014−2020 incorporates the premises of the Long-Term Strategy for Mobilising Investments in the Energy Renovation of Buildings, and within it the following targets: '*To reduce end-use energy consumption in buildings by 15 % by 2030 and reduce greenhouse gas emissions by 53 % by 2020 relative to 2005, which will require the complete energy renovation of buildings and the continued replacement of heating oil with low-carbon energy sources. First and foremost, this is a measure aimed at encouraging rapid economic growth and providing a way out of the crisis. The objective is also to improve the ratio between subsidies and the effects of investments, especially in the public sector.'*

A3.1.2. AN sNES

AN sNES (**national targets in relation to nearly zero-energy buildings**, target under Article 9 of Directive 2010/31/EU, see Section A1.2) was adopted by the government on 22 April 2015.

A3.1.3. OP TGP 2020

The Operational Programme for Reducing Greenhouse Gas Emissions by 2020 defines measures for achieving the legally binding targets for reducing greenhouse gas emissions by 2020 in accordance with Decision No 406/2009/EC.[55] It also includes the outlook up to 2030.

The OP TGP 2020 sets the following targets in relation to buildings:

- **Indicative sectoral targets up to 2030 and the outlook to 2050:** The OP TGP 2020 sets the indicative sectoral targets for reducing greenhouse gas emissions. These targets are also aligned with the target of reducing greenhouse gas emissions by 2050 under the Roadmap for Moving to a Competitive Low-Carbon Economy in 2050.[56] The framework of the OP TGP 2020 is provided by GHG emissions in sectors outside the EU-ETS. It therefore does not include the majority of emissions from industry. The indicative sectoral targets for reducing greenhouse gas emissions of importance in relation to buildings are: a 66 % reduction of GHG emissions in general consumption by 2030 relative to 2005 with the aim of having a carbon-neutral building sector by 2050.
- **Greenhouse gas emission reduction target up to 2020 in relation to buildings:** The target is to reduce GHG emissions by 53 % by 2020 relative to 2005. This will require the complete energy renovation of buildings and the continued replacement of heating oil with low-carbon energy sources.

[54] AN URE 2008–2016 and AN URE 2010–2016 are based on Directive 2006/32/EC. New obligations have been added to the new AN URE 2014–2020 in response to the new Directive, and the programming period has been extended to 2013.

[55] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitment up to 2020 (OJ L 140, 5.6.2009, p. 136).

[56] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Roadmap for Moving to a Competitive Low-Carbon Economy in 2050, 8 March 2011.

First and foremost, this is a measure aimed at encouraging rapid economic growth and providing a way out of the crisis.

- **Long-term indicative greenhouse gas emission reduction targets in relation to buildings:** 'The long-term vision is to reduce greenhouse gas emissions from the use of fuels in buildings to almost zero by 2050 so that buildings have low energy requirements that are covered by renewable energy sources as a matter of priority.'
- **OP TGP 2020 indicators in relation to buildings, and their target values:** A system of indicators has been approved in the OP TGP 2020 for monitoring implementation of the programme. This system also sets the target values for 2020. These have been evaluated in detail as part of the *Establishment of a System for Monitoring the Implementation and Assessment of the Effectiveness of Measures Having an Impact on GHG Emission Trends* project, and determined on the basis of projections of GHG emissions and the factors affecting them.

Table A 7: Indicators in relation to buildings from the OP TGP 2020 and the target values in 2020

No	Indicator	Unit	Status (year)	2020 target
3	Financial lever for investments in the public sector	EUR/EUR	0.74 (2013)	0.33
4	Reducing emissions and improving energy efficiency in the public sector	kt CO_2 equivalent GWh	15.9 (2013)	64.4
5	Floor area of public sector buildings that have undergone energy renovation	1 000 m^2	513 (2013)	1 772
6	CO_2 intensity in the commercial and institutional sectors	t CO_2/EUR $millions_{1995}$	46.5 (2012)	31.7
7	Reducing GHG emissions and improving energy efficiency in the housing sector	GWh kt CO_2 equivalent	487.2 (2013)	1 408
8	Specific GHG emissions in the housing sector	kg CO_2 equivalent/m^2	15.8 (2012)	10
9	Share of heat from RES in use of heat in general consumption	%	53 % (2013)	61 %

A3.1.4. OP EKP 2014−2020

The Operational Programme for the Implementation of European Cohesion Policy 2014–2020 is an implementing document that will form the basis for utilising funds made available from the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund (CF) in the 2014–2020 period.

