REPUBLIC OF SLOVENIA
**MINISTRY OF INFRASTRUCTURE**

# Action Plan for Nearly Zero-Energy Buildings Up to 2020 (AN sNES)[1]

# Slovenia

**April 2015**

[1] Pursuant to Article 331 of the Energy Act (EZ-1) and Article 9 of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).

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## Summary

Article 330 of the Energy Act (EZ-1) sets out the requirement for all new buildings to be nearly zero-energy. In that act, the term 'nearly zero-energy building' means a building with very high energy efficiency or requiring a very low quantity of energy in order to function, where the energy required is produced to a large degree from renewable energy sources at the actual location or nearby.

The transitional provisions of Article 542 state that the provision of Article 330 of the act shall begin to be applied on 31 December 2020. Article 330 of this Act shall begin to be applied on 31 December 2018 for new buildings owned by the Republic of Slovenia or by local self-governing communities and occupied by public sector entities.

Article 331 of the same act imposes on the government the obligation to adopt an Action Plan for Nearly Zero-Energy Buildings (AN sNES) and to define in detail its content and the method used to report to the European Commission:

1. The government shall, at the proposal of the ministry responsible for energy, adopt and every three years renew the Action Plan for Nearly Zero-Energy Buildings Up to 2020.
2. The Action Plan for Nearly Zero-Energy Buildings contains targets, and the programmes and measures for achieving these targets, as well as the human and financial resources for the implementation of programmes and measures. In this plan the government shall also formulate policies and measures to encourage the energy renovation of existing buildings so that they become nearly zero-energy.
3. The ministry responsible for energy shall compile a report on the progress made in increasing the number of nearly zero-energy buildings every three years and notify the European Commission thereof.

These provisions of the Energy Act (EZ-1) constitute the transposition of requirements regarding nearly zero-energy buildings contained in Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. The directive states that buildings constructed after 31 December 2020 that use energy for heating and/or cooling for their operation shall be constructed as nearly zero-energy buildings. This requirement shall begin to apply to non-residential public buildings owned and occupied by public authorities two years prior to this. Under Article 9 of Directive 2010/31/EU, Member States must ensure that:

- by 31 December 2020 all new buildings are nearly zero-energy;
- after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings.

Member States shall also draw up national plans for increasing the number of nearly zero-energy buildings. These national plans may include targets differentiated according to the category of building. Member States shall furthermore, following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are renovated into nearly zero-energy buildings. In the first half of 2014, Slovenia compiled an analysis of the cost-optimal levels of minimum energy performance requirements for buildings,[2] which lay the expert foundations for a technical definition of a nearly zero-energy building. It is envisaged that the technical definition of a nearly zero-energy building will be laid down in the updated technical regulation on the energy performance of buildings, planned for 2015.

Three types of building were analysed:

- single-family houses (covering buildings classified into sub-classes of the standard classification of buildings and parts of buildings with the following codes: CC-SI 1110 Single-family houses and CC-SI 1121 Two-apartment buildings).
- multi-apartment building;
- non-residential building (office building or administrative building).

The expert bases for formulating a technical definition of a nearly zero-energy building cover new construction as well as the complete renovation of existing building types.

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

The definition of a nearly zero-energy building covers the minimum requirements regarding the maximum permitted heating, cooling or air-conditioning needs, the preparation of hot water, lighting within the building in accordance with the technical construction legislation (PURES 2010), determination of the maximum permitted consumption of primary energy within the building, and the minimum permitted share of renewable energy sources in total energy input for the operation of the building.

The maximum permitted heat for the heating of a building, in the case of a single-family house with a proposed factor (envelope/volume) of 0.6 $m^{-1}$ under the PURES 2010 requirements (Figure 2010) is limited to 48 kWh/$m^2$a up to the end of 2014. This restriction is reduced still further to 38 kWh/$m^2$a from the beginning of 2015. An additional reduction in the maximum required heat for the heating of a building to 25 kWh/$m^2$a is envisaged with the introduction of minimum requirements for a nearly zero-energy building.

| **Building type** | **Maximum permitted primary energy value per unit of conditioned# surface area per year (kWh/$m^2$a)** | | **Share of RES (%)** |
|---|---|---|---|
| | New building | Major renovation (reconstruction) | RER** |
| **Single-family houses** | 75 | 95 | 50 |
| **Multi-apartment buildings** | 80 | 90 | 50 |
| **Non-residential buildings*** | 55 | 65 | 50 |

Notes:
* *Based on an analysis of the cost-optimal level for office buildings as the most strongly represented group of non-residential buildings. Exemptions for other types of non-residential building will be set out in the regulation on the energy performance of buildings.
** RER (renewable energy ratio) is the share of renewable energy sources in total energy input (REHVA definition).
# conditioned surface area of a building (Ak) is the heated or cooled enclosed net surface area of a building determined in accordance with the SIST EN ISO 13789 standard and the rules on the methodology for the energy performance of buildings.

The intermediate targets for nearly zero-energy buildings by 2020 in the area of nearly zero-energy new construction and complete renovation are shown in the tables below.

| **AN sNES intermediate targets – new buildings** | | **Unit** | **2015** | **2018** | **2020** |
|---|---|---|---|---|---|
| Single-family houses | | $m^2$ | 76 850 | | 267 500 |
| Multi-apartment buildings | | $m^2$ | 9 753 | | 73 650 |
| Public buildings | | $m^2$ | 53 320 | 84 126 | |
| Other non-residential buildings | | $m^2$ | 50 030 | 115 970 | |

| **AN sNES intermediate targets – complete renovation** | **Unit** | **2015** | **2018** | **2020** |
|---|---|---|---|---|
| Single-family houses | $m^2$ | 241 000 | | 2 395 000 |
| Multi-apartment buildings | $m^2$ | 88 000 | | 596 000 |
| Public buildings | $m^2$ | | 123 000 | |
| Other non-residential buildings | $m^2$ | | 190 000 | |
| Public buildings owned and occupied by the core public sector (3% under the EED) | $m^2$ | 2 000 | 20 000 | |

In accordance with the obligation regarding the renovation of buildings referred to in the introduction, Slovenia is obliged to adopt the Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings. In accordance with the requirements of Commission Delegated Regulation (EU) No 244/12 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings, the Action Plan defines a nearly zero-energy building by establishing a comparative methodological framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements and Directive 2010/31/EU.

The Action Plan for Nearly Zero-Energy Buildings also constitutes the foundation for the Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings, as defined in Article 348 of the EZ-1, which will also more precisely define the measures and sources of financing for renovation.

## 1. Introduction

Article 330 of the Energy Act (EZ-1)[3] sets out the requirement that **'all new buildings must be nearly zero-energy'**.

In that act, the term 'nearly zero-energy building' means a building with very high energy efficiency or requiring a very low quantity of energy in order to function, where the energy required is produced to a large degree from renewable energy sources at the actual location or nearby.

The transitional provisions of Article 542 state that 'the provision of Article 330 of the act shall begin to be applied on 31 December 2020. Article 330 of this Act shall begin to be applied on 31 December 2018 for new buildings owned by the Republic of Slovenia or by local self-governing communities and occupied by public sector entities'.

Article 331 of the same act imposes on the government the obligation to adopt an Action Plan for Nearly Zero-Energy Buildings (AN sNES) and to define in detail its content and the method used to report to the European Commission:

**(1) The government shall, at the proposal of the ministry responsible for energy, adopt and every three years renew the Action Plan for Nearly Zero-Energy Buildings Up to 2020.**

**(2) The Action Plan for Nearly Zero-Energy Buildings contains targets, and the programmes and measures for achieving these targets, as well as the human and financial resources for the implementation of programmes and measures. In this plan the government shall also formulate policies and measures to encourage the energy renovation of existing buildings so that they become nearly zero-energy.**

**(3) The ministry responsible for energy shall compile a report on the progress made in increasing the number of nearly zero-energy buildings every three years and notify the European Commission thereof.**

These provisions of the Energy Act (EZ-1) constitute the transposition of requirements regarding nearly zero-energy buildings contained in Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (Directive 2010/31/EU).[4] Directive 2010/31/EU states that buildings constructed after 31 December 2020 that use energy for heating and/or cooling for their operation shall be constructed as nearly zero-energy buildings. This requirement shall begin to apply to non-residential public buildings owned and occupied by public authorities two years prior to this. Under Article 9 of Directive 2010/31/EU, Member States must ensure that:

(a) by 31 December 2020 all new buildings are nearly zero-energy;

(b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings.

Member States shall also draw up national plans for increasing the number of nearly zero-energy buildings. These national plans may include targets differentiated according to the category of building. Member States shall furthermore, following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are renovated into nearly zero-energy buildings.

As the above European directive explains in more detail, national plans should include, among other things, the following elements:

(a) a detailed explanation of the application in practice of the definition of nearly zero-energy buildings drawn up by Member States, reflecting their national, regional or local conditions, and including a numerical indicator of primary energy consumption expressed in kWh/m2 per year; primary energy factors used for determining the primary energy use may be based on national or regional yearly average values and may take into account relevant European standards;

[3] UL RS, 17/2014.

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

(b) intermediate targets for improving the energy performance of new buildings by 2015 with a view to preparing the implementation of Article 9(1) of Directive 2010/31/EU;

information on the policies and the financial or other measures adopted in the context of Article 9(1) and (2) of Directive 2010/31/EU for the promotion of nearly zero-energy buildings, including details of national requirements and measures concerning the use of energy from renewable sources in new buildings and existing buildings undergoing major renovation in the context of Article 13(4) of 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[5] (Directive 2009/28/EC) and Articles 6 and 7 of Directive 2010/31/EU.

In the first half of 2014, Slovenia compiled an analysis of the cost-optimal levels of minimum energy performance requirements for buildings,[6] which lays down the expert foundations for a technical definition of a nearly zero-energy building. It is envisaged that the technical definition of a nearly zero-energy building will be laid down in the updated technical regulation on the energy performance of buildings,[7] planned for 2015, or (with due regard to the deadlines for the transposition of the requirements of Directive 2010/31/EU) in the national plan for increasing the number of nearly zero-energy buildings.

We can define a nearly zero-energy building on the basis of the expert foundations for establishing the cost-optimal levels of minimum energy performance requirements for buildings, and formulate a national plan to increase the number of nearly zero-energy buildings on the basis of an overview of the situation and of the potentials for the nearly zero-energy construction and renovation of the building stock.

The detailed plan of the application in practice of the definition of nearly zero-energy buildings, the intermediate targets up to 2015 and the policies and financial or other measures for promoting nearly zero-energy buildings take account of the current strategic documents and expert foundations which Slovenia has either already adopted or which are being produced at the same time as this national plan to increase the number of nearly zero-energy buildings:

- Energy Efficiency Action Plan 2008–2016 (AN URE );
- Renewable Energy Action Plan 2010–2020 (AN OVE);
- Operational Programme for the Implementation of Cohesion Policy 2014−2020;
- Long-Term Energy Balances up to 2030 and the Expert Foundations for Determining National Energy Targets (DB 2030). IJS-DP-11467. rev. 2[8] March 2014;
- Operational Programme to Reduce Greenhouse Gas Emissions by 2020 with the Outlook to 2030. OP TGP 2020. December 2014;
- National Energy Efficiency Action Plan 2014–2020 (AN URE 2020), June 2014, draft (this also envisaged in the detailed preparation of the *Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings*).

[5] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy generated from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (OJ L 140 of 5.6.2009, Directive 2009/28/EC).

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

[7] Rules on the Efficient Use of Energy in Buildings; PURES (UL RS 52/2010, 30 June 2010) and technical guideline TSG-1-004:2010 Efficient use of energy (PURES 2010).

[8] Update of documents from 2011: Institut Jožef Stefan, CEU; ELEK, d.o.o., IREET, d.o.o., ELAPHE, d.o.o. GI ZRMK, d.o.o., et al.: Long-Term Energy Balances of the Republic of Slovenia 2010−2030 – Part 1: Points of departure, I.TS-DP-10548, ver. May 2011 and Institut Jožef Stefan, CEU; ELEK, d.o.o., IREET, d.o.o., ELAPHE, d.o.o. GI ZRMK, d.o.o., et al.: Long-Term Energy Balances of the Republic of Slovenia 2010−2030 – Part 2: Results, IJS-DP-10581, ver. June 2011.

# 2. Definition of a nearly zero-energy building

## 2.1. Overview of construction legislation in the field of the energy performance of buildings

In June 2010, pursuant to Directive 2010/31/EU, on the basis of the Construction Act[9] (ZGO-1), Slovenia adopted the Rules on the Efficient Use of Energy in Buildings[10] (PURES 2010), which introduces the methodology for calculating indicators of the energy performance of buildings in accordance with the European standards in force,[11] or rather with the main standard, namely SIST EN ISO 13790, and lays down the minimum energy performance requirements for new buildings and major renovations of existing buildings; it also prescribes the minimum requirements relating to maintenance and technical improvements (before the end of the life cycle of an individual element, system or sub-system of a building). PURES 2010 laid down requirements for all public buildings that were 10% more stringent.

One important new feature of PURES 2010 is the requirement for a share of renewables in overall end-use energy for the operation of (all) systems in buildings of at least 25 %, which is deemed to have been met in the following cases as well:

- if the share of end-use energy for heating and cooling of a building and the preparation of hot water is obtained in one of the following ways:
  - at least 25% from solar radiation
  - at least 30% from gaseous biomass
  - at least 50% from solid biomass
  - at least 70% from geothermal energy
  - at least 50% from ambient heat
  - at least 50% from high-efficiency CHP installations in compliance with the regulation governing support for electricity generated in the high-efficiency co-generation of heat and power
  - the building is supplied to at least 50% from a system of energy-efficient district heating or cooling;
- or if the heat required for heating is at least 30% lower than the limit value referred to in Article 7 of PURES 2010;
- or for single-family houses: if solar collectors with a light surface of at least 6 $m^2$ and an annual yield of at least 500 kWh/($m^2$a) have been installed.

PURES 2010 sets strict minimum requirements for thermal insulation of the envelope (opaque elements, windows and doors) and the maximum permitted annual heat requirement for heating, which together with the prescribed 25 % of renewable sources in overall end-use energy for operation of the systems in the building and the technical requirements for the systems (gas-fired condensing boilers, the required COP for heat pumps, the required efficiency of ventilation recovery systems, the compulsory use of renewable sources in DHW systems), constitutes a key part of the minimum requirements for energy-efficient buildings, while primary energy for heating and cooling is defined somewhat loosely, with stricter provisions envisaged as part of the updating of the Rules.

The requirements of PURES 2010 are summarised below:

[9] Construction Act (ZGO-1).

[10] Rules on the Efficient Use of Energy in Buildings, PURES (UL RS 52/2010, 30 June 2010) and technical guideline TSG-1-004:2010 Efficient use of energy (PURES 2010).

[11] 'European standard' means a standard adopted by the European Committee for Standardisation (CEN). To support implementation of the provisions of Directive 2010/31/EU, the European Commission has given the CEN a mandate to prepare a family of standards under the working designation 'CEN EPBD'.

**Minimum requirements for the construction of new buildings and the major renovation of existing buildings under PURES 2010, entry into force of which is envisaged from the beginning of 2015:**

**Maximum permitted annual required heat for heating ($g_N$H) of a building (from 31 December 2014)** calculated per unit of conditioned useful surface area $A_u$ or volume $V_e$ of the building, may not exceed:

- for residential buildings: $Q_{NH}/A_u \leq 45 + 60\, f_0 - 4.4\, T_L$ (kWh/(m$^2$a))
- for non-residential buildings: $Q_{NH}/V_e \leq 0.32\,(45 + 60\, f_0 - 4.4\, T_L)$ (kWh/(m$^3$a))
- for public buildings -10%: $Q$NH/$V$e $\leq 0.29\,(45 + 60\, f_0 - 4.4\, T_L)$ (kWh/(m$^3$a))

**The maximum permitted annual energy requirement for cooling ($Q_{NC}$) a residential building**, calculated per unit of cooled building area $\boldsymbol{A_u}$ may not exceed:

- for residential buildings: $Q_{NC}/A_u \leq 50$ kWh/(m$^2$a)

**The maximum permitted annual primary energy for the operation of systems in a building ($Q_p$,)**, converted into a unit of heated building surface area $\boldsymbol{A_u}$, may not exceed:

- for residential buildings: $Q$p/Au = 200 +1.1 (60 $f_0$ – 4.4 $T_L$) kWh/(m$^2$a)

**The maximum permitted thermal transmittance values** *($U_{max}$)* for individual building elements of the thermal envelope of buildings are given in Table 1.

**The coefficient of the maximum permitted specific transmission** heat losses through the surface of the thermal envelope of the building A, determined by the formula H'$_T$ (W/m$^2$K) = $H_T$/A, may not exceed:

$$H'_T \geq 0.28 + \frac{T_1}{\quad} + \frac{0.04}{\quad} + \frac{z}{\quad};$$

where $T_1$, is the average annual air temperature ($^o$C) and with the proportion of glazed surfaces in the envelope (-).

**Public buildings:**

- The minimum requirements are 10% stricter for public buildings, i.e. 90% of the level of the general minimum requirements.

Symbols used

| | |
|---|---|
| $A_u$ | useful floor area of building (m$^2$); |
| $f_0$ | shape factor; ratio between the external area of the thermal envelope of the building and the heated volume of the building (f(0) = A/(V(e)), (m(na -1))); |
| H'$_T$ | specific transmission heat loss coefficient (W/(m$^2$K)); |
| $H_T$ | specific transmission heat losses (W/K); |

| | |
|---|---|
| $Q_{NC}$ | annual energy need for cooling; this is the energy that must be introduced to a building in one year in order to meet the design indoor temperatures in the cooling season as determined by the SIST EN ISO 13790 standard (kWh/a); |
| $Q_M$, | annual energy need for heating; this is the energy that must be introduced to a building in one year in order to meet the design indoor temperatures in the heating season as determined by the SIST EN ISO 13790 standard (kWh/a); |
| $Q_p$ | annual primary energy (kWh/a); energy of primary energy carriers obtained by exploiting natural energy sources that have not been exposed to any technical conversion; |
| $T_L$ | average annual outside air temperature (°C); |
| $V_e$ | conditioned (gross) volume of building ($m^3$); |
| z | non-dimensional ratio between the window area and the area of the thermal envelope of the building (/). |

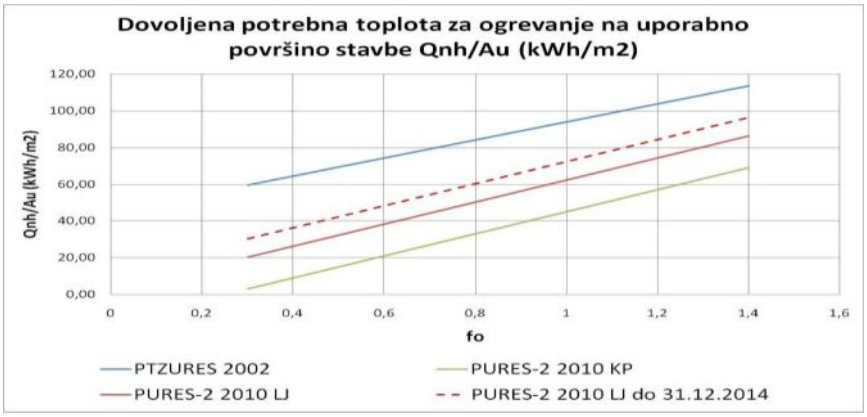
The maximum permitted thermal transmittance values ($U_{max}$) for individual building elements of the thermal envelope which must be observed in new buildings, reconstructions and building maintenance are given in Table 1. The technical guideline TSG-1-004:2010 Efficient Use of Energy, the use of which is mandatory under PURES 2010, also brings a range of other minimum requirements for the energy performance of systems and sub-systems in buildings.

Figure 1 shows the level of the minimum requirement for the maximum permitted energy need for heating, where it is worth highlighting the reduction of the minimum requirement by around 10 kWh/($m^2$a) after 31 December 2014 (PURES-2 2010 LJ up to 31 December 2014) in comparison to the requirement in force (PURES-2 2010 LJ) (shown for climatic conditions in Ljubljana, which are comparable to the greater part of the rest of Slovenia).

Figure 2 gives a chronological overview of the tightening of the maximum permitted annual energy need for heating from 1970 to the present day, where we can observe both a tightening of energy performance requirements and an increasing complexity in the way they are written.

Table 1: Maximum permitted thermal transmittance values (Umax) for individual building elements that delimit heated spaces (taken from Table 1 in point 3.1.1. of the technical guideline) 12

| | **Building elements that delimit heated spaces** | **$U_{max}$ (W/(m$^2$K))** |
|---|---|---|
| 1 | External walls and walls abutting unheated spaces | 0.28 |
| 2 | External walls and walls abutting unheated spaces – smaller surfaces which in total do not exceed 10% of the opaque surface of the external wall | 0.60 |
| 3 | Walls abutting heated neighbouring buildings | 0.50 |
| 4 | Walls between apartments and walls abutting staircases, hallways and other less heated areas | 0.70 |
| | Internal walls and between-floor structures between the heated areas of different units and different users or owners in non-residential buildings | 0.90 |
| 5 | External wall of heated areas in contact with the ground | 0.35 |
| 6 | Floor in contact with the ground (does not apply to industrial buildings) | 0.35 |
| 7 | Floor above an unheated cellar, unheated area or a garage | 0.35 |
| 8 | Floor above ambient air | 0.30 |
| 9 | Floor in contact with the ground and floor above an unheated cellar, unheated area or garage with panel/underfloor heating (surface heating) | 0.30 |
| 10 | Ceiling abutting onto an unheated area, ceilings making up flat or inclined roofs (flat or inclined roofs) | 0.20 |
| 11 | Smaller terraces that together do not exceed 5% of the surface area of the roof | 0.60 |
| 12 | Ceiling in contact with the ground | 0.35 |
| 13 | Vertical windows or balcony doors and heated winter gardens with wooden or synthetic frames | 1.30 |
| | Vertical windows or balcony doors and heated winter gardens with steel frames | 1.60 |
| 14 | Roof windows, glazed roofs | 1.40 |
| 15 | Roof lights, dome skylights (up to a total of 5% of the surface area of the roof) | 2.40 |
| 16 | Entrance doors | 1.60 |
| 17 | Garage doors | 2 |

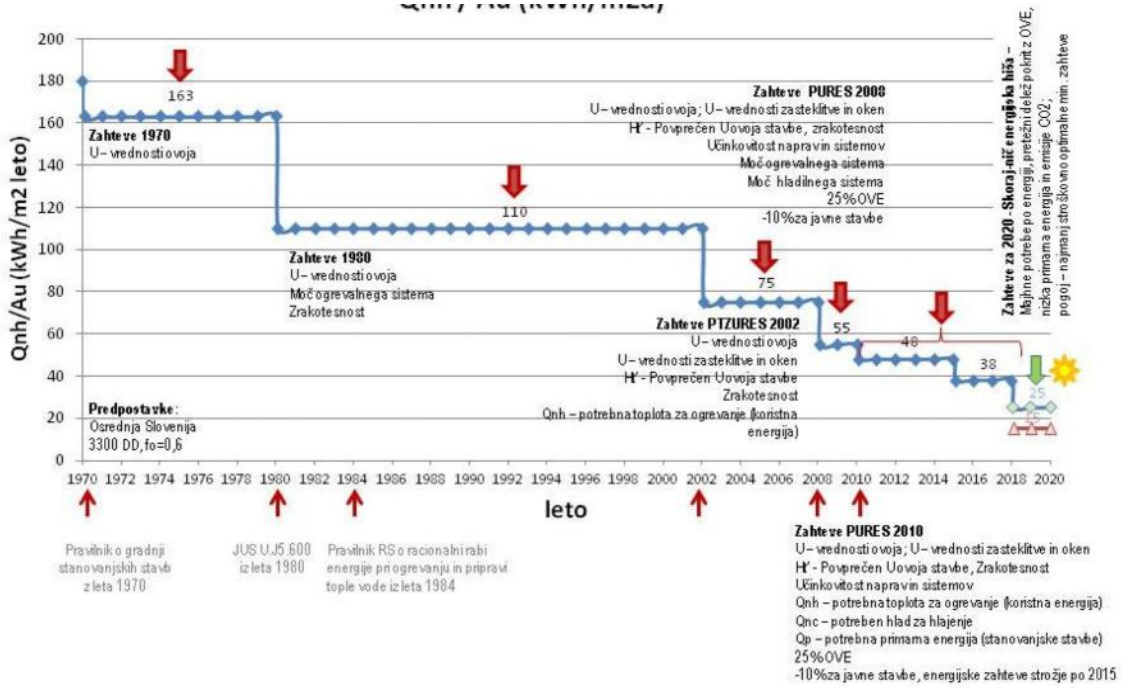



Maximum permitted energy need for heating per useful floor area of building Qnh/Au (kWh/m2)

12 Technical Guideline TSG-1-004 Efficient Use of Energy, MzIP, 2010.

Figure 1: Comparison between the maximum permitted energy need for heating a building under PURES 2010 (PURES-2 2010 LJ up to 31 December 2014 – for climatic conditions in Ljubljana, which are comparable with the majority of the climate conditions pertaining in the rest of Slovenia), and the stricter requirements entering into force from the beginning of 2015 (PURES-2 2010 LJ for Ljubljana and PURES-2 2010 KP for Koper), and also in comparison with the requirement of the previous PTZURES 2002 rules[13] (Source: GI ZRMK).

