REPUBLIKA SLOVENIJA
VLADA REPUBLIKE SLOVENIJE

Gregorčičeva 20-25, Sl-1001 Ljubljana

T: + 386 1 478 1000
F: + 386 1 478 1607
E: gp.gs@gov.si
http://www.vlada.si/

Number: 360-7/2023-2430-73
Date: 22 June 2023

This document is an automatic machine translation to English and may not precisely depict facts or figures as they were intended in the original language.

Draft update proposal (2024):

INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN OF THE REPUBLIC OF SLOVENIA

Table OF Contents

List of figures

List of tables

SECTION A: NATIONAL PLAN

1 REVIEW AND PROCESS OF ESTABLISHMENT OF THE PLAN

The Integrated National Energy and Climate Plan (NECP) is a strategic document that has to set out objectives, policies and measures for the five dimensions of the Energy Union for the period up to 2030 (with a 2040 perspective):

1. decarbonisation (greenhouse gas (GHG) emissions and renewable energy (RES));
2. energy efficiency,
3. energy security,
4. the internal energy market; and
5. research, innovation and competitiveness.

Regulation (EU) 2018/1999 of 11 December 2018 on the Governance of the Energy Union and Climate Action (Regulation (EU) 2018/1999) imposed an obligation on Member States to submit their NECPs by 31 December 2019. In accordance with Regulation (EU) 2018/1999, Member States are obliged by 30 June 2023 to submit the draft updated latest notified NECPs and by 30 June 2024 to submit the updated latest notified NECPs.

The Government of the Republic of Slovenia (hereinafter: the Government of the Republic of Slovenia) adopted the first NECPs on 27 February 2020. General information on the preparation of the draft NECPs and on the adoption of the NECPs can be found in the NECPs, which is publicly available and accessible on the NECPs website, and[1] more detailed information on the process of preparing the NECPs and individual activities can be found on the NECPs website (2020).[2]

Taking into account the obligations stemming from Regulation (EU) 2018/1999, the Ministry of Infrastructure responsible for energy (Ministry) started already in spring 2022 with the process of updating the NECPs, which will take place in 2022-2024 and will include:

- reporting on the implementation of the adopted NECPs,
- updating the technical basis for preparing the update of the NECPs,
- update of the NECPs,
- design and conduct multilevel climate and energy dialogues.

Introductory activities

For the modernisation process of the NECPs, the Ministry obtained technical and technical assistance from a consortium of contractors (hereinafter referred to as the NECCP), consisting of the Institute 'Jožef Stefan', the Centre for Energy Efficiency (IJS-CEU, lead partner), the Institute for Economic Research, ELEK, d.o.o., ELES, d.o.o., Plinovodi, d.o.o., JHA d.o.o.,

[1] The NECPs (2020) can be accessed via the following link: https://www.energetika-portal.si/fileadmin/dokumenti/publikacije/nepn/dokumenti/nepn_5.0_final_feb-2020.pdf.

[2] The NECPs website (2020) is accessible via https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2020/.

Gozdarski Institute of Slovenia, Agricultural Institute of Slovenia, Centre of Business Excellence of the University of Ljubljana and Strojnakulta of the University of Ljubljana.

In June 2022, the Ministry and the NECC coordinated an initial report setting out a proposal for a project implementation methodology, defining the results per work package and a more detailed timeline for the implementation of the project.[3] The online platform 'National Energy and Climate Plan' (NECP website), which is located on the Energy Portal and serves as a central website where all information on the activities of the NECPs update is published and compiled, was subsequently comprehensively renewed.[4]

In parallel, a Public Engagement Framework Plan was developed in summer 2022 with the aim of establishing a comprehensive multilevel climate and energy dialogue and ensuring early and effective public involvement in the modernisation process of the NECPs. It will allow local authorities, civil society organisations, the business community, investors and other relevant stakeholders and the general public to actively engage and discuss the different scenarios envisaged for energy and climate policies, including long-term ones, and to assess progress. The Public Engagement Plan foresees three sets of public consultation that will take place between May 2022 and June 2024, in line with the activities of the NECPs and the envisaged timeline.[5]

In December 2022, in order to ensure cross-sectoral coherence in monitoring, updating and fulfilling the measures of the NECPs and the Resolution on the Long-term Climate Strategy of Slovenia to 2050 (ReDPS50), a Government Working Group on the Comprehensive National Energy and Climate Plan and the Long-term Climate Strategy of Slovenia to 2050 was also established. In spring 2022, the Working Group reviewed the state of play and the summer of the year, a review of the objectives by dimension of the Energy Union. In the following, it was actively involved in monitoring the implementation of the NECPs and reporting and updating the technical bases and the NECPs.

At the same time, in February 2023, the Ministry launched the process of obtaining technical assistance from the European Commission in the preparation of the update of the NECPs. The objective of this technical assistance is to provide or complement key data for the integrity and credibility of the NECPs and to provide strategic guidance to address identified shortcomings. The Ministry, in cooperation with the European Commission (EC), has prepared a revised final project plan, which will serve as a basis for technical assistance under the guidance of the ICF.

All the procedures relating to the update of the NECPs were initially managed by the Ministry of Infrastructure and, following the reform of the Government of the Republic of Slovenia (April 2023), the Ministry of the Environment, Climate and Energy, which is responsible for the environment, climate and energy (hereinafter: the Ministry), is leading the process.

[3] The initial report shall be accessible through: https://www.energetika-portal.si/fileadmin/dokumenti/publikacije/nepn/dokumenti/nepn2024_zacetno_porocilo.pdf.

[4] The revised NECPs website is available via: https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/

[5] The Public Engagement Plan is accessible via https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/#c1544.

Integrated environmental impact assessment

In order to implement the principles of sustainable development, integrity and prevention, an overall environmental impact assessment must be carried out in the process of drawing up a plan, programme, plan or other general act and amendments thereto, the implementation of which is likely to have significant effects on the environment. The integrated environmental impact assessment (CPVO) is governed by the Environmental Protection Act (ZVO-2) in part comprising Articles 77-87. To this end, on 19 August 2022 the Ministry sent the Ministry of the Environment and Spatial Planning (hereinafter MOP) a notification of its intention to prepare a proposal to update the NECPs in the years 2022-2024. In this context, it requested a decision on whether the update of the NECPs will require the implementation of a comprehensive environmental impact assessment (hereinafter CPVO) procedure and received a decision (No 35409-530/2022-2550-13) on the CPVO for the NECPs at the end of September 2022 to:

- a comprehensive environmental impact assessment should be carried out in the process of preparing and adopting the NECPs;
- in the process of preparing and adopting the NECPs, an assessment of the acceptability of the effects of the implementation of the plan on protected areas must be carried out.

In accordance with the MOP's decision that the modernisation of the NECPs requires the implementation of the CPVO, the Ministry has already obtained full technical and technical support for the implementation of the CPVO by a consortium of institutions consisting of the Elektroinštituta Milan Vidmar (EIMV), wrapped, advocacy, d.o.o., STRITIH, Advisory for Sustainable Development, d.o.o., and Špela Polak Bizjak, s.p. (hereinafter: CPVO Consortium). In spring 2023, the Ministry and the Consortium prepared a draft initial report setting out, in addition to the scope of work, commitments and schedule, the following:

- the work packages approach;
- an indicative plan of cooperation with contributors and the public,
- the manner in which the contractor will minimise the negative environmental impact of the performance of the subject matter of the contract.

The CPVO process, in which some environmental NGOs have already been involved as side participants, will be carried out in accordance with Slovenian legislation and will take place in several steps, including:

- preparation of the content and consultation baselines;
- preparing a draft environmental report;
- publicising the draft environmental report, consulting the public and complementing the draft environmental report;
- the cooperation of Member States in the event of significant transboundary effects; and
- the decision on the admissibility of the updated environmental report and the updated NECPs.

By June 2023, internal recommendations were made on reducing the environmental impact of the first proposal for an update of the NECPs, which will be followed by the formulation of policies and measures with a minimum environmental impact. Tentatively in summer 2023, a

content phase follows, where the CPVO, in cooperation with the contracting authority, the NECC, the consultants and the public, will examine the environmental principles and define the necessary data and methodology for impact assessment. The results will be integrated in the draft content report, which will form the basis for the so-called external content, where at least two workshops will be organised for opinion-givers, secondary participants and the interested public, where participants will be able to express their views, comments and suggestions. These will be taken into account as far as possible in the final report. A draft environmental report and an addendum for protected areas will follow in autumn 2023. Both documents will be submitted to the process of obtaining an opinion on adequacy and a workshop will be organised for the consultants at the same time, where the CPVO consortium will present the conclusions of the draft environmental report and provide the requested clarifications. In spring 2024, a public hearing, discussion and updating of the environmental report is followed in the light of the comments made in the public hearing. All information concerning the implementation of the CPVO will also be published in full and in full on the NECCP website.[6]

Monitoring of the implementation of the NECPs

Monitoring and reporting on the implementation of the NECPs is also an important activity for the successful implementation and preparation of the update of the NECPs. This must be based on a good assessment of the situation, obstacles and opportunities we face in Slovenia. Already before the adoption of the NECPs, we established a high-quality and broad set of indicators to monitor the implementation of part of the climate and energy policy in Slovenia as part of the annual climate and energy mirrors, some of which were also included in Slovenian Environmental Indicators published by ARSO.

A report on the state of implementation of the NECPs in Slovenia was prepared in summer 2022, in accordance with the decision of the Committee of the National Assembly on Infrastructure, the Environment and Spatial Planning. The report took into account the latest available data and estimates (mainly for 2020) and briefly provided key findings per dimension of the Energy Union, i.e.: (a) objectives, b) state of play and c) implementation assessments. The report was accompanied by a list of measures contained in the NECPs with information on the implementation of individual actions. The report was adopted by the Government of the Republic of Slovenia on 19 October 2022 and forwarded to the National Assembly for information.[7]

In line with Regulation (EU) 2018/1999 and the Commission Implementing Regulation adopted on 15 November 2022 (Regulation MS reporting of information in the governance of the energy union; Annex – Regulation MS reporting of information in the governance of the energy union), Slovenia prepared and carried out a comprehensive biennial reporting to the Commission by 15 March 2023 (Integrated National Energy and Climate Report (NEPP)) in

[6] The CPVO's web site is accessible via: https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/celovita-presoja-vplivov-na-okolje/

[7] The report on the implementation of the NECPs is available at: https://www.energetika-portal.si/fileadmin/dokumenti/publikacije/nepn/izvajanje/nepn_porizv_sep2022.pdf

spring 2023 and also prepared a separate shorter summary report.[8] The preparation of the NEPP involved a wide range of actors responsible for the implementation of the NECPs and the monitoring of implementation. However, the process was to a large extent intertwined with the parallel development of updated technical bases and scenarios of the NECPs.

Public consultation and modernisation of expertise and NECPs

The first round of public consultation on the update of the NECPs (preliminary/preliminary consultation) took place in autumn 2022 (August-December 2022). It included a public hearing, an online consultation and targeted expert consultations. A public hearing took place at the Faculty of Electrotechnical in Ljubljana at the end of September 2022. Some 95 participants attended the event. Opening remarks by Minister mag. Bojana Kumra followed the presentation of the process of updating the NECPs, the Report on the implementation of the NECPs, the results of the opinion poll "Public attitudes towards renewable energy sources" and the main challenges and orientations for the modernisation of the NECPs. There was an open debate and an invitation to all participants to actively participate in the consultation process.[9] An online public consultation on the objectives and orientations of the NECPs took place between 26 August and 21 October 2022. 135 representatives of the interested public participated in the consultation, where contributions could be submitted via an online survey. Of these, 46 entries were valid and further processed. An analysis of the online consultation on the update of the NECPs was prepared (August – October 2022). The main messages of the online consultation were usefully taken into account in the update of the technical bases for the NECPs and in the preparation of the first draft update of the NECPs.[10] A series of 8 targeted thematic consultations were carried out with stakeholders with a view to establishing a broad expert dialogue and involving a wider professional public in the preparation of the update of the NECPs, as well as building broad expert consensus and providing quality data and views on the baselines and orientations of the NECPs reform. The consultations, attended by around 210 experts and representatives of different institutions or businesses, addressed the key drivers of Slovenia's future development, key areas, sectors and technologies with the greatest challenges and uncertainties in the future development and green transition in Slovenia. The range and content of the consultations have been designed and adapted to the results and orientations of the preliminary public consultation process. A joint report was prepared on the consultations carried out and information on each individual consultation carried out, including a brief summary and a report from the consultation. The main messages

[8] A summary summary report on the implementation of the NECPs (March 2023) can be accessed via: https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/spremljanje-izvajanja-nepn/#c1507.

[9] All the information and material presented can be found on the NECCP website – preliminary public consultation, via the following link: https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/preliminarno-posvetovanje/#c1719.

[10] The analysis of the online consultation on the update of the NECPs is also available on the NECPs website – preliminary public consultation, via the following link: https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/preliminarno-posvetovanje/#c1719.

of the targeted consultations were reasonably taken into account in the update of the technical bases for the NECPs and in the preparation of the first draft update of the NECPs.[11]

The modernisation of the technical bases started in autumn 2022. Don spring 2023 has been produced a Consultation Paper – NECU Update Scenarios, which was simultaneously submitted for inter-ministerial coordination and submitted for a second public consultation.

The second set of public consultation aimed to consult on the proposed orientations and objectives in the first draft update of the NECPs. The consultation, which ran from Monday 3 April to Wednesday 3 May 2023 inclusive (30 days) included, similarly to autumn 2022, a public hearing (6 April 2023), an online consultation (3 April – 3 May 2023) and targeted thematic consultations (April 2023). The public hearing, which launched the second round of public consultation, took place on Thursday 6 April 2023 from 14:00 to 16:00 hours in Ljubljana, Faculty of Electrical Engineering. The online consultation was aimed at consulting the general and professional public on the proposed orientations and objectives in the first draft update of the NECPs. In the period from 3 April to 4 May 2023 inclusive, 929 clicks were recorded to address the survey and 279 clicks per survey. Of these, 137 respondents started to respond to the survey, 73 of which closed. All completed surveys (73) and partially completed surveys (64) were reviewed, excluding entries that were completely empty or anonymous. All entries included in the analysis were published on the NECPs website. In addition to the replies to the online survey, the Ministry received a number of separate comments on the update of the NECPs during the consultation period. In some cases, the comments were the same as those made through the online survey, and in some cases they were additional comments. All replies and comments received in the context of the online consultation, as well as any additional comments received, have been comprehensively reviewed and taken into account as far as possible in the preparation of the second draft update of the NECPs. A large part of the replies and comments also concerned measures for which full programming will take place in summer and autumn 2023, which means that these comments will be taken into account below. An analysis of the online public consultation on the update of the NECPs, which took place in April 2023, was also prepared and published. Similarly to autumn 2022, targeted thematic consultations aimed at consulting the expert public were carried out on the proposed orientations and objectives in the first draft update of the NECPs. The topics of targeted expert consultations were i) The future of natural gas and alternatives, ii) Green transition in industry, iii) Security of energy supply and energy efficiency, iv) Sustainable transport and alternative fuels, v) Development and potential of Slovenia's electricity supply, vi) heating and cooling strategy and sector integration. The expert consultations carried out and all comments received (during the conduct of the consultations and subsequently in writing) led to a report on the conduct of expert consultations on the update of the NECPs.[12]

[11] More detailed information on each individual consultation can be found on the NECCP website – Target thematic stakeholder consultations, via the following link: https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/preliminirano-posvetovanje/tematski-posveti/.

[12] All comments received and response reports prepared, as well as other information related to the second set of public consultation, can be found on the NECCP website via https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/javna-predstavitev-prvega-predloga-posodobitve-nepn/.

Finally, a first draft update of the NECPs was prepared on the basis of the draft update of the technical background, comments and suggestions made in the two rounds of public consultation (autumn 2022 and spring 2023) and the comments and suggestions made in the first inter-ministerial coordination (April 2023).

This first draft update of the NECPs contains a draft review and update process of the plan (i.e. Chapter 1 of the NECPs), a draft update of the technical background (i.e. Chapter 4 of the NECPs) and a draft update of the NECPs' orientations and objectives (Chapter 2 of the NECPs). This draft update of the NECPs does not yet contain a proposal for an update of Chapter 3 (Policy and measures) and Chapter 5 (Impact assessment of planned policies and measures). After an additional round of inter-ministerial coordination, the draft was submitted to the Government of the Republic of Slovenia for information and will be submitted to the European Commission by 30 June 2023 in accordance with Regulation (EU) 2018/1999.

Next steps (indicative)

A further step in the process of updating the NECPs includes an update of Chapter 3. In the summer and autumn months of 2023, complementarities and programming of additional actions will be carried out. On the basis of a comprehensive draft update of the NECPs, a draft environmental report will be prepared and we expect further involvement of the general and expert public in the context of the CPVO process. In the light of the positive experience of the regional consultation in preparation of the first NECPs, we will seek to reorganise the regional consultation with neighbouring countries on the modernisation of the NECPs. The event will be a good opportunity for a comprehensive exchange of views as well as for exploring opportunities for possible or strengthening existing regional cooperation. In this context, we also expect an important contribution from technical assistance, which Slovenia benefits from through the European Commission, in the form of an analysis of the opportunities for cooperation with neighbouring countries. The recommendations are received by the European Commission by the end of 2023. The update of the expert bases will be completed in early 2024. In accordance with the Environmental Protection Act, the final proposal for updating the NECPs and a formal public consultation will be made public in spring 2024. It will be carried out in parallel with the implementation of the environmental report and the supplement for protected areas. All comments received will be answered in the summary report. The objective of this consultation is to obtain final guidance from the professional and secular public on the final proposal for updating the NECPs. On the basis of the comments received, the draft update

of the NECPs will be duly upgraded and submitted to the Government of the Republic of Slovenia for adoption.

1.1 Summary

Political, economic, environmental and social context of the plan

On 7 December 2017, the Government of the Republic of Slovenia adopted the **Slovenia 2030 Development Strategy (SRS 2030)**, the country's overarching development document, which focuses on quality of life for all.[13] The strategy incorporates the Sustainable Development Goals (SDGs) agreed at global level and five strategic orientations and twelve interrelated development goals, setting Slovenia's new long-term development basis.

In parallel with the preparation of the updated NECPs, a comprehensive environmental impact assessment of the implementation of the modernised NECPs will be carried out, including a discussion on the complexity of the targets and contributions until 2030 (with a view to 2040). A broad and informed debate will take place on an expert basis and will be key to building consensus among the widest possible range of stakeholders on increased and significantly more demanding Slovenia's 2030 targets, which will take into account relevant national circumstances and represent an appropriate step towards a climate-neutral Slovenia by 2050.

The projects and measures set out in the updated NECPs will be in the public interest from an energy and climate policy perspective, in line with the Energy Act.

The adoption of the updated NECPs and its submission to the Commission is also

As highlighted in the JRC 2030, Slovenia's future development will depend heavily on its ability to respond and adapt to trends and challenges in the global environment. Trends point to profound changes in particular in demographic trends, pressures on ecosystems, competition for global resources and economic development. Cooperation and coherence at global, European and national level, as well as cross-border cooperation, are thus becoming increasingly important.

Slovenia is gradually making progress in terms of quality of life and economic development, and some pressures on the environment are diminishing. Nevertheless, in many areas of economic, social and environmental development, it lags far behind the most developed countries, with different regional backlogs.

Positive developments have been achieved in recent years in reducing the environmental burden that people in Slovenia continue to put too much pressure on our lifestyles and production processes. GHG emissions have decreased in a context of lower economic activity in the aftermath of the economic crisis since 2008 and the outbreak of the COVID-19

[13] Slovenia's 2030 Development Strategy: http://www.vlada.si/fileadmin/dokumenti/si/projekti/2017/srs2030/Strategija_razvoja_Slovenije_2030.pdf

pandemic, but their level per unit of GDP remains higher than the EU average. In particular, the increase in transit road transport and overall unsustainable mobility is an environmental problem. The decrease in household and industrial consumption leads to a decrease in overall energy consumption, but remains relatively high per unit of GDP due to the high share of energy-intensive businesses. Thus, by 2030, taking into account the Energy Union dimension, Slovenia will actively pursue the progressive decarbonisation of the energy-intensive industry and provide financial incentives to restructure production processes through the deployment of green technologies.

Compared to the EU, Slovenia's economy is above-average based on the use of raw materials, which is reflected in its lower material efficiency and reduces its competitiveness. In some areas, such as the share of RES and organic farming, Slovenia performs (at the same time still) better than the EU average.

In addition, Slovenia has favourable natural conditions such as coastal and marine resources and biodiversity. Nevertheless, inadequate use of natural resources, in particular in urbanisation, agriculture and water management, undermines the conservation of species and their habitats.

Adaptation to climate change and the transition to a climate-neutral and circular economy that preserves natural resources requires changes in production and consumption to more sustainable forms. This could preserve the competitiveness of the economy and improve the quality of life of the population in the long term.

Strategy relating to the five dimensions of the Energy Union

According to the JRC 2030, Slovenia's core objective is to ensure a quality of life for all by 2030, which can be achieved through balanced economic, social and environmental development that respects the planet's limits and capabilities and creates the right conditions and opportunities for present and future generations. At the individual level, quality of life is reflected in good opportunities for work, education and creation, in decent, safe and active living, in a healthy and clean environment and in engaging in democratic decision-making and co-governance of society.

Slovenia's strategic orientations for achieving quality of life by 2030 are:

- inclusive, healthy, safe and responsible society;
- learning for and throughout life;
- a highly productive economy that creates added value for all;
- a conserved healthy natural environment;
- high level of cooperation, competence and efficiency of governance.

The five strategic orientations for achieving the core objective of the strategy will be pursued by Slovenia acting in a variety of interlinked and interdependent areas covered by the 12 development objectives of the strategy. Each of these targets is also linked to the **Sustainable Development Goals of the 2030 Agenda** and identifies key areas where action will be needed to achieve a quality of life for all. The objectives provide the basis for the formulation

of priorities and actions of the Government of the Republic of Slovenia, regional development actors, local communities and other stakeholders.

In line with the JRC 2030 and taking into account the Energy Union dimension, Slovenia's 2030 development focus will be the transition towards a low-carbon circular economy and sustainable management of natural resources. **The long-term climate strategy 2050**, adopted in July 2021, includes a comprehensive analysis of the different scenarios for contributing to the fulfilment of the commitments of the Union and the Member States under the United Nations Framework Agreement on Climate Change and the Paris Agreement, including a pathway towards net-zero GHG emissions in the Union by 2050 and negative emissions thereafter, and the impacts of those scenarios on the remaining global and EU-carbon budgets as a basis for the discussion on cost-effectiveness, and fairness in reducing GHG emissions.[14] The update of the NECPs in 2023 and 2024 will also take into account the new EU strategic and legislative decisions prepared and taken on the basis of the European Green Deal and will accordingly include the Fit for 55 and the 'REPowerEU' legislative packages.

The expert bases for the 2050 long-term climate strategy and the NECPs have been developed in a coordinated manner in Slovenia.

Overview table with the plan's key objectives, policies and measures

The first draft update of the NECPs contains a draft review and update process of the plan (i.e. Chapter 1 of the NECPs), a draft update of the NECPs' guidelines and objectives (Chapter 2 of the NECPs) and a draft update of the technical bases (i.e. Chapter 4 of the NECPs). This draft update of the NECPs does not yet contain a proposal for an update of Chapter 3 (Policy and measures) and Chapter 5 (Impact assessment of planned policies and measures). The proposed key objectives and contributions of the updated NECPs across the five dimensions of the Energy Union are set out below.

Table1: Slovenia's key objectives and contributions until 2030

SLOVENIA'S KEY OBJECTIVES AND CONTRIBUTIONS UNTIL 2030
1 Decarbonisation dimension
Overview of key objectives: • **contribute to achieving net-zero GHG emissions at EU level by 2050 as a starting point for the planning of targets, policies and necessary measures for 2030;**

[14] The resolution on Slovenia's 2050 long-term climate strategy (ReDPS50) is accessible through: http://www.pisrs.si/Pis.web/pregledPredpisa?id=RESO131.

- **reducing total GHG emissions by at least 55 % by 2033 compared to 2005,**
- **reduce GHG emissions more by 2030**, as required by the Burden Sharing Decree in Slovenia, i.e. by **at least 28-31 % compared to 2005,** by achieving sectoral targets:
  - transport: + 3 %,
  - wide use: — 74 %,
  - agriculture: — 1 %,
  - waste Management: — 67 %,
  - industry*: — 55 %,
  - energy*: — 48 %.

  ** only the part of the non-ETS sector,*
- **reducing GHG emissions in buildings** by at least 70 % by 2030 compared to 2005,
- **ensure that LULUCF emissions do not exceed sinks in the period from 2021 to 2025 and that a sink in the LULUCF sector is at least -146 kt CO_2 eq in 2030;**
- **in the field of adaptation, reduce vulnerability, vulnerability and vulnerability of Slovenia to the impacts of climate change** and increase the resilience and adaptive capacity of society;
- **ensuring climate justice;**
- **ensuring the transition to a low-carbon circular economy** by promoting sustainable consumption and production;
- **achieve a share of at least 30-35 % of RES in final energy use by 2030;** and
  - **achieve at least 2/3 of energy use in RES buildings** (share of use of RES in final use of energy products excluding electricity and district heat), prohibition of sale and installation of new boilers using fuel oil after 2022;
  - **at least 30 % share of RES** (including waste heat) in industry,
  - **an annual increase of at least 2-3 % in the share of RES and waste heat and cold** in district heating and cooling systems and achieving at least 25-40 % of that production by 2030;
  - **at least 52 % share of RES** in electricity generation,
  - **at least 41 % share of RES in** heating and cooling,
  - **at least 26 % share of RES** in transport,
- the**introduction and rapid expansion of accompanying energy activities** to enable the installation of generating installations producing electricity from the sun or wind in a room whose primary purpose is different (agricultural, road, water, etc.),
- the location of renewable energy sources (solar and wind) also in Natura 2000 sites;
- **accelerated solarisation of roofs in the public sector**,
- **decarbonising EE production – phasing out coal use**: the cessation of operations of coal units by 2033 at the latest, in accordance with the principles of a just transition,
- progressive decarbonisation of **energy-intensive industries and hard** ***to abate sectors*****:** provide **financial incentives** for the restructuring of production processes

through the deployment of green technologies, green gases including hydrogen and green fuels and technologies for CO_2 capture and storage; • **increased investment in the human resources** and new skills needed for the transition to a climate-neutral society and for **reducing the implementation deficit**.
2 Dimension of energy efficiency
Overview of key objectives: • **Accelerating energy and material efficiency improvements in all sectors** (including energy supply) as a key enabler of a successful exit from the energy crisis and the effective implementation of the green transition (and thus reducing the consumption of energy and other natural resources) in accordance with the energy efficiency first principle, which is a prerequisite for a successful and competitive transition to a climate-neutral society; • to **improve energy efficiency and the volume of annual savings under the mandatory savings scheme by 2030, at least in line with the indicative target to be set in the new Energy Efficiency Directive**; • ensure that the **policies and measures adopted are systematically implemented so that final energy consumption does not exceed 51 TWh (4.426 ktoe)**, • **reduce final energy consumption in buildings** by **20 %** by 2030 compared to 2020 and ensure a reduction in GHG emissions in buildings of at least 70 % by 2030 compared to 2005, • **ensure accessibility to energy efficiency** for all – including financially weaker users; • **active and accelerated support to industry to increase efficiency and competitiveness, the** uptake of new efficient green technologies and the circular economy, • **accelerate the implementation** of information, awareness-raising and training programmes for different target groups on the benefits and practical aspects of developing and applying technologies for energy efficiency and exploitation of RES and understanding the concept of sufficiency and motivation for less material well-being.
3 Dimension of energy security
Overview of key objectives: • **secure and competitive energy supply;** • ensuring an adequate level of security of electricity supply:

- **maintain a high level of electricity interconnection** with neighbouring countries, a target of more than 80 %;
- **at least 85 % of electricity supply from generating installations in Slovenia by 2030** and **100 % by 2040**; and
- **at least 80 % of the power demand in critical hours of electricity transmission network loads with domestic generation capacity by 2030 and maintaining at least 80 % of the power demand beyond 2033** (discharge of coal),
- **continuing the exploitation of nuclear energy** and maintaining excellence **in the operation of nuclear installations in Slovenia,**a quaternary common operational performance indicator (WANO) greater than 96 and taking a **qualitative and transparent decision on the construction of a new nuclear power plant as soon as possible and not later than 2027;**
- **increasing the resilience of the electrodistribution network to disruptions** – increase the share of the underground medium-voltage network from the current 35 % to at least 50 %;
- the**accelerated development of system services and the active role of consumers** in the field of EE, DT, etc.,

- **ensuring a secure and competitive gas supply:**
  - upgrading connections with neighbouring countries and preparing to operate with new, climate-neutral, gases,
  - **reducing import dependency** on fossil fuels also through domestic production of renewable gaseous and liquid fuels; **a 2030 target of at least a 5 % share of gaseous fuels and a 1 % share of** renewable liquid fuels from sources in Slovenia;
- **accelerating the development of energy storage technologies, infrastructure and services and meeting the following sub-targets:**
  - ensure, by accelerating the construction of ČHE and battery SHEE, that the share of their capacity (in GWh) in the daily use of EE is greater than that of the total annual production of photovoltaic and wind power plants in the annual use of EE,
  - ensure the installation of SHEE to new photovoltaic plants of at least 25 % of their capacity,
  - promoting the installation of heat storage tanks (in buildings, DHS, etc.),
  - ensure the construction of two major electrolysis units for the purpose of storing peaks of electricity generated in hydrogen,
- **diversification of sources of supply routes, production capacities, locations and technologies in energy supply.**

4 Dimension of the internal energy market

Overview of key objectives:

- **provide additional financial, human and technical resources to accelerate the integrated development and management of the electricity distribution network for enhanced capacity, resilience, advancedness, connectivity and adaptability**, enabling the use of resource and load flexibility, integration of heat pumps, accelerated deployment of e-mobility, integration of electricity generation and storage facilities from RES,
- **to place electricity infrastructure more effectively in space;**
- **establish, by 2026 at the latest, continuous monitoring of voltage quality at the measuring points of electricity consumers** in connection with the upgrading of the smart metering system and the provision of technical conditions for the development of the market with flexibility;
- further **develop the regulatory framework towards supporting the transition to a climate-neutral society**, so that the approved network development plans and investment plans of network operators can be coordinated and that the **share of investment funding provided for the implementation of the approved development plans of electricity network operators is 100 %**;
- **support the development of an efficient and competitive market** to make full use of the flexibility of the electricity system and of new technologies, so that the supply of flexibility in the service market in 2030 will enable the provision of 100 % FRR requirements;
- **support cross-sectoral integration** and implementation of new cross-sectoral system services;
- **to promote research and development cooperation** between undertakings within and outside the sector,
- **ensure the further development of the pipeline system and prepare the system for the deployment (operation) of hydrogen in line with gas flows and system capacities, as well as the deployment of hydrogen and new sources of RES gases,**
- **prepare a regulatory and supportive environment** for the production of**renewable substitute** gases and the preparation of pipeline networks for the transport and supply of new gases (indicative target of at least 10 % of renewable methane or hydrogen in the transmission and distribution network by 2030) **and support development and research and domestic renewable gas production projects**,
- **enable the alleviation and reduction of energy poverty** by accelerating the implementation of social policy measures, general housing policymeasuresand the

existence**of**targeted measures **aimed at reducing the share of households in energy poverty to between 4.6 % and 3.8 % by 2030** for energy poor households and **between 3500 and 10.500 energy efficiency and RES investments.**

5 R & I and competitiveness dimension

Overview of key objectives:

- **increasing investment in R & D –** at least 3.5 % of GDP by 2030 (of which at least 1¼% of GDP is public money, in line with ZRISS 2030);
- **increased investment in the development** of human resources and new skills needed for the transition to a climate-neutral society;
- linking the content of Slovenia's new scientific research and innovation strategy 2030 (ZRISS 2030) with the NECPs, thereby encouraging the financing of the content of climate action;
- supporting businesses **for an efficient and competitive transition towards a climate-neutral and circular economy**;
- promoting **targeted research projects** and **multidisciplinary R & D programmes** at all Technology Readiness Levels (TRL 1-9) and **demonstration projects** aimed at achieving a climate-neutral society and circular economy that are of direct interest to the economy or the public sector and meet national development objectives, in particular in the areas of energy efficiency, circular economy and green energy technologies;
- **directing companies to finance and engage** in R & D programmes and demonstration projects **through active tax policy**,
- **promoting new and strengthening existing energy R & D programmes** in line with the objectives of the NECPs and the Resolution on the Long-term Climate Strategy of Slovenia to 2050 (ReDPS50), with a focus on research on hydrogen utilisation technologies and green electricity generation and use technologies,
- **promoting the use of digitalisation** in climate action and **increasing cybersecurity in all strategic systems**,
- the**use of advanced methods and technologies** (including supercomputing capacities) in modelling, simulating and monitoring climate change and finding solutions to reduce emissions, transition to a low-carbon circular economy and adapt to climate change;
- promoting public and private sector R & D programmes at all Technology Readiness Levels (TRL 1-9) with the aim of achieving a climate-neutral society, in particular in the areas of Slovenia's Sustainable Smart Specialisation Strategy (S5) contributing to climate objectives;
- support the upgrade and deployment of research infrastructures in public research organisations to invest in the deployment of technologies, systems and

infrastructures for affordable clean energy (including emission-reducing energy storage technologies, energy poles and nuclear research infrastructure).
  - active involvement of Slovenia in European initiatives to promote innovation and in centralised EU funds projects in the field of climate neutral society and circular economy;
  - create competitive conditions for R & D and innovative work in public enterprises;
- a**competitive and socially responsible enterprise and research sector** with three strategic objectives, in line with Slovenia's 2030 Development Strategy and its objectives:
  - achieving 95 % of average productivity in the EU by 2030;
  - rankings in the group of EU Innovation Leaders by 2030 (European Innovation Index at least 125 in S5);
  - rankings in the first third of EU countries across all five core components of the Digital Economy and Society Index (DESI) by 2030 (at least 9th in S5).

1.2 Overview of current policy situation

Slovenia's energy and climate policy aims to ensure a secure, secure and competitive energy supply in a sustainable manner by ensuring the transition to a climate-neutral society and by achieving the Sustainable Development Goals by, inter alia, creating an enabling environment for economic development and the creation of high value-added jobs, improving quality of life and increasing environmental responsibility, and providing acceptable energy services for residents and the economy.

The key challenges for Slovenia in the area of energy and climate policy are:

- gradually reducing energy consumption and increasing energy and material efficiency in all sectors;
- accelerated development of the electricity distribution network to enhance strength, resistance to disturbances and advancedness, allowing for an accelerated exploitation of resource and load flexibility, integration of heat pumps, meeting the requirements related to the accelerated deployment of e-mobility and accelerated integration of renewable power generating installations; it will be necessary to provide financial resources for additional investment by distribution companies and to ensure that the level of network charges is set in a sustainable way.
- the effective spatialisation of infrastructure projects that contribute to achieving the objective of a climate-neutral society;
- phasing out fossil resources in all sectors;
- sustainable traffic management and transition to alternative fuels;
- accelerated development of district heating and cooling systems,
- decarbonisation of natural gas supply and integration of the gas and electricity sectors;
- maintaining the excellence and safe operation of nuclear installations in Slovenia and preparing guidelines for decisions on the future use of nuclear energy and the possible construction of a new nuclear power plant;

- technological development and commercial breakthrough of RES, advanced technologies and services, including energy storage and efficient use,
- reducing the implementation deficit by all actors and at all levels, in order to fully and effectively manage and implement measures for the transition to a climate-neutral society.

The main task of the future development of energy in Slovenia is to ensure a balance between the three fundamental pillars of energy policy, which are inextricably intertwined: climate sustainability, security and competitiveness of energy supply.

In the long term, Slovenia has committed to honour its commitments under the Paris Agreement to keep the increase in global temperature below 2 °C by reducing GHG emissions and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. Slovenia ratified the Paris Agreement in 2016.[15]

In May 2019, the Government of the Republic of Slovenia supported the objective of achieving net zero GHG emissions at EU level by 2050. In July 2021, the Resolution on Slovenia's Long-term Climate Strategy 2050 (ReDPS50) was adopted, setting a clear target of achieving net-zero emissions or climate neutrality by 2050. Slovenia also enacted this target in 2022. In April of this year, the new Environmental Protection Act entered into force, Article 143 of which states that the country is to ensure the achievement of the climate policy objective or climate neutrality objective in Slovenia by 2050. In September 2022, the ministry responsible for the environment, in line with the commitment and vision of the 2050 long-term climate strategy, started working on a new proposal for a Climate Change Act, which will serve as the legal framework for the implementation, management, monitoring and reporting of all aspects of climate policy in Slovenia.

In the area of adaptation to climate change, Slovenia adopted a Strategic Framework on Adaptation to Climate Change in December 2016, which provides guidance on adaptation to climate change in Slovenia. It sets out the vision that "by*2050, society in Slovenia will become adapted and resilient to the impacts of climate change with a high quality and safety of life that fully seizes opportunities in a changing climate based on sustainable development"*.

The Vision aims at strengthening the capacity to adapt to climate change, manage risks and seize the opportunities of climate change, with the overall objective of reducing Slovenia's vulnerability, vulnerability and vulnerability to climate change impacts and increasing the resilience and adaptive capacity of society.

The objective of reducing GHG emissions is also reflected in **setting the most ambitious and development-oriented share of RES** in end-use that takes due account of relevant national circumstances. With the updated NECPs, Slovenia will actively seek to create the appropriate structural environment and promote the necessary changes to enable, taking into account the Fit for 55 and the "REPowerEU" legislative packages, a significantly higher and more ambitious target of **at least 30-35 % RES in final energy consumption by 2030** with a view to further increasing the share of RES by 2040 (and 2050) at the next update of the NECPs in 2029.

[15] Act ratifying the Paris Agreement, Uradni list RS (UL RS; Official Gazette of the Republic of Slovenia) No 77/16.

In the field of transport and transport infrastructure up to 2030, Slovenia is the basic document entitled ` **Strategy for the Development of Transport in the Republic of Slovenia until 2030'**.[16] A number of measures have already been implemented in recent years for the development of rail infrastructure and public transport, as well as in the area of sustainable mobility (these actions are detailed in Chapter 4).

Energy **efficiency measures have** positive effects both for final consumers and the economy and for the environment, while also having markedly favourable macroeconomic effects such as boosting economic growth, creating jobs and reducing import dependency on fossil fuels. Promoting efficient energy use by consumers reduces consumption and thus energy costs, has a positive impact on human health and makes the economy more competitive. Increasing energy efficiency (and thus reducing energy use) is **Slovenia's first and key measure for the transition in a climate-neutral society**.