Under the new financial perspective, Member States are obliged to earmark at least 20 % of the funds to achieving the climate targets.

Measures to reduce GHG emissions and increase energy efficiency and the use of renewable energy sources have been put in programme form as part of the thematic objective entitled 'Support for a move to a low-carbon economy' and are addressed within a number of priority axes: Priority Axis 4 'Sustainable Use and Production of Energy, and Intelligent Networks' in particular, along with Priority Axis 3 'Dynamic and Competitive Businesses for Green Economic Growth' and Priority Axis 1 'International Competitiveness of Research, Innovation and Technological Development in Accordance with Smart Specialisation for Enhanced Competitiveness and the Greening of the Economy'.

Even though measures from different priority axes are envisaged in relation to buildings, monitoring of the results in terms of the effects on the targets for the climate and energy package within the OP EKP 2014–2020 document itself are, for the moment, only planned within Priority Axis 4 (and only for certain measures) (see

Table **Napaka! Vira sklicevanja ni bilo mogoče najti.**). Monitoring of the effects of the planned subsidies on compliance with the climate and energy targets has not yet been established for the series of measures relating to buildings.

Table A 8: Result indicators for individual programmes by specific objective (for the ERDF and Cohesion Fund) for the 'Sustainable Use and Production of Energy, and Intelligent Networks' priority axis (Source: OP EKP 2014–2020)

Identifier	Indicator	Measurement unit	Baseline value	Baseline year	Target value for 2023	Data source	Frequency of reporting
4.1	Annual energy consumption of public sector buildings	GWh/year	1 870	2013	1 630	Long-term energy balances 2030	Annual
4.3	Annual energy savings in households	GWh/year	198	2013	300	Eco Fund	Annual

Table A 9: Indicators of Priority Axis 4 ('Sustainable Use and Production of Energy, and Intelligent Networks') relevant to buildings (Source: OP EKP 2014–2020)

Identifier	Indicator	Measurement unit	Fund	Target value for 2023	Data source	Frequency of reporting
CO31	Energy efficiency: No of households in a building with a higher energy class.	No of households	CF	2 500	Estimate	Annual
CO32	Energy efficiency: Reduction in annual primary energy consumption in public buildings	kWh/year	CF	23 000 000	Implementing body	Once a year
4.4	Useful floor area of buildings from the entire public sector that have undergone energy renovation	m^2	CF	1 800 000	AN-URE 2020	Annual
4.5	Useful floor area of buildings owned and occupied by central government that have undergone energy renovation	m^2	CF	180 000	Implementing body	Annual
4.6	No of energy renovation demonstration projects carried out for various building types	No	CF	5	Implementing body	Annual

Table A 10: Indicators of Priority Axis 3 ('Dynamic and competitive businesses for green economic growth') of importance for the area of buildings (Source: OP EKP 2014–2020)

Identifier	Indicator	Measurement unit	Fund	Target value for 2023	Data source	Frequency of reporting
3.7	No of enterprises that have introduced measures for efficient resource management (includes measures to increase energy and materials efficiency)	No	ERDF	1 000	Monitoring (MzI, MOP, MGRT)	Annual

A3.1.5. AN OVE

AN OVE 2010−2020 (revision under preparation) also lays down plans for increasing the share of RES in buildings. The estimated shares of RES are shown in the table.