**Maximum permitted energy need for heating under the regulations on the energy performance of buildings in Slovenia**
**Qnh / Au (kWh/m2a)**




Qnh/Au (kWh/m2 year)

**1970 requirements**
U – values of the envelope

**Assumptions:**
Central Slovenia
3300 DD. $f_o$=0.6

**1980 requirements**
U – values of the envelope
Power of the heating system
Airtightness

**PTZURES 2002 requirements**
U – values of the envelope
U – values of the glazing and windows
H – average U of the building envelope
Airtightness
Qnh – energy need for heating (useful energy)

**PURES 2008 requirements**
U – values of the envelope; U – values of the glazing and windows
H – average U of the building envelope, airtightness

[13] Rules on Thermal Insulation and the Efficient Use of Energy in Buildings (PTZURES 2002), UL RS 42/02.

Efficiency of equipment and systems
Power of the heating system
Power of the cooling system
25% RES
-10% for public buildings

**Requirements for 2020 – nearly zero-energy house**
Lower energy needs predominantly covered by RES,
low primary energy and CO2 emissions;
condition – lowest cost-optimal levels of minimum requirements

1970 Rules on the Construction of Residential Buildings

JUS U.J5.600 from 1980

Rules of the Republic of Slovenia on the Rational Use of Energy for Heating and the Preparation of Hot Water, 1984

**PURES 2010 requirements**
U – values of the envelope; U – values of the glazing and windows
H – average U of the building envelope Airtightness
Efficiency of equipment and systems
Qnh – energy need for heating (useful energy)
Qnc – energy need for cooling
Qp – primary energy need (residential buildings)
25% RES
-10% for public buildings, energy requirements stricter after 2015

Figure 2: Overview of the tightening of the prescribed minimum requirements for the energy performance of buildings in Slovenia and the increase in the complexity of the minimum requirements (Source: Gl ZRMK).

The results of the analysis of the cost-optimal levels of minimum requirements[14] for the energy performance of buildings showed that the existing minimum requirements for new residential buildings prescribed by the PURES 2010 rules lie within the prescribed area of the cost optimal level. The reason for this lies in the national energy and climate policy in the building sector, which has, in buildings, identified large potentials for energy efficiency and the use of renewable energy sources at building level. The same findings also ensue from the analysis of the cost-optimal levels of requirements for non-residential office buildings and the minimum requirements for the complete and partial renovation of single-family houses, multi-apartment buildings and non-residential (office) buildings.

It should be pointed out that the minimum requirement for primary energy as laid down in PURES 2010 is apparently not strict enough in the light of the results of the analysis of the cost-optimal level; however, owing to a series of partial minimum requirements for buildings and systems, buildings that conform to PURES 2010 have no difficulty in achieving a primary energy use that is lower than the maximum permitted value prescribed.

Buildings designed in accordance with the national PURES 2010 legislation have a high level of thermal protection and energy-efficient windows such that the total transmission heat losses through the building envelope ($H'_T$) are below 0.4 W/($m^2$K); likewise, use of the most advanced gas condensing boiler and solar collector technologies for the preparation of sanitary hot water, or other systems such as heat pumps or biomass boilers, is required, leading to the prescribed share of renewable energy sources in buildings (at least 25% from 2010).

The minimum requirements for nearly zero-energy buildings, presented below, will, in accordance with the EZ-1 and Directive 2010/31/EU, lead to the design of buildings with significantly lower energy needs and a significantly higher proportion of coverage of these needs with renewable energy sources, as generally required under the current Rules on the Efficient Use of Energy in Buildings (PURES 2010).

[14] ŠIJANEC ZAVRL, Marjana, STEGNAR, Gašper, GJERKEŠ, Henrik, RAKUŠČEK, Andraž. Expert foundations for determining the cost optimal levels for the minimum energy performance requirements by using a comparative methodological framework and the expert foundations for the National Action Plan for Nearly Zero-Energy Buildings 2012–2020. Ljubljana: Gradbeni inštitut ZRMK, 2014. one volume (separate pages), illustrated [COBISS.si-ID 512045851].

## 2.2. Points of departure for a nearly zero-energy building

Article 313 of the Energy Act (EZ-1) defines a **'nearly zero-energy building'** as **'a building with very high energy efficiency or requiring a very low quantity of energy in order to function, where the energy required is produced to a large degree from renewable energy sources at the actual location or nearby'.**

The points of departure for defining the national criteria for nearly zero-energy buildings are provided by the results of the analysis of the cost-optimal levels of minimum requirements for the energy performance of buildings drawn up in accordance with European legislation (Regulation No 244/2012[15] and the accompanying guidelines[16]). The figures below represent the lifetime costs of buildings (NPV, net present value) depending on primary energy ($Q_p$) for the different energy designs of the building types selected.

Three building categories have been analysed: single family houses (including single-family houses with no more than two apartments), multi-apartment buildings and non-residential buildings (office buildings or administrative buildings). The expert foundations for formulating a technical definition of a nearly zero-energy building cover new construction as well as the complete renovation of existing buildings.

Primary energy consumption is determined using a dynamic simulation for the climatic region of Central Slovenia. The results are derived from the cost-optimal levels of the minimum requirements for the energy performance of buildings, where the non-renewable part of primary energy is taken into account for the purpose of assessing the cost-optimal level, in accordance with Regulation No 244/2012 and the accompanying guidelines. **The calculation of general annual primary energy consumption includes the energy consumed for heating, cooling, ventilation, hot water and lighting.** The main reference for this is Annex I to Directive 2010/31/EU, which is applied in full to the cost-optimal methodology.

Other areas of energy consumption, such as energy for the operation of office appliances, lifts and escalators and energy for the operation of household appliances, are not included. The permitted values under PURES 2010 and the Technical Guidelines for Construction, e.g. the power density of lighting, the thermal transmittance of a building element, specific energy consumption for hot water, etc. have also been taken into account. In relation to renovations of existing buildings, individual measures on the thermal envelope are also envisaged within the group of energy scenarios, along with integrated measures that involve, in addition to the renovation of the thermal envelope, replacement of the heating and hot water system in accordance with the energy consumption provisions laid down in Directive 2010/31/EU. Four combinations for the thermal envelope have been compiled for every system replacement case. We can therefore define the limit value for primary energy with the aid of a study of the cost-optimal levels of the minimum energy performance requirements; this limit value represents the level of a nearly zero-energy building and is shown in Figures 3 to 8.

It should be pointed out that the location of a building has an important impact on energy consumption. Various influences, such as solar radiation, outside temperature, wind and the exposure of the building, which are conditioned by the location, cannot always be fully factored in. All building types have been addressed at a reference location in Central Slovenia with a continental climate (temperature deficit of 3 300 K*days/year, solar radiation energy of 1 121 kWh/m$^2$a). Buildings located in a milder climate require considerably less energy for heating; on the other hand, the energy consumed when using a building cooling system is markedly higher than it is in hilly, higher-lying areas. All the buildings are simple, compact shapes and are the most commonly represented form within the building stock, have a favourable shape factor (f(0) (single-family house) = 0.7. f(0) (multi-apartment building) = 0.41. f(0) (non-residential building) = 0.39) and favourable associated heat losses through the envelope.

The lifelong costs of individual energy designs for buildings relate to a 30-year building lifecycle with new buildings or those that have undergone major renovation, cover the costs of investment, maintenance, the replacement of elements and energy consumption, and are shown in relation to their net present value.

[15] DELEGATED COMMISSION REGULATION (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings (16 January 2012).

[16] Guidelines accompanying Delegated Commission Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements (19 April 2012).

At the same time, we also define the lowest required share of RES in a nearly zero-energy building, which is shown in Figures 9 to 14 for the cases addressed, on the basis of an analysis of the indicator of renewable energy sources as a share of the total energy input. The RES share includes energy generated on the building from renewable sources (e.g. ambient energy, solar energy, solar electricity from photovoltaic systems, wind energy and hydroenergy) and the renewable part of energy input (e.g. biomass, district heating systems and/or cooling with a share of the energy generated by RES), reduced by the renewable energy discharged outside the boundaries of the building in question. In this way we are able to distinguish between energy generated from RES on and nearby the building and any energy also generated from RES to a certain share but outside the impact area relevant to a definition of a nearly zero-energy building (green electricity in the national grid is not covered by RES within this definition). The balance of energy input, energy discharged and energy generated is produced at the monthly level.

The national definition of a nearly zero-energy building pursues the objective of promoting the widest possible use of technologies for generating energy from RES on a building, on-site or nearby that are technically mature but not yet economically justifiable, as well as promoting the technical development and use of advanced technologies for energy-efficient buildings and the use of RES.

The limit value of primary energy in a nearly zero-energy building is therefore established at the expert level within the expert council for energy efficiency at the Ministry of Infrastructure (MzI) such that it achieves and exceeds the cost-optimal level and, at the same time, envisages the use of key modern technologies for energy-efficient buildings and the use of RES. The limit value for the share of RES is set so that all energy designs that provide more than half the energy from renewable sources are permissible.

Alongside these requirements, a nearly zero-energy building must also meet all the generally applicable technical building requirements laid down by building legislation (PURES 2010). Building legislation has been tightened in line with the provisions adopted at the end of 2014. From 1 January 2015, the permitted energy need for heating is around 20% lower than that permitted in 2010. In 2015 the ministry is planning periodic revisions of the minimum requirements contained in PURES 2010, in line with Directive 2010/31/EU.

Symbols used (ventilation, heating and sanitary hot water preparation systems used, and the use of RES in the dynamic simulation):

| | |
|---|---|
| HP a/w | air/water heat pump |
| HP a/w + MVR | air/water heat pump + mechanical ventilation recovery |
| HP w/w | water/water heat pump |
| HP w/w + MVR | water/water heat pump + mechanical ventilation recovery |
| gas-fired CB | gas-fired condensing boiler |
| gas-fired CB + MVR | gas-fired condensing boiler + mechanical ventilation recovery |
| DH | district heating |
| DH + MVR | district heating + mechanical ventilation recovery |
| BB | biomass boiler |
| BB + MVR | biomass boiler + mechanical ventilation recovery |
| BB + SC | biomass boiler + solar collectors |
| BB + MVR + SC | biomass boiler + mechanical ventilation recovery + solar collectors |
| HP w/w + PS | water/water heat pump + photovoltaic system |
| HP w/w + MVR + PS | water/water heat pump + mechanical ventilation recovery + photovoltaic system |

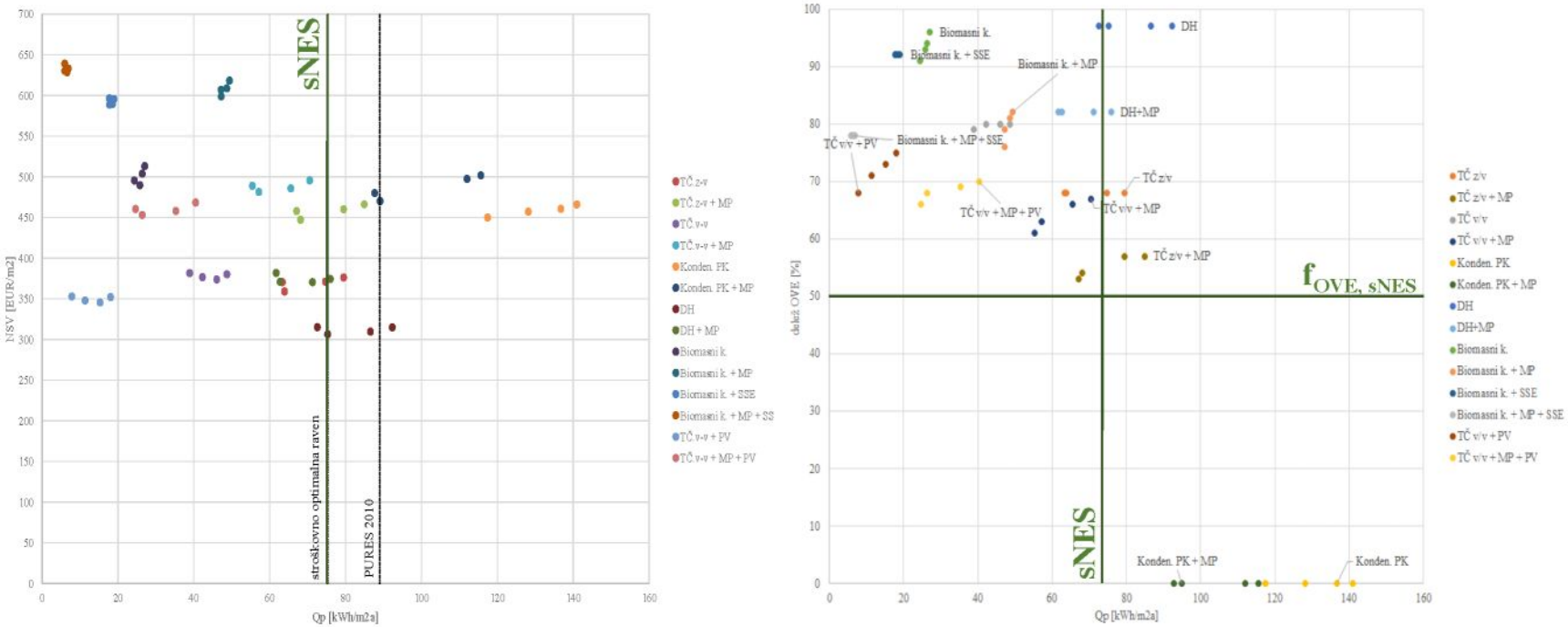



Figure 3: Single-family house, new-build – lifelong costs dependent on the primary energy of the building type with the limit primary energy value (left) and the share of renewable energy sources relative to primary energy consumption (right) for a nearly zero-energy building.

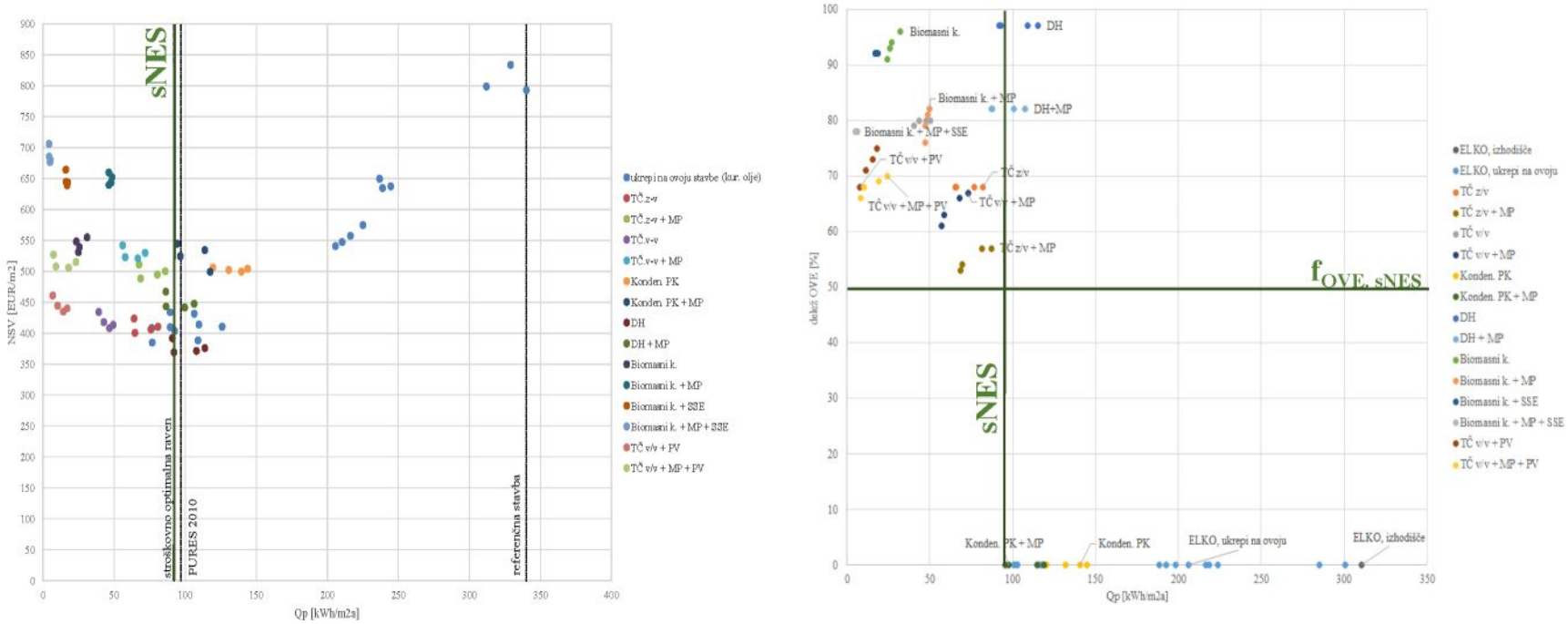



Figure 4: Single-family house, renovation – lifelong costs dependent on the primary energy of the building type with the limit primary energy value (left) and the share of renewable energy sources relative to primary energy consumption (right) for a nearly zero-energy building.

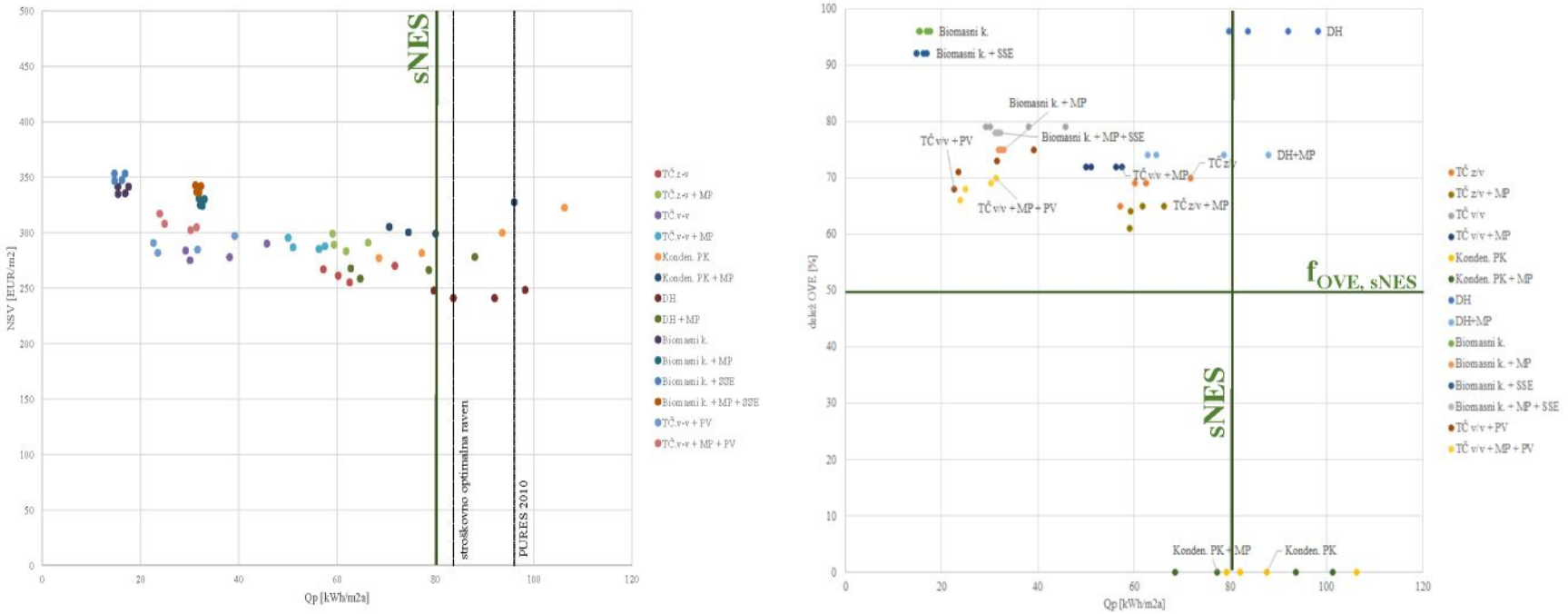



Figure 5: Multi-apartment building, new-build – lifelong costs dependent on the primary energy of the building type with the limit primary energy value (left) and the share of renewable energy sources relative to primary energy consumption (right) for a nearly zero-energy building.