Security of supply is one of the three fundamental pillars of energy policy and is inextricably linked to climate sustainability and the competitiveness of energy supply. In order to ensure security of energy supply, Slovenia will ensure, in a sustainable and economically justified manner, sufficient supply of energy resources and sufficient capacity and diversification of supply routes, sufficient capacity and regular maintenance of networks, adequate cross-border interconnections and operationally reliable and efficient cooperation of energy systems, distributed sources of electricity and energy storage facilities. Given the size of Slovenia and the EU's energy policy, the interconnection of supply routes and resources in the region is very important for Slovenia. In view of climate change, maintaining security of supply will be particularly highlighted in the electricity system.

In order to achieve the ambitious energy and climate policy objectives, **Slovenia will provide better conditions for the accelerated development of the electricity distribution network** to increase its strength, resilience to disruption, advancedness and the use of flexibility of resources and burdens, as this network is the **cornerstone of the future transition to a climate-neutral society** and will only enable the accelerated connection of heat pumps to meet the requirements linked to the accelerated deployment of e-mobility and the accelerated integration of renewable energy installations.

Slovenia will endeavour to **reduce as far as possible the use and import of fossil energy sources** by phasing out the use of fossil energy sources, with an emphasis on increasing energy efficiency, and increasing the use of renewable and low-carbon sources. According to decarbonisation projections, the share of RES in energy balances will increase.

Slovenia's electricity interconnections fluctuated around 80 % in 2020 and 2021, thus well above the 15 % target for 2030.

Slovenia has several projects of common interest in the field of natural gas transmission. In the field of natural gas transmission, this is a transport connection project between Slovenia and Hungary, which will create the missing pipeline link between the two systems and allow gas to be transported from Hungary via Slovenia to Italy and vice versa, and thus access to LNG-terminals and underground storage facilities. The second project concerns the increase

[16] Accessible at the following web link: http://www.MZI.gov.si/si/dogodki/strategija_razvoja_prometa_v_rs/

of the bilateral capacity of the transmission connection between the Slovenian-Croatia and Slovenian-Austrian Intercotics for LNG-terminal access. In addition, Slovenia is planning two two-way hydrogen corridors: Hungary – Slovenia – Italy and Croatia – Slovenia – Austria, which will consist partly of existing gas and partly of new hydrogen infrastructure. Duplicate gas backbone pipelines will be used to create corridors, allowing for the creation and simultaneous separate operation of two parallel transmission systems, one for gas and one for hydrogen.

In the area of **research, development, innovation and competitiveness** (including the objectives of the Energy Union), a new scientific research and innovation strategy of Slovenia 2030 (ZRISS 2030) was adopted in March 2022, which also includes R & D to achieve these objectives, taking into account the achievement of the climate-neutral society objectives.[17] In order to achieve the objectives set, the updated NECPs confirms as a target an increase in R & D investment of at least 3.5 % of GDP by 2030 (of which 1.25 % of GDP of public money), with resources dedicated to the objectives of a climate-neutral society increasing and expected to be channelled to targeted research projects, multidisciplinary R & D programmes and demonstration projects, and science-business R & D programmes.

Key issues of cross-border relevance

Slovenia is a small country and its energy system is highly integrated with neighbouring countries, in particular Italy, Austria, Croatia and Hungary. Only the construction of cross-border gas infrastructure with Hungary is still missing. In view of the increasing volume of energy transmission in the energy system, a well-functioning and integrated energy market at both regional and EU level is essential for Slovenia. In addition, it should be noted that the joint management of freight transport in Slovenia and the wider region is one of the key issues of cross-border relevance, which will be addressed by Slovenia at cross-neighbourly, regional and EU-levels with the aim of limiting freight traffic on roads also through inter-state cooperation. Knowledge of objectives, energy policies and measures in neighbouring countries and consultation and constructive cooperation on regional infrastructure issues are of utmost importance for Slovenia.

Administrative structure of implementing national energy and climate policies

Following the entry into force of the State Administration Act in February 2023, the Ministry of the Environment, Climate and Energy performs tasks in the areas of environmental protection, environmental assessments, climate change and waste management, energy, energy efficiency and renewable energy sources, supply of petroleum products and alternative fuels infrastructure in transport and sustainable mobility, integrated transport planning and public passenger transport in domestic and cross-border transport. A number of other ministries are also involved in the implementation of the measures. An interdepartmental expert group of various ministries has been set up to support the drafting of the updated NECPs. Separately,

[17] The Resolution on Slovenia's scientific research and innovation strategy 2030 (ReZrIS30) is accessible via http://www.pisrs.si/Pis.web/pregledPredpisa?id=RESO133.

the Climate Council is also established as an independent national scientific advisory body for climate policy. Its tasks will be to provide scientific advice in the form of expert opinions and recommendations to the Government on existing and proposed climate policy measures and their compliance with ratified international treaties and the EU acquis on climate change.

1.3 Consultations and involvement of national and Union entities and their outcome

Involvement of the national Parliament

The National Assembly is not directly involved in the process of adopting the update of the NECPs, as the NECPs and its update are adopted by the Government in accordance with the Energy Act. Nevertheless, the Government of the Republic of Slovenia endeavours to keep the National Assembly informed of the progress of the process of preparing the update of the NECPs, which is done through information on the adopted government material, until the National Assembly is informed on an ad hoc basis by means of parliamentary questions. Notwithstanding the above, members of the National Assembly, like all other stakeholders, are kindly invited to participate in the NECPs modernisation activities.

Following a decision of the Committee of the National Assembly on Infrastructure, Environment and Spatial Planning, a report on the state of implementation of the NECPs was prepared in summer 2022. The report took into account the latest available data and estimates (mainly for 2020) and briefly provided key findings per dimension of the Energy Union, i.e.: (a) objectives, b) state of play and c) implementation assessments. The report was accompanied by a list of measures contained in the NECPs with information on the implementation of individual actions. The report was adopted by the Government of the Republic of Slovenia on 19 October 2022 and forwarded to the National Assembly for information. The Government of the Republic of Slovenia will inform the National Assembly of the draft update of the NECPs to be submitted to the European Commission and the biennial National Energy and Climate Reports. In the following, the Government will also endeavour to further inform and involve the National Assembly in the activities of updating the NECPs (update of the background documents, preparation of a comprehensive draft update of the NECPs, implementation of the CPVO).

Involvement of local and regional authorities

Organisations representing local communities, like other stakeholders, were invited to participate in all the activities of the modernisation of the NECPs, and the response of municipalities (the level of provinces in Slovenia has not yet been established) was initially somewhat smaller – only some of the 212 municipalities, of which 12 have the status of urban municipalities, have been involved in the modernisation activities of the NECP (e.g. the City of Ljubljana). This process is intensifying and, on 14 June 2023, a consultation was held with the Association of Municipal Municipalities of Slovenia (ZOS) in the City of Ljubljana on the modernisation of the NECP, in which representatives of urban municipalities and other municipalities of Slovenia participated. The consultation focused in particular on key topics

related to the modernisation of the NECPs and urban municipalities such as transport, energy use and renewable energy. We expect this process to continue and intensify.

Consultations of stakeholders, including the social partners, and engagement of civil society and the general public

In accordance with Regulation (EU) 2018/1999, the preparation of the update of the NECPs in Slovenia is carried out in such a way as to enable the public to participate effectively. To this end, the NECPs website has been comprehensively revamped, where all information concerning the preparation of the update of the NECPs is made available in spot and publicly available, with the aim of ensuring that the professional and general public is informed. Reasonable time limits are set for informing the public, who can participate and express its views. A multilevel climate and energy dialogue is also in place, in which local authorities, civil society organisations, the business community, investors and other stakeholders, as well as the general public, can actively participate.

The public consultation to prepare the update of the NECPs will take place in several steps, in line with the Indicative Public Engagement Plan.

1. A preliminary consultation on the preparation of the draft NECPs took place in autumn 2022, when all interested stakeholders, i.e. local authorities, civil society organisations, business community, investors and other stakeholders as well as the general public, were invited to a public consultation and dialogue on the national 2030 targets and the achievement of climate neutrality. As part of the preliminary consultation, a public hearing, an online public consultation and a series of targeted thematic consultations were carried out.[18]
2. The second round of public consultation took place in spring 2023. It aimed to consult on the proposed orientations and objectives in the first draft update of the NECPs and included a public presentation, a general online consultation and several targeted expert (focus) consultations with key stakeholders.[19]
3. The final consultation on the preparation of the NECPs will take place following the positive opinion of the MOP on the adequacy of the NECPs and the environmental report, i.e. in spring 2024, when both documents will be publicly disseminated and all interested stakeholders consulted.

In a separate and meaningful manner with the process of preparing the modernised NECPs, public engagement will take place in the context of the CPVO, where a Public Engagement Framework Plan is being drawn up, which will meaningfully liaise with the public in the preparation of the updated NECPs.

[18] For more information, see the section 'Public consultation and updating of backgrounds and the NECPs' above and the NECPs website 'Preliminary public consultation', accessible via https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/preliminarno-posvetovanje/.

[19] For more information, see the section "Public consultation and updating of scientific backgrounds and NECPs" above and the NECPs website "Public presentation of the first proposal for an update of the NECPs", accessible via https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt-2024/sodelovanje-z-javnostjo/javna-predstavitev-prvega-predloga-posodobitve-nepn/.

In parallel, a number of technical and public events are actively involved or co-organised by the Ministry and the NECCP, representing the monitoring of the implementation of the NECPs and the process of updating the technical bases and the NECPs. An example of this is the cooperation with the Chamber of Commerce of Slovenia and representatives of youth organisations, with which a joint consultation on the draft update of the NECPs was prepared in May 2023 at management and expert level. Such activities are expected to continue and intensify further in the second half of 2023 and in the first half of 2024.

Consultations of other Member States

In the light of the positive experience of the regional consultation in preparation of the first NECPs, we will work towards a reorganised regional consultation with neighbouring countries on the modernisation of the NECPs. The event will be a good opportunity for a comprehensive exchange of views as well as for exploring opportunities for possible or strengthening existing regional cooperation. In this context, we also expect an important contribution from technical assistance, which Slovenia benefits from through the European Commission, in the form of an analysis of the opportunities for cooperation with neighbouring countries.

However, Slovenia regularly monitors the activities of other Member States related to the preparation of the updated draft NECPs and participates actively in related activities at EU level within the Energy Union Committee and the Climate Change Committee.

Cooperation with the Commission

Slovenia actively participates in the work of the Energy Union Committee and the Committee on Climate Change in connection with the preparation of a modernised NECPs at EU level. Slovenia has also asked the European Commission for the technical assistance it provides to Member States for the preparation of the updated NECPs. The implementation of technical assistance started in spring 2023 and in this regard Slovenia will professionally step up the preparation of updated technical bases for the NECPs, cooperation with neighbouring countries and the planning of policies and measures in the updated NECPs. Slovenia will also thoroughly and comprehensively examine the European Commission’s recommendations, in line with Regulation (EU) 2018/1999, and take them into account as far as possible in the preparation of the final updated NECPs.

2 NATIONAL TARGETS

The chapter includes **first proposals for new national targets across the five dimensions of the 2030 NECPs**. The proposed new targets are the results of the first calculations and the first evaluations of the new 2030 NECPs targets, so the targets are given in ranges or the current estimated value is given. The final values of the targets will be aligned with the adopted Fit for 55 legislative framework, the Energy Efficiency, Renewables Directive, etc., which is still in final coordination. The results of the consultation process and the final model calculations will be taken into account.

2.1 Decarbonisation dimension

Overview of key objectives:

- **contribute to achieving net-zero GHG emissions at EU level by 2050 as a starting point for the planning of targets, policies and necessary measures for 2030;**
- **reducing total GHG emissions by at least 55 % by 2033 compared to 2005,**
- **reduce GHG emissions more by 2030**, as required by the Burden Sharing Decree in Slovenia, i.e. by **at least 28-31 % compared to 2005,** by achieving sectoral targets:
  - transport: + 3 %,
  - wide use: — 74 %,
  - agriculture: — 1 %,
  - waste Management: — 67 %,
  - industry*: — 55 %,
  - energy*: — 48 %.

  ** only the part of the non-ETS sector,*
- **reducing GHG emissions in buildings** by at least 70 % by 2030 compared to 2005,
- **ensure that LULUCF emissions do not exceed sinks in the period from 2021 to 2025 and that a sink in the LULUCF sector is at least -146 kt CO_2 eq in 2030;**
- **in the field of adaptation, reduce vulnerability, vulnerability and vulnerability of Slovenia to the impacts of climate change** and increase the resilience and adaptive capacity of society;
- **ensuring climate justice;**
- **ensuring the transition to a low-carbon circular economy** by promoting sustainable consumption and production;
- **achieve a share of at least 30-35 % of RES in final energy use by 2030;** and
  - **achieve at least 2/3 of energy use in RES buildings** (share of RES use in final use of energy products excluding electricity and district heat),
  - **at least 30 % share of RES** (including waste heat) in industry,
  - **an annual increase of at least 2-3 % in the share of RES and waste heat and cold** in district heating and cooling systems and achieving at least 25-40 % of that production by 2030;
  - **at least 52 % share of RES** in electricity generation,
  - **at least 41 % share of RES in** heating and cooling,
  - **at least 26 % share of RES** in transport,
- the**introduction and rapid expansion of accompanying energy activities** to enable the installation of generating installations producing electricity from the sun or wind in a room whose primary purpose is different (agricultural, road, water, etc.),
- the location of renewable energy sources (solar and wind) also in Natura 2000 sites;
- **accelerated solarisation of roofs in the public sector**,
- **decarbonising EE production – phasing out coal use**: the cessation of operations of coal units by 2033 at the latest, in accordance with the principles of a just transition,
- progressive decarbonisation of **energy-intensive industries and hard *to abate sectors*:** provide **financial incentives** for the restructuring of production processes through the deployment of green technologies, green gases including hydrogen and green fuels and technologies for CO_2 capture and storage;

2.1.1 Greenhouse gases emissions and removals

The Government of the Republic of Slovenia has established in the JRC 2030 that "the transition to a low-carbon circular economy (...) is a priority development path for the whole economy".[20] The key objective of Slovenia's long-term climate policy is a necessary transition to achieve climate neutrality by 2050, which is also enshrined in theZkon on Environmental Protection. The objective of achieving net zero emissions (sinking equal to remaining anthropogenic GHG emissions) or achieving climate neutrality by 2050 is in line with the Paris Agreement. The objectives of the NECPs follow this long-term trajectory and are in line with*the Resolution on the Long-term Climate Strategy of Slovenia to 2050 (ReDPS50)* [21]. Under *the* ReDPS50, Slovenia will reduce GHG emissions by 80-90 % compared to 2005, while accelerating the implementation of policies to adapt to climate change and ensure climate security for the population (see also Chapter 4.1.1). The ReDPS50 also defines strategic sectoral objectives for 2050.

Tax exemptions or refunds that encourage the use of fossil fuels contrary to the GHG emission reduction targets **will be phased out by 2030**. The inefficient use of fossil fuels and coal imports will become uneconomic **with the gradual increase of CO2[22]and other taxes.**

In order to achieve the goal of decarbonising the economy**, energy-intensive industries and** hard to *abate sectors will benefit from***financial incentives (** domestic and EU resources: Climate Fund, Innovation Fund, Modernisation Fund, etc.) to restructure production processes by introducing green technologies, green gases including hydrogen and green fuels and technologies for CO_2 capture and storage. Slovenia will also provide fiscal incentives in the form of credits for the implementation of investments in energy efficiency, energy end-use reduction or investments in self-consumption and renewable energy supply (RES). A scheme to promote the implementation of CCS projects in hard-to-decarbonise sectors and other measures to reduce GHG emissions in industry, based on the Net Zero Industry Act, will also be needed.

Binding 2030 GHG emission targets of Slovenia in the non-ETS sectors (not ETS)

Under the Regulation on binding GHG emission reductions for Member States, **Slovenia**[23] **is committed to reducing its GHG emissions in the non-ETS sectors by at least 27 % below 2005 levels by 2030.** In addition to the 2030 target, the Regulation also provides for a linear trajectory that should not be exceeded, taking into account the flexibility provided for in the Regulation.

---

[20] Adopted on 7 December 2017, available at: http://www.vlada.si/fileadmin/dokumenti/si/projekti/2017/srs2030/Strategija_razvoja_Slovenije_2030.pdf

[21] Resolution on the long-term climate strategy of Slovenia to 2050 (Uradni list RS (UL RS; Official Gazette of the Republic **of** Slovenia) **Nos** 119/21 and 44/22 – ZVO-2)

[22] The progressive alignment of the level of environmental tax on air pollution with CO_2 emissions to the level of the price of allowances.

[23] Regulation (EU) 2023/857 sets national GHG emission reduction targets for each EU Member State. The form and manner of monitoring and reporting under the Decree on binding GHG emission reductions have been harmonised for all Member States under the Regulation on the Governance of the Energy Union and Climate Action.

In order to successfully achieve the (non-ETS) GHG emission reduction target, it is important to manage and reduce emissions in all sectors involved and therefore the NECPs set sectoral targets for reducing GHG emissions by 2030 compared to 2005 (Preglednica 1)[24].

Table2: Sectoral targets and GHG emission reductions in non-ETS sectors

Sectors	Annual GHG emissions [kt CO_2 eq]			Reduction targets compared to 2005 [kt CO_2 eq]	Decrease from 2021
	2005	**2021**	**2030**	**2030 NECPS**	**2030 NECPS**
Transport	4.401	5.205	4.507	3 %	13 %
Wide use	2.719	1.258	700	—74 %	—44 %
Agriculture	1.799	1.813	1.778	—1 %	—2 %
Waste management	849	429	279	—67 %	—35 %
Industry[25]*	1.487	1.211	823	—55 %	—32 %
Energy[26]*	635	508	330	—48 %	—35 %

** Only the part of the sector not covered by the ETS.*

In order to address the transport problem, which accounts for as much as half of GHG emissions (non-ETS), it is crucial to design and implement appropriate measures that will have an impact on GHG emissions correctly and effectively. As a first step, due to the continuous growth of road (freight and passenger) transport, Slovenia needs to pay particular attention to **rail transport and sustainable mobility measures**. By doing so, it will reduce the carbon footprint of the transport sector and ease the burden on transport, which is becoming unsustainable for Slovenian roads. **To implement this goal, we will upgrade existing railway infrastructure, develop cycling and walking infrastructure, develop integrated public transport, promote sustainable modes of transport, improve the integration of spatial and transport planning, and develop a supportive environment for increased efficiency and use of alternative fuels in transport.**

Slovenia needs to manage the growth in energy use of passenger and freight transport over the next decade and channel transport flows to alternative modes of transport. A **gradual reduction of energy use through increased energy efficiency and a shift to low-emission vehicles or more energy-efficient transport modes** is crucial. To promote walking and cycling, we will actively promote the construction of cycling and pedestrian infrastructure wherever it is meaningful and environmentally acceptable. In this way, Slovenia will provide the population with easy, fast, green and environmentally friendly and non-

[24] Established by taking into account legally binding targets, policy decisions already taken at EU level on long-term objectives, the cost of reducing GHG emissions in Slovenia and other general development, sectoral and environmental objectives, and taking into account the effects of technological solutions.

[25] Industry includes emissions from the combustion of fuels in industry (1.A.2) and industrial processes sectors (2.)

[26] Energy includes emissions from the energy supply sector (1.A.1) and fugitive emissions (1.B).

invasive traffic in recent kilometres, as well as urban centres. The aim is to reduce the number of journeys by private car and to significantly increase the number of journeys on foot, bicycle or public passenger transport as a proportion of travel.

Total GHG emissions

The NECPs show that Slovenia will reduce its overall GHG emissions by at least 37-40 % by 2030 compared to 2005 and by at least 55 % by 2033.

The NECPs provide for the **phasing out of domestic and imported coal** for energy purposes and the cessation of operation of all coal units by 2033 at the latest, in line with the principles of a just transition.

Commitments made by Slovenia under Regulation (EU) 2018/841 and Regulation (EU) 2023/839

In the period 2021-2030, the land use, land use change and forestry sector is also part of the EU's Nationally Determined Contribution (NDC). *Land Use, Land Use Change and Forestry (LULUCF)*). **Slovenia's objective is to ensure that in the LULUCF sector:**

- **emissions will not exceed sinks in the period 2021-2025;**
- **in the period 2026-2029, the sum of the differences between net emissions (in all reporting categories) and average net emissions in 2021, 2022 and 2023 shall not exceed the budget for the period 2026-2029;**
- **achieve a sink of at least -146 kt CO_2 eq in 2030.**

Slovenia may use general flexibilities, managed forest land flexibility and the land-use mechanism, in line with the conditions and provisions of the EU LULUCF Regulations, to achieve the targets in the LULUCF sector, where appropriate.

Slovenia's long-term climate strategy

The NECPs build on the vision, objectives and orientations *of the Resolution on Slovenia's long-term climate strategy to 2050 (ReDPS50)* [27] and presents an action plan for its implementation.

The climate strategy is based on the principlesof reducing GHG emissions, energy efficiency and reducing energy consumption, climate justice, a just transition and science. The objectives and measures shall be based on the latest and internationally recognised scientific knowledge and shall be based on the principles of the law governing the protection of the environment, including the main principles of sustainable development, integrity, cooperation, the polluter pays principle, prevention and precaution. These include the principle of competitiveness, the principle of respect for sectoral objectives to facilitate sectoral policy integration, the principle of cost-effectiveness, the principle of ensuring Slovenia's active role in the international community, the principle of the conservation of habitats which are

[27] Resolution on the long-term climate strategy of Slovenia to 2050 (Uradni list RS (UL RS; Official Gazette of the Republic of Slovenia) Nos 119/21 and 44/22 – ZVO-2)

important for the conservation of biodiversity and whose condition is deteriorating also as a result of climate change, and the principle of the preservation of cultural heritage.

The main direction pursued by the climate strategy is to reduce GHG emissions. Horizontal orientations applicable to all sectors include further material efficiency, promotion of low-carbon resources, energy efficiency, sustainable spatial development, sustainable construction and promotion of digitalisation, and public administration as a role model. Slovenia will not adopt policies and measures and will not invest funds in a way that would undermine the commitments of the Paris Agreement.

The key direction of the ReDPS50 on climate justice is that Slovenia will ensure: that the costs and benefits of the transition are distributed fairly; that no one is left behind in the transition to a low-carbon society; that the most vulnerable populations are also able to implement climate change mitigation and adaptation measures and that those most affected by the transition receive timely assistance for the necessary action. In this context, the design and implementation of other policies that contribute to reducing the level of inequality in society will also be very important to ensure a just transition. Slovenia will ensure that the most vulnerable sections of the population are also able to implement the measures for the noon transition and, in particular, that the measures do not worsen the financial situation of the first and second income quintile groups. Measures that would affect the most vulnerable groups will be compensated for by appropriate mechanisms for these groups.

The ReDPS50 also guides consumer and production processes towards a low-carbon circular economy and gives the following key orientations: Slovenia will join the implementation of the activities proposed by the new European Circular Economy Action Plan, namely: participating in the development and adoption of binding legislative requirements on sustainable products in the EU, empowering consumers and taking into account the circular economy in public procurement, focusing on the most resource-consuming and potential-intensive sectors, waste prevention and its transformation into high-quality secondary resources, linking circular action efforts and involving people, regions and cities, participating in global efforts on the circular economy. The strategy focuses on increasing material efficiency through the use of less materials, by designing products for longer lifetimes, with reparability and longer product use times, by using less-emitting and recyclable materials, by reusing materials and recycling, by sharing products.

Other national targets

As part of[28] the 8th Development Goal, the **transition to a low-carbon circular economy**, JRC 2030 sets two performance indicators in addition to the target **share of renewables in final energy use to** monitor the achievement of the target[29]:

- **material productivity** – reach the target value of 3.5 PPS/kg by 2030 (compared to baseline value of PPS 1,79/kg in 2015);

[28] **Slovenia's 2030 Development Strategy**, available at: http://www.vlada.si/fileadmin/dokumenti/si/projekti/2017/srs2030/Strategija_razvoja_Slovenije_2030.pdf

[29] JRC 2030, p. 39.

- **emission productivity** – to reach the EU average in 2030 (based on a baseline of 2.9 PPS/kg_{CO2} equivalent in 2015).

The Resolution on the National Programme on Strategic Guidelines for the Development of Slovenian Agriculture and Food "Our Food, Rural and Natural Resources since 2021"[30] defines the basic strategic framework for the functioning of agriculture, food and rural areas and forms the basis for the new strategic planning beyond 2021. The resolution also includes specific objective B.2 Mitigation of climate change and adaptation to climate change among its specific objectives under the heading 'Sustainable management of natural resources and the provision of public goods'. The resolution states that in order to avoid exacerbating the further effects of climate change, it will be necessary to reduce the vulnerability of agriculture to climate change and to limit greenhouse gas emissions. This highlights the limited capacity of the agricultural sector to mitigate climate change in order to increase food production.

The Common Agricultural Policy Strategic Plan 2023-2027 for Slovenia (confirmed in October 2022) established, for the[31] first time in the history of implementation of the Common Agricultural Policy, a separate specific objective dedicatedto climate change mitigation and adaptation (SO4 contributing to climate change mitigation and adaptation, including reducing greenhouse gas emissions and increasing carbon sequestration, and promoting sustainable energy). Four needs have been defined under SO4 specific objective:

P13 Reducing GHG and ammonia emissions from agriculture,

P15 Adaptation to climate change in agriculture and forestry,

P16 Restoration of forest following natural disasters and adverse weather conditions,

P38 fire protection in forests.

Indirectly or partially, they were also addressed to the following needs:

P26 Promoting sustainable energy use and the development of the circular and bio-economy; and

P32 Provision of animal-friendly husbandry methods.

Under SO5 Promoting sustainable development and efficient management of natural resources such as water, soil and air, including reduction of chemical dependency, the following was also addressed: Need P14 Conservation and quality assurance of agricultural soils and prevention of erosion.

Among the interventions of the Strategic Plan contributing directly to the reduction of methane and nitrous oxide emissions, investments in covered storage of livestock manure, support for low-emission fertilisation techniques (investments in equipment and co-financing of implementation), support for measures requiring fertilisation based on soil testing, support for the use of urease inhibitors, nitrification and denitrification, support for precision fertilisation, reduction of methane releases from digestive livestock by optimising feed ration and feed

[30] **Resolution Our food, rural areas and natural resources since 2021**, accessible at: https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2020-01-0203/resolucija-o-nacionalnem-programu-o-strateskih-usmeritvah-razvoja-slovenskega-kmetijstva-in-zivilstva-nasa-hrana-podezelje-in-naravni-viri-od-leta-2021-renpursk

[31] CAP Strategic Plan 2023-2027 for Slovenia, available at: https://skp.si/skupna-kmetijska-politika-2023-2027

additives to limit methanogenesis in the rumen and financial incentives for legume cultivation should be highlighted.

In line with the NECPs orientations, sectoral reductions in GHG emissions by at least 2 % by 2030 compared to 2005 shall be taken into account when drawing up the strategic orientations for agricultural policy beyond 2027.

The most important natural resources in Slovenia include agricultural land, which together account for 33 % of the area. High-quality agricultural land is limited in Slovenia and its maintenance is therefore of utmost importance. The structure of agricultural land is dominated by permanent grassland, which determines the orientation of Slovenian agriculture towards livestock farming. On the one hand, livestock farming is a source of methane emissions and, on the other hand, through maintaining grassland and contributing to carbon stocks in cropland, it contributes to harnessing the potential of agricultural soils to embed carbon from the atmosphere. CAP Strategic Plan interventions contribute to increasing soil carbon stocks through incentives for different ways of greening stubble and through incentives to implement conservation tillage.

Already in 2016, Slovenia adopted the **National Strategic Framework for Adaptation to Climate Change (SOPPS)**,[32] which includes guidance on how to better integrate adaptation into policies, measures and practices. The document sets out a vision for Slovenia to become an adapted and resilient society with high quality and safety of life by 2050, making full use of opportunities in a changing climate. The same vision is set out in the Resolution on Slovenia's long-term climate strategy to 2050.

The key objective of the modernised NECPs in the field of climate change adaptation is to significantly strengthen policy and action in this area (establishing a Climate Change Adaptation Centre and local points for regions and municipalities), including research and the development of background documents.

2.1.2 Renewable energy

Total share of RES by 2030

The NECPs set a target for 2030 of at least 30-35 % share of renewables in final energy use.

In preparing the first NECPs, Slovenia weighed up the previously adopted JRC 2030 target of 27 % RES by 2030, and established, based on updated technical backgrounds and specific

[32] **The Strategic Framework for Adaptation to Climate**Change, adopted by the Government of the Republic of Slovenia in December 2016, sets out the framework and guidelines for adaptation to climate change in Slovenia. Available at: http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/podrocja/podnebne_spremembe/SOzP.pdf

national circumstances, a development-oriented and achievable national RES share and sectoral targets for 2030.[33]

Slovenia will work actively to improve energy efficiency in all sectors and thus to limit energy use. This will reduce primary and final energy use. **Slovenia will promote and promote the use of RES through appropriate legislative measures (positive legal discrimination), which has an extremely important impact on the security of energy supply by reducing import dependency on fossil fuels.** In addition to increasing the share of RES in energy end-use, the share of RES also needs to be increased in the electricity and gas sectors.

When taking measures in the field of RES, particular attention will be paid to the **debureaucratisation and proper integration of RES into buildings, space and energy system**, as well as to the procedures for locating all necessary facilities in space.

Slovenia will also actively pursue the **introduction and rapid expansion of accompanying energy activities** to enable the installation of generating installations that produce electricity from the sun or wind in an area whose primary purpose is different (agricultural, road, water, etc.), the location of renewable energy sources (solar and wind) also in Natura2000 sites and the accelerated **solarisation of roofs in the public sector**.

If all planned policies and measures are successfully implemented by 2030, it is possible to achieve:

- **at least 30-35 % total RES share** and RES sectoral shares:
  - 52 % share in the electricity sector;
  - 41 % share in the heat and cooling sector;
  - 26 % share in transport.
- The share of RES increases in particular after 2025, as a result of a faster increase in electricity production from RES and a decline in gross final energy consumption. The increase in the use of RES in heating and cooling and transport is lower.
- Under the new RES Directive, the share of advanced biofuels is gradually increasing in all scenarios.
- Increasing the share of gaseous RES fuels (hydrogen, biomethane and other gases) to reach **at least 10 % to 30 % of the share of gaseous RES fuels in the total gas supply by 2030[34].**

Trajectories of total RES share 2021-2030

Figure 1 and Table 3 show the trajectories of the total RES share over the period 2021-2030.

[33] The share of RES that we will not be able to achieve in Slovenia due to environmental restrictions or other reasons will have to be ensured by Slovenia through other measures under the Regulation, e.g. participation in cross-border projects, statistical transfer or payments to the EU RES financing mechanism.

[34] ENTSO-G and ENTSO-E scenarios foresee 1.157 GWh of hydrogen and 2.200 GWh of biomethane (and SNP) for Slovenia for 2030 and the final share and volumes will be determined following the preparation of the Guide Strategy and other analyses.

1Figure: Estimated trajectories of the total share of RES in final energy consumption from 2020 to 2030 compared to actual trajectory

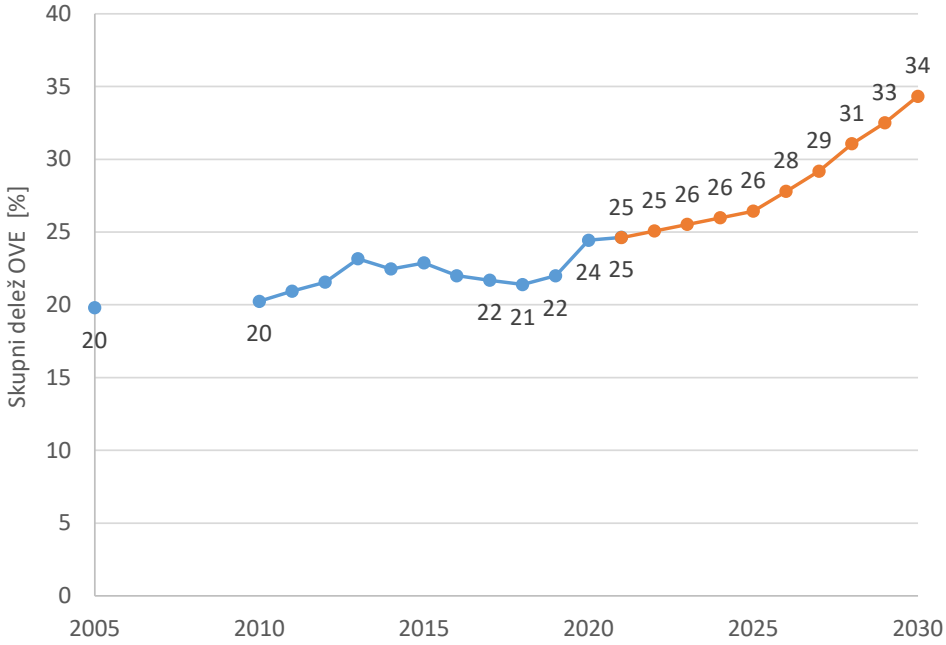


Table3: Estimated trajectories of the total share of RES in final energy consumption from 2020 to 2030

RES Year	**Estimated trajectories of total RES share** [%]
2020	25,0
2021	25,0
2022	25,1
2023	25,5
2024	26,0
2025	26,4
2026	27,8
2027	29,2
2028	31,1
2029	32,5
2030	34,3

Sector shares of RES in 2021-2030

2Figure: Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2020 to 2030 in the electricity sector compared to actual trajectory

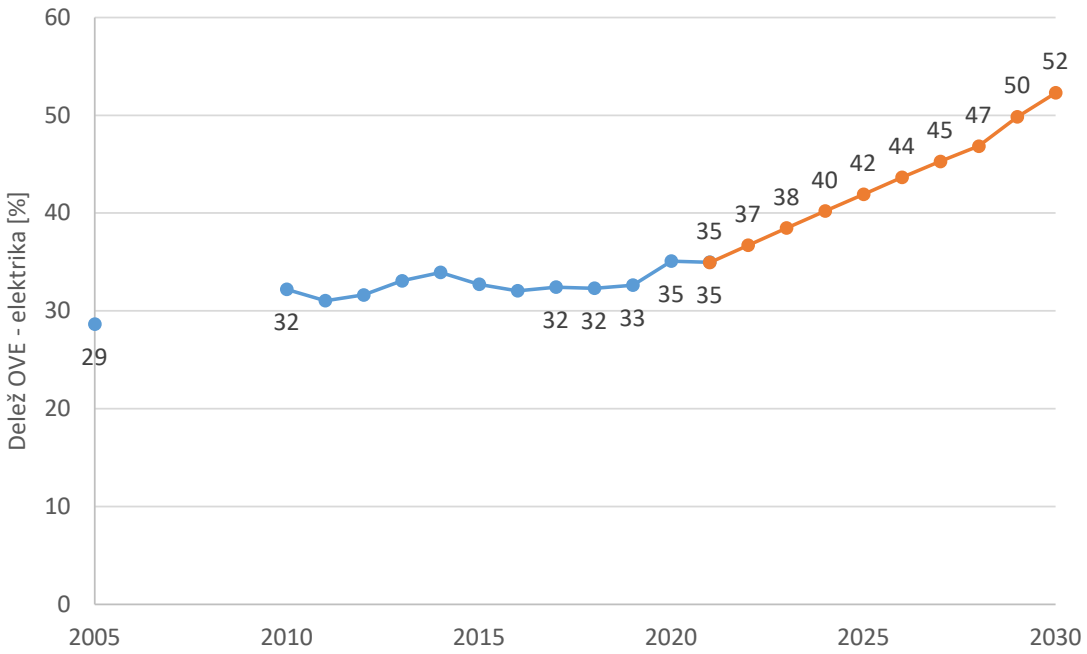


Table4: Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2020 to 2030 in the electricity sector (ESE-E)

RES-E Year	RES-E share path [%]
2020	33,7
2021	34,9
2022	36,7
2023	38,5
2024	40,2
2025	41,9
2026	43,7
2027	45,3
2028	46,8
2029	49,9
2030	52,3

3Figure: Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2020 to 2030 in the heating and coolingsector compared to actual trajectory

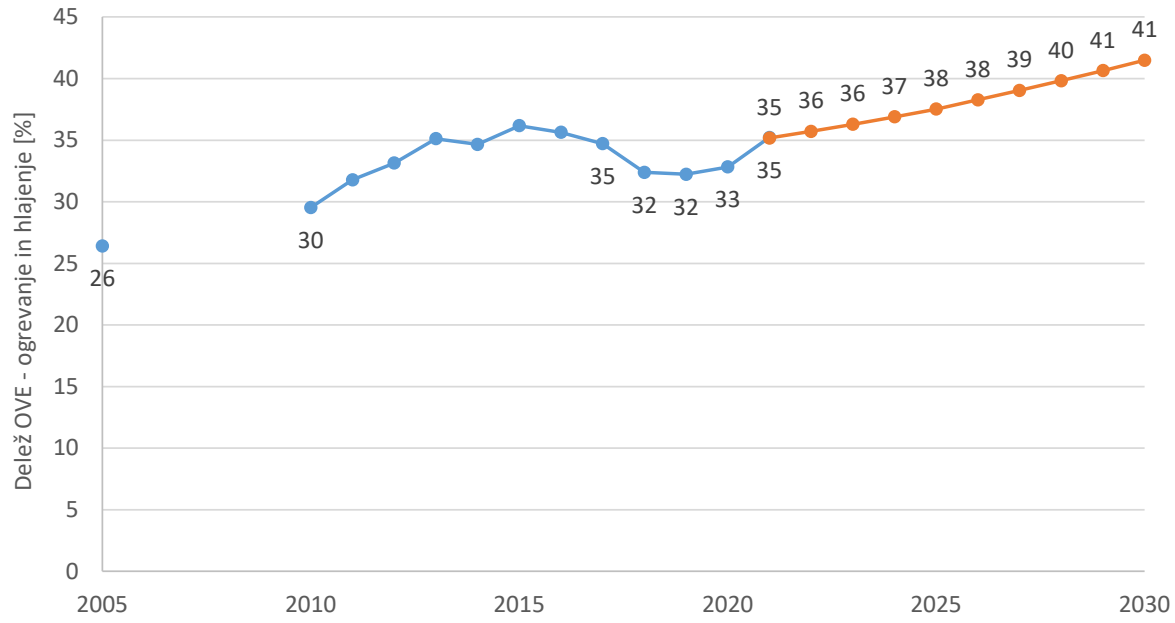


Table5: Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2020 to 2030 in the heating and cooling sector (OiH)

RES-OiH Year	RES-OiH share path [%]
2020	35,0
2021	35,2
2022	35,7
2023	36,3
2024	36,9
2025	37,5
2026	38,3
2027	39,0
2028	39,8
2029	40,6
2030	41,5

4Figure: Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2020 to 2030 in the transport sector compared to actual trajectory

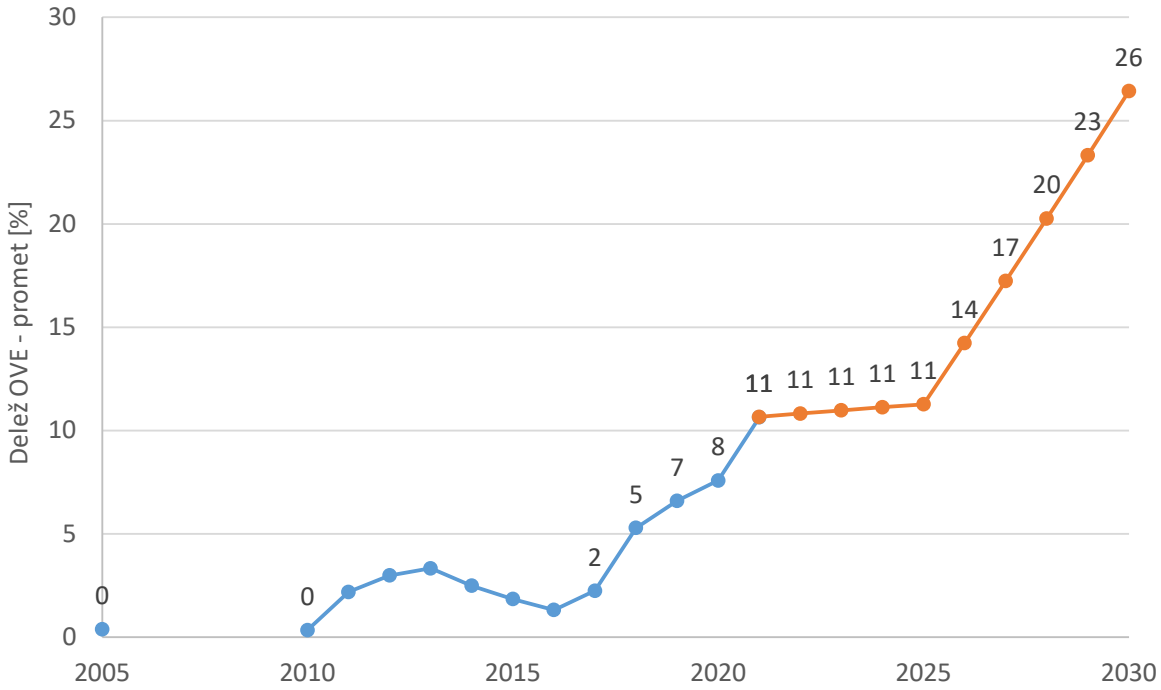


Table6: Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2020 to 2030 in the transport sector (OVE-T)

RES-T Year	RES-T share path [%]
2020	9,9
2021	10,7
2022	10,8
2023	11,0
2024	11,1
2025	11,3
2026	14,2
2027	17,2
2028	20,3
2029	23,3
2030	26,4

The target share of RES in transport under the harmonised RES Directive proposal is 29 %, but if the country plans a lower use of biofuel based on crops used for food and feed, it is possible to reduce the share, which Slovenia has benefited from.