Table A 11: Estimated shares of renewable energy sources in buildings (Source: AN OVE 2010−2020)

[%]	**2005**	**2010**	**2015**	**2020**
Housing sector	32.6	38.9	49	54.1
Commercial sector	11.4	21	31.4	41.1
Public sector				
Industry	17.1	18	19.8	22.1
Total	21.8	26.7	32.2	36.1

Annex B

Calculation of energy indicators for different variants of measures for the energy renovation of buildings

Table B 1: Primary energy use in single-family house – major renovation (1960)

Measure /package /variant of measures	Energy need		Energy use					Energy delivered, specified by source					Primary energy	Reduction in primary energy compared to the reference building
	for heating	for cooling	heating	domestic hot water	ventilation	cooling	lighting	natural gas	ELHO	electricity	biomass	district heating		
	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	%
P63	46	3	68	12	0	0	1	0	0	2	12	0	6	98 %
P64	41	3	66	12	0	0	1	0	0	2	9	0	6	98 %
P65	26	4	60	12	0	0	1	0	0	2	3	0	5	98 %
P66	20	4	60	12	0	0	1	0	0	2	3	0	5	98 %
P70	45	4	14	0	0	0	1	0	0	3	0	0	8	97 %
P73	26	4	17	0	4	0	1	0	0	4	0	0	10	97 %
P74	20	4	17	0	4	0	1	0	0	3	0	0	8	97 %
P69	52	3	16	0	0	0	1	0	0	4	0	0	11	96 %
P62	45	4	80	12	4	0	1	0	0	5	23	0	17	95 %
P68	68	2	17	0	0	0	1	0	0	6	0	0	15	95 %
P59	75	2	93	12	4	0	1	0	0	5	36	0	18	94 %
P60	68	2	89	12	4	0	1	0	0	5	32	0	18	94 %
P61	52	3	81	12	4	0	1	0	0	5	24	0	17	94 %
P67	75	2	18	0	0	0	1	0	0	7	0	0	18	94 %
P72	41	3	22	0	4	0	1	0	0	7	0	0	19	94 %
P53	52	3	50	28	5	0	1	0	0	7	78	0	26	92 %
P54	45	4	49	28	5	0	1	0	0	6	77	0	25	92 %
P71	46	3	24	0	4	0	1	0	0	9	0	0	24	92 %
P52	68	2	71	28	5	0	1	0	0	6	99	0	27	91 %
P51	75	2	78	28	7	0	1	0	0	8	106	0	32	90 %
P30	45	4	14	0	0	0	1	0	0	16	0	0	40	87 %
P29	52	3	16	0	0	0	1	0	0	17	0	0	44	86 %
P28	68	2	17	0	0	0	1	0	0	19	0	0	48	85 %
P57	26	4	44	28	14	0	1	0	0	16	72	0	47	85 %
P58	20	4	44	28	14	0	1	0	0	16	72	0	47	85 %
P27	75	2	18	0	0	0	1	0	0	20	0	0	51	84 %
P55	46	3	67	28	14	0	1	0	0	16	95	0	50	84 %
P56	41	3	60	28	14	0	1	0	0	16	88	0	49	84 %
P34	20	4	17	0	4	0	1	0	0	22	0	0	57	82 %
P33	26	4	17	0	4	0	1	0	0	23	0	0	59	81 %
P21	52	3	18	0	6	0	1	0	0	26	0	0	66	79 %
P22	45	4	18	0	6	0	1	0	0	26	0	0	65	79 %
P25	26	4	16	0	10	0	1	0	0	27	0	0	70	78 %
P26	20	4	16	0	10	0	1	0	0	27	0	0	69	78 %
P32	41	3	22	0	4	0	1	0	0	27	0	0	68	78 %
P13	52	13	49	17	0	0	1	0	66	2	0	0	77	77 %
P18	45	15	49	17	0	0	1	0	66	2	0	0	77	77 %
P31	46	3	24	0	4	0	1	0	0	29	0	0	73	77 %
P20	68	2	22	0	6	0	1	0	0	30	0	0	77	75 %
P12	62	11	61	17	0	0	1	0	78	2	0	0	89	74 %
P17	55	12	61	17	0	0	1	0	78	2	0	0	89	74 %
P19	75	2	24	0	6	0	1	0	0	32	0	0	82	74 %