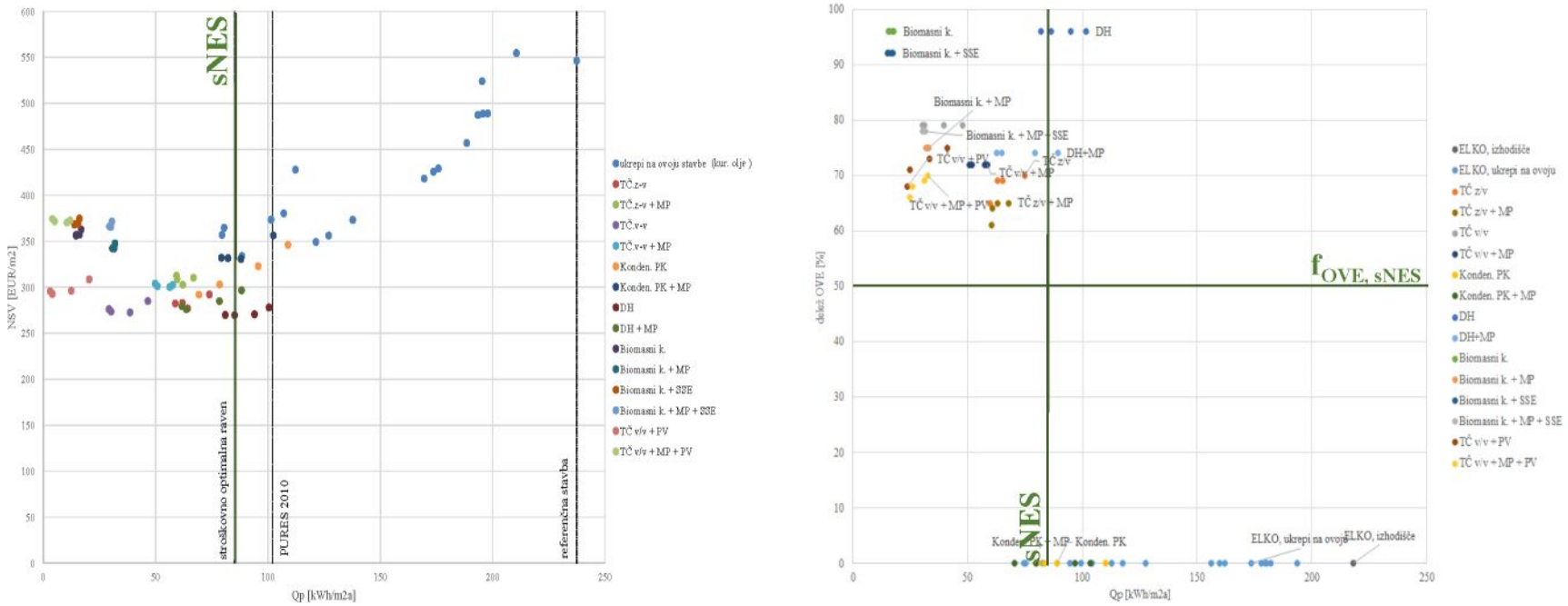



Figure 6: Multi-apartment building, renovation – lifelong costs dependent on the primary energy of the building type with the limit primary energy value (left) and the share of renewable energy sources relative to primary energy consumption (right) for a nearly zero-energy building.

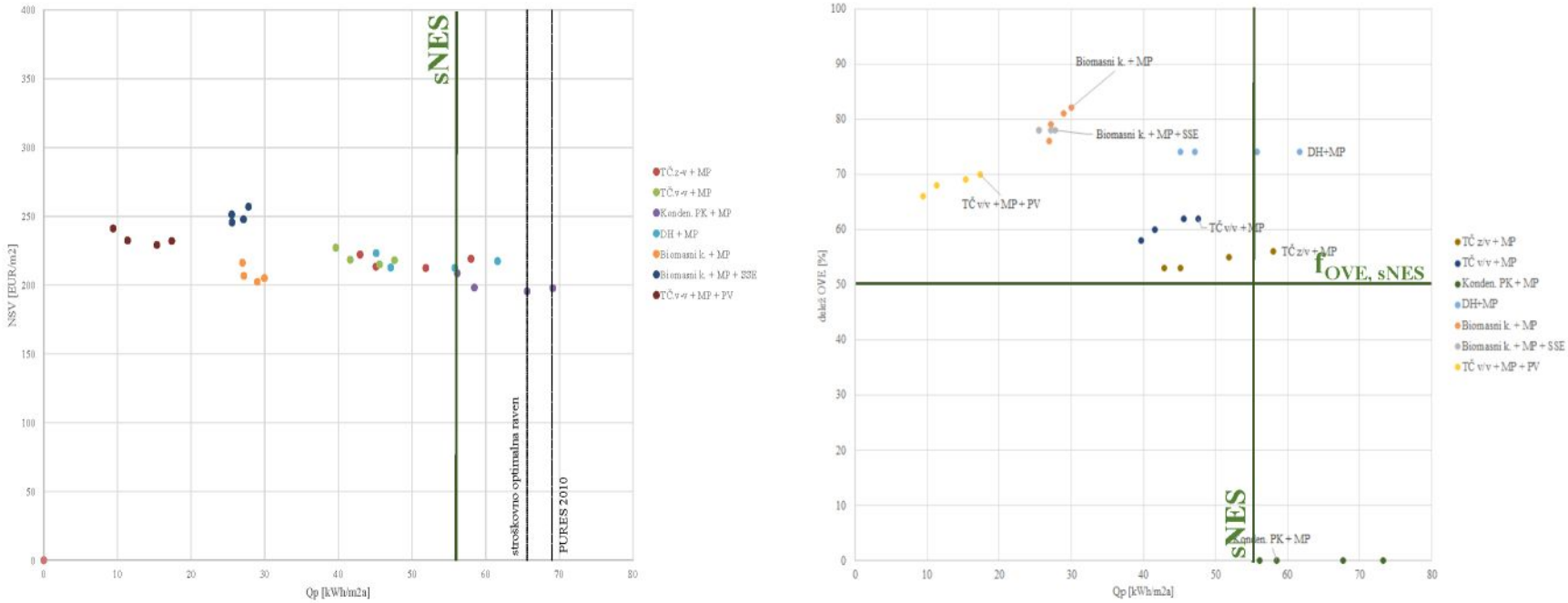



Figure 7: Non-residential (office) building, new-build – lifelong costs dependent on the primary energy of the building type with the limit primary energy value (left) and the share of renewable energy sources relative to primary energy consumption (right) for a nearly zero-energy building.

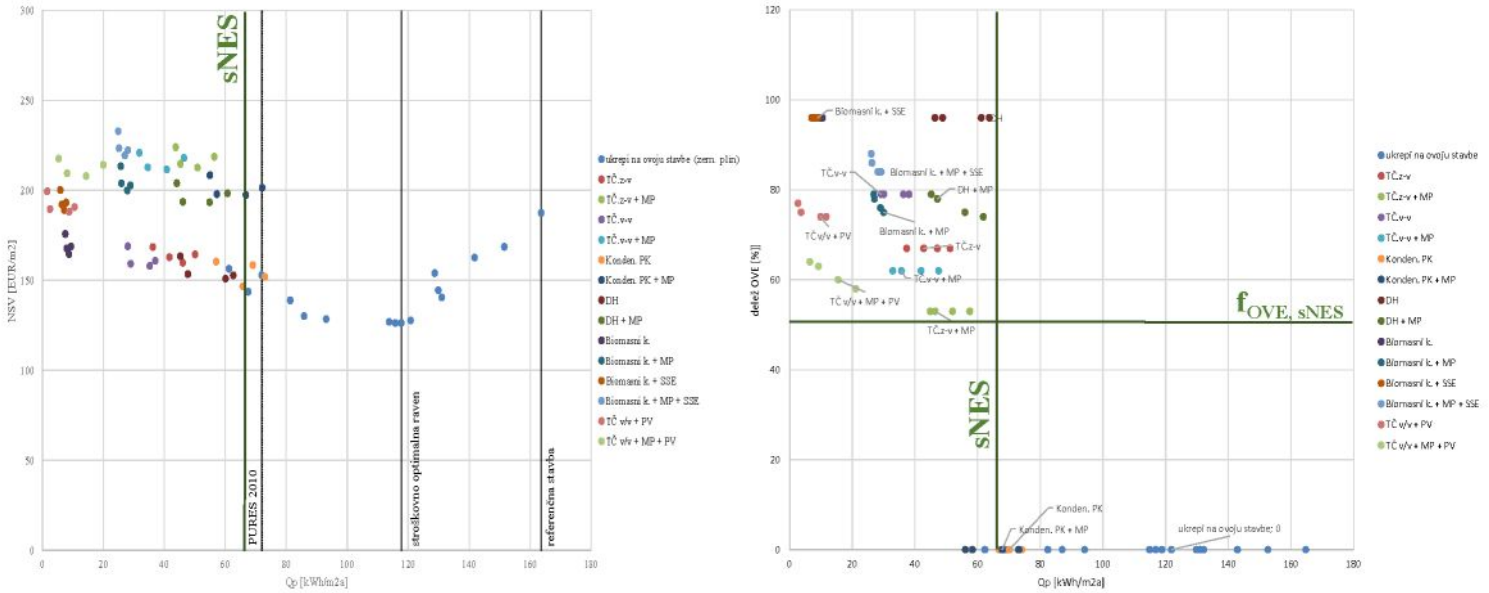



Figure 8: Non-residential (office) building, renovation – lifelong costs dependent on the primary energy of the building type with the limit primary energy value (left) and the share of renewable energy sources relative to primary energy consumption (right) for a nearly zero-energy building.

## 2.3. Definition of a nearly zero-energy building

The term 'nearly zero-energy building' means a building with very high energy efficiency or requiring a very low quantity of energy in order to function, where the energy required is produced to a large degree from renewable energy sources at the actual location or nearby.

The definition of a nearly zero-energy building covers the following elements:

A. definition of a building with very high energy efficiency
B. very low quantity of energy required for operation of the building
C. minimum permitted share of renewable energy sources or energy need generated to a large degree from renewable energy sources on-site or nearby.

### A. Building with very high energy efficiency

An additional reduction in the maximum energy need for the heating of a building is envisaged with the introduction of minimum requirements for a nearly zero-energy building:

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

The upper value is being adjusted accordingly in the regulation on the efficient use of energy in buildings (PURES), taking into account the climatic characteristics at the building's location and the proposed building factor.

### B. + C. Low quantity of energy required for operation of the building and minimum permitted share of RES

The following maximum permitted primary energy values and minimum permitted shares of RES relative to building type are envisaged for a nearly zero-energy building under the study of the cost-optimal level of minimum requirements (Figures 3 to 8):

Table 2: Maximum permitted primary energy values relative to individual building type.

| **Building type** | **Maximum permitted primary energy value per unit of conditioned# surface area per year (kWh/m$^2$a)** | | **Minimum RES share [%]** |
|---|---|---|---|
| | New building | Major renovation[17] (reconstruction) | RER** |
| **Single-family houses** | 75 | 95 | 50 |
| **Multi-apartment buildings** | 80 | 90 | 50 |
| **Non-residential buildings*** | 55 | 65 | 50 |

* Based on an analysis of the cost-optimal levels for office buildings as the most strongly represented group of non-residential buildings;
exemptions for other types of non-residential building will be set out in the regulation on the energy performance of buildings.
** RER (renewable energy ratio) is the share of renewable energy sources in total energy input.[18],[19]

[17] In accordance with the definition in the EZ-1.
[18] According to the REHVA definition (Federation of European Heating, Ventilation and Air Conditioning Associations), Kumitski, Jarek. 43rd International HVAC&R Congress and Exhibition, December 2012.
[19] REHVA nZEB technical definition and system boundaries for nearly zero-energy buildings. 2013 revision for uniform national implementation of EPBD recast prepared in cooperation with European standardisation organisation CEN. Report No 4, 2013.

$$RER = \frac{\sum_i E_{ren,site,i} - \sum_i E_{exp,i}^{ren} + \sum_i E_{del,ren,i}}{\sum_i E_{ren,site,i} - \sum_i E_{exp,i}^{ren} + \sum_i E_{del,ren,i} + \sum_i E_{del,nren,i} - \sum_i E_{exp,i}}$$

$RER$ share of renewable energy sources in the total energy input for operation of the building;

$E_{ren,site,i}$ renewable energy generated (at the location) i, kWh/a;

$E_{exp,i}^{ren}$ energy supplied i, which replaces the renewable part of the energy input in the network,[20] kWh/a;

$E_{del,ren,i}$ renewable part of the energy input i (outside the location of the building), kWh/a;

$E_{del,nren,i}$ non-renewable part of the energy input i (outside the location of the building), kWh/a;

$E_{exp,i}$ energy supplied I, kWh/a;

Figures 3 to 8 present the lifelong costs of all building types depending on primary energy and the shares of the renewable energy sources that the analysed technologies utilise. The boundaries for primary energy and the share of renewable sources are presented for the reference buildings; they show, for the building in question, which building envelopes and technologies meet the criteria of a nearly zero-energy building.

The prescribed share of renewable sources takes into account the energy generated from renewable energy sources on-site (e.g. technical system for generation from solar energy, ambient heat, wind, etc.) and the renewable part of the energy input over the assessment boundary[21] (e.g. wood biomass, the renewable part of energy from district heating or cooling 'nearby', the renewable part of electricity input generated using a photovoltaic system or wind 'nearby', the renewable part of heat generated using solar collectors or heat pumps 'nearby'), while the energy transmitted from a renewable source that leaves the assessment boundary is subtracted. The renewable part of electricity from the grid is not factored into the share of renewable sources for nZEB. It will only be possible to define this methodological solution in more detail after the new CEN EPBD standards have been adopted and the rules governing the efficient use of energy in buildings (PURES) are amended.

The maximum permitted primary energy values will be achieved for a nearly zero-energy building by increasing the share of local RES using the technologies outlined below.

District heating systems using wood biomass as the energy source within energy conversion systems efficiently reduce primary energy consumption. Co-generation or poly-generation systems are most appropriate owing to the transformation of wood biomass (and potentially also waste) into high-efficiency thermal energy with a potential local energy source, at the same time as increasing the share of RES in the national electricity system without polluting the environment with solid particle and other emissions with a pronounced local impact, such as nitrogen and carbon dioxide.

Article 322 of the Energy Act (EZ-1) states that district heating and cooling systems must be efficient. Distributors of heat must ensure that heat from at least one of the following sources is provided at an annual level:

- at least 50% of heat generated from renewable energy sources
- at least 50% from waste heat
- at least 75% from heat from cogeneration
- or at least 75% from a combination of heat from the above three indents.

[20] Until the rules governing the efficient use of energy in buildings are amended, this article is equal to 0 under the new CEN EPBD standards (particularly FprEN 15603:2014 Energy performance of buildings – Overarching standard EPB).

[21] The **assessment boundary** is, under prEN 15603:2014, the boundary at which the energy balance of input and transmitted energy is determined with a view to determining the primary energy consumption indicator.

With amendments to the rules on the efficient use of energy in buildings, the alternative achievement of the obligatory shares of renewable energy sources will be defined similarly to how they are currently defined (in Article 16 of PURES 2010).

Several other systems that are more dependent on the natural fluctuation of weather conditions (solar collectors, solar power plants) may, in the case of own consumption in nearly zero-energy buildings, also be suitable for improving the primary energy balance, their value lying chiefly in the accessibility of the technology, in economic and technical terms, to individuals.

The indicator of specific $CO_2$ emissions is calculated as an indicator for buildings, but is not restricted by regulation nor subject to a technical nZEB definition.

**Follow-up activities**

Alongside the final and general introduction of the minimum requirements for a nearly zero-energy building (no later than by 2018/2020), it is of crucial importance to ensure that the standard profiles of use of buildings are aligned with the emerging new generation of CEN EPBD standards, that the area of energy consumption included in the determination of energy indicators is re-examined (the consumption of energy for lighting is also taken into account in residential buildings in Slovenia) and that a study is made of how to factor renewable energy sources produced on/alongside/nearby a building into the calculation.

The existing national conversion factors for calculating primary energy will have to be examined and upgraded in Table 3.

Table 3: Conversion factors for calculating annual primary energy for individual types of energy source

| Energy source | Conversion factor |
|---|---|
| **heating oil** | 1.1 |
| **gas** | 1.1 |
| **coal** | 1.1 |
| **wood biomass** | 0.1 |
| **electricity** | 2.5 |
| **district heating without co-generation** | 1.2 |
| **district heating with co-generation** | 1.0 |

Source: PURES 2010.

After approval of the new CEN standard FprEN 15603:2014 (Energy performance of buildings – Overarching EPB standard), the values of the factors of conversion into primary energy will have to be updated and determined, as will the calculation of the share of renewable energy sources.

The new draft standard envisages three conversion factors for primary energy for each energy source used:

- f(Ptot) – total primary energy factor
- f(Pnren) – factor of non-renewable part of primary energy conversion
- f(Pren) – factor of renewable part of primary energy conversion.

Adoption of the new standard will also lead to changes to the calculation of the share of renewable energy sources. Currently only the non-renewable part of the conversion factor for primary energy is defined; calculation of RES as a share of total primary energy is therefore not currently possible under the coming standard. This standard will also lead to expansion of the use of (at least) quasi-stationary hourly methods for calculating energy consumption, enabling the more appropriate, non-stationary treatment of input and transmitted energy in more complex buildings, which is also a necessary basis for the appropriate treatment of the energy interaction of a building with its immediate environment.

The adoption of the new CEN standards has prompted the preparation of amendments to the rules governing the efficient use of energy in buildings. The new rules will make it possible to determine exemptions and particularities for all types of nearly zero-energy building.

In determining the exemptions and particularities, the requirements regarding spatial planning will have to be taken into account and special attention paid to the cogeneration of heat and power, restrictions regarding

mandatory connections, the protection of air quality, etc. Particular focus must be given to appropriate substantive and formal links to local energy concepts and spatial planning acts.

## 3. National building stock and potentials for a nearly zero-energy building

The Recast EPBD aims to promote the construction of nearly zero-energy buildings even before the final deadline for introducing requirements for new buildings.

To this end, the Action Plan defines the potentials for the construction of new nearly zero-energy buildings:

- for new single-family houses
- for new multi-apartment buildings
- for new public buildings
- for other new non-residential buildings

and the potentials for the nearly zero-energy complete renovation of existing buildings:

- for single-family houses
- for multi-apartment buildings
- for public buildings
- for other non-residential buildings
- for public buildings owned and occupied by the core public sector (requirement for the renovation of 3% of the total floor area per year)

For the purposes of this Action Plan, residential housing stock covers:

- single-family houses;
- multi-apartment buildings.

For the purposes of this Action Plan, non-residential building stock covers:

- public buildings owned and occupied by the core public sector;
- public buildings (excluding buildings owned and occupied by the core public sector);
- other non-residential buildings.

Single-family houses and multi-apartment buildings are classified into sub-classes of the standard classification of buildings and parts of buildings with the following codes: CC-SI 1110 Single-family houses and CC-SI 1121 Two-apartment buildings.

When determining public buildings owned and occupied by the core public sector in this Action Plan, account was taken of the register published on the website of the Ministry of Infrastructure on 18 April 2014

(http://www.energetika-portal.si/fileadmin/dokumenti/podrocja/energetika/javne_stavbe/evidenca_javnestavbe_jun_2014.htm).

Public buildings (excluding buildings owned and occupied by the core public sector) in this Action Plan are classified into sub-classes of the standard classification of buildings and parts of buildings with the following codes: CC-SI 11302 Residential buildings for other special social groups. CC-SI 12201 Public administration buildings and CC-SI 126 Buildings for public entertainment, education or hospital and institutional care

Other non-residential buildings in this Action Plan are classified into sub-classes of the standard classification of buildings and parts of buildings with the following codes: CC-SI 121 Hotels and similar buildings CC-SI 12202 Banks, post offices, insurance companies. CC-SI 12203 Buildings used as places of business, for clerical and administrative purposes, e.g. banks, post offices, insurance companies, etc. and CC-SI 123 Wholesale and retail trade buildings and buildings for service activities.

The potentials for the construction of nearly zero-energy buildings take into account the trends relating to new buildings and the possibility of more advanced requirements for energy efficiency and the use of renewable energy sources in the complete renovation of existing buildings.

Nearly zero-energy renovation is a special challenge that can be met under certain special conditions:

- if the complete renovation of existing building stock is planned

- if we have an unrenovated building in single ownership or the approval of all co-owners
- with adequate (co-)financing of the project and incentives.

Complete advanced energy renovation can be made more difficult by:

- the strict protection conditions applying to buildings protected in accordance with regulations on the protection of cultural heritage
- a lack of knowledge and experience in the planning and implementation of more complex nearly zero-energy renovation projects.

## 3.1. Structure of the existing building stock

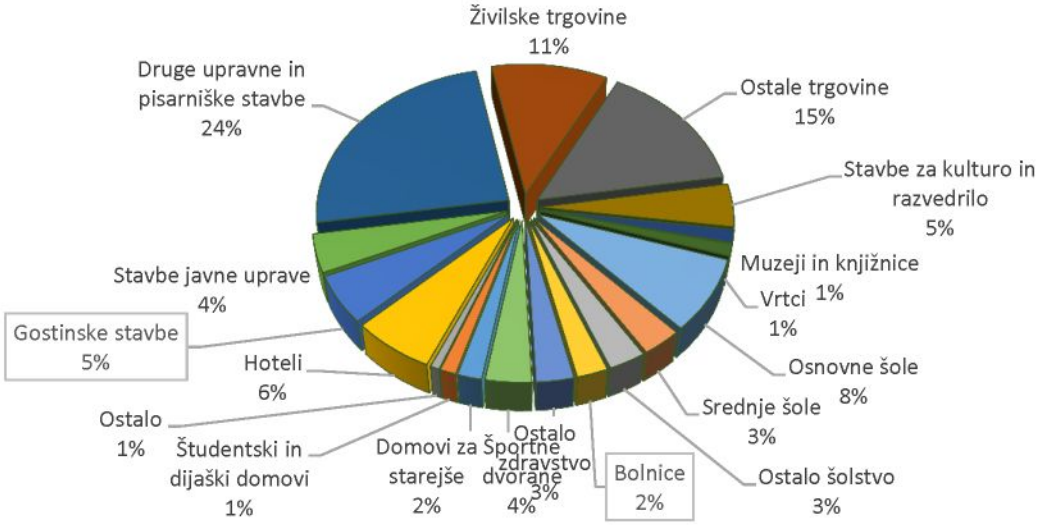
If we compare the useful floor area of the national building stock on the basis of the Property Register,[22] we find that, by purpose of use (CC-SI figures in Table 4), residential buildings, and among them single-family houses, predominate, while office buildings are the largest sub-group within non-residential buildings (Figure 15).