Trajectories per renewable technology that Slovenia intends to use

The results of the expected future development of RES technologies are projected in the tables below.

Table7: Estimated trajectories per renewable technology that Slovenia plans to use to achieve the overall and sectoral trajectories for renewable energy from 2020 to 2030, including expected gross final energy consumption per technology, in GWh

GWh	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total gross end-use RES	13.236	14.262	14.545	14.829	15.112	15.395	16.047	16.700	17.353	18.273	19.120
Solar energy	488	571	915	1.258	1.601	1.944	2.328	2.711	3.094	3.477	3.861
Wind energy	6	6	6	6	6	6	76	146	216	286	356
Hydropower	4.585	4.622	4.575	4.527	4.479	4.431	4.435	4.438	4.442	4.713	4.716
Biogas	148	134	132	129	127	124	127	130	133	136	139
Bioliquids	1.081	1.192	1.255	1.318	1.381	1.444	1.597	1.751	1.905	2.059	2.213
Woody biomass	5.722	6.369	6.146	5.922	5.699	5.476	5.361	5.246	5.131	5.017	5.009
Ambient energy	683	804	936	1.069	1.201	1.333	1.404	1.476	1.547	1.618	1.778
Other RES heat	522	563	581	600	618	636	719	802	885	967	1.050

Table8: Estimated trajectories by renewable technologies Slovenia plans to use to achieve overall and sectoral trajectories for renewable energy from 2020 to 2030 in the electricity sector

GWh	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gross final consumption of electricity from RES	5.228	5.353	5.657	5.961	6.265	6.569	7.033	7.497	7.961	8.692	9.351
Solar energy (SFE)	368	453	737	1.139	1.483	1.826	2.212	2.598	2.984	3.370	3.756
Wind energy	6	6	6	6	6	6	76	146	216	286	356
Hydropower	4.585	4.622	4.575	4.527	4.479	4.431	4.435	4.438	4.442	4.713	4.716
Biogas	113	103	108	113	118	123	125	127	129	132	134
Woody biomass (CHP and co-incineration)	155	169	173	176	180	183	185	188	190	192	301
Geothermal energy	0	0	0	0	0	0	0	0	0	0	88

Table9: Estimated trajectories by renewable technologies Slovenia plans to use to achieve overall and sectoral trajectories for renewable energy from 2020 to 2030 in the heating and cooling sector

GWh	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gross end-use of RES for heating and cooling	6.926	7.717	7.633	7.549	7.466	7.382	7.417	7.452	7.487	7.522	7.557
Solar energy	119	118	118	118	119	119	116	113	110	107	105
Biogas	35	32	24	16	9	1	2	3	4	4	5
Woody biomass	5.566	6.200	5.973	5.746	5.519	5.293	5.176	5.059	4.942	4.825	4.708
Ambient energy	683	804	936	1.069	1.201	1.333	1.404	1.476	1.547	1.618	1.690
Other RES heat	522	563	581	600	618	636	719	802	885	967	1.050

Table10: Estimated trajectories by renewable technologies Slovenia plans to use to achieve overall and sectoral trajectories for renewable energy from 2020 to 2030 in the transport sector

GWh	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gross final use of RES in transport	1.149	1.269	1.255	1.438	1.527	1.623	1.909	2.200	2.497	2.798	3.103
Biofuels	1.081	1.192	1.255	1.318	1.381	1.444	1.597	1.751	1.905	2.059	2.213
of which advanced biofuels	188	359	386	413	440	466	655	844	1.033	1.222	1.411
Electricity from RES	68	77	0	120	146	174	243	317	397	481	568
Synthetic fuels (RFNBO) and 'green' hydrogen	0	0	0	0	0	5	68	132	195	258	322

Biomass use

The NECPs do not foresee significant imports of woody biomass for energy needs. The use of woody biomass is aligned with the LULUCF targets and does not reduce sinks. In order to achieve this objective it is necessary to ensure forest management in accordance with existing forest management plans and to improve domestic timber processing. Therefore, the orientations of the NECPs are as follows:

- high-quality wood products from Slovenian forests are processed at home into products with the highest added value (strengthening value chains), and for energy purposes (including as a source for synthetic fuels and synthetic gases), only low-quality wood and fine wood that is less suitable for industrial processing, forest and wood residues and harvested wood should in principle be used;
- wood should be properly integrated into the sustainable construction system and indicators and green public procurement.

Woody biomass from Slovenian forests is an important factor in mitigating climate change, sustainable development, security of heat supply, positive economic effects, synergistic effects along the woodworking chain and reducing import dependency. The economic aspect is also important in this regard, as the exploitation of less quality and fine wood for industrial and energy purposes greatly improves the economics of wood processing chains. Woody biomass plays a major role in the production of heat and electricity in district systems and industry and in the production of synthetic fuels using the latest technologies. Woody biomass can only be used for energy purposes in a controlled manner, with the highest possible efficiency and minimising negative environmental impact (with minimum emissions of ambient air pollutants: particulate matter, nitrogen oxides, volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), persistent organic pollutants (POPs), etc., which will represent both educational, legislative and technical implementation challenges.

The use of biomass in modern individual, collective and industrial installations for heating, heat and electricity production is important for Slovenia as this allows Slovenia to improve its security and competitiveness in its energy supply, to phase out fossil fuels and to reduce GHG emissions.

Use of biofuels

The use of biofuels will **prioritise the development, production and use of advanced sustainable biofuels.** In doing so, we will exploit the development potential according to available raw materials and encourage the necessary technological development through development incentives to implement pilot projects.

Slovenia will encourage the development of technologies for the production of sustainable biofuels, advanced synthetic gaseous and liquid fuels and use imported until it develops and establishes its own production.

Other RES objectives

In view of the complexity of achieving the overall RES target, Slovenia has set itself objectives in the following sectors:

- **at least 2/3 of energy use in RES buildings** (share of RES use in final use of energy products excluding electricity and district heat)
- **an annual increase of at least 3 % in the share of RES in heating and cooling in industry**, including waste heat and cold (exploitation priority),[35]
- **at least 30 % share of RES** (including waste heat) in industry,
- **an annual increase of at least 2-3 % in the share of RES and waste heat and cold in district heating[36] and cooling systems and achieving at least 25-40 % of that production by 2030;**
- **continue to actively promote the development of RES communities** and target investments in RES to areas where no further major investments in networks are needed.

The state of play of RES and relevant national circumstances (the chapter will be fully updated in the next stage of preparation)

Article 5 of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action provides that, when determining the national RES contribution up to 2030, Member States must also take into account all relevant circumstances affecting the deployment of RES, such as fair distribution in the EU, economic conditions and capacities, including GDP per capita, potential for cost-effective deployment of renewable energy, geographical, environmental and natural constraints, level of electricity interconnection and other relevant circumstances. Slovenia already noted when preparing its first NECPs in 2019 that the Commission had prepared its recommendation to Slovenia on the 37 % RES share by 2030 based solely on the application of the indicative formula in Annex 2 of Regulation (EU) 2018/1999, and the Commission clearly failed to take into account the relevant circumstances affecting the determination of the RES share, although it should have done so in accordance with Article 31(2) of Regulation (EU) 2018/1999.

Also when preparing the update of the NECPs, Slovenia cannot fully take into account the orientations of the Fit for 55 legislative package and the Commission's recommendations ('RePowerEU') in the part related to the national contribution to the 2030 RES target, taking into account all relevant circumstances. In the following, Slovenia justifies some relevant circumstances, which must also be taken into account when determining the national contribution to the 2030 RES target in accordance with Article 5 of Regulation (EU) 2018/1999.

a. State of the transport sector

In line with the RES Directive, Slovenia has adopted an ambitious target for the use of RES of 25 % of RES by 2020. Slovenia achieved 24.1 % of RES in 2020 and 24.64 % of RES in 2021, falling short of the target.

Countries with a high share of transport in gross final energy consumption and a high starting share of RES are much more difficult to progress than other countries, despite potentially

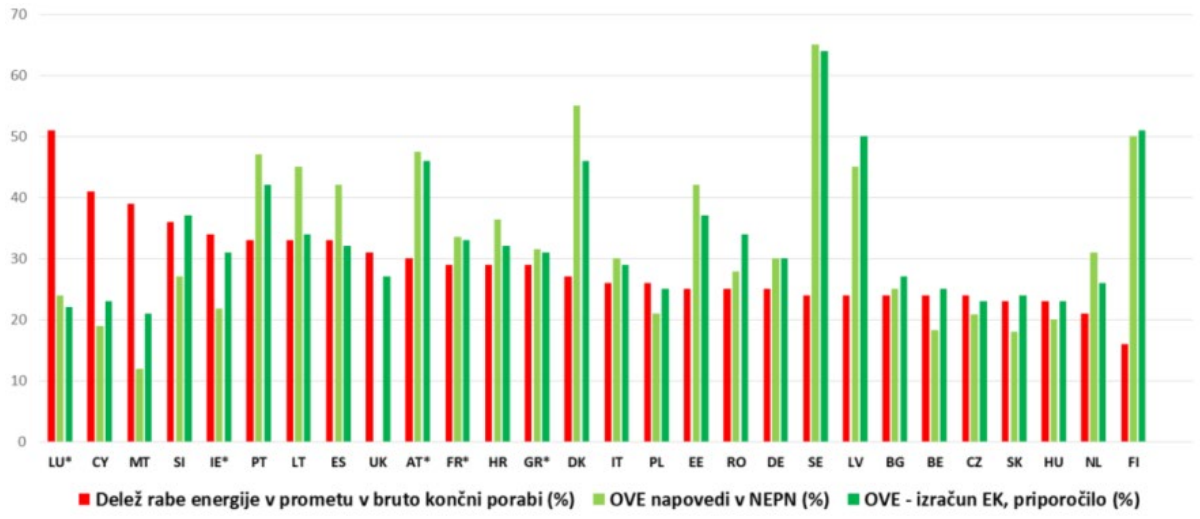
[35] In line with the requirements of Article 23 of recast Directive (EU) 2018/2001 on the promotion of the use of RES.

[36] In line with the requirements of Article 24 of recast Directive (EU) 2018/2001 on the promotion of the use of RES and the new RES Directive under preparation.

greater potential and available financial resources, as a small share of RES in transport requires much higher shares (often not available) in the heat and electricity sectors (therefore the overall RES potential is lower).

Slovenia ranks 4th in the EU as regards the share of energy consumption in the transport sector in final energy use (Figure 8), where the uptake of RES is extremely demanding, as RES are only biofuels whose use is limited by different standards and at the same time their production is a major sustainable challenge (mainly the first generation).

5Figure: Comparison of projected national shares of RES, EC calculation and share of energy use in transport, source: MZI based on IJS-CEU calculations, 2019



Projections of the transport sector point to a further increase in transport volumes in Slovenia up to 2030, i.e. both personal and especially freight, which will further increase energy consumption in the sector – scenario projections show an increase in energy consumption in the transport sector by between 6 % and 24 % by 2030. This will mean that the deployment of RES in the transport sector by 2030 will be extremely demanding, difficult and will severely limit the achievement of the overall share of RES by 2030, as Slovenia will have to do so in the other two sectors (electricity; heat) to compensate for a lower share of RES in the transport sector.

b. Environmental and other constraints affecting the introduction of energy from renewable energy sources in Slovenia

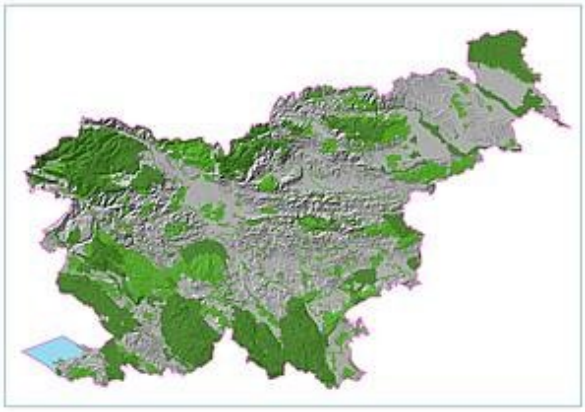
There are *355 Natura 2000 sites* in Slovenia, of which 324 are designated under the Habitats Directive and 31 under the Birds Directive. The sites cover 37.46 % of the territory of Slovenia and are home to 114 endangered plant and animal species and 60 habitat types under the Habitats Directive and 122 protected species under the Birds Directive. Given the surface area of Natura 2000 sites and the number of protected species, Slovenia is at the top of Europe. In this context, many sites (see figure below) suitable for the deployment of RES (mainly hydro and wind power plants) are under Natura 2000 protection. As a result, the possibilities for wind energy use are limited and much smaller than in other EU countries (Slovenia has no possibility

to*install offshore wind farms*). The additional wind energy potential reduces highly scattered settlements (very few locations with adequate wind speeds meet the requirements for the necessary deviation from settlements for noise protection purposes).

In addition to nature conservation and the protection of water bodies, the implementation of large hydropower (HE) projects is very useful for other uses such as drinking water supply, irrigation water, flood protection, tourism, recreation and other benefits.

Electricity generation from RES will only be possible if a national consensus is reached on the relationship between protection regimes and the self-sufficiency of the population with strategically important resources (water, food and energy). Further promotion of the use of RES in Slovenia is conditional on environmental and spatial legislation – the future implementation of RES projects by 2030, especially in the area of hydropower and wind, will only be feasible in Slovenia if environmental impact assessment procedures, procedures for the predominance of other public benefits over the public interest of nature conservation are properly carried out and the application of water exemptions (in accordance with EU law).

6Figure: Map of Natura 2000 sites in Slovenia



Source: Natura2000.si

In addition to the challenging spatialisation processes, opposition to further exploitation of hydropower and wind power in Slovenia is also growing in some local communities, the general public and parts of the non-governmental sector, as there is no awareness of the need for self-sufficiency of strategic resources for the survival of the population. The target of 33 % of RES in 2030 alone will not be achieved by projects outside Natura 2000 or whose environmental impact is likely to be assessed as non-significant. In order to achieve this objective, it will also be necessary to carry out projects for the construction of HE and wind farms (VE), which are likely to have an impact on nature deemed to be substantial and therefore require a process of overriding another public interest over the public interest of nature conservation. Without effective environmental measures that take into account successfully implemented decisions on exemptions under EU water and nature protection legislation, the implementation of these projects will not be possible.

C. Enhancing energy efficiency in the heating and cooling sector and the impact on the overall share of RES

Increasing energy efficiency in the buildings and heating and cooling sectors also has a direct impact on reducing RES consumption. More specifically, the rehabilitation or improvement of the thermodynamic properties of building envelopes and distribution networks can lead to savings in heat consumption for space heating and cooling, which in turn reduces the consumption of RES (wood biomass) in this sector and has a negative impact on the overall share of RES.

D. Taking into account a higher share of energy-intensive industry in Slovenia than the EU average

Almost two thirds (61.8 %) of final energy in industry was consumed in five energy-intensive industries in 2020: metal production (23.4 %), paper and paper products (12.7 %), non-metallic mineral products (12.2 %), chemicals and chemical products (8.9 %) and pharmaceutical raw materials and preparations (4.6 %); (source: SURS). If energy-intensive industries include the production of pharmaceutical raw materials and preparations, we see that in 2020, energy-intensive industries generated almost one third (32.9 %) of value added in the Slovenian industry (and 14.3 % excluding the manufacture of pharmaceutical raw materials and preparations), which places Slovenia in the third place in the EU according to this indicator (source: EUROSTAT). This share is higher only in Belgium, and Denmark, but in these members, the contribution of the chemical and pharmaceutical industries in value added is significantly higher than that of these industries in Slovenia. Currently, commercially available technologies in these sectors do not allow for an increased use of RES.

2.2 Dimension energy efficiency

Overview of key objectives:

- **Accelerating energy and material efficiency improvements in all sectors** (including energy supply) as a key enabler of a successful exit from the energy crisis and the effective implementation of the green transition (and thus reducing the consumption of energy and other natural resources) in accordance with the energy efficiency first principle, which is a prerequisite for a successful and competitive transition to a climate-neutral society;
- to **improve energy efficiency and the volume of annual savings under the mandatory savings scheme by 2030, at least in line with the indicative target to be set in the new Energy Efficiency Directive**;
- ensure that the **policies and measures adopted are systematically implemented so that final energy consumption does not exceed 51 TWh (4.426 ktoe)**,
- **reduce final energy consumption in buildings** by **20 %** by 2030 compared to 2020 and ensure a reduction in GHG emissions in buildings of at least 70 % by 2030 compared to 2005,
- **ensure accessibility to energy efficiency** for all – including financially weaker users;
- **active and accelerated support to industry to increase efficiency and competitiveness, the** uptake of new efficient green technologies and the circular economy,
- **accelerate the implementation** of information, awareness-raising and training programmes for different target groups on the benefits and practical aspects of developing and applying technologies for energy efficiency and exploitation of RES and understanding the concept of sufficiency and motivation for less material well-being.

Energy and material efficiency combined with sustainable use and local energy supply is the most important development segment of modern society. The accelerated development of these areas, based on an increase in the quality of energy services with lower energy inputs, is one of the cornerstones of the transition towards a climate-neutral society and will have a key impact on the future competitiveness of Slovenian industry and society, and it is important to strengthen the already well-developed competences of Slovenian companies in this area.

Efficient use of energy and natural resources is a priority and key development and energy policy measure to increase the competitiveness and decarbonisation of Slovenian industry and society.

For Slovenia, the accelerated development of energy-efficient technologies also means reducing energy dependency, which will contribute not only to achieving environmental and

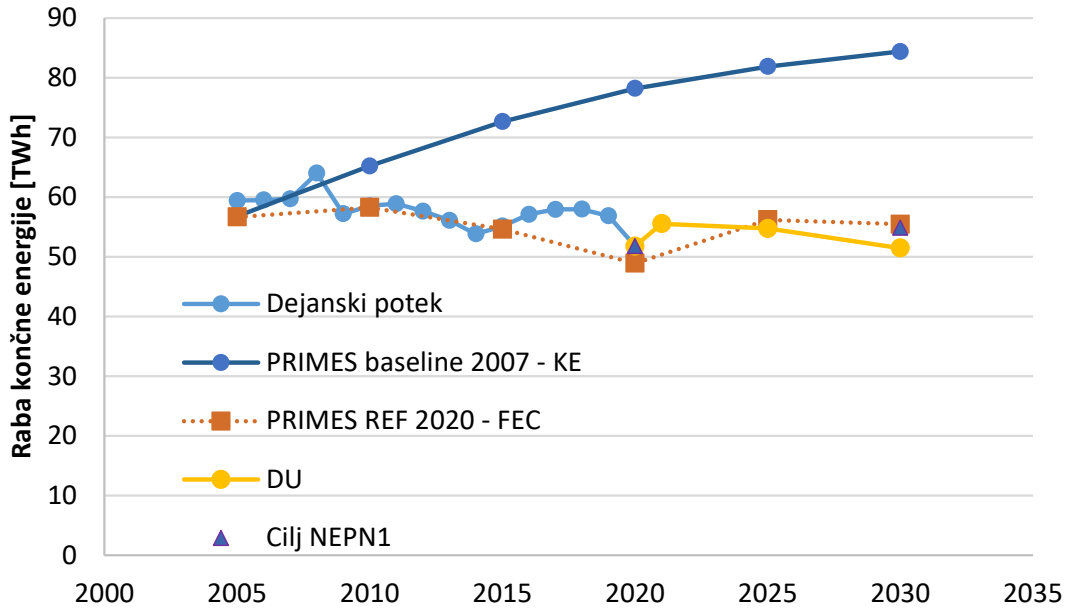
climate objectives, but also to increasing the security of energy supply and other beneficial national economic effects.

2.2.1 National contribution to energy efficiency by 2030

Slovenia's objective is to improve energy efficiency by 2030 at least in line with the indicative target to be set in the new Energy Efficiency Directive. When the adopted policies and measures are systematically implemented, final energy consumption should not exceed 51 TWh (4.426 ktoe) in 2030. Calculated to the level of primary energy, the use would not exceed 70 TWh (6.026 ktoe) in 2030.

Slovenia can achieve **lower final and primary energy consumption** by 2030 compared to the 2020 PRIMES Reference Scenario. The new Energy Efficiency Directive sets new indicative targets for Member States. **Transport has the greatest impact on the long-term management of primary and final energy** consumption, which, due to high "volatility", expected growth trends and a high share of energy consumption (about 40 % of total final energy consumption), can seriously jeopardise the achievement of the 2030 targets if measures are not implemented.

7Figure: Demonstration of how the contribution to URE by 2030 has been achieved in final energy



8Figure: Demonstration of the achievement of the contribution to URE by 2030 in primary energy

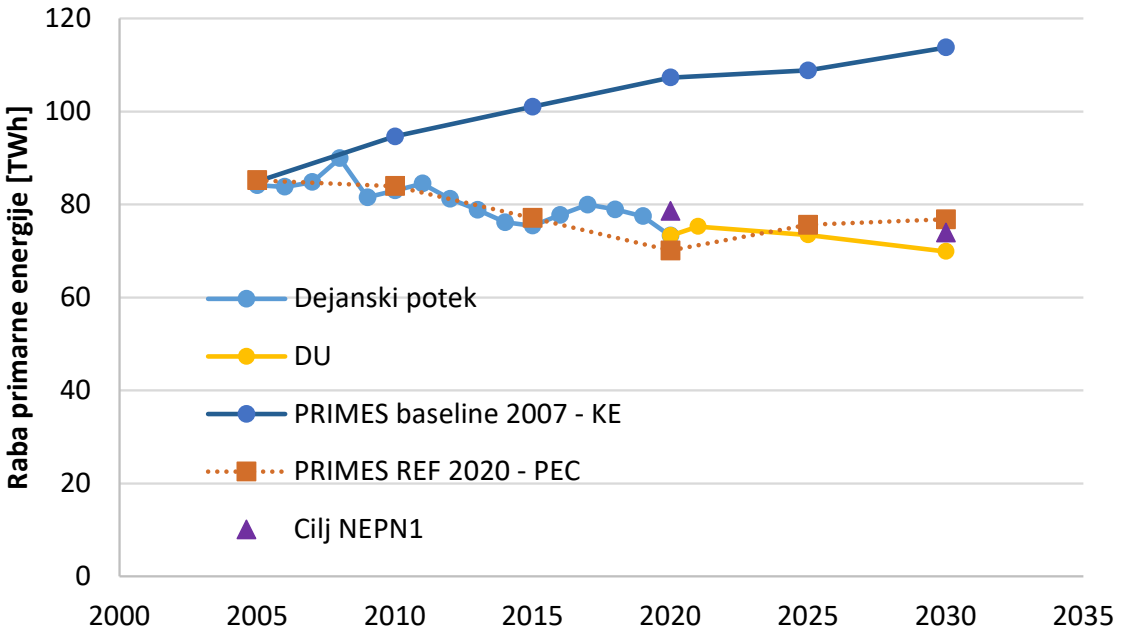


Table11: Estimated primary and final energy consumption trajectories for 2030 in TWh

[TWh]	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
D.E.[37]	73,3	75,2	74,7	74,1	73,5	72,9	72,3	71,8	71,2	70,6	70,1
KE	51,8	55,6	55,4	55,2	54,9	54,7	54,1	53,4	52,8	52,1	51,5

Source: The NECPs have been constructed using the updated and extended REES-SLO model, more in Chapter 4.

2.2.2 Savings achieved under the mandatory savings scheme

Slovenia will continue to implement the scheme of mandatory energy savings among final customers[38] through the implementation of energy services and measures by energy suppliers

[37] Primary energy is deflinary according to EUROSTAT's definition of primary energy, i.e. it does not include non-energy use and energy from the environment. Final energy includes industrial use, transport and widespread use without energy from the environment, also in accordance with EUROSTAT's definition.

[38] Decree on the Provision of Energy Savings, Official Gazette of the Republic of Slovenia No 96/14.

and the EWC and will upgrade the scheme in line with the amendments to the Energy Efficiency Directive.[39]

The new annual savings over the period from 1 January 2021 to 31 December 2030 must be at **least 1.49 % of annual final energy consumption, averaged over[40]the most recent three-year period prior to 1 January 2019, in accordance with the new Energy Efficiency Directive**. The obligation will be split between 2021 and 2030 between the contribution of delivering savings from energy suppliers and with an alternative measure – the implementation of the Eco Fund programmes and tax mechanisms.[41]

Slovenia must achieve the following savings in the period 2021-2030 under the new Energy Efficiency Directive.

Table12: Required savings over the period 2021-2030

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Share	0.8 %	0.8 %	1.3 %	1.3 %	1.5 %	1.5 %	1.5 %	1.9 %	1.9 %	1.9 %
Volume of annual savings [GWh]	458	458	745	745	859	859	859	1.089	1.089	1.089

2.2.3 Indicative milestones of the long-term strategy for the renovation of the national building stock

Roadmap of the long-term strategy for the renovation of the national stock of residential and non-residential buildings, both public and private, with nationally determined measurable progress indicators, evidence-based estimates of expected energy savings and wider benefits, and contributions to the Union's energy efficiency targets under Directive 2012/27/EU in accordance with Article 2a of Directive 2010/31/EU

The **Long-Term Strategy for Promoting Energy Renovation of Buildings** (DSEPS, adopted 2015) set important targets for reducing energy use in buildings.[42] A follow-up to the long-term strategy to boost investment in energy renovation of buildings was adopted in 2018.[43]

The vision set out in the current DSEPS and contained in the NECPs is to achieve low-carbon energy use in buildings by 2050, which Slovenia will achieve by significantly improving energy efficiency and increasing the use of RES in buildings. This will also significantly reduce emissions of other harmful substances into the air. It also aims to make Slovenia visible in the area of sustainable construction. **A long-term renovation strategy to support building renovation by 2050**, in line with Directive 2018/844 amending Directive 2010/31/EU on the

---

39 The new Directive is in the final adoption process.

40 Editing the text following the final approval of the new Energy Efficiency Directive.

41 The NECPs foresee a gradual increase in the CO2 environmental tax$_{and}$ the contribution to energy efficiency. Prior to the notification of the additional alternative mechanism, more detailed analyses of the price flexibility of energy products will have to be carried out in the light of the envisaged increase in the levy.

42 **Long-term strategy to boost investment in energy renovation**of buildings, October 2015, available at: http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/dseps/dseps_final_okt2015.pdf.

43 **Complementing the Long-term Strategy for Promoting Investment in Energy Renovation**of Buildings, February 2018, available at: https://www.energetika-portal.si/fileadmin/dokumenti/publikacije/dseps/dopolnitev_dseps_feb_2018.pdf.

energy performance of buildings and Directive 2012/27/EU on energy efficiency, was adopted in February 2021 and is also aligned with the NECPs and the Long-term Climate Strategy.

2.2.4 Indicative milestones for 2030, 2040 and 2050

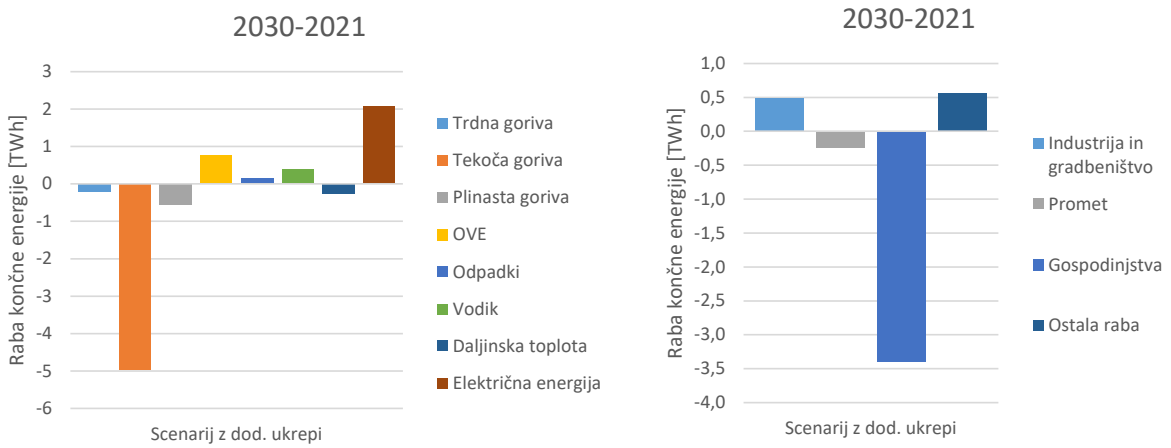
Nationally determined measurable progress indicators, evidence-based estimates of expected energy savings and wider benefits and their contributions to the Union's energy efficiency targets, as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both public and private, in line with Article 2a of Directive 2010/31/EU, have been set out in the new Long-term Renovation Strategy to support building renovation by 2050.

2.2.5 Overview of key projections of the contribution to URE until 2030

Including long-term objectives or strategies and sectoral targets and national targets in areas such as energy efficiency in the transport sector and heating and cooling.

The NECPs are based on the assumption that new more energy-efficient technologies in all sectors of energy use and local energy supply will be key to successfully combat climate change and must enable the achievement of objectives with costs that the economy will be able to bear. The expected changes in final energy use by sector and fuel are shown in the figure below.

9Figure: Expected changes in final energy consumption by sector and fuel



The penetration of energy-efficient technologies onto markets today is mainly constrained by the lack of information and limited investment capacity of final energy consumers. The NECPs foresee that the necessary societal changes and associated changes in financial flows will take place over the next decade, significantly accelerating the penetration of competitive energy efficient technologies. Additional support is planned for the uptake of new technologies and the further development and quality management of energy services: planning, implementation, supervision of construction, targeted monitoring of energy use and active energy management in and on buildings.

Slovenia has produced an assessment of the potential for efficient heating and cooling and a draft of a comprehensive heating and cooling strategy. With additional measures in the NECPs, it aims to strengthen and improve local planning of efficient heating and cooling and to create better conditions (financial and technical assistance) for the further development of community systems – accelerated renovation, efficiency gains and greening, and the expansion and construction of new (smaller and micro) district heating and cooling systems in areas with a higher heat and cold demand density. Increasing their competitiveness and resilience to energy price spikes, as well as the active role of consumers, is also an important objective in this respect.

The vision set out in the Market Development Strategy for the deployment of appropriate infrastructure for alternative fuels in the transport sector in the Republic of Slovenia, which is also contained in the NECP, envisages the intensive promotion of e-mobility. In order to achieve the objectives set and accelerate the promotion of e-mobility, appropriate conditions should also be provided for the accelerated modernisation of the electricity distribution network. This task remains unrealised and will require much more attention in the coming years.

2.3 Dimension energy security

Overview of key objectives:

- **secure and competitive energy supply;**
- ensuring an adequate level of security of electricity supply:
  - **maintain a high level of electricity interconnection** with neighbouring countries, a target of more than 80 %;
  - **at least 85 % of electricity supply from generating installations in Slovenia by 2030** and **100 % by 2040**; and
  - **at least 80 % of the power demand in critical hours of electricity transmission network loads with domestic generation capacity by 2030 and maintaining at least 80 % of the power demand beyond 2033** (discharge of coal),
  - **continuing the exploitation of nuclear energy** and maintaining excellence **in the operation of nuclear installations in Slovenia,**a quaternary common operational performance indicator (WANO) greater than 96 and taking a **qualitative and transparent decision on the construction of a new nuclear power plant as soon as possible and not later than 2027;**
  - **increasing the resilience of the electrodistribution network to disruptions** – increase the share of the underground medium-voltage network from the current 35 % to at least 50 %;
  - the**accelerated development of system services and the active role of consumers** in the field of EE, DT, etc.,
- **ensuring a secure and competitive gas supply:**
  - upgrading connections with neighbouring countries and preparing to operate with new, climate-neutral, gases,
  - **reducing import dependency** on fossil fuels also through domestic production of renewable gaseous and liquid fuels; **a 2030 target of at least a 5 % share of gaseous fuels and a 1 % share of** renewable liquid fuels from sources in Slovenia;
- **accelerating the development of energy storage technologies, infrastructure and services and meeting the following sub-targets:**
  - ensure, by accelerating the construction of ČHE and battery storage systems EE (SHEE), that the share of their capacity (in GWh) in the daily use of EE is greater than that of the total annual production of photovoltaic and wind power plants in the annual use of EE,
  - ensure the installation of SHEE to new photovoltaic plants of at least 25 % of their capacity,
  - promoting the installation of heat storage tanks (in buildings, DHS,etc.),
  - ensure the construction of two major electrolysis units for the purpose of storing peaks of electricity generated in hydrogen,
- **diversification of sources of supply routes, production capacities, locations and technologies in energy supply.**

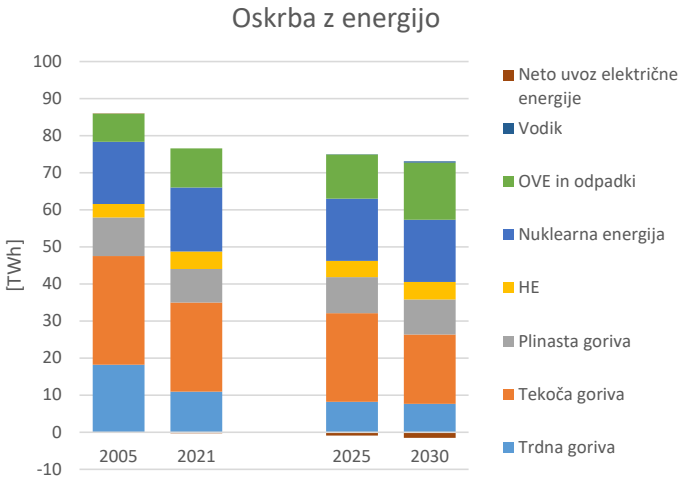
2.3.1 National objectives and contributions referred to in Article 4(c)

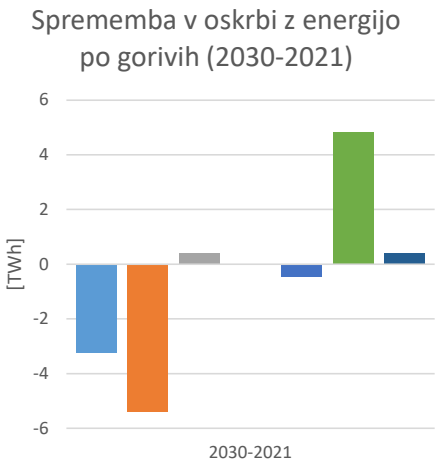
The key objective of the future development of energy in Slovenia is to continue to ensure a balance between the three fundamental objectives of energy policy, namely:

(1) minimise impacts on the environment,
(2) adequate security of supply; and
(3) competitive energy supply.

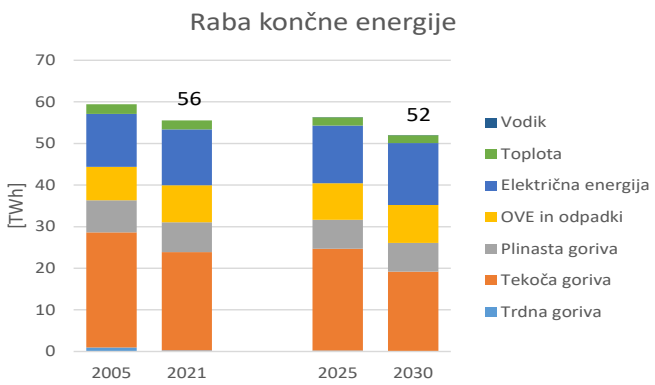
The further development of energy in Slovenia will require coordinated action in the technological, legislative, economic and social fields with the **aim of reducing energy needs, reducing import dependency, increasing diversification (sources, technologies and locations of production, supply routes, etc.) and energy storage, and managing risks and emergencies in energy markets.** Without adequate support and communication with the public, the new investments envisaged by the NECPs will not have an appropriate impact or will not be carried out at all. The expected structure of primary and final energy consumption is shown in the figures below.