Measure /package /variant of measures	**Energy need**		**Energy use**					**Energy delivered, specified by source**					Primary energy	Reduction in primary energy compared to the reference building
	for heating	for cooling	heating	domestic hot water	ventilation	cooling	lighting	natural gas	ELHO	electricity	biomass	district heating		
	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	%
P24	41	3	20	0	11	0	1	0	0	32	0	0	81	74 %
P16	65	10	64	17	0	0	1	0	81	2	0	0	93	73 %
P23	46	3	21	0	12	0	1	0	0	34	0	0	87	72 %
P49	26	4	29	26	7	0	1	0	0	8	0	55	88	72 %
P50	20	4	29	26	7	0	1	0	0	8	0	55	87	72 %
P45	52	3	33	26	7	0	1	0	0	9	0	59	93	70 %
P46	45	4	32	26	7	0	1	0	0	9	0	58	92	70 %
P15	75	8	77	17	0	0	1	0	93	2	0	0	106	69 %
P41	26	4	58	25	0	0	1	84	0	2	0	0	98	69 %
P42	20	4	57	25	0	0	1	82	0	2	0	0	95	69 %
P11	79	8	78	17	0	0	1	0	96	2	0	0	109	68 %
P14	72	9	79	17	0	0	1	0	96	2	0	0	110	68 %
P48	41	3	40	26	7	0	1	0	0	8	0	66	101	68 %
P44	68	2	46	26	7	0	1	0	0	9	0	72	109	65 %
P47	46	3	45	26	7	0	1	0	0	9	0	71	107	65 %
P10	92	6	94	17	0	0	1	0	111	2	0	0	126	63 %
P40	41	3	66	25	4	0	1	91	0	5	0	0	115	63 %
P43	75	2	51	26	7	0	1	0	0	9	0	77	115	63 %
P39	46	3	69	25	4	0	1	94	0	5	0	0	119	62 %
P38	45	4	71	25	4	0	1	96	0	5	0	0	121	61 %
P37	52	3	81	25	4	0	1	106	0	5	0	0	132	58 %
P36	68	2	89	25	4	0	1	114	0	5	0	0	141	55 %
P35	75	2	93	25	4	0	1	118	0	5	0	0	145	53 %
P4	135	3	166	17	0	0	1	0	183	2	0	0	206	40 %
P3	139	3	170	17	0	0	1	0	187	2	0	0	210	38 %
P2	144	2	176	17	0	0	1	0	193	2	0	0	216	36 %
P1	150	3	184	17	0	0	1	0	200	2	0	0	225	34 %
P6	167	2	196	17	0	0	1	0	213	2	0	0	239	30 %
P7	164	2	194	17	0	0	1	0	211	2	0	0	237	30 %
P5	170	2	202	17	0	0	1	0	218	2	0	0	245	28 %
P9	200	2	262	17	1	0	1	0	279	2	0	0	312	8%
P8	211	2	277	17	1	0	1	0	294	2	0	0	329	3%

Table B 2: Primary energy use in multi-apartment building VSS1 – major renovation (1960)