Table 4: Useful floor area by individual group under the CC-SI standard classification of non-residential buildings in Slovenia (Source: 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$^2$] |
|---|---|---|---|
| 121 | Hotels and similar buildings | | |
| 12111 | Hotels and similar short-stay accommodation buildings | | 1 567 |
| 12112 | Inns, restaurants and bars | | 1 312 |
| 12120 | Other short-stay accommodation buildings | | |
| 122 | Office buildings | | |
| 12201 | Public administration buildings | | 1 042 |
| 12202 | Banks, post offices, insurance companies | | 6 003 |
| 12203 | Buildings used as places of business, for clerical and administrative purposes, e.g. banks, post offices, insurance companies, etc. | | |
| 123 | Wholesale and retail trade buildings and buildings for service activities | | |
| 12301 | Wholesale and retail trade buildings | | 2 633 |
| 12302 | Market halls, exhibition grounds | | - |
| 12303 | Service stations | | - |
| 12304 | Buildings for service activities | | 3 647 |
| 126 | Buildings for public entertainment, education or hospital and institutional care | | |
| 12610 | Buildings for public entertainment | | 1 170 |
| 12620 | Museums and libraries | | 358 |
| 12630 | School, university and research buildings | Nursery schools | 319 |
| | | Primary schools | 1 998 |
| | | Secondary schools | 757 |
| | | Other education buildings | 706 |

[22] Property Register (REN), GURS, retrieved April 2014.

| | | | |
|---|---|---|---|
| 12640 | Hospitals and institutional care buildings | Hospitals | 591 |
| | | Other healthcare buildings | 713 |
| 12650 | Sports halls | | 871 |




Food shops 11%
Other shops 15%
Buildings for public entertainment 5%
Museums and libraries 1%
Nursery schools 1%
Primary schools 8%
Secondary schools 3%
Other education buildings 3%
Hospitals 2%
Other healthcare buildings 3%
Sports halls 4%
Retirement homes 2%
Student and pupil dormitories 1%
Other buildings 1%
Hotels 6%
Hotels and similar buildings 5%
Public administration buildings 4%
Other administrative and office buildings 24%

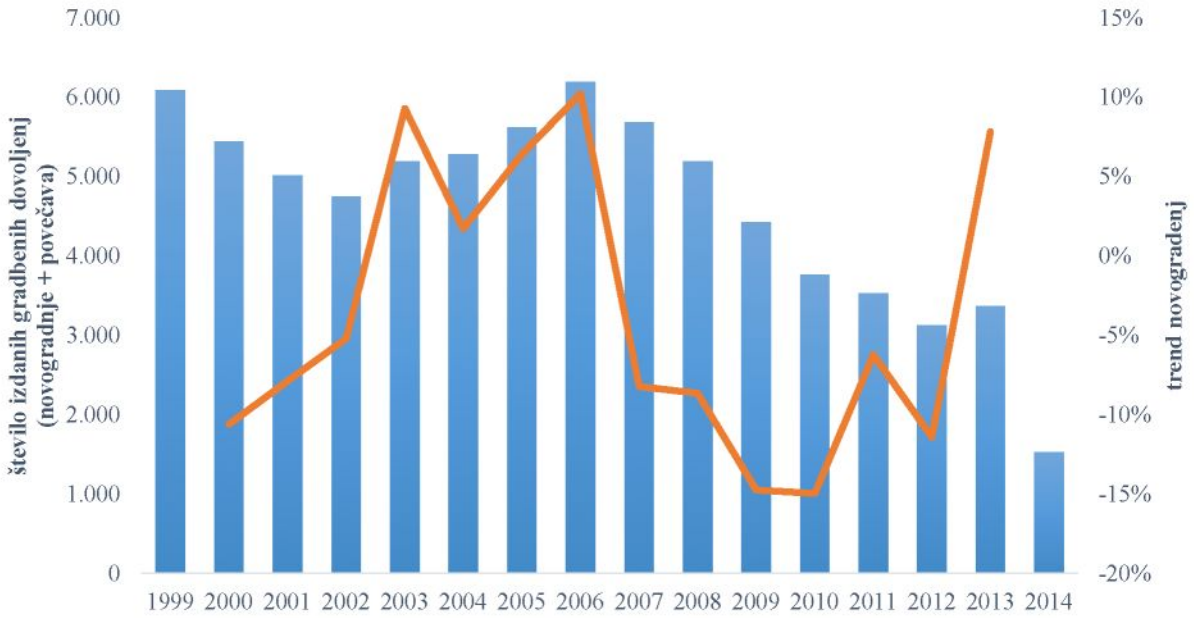
Figure 9: Useful floor area by individual group of the CC-SI standard classification of buildings in Slovenia.

### 3.2. Trend in relation to new buildings

Between 1999 and 2013, over 74 000 construction permits for new buildings and extensions were issued in Slovenia (Figure 10). The Statistical Office of the Republic of Slovenia records[23] the number of new-builds or the implementation of works leading to the construction of a new building or an extension/addition of another

[23] See: http://pxweb.stat.si/pxweb/Database/Ekonomsko/Ekonomsko.asp#19.

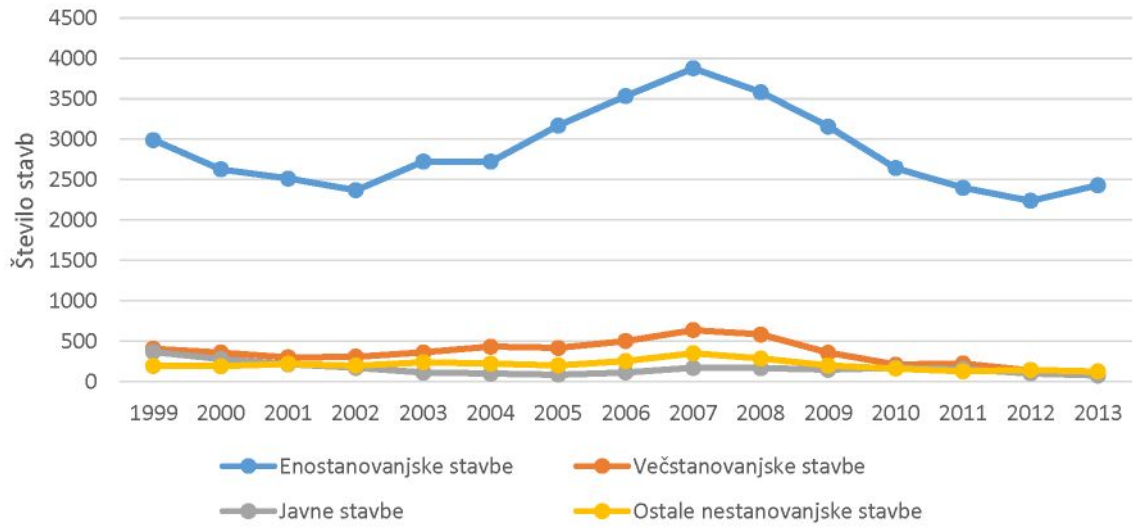
floor to an existing building, or the implementation of works that significantly changes the external appearance of a building. The trend in the number of building permits issued annually shows the effect of the property crisis, with a pronounced fall since 2006.




No of construction permits granted (new-builds and extensions)
Trend in relation to new buildings

Figure 10: No of construction permits granted for new-builds and building extensions, and the trend in relation to new buildings (Source: SURS).

The highest number of building permits was issued in 2006 – a little over 6 000 (Figure 10). From that year onwards, the total number of permits issued fell between 8 and 15% a year up to 2012. However, in 2013 there was a rise of 8% in the number of permits issued relative to 2012.




No of buildings
Single-family houses

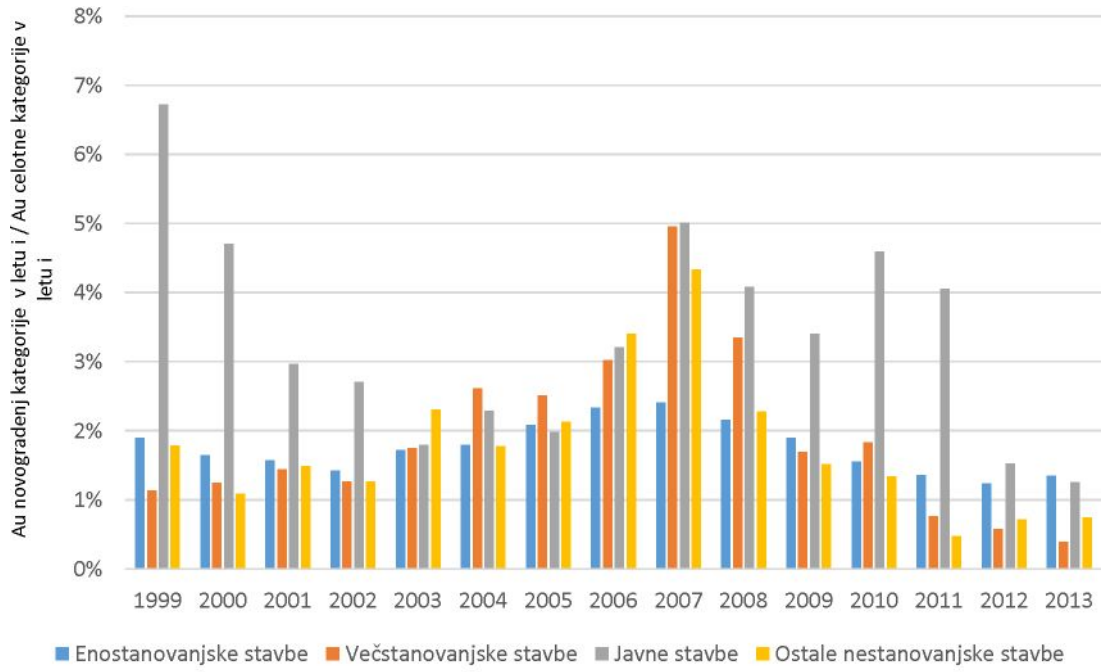
Public buildings
Multi-apartment buildings
Other non-residential buildings

Figure 11: Number of new buildings for which building permits were issued (Source: SURS).

An overview of the number of building permits for new buildings by building group shows that the biggest fall in the number of permits granted can be seen among multi-apartment buildings, with 40% fewer permits granted in 2010 and 2012 than last year. After 2007, an average of 15% fewer permits were granted in the housing sector, while in the service sector there was a 13% mean annual fall in the number of permits granted.

Table 5: Annual number of new buildings for which building permits were issued, by building group (Source: SURS).

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Single-family buildings** | 2 988 | 2 626 | 2 512 | 2 367 | 2 723 | 2 721 | 3 167 | 3 533 | 3 877 | 3 581 | 3 155 | 2 641 | 2 397 | 2 236 | 2 430 |
| **Multi-apartment buildings** | 406 | 358 | 298 | 306 | 360 | 432 | 416 | 501 | 636 | 583 | 357 | 210 | 224 | 135 | 112 |
| **Public buildings** | 366 | 278 | 214 | 169 | 110 | 98 | 84 | 112 | 169 | 165 | 146 | 171 | 156 | 101 | 75 |
| **Other non-residential buildings** | 193 | 190 | 220 | 196 | 240 | 221 | 200 | 253 | 351 | 285 | 198 | 159 | 127 | 143 | 125 |



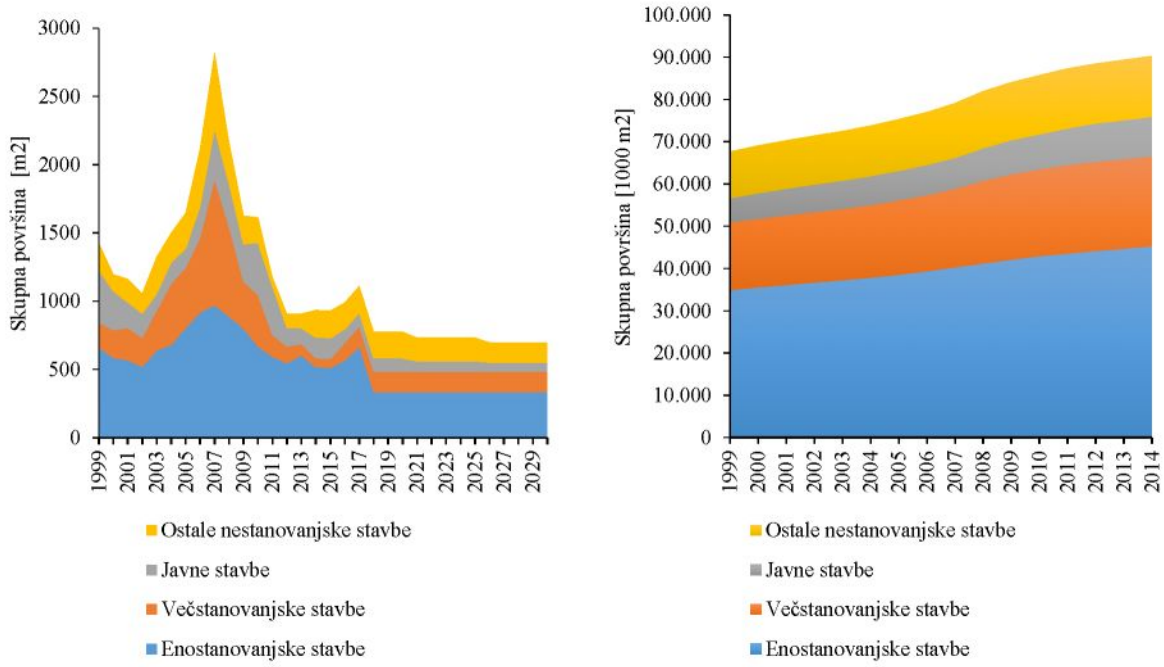

Au of new buildings of category in year i / Au of entire category in year i
Single-family houses
Multi-apartment buildings
Public buildings
Other non-residential buildings

Figure 12: New buildings 1999–2013 for which building permits were issued (source: SURS).

Figure 12 shows the growth and fall in the number of new buildings in relation to individual building type in a specific calendar year. There has been a noticeably sharp fall in the construction of multi-apartment buildings and of other non-residential buildings since 2007, while the trend in construction of single-family houses and public buildings has not seen such a marked decline.

### 3.3. Projected development of building stock

Based on the permits granted for the construction of new buildings from 1999 and the prognoses derived from the *Long-term Energy Balance of Slovenia up to 2030 and the Expert Foundations for Determining the National Energy Targets*, it is envisaged that the total cumulative floor area of new buildings will fall (Figure 13) by 2030. The floor area of finished apartments has reduced since 2008 on account of the economic crisis; this is particularly evident in multi-apartment buildings. The projection[24] for finished apartments is based on an estimate of the shortfall in the number of apartments (just over 31 000 housing units in 2012). Owing to the growth in the number of households, the shortfall in the number of apartments will increase to just over 69 000 apartments by 2030.




Floor area [$m^2$]
Other non-residential buildings
Public buildings
Multi-apartment buildings
Single-family houses

Total floor area [1 000 $m^2$]
Other non-residential buildings
Public buildings Multi-apartment buildings
Single-family houses

Figure 13: Total floor area of new buildings of individual building stock categories – trends and projection [Source: SORS IJS-CEU] (left) and floor area of building stock – trends and projection (Source: SORS. REN 2014) (right).

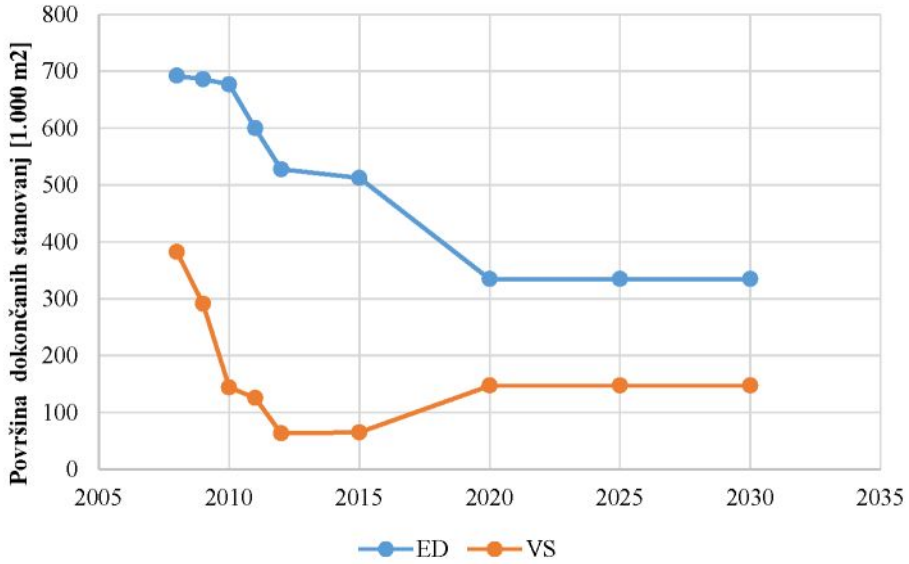
[24] Long-Term Energy Balances up to 2030 and the Expert Foundations for Determining National Energy Targets, IJS, 2014.

The total floor area of the building stock (Figure 13) is increasing on account of new apartments and public sector buildings. Building stock in Slovenia will, according to the prognoses for 2030, comprise 50% single-family houses, 23% multi-apartment buildings, 10% public buildings and 17% other non-residential buildings.

## 3.4. Residential buildings and the plan to increase the number of nZEB by 2020

### 3.4.1. New residential buildings – nearly zero-energy new buildings

The floor area of finished apartments in single-family houses and multi-apartment buildings has reduced since the end of 2008 as a result of the economic crisis; this applies in particular to apartments in multi-apartment buildings. The projection[25] for finished apartments by 2030, which forms the basis for an estimate of the share of nearly zero-energy new buildings in the context of the scope of residential construction, is based on a national estimate of the shortfall in housing, which in 2012 amounted to just over 31 000 apartments and will increase to 69 000 by 2030 on account of a growth in the number of households. The total floor area of apartments is increasing as a result of the construction of new housing. Demolition applies to a mere 0.05% of the floor area of the building stock.



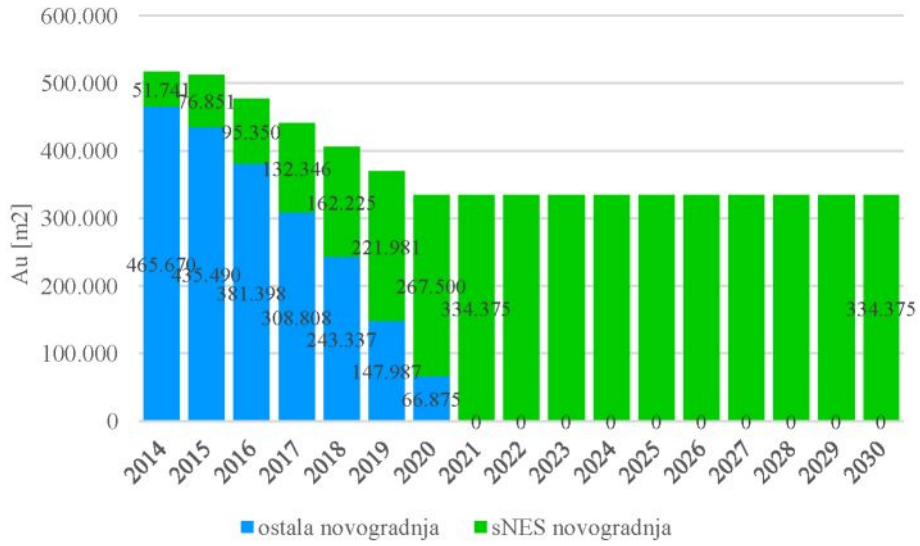

Floor area of finished apartments [1 000 m2]

Figure 14: Projection for the floor area of finished new apartments separated into single-family (SF) and multi-apartment (MA) buildings by 2030 (source: AN URE 2020).

Figures 15 and 16 below give a projection of the trend in the construction of nearly zero-energy buildings for new single-family houses and new multi-apartment buildings. Under the Recast EPBD, Member States must ensure that all new buildings are nearly zero-energy buildings by 31 December 2020, meaning that the share of new buildings that meet the requirements applying to a nearly zero-energy building must be 100% from 1 January 2021. We will arrive at this share gradually. It will be a relatively low share of the housing stock at the outset and will be based on experiences derived from the construction of passive and low-energy houses with a high share of RES. It is envisaged that the share of nearly zero-energy new multi-apartment buildings will rise significantly only as the deadline set by the Directive for enforcement of the requirement approaches. The key

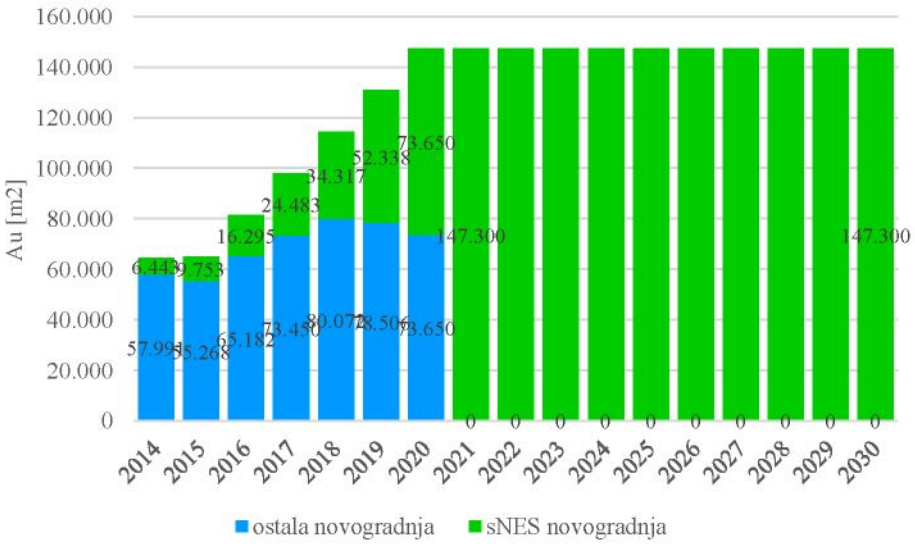
[25] AN URE 2020, IJS, June 2014.

instruments are: incentives in the form of grants and returnable funds, the provision of information to investors (energy efficiency and RES technologies, examples of good practice derived from buildings constructed, open days for nearly zero-energy buildings), advisory services, and the training of engineering and implementation staff.




Au [m2]
other new buildings
nZEB new buildings

Figure 15: Projection for the construction of new single-family houses, with an estimate of the potential for the gradual introduction of construction of nearly zero-energy single-family houses




Au [m2]
other new buildings
nZEB new buildings

Figure 16: Projection for the construction of new multi-apartment buildings, with an estimate of the potential for the gradual introduction of construction of nearly zero-energy multi-apartment buildings.

The construction of 267 500 m2 of new nearly zero-energy single-family houses is envisaged by 2020 (an estimated 76 851 m2 by 2015), alongside the construction of 147 300 m2 of new nearly zero-energy multi-apartment buildings by 2020 (9 753 m2 by 2015).

### 3.4.2. Existing residential buildings – nearly zero-energy renovation

In order to determine the potentials of nearly zero-energy renovation, we have broken down the existing housing stock in the (REN 2014) by year of construction into age classes, taken from the IEE Tabula project.[26] The number of buildings, number of apartments and the floor area was then recorded, by purpose of use or by individual CC-SI building classification (Table 6). Some 89% of the housing stock comprises single-family houses, accounting for 67% of the total apartment floor area.