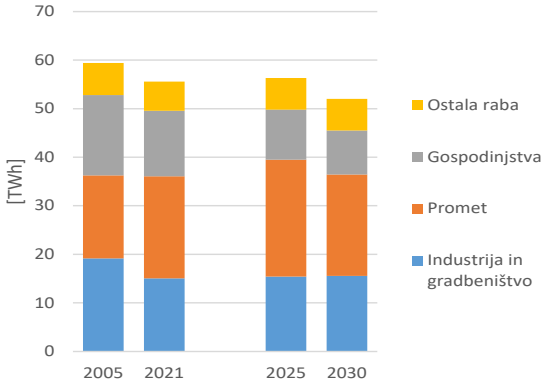
10Figure: Expected structure of primary energy use – energy supply





11Figure: Expected structure of energy end-use[44]





[44] In final energy, which also takes into account the energy of the environment

The relationship between individual resources will be based on a long-term assessment of resource provision, the competitive price of the final product, spatial and environmental acceptability and sustainability. **The target is to supply at least 85 % of electricity from generating installations in Slovenia by 2030 and 100 % by 2040**, or to have sufficient generation capacity for Slovenia's self-sufficiency in electricity supply. In order to ensure an adequate level of security of electricity supply, it will be **necessary to ensure at least 80 % of the power demand in critical hours of the transmission grid load of domestic generation capacity** at a maximum of 100 hours by 2030 and to maintain at least 80 % of the power demand beyond 2033 (coal phase-out).

The achievement of the target share of electricity supply (GWh) from generating installations in Slovenia is determined at annual level as the ratio of the sum of all gross electricity produced in Slovenia (production from NEK is 50 %) to the total electricity use in Slovenia (sum of gross electricity produced in Slovenia and net imports of electricity in the current year). Failure to achieve the objective is permissible in the event of favourable market conditions, but only if there is sufficient production capacity to achieve the objective.

The achievement of the target share of power demand (MW) during critical hours of the transmission grid load of domestic generation capacity shall be determined by analysing the maximum 100 hour loads on the transmission system for the previous calendar year. The actual hourly power generation of power **plants on the transmission network** and the hourly power achieved from imports shall be taken into account. Compare the sum of power from:

- **A – residual power of power plants:** power plants providing system services, still available power plants not operated at full power and power plants under operational standby, refurbishment or forced failure located in the SLO area (100 % power from NEK is taken into account); and
- **B – Imports:** time-equal hourly import power.

The criterion is met if **A > B**, and the target share of 80 % of power is met if the criterion is met in at least 80 out of the 100 maximum hourly loads on the transmission network, while at the same time, during the remaining hours, the difference B – A does not exceed 20 % of the hourly load on the transmission network. In other words, in 80 % of the critical hours analysed (100 hours of maximum hourly loads), the difference (balance sheet) of the remaining sum of power plants in the territory of Slovenia must be positive in relation to import power. **Therefore, the aim is to have enough reserves in the production installations to cover all power imports in at least 80 % of the most critical hours and at least 80 % of the power in all the most critical hours.**

This will require ensuring sufficiency of supply in different seasons, storage of RES peaks through sector integration, adequate resources for the provision of ancillary services and an adequate level of operational reliability at any time.

At the strategic level, the Republic of Slovenia supports the further exploitation of nuclear energy for the production of electricity, including through the construction of a new nuclear power plant or small modular nuclear reactors (SMR). In real terms, the year of construction of the new nuclear power plant or SMR will be the subject of business optimisation by the investor (for the new nuclear electricity company GEN Energy) and the implementation will also depend on the social acceptability of the project. The investor must, as soon as possible, establish theconditions for a high-quality entrepreneurial decision to optimise the implementation of the investment (e.g. additional electricity market research in the EU and the region, the ongoing development of the Yemeni technologies, etc.) and ensure transparency of procedures and contracts.

In order to continue the exploitation of nuclear energy, it is necessary to maintain the viability of the operation of nuclear installations in Slovenia at a high level, in accordance with the quaternary common operational performance indicator established by the World Association of Nuclear Operators (WANO) to facilitate the monitoring of efficiency and comparisons between nuclear power plants. It is calculated using the weighting values of the individual indicators and has a value of 0 to 100. The target value of the indicator is more than 96 for Slovenia.

Energy storage is of increasing strategic importance. Slovenia will continue to provide, in accordance with Council Directive 2009/119/EC, a quantity of reserves of oil and its derivatives corresponding to at least 90 days' average consumption in the previous year. However, electricity storage and the integration of different sectors is a growing challenge due to the increased volume of RES[45].

On the transmission and distribution network, it will therefore be necessary to accelerate the installation of battery capacity and the construction of pumping HEs, heat storage in district heating systems, and to ensure the storage of seasonal peaks of electricity in the form of SNP/H_2 using pipeline systems. In view of the projected high growth in RES production from photovoltaic plants, not only in Slovenia but also in neighbouring countries, it will be necessary to **ensure, in parallel with their connection to the grid, the construction of SHEE, including SHEE based** on the conversion into hydrogen and onwards into synthetic gaseous or liquid fuels, to the **extent that their capacity (in GWh) in the daily use of EE on the transmission network will be higher than the share of total annual production of photovoltaic and wind power plants in the annual use of EE.** In order to achieve this objective, the construction of SHEE in the immediate vicinity of (large) photovoltaic plants on an annual scale of at least 25 % of new built capacity (MW) is also encouraged, thus

[45] The aim ofensuring a stable amount of electricity is for systems to regulate excesses and energy deficits, which are divided into: reservoirs, consumption adjustment systems, power control systems and systems for balancing mutual assistance between different energy systems. The fastest changes in energy production volumes occur in solar power plants. Their production control systems must be capable of rapid adjustment and therefore, as a rule, consist of battery packs or capacitor kits. As a result of slower changes in wind energy density, it is possible to regulate wind generation by storing energy in the form of gravitational storage tanks. The most famous form of these storage facilities is pumped-storage power plants. These systems are able to cope with excesses and energy deficits over a shorter period of time, accessible battery systems are able to regulate the energy cycle for up to a few hours, while gravity storage tanks are able to do so for up to a few days. For longer periods of regulation of surpluses and energy deficits, it will be necessary to provide solutions that allow for regulating energy cycles over a period of a few months. In the past, seasonal hydropower has played this role.

significantly reducing additional electricity grid losses and the need to strengthen electricity grids. Given the key role of savings banks in the future electricity grid, it is necessary to consider capping/cancelling the network charge for reservoirs in the charging and generator operating regime in order to make the economics of investment in SHEE an incentive.

In the area of security of gas supply, Slovenia will continue to implement and strengthen measures to ensure security of supply in the gas market to ensure diversification of sources and supply routes, to cooperate with other EU Member States (promoting regional and bilateral solidarity), to ensure the obligation of suppliers to deliver gas to final customers under concluded supply contracts from at least two different sources of supply, to protect protected customers, etc., in line with the requirements of the Energy Act and implementing acts. To this end, Slovenia will strengthen gas interconnections between countries to ensure continued security of system operation and supply even in the event of a failure of any gas source.

Through energy efficiency measures, Slovenia will aim to reduce gas imports. To the extent possible, we will promote domestic production of renewable gases, as well as R & D in this field. Projects in the field of domestic hydrogen production from RES electricity and synthetic methane and other fuels from wood and other biomass and waste are essential.

In the area of electricity supply, Slovenia's electricity transmission system will continue to be able to run smoothly at any time in the event of a failure of one part. ELES, as a transmission system operator, plans in its development plans to strengthen and upgrade the network and develop complex system platforms that will in the future ensure a high-quality electricity supply to consumers and better resilience against possible disruptions that may occur in Slovenia's electricity system.[46]

The distribution network development plan in force meets the expected increased needs in the field of electricity distribution, but the resources for its implementation are not provided. This is why we will introduce **more development-oriented funding for future distribution network development to increase capacity, resilience to disruption, advancedness and use of flexibility of resources and burdens.** More advancedness and ability to exploit the flexibility of resources and burdens in the distribution network will also be achieved through better connectivity of the elements behind the metering point (final deployment of smart grids, communities, cities, etc.). **It is important that the increase in network capacity (which is and will be a necessary but lengthy process) and the introduction of the flexibility market take place in parallel as they support each other.**

In view of the increasing frequency and intensity of weather events (e.g. the gland in 2014, wind in 2017), it is crucial to increase the resilience of the electrodistribution network to disruptions, including **by increasing the share of underground NN grids from the current 35 % to at least 50 %, in order to increase energy security (sigurity).**

The future development of the electricity generation sector includes:

- until 2030, the sector will still largely rely on the use of the primary resource mix from Slovenia, mainly RES and nuclear energy, and maintain the use of indigenous coal;

[46] Simulation analyses have shown that, in the event of outages, most problems are expected on the Primorska and Dolenjska network, while loads are also high on the Pomurje network.

- we will improve the diversification of primary sources for electricity generation, and the development will focus as a priority on maximising the exploitation of RES, using a variety of RES resources and technologies, with the aim of maximising their diversification, including through the use of woody biomass for high-efficiency combined heat and power, with a target of at least 5 % of electricity production in Slovenia by 2030;
- maintain the excellence and safe operation of nuclear installations in Slovenia and explore as soon as possible the possibility of introducing new nuclear technologies – carrying out all necessary economic and other expert analyses and activities to enable a decision to be taken on the construction of a new nuclear power plant by 2027 at the latest;
- by 2033 at the latest, all coal use will be phased out and sufficient capacity of **predictable** production resources in Slovenia will have to be ensured in due time so that we **can always use our own resources to provide at least 80 % of the necessary power in the electricity grid** through appropriate diversification in terms of both locations and technologies.

2.3.2 Other objectives and contributions set out in Annex 1 relating to the energy security dimension

In addition to the above, the NECPs do not foresee additional specific objectives to increase the flexibility of the national energy system, to increase the diversification of energy sources and supplies from third countries to increase the resilience of regional and national energy systems and to reduce dependence on energy imports from third countries and to increase the resilience of national and regional energy systems.

2.4 Dimension Internal energy market

Overview of key objectives:

- **provide additional financial, human and technical resources to accelerate the integrated development and management of the electricity distribution network for enhanced capacity, resilience, advancedness, connectivity and adaptability**, enabling the use of resource and load flexibility, integration of heat pumps, accelerated deployment of e-mobility, integration of electricity generation and storage facilities from RES,
- **more efficient positioning of the electro-generating infrastructure into the room;**
- **establish, by 2026 at the latest, continuous monitoring of voltage quality at the measuring points of electricity consumers** in connection with the upgrading of the smart metering system and the provision of technical conditions for the development of the market with flexibility;
- further **develop the regulatory framework towards supporting the transition to a climate-neutral society**, so that the approved network development plans and investment plans of network operators can be coordinated and that the **share of investment funding provided for the implementation of the approved development plans of electricity network operators is 100 %**;
- **support the development of an efficient and competitive market** to fully exploit the flexibility of the electricity system and new technologies, so that the supply of flexibility in the service market in 2030 allows for the provision of 100 % of the frequency restoration reserve (RPF) requirements;
- **support cross-sectoral integration** and implementation of new cross-sectoral system services;
- **to promote research and development cooperation** between undertakings within and outside the sector,
- **ensure the further development of the pipeline system and prepare the system for the deployment (operation) of hydrogen in line with gas flows and system capacities, as well as the deployment of hydrogen and new sources of RES gases,**
- **prepare a regulatory and supportive environment** for the production of**renewable substitute** gases and the preparation of pipeline networks for the transport and supply of new gases (indicative target of at least 10 % of renewable methane or hydrogen in the transmission and distribution network by 2030) **and support development and research and domestic renewable gas production projects**,
- **enable the alleviation and reduction of energy poverty** by accelerating the implementation of social policy measures, general housing policymeasuresand the existence**of**targeted measures **aimed at reducing the share of households in energy poverty to between 4.6 % and 3.8 % by 2030** for energy poor households and **between 3500 and 10.500 energy efficiency and RES investments.**

2.4.1 Electricity interconnectivity

Slovenia's long-term objective is to continue improving electricity interconnection in the region. Slovenia's electricity interconnections fluctuated around **80 %** in 2020 and 2021, thus well above the 15 % target for 2030.[47]

2.4.2 Energy transmission and distribution infrastructure

Electricity transmission and distribution infrastructure

The current development plan meets the expected additional needs in the field of electricity distribution, but its implementation does not provide financial, human and technical resources. In order to achieve the ambitious energy and climate policy objectives, **Slovenia will provide better conditions for the accelerated development of the electricity distribution network, which is the cornerstone of the future transition to a climate-neutral society,** so that the accelerated integration of renewable energy installations, generation and demand response, increased connectivity and integration of heat pumps and other elements behind the metering point, and the requirements related to the accelerated deployment of e-mobility can be met. The objective is to increase the capacity, resilience to disruption, advancedness and exploitation of the flexibility of resources and burdens of the electricity distribution network, in line with the sustainable needs of distribution system users. **Simpler and more efficient abundance of electricity infrastructure into space** will be essential, as the proposals largely slow down the transition to a climate-neutral society.

The deployment of smart grids in the electricity distribution system requires accelerated digitalisation of the electricity distribution network and enabling the provision of new services, including on the distribution transmission network, which will require an adequate number of professional staff and technical means to run, develop and maintain a modern distribution and transmission network. The integration of the distribution and transmission systems and the establishment of a single platform for monitoring and insight into Slovenia's actual electricity generation and consumption at any time will be essential.

The establishment of continuous monitoring of voltage quality at the metering points of electricity consumers is crucial as the electricity distribution grid is becoming an increasingly short-lived barrier to the transition to a climate-neutral society. The consequences of underinvestment in the development and amplification of, in particular, the low-voltage grid are reflected in the increasingly difficult connection of diffuse energy sources and increased burdens (CMS, e-mobility). A key problem is the provision of adequate voltage conditions at the metering points of customers in accordance with standard SIST EN 50160. Distribution carries out continuous monitoring (SN collectors in RTP 110/x, small-scale TP SN/NN) and periodic monitoring. Modern advanced metering equipment at demand points already allows continuous measurement of the voltage profile and data on voltage quality at the measuring point are not available to customers, although they have the right to know the quality of the

[47] **State of the Energy Union – Slovenia**, available at: https://ec.europa.eu/commission/sites/beta-political/files/energy-union-factsheet-slovenia_en.pdf

"goods" they receive at the measuring point. Data on voltage conditions at the end of the NN network and trends in change are key to determining the priorities and the way in which the network is developed (network reinforcement, smart grids). On-line data on voltage conditions at measuring points would also help to develop a market with flexibility.

Gas transmission and distribution infrastructure

Slovenia will ensure the further development of the gas pipeline system in line with the modified gas flows and the use of the system, including new sources of RES and waste gases. Given the changed geopolitical situation on the Eastern Supply Corridors since February 2022, and the EU's actions to reduce exposure to Eastern supply sources, the transmission system operator (TSOs) plans to increase transmission capacity at the border point with the Italian transmission system as a matter of priority, which is also reflected in the improvement of the N-1 infrastructure criterion. The N-1 infrastructure criterion will increase to an area above 85 % in 2023 and 2024.

Approximately 30 % of natural gas is supplied to final customers via the distribution network we have in 83 local communities (out of 212). The future development of existing and new gas distribution networks depends primarily on the ability to supply substitute gases of renewable origin.

Decarbonisation of natural gas supply

The objective of the NECPs is to establish technical, legislative and incentive conditions to enable the decarbonisation of gas supply in Slovenia. To this end, we will prepare a regulatory and supportive environment for replacing fossil methane with substitute gases in the gas network (10-30 % by 2030) that will be produced in Slovenia or imported under the system of guarantees of origin. Gas transmission and distribution infrastructure shall be properly upgraded to allow for the transfer of a larger share of RES from production sites within Slovenia or from border points to final consumers in Slovenia and for a later transition to 100 % hydrogen transport in these networks.

In line with EU legislation, the market for renewable substitute gases will be developed.

Decarbonisation of gas supply will be achieved by replacing gas with renewable and other low-carbon gases, highlighting:

1. **hydrogen** – produced by electrolysis of water using electricity from RES and nuclear power (sector coupling),
2. **synthetic methane** – produced using CO_2 or CO methanencies of hydrogen in catalytic or biological methanestone reactors where hydrogen, CO and CO_2 are obtained by gasification of organic materials, but where hydrogen referred to in point 1 and CO_2 recovered from pollution sources may be used;
3. **biomethane** – methane produced by gasification of woody biomass or from biogas produced by the degradation of organic substances such as slurry, crop residues and plant material, municipal sewage in treatment plants, etc., under anaerobic conditions in fermenters (guards), as biogas is not suitable for injection into the pipeline network

due to its composition (may contain up to 50 % CO_2 and other impurities in smaller concentrations).

2.4.3 Sector coupling

The integration of different energy sectors, in particular electricity, gas, transport, industry and district heating and cooling, will be key to successfully achieving the energy and climate objectives. To this end, we will ensure adequate technical capacity to convert renewable electricity[48] into renewable gas, hydrogen or synthetic methane and heat (i.e. 'Power-to-gas' and 'power-to-heat'). This will allow the seasonal storage of renewable energy in the form of gases also in storage facilities in neighbouring countries. Where necessary, storage of renewable gases will also be possible only for a short period of time or for offsetting short variations in intraday consumption (within the storage capacity of the transmission pipeline, heat storage tanks, etc.), which the pipeline system and district heating systems offer to a much greater extent than the electricity system.

Energy conversion will optimise the construction of the electricity and gas grid, since the grid can be used to transport energy which is most appropriate in the circumstances. This reduces the investment costs of the transition to a climate-neutral society.

Increased RES generation will have a significant impact on the functioning and integration of energy markets, where increased fluctuations in unpredictable generation will require the provision of efficient market-based instruments to develop flexibility and the necessary new energy services and flexible resources, including high-efficiency cogeneration. By converting and storing peaks of electricity into gas fuels and heat, and exploiting excess heat, we will connect the gas, heat and electricity sectors to achieve synergistic effects and reduce energy prices.

It will be necessary to develop a national approach to the integration of heat infrastructure and integration into other sectors at local and national level.

2.4.4 Market integration

The electricity and natural gas market in Slovenia is open and liberalised.

Wholesale and retail electricity markets

The long-term objective of the NECPs is to continue the open operation of the electricity market in Slovenia without regulatory constraints.

Slovenia will continue to actively support activities in the area of market integration with the aim of optimising the capacity utilisation of existing tradable interconnectors. Slovenia is among the leading countries in this area and already has integrated markets for day-to-day and intraday with Italy, Austria, Hungary and Croatia. The allocation of long-term transmission

[48] It may also be in excess of conventional electricity at that time.

capacity (annual, monthly) for transmission across Slovenian borders takes place in the joint European auction house Jao, based in Luxembourg.

Slovenia is committed to meeting the criterion of 70 % availability of cross-border transmission capacity, which we achieve through optimal planning and management of electricity system operation. We also plan to further develop the network in line with these regulatory requirements.

In line with the intervention legislation adopted in September 2022,Slovenia has[49] capped prices for balancing energy aRPF. The measure is expected to remain in force until the end of 2025. It does not have regulated prices in the field of electricity, with the exception of the price of *last resort supply*provided by the electricity distribution operator to customers if they so request. This price must be higher than the market price, but not more than 20 %. The purpose of this arrangement is to redirect customers to a contract with the selected supplier at a market price.

The stock exchange in Slovenia also operates successfully as a nominated electricity market operator (Engl. *Nominated Electricity Market Operator (NEMO*). The share of energy exchanged on the stock exchange is high, accounting for 88.6 % of consumption from Slovenia's transmission network in 2022. The daily and intraday markets provide a good price signal. Market participants also have the possibility to trade futures products, but liquidity is extremely low.

Some of the balancing services are already being sourced from diffuse sources. In line with EU legislation, we will continue to develop solutions that allow system users to offer their services also through independent aggregators.

The final roll-out of advanced meters is foreseen by 2025. At the same time, a data capture and storage system is being developed, as well as advanced interconnectivity of the elements behind the measuring point with the elements before it. In order to increase the efficiency of the network, we need to work towards accelerating the deployment of advanced metering systems and adapting them also tothe establishment of continuous voltage quality monitoring. A free-of-charge single web portal My Electric – System for Uniform Access to Measurement Data (SEDMp) is in place. The portal is thus one of the services of the National Data Hub Single Entry Point, in line with the Energy Act. The project continues with the development of services for data beneficiaries (suppliers, aggregators, commissioners). The data will be retrieved by the beneficiaries through electronic data exchange (B2B). The portal shall also provide end-users with adequate technical equipment on the quality of the electricity supply.

Competition between suppliers has been reduced by the energy crisis, including the size of the market limiting the number of competitors, which will require due attention once the crisis has come out.

By means of the Electricity Supply Act (ZOEE), Slovenia has put in place appropriate legal bases for the development of an efficient and competitive market to exploit the full potential

[49] Act on Measures for the Management of Crisis Situations in the Field of Energy Supply**(ZUOKPOE**), sep. 2022 is valid until 31 12. 2025

of the flexibility of the electricity system and new technologies. However, promoting demand flexibility and all active customer roles in practice (encouraging the introduction of battery storage tanks, distributed generation, community aggregation, energy communities, simultaneous multi-supplier contracts and independent aggregators, the possibility of supply at a dynamic price, etc.) remains an important development direction of the NECPs.

Other national targets, which would be related to other aspects of the internal energy market, are not defined by Slovenia outside the current EU legislation.

Gas market

The long-term objective is to continue the open operation of the gas market in Slovenia without regulatory constraints, but with appropriate incentives in particular to increase the use of RES.

Slovenia will continue to strengthen its links with trading points in neighbouring countries. The planned connection to Hungary will also allow direct delivery from the Hungarian trading point.[50]

With a view to achieving energy and climate targets, we will also follow EU guidelines and legislation in Slovenia to gradually replace the share of gas with renewable gases such as synthetic gas, hydrogen and biomethane. The appropriate transformation of renewable gases into the energy balance will require the development of a market for renewable gases, which may exist either as part of the gas market or as a stand-alone market. Gas system operators will also contribute to the development of the renewable gas market through unbiased connection and access to the system of producers of renewable and other low-carbon gases.

Slovenia will ensure the development of a market for renewable gases that will allow for price competitiveness of renewable gases on the domestic market. A certification system for renewable gases such as hydrogen, biomethane and SNP will be put in place that is consistent with the certification of renewable gases in other Member States, allowing export of renewable gases produced abroad in Slovenia.

2.4.5 Energy poverty

The 2030 energy poverty target is to reduce the share of energy poor households to a range of **4.6 % (a less ambitious target) and 3.8 % (a more ambitious target).** The target is consistent with the indicator used to calculate the share of energy poor.

The second energy poverty target for 2030 is **3500 (a less ambitious target) or 10.500 (more ambitious) implementation investments** in energy efficiency (EE) and renewable energy (RES) use by households in energy poverty.

[50] With a view to positioning and insighting the possibilities and opportunities for gas market integration around Slovenia, the Energy Agency carried out a study in 2018, which concludes that there is no need for formal further market integration for the Slovenian market following the models recommended by ACER's target market model. Instead, Slovenia is recommended to ensure the implementation of network codes by the regulator and Slovenian traders can continue to use an easily accessible Austrian hub. Sufficient short-term cross-border capacity at competitive prices is key in this regard. In addition, the study encourages the regulator and the transmission system operator to implement projects enabling the diversification of gas sources (Samoocena and the development prospects of the Slovenian wholesale natural gas market, 2018, p. 54, available at: https://www.agen-rs.si/documents/10926/135879/Samoocena-in-razvojne-mo%C5%BEnosti-slovenskega-veleprodajnega-trga-z-zemeljskim-plinom---kon%C4%8Dni/9506c55a-3dbe-4648-91ed-20284d1af87a)

According to the Statistical Office of the Republic of Slovenia (SURS), in **2022** energy poverty was **7.2 % and 62.000 households respectively, or 4.9 % and 102.000 persons respectively.** Energy poverty worsened in 2022 compared to the previous year, as a result of the rise in energy and energy prices, as well as in other living goods. Indeed, the latest figures show that the number of households in energy poverty increased by 0.7 percentage points in 2022 (although the figure is still lower than in 2020), while the number of energy poor remains unchanged. This points to a strengthening of the problem, especially for single-person households. The new situation requires stepping up the implementation of energy poverty alleviation measures aimed at reducing the current burden of energy poverty, as well as measures to alleviate energy poverty (addressing the causes, in particular by increasing energy efficiency).

Slovenia will also set itself the objective of ensuring energy savings in energy poor households.

In the field of energy poverty, the NECPs define the following activities:

1. Setting up an energy poverty alleviation scheme with all measures under the scheme: setting up a project office with a local advisory network and setting up an informal information and awareness-raising network (pre-condition for the implementation of other measures under the scheme), investment incentives for energy efficiency and RES measures for the energy poor, energy advice for the energy poor (comprehensive support to this target group for the implementation of energy efficiency and RES measures, as well as addressing problems that are not necessarily of a technical nature), information to the energy poor through actors in an informal local information and awareness-raising network, a project office with a local energy poverty advisory network providing integrated multidisciplinary assistance (technical, social and personal assistance) for the energy poor in one place.
2. Launch a pilot phase of the scheme's deployment (2024-2026).
3. Implementation of long-term financing of the operation of the scheme (prepared within the update of the NECPs).
4. Establishment and functioning of a Strategic Energy Poverty Council.
5. Planning and implementing measures to reduce energy poverty at local level.
6. Implementation and monitoring of the implementation of the Energy Poverty Action Plan and its first update in 2026 and every 3 years thereafter.

Slovenia's indicative objective is also to alleviate and reduce mobility poverty. As part of the further preparation of the update of the NECPs, analyses will be carried out and the necessary objectives and measures will be proposed.

2.5 Dimension research, innovation and competitiveness

Overview of key objectives:

- **increasing investment in R & D –** at least 3.5 % of GDP by 2030 (of which at least 1¼% of GDP is public money, in line with ZRISS 2030);
- **increased investment in the development** of human resources and new skills needed for the transition to a climate-neutral society;
- linking the content of **Slovenia's new scientific research and innovation strategy 2030** (ZRISS 2030) with the NECPs, thereby encouraging the financing of the content of climate action;
- supporting businesses **for an efficient and competitive transition towards a climate-neutral and circular economy**;
- promoting **targeted research projects** and **multidisciplinary R & D programmes** at all Technology Readiness Levels (TRL 1-9) and **demonstration projects** aimed at achieving a climate-neutral society and circular economy that are of direct interest to the economy or the public sector and meet national development objectives, in particular in the areas of energy efficiency, circular economy and green energy technologies;
- **directing companies to finance and engage** in R & D programmes and demonstration projects **through active tax policy**,
- **promoting new and strengthening existing energy R & D programmes** in line with the objectives of the NECPs and the Resolution on the Long-term Climate Strategy of Slovenia to 2050 (ReDPS50), with a focus on research on hydrogen utilisation technologies and green electricity generation and use technologies,
- **promoting the use of digitalisation** in climate action and **increasing cybersecurity in all strategic systems**,
- the**use of advanced methods and** technolgies (including supercomputing capacities) to model, simulate and monitor climate change, and to find solutions to reduce emissions, move towards a zero-carbon circular economy and climate change spraying;
- **promoting public and private sector R & D programmes** at all Technology Readiness Levels (TRL 1-9) with the aim of achieving a climate-neutral society, in particular in the areas of Slovenia's Sustainable Smart Specialisation Strategy (S5) contributing to climate objectives;
- **support the upgrade and deployment of research infrastructures** in public research organisations to invest in the deployment of technologies, systems and infrastructures for affordable clean energy (including emission-reducing energy storage technologies, energy poles and nuclear research infrastructure).
- active involvement of Slovenia in European initiatives to promote innovation and in centralised EU funds projects in the field of climate neutral society and circular economy;
- create competitive conditions for R & D and innovative work in public enterprises,

- a**competitive and socially responsible enterprise and research sector** with three strategic objectives, in line with Slovenia's 2030 Development Strategy and its objectives:
  - achieving 95 % of average productivity in the EU by 2030;
  - rankings in the group of EU Innovation Leaders by 2030 (European Innovation Index at least 125 in S5);
  - rankings in the first third of EU countries across all five core components of the Digital Economy and Society Index (DESI) by 2030 (at least 9th in S5).

For research, innovation and competitiveness, which fall under the scope of the Energy Union, Slovenia does not have a separate strategy document but is identified as one of the priority areas in the broader context of the country's development strategy, research and innovation strategy, industrial policy and competitiveness promotion programmes.

In order to achieve the stated objectives of the NECPs, it confirms as a target **an increase in R & D investment of at least 3.5 % of GDP by 2030 (of which 1.25 % of GDP of public funds), with resources dedicated to the objectives of a climate-neutral society increasing and expected to be channelled to targeted** research projects, multidisciplinary R & D programmes and demonstration projects, and science-business R & D programmes. With a view to achieving the targets set, we will increase investment in R & D in the future, with an investment level of 2.13 % of GDP in 2021, of which public funding amounted to 0.53 % of GDP (SURS, 2023). Slovenia is thus lagging behind the EU average of 2.26 % of GDP in 2021, of which 0.73 % of GDP (2020) public R & D spending (Eurostat, 2023).

In the area of research, development, innovation and competitiveness (including the objectives of the Energy Union), anew scientific research and innovation strategy of Slovenia 2030 (ZRISS 2030) has been developed, which also includes R & D to achieve these objectives, taking into account the achievement of the climate-neutral society objectives.

We will **also devote more financial resources to transforming educational content** to create a digital and research-driven society of the future. This kind of society will create a future that is properly educated to meet the ever-increasing needs arising from climate change and the need to cope with it. At the same time, Slovenia will develop into a country with a competitive workforce able to green jobs in its economy.

In order to achieve the objectives set, the NECPs in the field of research and innovation envisage the following activities:

- **delivering ZRISS 2030 taking into account the achievement of the objectives of a climate-neutral society,**
- **establishing systematic monitoring of R & D & I projects and funds for the green transition;**
- **developing scientific disciplines as a matter of priority in the long term, in line with the development needs of Slovenia and the interests of the domestic economy**, in particular in the field of a climate-neutral society;
- the**deployment of multidisciplinary R & D programmes** in all areas related to energy management, in particular in the field of sustainable energy use,
- the**implementation of targeted R & D programmes and demonstration projects** that improve the practical capacity to prepare and implement quality projects in the fields of energy efficiency, circular economy and green energy technologies,
- **accelerated participation of R & D institutions and** industry at all Technology Readiness Levels (TRL 1-9) and joint integration in international projects;
- **support the upgrade and deployment of research infrastructures in public research organisations for investments to deploy technologies, systems and**

infrastructures for affordable clean energy and to reduce GHG emissions (including energy storage technologies, energy poles and nuclear research infrastructure).

- the**introduction of digitalisation** in the implementation and monitoring of measures to combat climate change, as by promoting and accelerating digitalisation, we increase the use of advanced technologies, influence the advanced performance of individual actors in society and tackle climate and societal challenges in an innovative way; **particular emphasis will be placed on increasing cybersecurity** and reducing the vulnerability of all key strategic systems in the country.
- using supercomputing capabilities to model, simulate and monitor climate change and find solutions;
- **active involvement of Slovenia in European initiatives to promote innovation** and in centralised EU funds projects in the field of climate neutral society and circular economy.

The above-mentioned set of activities is integrated into R & I-related development policies, in particular the close link with industrial, enterprise and scientific research and innovation and education policies. The transition to a climate-neutral society requires that the area of sustainable energy production and use become a priority area for research, development and innovation. Investing in research and promoting innovation in low-carbon technologies and energy efficiency not only contributes to sustainable development, but also contributes to a secure and competitive functioning of the energy sector, which makes an important contribution to the competitiveness of the economy as a whole. The cross-cutting dimension of research, development, innovation and competitiveness also makes an important contribution to achieving the objectives of the other four dimensions of the Energy Union. In Slovenia, the main areas of energy research in the future will be: **renewable energy sources, energy efficiency in buildings[51], hydrogen use, nuclear energy, electricity from RES and electricity and electricity systems, green gas technologies, heat and heat systems, circular economy, etc.** In these areas, we will also promote the development of technologies such as the upgrade of gasification and waste processing technologies for energy purposes, *power to X* technologies, hydrogen technologies, digitalisation of energy, cybersecurity, nanotechnologies, energy storage, emission capture, etc. Investment in alternative fuels technologies will be key in transport.

The NECPs shall also aim at strengthening competitiveness and technological development in the energy sector and developing new products, production processes, services and solutions suitable for transfer to the economy, in particular in relation to energy efficiency and RES and the climate-neutral and circular economy.

The Government of the Republic of Slovenia adopted the **JRC 2030** in December 2017, which defines two objectives relating to the research, innovation and competitiveness dimension in Slovenia:

[51] Including technological solutions for RES and EE in cultural heritage.

- the JRC's sixth objective is 'a*competitive and socially responsible enterprise and research sector'*, which sets out, inter alia, a *focus on environmentally acceptable technologies and eco-innovation*, which at the same time contribute to reducing environmental pressure as an important factor in the competitiveness of enterprises.
- the JRC's eighth goal 2030 sets a "*transition to a low-carbon circular economy"* as a priority development direction for the whole economy, breaking the link between economic growth and growth in the use of raw materials and non-renewable energy sources and the associated increased environmental burden.

In January 2023, the Slovenian Government adopted the Sustainable Smart Specialisation Strategy (S5).52 The upgraded S5 defines the green transition as a strategic objective, understood as the innovative, low-carbon, digital and knowledge-based transformation of the economy and society. Smart specialisation provides a platform for focusing development investment in areas where countries, including Slovenia, have a critical mass of knowledge, capacities and competences, and where they have the innovation potential to position themselves in global markets.

The Slovenian Smart Specialisation Strategy (S4) identified national strategic development priorities and niches in 2015 (upgraded 2017), supported in practice by a targeted, tailored and, above all, comprehensive package of measures. S4 presented a strategy to increase competitiveness by strengthening the innovation capacity of the economy, diversifying existing industry and service activities and growth of new and fast-growing industries/businesses. In addition, with the implementation of S4, Slovenia has introduced a new model of development cooperation among key innovation stakeholders and has been able to significantly better integrate into European and international innovation networks, platforms and consortia. The implementation of S4 thus represented and represents one of the key tools for strengthening and upgrading Slovenia's innovation ecosystem.

The strategy for the new period to 2030 (S5) puts sustainability at the forefront and identifies the green transition as its primary objective. The objectives of S5 are: (1) raising value added per employee; (2) improving competitiveness in global markets through increased knowledge and technologies in Slovenia's exports; (3) Increasing entrepreneurial activity.

In the transition to S5, the strategy sets the green transition as a central objective, which cannot be achieved without the right skills and competences, as well as without adequate and sufficiently developed tools – key enabling technologies, including ICT. S5 is divided into four thematic areas of investment to support:

a. enhancing research and innovation capacities and the uptake of advanced technologies;
b. improving the growth and competitiveness of SMEs and job creation in SMEs;
c. developing skills for smart specialisation, industrial transition and entrepreneurship; and
d. digital transformation.

[52] **S5 – Slovenia's Sustainable Smart Specialisation Strategy**, available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.gov.si%2Fassets%2Fministrstva%2FMKRR%2FKljucni-dokumenti-S5%2FS5_Verzija-1.0_lektoriran-cistopis_23.1.2023_3.docx&wdOrigin=BROWSELINK.

In addition to public research funding from the Slovenian budget and private sector investment, **European cohesion funds** in 2021-2027, including those under the **Recovery and Resilience Plan (RRP) and the Just Transition Fund (JTF), will play an** important role in promoting research, development, innovation and competitiveness by 2030. In addition, it is planned that the **Climate Change Fund** will also play an important role in the future, which will be used, inter alia, to finance R & D and demonstration projects in the field of energy to explore the use of hydrogen and technologies for the production and use of electricity from RES, aimed at reducing emissions and adapting to climate change, including participation in the initiatives of the European Strategic Energy Technology Plan (**SET**-Plan) and the European Technology Platforms (SET-Plan, 2018). In addition, the EU Innovation Fund will also be available in the 2021-2027 programming period to support innovation in low-carbon technologies, and funding to boost research and innovation in green technologies will also be available from LIFE and Horizon Europe.

3 POLICIES AND MEASURES

Chapter 3 is not yet updated. The measures in the existing NECPs are under review and will be redrafted if necessary. In parallel, new additional measures are being developed that are needed to achieve the planned more ambitious targets.

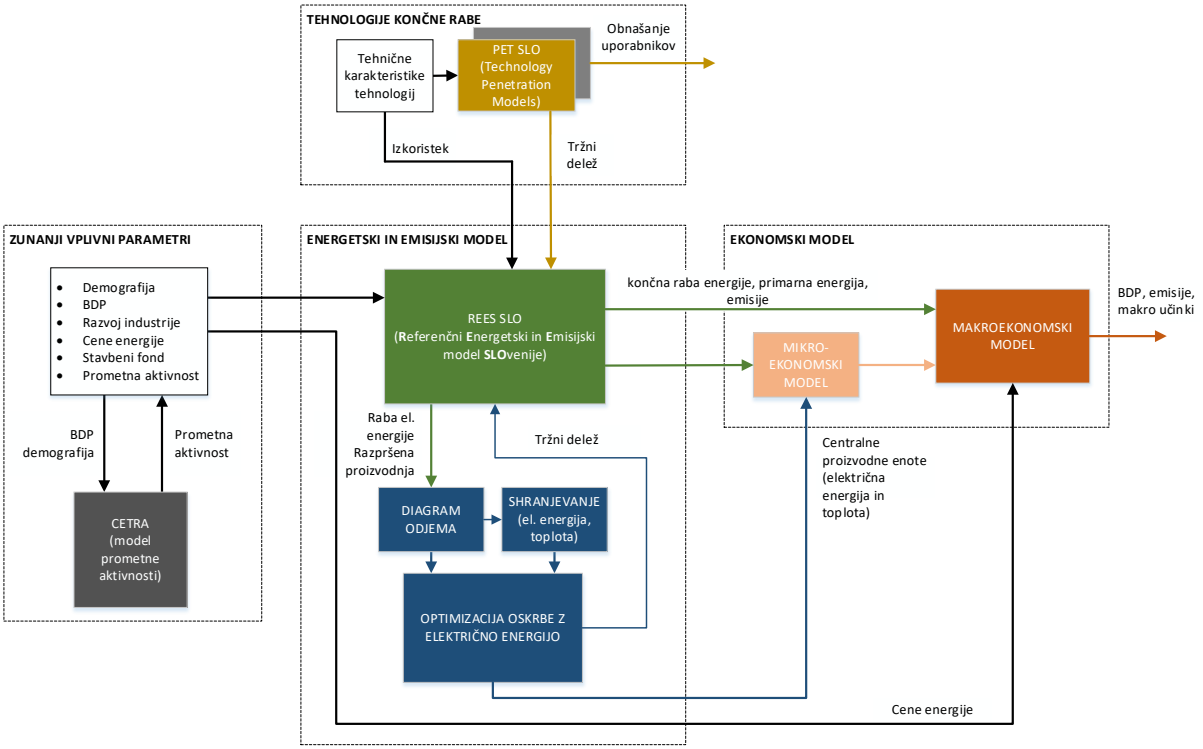
SECTION B: ANALYTICAL BASIS

The comprehensive preparation and analysis of the new NECPs is still ongoing and the chapter is not yet fully updated.