Measure/package/variant of measures	**Energy need**		**Energy use**					**Energy delivered, specified by source**					Primary energy	Reduction in primary energy compared to the reference building
	for heating	for cooling	heating	domestic hot water	ventilation	cooling	lighting	natural gas	ELHO	electricity	biomass	district heating		
	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	%
P69	30	16	10	0	1	0	2	0	0	2	0	0	5	98 %
P70	27	17	9	0	1	0	2	0	0	1	0	0	4	98 %
P74	7	27	7	0	12	0	2	0	0	2	0	0	5	98 %
P73	9	25	7	0	12	0	2	0	0	2	0	0	6	97 %
P72	17	21	9	0	12	0	2	0	0	4	0	0	12	95 %
P68	41	12	13	0	1	0	2	0	0	5	0	0	14	94 %
P71	20	20	10	0	12	0	2	0	0	5	0	0	13	94 %
P53	30	16	68	22	1	0	2	0	0	2	90	0	16	93 %
P54	27	17	65	22	1	0	2	0	0	2	87	0	16	93 %
P61	30	16	68	22	1	0	2	0	0	2	83	0	15	93 %
P62	27	17	65	22	1	0	2	0	0	2	80	0	15	93 %
P51	44	11	76	22	1	0	2	0	0	3	98	0	18	92 %
P52	41	12	72	22	1	0	2	0	0	3	94	0	17	92 %
P59	44	11	76	22	1	0	2	0	0	3	91	0	17	92 %
P60	41	12	72	22	1	0	2	0	0	3	87	0	17	92 %
P67	44	11	16	0	1	0	2	0	0	8	0	0	22	90 %
P29	30	16	10	0	1	0	2	0	0	12	0	0	31	86 %
P30	27	17	9	0	1	0	2	0	0	12	0	0	30	86 %
P64	17	21	9	22	10	0	2	0	0	11	17	0	31	86 %
P65	9	25	4	22	10	0	2	0	0	11	12	0	31	86 %
P66	7	27	1	22	10	0	2	0	0	11	9	0	30	86 %
P55	20	20	13	22	10	0	2	0	0	11	35	0	33	85 %
P56	17	21	9	22	10	0	2	0	0	11	31	0	33	85 %
P57	9	25	4	22	10	0	2	0	0	11	26	0	32	85 %
P58	7	27	1	22	10	0	2	0	0	11	23	0	32	85 %
P63	20	20	13	22	10	0	2	0	0	11	21	0	32	85 %
P28	41	12	13	0	1	0	2	0	0	15	0	0	40	82 %
P27	44	11	16	0	1	0	2	0	0	19	0	0	48	78 %
P34	7	27	7	0	12	0	2	0	0	20	0	0	51	77 %
P33	9	25	7	0	12	0	2	0	0	20	0	0	52	76 %
P32	17	21	9	0	12	0	2	0	0	23	0	0	57	74 %
P22	27	17	21	0	1	0	2	0	0	23	0	0	60	73 %
P31	20	20	10	0	12	0	2	0	0	23	0	0	59	73 %
P25	9	25	11	0	12	0	2	0	0	24	0	0	61	72 %
P26	7	27	10	0	12	0	2	0	0	24	0	0	60	72 %
P21	30	16	23	0	1	0	2	0	0	25	0	0	63	71 %
P24	17	21	11	0	12	0	2	0	0	25	0	0	63	71 %
P50	7	27	1	22	12	0	2	0	0	14	0	23	63	71 %
P20	41	12	23	0	1	0	2	0	0	26	0	0	65	70 %
P49	9	25	2	22	12	0	2	0	0	14	0	24	65	70 %

Measure/package/variant of measures	**Energy need**			**Energy use**					**Energy delivered, specified by source**						Reduction in primary energy compared to the reference building
		for heating	for cooling	heating	domestic hot water	ventilation	cooling	lighting	natural gas	ELHO	electricity	biomass	district heating	Primary energy	
		kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	%
P23		20	20	14	0	12	0	2	0	0	27	0	0	68	69 %
P38		27	17	34	24	1	0	2	58	0	2	0	0	70	68 %
P13		30	16	28	33	3	0	2	0	61	5	0	0	80	67 %
P18		27	17	29	33	3	0	2	0	62	5	0	0	81	66 %
P19		44	11	27	0	1	0	2	0	0	30	0	0	75	66 %
P37		30	16	42	24	1	0	2	66	0	2	0	0	80	64 %
P48		17	21	14	22	13	0	2	0	0	14	0	36	79	64 %
P16		35	14	34	35	3	0	2	0	69	5	0	0	88	63 %
P42		7	27	20	22	12	0	2	42	0	13	0	0	80	63 %
P41		9	25	22	22	12	0	2	44	0	13	0	0	83	62 %
P46		27	17	40	22	1	0	2	0	0	2	0	63	82	62 %
P45		30	16	44	22	1	0	2	0	0	2	0	66	86	60 %
P40		17	21	26	22	12	0	2	49	0	14	0	0	89	59 %
P47		20	20	22	22	13	0	2	0	0	14	0	44	89	59 %
P17		35	14	39	42	3	0	2	0	81	5	0	0	101	57 %
P36		41	12	57	24	1	0	2	81	0	3	0	0	97	56 %
P44		41	12	51	22	1	0	2	0	0	3	0	73	95	56 %
P12		38	13	37	49	3	0	2	0	86	5	0	0	107	55 %
P15		44	11	45	46	3	0	2	0	91	5	0	0	112	53 %
P39		20	20	41	22	12	0	2	63	0	13	0	0	103	53 %
P43		44	11	56	22	1	0	2	0	0	3	0	78	102	53 %
P35		44	11	69	24	1	0	2	93	0	3	0	0	110	50 %
P14		51	10	56	43	3	0	2	0	99	5	0	0	121	49 %
P11		54	9	53	51	3	0	2	0	104	5	0	0	127	46 %
P10		60	8	61	53	3	0	2	0	114	5	0	0	138	42 %
P4		77	5	95	48	3	0	2	0	143	5	0	0	169	29 %
P3		79	5	97	49	3	0	2	0	147	5	0	0	174	27 %
P2		81	5	99	49	3	0	2	0	149	5	0	0	176	26 %
P1		84	5	103	57	3	0	2	0	160	5	0	0	188	21 %
P7		95	4	112	52	3	0	2	0	165	5	0	0	193	19 %
P6		96	4	113	53	3	0	2	0	167	5	0	0	196	18 %
P9		95	4	124	42	3	0	2	0	166	5	0	0	195	18 %
P5		97	4	115	53	3	0	2	0	169	5	0	0	198	17 %
P8		105	3	138	42	3	0	2	0	180	5	0	0	211	11 %