Table 6: State of residential building stock (Property Register)

| Building type (period of construction) | No of buildings | No of apartments | Au [1 000 $m^2$] |
|---|---|---|---|
| Single-family houses | | | |
| CC-SI111 (up to 1945) | 118 323 | 118 323 | 9 348 |
| CC-SI 111 (1946–1970) | 96 378 | 96 378 | 8 857 |
| CC-SI 111 (1971–1980) | 70 128 | 70 128 | 7 165 |
| CC-SI 111 (1981–2002) | 132 176 | 132 176 | 13 387 |
| CC-SI 111 (2003–2008) | 21 395 | 21 395 | 2 466 |
| CC-SI 111 (2009–) | 14 055 | 14 055 | 1 658 |
| Multi-apartment buildings | | | |
| Two-family houses | | | |
| CC-SI 1121 (up to 1945) | 8 644 | 16 665 | 1 214 |
| CC-SI 1121 (1946–1970) | 8 215 | 15 756 | 1 186 |
| CC-SI 1121 (1971–1980) | 5 866 | 11 242 | 925 |
| CC-SI 1121 (1981–2002) | 4 835 | 9 157 | 790 |
| CC-SI 1121 (2003–2008) | 679 | 1 251 | 109 |
| CC-SI 1121 (2009–) | 444 | 879 | 61 |
| Buildings with three or more apartments | | | |
| CC-SI 1122 (up to 1945) | 8 101 | 46 732 | 2 685 |
| CC-SI 1122 (1946–1970) | 7 009 | 90 470 | 4 527 |
| CC-SI 1122 (1971–1980) | 3 559 | 78 075 | 4 017 |
| CC-SI 1122 (1981–2002) | 4 071 | 70 932 | 3 760 |
| CC-SI 1122 (2003–2008) | 1 458 | 22 102 | 1 302 |
| CC-SI 1122 (2009–) | 673 | 11 775 | 710 |

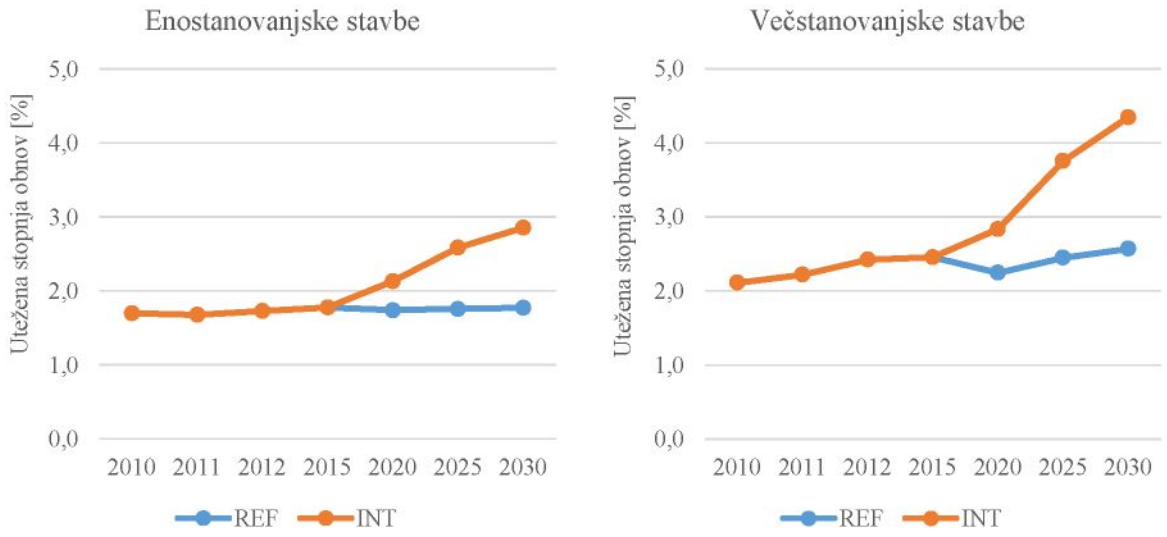
[26] IEE Tabula is a project under the Intelligent Energy Europe programme. It has produced a standard European building typology, http://episcope.eu/building-typology/.


No of buildings
Multi-apartment buildings 11%
Single-family houses 89%

Total floor area of apartments
Multi-apartment buildings 33%
Single-family houses 67%

Figure 17: Proportion of the total number and floor area of single-family and multi-apartment buildings according to data from the Property Register.

The weighted renovation rate (reference and intensive scenarios) under the *Long-Term Energy Balances up to 2030 and the Expert Foundations for Determining National Energy Targets* was taken for the projection of the renovation of the existing housing stock. Under this scenario, 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 18 shows the projection for the renovation of single-family houses and multi-apartment buildings up to 2030 for both scenarios, including nearly zero-energy renovation.

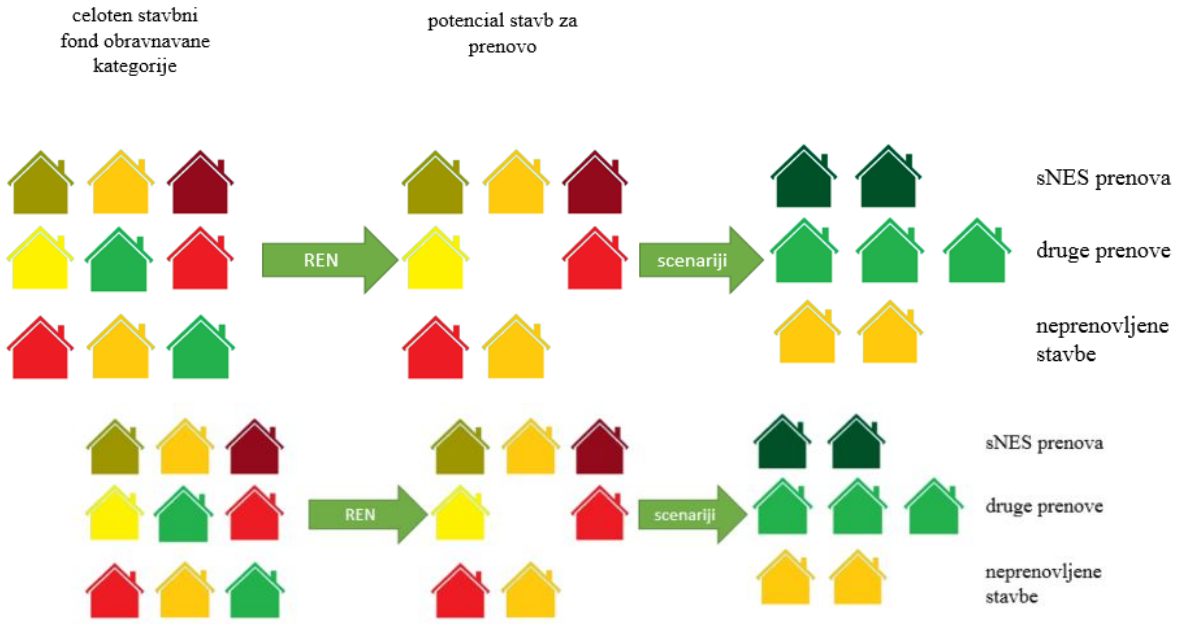



Single-family houses
Weighted level for renovation [%]

Multi-apartment buildings
Weighted level for renovation [%]

Figure 18: Weighted level for renovation in the period for single-family and multi-apartment buildings in the reference (REF) and intensive (INT) strategy.

The starting point for housing stock was taken from the Property Register, which contains the renovation rate at the level of the thermal envelope of a building. It states whether an individual building element (façade, windows, roof) has been renovated and when it was renovated. The potential of buildings for complete renovation comprises buildings where at least two elements of the building's thermal envelope (walls, windows, roof) have already reached the end of their lifecycle and therefore require replacement. This potential will increase in the period up to 2030 because each year new buildings requiring complete renovation will join the cumulative potential; on the other hand, according to the envisaged scenario of renovation, the cumulative share of buildings that meet the conditions for complete energy renovation will fall as work is carried out.




Entire building stock of the category in question
Potential for renovation of buildings
nZEB renovation
other renovations
unrenovated buildings

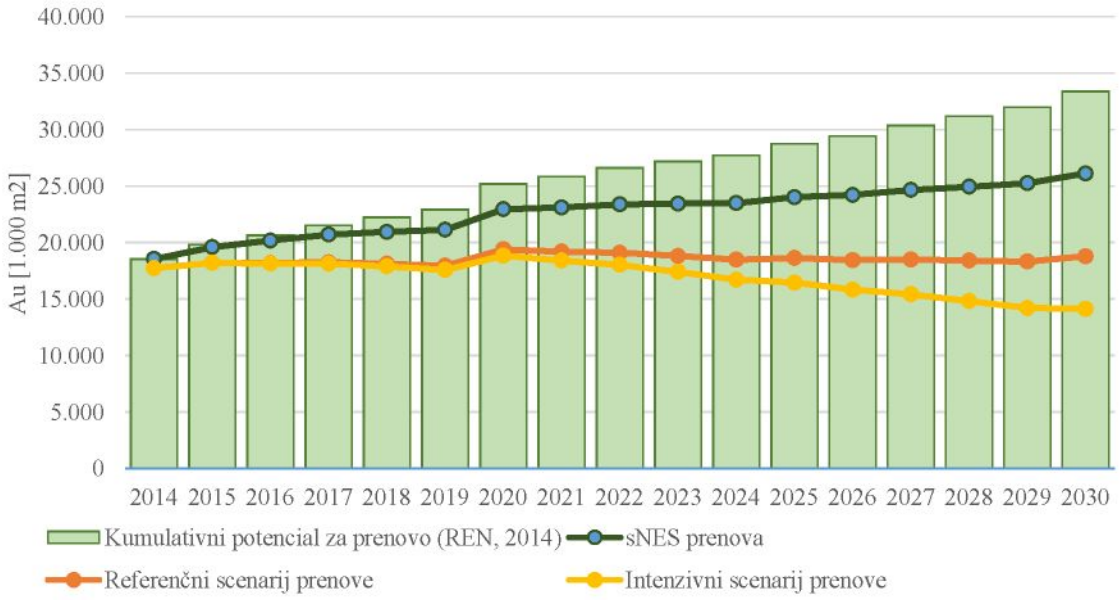
Figure 19: Schematic illustration.

Complete renovation is divided into renovation following which the building meets the requirements of a nearly zero-energy building (nZEB renovation) and other renovation (partial complete renovation). Renovation restrictions are taken into account when determining the potential share of nearly zero-energy renovation; these restrictions include protection of buildings protected under cultural heritage protection regulations, 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 buildings protected under cultural heritage protection regulations).

The share of renovation after which a building may be treated as nearly zero-energy will be small in the initial years. It is expected that renovation under the criteria of nearly zero-energy buildings in the residential building stock will lag behind the renovation of public buildings. The obligations relating to zero-energy new buildings for public buildings begin to take effect on 1 January 2019, and model examples will set the pattern for residential buildings in the transition period. It is therefore envisaged that the share of renovation following which a building meets the requirements of a nearly zero-energy building during the renovation period will gradually increase and comprise the majority of all renovation under the weighted reference scenario of renovation up to 2030.

The nearly zero-energy renovation of 2 257 000 $m^2$ of single-family houses (Figure 20), which are among the buildings requiring complete energy renovation, is envisaged by 2020 (a figure of 232 000 $m^2$ is estimated by 2015).

Figure 20 shows the potential for the complete renovation of single-family houses, where buildings requiring complete renovation constitute the cumulative potential. Under the envisaged scenario for nearly zero-energy renovation (nZEB renovation), over 45 000 single-family houses will be renovated by 2030 (Figure 20 shows the floor area above the 'nZEB renovation' curve). All other renovation is shown as floor area between the 'nZEB renovation' curve and the renovation scenario curve (reference, intensive). The reference scenario envisages the renovation of 7 326 000 $m^2$ (intensive scenario 11 993 000 $m^2$), which means 63% of the renovated floor area or 29 169 buildings. The floor area below the renovation scenario curves represents the unexploited potential of building renovation.

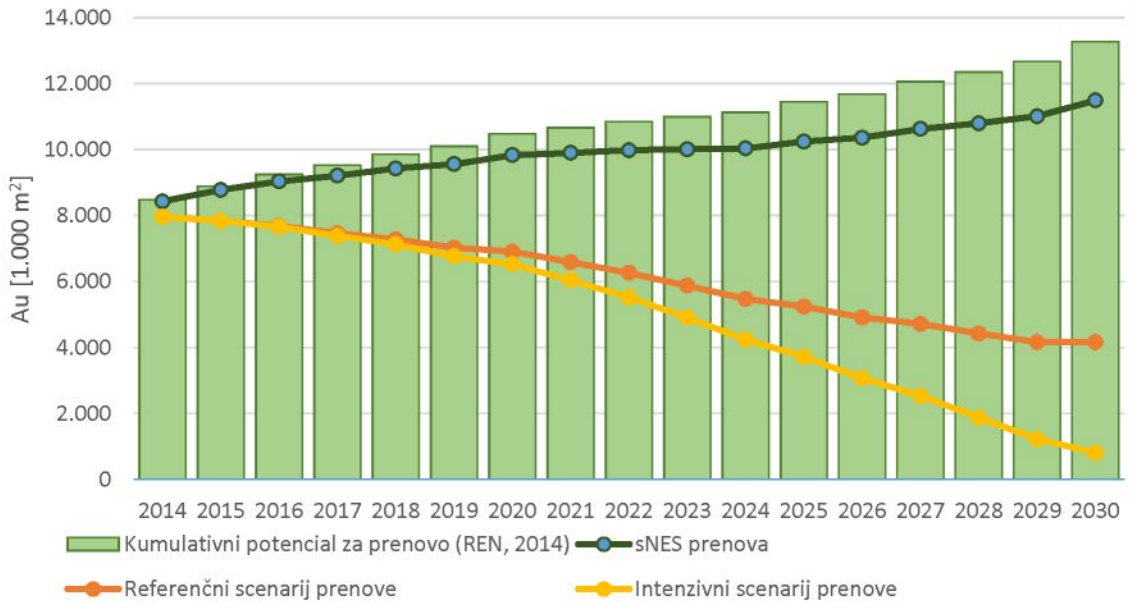



Au [1 000 m2]
Cumulative potential for renovation (REN, 2014)
nZEB renovation
Reference scenario for renovation
Intensive scenario for renovation

Figure 20: Potential for the complete renovation of single-family houses, with an estimate of the scope of nearly zero-energy renovation of existing single-family houses.

The socially acceptable and financially viable potential for the complete renovation of buildings is slightly lower among multi-apartment buildings (Figure 21) than among single-family houses, the considerable technical potential notwithstanding. In the same way, the nearly zero-energy renovation of 649 000 m2 of multi-apartment buildings, which are among the buildings requiring complete energy renovation, is envisaged by 2020 (a figure of 107 000 $m^2$ is estimated by 2015).

Figure 21 shows the potential for the complete renovation of multi-apartment buildings, where buildings requiring complete renovation constitute the cumulative potential. Under the envisaged scenario for nearly zero-energy renovation (nZEB renovation), over 1 100 multi-apartment buildings will be renovated by 2030 (Figure 21 shows the floor area above the 'nZEB renovation' curve). All other renovation is shown as floor area between the 'nZEB renovation' curve and the renovation scenario curve (reference, intensive). The reference scenario envisages the renovation of 7 311 000 $m^2$ (intensive scenario 10 683 000 $m^2$), which means 46% of the renovated floor area or 2 109 buildings. The floor area below the curve represents the unexploited potential of building renovation.




Au [1 000 m2]
Cumulative potential for renovation (REN, 2014)
nZEB renovation
Reference scenario for renovation
Intensive scenario for renovation

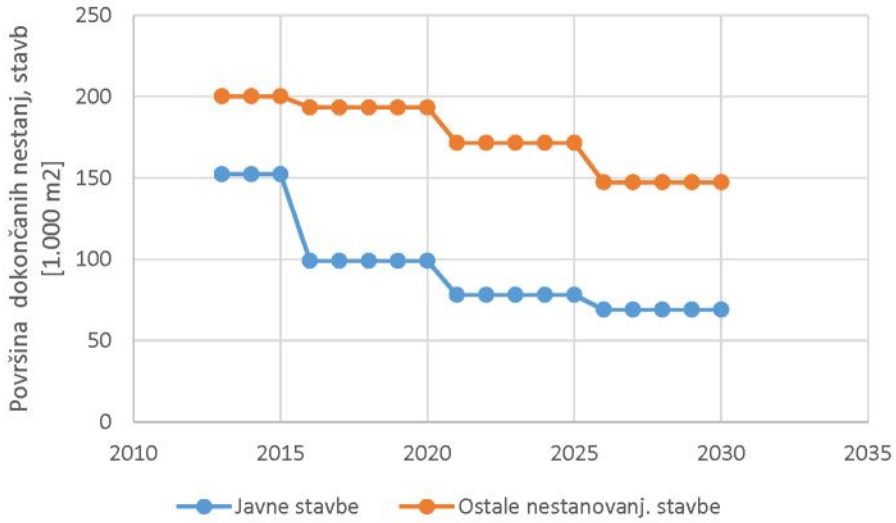
Figure 21: Potential for the complete renovation of multi-apartment buildings, with an estimate of the scope of nearly zero-energy renovation of existing multi-apartment buildings.

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 returnable sources of funds for the financing of nearly zero-energy renovations (dedicated funds and financing from international financial institutions), the provision of information to building owners and managers, demonstration projects, a link to the support scheme for the supply of heat from RES – for optimisation of the operation of energy systems within the framework of the financing 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 buildings protected under the regulations on cultural heritage protection, with an emphasis on nearly zero-energy technologies, support for achieving the energy renovation targets within housing legislation, etc.

## 3.5. Non-residential buildings and the plan to increase the number of nearly zero-energy buildings by 2020

### 3.5.1. New non-residential buildings – nearly zero-energy new buildings

Under the AN URE 2020 and the *Long-Term Energy Balances of Slovenia up to 2030 and the Expert Foundations for Determining National Energy Targets*, the floor area of new finished buildings in the service sector will fall over the years (Figure 22).

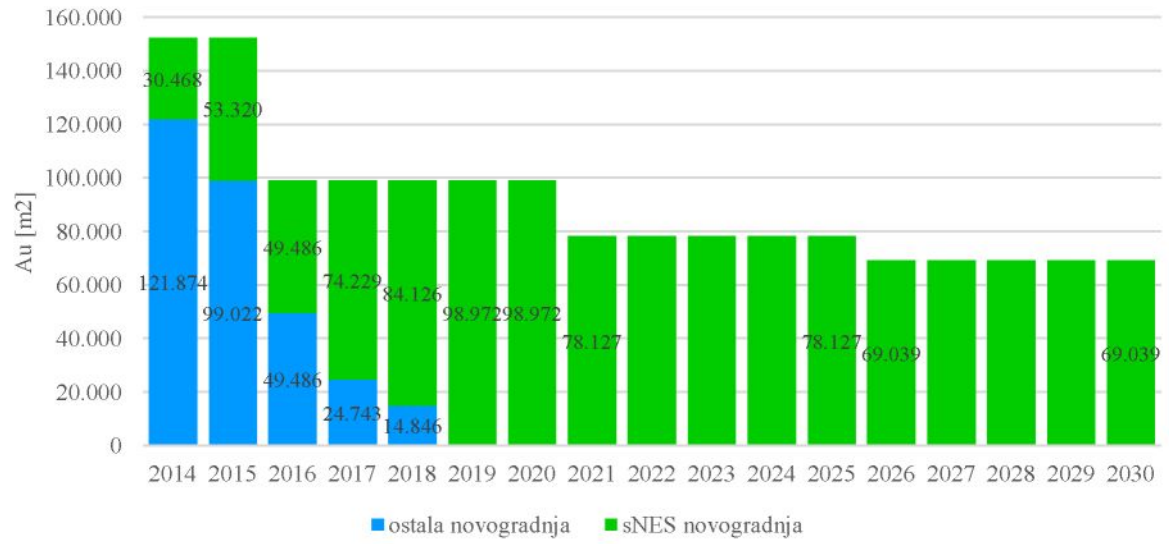



Floor area of finished non-residential buildings [1 000 m2]
Public buildings
Other non-residential buildings.

Figure 22: Floor area of finished non-residential buildings by 2030 (AN URE 2020)

Under the Recast EPBD, Member States must ensure that all new buildings are nearly zero-energy buildings by 31 December 2018, meaning that the share of new buildings that meet the requirements applying to a nearly zero-energy building must be 100% from 1 January 2019. Under Article 5 of the Energy Efficiency Directive (EED, 2012/27/EU), public buildings will act as a model for other building stock. This share of nearly zero-energy non-residential buildings will increase uniformly until the deadline for public and other non-residential buildings.

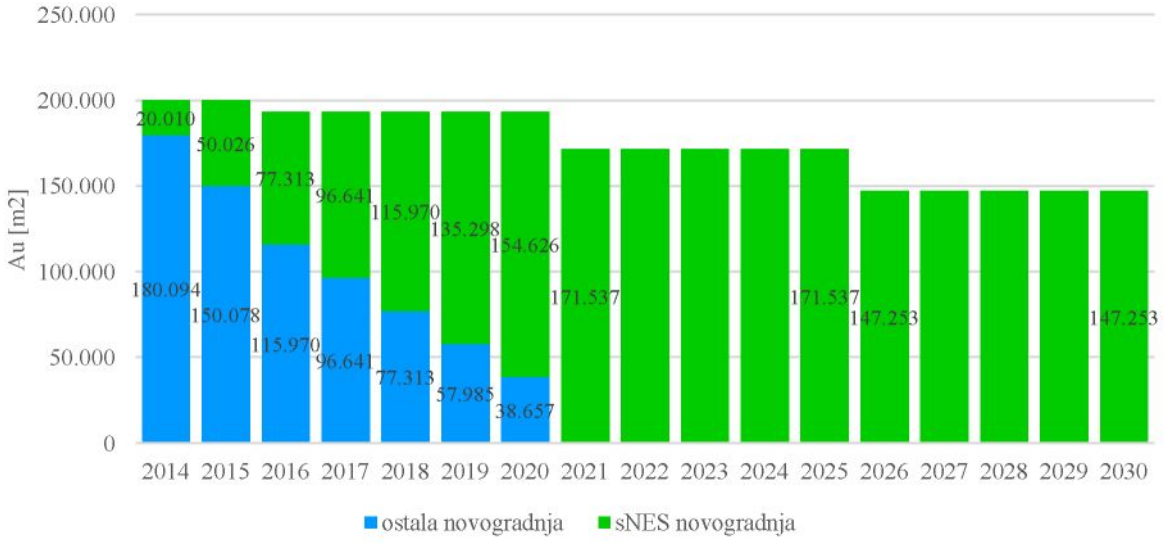
The instruments required for ensuring the nearly zero-energy new construction of non-residential buildings are: financial incentives in the form of grants and returnable funds (for the public sector chiefly cohesion funds), international sources of financing, the training of contracting authorities, project designers, contractors and users of nearly zero-energy buildings, the upgrading of regulations and the introduction of certification for sustainable buildings, the promotion of energy efficiency within spatial planning, the development of solutions for the renovation of buildings protected under the regulations on cultural heritage protection and for other 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 bases for target indicators for energy efficiency and RES in the public sector, the rerouting of some financial incentives to demonstration projects (cohesion funds), the monitoring of the indicators of achievement, and promotion.




Au [m2]
other new buildings
nZEB new buildings

Figure 23: projection for the construction of new public buildings, with an estimate of the potential for the gradual introduction of new nearly zero-energy public buildings.

The construction of 84 126 $m^2$ of new nearly zero-energy public buildings is envisaged by 2018 (an estimated 53 320 $m^2$ by 2015), alongside the construction of 115 970 $m^2$ of new nearly zero-energy non-residential buildings by 2018 (50 026 $m^2$ by 2015).




Au [m2]
other new buildings
nZEB new buildings

Figure 24: Projection for other new non-residential buildings, with an estimate of the potential for the gradual introduction of new nearly zero-energy non-residential buildings.

### 3.5.2. Existing non-residential buildings – nearly zero-energy renovation

The cumulative potential of buildings for renovation comprises buildings where at least two elements of the building's thermal envelope (walls, windows, roof) have already reached the end of their lifecycle and require replacement. This potential will increase in the period up to 2030, with the cumulative share of buildings not in the renovation plan under the envisaged renovation scenario falling. The potential was, in accordance with the procedure described, determined within the framework of data on buildings in REN 2014.