4 STATE OF PLAY AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

The central tool used in this analysis to calculate energy balances, emissions and costs of energy use and supply in Slovenia is the reference energy ecological model, called REES-SLO, developed in the MESAP environment in the form of a linear grid model of processes and interconnections, which allows for a consistent modelling of energy use based on energy service needs and calculations of sectoral energy, economic, environmental and other impacts. The reference model of the energy system is essentially a set of programs and tools that mathematically describe an individual subsystem in the interdependence of all the variables affecting such subsystem and then integrate these subsystems into an appropriate whole representing the real energy system. Modern energy system models, of which the REES-SLO model is also representative, use an integrated approach, combining the characteristics of specific and general models so that we can assess sectoral energy, economic and environmental impacts. A schematic illustration of the overall concept and interconnections of the individual models used to calculate the 2030 climate and energy targets is given in the figure below.

12Figure: Schematic presentation of the overall concept and interactions of individual models for calculating the 2030 climate and energy targets



4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

i. Macroeconomic forecasts (GDP and population growth)

Economic development

Slovenia achieved relatively high economic growth rates in the run-up to the financial crisis that broke out in 2008. The average GDP growth rate was 3.5 % between 2000 and 2003 and 4.9 % over the period 2004-2008. With the economic crisis, GDP growth slowed down already in 2008 and GDP fell sharply in 2009 (-7.5 %). The rapid deterioration in the national and international environment has been most marked by the decline in exports and investment, which have been key drivers of economic growth in recent years. After modest GDP growth in 2010 and stagnation in 2011, Slovenia returned to a period of negative growth rates in 2012, which continued in 2013. Positive GDP growth figures were again recorded between 2014 and 2019, mainly due to increased exports. The average GDP growth rate in 2014-2019 was 3.5 %. As a result of the Covid-19 crisis, Slovenia's GDP contracted by 4.3 % in 2020, but grew by 8.2 % the following year. In 2022, Slovenia's GDP continued to grow at a relatively strong pace of 5.4 %. Average annual economic growth in 2005-2022 was 2.3 %.

Table13: Annual change in gross domestic product volume by year in 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Annual revision of volume (%)	3,8	5,7	7,0	3,5	— 7,5	1,3	0,9	— 2,6	— 1,0	2,8	2,2	3,2	4,8	4,5	3,5	— 4,3	8,2	5,4

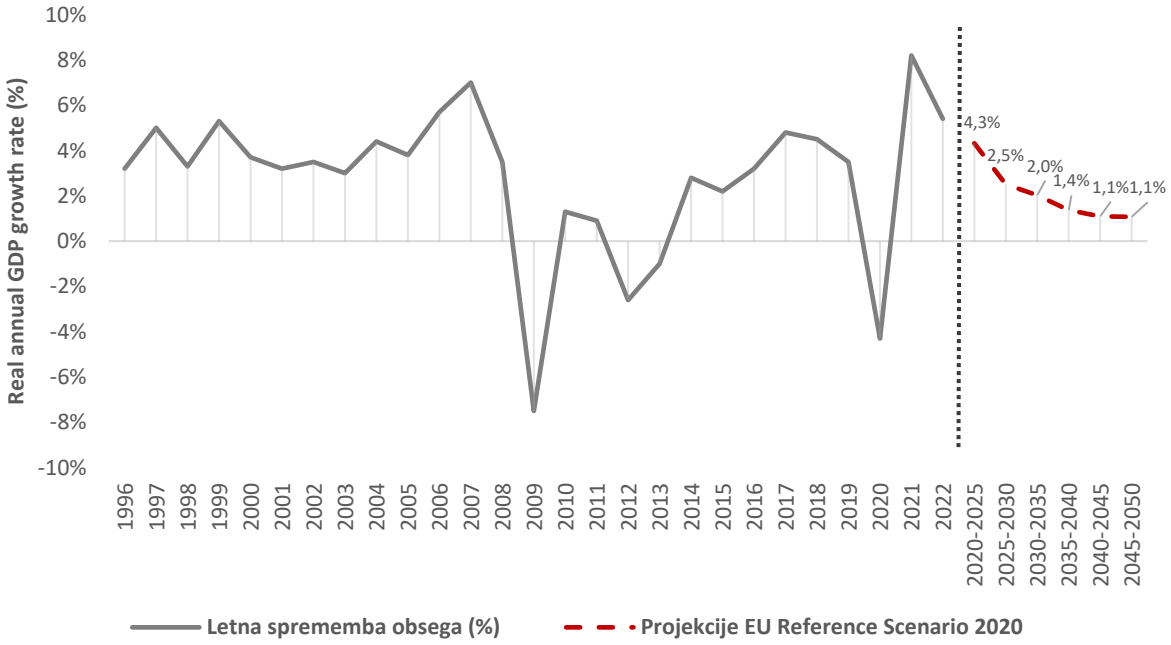
With high economic growth rates, Slovenia gradually approached the EU's average development, measured by GDP per capita in purchasing power, in the period before the crisis in 2008 and lags behind the EU-28 average by only 10 % in 2008. However, since the onset of the economic crisis in 2008, Slovenia has been in the group of EU Member States with the largest decrease in GDP per capita in purchasing power. In 2018, Slovenia's GDP per capita in purchasing power was 87 % of the EU-27 average, 2 percentage points higher than in 2017. The value of this indicator was thus high most recently in 2007. Over the period 2018-2021, the value of the indicator increased. In 2021, GDP per capita in purchasing power in Slovenia was 90 % of the EU-27 average.

In the composition of GDP, the share of services is increasing slowly as the share of industry shrinks. The industry's share, which represented around 27 % of GDP over the period 2000-2008, fell below 24 % over the next five years, mainly due to the sharp decline in construction. Today, the share of industry remains at a similar level.

For the calculations of energy and emissions balances and scenarios up to 2030 and 2040 and 2050 respectively, the results of GDP projections will be taken into account using the GEM-E3 model, which was also used by the Commission in the reference scenario.[53] In line with the economic growth projections considered, average annual GDP growth in the target scenario for the period analysed until 2050 is shown in the figure below.

[53] European Commission, Directorate-General for Climate Action, Directorate-General for Energy, Directorate-General for Mobility and Transport, De Vita, A., Capros, P., Paroussos, L., et al., EU reference scenario 2020: energy, transport and GHG emissions: Trends to 2050, Publications Office, 2021 (material available at: https://energy.ec.europa.eu/data-and-analysis/energy-modelling/eu-reference-scenario-2020_en).

13Figure: Real growth rates of gross domestic product, source: SURS and projections

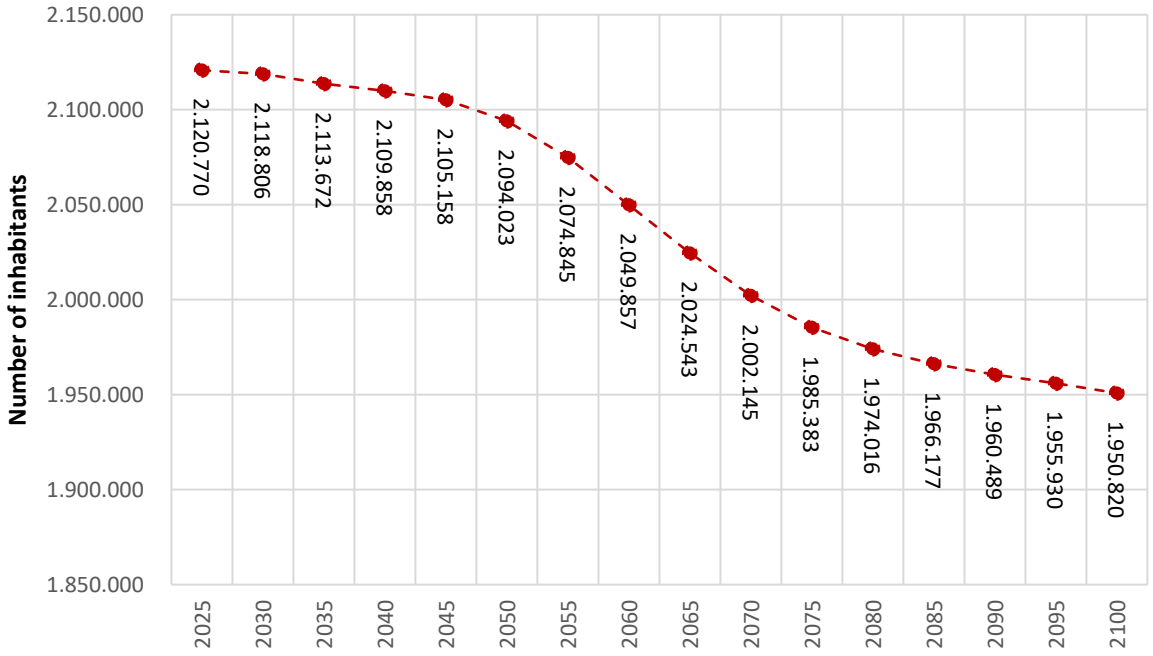


Source: European Commission, Directorate-General for Climate Action, Directorate-General for Energy, Directorate-General for Mobility and Transport, De Vita, A., Capros, P., Paroussos, L., et al., EU reference scenario 2020: energy, transport and GHG emissions: Trends to 2050

Population

In cooperation with Eurostat and the national statistical offices, population projections up to 2100 have been made for Slovenia. Slovenia's population is expected to grow by 2025 (to around 2.120.770), after which the population is expected to slowly decline. According to EUROSTAT, Slovenia is expected to have a population of around 1.950.000 in 2100, 8 % less than in 2025 (see figure below). Slovenia is expected to have 2.118.806 inhabitants in 2030 and 2.109.858 in 2040. Population projections in the analysis affect new housing needs, consumption of energy and other goods and services, and government revenues.

14Figure: Projection of Slovenia's population



Source: Eurostat, 2023

ii. Sectoral changes expected to affect the energy system and GHG emissions

The main sectoral changes that will have an impact on the energy system and GHG emissions, which are also taken into account when designing energy use models to calculate energy and emissions balances, are mainly due to:

- giving priority to the principle of energy efficiency in all sectors concerned;
- transition to electricity (where technologically feasible and sustainable in the long term);
- increasing the use of RES (where technologically feasible and sustainable in the long term).

In the following, we provide the leading parameters by sector, namely buildings, transport and industry, and briefly summarise the current situation.

Buildings

According to SURS data, 832.048 private households in Slovenia were home to 2.101.655 inhabitants in January 2020. Despite the decline in population after 2025, the total number of households will continue to increase due to the continued decline in the average household size. In the base year 2020, this was 2.46 members per household, compared to 2.28 in 2030.

Ten years later in 2040 it will be further reduced to 2,11 in 695.560 residential dwellings, where there will be 882.245 households.

The surface area of buildings and their overall growth are key to understanding the energy performance of the building stock. The floor area of the dwellings that is heated shall be taken into account. The housing stock is divided into single and multi-dwelling buildings. New housing growth is projected to remain at the levels observed in previous years until 2030, before declining slightly by 2040. The total floor area of dwellings will thus be close to 68 million m^2 in 2030.

The total area of the non-residential building stock in 2020 was 23.7 million m^2. The growth of the surface area of buildings by 2030 and 2040 is projected to be approximately the same as in statistics and data from the real estate register. The total surface area of buildings will thus be 27.6 million m^2 in 2030 and 30.3 million m^2 in 2040.

Transport

The traffic projection depends on the various drivers of transport. These factors may be external or internal, and individual factors may be influenced by the policies and strategies adopted. External factors are: number and age structure of the population, motorisation rate, population pattern, employment, growth of gross social product, number of jobs and their structure by space, domestic and international trade, domestic and international tourism. In addition, the projected growth in transhipments in the ports of Koper, Trieste and Rijeka also has an impact on goods traffic. The projected demand under the transport model is also based on the expected European socio-economic situation.

Domestic transport depends, on the one hand, on the conditions imposed by Slovenian regional centres in relation to their catchment areas or specific Slovenian characteristics and, on the other hand, on global processes which also affect Slovenia. Slovenia, as a territorially small country, is even more dependent on the external environment than others. External transport depends primarily on globalisation processes and European characteristics.

The factors mentioned above contribute to an increase in transport activity, as it has not yet been possible to decouple economic and transport growth. Traffic growth measures represent passenger-kilometres for passenger traffic and tonne-kilometres for freight transport. The table below shows projections until 2050 showing the evolution of motor transport activity (road and rail) in three scenarios.

- The scenario with existing measures (OU) assumes a continuation of the past trend – although there is an increase in the volume of PSOs (road and rail), the structure of passenger traffic does not change, personal motor traffic still largely predominates and passenger car occupancy does not change.
- The scenario with additional measures of the HIP (DU – HIP) assumes that total passenger transport activity will continue to grow, but at a lower rate than in the scenario with existing measures. The structure of traffic improves at the expense of PES, cycling and walking, but personal motor traffic continues to dominate.

- The scenario with additional measures of the UP (UP) assumes that the growth in total passenger transport activity will stop by 2050 at the expense of both a change in the structure of passenger transport (higher share of public procurement, walking and cycling), as well as measures to reduce distances, travel needs and an increase in vehicle occupancy.

Table14: Projection of transport activity for passenger transport under different scenarios

[mio pkm]	2019	2025	2030	2035	2040	2045	2050
MA							
TOTAL	**51.824**	**55.828**	**59.164**	**62.649**	**66.134**	**69.619**	**73.104**
Passenger car – domestic	27.595	29.507	31.101	32.813	34.525	36.237	37.949
Passenger car – foreign	19.785	21.156	22.299	23.526	24.754	25.981	27.209
Bus (public transport)	807	897	972	1.025	1.079	1.132	1.186
Bus (tourist)	1.994	2.434	2.801	3.142	3.482	3.822	4.163
Passenger train	698	831	943	1.057	1.172	1.286	1.401
Motors and mopeds	323,0	345	364	384	404	424	444
Foot and bicycle	622	656	684	701	719	736	753
DU – HIP							
TOTAL	**51.824**	**52.878**	**54.812**	**55.847**	**56.882**	**57.917**	**58.952**
Passenger car – domestic	27.595	27.463	27.353	27.086	26.819	26.552	26.286
Passenger car – foreign	19.785	19.690	19.612	19.420	19.229	19.038	18.846
Bus (public transport)	807	1.152	2.495	3.093	3.691	4.290	4.888
Bus (tourist)	1.994	2.401	2.741	2.892	3.042	3.193	3.344
Passenger train	698	888	1.047	1.483	1.920	2.356	2.792
Motors and mopeds	323,0	321	320	317	314	311	308
Foot and bicycle	622	961	1.244	1.555	1.866	2.177	2.488
DU – UP							
TOTAL	**51.824**	**52.331**	**53.868**	**53.499**	**53.130**	**52.761**	**52.393**
Passenger car – domestic	27.595	27.410	28.137	27.191	26.246	25.301	24.356
Passenger car – foreign	19.785	19.267	18.836	18.203	17.570	16.938	16.305
Bus (public transport)	807	918	1.273	1.634	1.995	2.356	2.717
Bus (tourist)	1.994	2.401	2.740	2.891	3.042	3.193	3.344
Passenger train	698	889	1.020	1.338	1.657	1.975	2.294
Motors and mopeds	323,0	315	308	297	287	277	266
Foot and bicycle	622	1.131	1.555	1.944	2.333	2.722	3.111

Table15: Projection of transport activity for freight transport in different scenarios

[mio tkm]	2019	2025	2030	2035	2040	2045	2050
MA							

TOTAL	**55.298**	**67.865**	**78.338**	**87.855**	**97.372**	**106.889**	**116.406**
Light duty vehicles	1.461	1.784	2.053	2.302	2.551	2.801	3.050
Heavy goods vehicles – domestic	30.954	37.791	43.488	48.771	54.054	59.337	64.621
Heavy goods vehicles – TUJA	17.591	21.476	24.714	27.716	30.719	33.721	36.724
Freight train	5.292	6.815	8.084	9.066	10.048	11.030	12.012
DU (HIP = UP)							
TOTAL	**55.298**	**67.173**	**77.068**	**81.311**	**85.553**	**89.796**	**94.038**
Light duty vehicles	1.461	1.759	2.008	2.119	2.229	2.340	2.450
Heavy goods vehicles – domestic	30.954	37.277	42.545	44.887	47.229	49.571	51.913
Heavy goods vehicles – TUJA	17.591	21.184	24.178	25.509	26.840	28.171	29.502
Freight train	5.292	6.953	8.337	8.796	9.255	9.713	10.172

Industry

We used data on production so far (base year 2020) as the model's leading input for industry. We have prepared the projection in line with forecasts based on industry developments so far, the situation in the base year 2020 and past dynamics. We also took into account producers' expectations of future trends, as well as guidelines and trends from academic literature and international studies. For energy-intensive industries, we have made physical product projections in physical units (kt) for industries C17 – paper and paper production, C23 – manufacture of non-metallic mineral products and C24 – metal production, with the exception of the C20 – Production of chemicals and chemical products, where we made a projection in monetary units (value added). Other sectors have been addressed on an aggregated basis, with the leading parameter being value added in monetary units.

Main influence parameters of the REES-SLO energy emission reference model

The table below shows the main impact parameters of the REES-SLO reference energy-emission model by sector. For all sectors, with the exception of the transport sector, we used the same guiding parameters of the model for both scenarios, i.e. MA and NECP, and we changed transport activity (passenger-kilometres and tonne-kilometres), which also changes transport work in a more demanding scenario with additional NECPs measures.

Table16: Main impact parameters of the REES-SLO reference energy emission model by sector

	Corps	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
Buildings							
Number of households	[]	800.780	802.531	820.052	833.964	846.906	860.141
Surfaces	[mio m²]	87,23	89,70	91,98	94,60	96,22	97,80
Households	[mio m²]	63,74	64,65	65,82	66,97	67,22	67,47

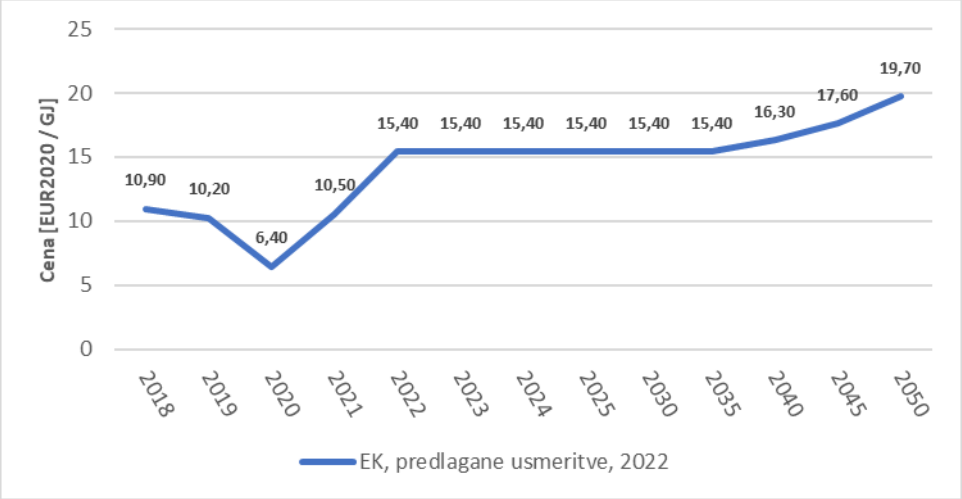
Services	[mio m²]	23,49	25,05	26,16	27,63	29,01	30,34
Transport: MA scenario							
PPPs	[mio pkm]	47.790	49.610	52.982	56.354	59.285	62.373
Domestic vehicles	[mio pkm]	29.715	31.732	33.968	36.204	38.108	40.116
Foreign vehicles	[mio pkm]	18.075	17.878	19.014	20.149	21.177	22.257
Tkm	[mio tkm]	56.629	60.334	72.897	85.460	94.355	104.175
Domestic vehicles	[mio tkm]	37.755	38.890	47.111	55.332	61.092	67.450
Foreign vehicles	[mio tkm]	18.874	21.444	25.786	30.127	33.263	36.725
Transport: NECPs scenario							
PPPs	[mio pkm]	47.790	49.126	52.099	55.075	55.635	56.300
Domestic vehicles	[mio pkm]	29.715	31.732	33.968	36.204	38.108	40.116
Foreign vehicles	[mio pkm]	18.075	17.688	18.633	19.578	19.578	19.578
Tkm	[mio tkm]	56.629	59.501	71.230	82.959	87.191	91.639
Domestic vehicles	[mio tkm]	37.755	38.458	46.248	54.037	56.793	59.690
Foreign vehicles	[mio tkm]	18.874	21.043	24.982	28.922	30.398	31.948
Industry							
Physical product							
C17	2017=1	1,00	1,03	1,05	1,06	1,08	1,11
C23 – Cement	2017=1	1,00	1,06	1,14	1,16	1,18	1,20
C24	2017=1	1,00	1,19	1,28	1,30	1,31	1,34
Primary aluminium	2017=1	1,00	0,00	0,00	0,00	0,00	0,00
Sec. Aluminium	2017=1	1,00	1,29	1,45	1,61	1,94	1,94
Added value	2017=1						
C20	2017=1	1,00	1,10	1,12	1,15	1,17	1,21
C23 – Other	2017=1	1,00	1,12	1,15	1,17	1,18	1,20
C – Other	2017=1	1,00	1,22	1,37	1,51	1,61	1,79

iii. Global energy trends, international fossil fuel prices, carbon price in the EU ETS

Energy prices

The development of energy prices in international markets is a very important factor which also influences future trends in energy supply in Slovenia. As Slovenia imports half of its primary energy from abroad, developments in external energy markets are decisive for the competitiveness of energy supply in Slovenia. Notwithstanding the fact that a significant part of supplies are made on the basis of medium and long-term contracts, supply prices will be tied to market prices, especially if we observe the long term (up to 2040 and 2050 respectively). Integration into the EU's internal energy and other energy markets is important for the security of supply and the emergence of Slovenian producers on export markets. Future energy prices in the international are highly uncertain. Projections of energy prices in the production of the NECPs are necessary to take decisions in uncertain circumstances. The figure below shows the results of various projections of oil price developments used for different strategic analyses in Slovenia and abroad.

15Figure: Forecasts of future oil prices on the international market

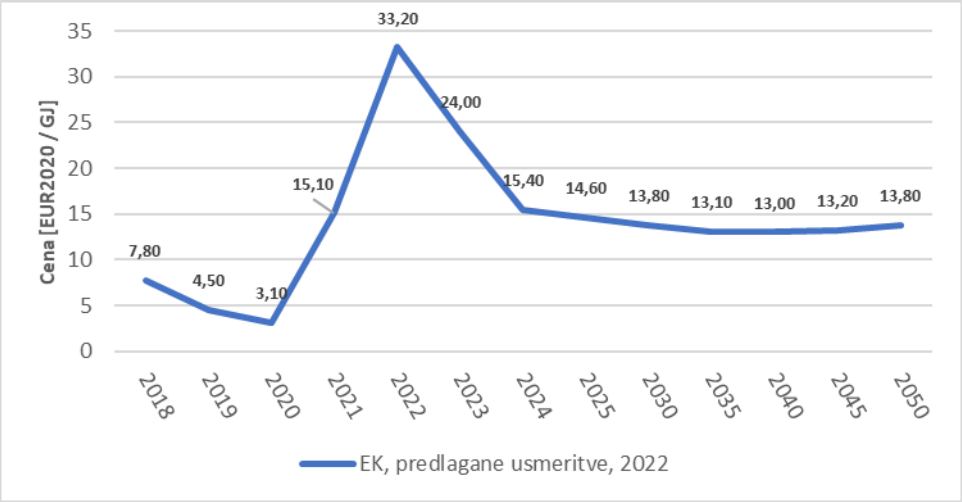


For the purposes of the NECPs, future oil and petroleum product price forecasts take into account the projections and recommendations of the European Commission's International Oil Price Forecasts used as an appropriate basis for long-term planning.

In the light of the objectives set out in the Paris Agreement, it was estimated that Slovenia would phase out the use of domestic and imported coal for energy purposes. Indigenous coal is used for energy purposes in the Šoštanj thermal power plant.

Changes in global markets are leading to uncertainty in oil and natural gas prices, which is particularly problematic for Slovenia, which imports 100 % of liquid fuels and natural gas. At the beginning of the COVID-19 pandemic, global demand for oil decreased, leading to excess supply and contributing to lower prices – on average to 44 dollars/bars (WEO 2022). With the re-launch of the economies, demand for oil and thus prices increased – in 2022, the price was already 105 dollars/barrels. Less new oil sources were also detected during the pandemic period, which will have an impact on fossil fuel prices in the future. The uncertainty of future energy prices is also affected by Russia's invasion of Ukraine, which has led the EU to cut off fossil fuel imports from Russia and to phase out the use of Russian gas by 2030 under the RePowerEU framework. Established countermeasures to reduce dependence on Russian energy and Russia's decision to reduce gas flows to the EU have led to an increase in the price of natural gas, which the IEA is expected to remain high in the coming years (WEO, 2022). As a result, demand for liquefied natural gas (LNG) has increased and could replace natural gas needs in the short term. Under the RePowerEU framework, a total reduction of natural gas imports is planned by 2030 through energy efficiency measures, investments in RES and an increase in oil and gas imports from other countries. The figure below shows the projected natural gas prices in the European market taken from the recommendations of the European Commission's parameters for reporting greenhouse gas projections in 2023.

16Figure: Past trends and forecast of gas price (NCV) in the European market



Source: EC, 2022.

Allowance prices

The modernised ETS significantly changes the market situation and has a significant impact on future developments. Emission allowance prices in the European market are influenced by several factors, in particular fossil fuel prices, EU emissions trading rules and the emissions market in the wider international context. Already today's situation suggests that the future price of allowances will be highly uncertain. In 2021, allowance prices in the EU tripled (WEO, 2022).

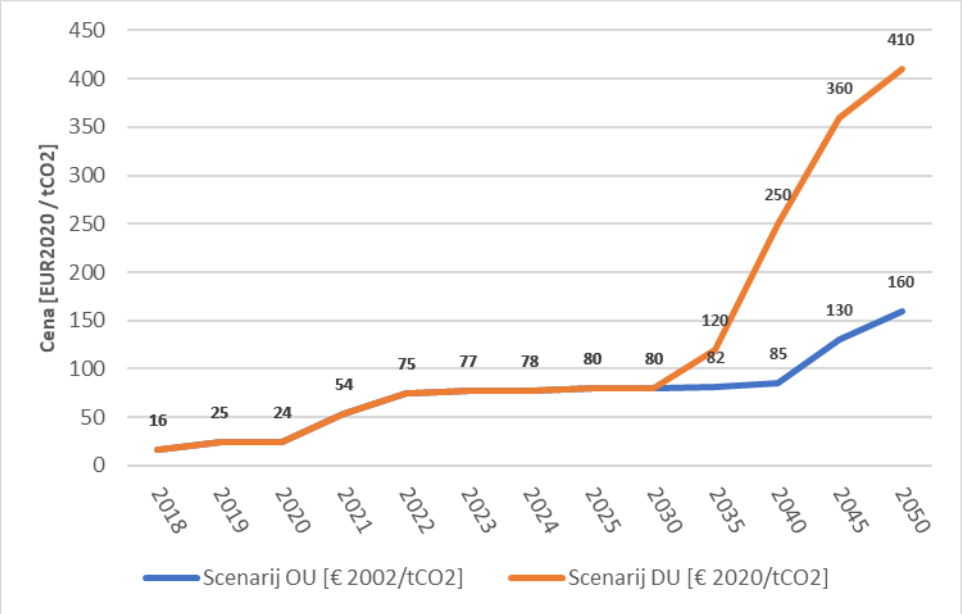
Decisions have recently been taken which will have an impact on the development of the trading system. For the period up to 2030, a new emission reduction target for the sectors covered by the EU ETS was set at 62 % compared to 2005. By 2024, allowances will be reduced by 90 million and an additional 27 million in 2026. For sectors covered by the CBAM (English: *Carbon Border Adjusment Mechanism*), free allocation of allowances will be phased out in the period 2026 to 2034.

A separate emissions trading system (i.e. EU ETS 2) for the buildings and transport sectors is expected to be in place by 2027. The latter will become the responsibility of fuel suppliers, who will become responsible for monitoring and reporting on the sale of fuels on the market. In the event of extreme energy prices potentially affecting vulnerable households, the roll-out is delayed until 2028. The price on this allowance market will be established separately and will be regulated at an early stage.

Technological developments will also have a significant impact on the price of emission allowances in both markets, due to their impact on the costs of individual technologies or emission reduction measures. The most significant impact on allowance prices is expected for the following technologies: accelerated use of energy from RES, new technologies in transport and carbon capture and storage. Emission allowance price projections have been taken from the Commission's analyses, which take into account the 55 % climate reduction target and the proposed international fossil fuel prices. The figure below shows the results of emission

allowance price projections against the scenario with existing measures (OMs) and the scenario with additional measures (AMs).

17Figure: Forecast of the price of allowances on the European market



Source: EC, 2022.

Electricity

While reference projections of international fuel prices and emission allowances are available and are regularly produced and updated by well-established international institutions, there are no such bases for electricity price projections. Uncertainties make future electricity prices even more unpredictable. In the first half of 2022, EU electricity prices were 30 % higher than the previous year. In the light of recent developments, future electricity prices remain even more unpredictable. According to the WEO 2022 (p. 300), higher electricity sales prices were affected by a higher price of fossil fuels – natural gas alone should be responsible for a larger share of the price increase. In addition, emission allowance prices, reduced electricity generation from nuclear power plants due to refurbishment and climatic conditions, also affected lower hydropower production. Future prices will also be affected by the pursuit of a reduction in dependence on imported natural gas, which will accelerate the development of RES (WOE, 2022). In the period up to 2030, in addition to emission allowance prices, electricity prices in Slovenia will be most affected by developments in the region. The construction of new transmission interconnections and new production capacity will have a significant impact on price developments in the region. We expect that electricity prices will vary considerably in time. Although today electricity prices are still determined mainly by natural gas and emission allowances, electricity generation from RES (sun) has a very significant impact on hourly prices. It is expected that these impacts (during the summer period of low daytime prices) will continue to increase across the EU, which is not significantly influenced by Slovenia. The accelerated construction of solar power plants is changing established practices and it is therefore expected that Italy, or the countries of southern Europe, will become electricity

exporters in the summer, which will also have a significant impact on prices in the wider region. By 2030, however, further increases in electricity prices are expected, especially in the winter period, partly driven by increased demand and accelerated electrification in all areas (e.g. electric vehicles, heat pumps, hydrogen production), as well as energy price developments. In the past, electricity stock exchange prices in EU countries did not cover the full cost of production, which made it difficult to invest in new generation capacity. The final price of electricity is also directly influenced by the State, which, by setting the level of taxation of energy products, takes account of fiscal and environmental objectives. The future electricity price for final customers will also be affected by the need to upgrade electricity networks, in particular distribution networks, and not least by the increased costs of providing system services (RVF and aRPF) due to the expected increase in the integration of occasional RES into the electricity system (EES).

IV. Technology cost developments

We set out below the costs of technologies or technological developments for the various technologies, focusing on building and distributed generation renovations, as well as an assessment of investment in the implementation of the CCS system.

Buildings

The specific investment in the energy renovation of buildings depends on the type of building, the extent of the renovation and, in the case of residential buildings, the construction period. From an energy point of view, a building falls into a specific so-called energy class reflecting its actual condition. At the time of energy renovation, a building moves between classes as it improves its energy performance. The scope of energy renovations may vary, identifying the following renovations: standard renovation, improved renovation and low-energy renovation. Never energy-renovated buildings can therefore be renovated in three different ways, depending on their scale, and their energy class will be improved accordingly. The value of the energy class of each building depends on the type of building, the extent of the renovation and the age of the building.

The tables below show the average specific investments in energy renovation for each type of building in the residential and non-residential sectors, since a number of different measures can be considered as partial renovations, which may vary greatly after the investment, e.g. changing windows, renovating the roof, installing mechanical ventilation, etc.

In the housing sector, special investment is generally more expensive in single-residential buildings due to a lower heated floor area. In the non-residential sector IDRs are 150-EUR$^{250/m^2}$. Specific investments remain stable until 2020 and gradually increase by 2030 and 2040 due to rising material and labour costs. The financial aspects of building renovation will be further analysed as part of the long-term strategy to promote the energy renovation of buildings.

Table17: Specific investment in partial and comprehensive energy renovation in single- and multi-apartment buildings depending on the construction period of the building

Building type	Construction period	Partial renovation [EUR/m²]			Comprehensive refurbishment [EUR/m²]		
		2020	2030	2040	2020	2030	2040
Single-dwelling buildings	before 1945	75	83	92	222	247	273
	1946-1970	102	114	126	222	248	274
	1971-1980	105	117	129	192	214	236
	1981-2002	95	106	118	180	200	220
	2003-2008	167	187	206	—	—	—
	After 2008	298	332	366	—	—	—
Multi-dwelling buildings	before 1945	72	80	88	99	110	121
	1946-1970	77	85	94	104	116	127
	1971-1980	48	54	59	122	136	150
	1981-2002	66	73	81	98	110	121
	2003-2008	106	119	130	—	—	—
	After 2008	165	184	203	—	—	—

Table18: Specific investment in partial and comprehensive energy renovation in different types of non-residential buildings

Group of non-residential buildings	Partial renovation [EUR/m²]			Comprehensive refurbishment [EUR/m²]		
	2020	2030	2040	2020	2030	2040
Residential buildings for specific social groups, hotels	51	57	63	146	148	163
Hospitality buildings, museums and libraries, education buildings and SR Works	45	47	50	129	130	143
Public administration buildings, administrative and office buildings	122	123	136	155	157	173
Cultural and entertainment stores and buildings	89	90	99	180	182	200
Health care buildings	106	107	118	144	146	161

Sports halls	57	57	64	108	109	120

Diffuse production

The figure below shows the specific investment costs for distributed generation technologies and their projected dynamics by 2050. The investment costs of individual technologies have been used separately by technology in the scenario analyses and for some technologies, in particular CHP, the average investment costs are shown in the graph below. We combined CHP technologies, namely gas turbines (estimated specific investment of EUR 1000/kW) and gas engines (estimated specific investment of EUR 700/kW). Similarly, wood biomass CHP technologies are shown, namely wood biomass gasification (estimated specific investment between EUR 4500 and 4000/kW) and ORC technology (specific investment estimated at EUR 320/kW). More detailed information on specific investment costs is given in the table below.

18Figure: Specific investment in distributed generation technologies

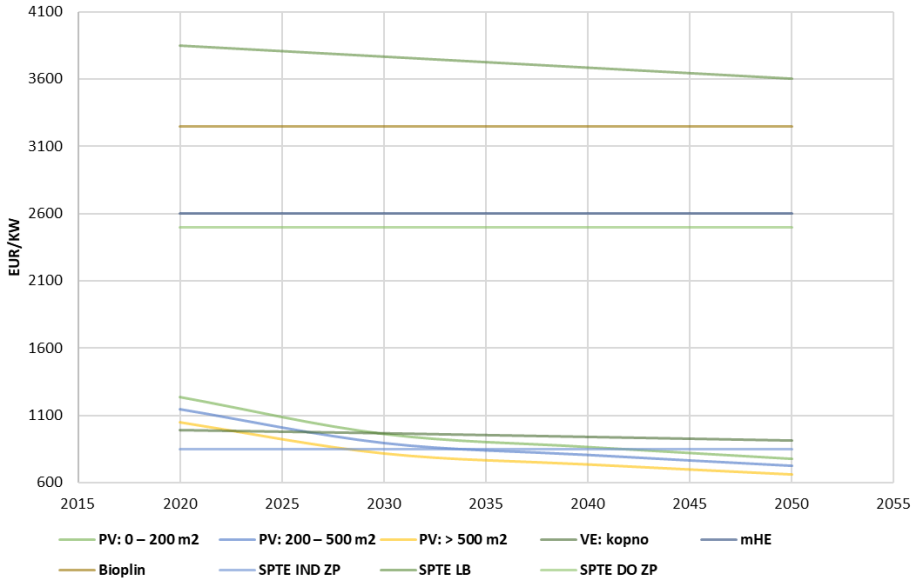


Table19: Specific investment in distributed generation technologies

Technology		2020	2030	2040	2050
IA: 0-200 m^2	EUR/kW	1.234	963	867	780
IA: 200-500 m^2	EUR/kW	1.147	895	806	725
IA: > 500 m^2	EUR/kW	1.048	818	737	663
KNOWS: shore	EUR/kW	990	968	941	915
mHE	EUR/kW	2.600	2.600	2.600	2.600
Biogas	EUR/kW	3.250	3.250	3.250	3.250
Fuel cells	EUR/kW	10.000	5.000	3.000	2.000

CHP of IND p.m. turbine	EUR/kW	1.000	1.000	1.000	1.000
IND CHP-CHP engines	EUR/kW	700	700	700	700
CHP IND WB	EUR/kW	3.850	3.767	3.683	3.600
CHP TO NG	EUR/kW	2.500	2.500	2.500	2.500
CHP Gasification	EUR/kW	4.500	4.333	4.167	4.000
CTH ORC	EUR/kW	3.200	3.200	3.200	3.200

Carbon Capture and Storage (CCS)

For CCS technologies, a large-scale demonstration programme has been set up in the EU with the aim of accelerating commercial program and implementation. One of the challenges for CCS deployment in the EU is the high costs associated with CO2 capture and storage. Economic viability remains an important obstacle and appropriate support mechanisms to overcome these obstacles should be put in place for wider deployment. Regardless of the current state of deployment of CCS technologies, these technologies provide an opportunity to significantly reduce CO2 emissions, especially in carbon-intensive and hard-to-decarbonise industries (i.e. *Hard to abate sectors*).

In Slovenia, there are also opportunities for CCS in existing energy sites and in the energy-intensive industry. Here we highlight industries emitting process emissions. In order to successfully implement targeted projects in industry, it is necessary to consider appropriate organisational forms for the successful implementation of the envisaged projects (e.g. the Contracts for Difference (CfD) scheme. *Carbon contract for difference*) and create incentives for Slovenian companies to apply for project funding tenders (domestic and EU – Climate Fund, Innovation Fund, Modernisation Fund, etc.). At the same time, it should be noted that under the applicable legislation (Article 166a of the Environmental Protection Act and Article 6 of the Mining Act) the injection and storage of carbon dioxide is prohibited in Slovenia.