Table B 3: Primary energy use in public building JSS1 – major renovation (1960)

Measure /package /variant of measures	Energy need		Energy use					Energy delivered, specified by source						Reduction in primary energy compared to the reference building
	for heating	for cooling	heating	domestic hot water	ventilation	cooling	lighting	natural gas	ELHO	electricity	biomass	district heating	Primary energy	
	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	kWh/m²a	%
P69	31	9	9	0	1	0	1	0	0	1	0	0	4	98 %
P70	28	10	9	0	1	0	1	0	0	1	0	0	3	98 %
P62	28	10	28	8	0	0	1	0	0	2	20	0	7	96 %
P74	4	19	4	0	0	7	1	0	0	2	0	0	6	96 %
P53	31	9	33	8	0	0	1	0	0	2	41	0	9	95 %
P54	28	10	28	8	0	0	1	0	0	2	36	0	9	95 %
P59	40	7	47	8	0	0	1	0	0	2	39	0	9	95 %
P60	37	7	40	8	0	0	1	0	0	2	32	0	8	95 %
P61	31	9	33	8	0	0	1	0	0	2	24	0	7	95 %
P51	40	7	47	8	0	0	1	0	0	2	55	0	10	94 %
P52	37	7	40	8	0	0	1	0	0	2	48	0	10	94 %
P68	37	7	12	0	1	0	1	0	0	4	0	0	10	94 %
P73	6	18	5	0	0	7	1	0	0	3	0	0	9	94 %
P67	40	7	13	0	1	0	1	0	0	4	0	0	12	93 %
P72	11	15	6	0	0	9	1	0	0	6	0	0	15	91 %
P71	13	14	7	0	0	10	1	0	0	8	0	0	21	87 %
P57	6	18	3	8	3	6	1	0	0	10	11	0	27	84 %
P58	4	19	1	8	3	6	1	0	0	10	9	0	27	84 %
P65	6	18	3	8	3	6	1	0	0	10	3	0	26	84 %
P66	4	19	1	8	3	6	1	0	0	10	1	0	26	84 %
P64	11	15	7	8	3	6	1	0	0	11	7	0	28	83 %
P29	31	9	9	0	1	0	1	0	0	12	0	0	30	82 %
P30	28	10	9	0	1	0	1	0	0	11	0	0	29	82 %
P55	13	14	10	8	3	6	1	0	0	11	18	0	30	82 %
P56	11	15	7	8	3	6	1	0	0	11	15	0	29	82 %
P63	13	14	10	8	3	6	1	0	0	11	10	0	29	82 %
P34	4	19	4	0	0	7	1	0	0	13	0	0	33	80 %
P28	37	7	12	0	1	0	1	0	0	14	0	0	36	78 %
P33	6	18	5	0	0	7	1	0	0	14	0	0	36	78 %
P22	28	10	13	0	0	0	1	0	0	14	0	0	37	77 %
P27	40	7	13	0	1	0	1	0	0	15	0	0	38	77 %
P32	11	15	6	0	0	9	1	0	0	16	0	0	42	75 %
P21	31	9	15	0	0	0	1	0	0	17	0	0	43	74 %
P26	4	19	5	0	4	8	1	0	0	17	0	0	45	73 %
P50	4	19	0	11	3	8	1	0	0	12	0	12	45	73 %
P25	6	18	5	0	4	8	1	0	0	18	0	0	46	72 %
P46	28	10	23	11	0	0	1	0	0	2	0	34	46	72 %
P20	37	7	17	0	0	0	1	0	0	18	0	0	47	71 %
P31	13	14	7	0	0	10	1	0	0	19	0	0	48	71 %
P49	6	18	1	11	3	8	1	0	0	12	0	13	47	71 %
P45	31	9	25	11	0	0	1	0	0	2	0	36	49	70 %
P19	40	7	18	0	0	0	1	0	0	20	0	0	51	69 %
P38	28	10	28	10	2	0	1	38	0	3	0	0	52	69 %
P24	11	15	6	0	4	10	1	0	0	20	0	0	52	68 %
P37	31	9	30	10	2	0	1	40	0	3	0	0	54	67 %
P42	4	19	14	10	3	7	1	25	0	11	0	0	56	66 %
P48	11	15	5	11	3	10	1	0	0	14	0	17	56	66 %
P18	28	10	33	16	0	0	1	48	0	2	0	0	58	65 %