Complete renovation is divided into renovation following which non-residential buildings meet the requirements of a nearly zero-energy building during the period of renovation (AN nZEB) and other renovation (Au renovation). Renovation restrictions are taken into account when determining the scope of complete nearly zero-energy renovation, e.g. of buildings protected under cultural heritage protection regulations, architectural limitations, 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 buildings protected under cultural heritage protection regulations), disorganised property registers for buildings owned and occupied by the core public sector (obligatory 3% renovation annually), 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 examples, good practice and demonstration projects from a technical standpoint as well as from the standpoint of the implementation of (green) public procurement in this area.

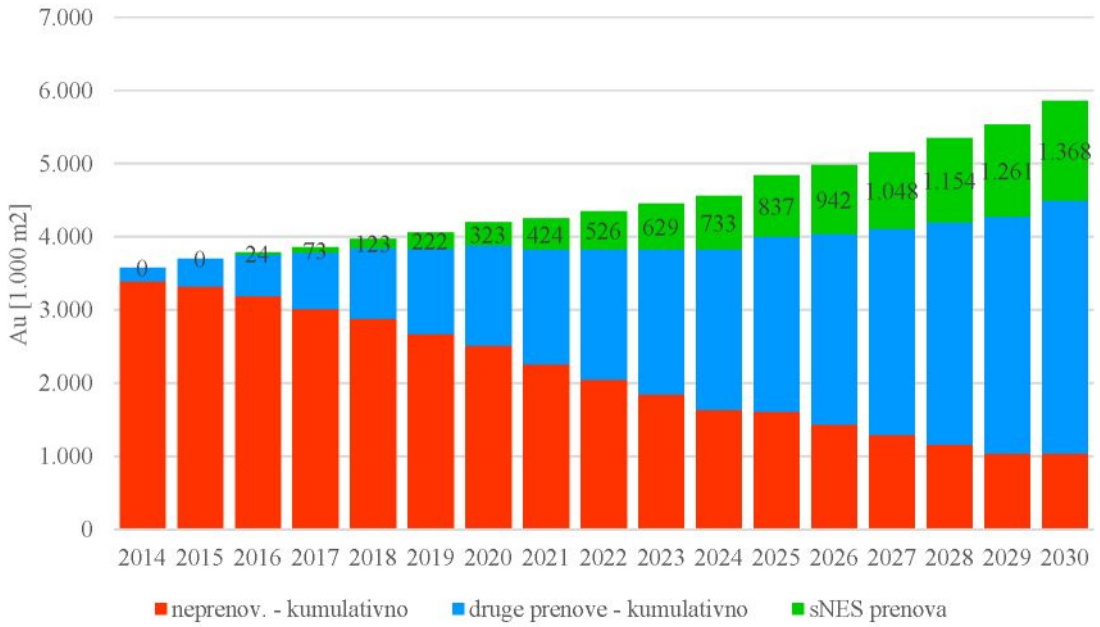
The prognoses for the nearly zero-energy renovation of existing non-residential buildings are based on three groups:

- public buildings
- other non-residential buildings
- public buildings owned and occupied by the core public sector (with a compulsory 3% renovation annually in accordance with Directive 2012/27/EU).[27]

The share of renovation after which a building may be treated as nearly zero-energy will be small at the outset. It is expected that renovation under the criteria of nearly zero-energy buildings will follow the model, i.e. the renovation of public buildings owned and occupied by the core public sector, with a minor delay of course. It is envisaged that the share of renovation following which a building meets the requirements of a nearly zero-energy building during the renovation period will gradually increase and comprise the majority of all renovation by 2030.

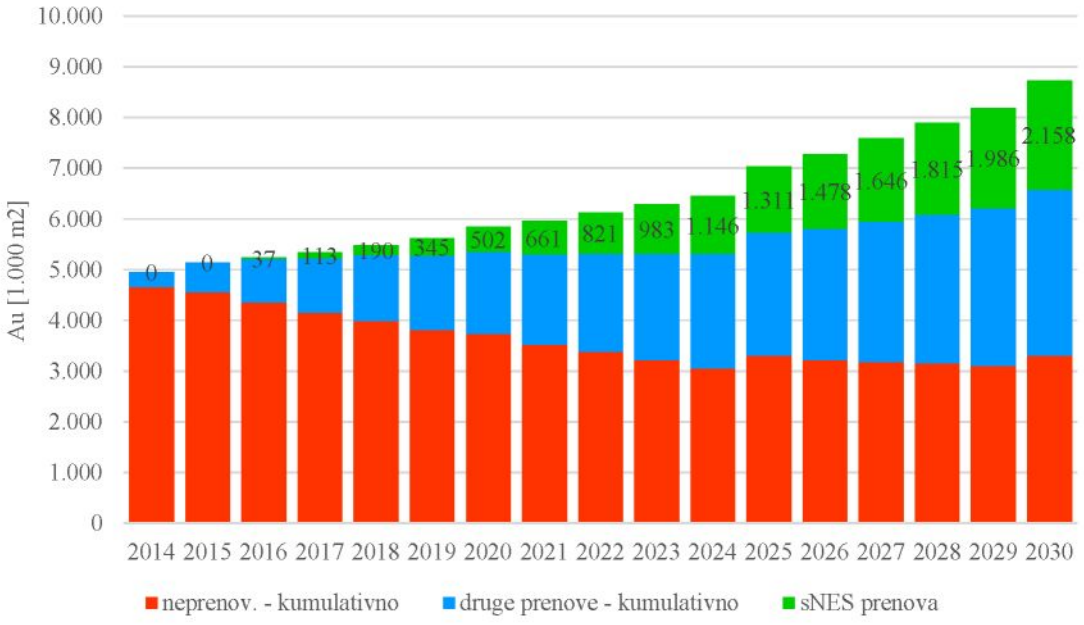
The nearly zero-energy renovation of 123 000 m2 of public buildings (Figure 25), which are among the buildings requiring complete energy renovation, is envisaged by 2020. The extent will be minimal by 2015, a conclusion based on interviews with responsible persons in the public sector. For other non-residential buildings (Figure 26), it is envisaged that 190 000 $m^2$ of buildings will be subject to nearly zero-energy renovation by 2018. Such renovation is not yet envisaged by 2015, with greater intensity expected from 2016 onwards.

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




Au [1 000 m2]
non-renovation – cumulative
other renovations – cumulative
nZEB renovation

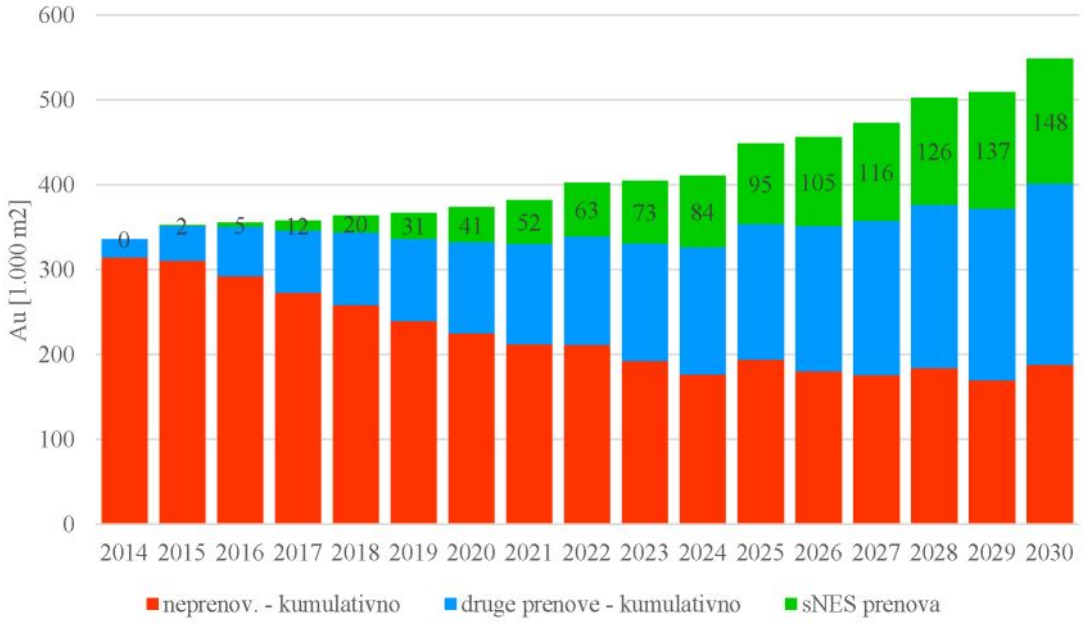
Figure 25: Potential for the complete renovation of public buildings, with an estimate of the scope of nearly zero-energy renovation of existing public buildings (excluding the 3% annual renovation of buildings owned and occupied by the core public sector).




Au [1 000 m2]
non-renovation – cumulative
other renovations – cumulative

nZEB renovation

Figure 26: Potential for the complete renovation of other non-residential buildings, with an estimate of the scope of nearly zero-energy renovation of existing other non-residential buildings.




Au [1 000 m2]
non-renovation – cumulative
other renovations – cumulative
nZEB renovation

Figure 27: Potential for the complete renovation of public buildings owned and occupied by the core public sector (3% under Directive 2012/27/EU), with an estimate of the scope of nearly zero-energy renovation.

Renovation of a total of 20 000 $m^2$ of public buildings owned or occupied by the core public sector (3% renovation annually) (Figure 27) is envisaged to take place by 2020 (2 000 $m^2$ by 2015). The column for an individual year shows the cumulative potential for renovation in relation to the age of the building and the work done on the building envelope. This potential will increase every year up to 2030 on account of the ageing of the building stock (as represented by the sum of the red, blue and green columns in Table 27). In reality, the potential of nZEB and other renovation (blue and green columns in Figure 27) will cumulatively fall (red column in Figure 27). The share of nearly zero-energy renovation is gradually increasing; however, due to a number of different restrictions (technical feasibility, buildings protected under regulations on cultural heritage protection), 100% nZEB renovation is not envisaged. These buildings have the potential to act as demonstration projects for nearly zero-energy renovation.

The instruments supporting the plan to increase the number of nearly zero-energy buildings in the public sector within the group of 3% of buildings owned and occupied by the core public sector and in the other non-residential sector are: financial incentives in the form of grants and returnable funds (for the public sector, particularly for buildings owned and occupied by the core public sector, these are chiefly cohesion funds), promotion of the introduction of energy performance contracting, private funds for the rest of the non-residential sector, financial resources from dedicated funds and the programmes of international financial institutions for the public and the rest of the non-residential sector, the rerouting of some financial incentives to promoting the provision of returnable funds, the training of contracting authorities, project designers, contractors and users of

nearly zero-energy buildings, the development of solutions for the renovation of buildings protected under the regulations on cultural heritage protection and for other 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 bases for target indicators for energy efficiency and RES in the public sector, the monitoring of the indicators of achievement, promotion, 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 potential for the complete renovation of public buildings is defined in the Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings.

## 4. Target for nearly zero-energy buildings by 2020

Tables 7 and 8 summarise the intermediate targets up to 2020 in the area of nearly zero-energy new buildings and renovation until full introduction of the provisions of Article 330 of the Energy Act (EZ-1).

Table 7: Intermediate targets for new nearly zero-energy buildings.

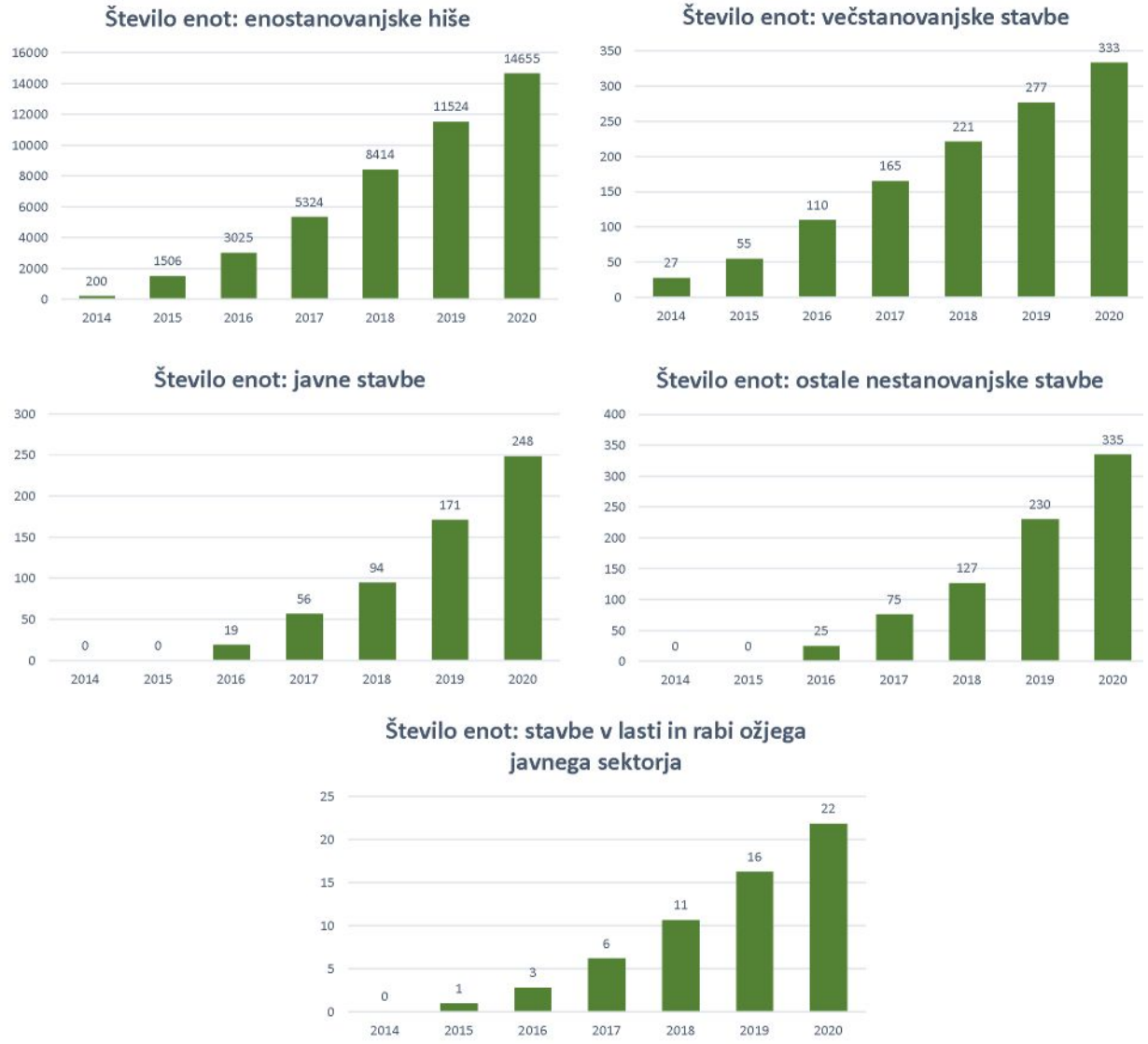
| **AN sNES intermediate targets – new buildings (cumulative)** | | **2015** | **2018** | **2020** |
|---|---|---|---|---|
| Single-family houses | $m^2$ | 76 850 | | 267 500 |
| Multi-apartment buildings | $m^2$ | 9 753 | | 73 650 |
| Public buildings | $m^2$ | 53 320 | 84 126 | |
| Other non-residential buildings | $m^2$ | 50 030 | 115 970 | |

Table 8: Intermediate targets for the nearly zero-energy renovation of buildings in the residential and service sector

| **AN sNES intermediate targets – complete renovation (cumulative)** | | **2015** | **2018** | **2020** |
|---|---|---|---|---|
| Single-family houses | $m^2$ | 241 000 | | 2 395 000 |
| Multi-apartment buildings | $m^2$ | 88 000 | | 596 000 |
| Public buildings | $m^2$ | | 123 000 | |
| Other non-residential buildings | $m^2$ | | 190 000 | |
| Public buildings owned and occupied by the core public sector (3% under the EED) | $m^2$ | 2 000 | 20 000 | |

Note: grey shading indicates that the setting of targets is not envisaged in the year in question.

Figure 28 shows the indicative number of buildings (cumulative) to be included in renovation under the AN sNES criteria. The average size of a building type from an individual group (REN 2014) was used for the estimate. This information is important because it shows the scope of the investments that will have to be prepared in the financial, technical and organisational senses within the business sector (other public buildings have not been evaluated in this simplified way because of the unclear typology).




Number of units: single-family houses
Number of units: multi-apartment buildings
Number of units: public buildings
Number of units: other non-residential buildings
Number of units: buildings owned and occupied by the core public sector

Figure 28: Rough estimate of the number of buildings (projects) planned for early nearly zero-energy renovation

# 5. Policies and financial and other measures

## 5.1. Policies and measures for the nearly zero-energy construction of new buildings and nearly zero-energy renovation

The Energy Efficiency Action Plan up to 2020 (AN URE 2020) provides a comprehensive overview of the instruments and programmes for the financing of the construction of energy-efficient buildings and the renovation of the existing building stock. Preparation is under way of the Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings (completion planned in June 2015). The points of departure are set out in two strategic documents: the Operational Programme to Reduce Greenhouse Gas Emissions by 2020 with the Outlook to 2030 and the Operational Programme for the Implementation of European Cohesion Policy 2014–2020. They are based on and update previous documents (AN URE and the OP ROPI) and the measures in force.

*The points of departure and measures of these policies are as below:*

Buildings accounted for 34% of end-use energy in 2012 (1.6 million t, households 24%, buildings in the service sector, public and private, 10%). Nearly zero-energy buildings, within the context of new buildings as well as that of complete renovation, have a special position; this is because, on the one hand, they serve as a model for other projects and, on the other, make a significant contribution to energy-efficiency and the increased use of renewable energy sources in the building sector precisely through the transition to more environment-friendly energy sources.

The planning documents presented in the introduction consistently emphasise that, owing to the ambitious targets in the area of energy efficiency (AN URE 2020) as well as the long-term vision regarding the reduction of emissions from buildings to almost zero by 2050, a situation must be established in the area of buildings so that energy needs are small and are covered as a matter of priority by renewable energy sources.[28] Investments in this sector must therefore be accelerated considerably as a matter of urgency.

The measure requires a large injection of funds; however, it is an area capable of attracting large investment capital from funds and other dedicated sources provided by international financial institutions, as well as private financing sources. As such, it is also important as a measure for rapid economic growth and a way out of the economic and financial crisis. Measures in this sector have considerable synergetic and multiplier effects, and strengthen economic competitiveness and employment in the long term as well. This involves the implementation or promotion of economically justified measures, as well as the implementation of more complex measures with demonstration effect elements and of incentives in the area of technological development and the use of advanced technologies in the area of energy efficiency and renewable energy sources, often with a relatively long payback period and a long lifecycle of measures.

The nearly zero-energy renovation of buildings, as well as the construction of nearly zero-energy buildings (as a model and demonstration), represent, for the Slovenian economy:

- a contribution to meeting environmental commitments;
- a contribution to achieving energy efficiency;
- greater use of renewable energy sources;
- a model for promoting investments;
- a challenge for green public procurement;
- the promotion of development and innovation;
- incentives to improve providers' qualifications and employability;
- initiation of an investment cycle and the strengthening of the economy/construction, with a range of multiplier effects.

The existing measures and those already adopted do not suffice to achieve the targets of the climate energy package and do not activate all the potentials for growth and development in this area. The range of measures is defined in the AN URE and AN OVE documents. New measures are being defined as part of the Operational Programme for the Implementation of European Cohesion Policy 2014−2020. Supplements (and the necessary

[28] OP TGP 2020 with the Outlook to 2030, IJS, December 2014.

upgrading thereof) to the existing measures for achieving the ambitious targets by 2020 are proposed in the Operational Programme to Reduce Greenhouse Gas Emissions by 2020 with the Outlook to 2030. The objective is to introduce a number of new instruments so as to promote increased building renovation with lower costs to the public purse. The activities will be focused on opening up possibilities for financing from private sources, encouraging the provision of dedicated returnable funds, and promoting energy contracting instruments and green loans. Activities will also be directed towards acquiring dedicated grants from international institutions. A number of instruments which have already been introduced and which have not yet been directed towards reducing greenhouse gas emissions and achieving energy savings will also need to be directed towards achieving these targets.

The key new features regarding the measures already adopted are:

- the upgrading of regulations on the energy performance of buildings so as to encourage energy renovation (they are currently focused on new buildings);
- the provision of returnable funds, financing of schemes, particularly from dedicated funds and programmes of international financial institutions for the public and housing sector, and the directing of part of the incentives to promoting the provision of grants.

Some instruments that have been adopted have not yet come into force or the funds for their implementation have not yet been provided. Activities will be strengthened so as to compensate for the shortfall in the implementation of measures from the AN URE 2020 and AN OVE programmes and ensure the provision of funds:

- directing of part of the financial incentives to introducing energy performance contracting; this measure is planned within the framework of the 'Sustainable consumption and generation of electricity, and smart grids' priority of the Operational Programme for the Implementation of European Cohesion Policy 2014−2020;
- establishment of a support scheme for the supply of heat from RES; this measure is confirmed in the EZ-1, with implementing regulations also being drawn up;
- directing of part of the financial incentives to demonstration projects; this measure is planned within the framework of the 'Sustainable consumption and generation of electricity, and smart grids' priority of the Operational Programme for the Implementation of European Cohesion Policy 2014−2020;
- 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 with financing from energy performance contracting.

The necessary funds for the financial incentives in the 2014–2020 period will have to be provided for new activities and the continuation of activities already planned. Funds will be provided and activities carried out for:

- the upgrading of financial aid for vulnerable groups of people with assistance in the form of social work;
- the development of solutions for the renovation of buildings protected under the regulations on cultural heritage protection and for other special groups of buildings; the measure will be designed in detail during the phases of preparation of the *Long-Term Strategy for Mobilising Investments in the Renovation of the National Building Stock of Public and Private Residential and Commercial Buildings*:
- support for the energy renovation of buildings with the integration of energy efficiency targets (with an emphasis on nearly zero-energy buildings) and of support measures for the energy renovation of buildings into housing legislation (particularly with regard to decision-making on renovation and the financing of renovation in multi-apartment buildings) and into other housing policy measures;
- the further financing of the energy renovation of buildings in the public sector to the level of nearly zero-energy buildings.

The following supplements to measures will be drawn up in relation to new buildings:

- the upgrading of regulations and the certification of sustainable buildings in support of the promotion of the early construction of nearly zero-energy buildings;

- the promotion of energy efficiency and the use of renewable energy sources in buildings and nearby within the context of spatial planning.

## 5.2. Placing of nearly zero-energy buildings within the set of existing measures and instruments

Below is a list of existing and new measures and instruments that affect the area of buildings and that comply with the targets in force in relation to energy efficiency, the use of renewable sources (AN OVE 2020) and climate (OP TGP 2020–2030); the current comprehensive versions of these measures and instruments arelaid down in the draft AN URE 2020 (of April 2015).

New nearly zero-energy construction and renovation represent a substantive upgrading of activities already planned within measures relating to the energy renovation of building stock, the tightening of regulations for the construction of new buildings, and the setting of criteria for the activities that the public sector, as the leading sector in the area of energy-efficiency, is obliged to carry out.