4.2 Decarbonisation dimension

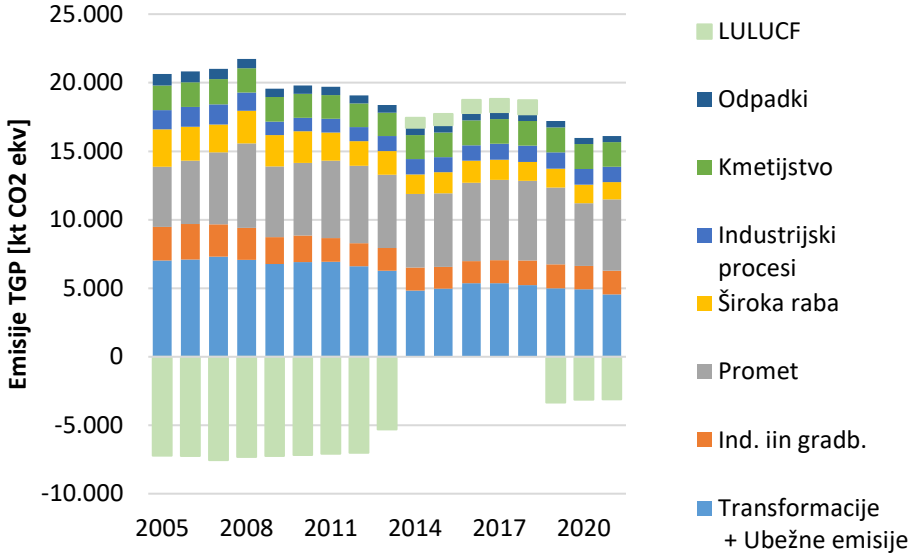
4.2.1 Greenhouse gases emissions and removals

I. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

Total emissions

The overall GHG emissions since 2005 for individual sectors are shown in the figure below. In 2021, we emitted 16.106 kt of CO_2 equivalent in Slovenia. Transport is the main emitting sector with 32 %, followed by a fugitive emission transformation sector with 28 %, industry with 18 % (emissions from combustion of fuels in industry and construction and industrial processes), agriculture with 11 %, widespread use with 8 % and waste with 3 %. LULUCF sinks accounted for -19 % of total emissions in 2021. In 2014-2018, the LULUCF sector was a source of emissions due to increased felling due to natural events.

19Figure: Trend of GHG emissions 2005-2021



Emissions from ESD (non-ETS)

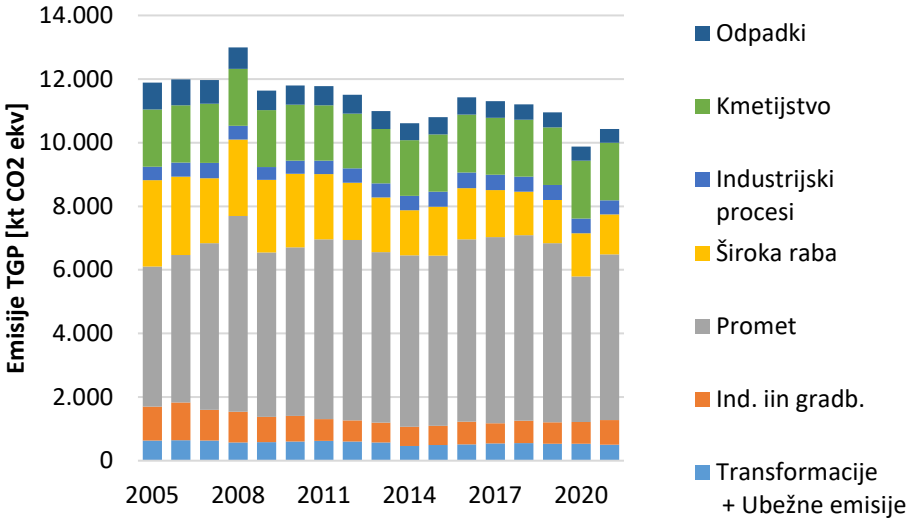
Decision 406/2009/EC established NEETs emission target commitments for EU Member States for the period 2013-2020. For this period, Slovenia met the targets as its embassies were significantly lower than prescribed. In the period 2021-2030, the targets were set by Regulation 2018/842, amended by Regulation 2023/857. The amended Decree requires Slovenia to reduce its NEETs emissions by 27 % by 2030 compared to 2005. This target will be translated into annual targets in the Implementing Regulation.

Emissions from the NEETs sectors were 10.425 kt CO_2 eq in 2021, 12 % less than in 2005. At the same time, this is almost 1 000 kt CO_2 equivalent less than the annual value established by the Commission.

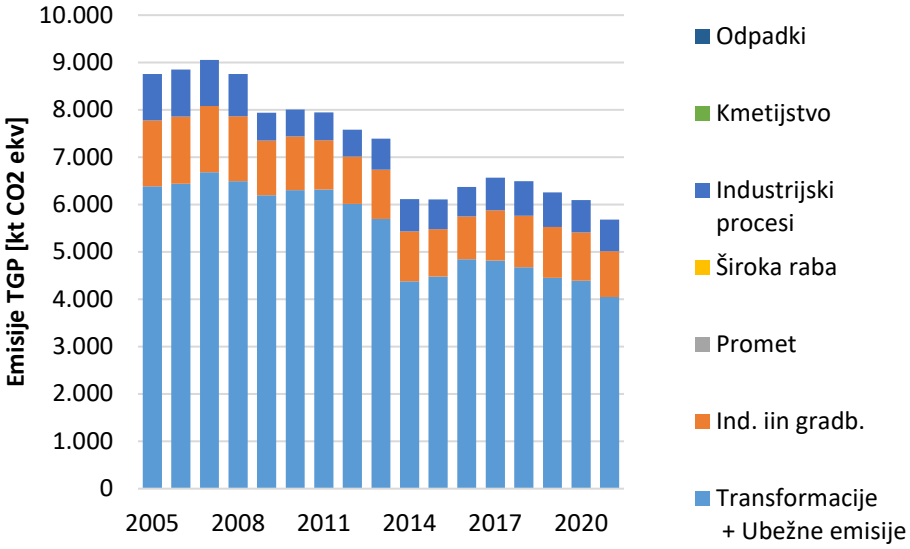
NEETs emissions increased by 6 % in 2021 compared to the previous year, which is to a large extent the increase in emissions in the transport sector. Transport accounts for 50 % of all NEETs emissions. In order to achieve the emission reduction target, it is therefore crucial to manage emissions in the transport sector, but emissions reductions are also needed in other sectors.

NEETs accounted for 65 % of total GHG emissions, the remaining 35 % being emissions from sources covered by the Emissions Trading Scheme (the so-called EU-ETS system).

20Figure: Evolution of emissions from ESD sectors (non-ETS) in the period 2005-2021



21Figure: Evolution of ETS sector emissions in the period 2005-2021



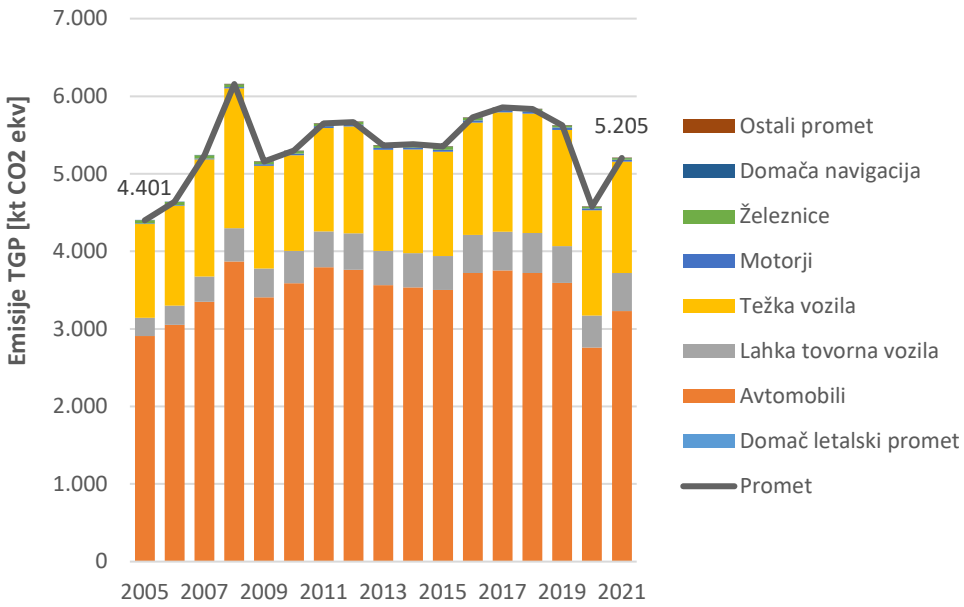
ETS emissions

GHG emissions covered by the EU-ETS scheme decreased by 7 % in 2021 compared to 2020 and were lower by 35 % compared to 2005. Emissions are decreasing throughout the period, with increases observed only in 2015-2017. Industry accounts for 29 % of emissions, the remaining part (71 %) being attributed to transformations together with fugitive emissions.

Transport

Total GHG emissions from transport in 2021 were 5.205[54] kt CO_2 eq. Between 2005 and 2021, emissions increased by 18 %, especially in 2005-2008. In 2021, road transport emissions accounted for 99.5 % of total transport emissions. Cars (62 %), heavy goods vehicles and buses account for 28 % of road transport emissions and 10 % for light-duty vehicles. In 2020, emissions decreased significantly as a result of measures to prevent the spread of SARS-CoV-2. The main driver of increasing emissions is the increased motor activity of domestic vehicles, and fuel sales to foreign vehicles also have a significant impact. The share of transport emissions from foreign vehicles varies over the years as a result of the change in the fuel price ratio in Slovenia and in neighbouring countries. The highest share was recorded in 2008 and 2012, when it exceeded 20 %. In 2021, the share was estimated to be negligible and very high in 2022 again.

22Figure: Analysis of trends in GHG emissions from transport 2005-2021



Industry

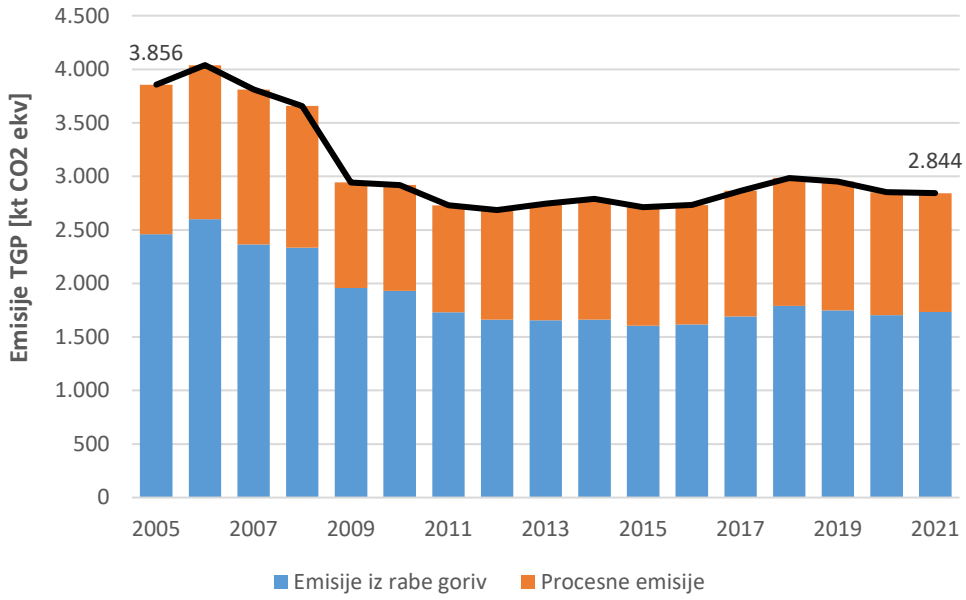
Total GHG emissions from the combustion of fuels in manufacturing and construction and from industrial processes were 2.851[55] kt CO_2 eq in 2021. Between 2005 and 2021, emissions decreased by 26 %, with emissions from the combustion of fuels reduced by 30 % and process emissions by 20 %. In 2021, process emissions in the total emissions of the manufacturing and construction sectors accounted for 39 %. The reduction in GHG emissions is due to a variety of factors, notably environmental commitments, the imposition of a levy on carbon dioxide emissions and emissions trading and the implementation of energy efficiency

[54] National GHG inventories – GHG emissions by main source groups, source: ARSO, 2023. http://okolje.arso.gov.si/onesnazevanje_zraka/vsebine/toplogredni-plini.
[55] National GHG inventories – GHG emissions by main source groups, source: ARSO, 2018. http://okolje.arso.gov.si/onesnazevanje_zraka/vsebine/toplogredni-plini.

measures, the use of renewable resources, improvements in industrial production processes and sector-specific restructuring.

The figure below shows a downward trend in GHG emissions in manufacturing and construction over the period 2005-2021.

23Figure: Analysis of trends in GHG emissions in manufacturing and construction 2005-2021



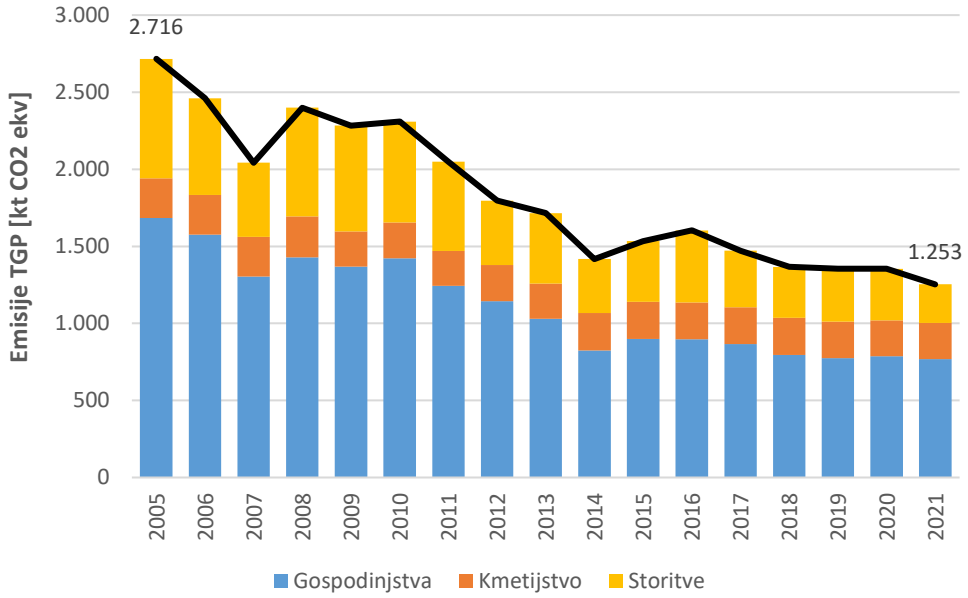
For CO2 emissions$_{in}$ manufacturing and construction (excluding indirect emissions from electricity consumption), the production of non-metallic mineral products (38 %), metal production with 19 %, the production of paper and paper products with 9 % and the production of chemicals and chemical products with 5 % account for the largest share. Other sectors together account for around 28 % of emissions in manufacturing and construction.

Wide use

Total GHG emissions from fuel combustion in the wide use sector (households, agriculture and services) amounted to 1253[56] kt of CO_2 equivalent in 2021. Between 2005 and 2021, emissions fell by 54 %, with emissions in services falling by 68 %, domestic emissions by 54 % and agricultural emissions by 9 %. In 2021, emissions in services accounted for 20 % of total emissions in the sector, households 61 % and agriculture 19 %. The reduction in GHG emissions is due mainly to the implementation of energy efficiency measures and the use of renewable resources, and in particular woody biomass in recent years to the accelerated energy of the environment that replaces fuel oil and gas in recent years. Compared to 2020, emissions decreased by 7 % in 2021.

[56] National GHG inventories – GHG emissions by main source groups, source: ARSO, 2018. http://okolje.arso.gov.si/onesnazevanje_zraka/vsebine/toplogredni-plini.

24Figure: Analysis of the evolution of GHG emissions in the building sector 2005-2021



II. Projections of sectorial developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

Overall GHG emissions are lower in the projections in both scenarios. In the scenario with existing measures, emissions remain at a similar level to 2019 and they are 17 % lower in 2030 compared to 2005, while in the scenario with additional measures (for transport the UP scenario is considered), emissions are reduced by 38 %. In 2040, emissions in the DU scenario are 67 %.

25Figure: Projected total GHG emissions up to 2040 for the scenario with existing measures and projected with additional measures

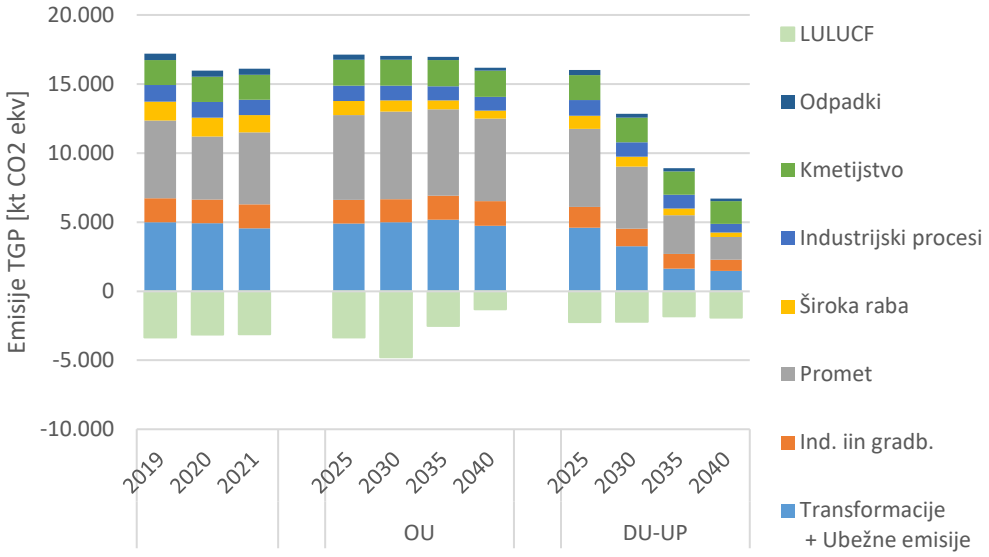


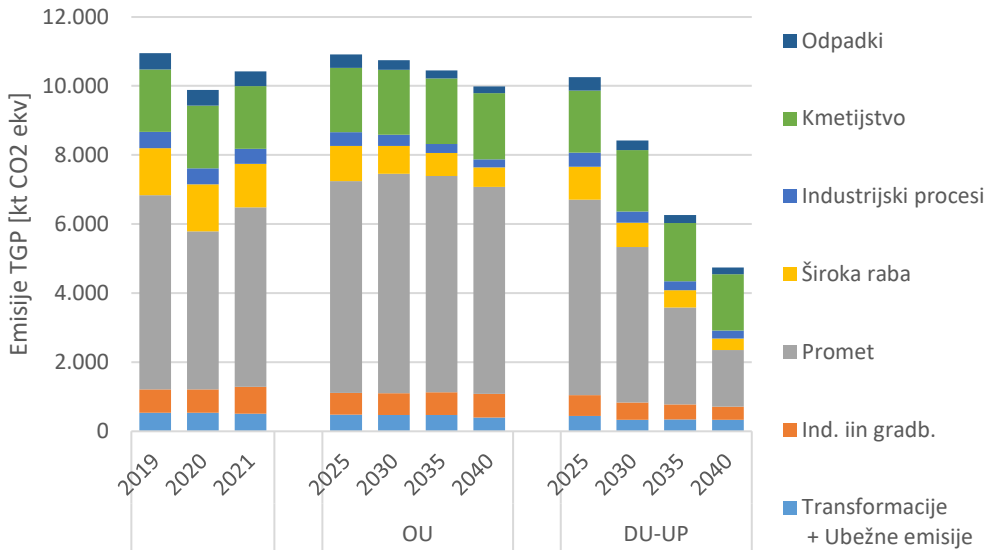
Table20: Total GHG emissions in Slovenia without LULUCF by 2030 in scenarios

		2005	2019	2020	2025	2030	Reduction 2030/2005
MA	[kt CO2 eq]	20.643	17.205	15.975	17.138	17.047	—17 %
DU – UP[57]	[kt CO2 eq]				16.020	12.841	—38 %

Non-ETS emissions have a similar pathway to total emissions, but are reduced to a lesser extent. The main source of emissions is transport, which accounts for more than half of total emissions. The share is further increased by 2030 to 60 % in the MA scenario and 54 % in the DR scenario. Under the MA scenario, emissions are reduced by 10 % in 2030 compared to 2005 and by 29 % in the MA-UP scenario.

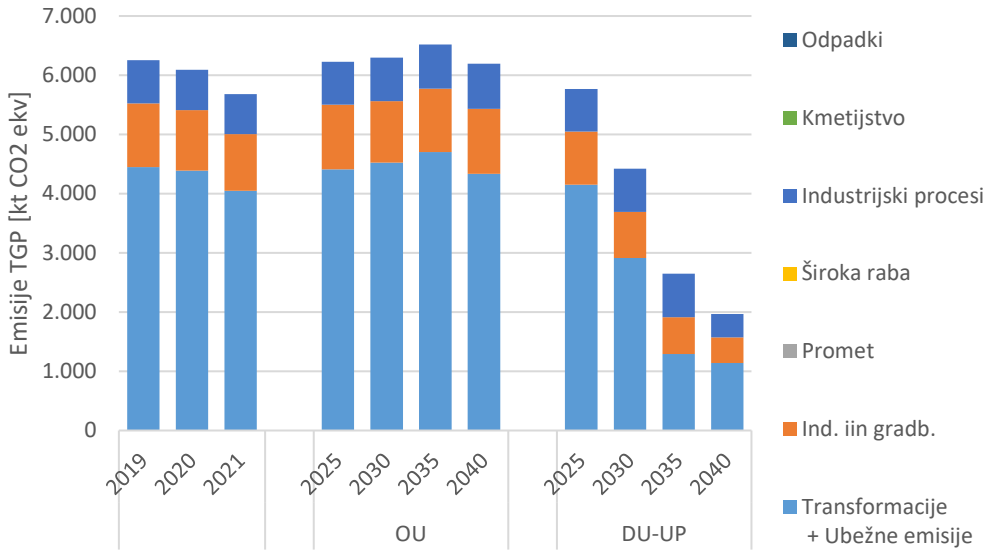
Under the Decree on binding annual GHG emission reductions for Member States from 2021 to 2030, Slovenia has a 27 % reduction for 2030, which is achieved and exceeded in the DR scenario.

26Figure: ESD (non-ETS) GHG emissions projection until 2040 for the scenario with existing measures and for the scenario with additional measures



[57] The du-UP is a scenario with additional measures that makes the transport sector more ambitious in terms of sustainable mobility measures. The document also uses only the acronym of the DU to indicate the same scenario.

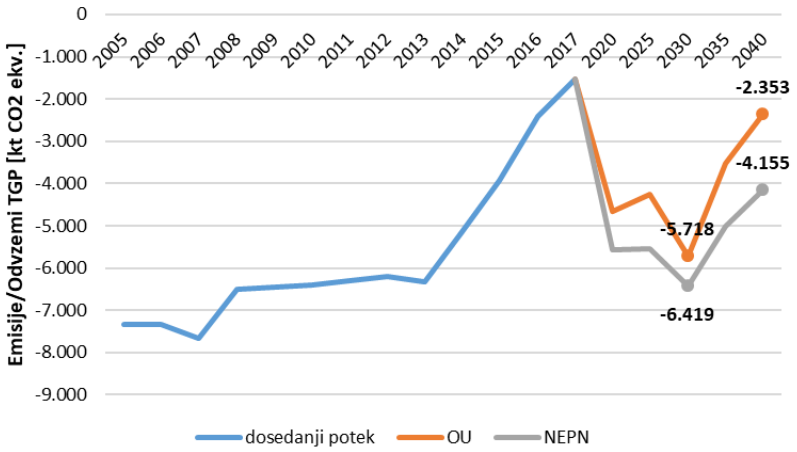
27Figure: Projected GHG emissions of the ETS sector until 2040 for the scenario with existing measures and for the scenario with additional measures



Emissions in the ETS sector under the MEA scenario increase until 2035 mainly due to the increase in emissions in the transformation sector. By 2030, under a scenario with existing measures, emissions in the ETS sector are reduced by 28 % compared to 2005. In the DU scenario, it is 49 % by 2030 due to the discontinuation of block 5 in TEŠ and by 78 % by 2040 due to the cessation of coal in electricity generation in 2033 and the reduction in emissions from industry.

The projections for the land use, land-use change and forestry sector are set out below. LULUCF). The MA scenario covers the measures and policies taken at the time of drawing up the projections, taking into account that they are implemented at similar dynamics up to 2050. The level of maximum possible felling in forests is gradually increasing and is determined in accordance with the forest management plans in force. The remediation of forests damaged by natural disasters and bark beetle graduation in 2014-2018, including forest restoration, is expected to be completed in 2023. The scenario foresees the implementation of measures in line with adopted strategies affecting the LULUCF sector (e.g. NGPs, AN RES, AN URE, JRC, RDP, etc.). The demand for, or quantity of, timber and the composition of harvested wood products correspond to trends in previous years. It is assumed that timber market participants do not change their habits. The overgrowth rate due to the abandonment of agricultural activity is roughly equal to the rate of deforestation, meaning that the forest area remains unchanged. Land-use change trends remain the same as in previous years. While machinery in agriculture is gradually increasing, no significant impact on emission reductions due to technological progress is expected in the future. Common agricultural policy measures and world market prices are the main drivers of the LULUCF sector.

28Figure: Net historical emissions and projection of net emissions in the LULUCF sector for two scenarios (OU and NECP)



Active forest management continues in the NECPs scenario, but more investment in forest restoration and tree composition change is needed. The proportion of spruce is decreasing, particularly in beech-growing areas, and the proportion of artificial restoration is increasing. The production times of key tree species are shortened and the rejuvenation periods of forests are shortening. The trend of population growth, economic growth and productivity continues. The self-sufficiency of food is increasing, mainly as a result of an increase in crop yields per hectare. At regional and local level, there is a stronger focus on efficient land use and optimisation of spatial plans. The country allocates more resources to investment in innovation and technological development. Some additional measures relevant for reducing emissions in the sector are under preparation.

Table21: GHG emissions of non-ETS sources in Slovenia by 2030 under scenarios

		2005	**2021**	**2025**		**2030**	
				MA	**DU**	**MA**	**DU**
Transformations + Fugitive emissions	[kt CO_2eq]	635	508	480	439	466	330
Ind. iin constructions.	[kt CO_2eq]	1.066	773	630	608	638	501
Transport	[kt CO_2eq]	4.401	5.205	6.133	5.656	6.348	4.507
Wide use	[kt CO_2eq]	2.719	1.258	1.017	961	809	700
Industrial processes	[kt CO_2eq]	421	438	404	404	322	322
Agriculture	[kt CO_2eq]	1.799	1.813	1.862	1.799	1.887	1.778
Waste		849	429	384	384	279	279
Total	[kt CO_2eq]	**11.891**	**10.425**	**10.910**	**10.250**	**10.749**	**8.418**
Decrease from 2005			—8 %	—14 %	—10 %	—29 %	—8 %

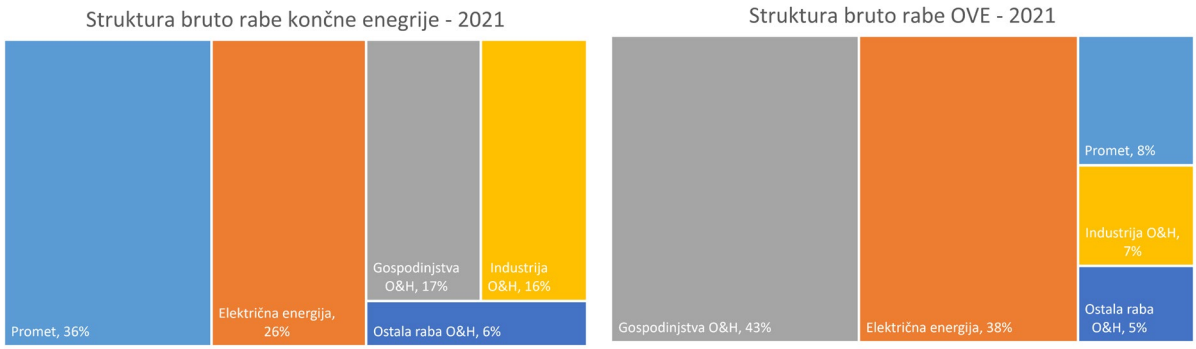
4.2.2 Renewable energy

Slovenia will at all times meet at least its 2020 target for the development of RES. In doing so, the Commission will also aim to reach at least the individual reference points for 2025 and 2027 and the 2030 target, contributing to increasing security of energy supply, reducing GHG emissions, economic growth and job creation, and employment.

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as by technology in these sectors

Slovenia achieved 24.1 % of RES in 2020 and 24.6 % of RES in 2021, lagging behind its target. The main contributors to the total use of RES of 1085 ktoe (12.617 GWh) were the use of RES for heat generation with 58 %, the production of electricity from RES contributed 40 % and the use of biofuels in transport accounted for 2 %. Households account for 85 % of the production of heat from RES, 14 % for industry and only 2 % for the services sector. Gross final energy consumption was 5.051 ktoe (58.742 GWh) in 2021. The largest share of gross use was in transport (36 %), 37 % in the heat sector and 26 % in gross electricity use.

29Figure: Structure of gross final energy consumption and gross consumption of RES in 2021



The sectoral shares in 2021 were:

- 35.0 % share of RES in gross electricity consumption;
- 35.2 % share of RES in gross heat demand,
- 10.6 % share of RES in transport.

The shares of RES in electricity and heat production are therefore very similar and the share of RES in transport is significantly lower, which means that a faster increase in energy use in transport relative to the other two sectors reduces the overall share of RES in gross final energy consumption. There are significant differences in the share of RES in the heat sector for industry, households and services. The share of RES in industry is 10 %, in households 63 % and in the services sector 22 %, including all district heat from RES in the service sector. In this context, it should be borne in mind that the total share of RES does not contribute to the

total share of RES in transport, since the share of RES in transport also takes into account RES electricity, and multiples are used for certain RES. Only the share of biofuels (excluding multiples) contributes to the overall share of RES, which was 6 % in 2021.

Between 2012 and 2017, electricity production from RES increased by 769 GWh. This was mainly driven by the construction of two new hydropower plants in Lower Savi (Krško and Brežice), which increased normalised production by 463 GWh, while the 15-year average operating hours increased by 3 % over this period.

The increase in the capacity of solar power plants during this period led to an increase of 290 GWh of electricity from RES. Electricity generation from wind (5 GWh) and woody biomass (55 GWh) also increased, while production from biogas and bioliquids decreased by 45 GWh.

In parallel with the increase in electricity generation from RES, gross electricity consumption also increased by 813 GWh in the period 2012-2021. Household growth (624 GWh) was the largest contributor to this. The share of electricity from RES increased from 31.6 % to 35.0 %.

The use of RES in the heat sector increased by 9 GWh between 2012 and 2021. The use of RES in industry increased by 303 GWh, but on the other hand the use of RES in households decreased by 472 GWh as a result of efficient energy use measures in buildings, which led to a reduction in the use of woody biomass. In the services sector, the use of RES decreased by 35 GWh. District heat production from RES increased by 213 GWh.

Gross heat consumption decreased by 1.232 GWh between 2012 and 2021. The main contributors were households, where heat consumption decreased by 1.738 GWh, services decreased by 405 GWh, and industrial consumption increased by 911 GWh. With regard to data for the services sector, it should be borne in mind that statistics for this sector are lacking, as uses of RES, with the exception of biogas and direct use of geothermal energy, are not recorded, which means that the observed decrease in energy use for heat during the observed period can be overestimated and is due to the substitution of fossil fuels from RES. The share of RES in heat increased from 33.1 % in 2012 to 35.2 % in 2021.

The use of bioliquids in transport increased by 596 GWh between 2012 and 2021. Overall energy use in transport decreased by 1.789 GWh, mainly due to measures to prevent the spread of SARS-CoV-2.

Slovenia did not reach its target of 25.0 % of RES in 2021, as the use of RES on the territory of Slovenia achieved a share of 24.6 %. The target was achieved by purchasing a statistical transfer of 208 GWh.

II. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

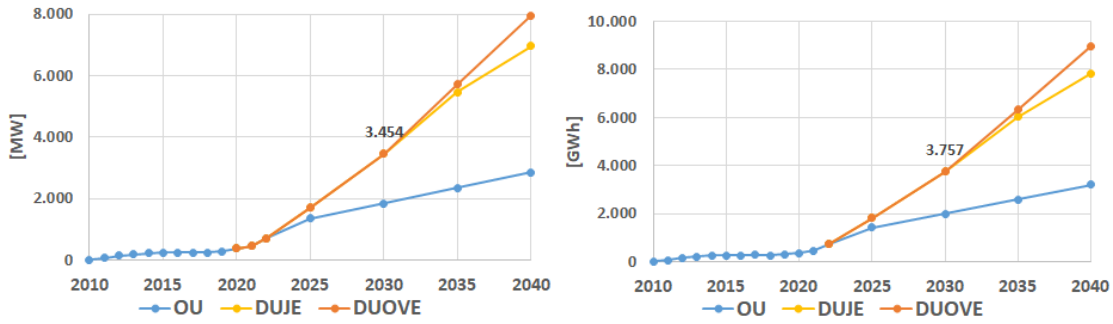
Distributed electricity generation from RES is an important pillar of future sustainable and self-consumption power generation, complementing generation in larger generating installations on the transmission network.

Solar energy

Solar power generation (SE) represents the largest developmental and environmentally acceptable potential for increasing electricity production from RES in Slovenia. From the point of view of sustainable land use, future development makes sense to prioritise the integration of SEs into buildings, industrial sites and degraded areas (in line with the SCOVE[58] and without negative impacts on cultural heritage). Given the limited capacity of SE to integrate into electricity grids, SE development is prioritised towards larger (community) SEs in locations where no additional investment in the grid is needed, and[59] encourages the deployment of electricity storage tanks.

In the analysed SE development scenarios, electricity generation from SEs increases to between 2 and 3.8 TWh (between 1.8 GW and 3.5 GW) by 2030 and to between 3.2 and 9 TWh by 2040 (between 2.8 and 8 GW, slightly less 7 TWh in the nuclear scenario). By 2030, this would require the installation of around 350 MW of SE capacity per year.

30Figure: Development of SE – Installed capacity and electricity generation for a scenario with existing measures and a scenario with additional measures (DIA and DUOVE)



The table below gives an overview of electricity generation in solar power plants (SE) by year for the period 2017-2040.

Table22: Solar power generation (SE) 2017-2040

	Corps	2020	2025	2030	2035	2040
MA scenario	GWh	368	1.437	2.006	2.595	3.204
Scenario Duje	GWh	368	1.822	3.757	6.037	7.834
DUOVE Scenario	GWh	368	1.822	3.757	6.314	8.960

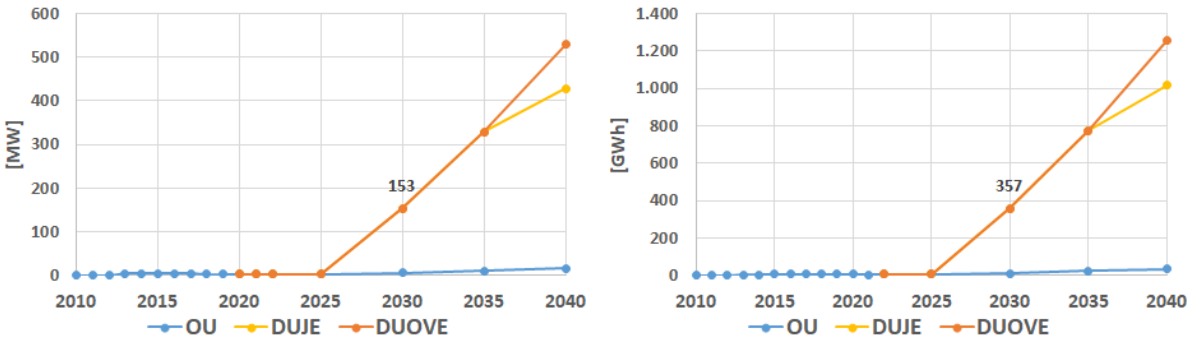
[58] Draft Act on the deployment of installations for the production of electricity from renewable energy sources, Government of the Republic of Slovenia 28.2.2023.

[59] Locations with increased use of electricity (all consumed at the site) or by connection directly to the NN network.

Wind energy

In the case of wind farms, we have difficulties in siteing (protection, protected and endangered areas) and in terms of social acceptability (diffuse settlements result in a limited number of locations of wind-suited areas where there are no humans and noise problems in the vicinity). It will be necessary to explore ways to increase social acceptance, including through greater involvement of the local environment in investments (investments and participation in energy produced). Therefore, in the analysed scenarios for the development of VEs up to 2040, we remain within the potential between 400 and 500 MW, which is comparable to the potential estimated in the context of the renovation of AN-OVE in 2015 and the 100 % RES scenario exceeds the capacity of 1 GW by[60]2050, which the RES-SLO study[61] estimated the potential in higher risk areas.

31Figure: Development of VE – Installed capacity and electricity generation for a scenario with existing measures and a scenario with additional measures (DUOVE and DUOVE)



The table below gives an overview of wind power generation by year for the period 2020-2040. Advanced operating technologies and systems with minimal noise and impact on birds and bats will be promoted.

Table23: Wind power generation (VE) 2020-2040

	Corps	2020	2025	2030	2035	2040
MA scenario	GWh	6	12	24	36	6
Scenario Duje	GWh	6	6	357	773	1.017

[60] **Comprehensive overview of potentially relevant wind energy sites,**expert basis for the renewal of the Renewable Energy Action Plan (2010-2020 period), Aquarius, August 2015.

[61] Enabling the deployment of renewables in the electricity sector in Slovenia, EY Parthenon, (REFORM/SC2021/091) 2023.