Measure /package /variant of measures	**Energy need**		**Energy use**					**Energy delivered, specified by source**						Reduction in primary energy compared to the reference building
	for heating	for cooling	heating	domestic hot water	ventilation	cooling	lighting	natural gas	ELHO	electricity	biomass	district heating	Primary energy	
	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	kWh/m^{2}a	%
P23	13	14	7	0	4	11	1	0	0	23	0	0	58	65 %
P41	6	18	15	10	3	7	1	26	0	12	0	0	58	65 %
P44	37	7	35	11	0	0	1	0	0	2	0	46	61	63 %
P17	31	9	36	16	0	0	1	52	0	2	0	0	62	62 %
P47	13	14	7	11	3	11	1	0	0	15	0	18	62	62 %
P43	40	7	37	11	0	0	1	0	0	2	0	49	64	61 %
P36	37	7	45	10	1	0	1	55	0	2	0	0	67	59 %
P40	11	15	21	10	3	9	1	31	0	13	0	0	68	59 %
P16	37	8	42	16	0	0	1	58	0	2	0	0	69	58 %
P35	40	7	47	10	1	0	1	57	0	2	0	0	69	58 %
P13	31	9	43	16	0	0	1	59	0	2	0	0	70	57 %
P12	34	8	46	16	0	0	1	62	0	2	0	0	73	56 %
P39	13	14	23	10	3	10	1	33	0	14	0	0	73	56 %
P15	40	7	47	16	0	0	1	63	0	2	0	0	74	55 %
P14	35	7	55	16	0	0	1	70	0	2	0	0	82	50 %
P11	39	7	58	16	0	0	1	74	0	2	0	0	87	47 %
P10	45	5	65	16	0	0	1	81	0	2	0	0	94	43 %
P4	69	3	84	16	0	0	1	100	0	2	0	0	115	30 %
P3	71	2	86	16	0	0	1	101	0	2	0	0	117	29 %
P2	73	2	87	16	0	0	1	103	0	2	0	0	119	28 %
P1	76	2	90	16	0	0	1	106	0	2	0	0	122	26 %
P6	75	2	98	16	0	0	1	114	0	2	0	0	131	21 %
P7	73	2	97	16	0	0	1	113	0	2	0	0	130	21 %
P5	77	2	99	16	0	0	1	115	0	2	0	0	132	20 %
P9	101	1	109	16	0	0	1	125	0	2	0	0	143	13 %
P8	104	1	118	16	0	0	1	134	0	2	0	0	153	7 %