The list of measures below (Tables 9, 10) is supplemented by activities for the early promotion of the introduction of nearly zero-energy buildings by 2015 (intermediate target) and by 2020, which is the deadline for full compliance with the provisions of Article 9 of the Recast EPBD.

Table 9: Selection of envisaged existing measures (as proposed by AN URE 2020) which at the same time constitute measures to increase the number of nearly zero-energy buildings (nZEB) by 2020

| Code | Instrument | New measure or upgrading of existing measures | Type of measure/Entity responsible | Target group |
|---|---|---|---|---|
| **V.I** | **Regulations on the energy performance of buildings Supplementing of the instrument** | OP TGP-2020/Supplementing of requirements for the introduction of nearly zero-energy buildings. Updating of regulations in relation to building renovation requirements. Updating of regulations in relation to reducing greenhouse gas emissions within the lifecycle.<br><br>***Link to nZEB:*** *Revision of PURES 2010 and its supplements with minimum technical requirements for nearly zero-energy buildings/definition of a nearly zero-energy building* | Regulation/Ministry responsible for spatial planning | All buildings |
| **H.I** | **Energy performance contracting** | OP TGP-2020/Preparation of acts for the public sector<br><br>OP EKP 2014–2020<br><br>***Link to nZEB****: acts for energy performance contracting and the nearly zero-energy renovation of the public sector* | Regulations/Ministry responsible for energy Financial incentives/Ministry responsible for energy | All buildings |
| **Additional measures AN URE** | **Energy efficiency within the framework of sustainable spatial planning** | AN URE 2, additional measures, AN OVE, Measure 22.<br><br>***Link to nZEB:*** *Ensuring greater use of renewable energy sources in nearly zero-energy buildings, particularly the use of renewable energy sources in buildings/location and nearby* | Regulations/Ministry responsible for spatial planning | |

| Code | Instrument | New measure or upgrading of existing measures | Type of measure/Entity responsible | Target group |
|---|---|---|---|---|
| **G.I** | **Financial incentives for energy-efficient renovation and the sustainable construction of residential buildings** | | | |
| | **Upgrading with instrument:** | | | |
| | • **Grant schemes** | OP TGP-2020/Eco Fund loan schemes and incentives to other providers of green loans for the residential sector. Financing of schemes, particularly from purpose-specific funds and programmes of international financial institutions. Link to incentives to introduce energy performance contracting. | Financial incentives/Ministry responsible for energy | Residential sector<br>Public sector |
| | • **Demonstration projects** | OP EKP 2014–2020/Pilot/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.<br>OP EKP 2014–2020/Energy renovation of buildings, with the involvement of housing cooperatives, to be implemented as part of integrated territorial investments (ITI) in selected urban areas. Support will also be aimed at management and at technical and organisational support for the renovation of multi-apartment buildings.<br>OP TGP-2020/Provision of funds for demonstration projects and acceleration of the measure.<br><br>***Link to nZEB:*** *nZEB demonstration project for new buildings, particularly in the public sector and nZEB for the renovation of existing buildings, application of innovative nZEB technologies* | OP TGP-2020/Provision of funds for demonstration projects and acceleration of implementation of the measure. | Residential sector |
| **G.2** | **Financial incentives for energy-efficient heating systems**<br><br>**Upgrading as for G.1 and:**<br><br>• **Support scheme for the generation of heat from RES** | AN URE<br><br>AN OVE, Measure 25.<br><br>***Link to nZEB:*** *nZEB buildings require incentives in relation to the use of heat from renewable energy sources, whether the heat from renewable energy sources is generated in the building or nearby, or from a district heating system using e.g. wood biomass* | Financial incentives/Ministry responsible for energy | |
| **G.5** | **Citizens' energy advice network** | AN URE<br><br>***Link to nZEB:*** *ENSVET is crucial* | Advice/Eco Fund | Residential buildings generally and special groups: multi-apartment buildings, vulnerable |

| Code | Instrument | New measure or upgrading of existing measures | Type of measure/Entity responsible | Target group |
|---|---|---|---|---|
| | **Upgrading of the instrument with elements that support Measure G.3** | *for providing information to and raising the awareness of target groups regarding nZEB* | | households |
| **J.1** | **Green public procurement** | AN URE<br><br>***Link to nZEB**: green public procurement has to be supplemented in the legal bases by technical criteria for nZEB in the design and implementation of works* | MF | |
| **J.2** | **Financial incentives for the energy-efficient renovation and sustainable construction of buildings in the public sector**<br><br>**Upgrading of the instrument with elements:** | AN URE<br><br>***Link to nZEB**: key instrument for the early introduction of nZEB in the public sector, which must serve as a model, involves nZEB in construction and renovation.* | | |
| | • **Financing 2014–2020** | AN URE, Measure J.2<br><br>OP EKP 2014–2020/In the 2014–2020 period, funds will be aimed at the energy renovation to public sector buildings owned and occupied by direct and indirect budget users and municipalities.<br><br>***Link to nZEB**: mobilisation of nZEB within the framework of 3% of public buildings and other public buildings*<br><br>The incentives will encourage investors to undertake complete energy renovation measures and, at the same time, to protect the environment, particularly through emission reduction, nature conservation, the use of natural materials and the promotion of energy-efficiency technologies.<br>OP TGP-2020/In 2014 25% and in 2020 80% of all financial support for the energy renovation to public buildings will be directed towards promoting energy performance contracting. | Financial incentives/Ministry responsible for energy | Public sector |

| Code | Instrument | New measure or upgrading of existing measures | Type of measure/Entity responsible | Target group |
|---|---|---|---|---|
| | • **Quality assurance for public sector projects** | AN URE, Measure J.2 J.3 AN OVE, Measure 35.<br><br>OP EPK 2014–2020/The establishment and operation of an 'office' as a coordinating body for project implementation will be supported, as will measures for the energy renovation of buildings or individual building elements, the replacement of building fixtures, the renovation of heating and cooling systems, and improvements to the efficiency of interior lighting.<br><br>OP EPK-2020/Financial incentives for the preparation of investment projects in the public sector.<br><br>***Link to nZEB**: mobilisation of nZEB within the framework of 3% of public buildings and other public buildings* | Group of instruments/Ministry responsible for energy | Public sector |
| | • **Promoting optimisation of the operation of energy systems (RE-CO)** | The measure will be carried out within the framework of investments in the energy renovation of public buildings in the 2014–2020 period in order to achieve greater savings by optimising the operation of energy systems and promoting energy-efficient conduct on the part of users.<br>The options for implementing measures to optimise the operation of energy systems in other existing public administration buildings through financing in the form of energy accounting and with the support of the above-mentioned 'office' and local energy agencies will be studied. | | |
| | • **Demonstration projects** | AN URE, Measure 1.5 J.2 J.4 H.1, H.3<br><br>OP TGP-2020/Provision of funds for demonstration projects and acceleration of the measure.<br><br>OP EKP 2014–2020/Pilot/demonstration projects for the energy renovation to 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.<br><br>Implementation of demonstration projects for the complete energy | Financial incentives/Ministry responsible for energy | Public sector |

| Code | Instrument | New measure or upgrading of existing measures | Type of measure/Entity responsible | Target group |
|---|---|---|---|---|
| | | renovation of various building types (public sector buildings, multi-apartment buildings, buildings protected under the regulations of cultural heritage protection).<br><br>***Link to nZEB:*** *very important – establishment of nZEB demonstration projects in the private and public sectors* | | |
| **V.3** | **Support scheme for electricity generated from renewable energy sources and high-efficiency CHP** | AN URE<br><br>***Link to nZEB:*** *ensuring that the energy needs of nearly zero-energy buildings are predominantly by RES produced nearby* | Financial incentives/Ministry responsible for energy | All buildings |
| **H.3** | **Information and awareness-raising activities** | AN URE<br><br>***Link to nZEB:*** *information and awareness-raising regarding nZEB for key actors* | Promotion and infrastructure/Ministry responsible for energy | All buildings – by target group |
| **H.4** | **Training programmes** | AN URE<br><br>***Link to nZEB:*** *training of providers of nearly zero-energy buildings ('Build Up Skills'), training of project designers and supervisors, training accreditation system (within the framework of non-formal lifelong learning) and the certification of providers of building elements and equipment for the generation of energy from RES.* | Training/Ministry responsible for energy | All buildings – by target group |

Table 10: Selection of envisaged new measures (as proposed by AN URE 2020) which at the same time constitute measures to increase the number of nearly zero-energy buildings (nZEB) by 2020

| Code | Instrument | New measure or upgrading of existing measures | Type of measures/Entity responsible | Target group |
|---|---|---|---|---|
| Buildings new Measure -1 | Support scheme for the renovation of cultural heritage buildings and other special building groups | Preparation and implementation of a new instrument for the renovation of cultural heritage buildings and other special building groups: development of renovation criteria, demonstration projects, development and introduction of technology, financial support scheme, provision of funds for the 2014–2020 period.<br><br>***Link to nZEB:*** *application of nZEB in cultural heritage buildings (emphasis on renewable energy sources in cultural heritage buildings alongside EE solutions for nZEB) – cultural heritage buildings predominate among public buildings* | Group of instruments/Ministry responsible for construction and ministry responsible for culture | Cultural heritage buildings and other special building groups |
| Buildings new | Integration of climate targets and energy | Partly in **AN** OVE, Measures 30 and 28 Housing legislation regulations (reserve funds, | Regulations and other instruments/Ministry | Residential buildings |

| | | | | |
|---|---|---|---|---|
| Measure -2 | policy into housing legislation and policy | energy performance contracting in multi-apartment buildings)<br><br>***Link to nZEB:*** *nZEB and the possibilities of a link with energy performance contracting, link between contracting and cost-optimal criteria for buildings or the package of measures for buildings* | responsible for housing policy | |

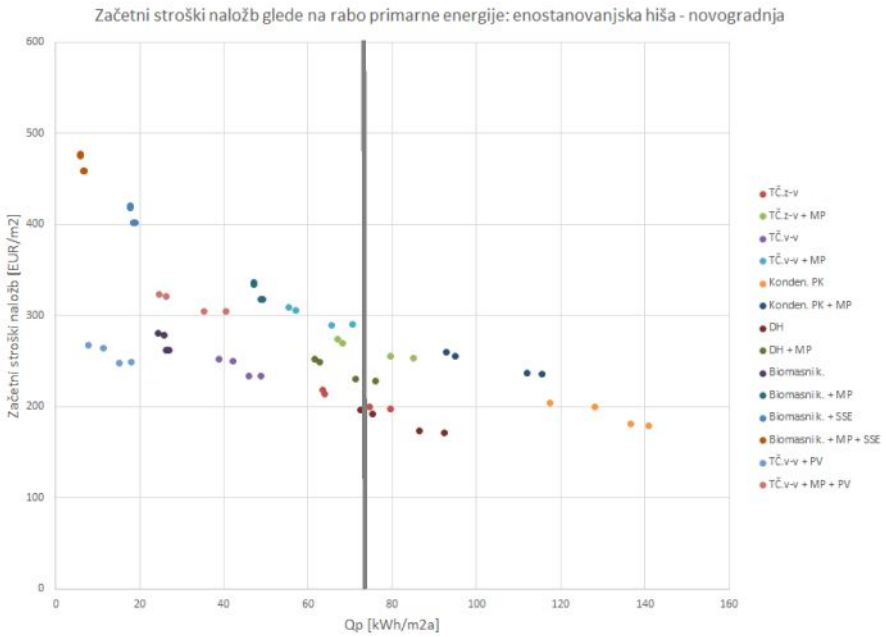
## Annex A – Assessment of initial investments in nZEB

The level of the initial investment in the implementation of measures was examined and shown in relation to the appurtenant primary energy consumption for every energy design for an individual reference building.

The graph (Figures A1 to A6) shows the indicative lower and upper thresholds for the initial investment in the energy design of a building relative to the threshold set for a nearly zero-energy building (defined in Chapter 2.3).

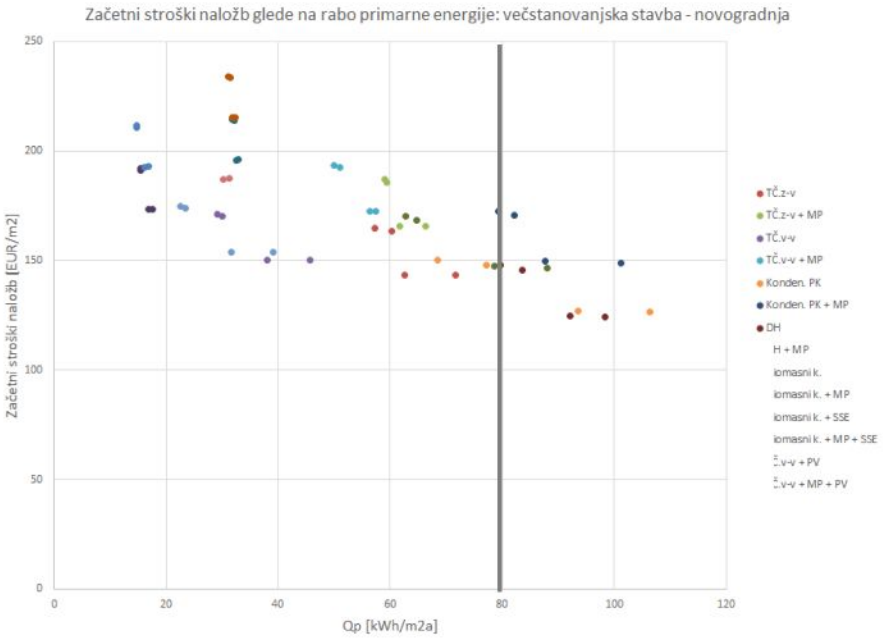
The total investment in new buildings (Tables A1, A2) or the renovation of the building stock (Tables A3, A4) of an individual category is equal to the product of the mean value of the initial investment costs and the floor area of buildings envisaged for nZEB new construction or nZEB renovation (Chapters 3.4.2., 3.5.2).

### New building



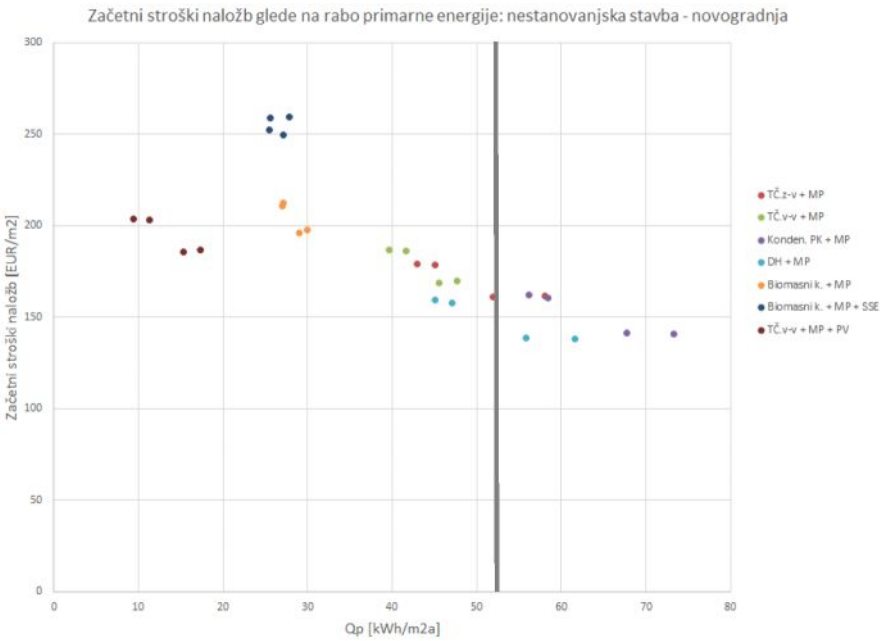

Initial investment costs relative to primary energy use: single-family house – new-build

Figure A1: Single-family house, new-build – initial investment costs dependent on the primary energy of the building type with the limit primary energy value for a nearly zero-energy building marked.




Initial investment costs relative to primary energy consumption: multi-apartment building – new-build

Figure A2: Multi-apartment building, new-build – initial investment costs dependent on the primary energy of the building type with the limit primary energy value for a nearly zero-energy building marked.




Initial investment costs relative to primary energy consumption: non-residential building – new-build

Figure A3: Non-residential building, new-build – initial investment costs dependent on the primary energy of the building type with the limit primary energy value for a nearly zero-energy building marked.

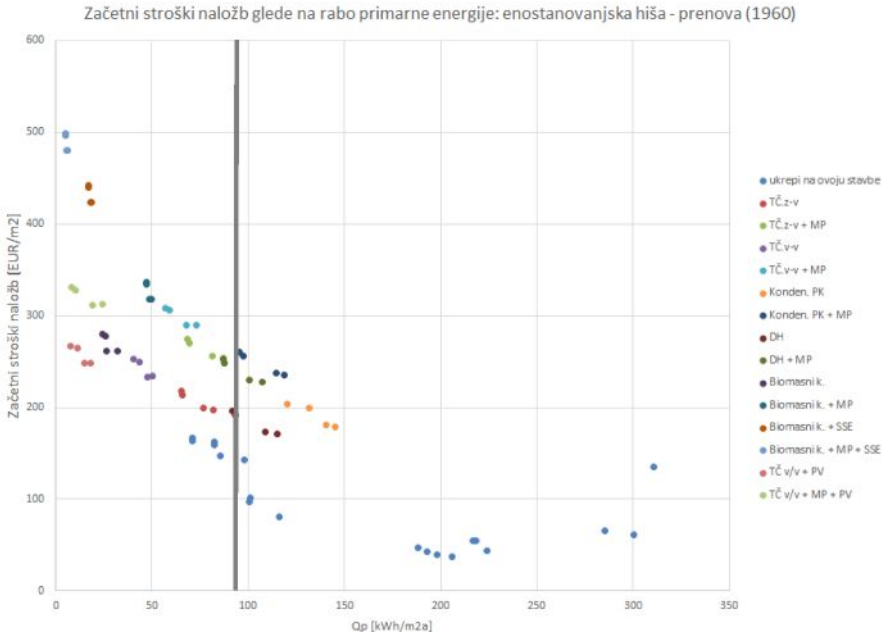
Table A1: Overview of total investments in new nearly zero-energy buildings 2014–2030.

| | Indicative lower limit of initial investment [EUR/m$^2$] | Indicative upper limit of initial investment [EUR/m$^2$] | Indicative median value of initial investment [EUR/m$^2$] | New buildings. 2014–2030 [N] | New buildings. 2014–2030 [1 000 m$^2$] | Total investment in new buildings [EUR millions] |
|---|---|---|---|---|---|---|
| Single-family houses | 200 | 375 | 288 | 27 198 | 4 352 | 1 251.1 |
| Multi-apartment buildings | 120 | 225 | 173 | 1 056 | 1 690 | 291.6 |
| Public buildings | 140 | 250 | 195 | 943 | 1 225 | 239 |
| Other non-residential buildings | 140 | 250 | 195 | 1 496 | 2 244 | 437.6 |

Table A2: Overview of total investments in new nearly zero-energy buildings 2014–2018 and 2014–2020.

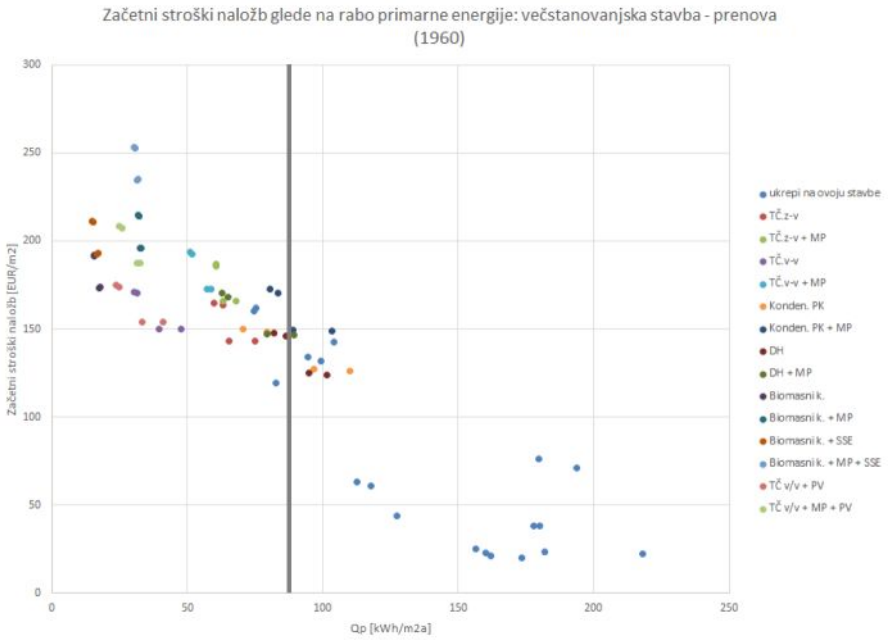
| | New buildings. 2014–2018 [N] | New buildings. 2014–2018 [1 000 m$^2$] | Indicative total investment in new non-residential buildings [EUR millions] | New buildings. 2014–2020 [N] | New buildings. 2014–2020 [1 000 m$^2$] | Indicative total investment in new residential buildings [EUR millions] |
|---|---|---|---|---|---|---|
| Single-family houses | | | | 6 300 | 1 008 | 289.8 |
| Multi-apartment buildings | | | | 167 | 217 | 37.5 |
| Public buildings | 224 | 292 | 95.5 | | | |
| Other non-residential buildings | 189 | 360 | 126.7 | | | |

## Existing housing stock



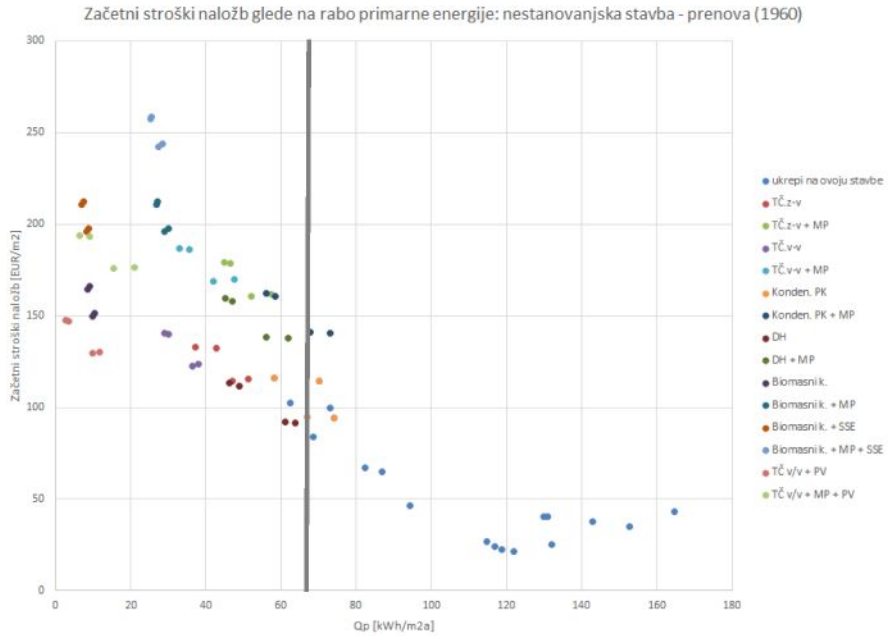

Initial investment costs with regard to primary energy use: single-family house – renovation (1960)

Figure A4: Single-family house, renovation – initial investment costs dependent on the primary energy of the building type with the limit primary energy value for a nearly zero-energy building marked.