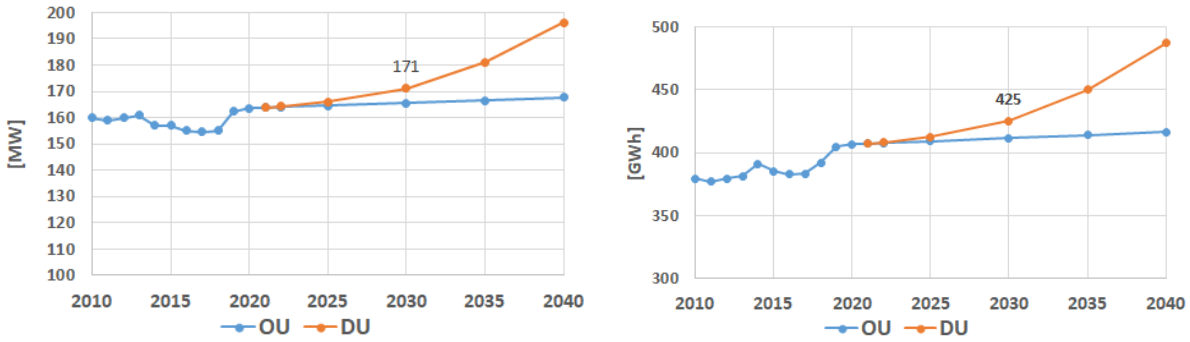
DUOVE Scenario	GWh	6	6	357	773	1.255

Hydropower

Small hydropower (mHE) has traditionally used the energy of watercourses to produce electricity throughout the country. Here too, we are faced with restrictions on their location in terms of nature protection (in terms of qualifying aquatic and bypass organisms and HT for Natura 2000 sites, natural values attached to water and protected areas of watercourses). Therefore, the NECPs follow the orientations of the Proposal for a Resolution on the Spatial Development Strategy of Slovenia 2050[62]: The potential for hydropower use of individual watercourses or parts thereof with small hydropower plants for local/regional needs shall be examined comprehensively in the framework of regional or municipal spatial planning documents, examining the exploitable hydropower potential, spatial potential for the use of existing barriers, requirements for the protection of aquatic and coastal habitats, water protection, ecological connectivity and maintaining the visibility of the landscapeKolikor is only possible with a view to minimising negative impacts on nature, the development of the MHE network shall be carried out in such a way that the upgrading and modernisation of existing, existing, existing HPPs and the revitalisation of existing, inoperative PHEs are given priority over the creation of new HREs, which should be linked to existing facilities (damages and barriers) in watercourses.

In the analysed scenarios, the existing capacity (164 MWe) is increased to a lesser extent by 2030, up[63]to 171 MWe and up to 196 MWe by 2040. This would represent an increase in current electricity production to around 425 GWh[64] in 2030 and up to 490 GWh in 2040.

32Figure: Development of installed capacity and electricity generation for the scenario with existing measures and for the NECPs scenario



[62] Accessible: https://gradiva.vlada.si/.

[63] In order to speed up development, there is a need for ex ante regulation and for procedures to be carried out smoothly, which, given the current disorderly situation, requires some more time.

[64] The values are normalised by taking into account 15 annual average operating hours. Although the actual electricity production in 2021 was 429 GWh (normalised 407 GWh).

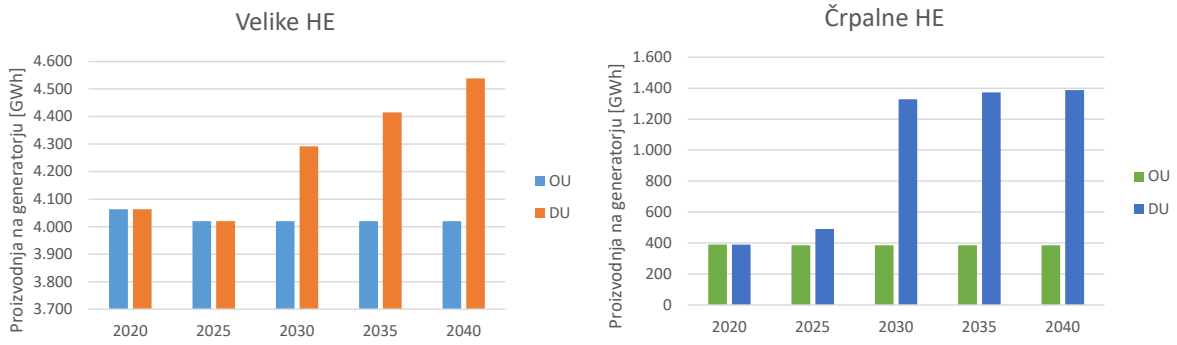
The table below shows electricity generation in small hydropower (mHE) by year for the period 2020-2040.

Table24: Normalised electricity generation in small hydropower (mHE) in 2020-2040

	Corps	2020	2025	2030	2035	2040
MA scenario	GWh	407	409	411	414	416
DU scenario	GWh	407	413	425	450	487

For the scenario with existing measures and for the scenario with additional measures, electricity and power generation in **large hydropower (HE)** is shown in the figures below. In the scenario with existing measures, large hydro power plants (together with pumped HEs) are projected to produce electricity in the generator in 2030 and 2040 in a range of 4.562 GWh. Under the additional measures scenario, the generator generates 5.620 GWh in 2030 and 5.927 GWh in 2040. The installed capacity of large HEs (including pumping) in 2030 and 2040 in the scenario with existing measures is 1.204 MW; in the scenario with additional measures, the figure is 1.599 MW in 2030 and 1.850 MW in 2040.

33Figure: Development of large HEs and ČHE – installed capacity and electricity generation on the generator[65]



The table below shows electricity generation on the generator in large hydroelectric power plants (HE) by year for the period 2017-2040.

Table25: Generator generation in large hydroelectric power plants (HE) excluding ČHE in 2020-2040

	Corps	2020	2025	2030	2035	2040
MA scenario	GWh	4.063	4.020	4.020	4.020	4.020

[65] The figure shows the possible development of hydropotential exploitation by a dotted line.

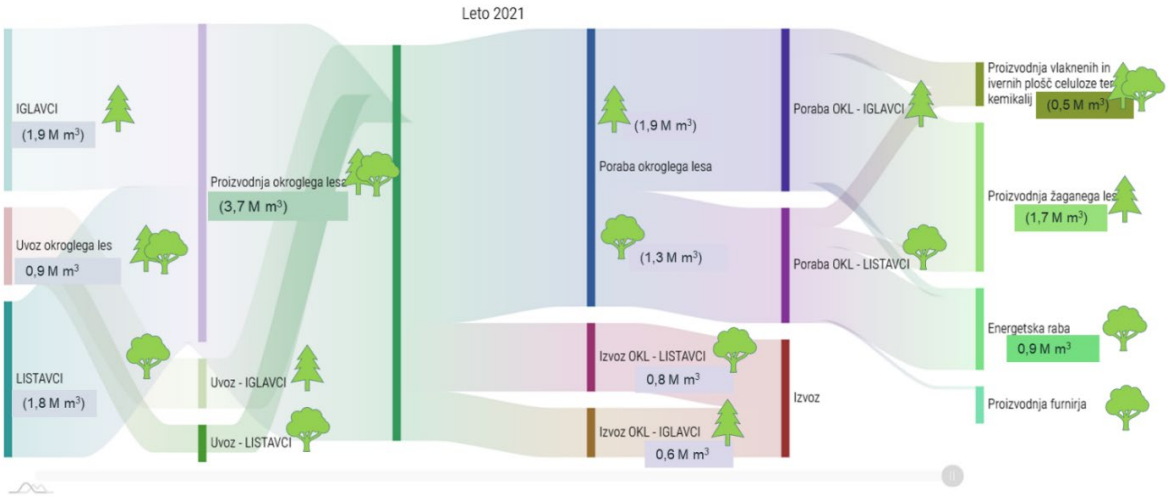
DU scenario	GWh	4.063	4.020	4.292	4.415	4.539

In order to ensure proper water management, which is of key strategic importance for the Republic of Slovenia in adapting to climate change, in the transition to a climate-neutral society and in achieving self-sufficiency and food targets, it is necessary to take into account the positive effects of multifunctional strategic state infrastructure and energy facilities on watercourses.

Woody biomass

The exploitation of sustainably available woody biomass (priority fine wood, low quality wood, processing residues from the wood processing industry, wood residues, etc.) shall prioritise the gasification of wood biomass with a view to producing synthetic gas and hydrogen and injection into gas pipeline networks in order to minimise energy conversions and minimise the loss of available wood biomass potential and electricity and heat generation in industry, district heating systems and services where maximum overall efficiency can be achieved by exploiting the available heat.

According to data from SURS (SISTAT), the production of roundwood was suitable for energy purposes from forests (crane category) in 2021 only 1 115 000 m 3 (^{net}), of which 997.000 m was 3 hardwood^{and} 118.000 m 3 conifers· This roundwood from forests is used for energy purposes. Given the strategic orientations that give absolute priority to the processing of wood into products, it will be possible to use only part of the lower quality roundwood potential and most of the wood residues and harvested wood for energy production. The needs of the woodworking industry for low quality roundwood are expected to increase to 1 098 000 m 3 by 2020,^{of} which 360.000 m 3^{hardwood} and 738.000 m 3^{coniferous} wood (net volume). In 2021, according to the latest estimates (source: GIS) used 980.000 m^3 wood (net quantity) for these purposes. Data on the production of wood forest products show how much roundwood from forests is directly used for energy purposes, and the potential in forests is higher, as the production of wood products does not include the amount of finewood (diameter below 10 cm) and the amount of wood residues, and the significant potential for energy purposes is represented by uncontaminated wood residues and uncontaminated harvested wood. According to the 2021 inventory of chips carried out by the Gozdarski Institute of Slovenia (the survey includes 241 chips), the production of chips in 2020 with the choppers surveyed was 2 417 000 nm 3. However, according to SURS data, the consumption of wood for energy purposes amounted to 2 518 800 t in 2021.



Wood flows in 2021 (source: Forestry Institute of Slovenia)

The potential for energy production from forest biomass is estimated at 6.598 GWh of heat; and

326 GWh of electricity. As a result, wood will contribute most of the heat (above 90 %) and about a third of electricity from agriculture and forestry. The same ratio as in AN RES (94.9: 5,1). Promoting cogeneration of electricity and heat while providing useful heat consumption is one of the necessary measures to make more efficient use of woody biomass.

In large power plants, in addition to the basic energy product, biomass, wood chips, is used as a source of RES used in the production of heat and electricity. The annual biomass consumption for these purposes fluctuates and reached 123 kt in 2021 (SURS), yielding to heat and up to 50 GWh of electricity. Biomass is becoming competitive with imported coal for the production of heat and electricity, but use is restricted only when co-incinerated on an existing coal plant and not on its own.

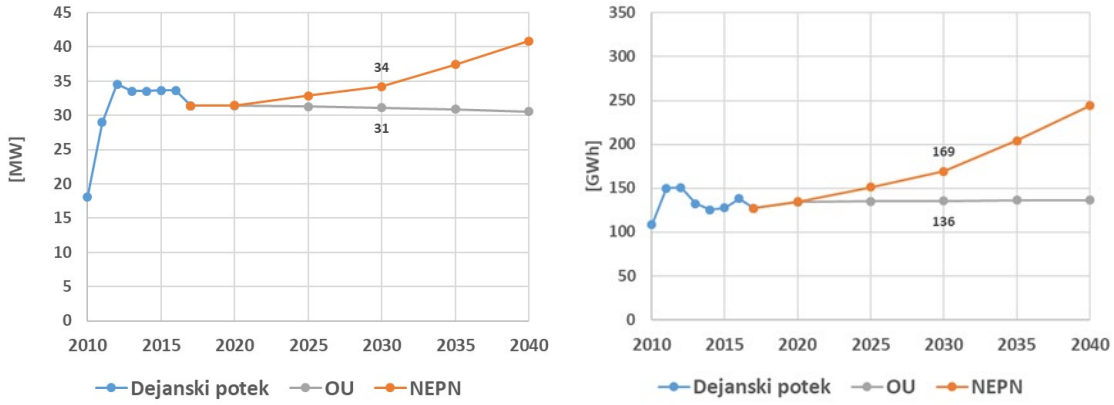
In the future, it is therefore necessary to support a modern and efficient system of combined heat and power production in an industry with high demand for both heat and electricity throughout the year. Particular emphasis should be placed on supporting systems in the woodworking industry, where wood residues (pipe residues, bark) are generated and the heat demand is high throughout the year (wood drying).

Biogas

Livestock manure represents a significant potential for biogas production due to relatively well-developed livestock farming. A theoretical calculation shows that manure from cattle, pigs and poultry could produce 315 GWh of electricity and 245 GWh of heat, and this raw material is also suitable for the production of biomethane, which is suitable for renewable gas and purified for injection into pipeline networks and as such can replace natural gas. Due to relatively small farms and their dispersion, only around one third of this potential is technically exploitable, and it is estimated that 0.2 % of cattle manure potential, 13.8 % of pig manure potential and 5.8 % of poultry manure potential is currently exploited.

In the analysed scenarios for the development of electricity generation from all types of biogas, the existing capacity (31 MWe) is increased to a lesser extent by 2030, up to 34 MWe and up to 41 MWe by 2040. This would represent an increase in current electricity production (127 GWh in 2017) to up to 170 GWh in 2030 and up to 245 GWh in 2040. This may involve production at the biogas production site or the cleaning and printing of biogas into the gas grid and in another location, in particular the extent and where the available heat can be exploited. The total potential of biogas production is thus around 480 GWh in 2030 and up to 700 GWh in 2040. It includes biogas production from sewage treatment plants, waste processing and includes landfill gas and the production of gas from agriculture, with no main crops being used, bearing in mind that agricultural land is intended for food production.

34Figure: Development of biogas (from agriculture, WW, waste and landfill gas) – installed capacity and electricity production for MA and NECP scenarios



The table below shows the production of electricity from biogas by year for the period 2017-2040.

Table26: Electricity generation from biogas 2017-2040

	Corps	2017	2020	2025	2030	2035	2040
MA scenario	GWh	127	134	135	136	136	137
DU scenario	GWh	127	135	151	169	204	244

The potential for producing second-generation biofuels and the potential of agricultural biomass for energy from combustion is not assessed in this document. Harvesting residues, woody biomass of permanent crops and woody biomass of hedgerows between parcels and agricultural land under planting. The presented potential also does not include energy from wood waste and spent wood products. The potential for sourcing bioethanol, which is in direct competition with food supply in terms of raw materials (cereals), is also not assessed. The fact that the potential of these RES is not evaluated does not mean that these resources cannot be the recipients of the incentives.

4.3 Dimension energy efficiency

The chapter sets out the results of scenarios for the transport sector, industry and wide use. The sector wide use includes households, agriculture and forestry and other consumption, which also includes the services sector. The scenarios for the development of the NECPs are aligned with the findings of the LIFE Climate Route 2050 and will also be appropriately aligned with the long-term climate strategy.

i. Current primary and final energy use in the economy and individual sectors (including industrial, residential, services and transport)

Primary energy use (according to the EUROSTAT definition) was 6.470 ktoe in 2021. The largest part, just over 70 %, was energy end-use, i.e. 4.719 ktoe (without a single bubble). Less than 30 % of the transformation losses from the transformation into electricity and heat, which make up the largest part, as well as transmission and distribution losses, the use of the energy sector and the self-use of transformations. In the context of final energy consumption, transport (38 % of final energy consumption) and manufacturing and construction account for 27 %. Households consume 23 % of final energy, while other uses account for 11 %.

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling (chapter not yet fully acquired)

Results of projections for the district heating sector and the potential for the application of high-efficiency cogeneration

District heating is an efficient system for distributing heat produced at a centralised location. This is low compared to more developed European countries (e.g. Iceland, Denmark, Sweden) – only 7.6 % of energy use comes from remote systems, mainly scattered settlements in Slovenia. In the EU, district heating systems are recognised as one of the key technologies in achieving reductions in GHG emissions and energy consumption. One of the priority objectives is energy efficiency in all sectors, resulting in reduced energy consumption in buildings. Slovenia has district heating mainly in cities. A wide range of fossil fuels with limited stocks are mostly used as an energy source.

In densely populated areas, district heating systems have proven to play a key role in decarbonising the heating and cooling sector. So-called Generation 4 systems, characterised by low working temperatures, flexibility of operation, the potential for combined heat and power, thermal storage, integration with the electricity generation sectors, transport and the integration of RES and waste heat, will play an important role.

Energy use in remote systems will decrease continuously both in the MA scenario and in the NECP scenario. In 2020, energy consumption will be higher due to planned new systems.

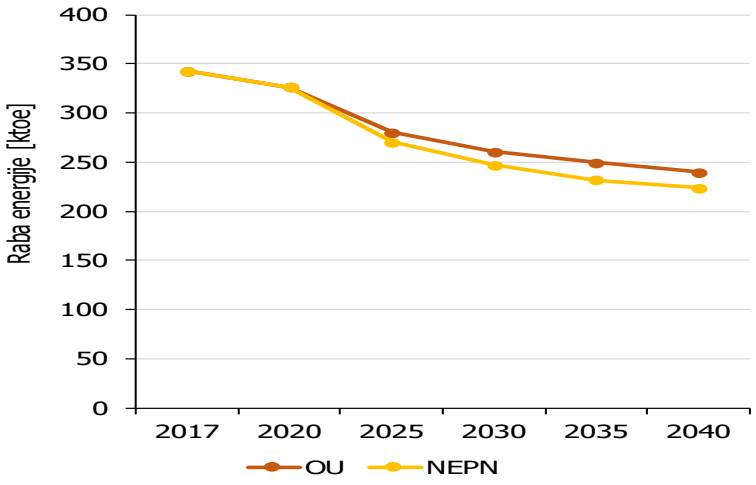
In 2030, under the MA scenario, energy use decreases by 24 % compared to 2017, reaching 261 ktoe, and further decreases by 6 percentage points to 240 ktoe by 2040. The projected reduction in energy consumption is the result of existing instruments in place that promote energy renovation of buildings and connection to remote systems. In the MA scenario, the dominant influence is the efficient use of energy in buildings, as energy renovations are significant and therefore lower energy use and relatively few new connections to the systems.

Under the NECP scenario, energy use decreases by 28 % in 2030 compared to base year 2017 and amounts to 247 ktoe. It shall be further reduced by 7 percentage points to 224 ktoe by 2040. The main difference for a significant reduction in energy consumption in the NECP scenario compared to the MA scenario is not only the wider implementation of energy renovations of buildings, but also the increased promotion of buildings to connect to remote systems, with a focus on multi-apartment and service sector buildings.

The structure of technologies and fuels in district heating systems shall take into account the guidelines for the decarbonisation of the sector. The use of fossil fuels is decreasing and the use of RES and the share of more efficient technologies – CHP and heat pumps – is increasing.

Compared to base year 2017, the scenario with existing measures will lead to the greatest reduction in the use of CHP solid fuels from 200 ktoe to 77 ktoe in 2030 and 43 ktoe in 2040. This share will decrease even more in the NECPs scenario, with consumption of 40 ktoe in 2030 and 34 ktoe in 2040. The projections take into account the increase in boilers using woody biomass – a 14 % increase in 2030 and a 20 % increase compared to the 2017 base year in the MA scenario. The NECP scenario also envisages a wider use of these systems than in a base year, but according to general orientations, energy use will not increase as much as in the MA scenario. The NECP scenario thus foresees a 17 % increase in the energy consumption of these boilers in 2030 and a further increase of only 4 % in 2040 compared to the 2017 base year, in order to promote other systems. Projections assume a general expansion of RES CHP systems.

35Figure: Projected energy consumption for the district heating sector for the scenario with existing measures and for the NECP scenario



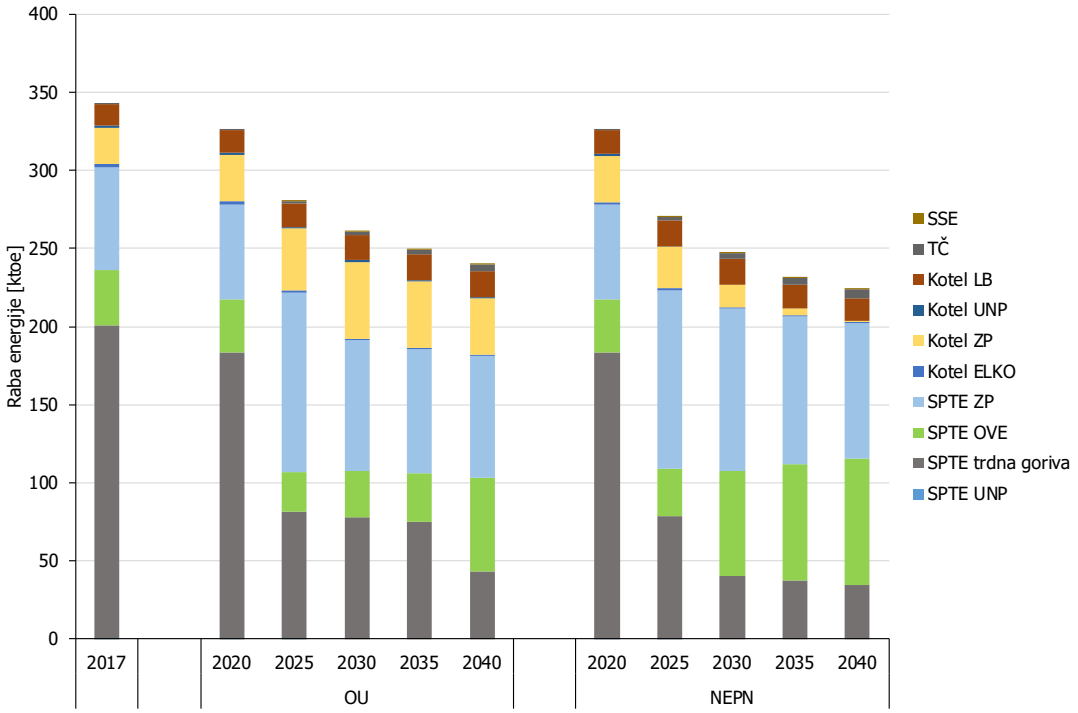
In the MA scenario, a further 14 % reduction in energy consumption to 30 ktoe from 35 ktoe in the base year 2017 follows in 2030. Furthermore, spending is projected to increase by 71 % in 2040 in terms of base year to 60 ktoe. The NECP scenario shows a 91 % increase in consumption in 2030 (67 ktoe) and a 130 % increase (81 ktoe) in 2040 compared to base year 2017.

Heat production in district systems amounted to 213 ktoe in the 2017 base year. Under both scenarios, energy use is decreasing. In the scenario with existing measures, MA decreases by 9 % (193 ktoe) in 2030 and by 15 % (180 ktoe) in 2040 compared to base year 2017. Energy use is further reduced in the NECP scenario, where it decreases by 16 % (178 ktoe) in 2030, and further decreases (by 22 %) in 2040 to 168 ktoe.

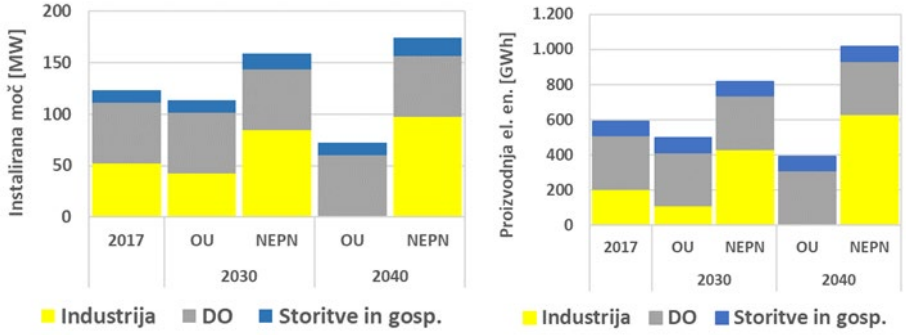
Table27: Heat generation in district heating systems by technology for the scenario with existing measures and the NECP scenario

MA	**Corps**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
CHP	ktoe	171,0	163,8	143,4	130,5	127,7	126,6
Boilers	ktoe	40,9	41,9	50,9	59,8	53,7	47,8
PT	ktoe	0,9	0,9	2,1	3,1	4,4	5,6
SSE	ktoe	0,0	0,0	0,1	0,3	0,4	0,4
NECPS	**Corps**	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
CHP	ktoe	171,0	163,7	148,2	143,6	145,2	142,9
Boilers	ktoe	40,9	42,0	39,6	27,6	17,4	13,4
PT	ktoe	0,9	1,1	4,1	6,3	8,7	11,1
SSE	ktoe	0,0	0,0	0,2	0,5	0,6	0,7

36Figure: Projected energy consumption and the structure of technologies and fuels for the district heating sector for the scenario with existing measures and the NECP scenario



37Figure: Projected installed power and electricity generation in CHP systems for the scenario with existing measures and for the NECP scenario



iii. Projections of existing energy efficiency policies, measures and programmes for primary and final energy consumption for each sector at least until 2040 (including for 2030)

The chapter presents the state of play of energy consumption and GHG emissions in 2020 and 2021 respectively and presents the results of model projections for the scenario with existing measures (MA scenario) and for the scenario with additional measures.

Transport

Transport is a sector that has a very significant impact on energy consumption and thus on the achievement of energy and environmental policy objectives in Slovenia, in particular in achieving the target of the share of renewables in gross final energy use. The challenges we face in transport are large, ranging from e-mobility, improving public transport, car-sharing opportunities, increasing freight transport, developing rail transport, changing habits to new social and business models.

Several scenarios for the development of transport activity and the evolution of energy consumption in transport were analysed in the preparation of the NECPs. The results/model scenarios are set out below, namely the MA scenario and the scenario with additional measures DU-HIP and DU-UP.

State of play

Transport consumed 1810 ktoe of energy in Slovenia in 2021, representing 38 % of final energy in Slovenia. The key energy products in the sector under consideration are petroleum products, which together accounted for 93 % of total energy in transport in 2021. Other sources of energy are renewables (biofuels) with 2 %, electricity with 1.1 % and natural gas with 0.3 %.

Results of transport projections

The use of energy in passenger transport varies considerably from 2020 onwards. In a scenario with existing measures, energy use is increasing until 2030, when it is 58.3 PJ without aviation and 6 % higher than in 2019 and 31 % higher than in 2005. 2019 is used for comparison because 2020 and 2021 are not comparable due to the impact of measures to prevent the spread of SARS-CoV-2 on traffic flows and thus on the use of oengrims in transport. By 2040, energy use shall be reduced by 14 % to 50.1 PJ compared to 2030. In 2030, diesel is dominated by 58 %, petrol accounts for 32 %, biofuels 5 %, electricity 3 %, with trains and road transport accounting for half, LPG 2 % and natural gas 1 %. Energy consumption per unit passenger-kilometre shall decrease by 13 % between 2019 and 2030 and by 33 % by 2040. Aviation fuel represents 1.2 PJ in 2019, 301.7 PJ in 20 301.7 PJ and 2.1 PJ in 2040. The air traffic projection is the same for all scenarios.

In the scenario with additional measures – rapid supply improvement (DU-HIP), energy use is maintained at a similar level to 2019 at 55.6 PJ until 2025. It then decreases significantly by 2030, bringing it to 47.6 PJ without air traffic, down by 15 % compared to 2019. By 2040, the reduction in energy consumption continues rapidly, reaching 28.7 PJ, 49 % less than in 2019. Energy consumption per passenger-kilometre in this scenario is 0.89 MJ/pkm in 2030 and only 0.52 MJ/pkm in 2040. In the Additional Measures – Demand Management (DU-UP) scenario, an even greater reduction in energy use is achieved, from 45.5 PJ to 45.5 PJ in 2030 and 23.4 PJ in 2040. The additional measures scenarios significantly increase the share of electricity after 2030, to 26 % in 2040, in particular on diesel.

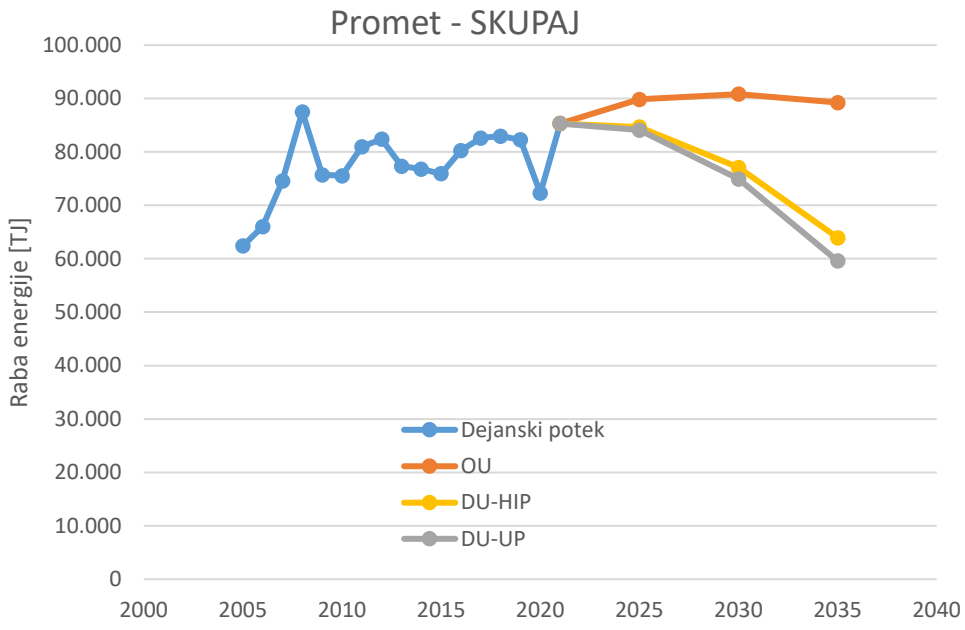
Energy use in freight transport is increasing until 2050 in the scenario with existing measures (OU) and up to 2030 in a scenario with additional measures (DU). In 2030, energy use under the MU scenario is 30.8 PJ, an increase of 23 % compared to 2019 and an increase of 81 %

compared to 2005. It shall be further increased by 7 % by 2040 compared to 2030. In the DU scenario, the use in 2030 is 11 % higher than in 2019 from 27.8 PJ and in 2040 from 22.4 PJ to 19 % lower than in 2030.

The fuel structure does not differ significantly between scenarios in 2030, with the highest prevalence of diesel in the MU scenario, with 87 % in the NECP scenario and 75 % in the NECP scenario. Biofuels with 6 % and electricity at 5 % are second in the MA scenario. Petrol represents a 1 % share. In the DU scenario, biofuels have a share of 11 % and electricity a 9 % share. By 2040, the share of electricity in the DU scenario increases significantly to 36 %, bringing the share of diesel to 36 %. There is also a sharp increase in the presence of hydrogen (18 %).

Energy consumption per tonne-kilometre unit in 2019 is 0.44 MJ/tkm. It decreases to 0.39 MJ/tkm in 2030 and to 0.36 MJ/tkm in the DU scenario. Freight transport therefore achieves significantly smaller reductions in specific energy use per transport work than in passenger transport, as the replacement of propulsion technologies is much slower, so that the reduction is due to incremental improvement of internal combustion engines, other drive trains and aerodynamics.

38Figure: Total energy use in transport for the scenario with existing measures and under the NECP scenario until 2040

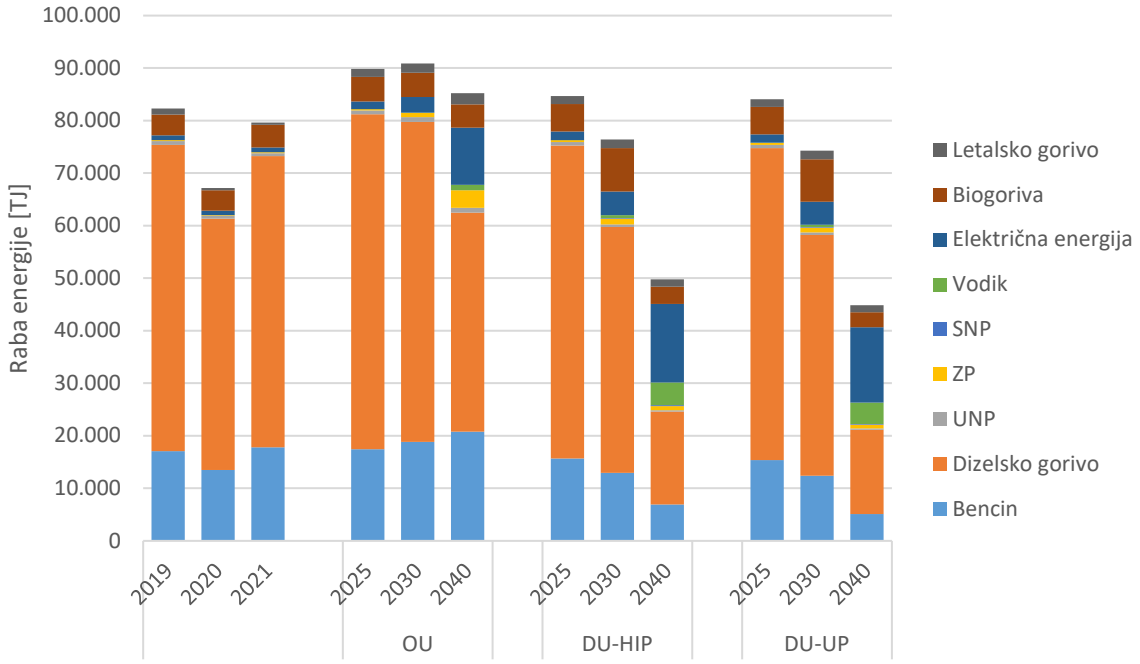


Total energy use is increasing in the MA scenario until 2030. Reach 90.8 PJ in 2030, 10 % more than in 2019 and 46 % more than in 2005. In 2040, total energy consumption is 85.2 PJ. In the scenarios with additional measures, energy use is increasing until 2025, after which the trend is reversed and energy use starts decreasing, more intensively after 2030. In 2030, total

energy use is 70.0 PJ in the DU-HIP scenario, 6 % lower than in 2019 and 74.8 PJ in the DU-UP scenario, 9 % less than in 2019. In 2040, the energy use is 52.5 PJ or 47.2 PJ.

The share of RES in transport according to the prescribed calculation methodology in the 2023 RES Directive in the RES scenario reaches 11 % in 2030. Biofuels contribute most to the share. In the scenarios with additional measures, the share of RES in transport in 2030 is 26.6 % and 26.5 % respectively, with a higher share also coming from biofuels.

39Figure: Projections of energy end-use and fuel structure for the transport sector for the scenario with existing measures and for the scenario with additional measures until 2040



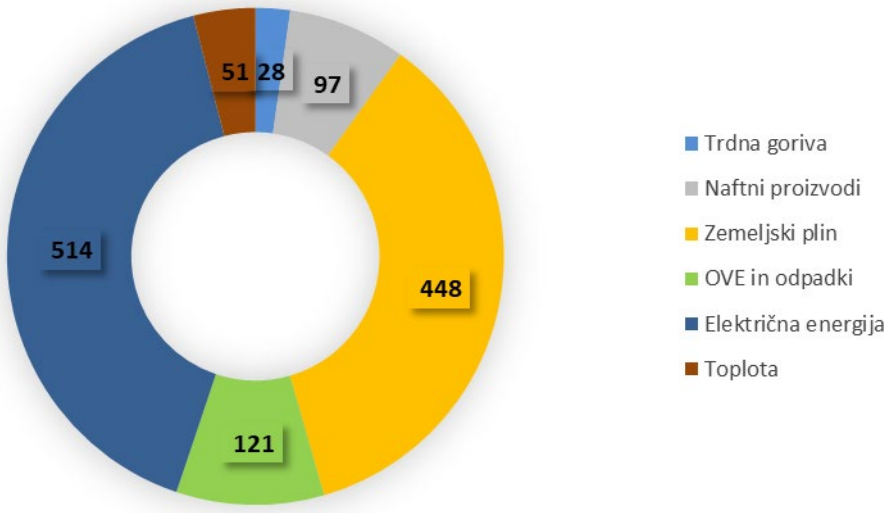
Industry

The projection of energy consumption and emissions in industry is a particular challenge, as industry faces important development switches (electricity and natural gas abandonment, use of hydrogen and synthesis gases, carbon capture and storage technologies). A particular challenge is the decarbonisation of the industrial sector, due to the high share of natural gas use in manufacturing, mainly in energy-intensive industries (paper, cement, steel, aluminium and chemicals). However, the inclusion and deployment of substantial efficiency measures, which are key to the transition to a circular economy, are of the utmost importance and up-to-date for the industry's development path.

Manufacturing and construction consumed 1259 ktoe of energy in Slovenia in 2020, accounting for 28 % of final energy in Slovenia. The key energy products in the sector under consideration are electricity and natural gas, which together accounted for 76 % in 2020, total energy in manufacturing and construction (see figure below), with electricity accounting for 41 %,

natural gas accounting for 36 %, renewable energy sources 10 % (wood biomass, biogas, environmental energy, solar), oil products 8 %, district heat 4 % and solid fuels 2 %.

40Figure: Scrapping of fuel consumption in manufacturing and construction in 2020 [ktoe]



Results of the projections for the industry sector

Energy use in manufacturing is increasing under the MA scenario with existing measures. It is 16 % higher in 2030 compared to 2020, at 1394 ktoe, increasing by 25 % by 2040 compared to the base year and standing at 1.505 ktoe.

However, according to the DU scenario, final energy consumption in manufacturing is increasing by 7 % by 2030, mainly due to increased production and measures to switch gas technologies to electricity, reaching 1285 ktoe by 2040 and increasing by 16 % compared to base year 2020. The increase is mainly due to the more intensive transition from gas technologies to electricity technologies and the increased use of electricity in the CCS carbon capture process. However, when spent on thermal energy, end-use in manufacturing is stagnating with higher planned production, increasing by 2 % by 2030 and remaining at the base year 2020 level by 2040. 69 ktoe of waste heat is expected to be recovered in 2030 and 84 ktoe in 2040.

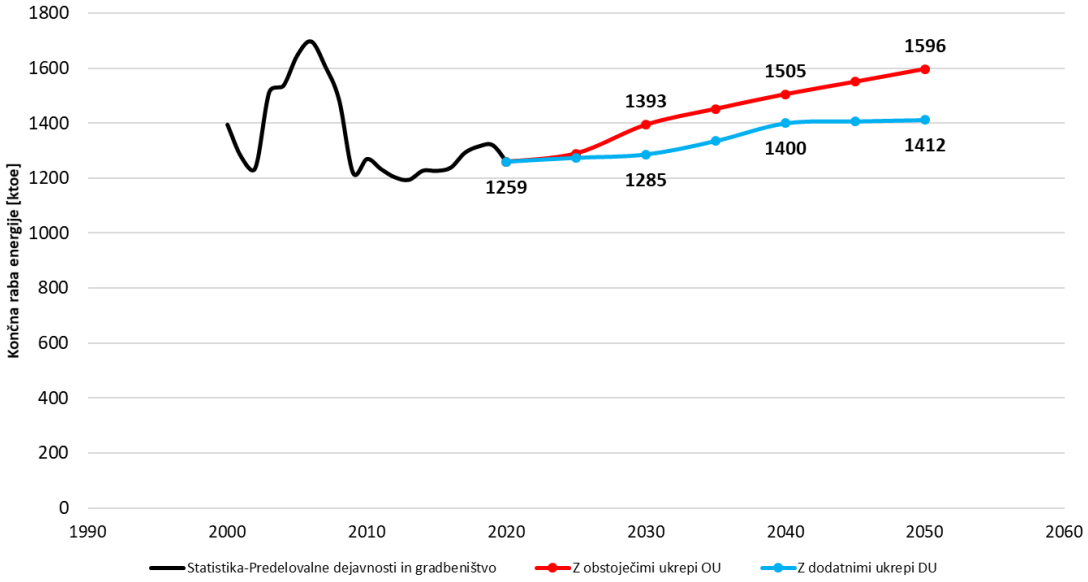
In the MA scenario with existing measures, the share of renewables is[66] 17 % in 2030 and 10 % in 2040; however, the DU scenario assumes a 40 % share of renewables by 2030 and a 64 % share by 2040. It should be noted here that the DU scenario foresees the use of hydrogen and synthetic gas/biomethane already in 2030, 10 % in 2030 and 25 % in 2040.