Initial investment costs relative to primary energy consumption: multi-apartment building – renovation (1960)

Figure A5: Multi-apartment building, renovation – initial investment costs dependent on the primary energy of the building type with the limit primary energy value for a nearly zero-energy building marked.



Initial investment costs relative to primary energy consumption: non-residential building – renovation (1960)

Figure A6: Non-residential building, renovation – initial investment costs dependent on the primary energy of the building type with the limit primary energy value for a nearly zero-energy building marked.

Table A3: Overview of total investments in the nZEB renovation of nearly zero-energy buildings 2014–2030.

| | Indicative lower limit of initial investment [EUR/m$^2$] | Indicative upper limit of initial investment [EUR/m$^2$] | Indicative median value of initial investment [EUR/m$^2$] | Renovated nearly zero-energy buildings 2014–2030 [N] | Renovated nearly zero-energy buildings 2014-2030 [1 000 m$^2$] | Total investments in nZEB renovation 2014–2030 [EUR millions] |
|---|---|---|---|---|---|---|
| Single-family houses | 200 | 400 | 300 | 45 325 | 7 252 | 2 175.6 |
| Multi-apartment buildings | 120 | 225 | 175 | 1 114 | 1 782 | 311.8 |
| Public buildings | 90 | 225 | 158 | 1 052 | 1 368 | 215.5 |
| Other non-residential buildings | 90 | 225 | 158 | 1 439 | 2 158 | 339.9 |
| Public buildings owned and occupied by the core public sector (3% under the EED) | 90 | 225 | 158 | 78 | 148 | 23.3 |

Table A4: Overview of total investments in the nZEB renovation of nearly zero-energy buildings 2014–2018 and 2014–2020.

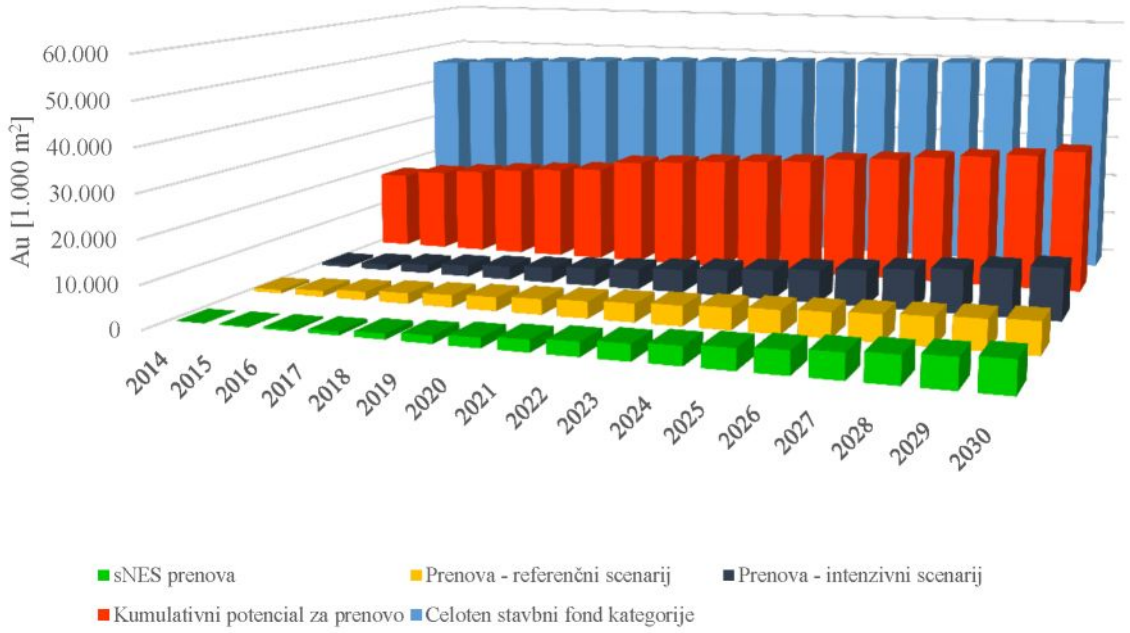
| | Renovation. 2014–2018 [N] | Renovation. 2014–2018 [1 000 m$^2$] | Indicative total investment in the renovation of non-residential buildings [EUR millions] | Renovation. 2014–2020 [N] | Renovation. 2014–2020 [1 000 m$^2$] | Indicative total investment in the renovation of residential buildings [EUR millions] |
|---|---|---|---|---|---|---|
| Single-family houses | | | | 14 108 | 2 257 | 677.2 |
| Multi-apartment buildings | | | | 405 | 649 | 113.5 |
| Public buildings | 94 | 123 | 19.3 | | | |
| Other non-residential buildings | 127 | 190 | 29.9 | | | |
| Public buildings owned and occupied by the core public sector (3% under the EED) | 11 | 20 | 3.2 | | | |

## Annex B – Potentials for renovation of the existing building stock

The renovation scenarios, for residential as well as non-residential buildings, are presented in Figures B1 to B5 and serve as a clear presentation of the share of nZEB and other renovation in comparison with the overall building stock or the potential for its renovation (it is defined by the age of the buildings and the situation regarding the level of renovation of components).

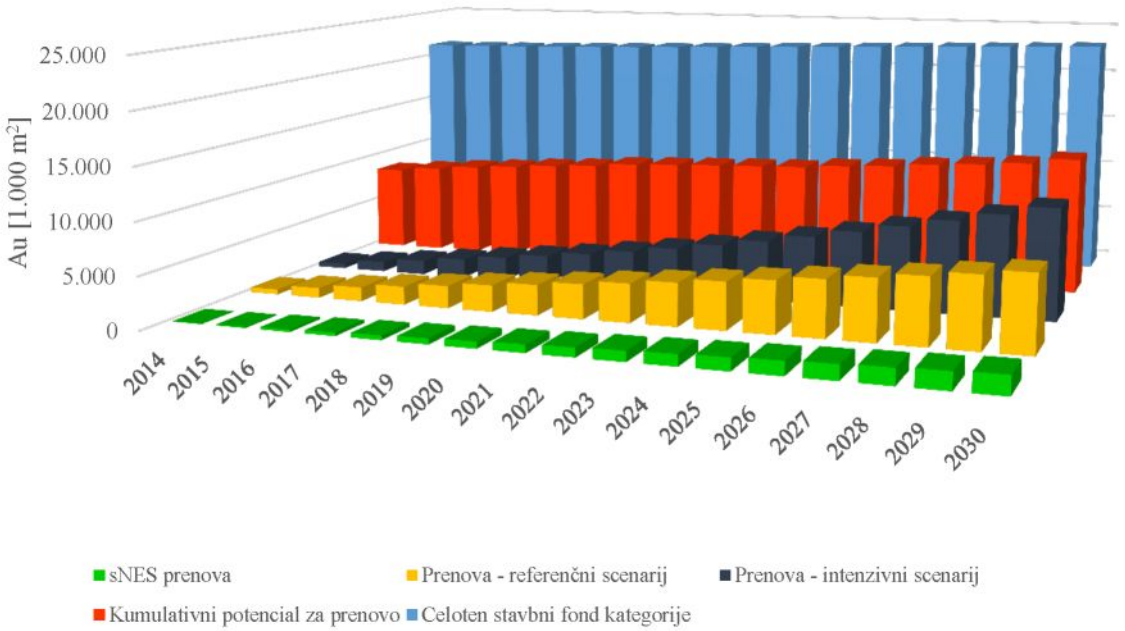
Diagrams B1 and B2 provide a comparison between the proposed nZEB renovation scenario and the renovation of other buildings (under the AN URE 2020, a reference or intensive scenario is envisaged for the renovation of residential buildings) for residential buildings. Diagrams B3, B4 and B5 provide a comparison between the proposed nZEB renovation scenario and the scenario for other non-residential buildings for the case of non-residential buildings. All diagrams of the renovation scenario present a comparison with the cumulative overall renovation potential of buildings and the overall building stock (in relation to the building type addressed).

### Existing residential buildings




Au [1 000 m2]
nZEB renovation
Renovation – reference scenario
Renovation – intensive scenario
Cumulative potential for renovation
Entire building stock of category

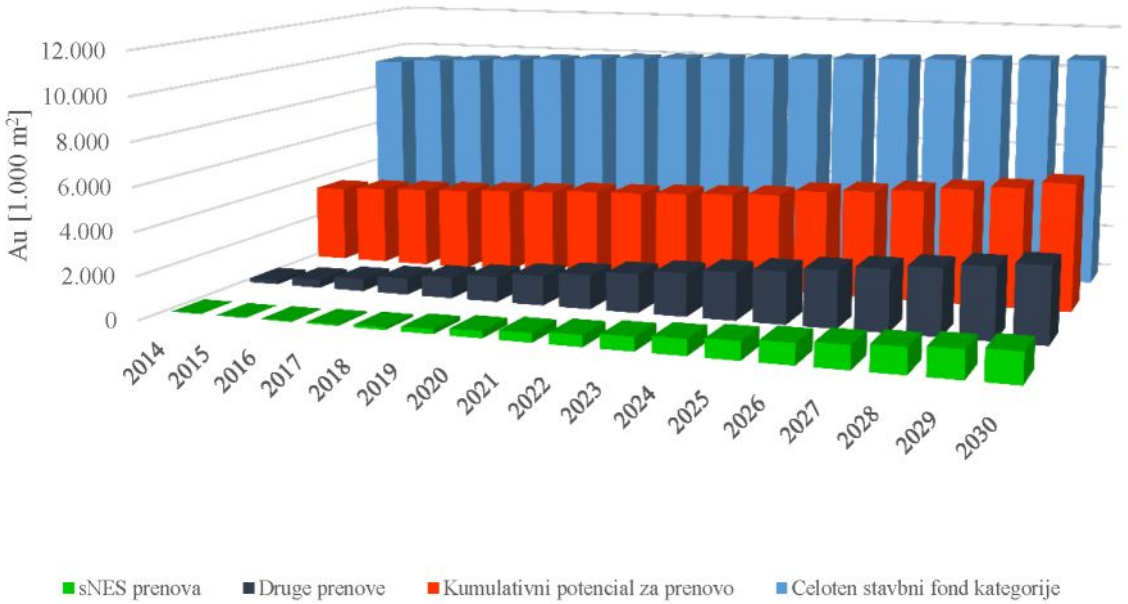
Figure B1: Projection of the building stock of single-family houses with renovation scenarios (nZEB renovation and two scenarios for the renovation of other buildings) by 2030




Au [1 000 m2]
nZEB renovation
Renovation – reference scenario
Renovation – intensive scenario
Cumulative potential for renovation
Entire building stock of category

Figure B2: Projection of the building stock of multi-apartment buildings with renovation scenarios (nZEB renovation and two scenarios for the renovation of other buildings) by 2030

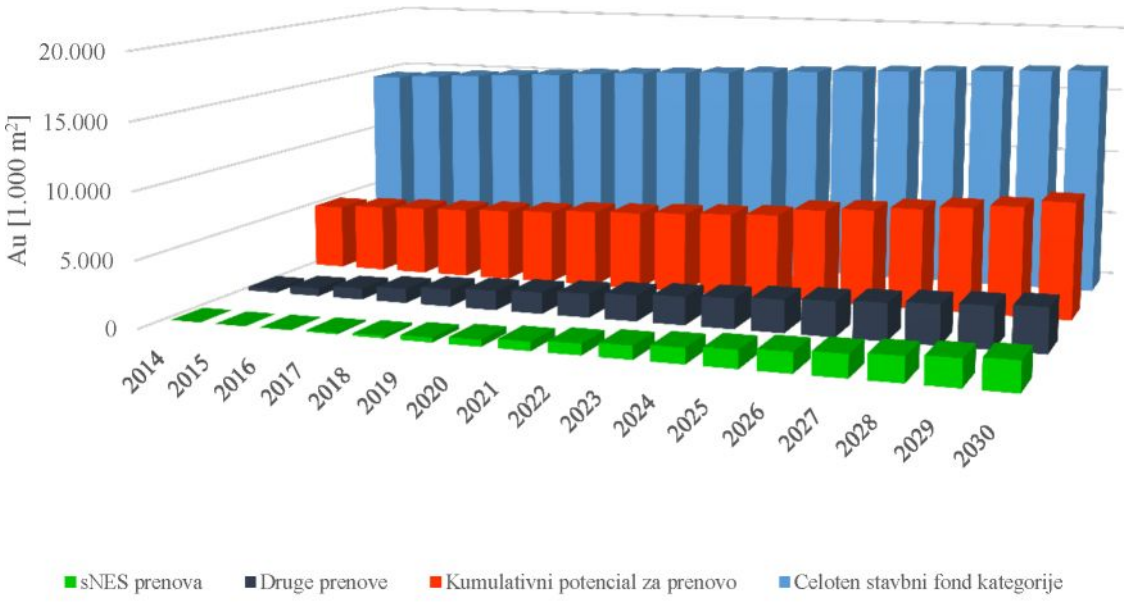
## Existing non-residential buildings




Au [1 000 m2]

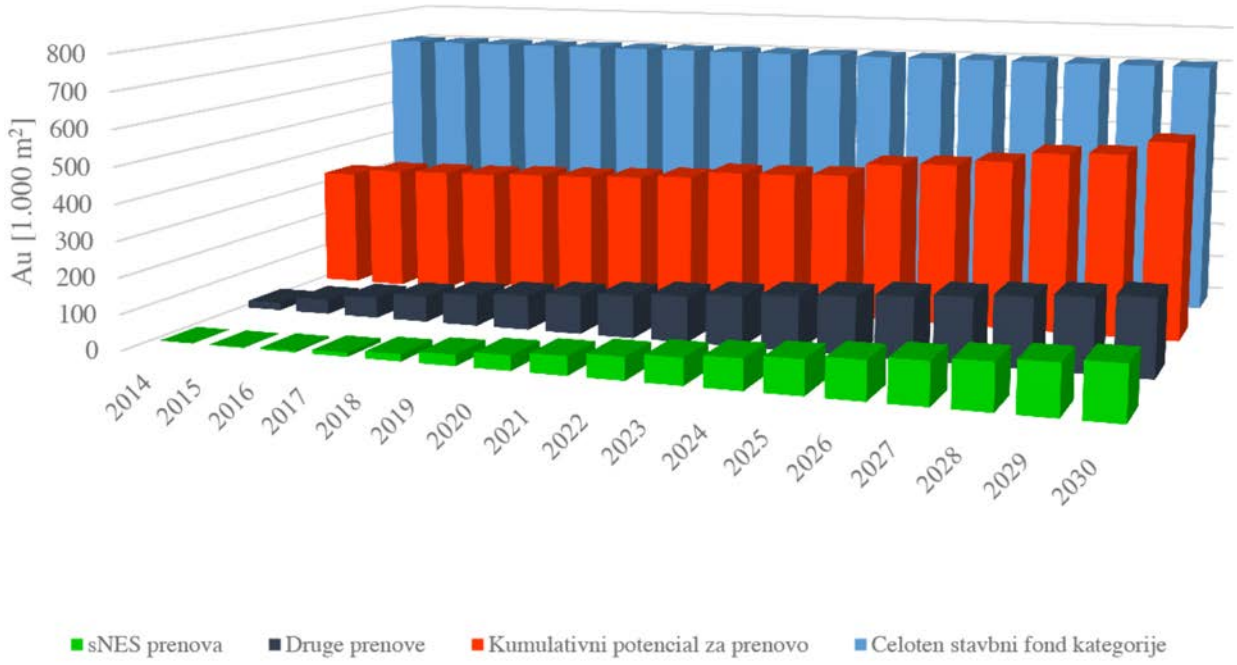
nZEB renovation
Other renovations
Cumulative potential for renovation
Entire building stock of category

Figure B3: Projection of the stock of buildings owned and occupied by the core public sector, with the renovation scenarios up to 2030.




Au [1 000 m2]
nZEB renovation
Other renovations
Cumulative potential for renovation
Entire building stock of category

Figure B4: Projection of the stock of buildings of the remaining service sector, with the renovation scenarios up to 2030.




Au [1 000 m2]
nZEB renovation
Other renovations
Cumulative potential for renovation
Entire building stock of category

Figure B5: Projection of the stock of buildings owned and occupied by the core public sector, with the renovation scenarios up to 2030 (3% of the EED).

# Annex C – Human resources for the construction of nearly zero-energy buildings

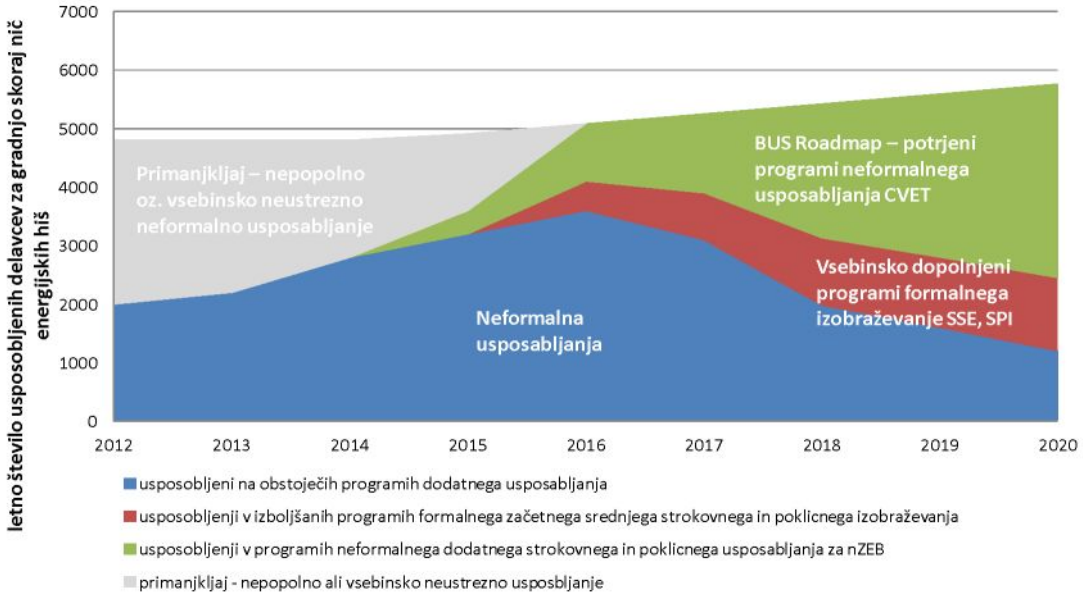
## nZEB providers

Within the framework of the European BUILD UP Skills initiative,[29] Slovenia has also reviewed the situation and assessed the human resources required for the implementation of nearly zero-energy buildings and complete energy renovation, and compiled a timetable for the implementation of activities to improve the training provided to providers. This has also been approved by the key stakeholders.

Effective initial training must be provided if the set targets are to be implemented. It is even more important to establish adequate forms of lifelong learning for building contractors and craftsmen carrying out the construction and renovation of buildings in line with nZEB technologies. The nZEB targets represent a considerable challenge to the construction sector and require the urgent and rapid transformation of the sector to enable it to meet the stricter requirements. One of the most important tasks is to raise the skills level of the workforce in order to enable it to carry out the latest procedures and practices regarding the construction of nearly zero-energy buildings.

The diagram below shows the Slovenian plan to improve the training of staff/contractors of nearly zero-energy buildings.

**Annual number of trained staff/contractors of nearly zero-energy buildings – preliminary estimate**




Number of trained staff for the construction of nearly zero-energy buildings
Deficit – incomplete or substantively inadequate non-formal training
Non-formal training
BUS Roadmap – approved 'CVET' programmes of non-formal training
Substantively supplemented SPE and SVE programmes of formal training
trained under existing additional training programmes
trained under improved formal initial secondary professional and vocational education programmes
trained under non-formal additional professional and vocational training programmes for nZEB
deficit – incomplete or substantively inadequate training

[29] BUILD UP Skills Slovenia, overview of the situation (2012) and timetable for the improved training of contractors (2013) (http://buildupskills. si).

Figure 1: Annual training for staff/contractors of nearly zero-energy buildings (Source: BUILD UP Skills Slovenia). 2013).

Young people in Slovenia are interested only to a very small degree in secondary vocational and professional education and training programmes (SPET) (SPE – secondary professional education; VTE – vocational technical education; SVE – secondary vocational education). There has been a constant fall in enrolment, from 15.8% of the population in the 2007/2008 academic year to 11.7% in the 2011/2012 academic year. This fall is particularly noticeable in professions in the construction sector (e.g. in the 2011/2012 academic year, only four bricklayers and six carpenters began initial training), while there has been only a moderate fall in enrolment in programmes for machine technicians and machinery installers. The upgrading of curricula for initial secondary vocational education courses is important and urgent; however, this cannot itself have a significant impact on improving the skills of manual workers who are on the labour market and engaged in energy performance tasks.

The workforce employed in the energy performance of buildings, nearly zero-energy buildings and energy renovation of existing buildings sector was assessed on the basis of a review of the labour market in the construction sector and of the measures planned within the AN URE 2 and AN OVE for the construction sector, as well as on the basis of the situation in formal and non-formal vocational education and training. An analysis of the development of the workforce in Slovenia shows that the labour market is being supplemented by newly employed workers from the regular education system with initial vocational education, from other sectors or from other employers in the construction sector, and very often from abroad, predominantly from the countries of ex -Yugoslavia (mostly Bosnia and Herzegovina). These three groups certainly require specialist training in the area of nearly zero-energy buildings. Such training is also required by workers who are not specialised in this area and who are insufficiently acquainted with nZEB technologies.

Lifelong learning for construction workers in Slovenia who work on low-energy buildings and energy renovation, as well as on the installation of nZEB technologies, comprises three pillars:

- formal vocational education (the periodic updating of the content of SPE and VTE programmes is envisaged);
- non-formal vocational education[30] (despite the fact that enables skills to be developed, it usually cannot be directly evaluated and certified. It can be indirectly evaluated within the National Vocational Qualifications system (www.npk.si) and with the aid of other non-formal certificates, which the BUILD UP Skills project will analyse in detail as part of the preparation of the timetable for improvements to the training of contractors).
- informal learning.

## nZEB project designers and supervisors

Topics relating to nearly zero-energy buildings should also be included in the education and lifelong learning programmes (additional formal education and non-formal training) for project designers (architects and engineers) and supervisors engaged in the construction of nearly zero-energy buildings.

In addition to technical proficiency in new developments in the field of nZEB and in building elements and systems, high-quality planning, implementation and the putting into operation of buildings, and their management in practice, are also important, with clearly defined tasks and competencies, as well as good technical knowledge, on the part of stakeholders in nZEB construction and renovation.

This is also a precondition for the establishment of a comprehensive system for ensuring the quality of the planning and construction/renovation of nearly zero-energy buildings, which will be built in the future on the basis of integrated planning and the gradual increase in the modelling of buildings using BIM technology.

[30] 'The results of non-formal education can be evaluated and lead to certification. Non-formal education is occasionally also called semi-structured learning. In contrast to formal education, it does not lead to publicly recognised (formal) education.' (Source: Janko Muršak, 'Temeljni pojmi poklicnega in strokovnega izobraževanja'/Basic concepts in vocational and professional education, CPI, 2012).