[66] The share is defined as the ratio between the sum of RES fuels (wood biomass, other RES and waste heat) and the sum of heat fuels (excluding district heat).

Electricity consumption is increasing from 498 ktoe in 2020 and further increases to 547 ktoe by 2030 and by 25 % by 2040, with existing measures at 601 ktoe. In the DU scenario, electricity use increases by 26 % by 2030 to 563 ktoe and by 40 % by 2040, i.e. 690 ktoe.

The trends in final energy consumption and the fuel structure for both scenarios up to 2040 are shown in the figure below.

41Figure: Projection of final energy consumption for the manufacturing and construction sectors for the scenario with existing measures and for the DR scenario



42Figure: Final energy consumption projection and fuel structure for the manufacturing and construction sectors for the scenario with existing measures and for the DU scenario

Cogeneration of heat and electricity in industry

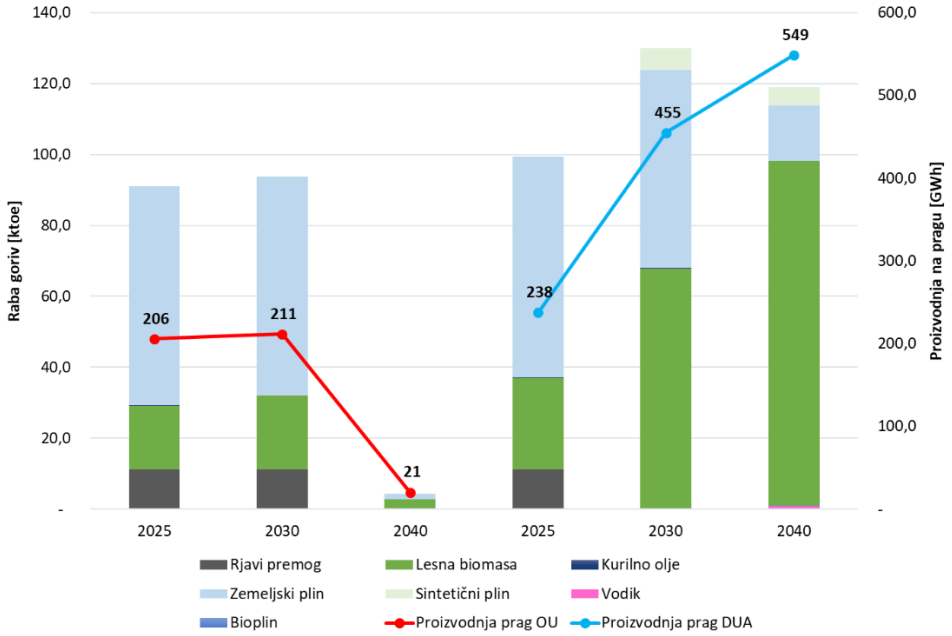
We have also envisaged the use of combined heat and power (CHP) technologies in industry. In 2020, 122 ktoe of fuel was consumed for the production of heat and electricity in CHP units: 15 ktoe are the use of brown coal, 28 ktoe use of woody biomass, 77 ktoe use of natural gas, 1 ktoe use of biogas and 0.1 ktoe fuel oil. In the base year 2020, units produced 88 ktoe of heat and 206 GWh of electricity.

In a scenario with existing measures, the status quo is envisaged in 2030 and no new CHP installations are foreseen in the existing measures scenario after 2030. The DU scenario is more ambitious in this area, with an increase in capacity to 88 MW (production of 455 GWh) by 2030 and 90 MW (electricity generation 550 GWh) by 2040.

The figure below shows the use of fuels for the production of heat by CHP plants in industry according to scenarios and the generation of electricity at the threshold. The columns show the final consumption of fuels for the production of heat in CHP units. In a scenario with existing measures, existing installations are in operation until 2030, and no new installations are foreseen after 2030 due to non-stimulative incentives. The DU scenario foresees a higher penetration of CHP technologies on wood biomass (52 % fuel consumption in 2030 and 79 % in 2040). Natural gas accounts for 43 % of fuel consumption in 2030 and 13 % of fuel consumption in 2040. The share of hydrogen and synthetic gas is increasing, accounting for 6 ktoe around 5 % of fuel use in 2030 and 7 % in 2040 (8 ktoe).

Fuel consumption for the production of electricity in CHP units shall be attributed to the transformation sector in accordance with the methodology of reporting and data collection.

43Figure: End-use of energy and electricity generation in CHP units in industry in scenarios



The generation of electricity in CHP plants will undoubtedly play an important complementary role in ensuring the supply of electricity, especially in view of the wider use of renewable sources and their stochastic nature.

Table28: Capacity and electricity generation in CHP technologies in industry under scenarios

Capacity [MW]	2020	2025	2030	2040
MA scenario	51	52	52	3
DU scenario	51	61	88	90
Production threshold [GWh]				
MA scenario	206	211	211	21
DU scenario	206	270	455	549

Wide use (households, agriculture and forestry and other uses)

By 2050, achieving the GHG emissions targets set in the sector will require net-zero emissions (households, agriculture and forestry and other consumption of which the services sector is part). The objective is extremely ambitious and will require the continuation of energy renovations of buildings and the promotion of RES technologies and centralised systems. By 2030 and beyond, the rate of integrated energy renovations will need to be raised continuously so that the overall renovation rate is above 2.7 % per year. This will be a major challenge for the public sector in particular, as there will be more demanding refurbishment cases for economic, technical and other reasons. The construction and renovation design process will

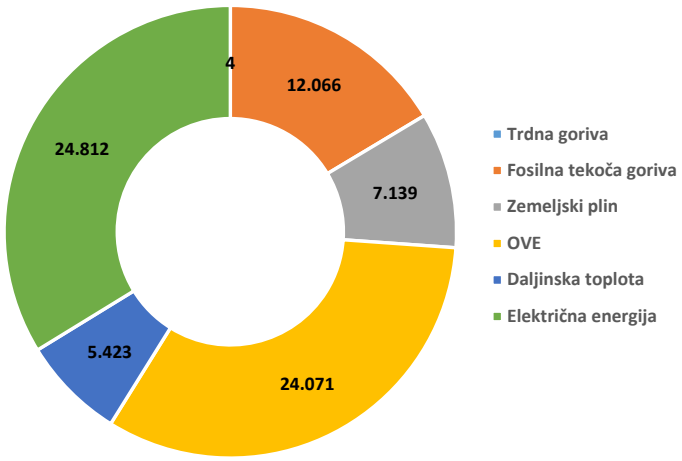
be supported by mandatory building information modelling, which will increase design efficiency, lower investment and reduced construction time.

For the construction of new buildings, regulations tightened in 2022. The tightening of regulations on efficient use of energy in buildings and the sustainable valuation of buildings will have an impact on the number of renovations and the energy performance of buildings. Since 2018, new buildings in the public sector need to be nearly zero-energy buildings, meaning they need to be highly energy efficient and use renewable energy sources. As of 2021, this applies to all buildings. Most of the buildings in Slovenia were built in the 1960-1990 period and reducing GHG emissions by 2030 and 2050 will also need to take into account other aspects of renovation, such as seismic, flooding, fire, etc. This will be done in the context of a long-term strategy to promote investment in the energy renovation of buildings, which will identify additional instruments for building renovation and a phased approach to the comprehensive stage-by-step renovation of buildings.

State of play

Energy use in the sector was 1657 ktoe (households, agriculture and forestry and other consumption) in 2020, representing 36 % of final energy in Slovenia. The key energy products in the sector under consideration are electricity (34 %), renewable sources (33 %), petroleum products (16 %), natural gas accounts for 10 % of the sector's energy use.

44Figure: Scrapping of fuel consumption in the building sector in 2020 [TJ]



The focus is to drastically reduce the use of fossil fuels in buildings and make the most of remote systems that allow for more flexibility and also connectivity with other sectors – power generation through heat storage and renewable energy elsewhere. A detailed spatial analysis has also been carried out to address the possibilities of expanding existing district heating systems and identifying new areas where micro and large district systems would be economically viable already today and in 2030 and 2040, when the demand for heat supply becomes lower due to more energy-efficient buildings. Thus, in view of the different scenarios,

a real possibility to connect to district heating systems for single and multi-dwelling buildings, public buildings and other service sectors has been identified.

Result of the projections for the sector widely used

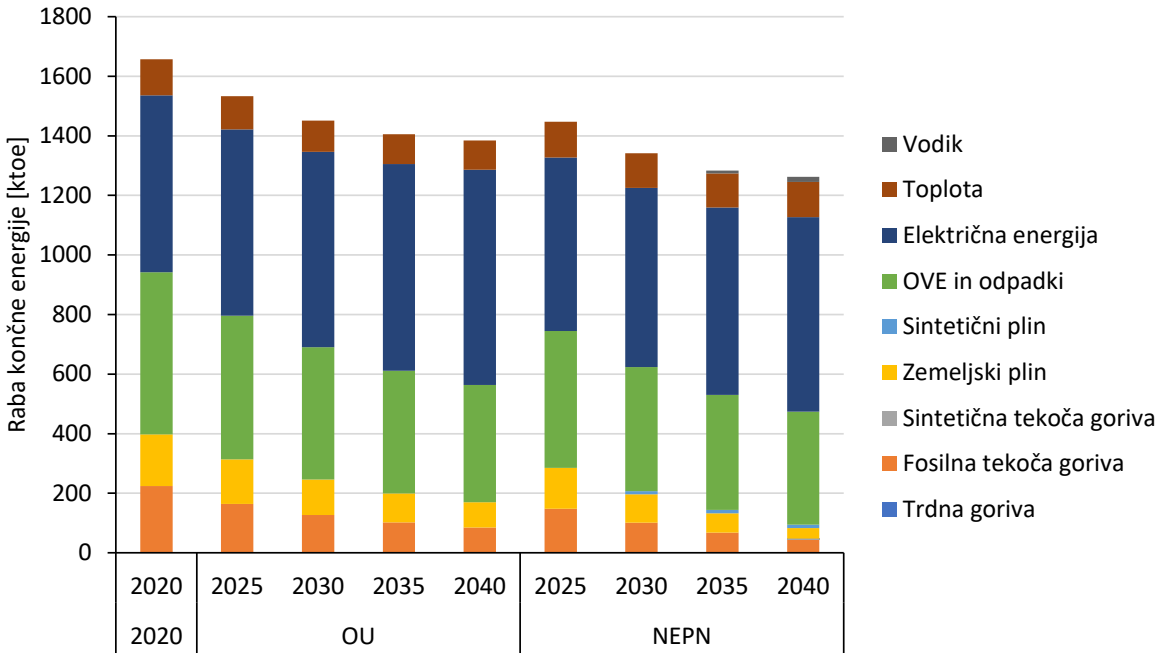
Energy use in the sector is decreasing in the scenario with existing MA measures. It is 15 % lower in 2030 compared to base year 2017, at 1448 ktoe, further reduced by 4 percentage points by 2040 to 1381 ktoe.

Compared to the scenario with existing measures, the NECP scenario foresees even more energy renovations, a stronger focus on RES technologies for heating and hot water production, and an increased number of connections to district heating systems and a significant increase in their number in areas where it is economically viable. In 2030, final energy consumption decreases by 17 % under the NECPs, reaching 1342 ktoe, while it decreases by 22 % in 2040 compared to 2020 and is 1.262 ktoe.

The trajectory towards net-zero emissions in buildings by 2050 leads to substantial fuel restructuring. Fossil fuel technologies will be confused either with RES technologies or with heat stations and connected to district heating systems. In the scenario with existing measures, the MA foresees a reduction of the final energy consumption of liquid fuels by 43 % in 2030 compared to 2020 and amounts to 127 ktoe. It shall be further reduced by 19 percentage points to 85 ktoe by 2040. Under the NECP scenario, however, final energy consumption is projected to be reduced by 53 % (101 ktoe) in 2030 and by 78 % (48 ktoe) in 2040 relative to the base year 2020.

The projections take into account the increase in final electricity consumption due to the 1st increase in the share of heat pumps as heating technologies in buildings in new constructions and replacements of old, inefficient systems, 2. the increase in electricity consumption of other technical systems in buildings (lighting, cooling) and 3. the increase in the electricity consumption of indoor equipment, where the service sector is a major consumer. The MIA scenario foresees an increase of 10 % in 2030 of 655 ktoe, while by 2040 final energy consumption is further increased by 12 percentage points to 723 ktoe. The NECPs scenario also foresees more replacements and increased use of heat pumps and more efficient lighting, more economic use of indoor equipment, etc. Therefore, final energy consumption in 2030 increases by only 1 % to 602 ktoe compared to 2020, while it increases to 654 ktoe in 2040, an increase of 10 % compared to the base year.

45Figure: Final energy consumption projection and fuel structure for the wide use sector for the scenario with existing measures and for the NECP scenario until 2040



Projections and balance of final energy consumption

The table below shows the results of the projections for all sectors of final energy consumption by energy components.

Table29: Final energy balance for 2005 and 2017 and projections for 2020, 2030 and 2040 under MA and NECP scenarios

				MA			DU		
		2005	**2020**	**2025**	**2030**	**2040**	**2025**	**2030**	**2040**
Final energy consumption	[ktoe]	**5.109**	**4.454**	**5.023**	**5.023**	**4.898**	**4.806**	**4.555**	**3.956**
Solid fuels	[ktoe]	80	28	30	5	0	19	4	0
Liquid fuels	[ktoe]	2.381	1.869	2.226	2.155	1.697	2.050	1.609	700
Gaseous fuels	[ktoe]	665	579	638	674	774	596	569	421
RES and waste	[ktoe]	691	691	730	693	622	788	841	729
Electricity	[ktoe]	1.096	1.114	1.241	1.329	1.626	1.180	1.335	1.784
Heat	[ktoe]	196	173	168	166	155	173	163	154
Hydrogen	[ktoe]	0	0	0	1	24	0	34	168
Industry	[ktoe]	**1.647**	**1.259**	**1.354**	**1.403**	**1.480**	**1.272**	**1.335**	**1.448**
Solid fuels	[ktoe]	80	28	30	5	0	19	4	0
Liquid fuels	[ktoe]	222	97	70	62	48	56	38	26

				MA			DU		
		2005	**2020**	**2025**	**2030**	**2040**	**2025**	**2030**	**2040**
Gaseous fuels	[ktoe]	541	448	482	535	609	453	440	358
RES and waste	[ktoe]	125	121	135	138	123	170	203	264
Electricity	[ktoe]	617	514	581	602	643	524	582	711
Heat	[ktoe]	62	51	57	61	58	51	44	36
Hydrogen	[ktoe]	0	0	0	0	0	0	23	53
Transport	[ktoe]	**1.469**	**1.593**	**2.146**	**2.170**	**2.035**	**2.009**	**1.790**	**1.146**
Solid fuels	[ktoe]	0	0	0	0	0	0	0	0
Liquid fuels	[ktoe]	1.452	1.478	1.992	1.967	1.564	1.836	1.455	598
Gaseous fuels	[ktoe]	0	3	6	20	81	9	24	21
RES and waste	[ktoe]	0	93	113	111	105	125	195	86
Electricity	[ktoe]	17	18	34	71	260	39	104	344
Heat	[ktoe]	0	0	0	0	0	0	0	0
Hydrogen	[ktoe]	0	0	0	1	24	0	11	97
Wide use	[ktoe]	**1.993**	**1.603**	**1.533**	**1.451**	**1.384**	**1.525**	**1.430**	**1.362**
Solid fuels	[ktoe]	0	0	0	0	0	0	0	0
Liquid fuels	[ktoe]	707	294	164	127	85	158	114	57
Gaseous fuels	[ktoe]	124	127	150	119	85	134	104	43
RES and waste	[ktoe]	565	477	483	445	394	494	445	398
Electricity	[ktoe]	462	582	625	655	723	618	648	729
Heat	[ktoe]	134	122	111	105	98	122	119	118
Hydrogen	[ktoe]	0	0	0	0	0	0	0	17

iv. Cost-optimal minimum energy performance levels resulting from national calculations in accordance with Article 5 of Directive 2010/31/EU

Minimum requirements for the energy performance of buildings are regulated by the Rules on energy efficiency in buildings. This was updated in 2022 in line with the requirements stemming from Article 5 of Directive 2010/31/EU and the establishment of minimum requirements applicable to nearly zero-energy buildings. Thus, all buildings are constructed and energy-novated as nearly zero-energy buildings in accordance with the rules governing energy efficiency in buildings. The requirements are in place at several levels, but vary depending on whether the building is energy-free, less demanding or complex buildings. For the latter, a detailed energy analysis of the building is foreseen. The overarching minimum requirements are in place at three levels, namely: Heat required for heating the building, 2. non-renewable primary energy and 3. share of RES in the building's overall energy balance. Cost-effective approaches and optimal levels are also further specified in a long-term strategy to promote investment in energy renovation of buildings.

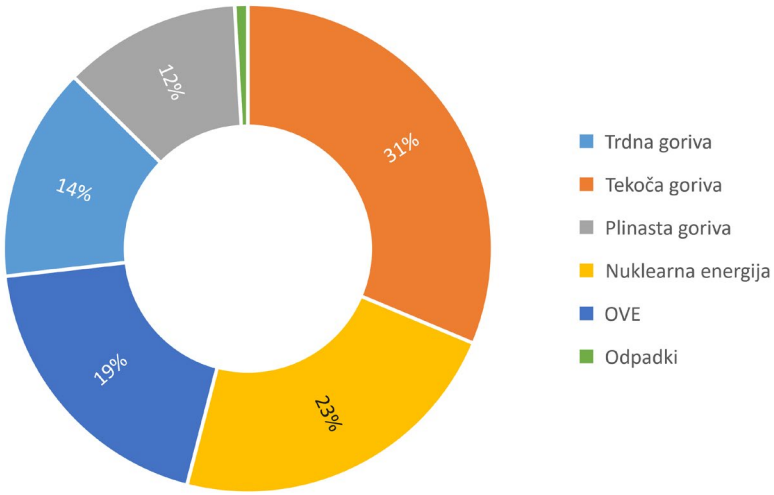
4.4 Dimension energy security

i. Current energy mix, domestic energy resources, import dependency, including relevant risks

Current energy mix

Fuels in the energy supply in 2021 are dominated by liquid fuels, which account for 31 %, nuclear energy with 23 %, RES (including HE) and 20 % residual waste, gaseous fuels with a 12 % share, solid fuels with a 14 % share.

46Figure: Structure of energy supply in 2021



The table below shows the structure of energy supply by energy product for 2017 and projections for both scenarios with existing measures (OU) and additional measures (NECP) for 2030 and 2040. Liquid fuels predominate throughout the period, but their consumption is already significantly reduced by 2030, mainly in the scenario with additional NECPs measures, due to the intensive electrification of transport.

Table30: Structure of energy supply by energy products for 2005 and 2020 and projection under MA and DU scenarios for 2030 and 2040

				MA		DU		
		2005	2020	2030	2040	2030	2040 RES	2040 nuclear
Energy supply without non-energy use	**[ktoe]**	**7.223**	**6.292**	**6.734**	**6.616**	**6.091**	**5.228**	**6.676**
Solid fuels	[ktoe]	1.506	1.013	780	552	659	0	0
Liquid fuels	[ktoe]	2.396	1.874	2.159	1.700	1.609	682	682
of which synthetic fuels	[ktoe]	0	0	0	0	14	61	61
Gaseous fuels	[ktoe]	803	730	1.212	1.634	811	818	848

of which synthetic fuels	[ktoe]	0	0	0	0	38	75	75
Nuclear energy	[ktoe]	1.533	1.655	1.450	1.451	1.447	1.445	3.550
RES and waste	[ktoe]	1.012	1.192	1.155	1.127	1.665	2.126	2.015
od hydropower	[ktoe]	298	424	394	395	405	432	432
Hydrogen	[ktoe]	0	0	1	24	34	175	175
Net imports Electricity	[ktoe]	—28	—172	—24	127	—133	—19	—595
Final energy consumption	**[ktoe]**	**5.109**	**4.454**	**5.023**	**4.898**	**4.555**	**3.956**	**3.956**
Solid fuels	[ktoe]	80	28	5	0	4	0	0
Liquid fuels	[ktoe]	2.381	1.869	2.155	1.697	1.609	700	700
Gaseous fuels	[ktoe]	665	579	674	774	569	421	421
RES and waste	[ktoe]	691	691	693	622	841	729	729
Electricity	[ktoe]	1.096	1.114	1.329	1.626	1.335	1.784	1.784
Heat	[ktoe]	196	173	166	155	163	154	154
Hydrogen	[ktoe]	0	0	1	24	34	168	168

Indigenous energy sources (three pillars of energy security)

In Slovenia, electricity generation mainly uses domestic resources, which are the cornerstone of energy and electricity security respectively. This involves the use of:

- RES, which provide a share through hydropower in large installations,
- domestic coal – lignite; and
- nuclear energy.

Thus, the three pillars of electricity security provided 15.065 GWh of electricity in 2021 and, taking into account Croatia's 50 % share in N Krško, the actual Slovenian electricity generation amounted to 12.356 GWh, representing 82.9 % of final electricity consumption[67]. The use of domestic resources ensures a secure and high-quality electricity supply.

Electricity balance

On the basis of historical annual consumption and production, we can analyse the adequacy of the system in terms of electricity balance conditions, which indicate the annual production and take-up and import and export of electricity in the Republic of Slovenia. Electricity imports/exports are due to discrepancies between domestic consumption and electricity generation. In the event of a shortage of domestic generation resources, there is imports of electricity from abroad. The table below shows the annual electricity balance deficit in Slovenia, which shows the necessary imports, which generally range from 16 to 18 %. The exception is 2020 when the deficit was lower due to the COVID-19 epidemic. In 2021, Slovenia imported 84 % of the time to cover electricity needs, with the highest imports of 1.232 MW. In this

[67] Source: Agen RS, Report on the situation of energy in Slovenia in 2021

context, it should be noted that production takes into account the 50 % share of NEK, but also that the deficit in the electricity balance analysis is not necessarily due to a lack of energy resources, but may be due to the economic ineligibility of electricity generation from Slovenian sources of production due to prices on the electricity market.

Table31: Annual electricity balance deficit in Slovenia

Leto	Primanjkljaj [GWh]	Primanjkljaj [%]	Primanjkljaj [h]	Primanjkljaj delež časa [%]
2021	2.435	17 %	7.321	84 %
2020	1.017	7 %	5.286	60 %
2019	2.445	17 %	7.093	81 %
2018	2.355	16 %	7.440	85 %
2017	2.557	18 %	7.451	85 %

Source: Slovenian Transmission System Development Plan from 2023 to 2032, p. 52

If only the physical situation is observed, Slovenia is a net exporter. It should be borne in mind that half of the production from NEK through an inter-state agreement is intended for exports to Croatia in the long term. At a time of higher demand in the network, Slovenia is covered by imports for a large part of its needs, while it is still able to produce surpluses of electricity exported to foreign markets in times of lower demand.[68]

In 2021, Slovenia received 14.423 GWh of electricity in the transmission and distribution system, a decrease of 1.324 GWh compared to 2020. The takeover of electricity from renewable generation installations amounted to 5.292 GWh, which is 221 GWh less than the previous year, while the takeover from fossil fuel power plants contributed 3.720 GWh or 475 GWh less than in 2020. NEK received 5.411 GWh of electricity into the transmission system, or 629 GWh less than the previous year. The quantities of energy are taken from electricity system operators' balance sheets based on physical flows.[69]

In 2021, 1.100 GWh of electricity from generation connected to the distribution system was absorbed into the distribution system (which also includes closed distribution systems).

Taking into account half the share of production from NEK, domestic energy sources contributed 11.718 GWh of electricity to the Slovenian electricity system in 2021, while consumption at final customers, including losses, amounted to 14.173 GWh of electricity. Slovenia covered 82.9 % of electricity consumption with domestic sources of production in 2021, import dependency, taking into account exports of half of NEK production, amounted to 17.1 %.

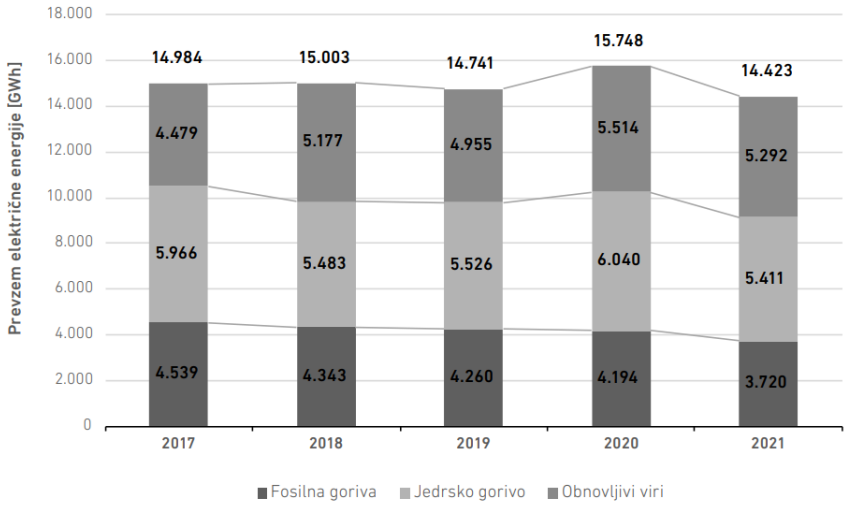
The share of electricity generated in hydropower and other renewable energy plants varies annually depending on hydrological and other conditions, as well as the scale of investments in the construction of generating units for the exploitation of renewable resources. In 2021,

[68] Development plan for the transmission system of the Republic of Slovenia from 2023 to 2032

[69] Report on the energy situation in Slovenia in 2021, available at https://www.agen-rs.si/documents/10926/38704/Poro%C4%8Dilo-o-stanju-na-podro%C4%8Dju-energetike-v-Sloveniji-v-letu-2021/17048023-cfc5-4283-8e48-5fa078ad2ae6

this share was around 37 % of all electricity produced in Slovenia, an increase of 2 % compared to the previous year. Fossil fuel power plants contributed around 26 % to total production, one percentage point less than the previous year, and NEK 38 % of all electricity produced.

47Figure: Primary resource shares for electricity generation in 2017-2021



Source: Report on the energy situation in Slovenia in 2021

Nine companies were active in electricity generation in installations with an installed capacity of more than 10 MW in 2021. One of these is Energetika Ljubljana, and the remaining companies are grouped under the auspices of the HSE Group, which constitutes the first energy pillar on the Slovenian wholesale market, or under the auspices of the GEN Group, the second energy pillar. Compared to the previous year, the installed power in the HSE group and the Energetika Ljubljana group remained virtually unchanged, while in the GEN group energy installed capacity increased by 11.7 % mainly due to the integration of two new gas blocks into the Brestanica TE. On the transmission network, installed power was increased by 3.7 %.

On the other hand, there is an even larger number of smaller dispersed electricity producers with different technologies. Most of these plants are included in the distribution network or closed distribution system (761 MW). Solar power plants (459 MW) predominate in the group of plants smaller to 10 MW, with CHP (134 MW) ranked second, while small hydroelectric power plants (127 MW) are the third largest.

As a result of the intergovernmental agreement between Slovenia and Croatia, half of NEK production belongs to Croatia, which reduces NEK's share of actual Slovenian electricity production. As a result, in 2021 power plants in Slovenia produced a total of 14.423 GWh of electricity and the actual Slovenian electricity production was lower at 11.718 GWh.

The total electricity consumption in Slovenia (taking into account the consumption of ČHE Avče) in 2021 amounted to 14.173 GWh and 13.336 GWh respectively without taking into account losses in the transmission and distribution system. Compared to 2020, total consumption was 427 GWh, or 3.1 %.

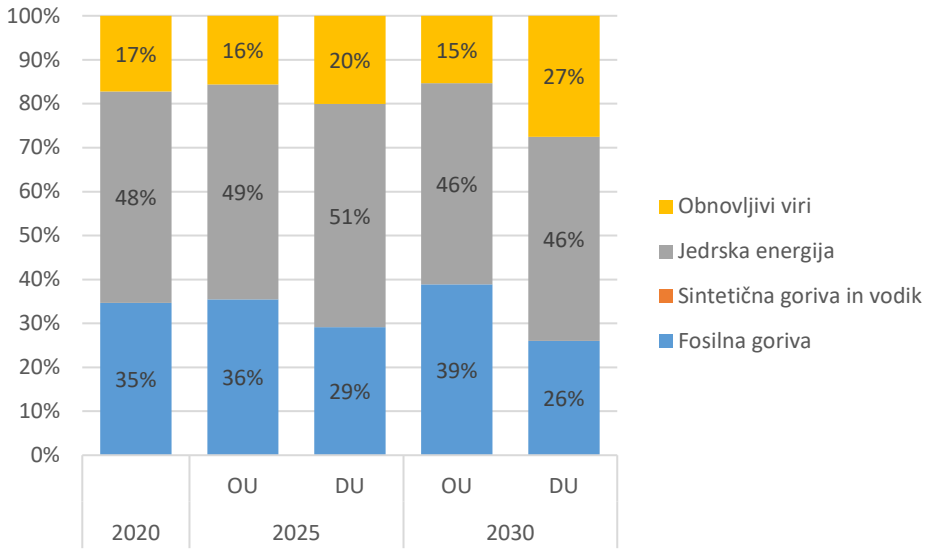
Three direct customers are connected to the transmission system and consumed 134 GWh of electricity in 2021. Through the distribution system, 30.9 GWh of electricity was exported to Italy from RTP Vrtojb and RTP Sežana. Customers in the ZDS consumed 1 350 GWh of electricity, 85 GWh less than in 2020, mainly due to lower consumption by the Talum ZDS. The pumped storage plant Avče used 384 GWh for pumping water for accumulation, which is 7 GWh less than the previous year. The losses in the transmission and distribution system amounted to 837 GWh of electricity, including losses from the import, export and transit of electricity flowing through the country.

The consumption of business and household customers on the distribution system was 4.5 % higher than in 2020 and was 11.467 GWh. Household consumers consumed 3 665 GWh of electricity in 2021, an increase of 3 % compared to the previous year. However, the consumption of business customers in the distribution system amounted to 7 803 GWh in 2021, which is 5.2 % higher than in 2020. The consumption of all final customers (excluding losses and excluding ČHE Avče) was 3.5 % higher in 2021 than in 2020.

Most of the consumption was covered by power plants located in Slovenia, the remainder coming from imports. Looking ahead, based on projections in the scenario with existing measures, an increase in electricity production from fossil energy (natural gas) is expected to increase due to the assumption of a stalemate in investment in renewable energy sources.

Under the additional measures scenarios, the NECP scenario, the RES scenario 100 % and the PES2 scenario, increased investment in generating installations using all types of renewable energy sources is expected: solar, hydro and wind, which has the effect of significantly increasing the share of electricity produced from RES and reducing the share of fossil fuels. A second scenario, in addition to additional RES, envisages a new nuclear power plant.

48Figure: Primary resource shares for electricity generation for 2020 and 2030 under scenarios

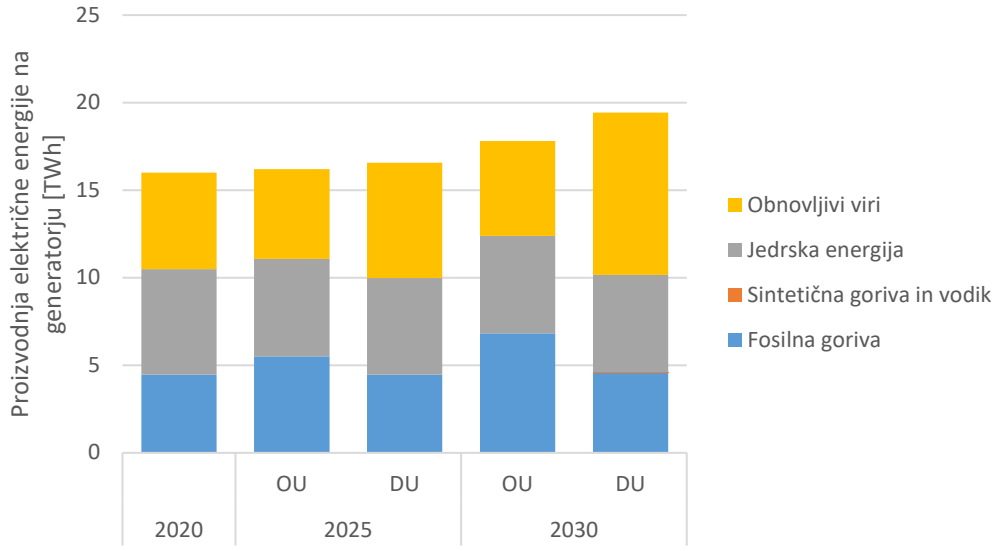


Until 2021, natural gas was used to a lesser extent in Slovenia for backup and peak production of electricity in the Šoštanj and Brestanica (TEB) thermal power stations. The first continuous and increased use of this energy product is expected in the coming years (after 2023) for the production of heat and electricity in Energetiki Ljubljana. This will result in burdensome production from mainly imported coal in Ljubljana from a more environmentally acceptable natural gas.

Most of the investments in large installations have in the past been aimed at replacing old coal plants for the more recent ones. The second part of the investment was also used in the past for the construction of additional back-up appliances using gas technology and the basis of more fuel use; liquid and gaseous fuels.

Both NECP scenarios focus in the future on increased use of RES and nuclear energy.

49Figure: Electricity generation in HE, TE and NEK in 2020 and 2030 under scenarios



Gas supply to Slovenia and access to resources

Due to the lack of own resources, the supply of natural gas to the Slovenian market is entirely dependent on its imports. Until the crisis in Ukraine, the supply of natural gas to Slovenia took place predominantly from Russia and, following the crisis, gas supplies diversified, also helped by an increase in transmission capacity at the border point with Italy. The major part of Russian gas supplies via Austria was thus replaced by the supply of Algerian gas via Italy and other supplies from the European gas market. As the Slovenian transmission system is connected to neighbouring transmission systems, gas hubs of the European gas market are involved in the supply of gas to Slovenia.

The Slovenian gas transmission system is embedded in a European and global international environment and gives users a choice. The selection system shall be connected through border interconnection points to the transmission systems of neighbouring countries under the

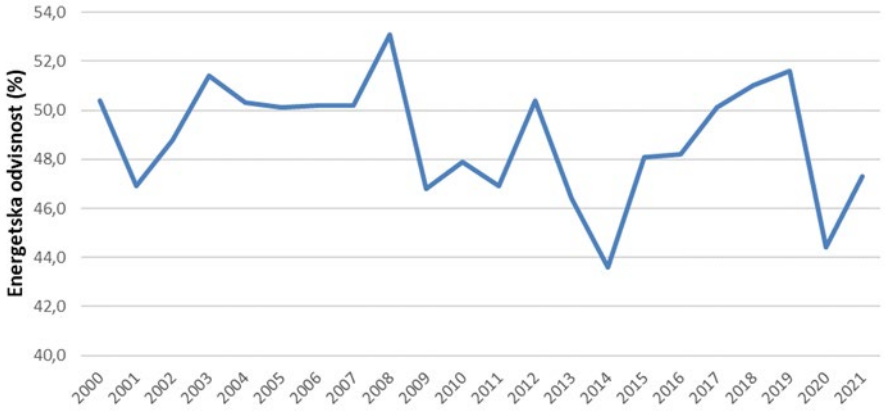
management of different transmission system operators (TSOs). The border interconnection points of the Slovenian TSO with neighbouring transmission systems are:

- connection to Austrian OPS Gas Connect Austria at the Ceršak border interconnection point,
- connection with the Italian Snam Rete Gas OPS at the Šempeter border interconnection point and
- connection to Croatian SCI Plinacro at the border interconnection point Rogatec.

Import dependency

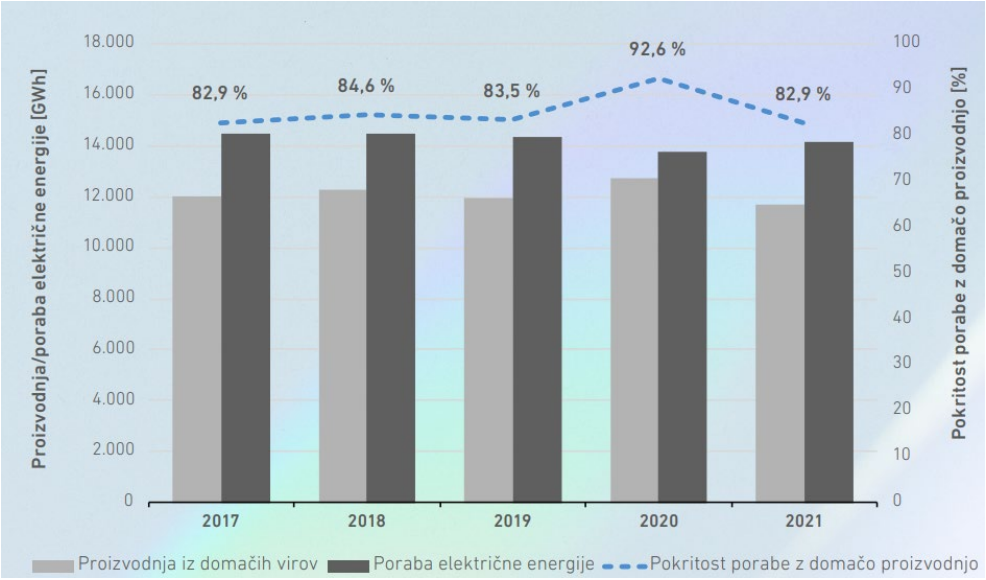
The total amount of domestic energy sources in Slovenia in 2021 was 3.3 million toe (=140 PJ), an increase of 9 % compared to 2020. With its indigenous energy sources, Slovenia met 53 % of its energy needs in 2021. The remaining necessary quantity has been secured from imports; the supply of petroleum products was fully ensured from imports (SURS, 2023).

50Figure: Energy dependency, Slovenia, source: SURS, 2019



Source: SURS, 2023

51Figure: Generation, use and coverage of electricity supply 2017-2021



Source: Report on the energy situation in Slovenia in 2021

The figure above shows the coverage of domestic electricity consumption by domestic generation resources. Large hydro, thermal and nuclear power plants,[70] which are connected to the electricity transmission system in Slovenia, mainly contribute to the production of electricity from indigenous sources. A small part of domestic generation is connected to the electricity distribution system. Due to the significant share of hydropower generation, total domestic generation is highly dependent on hydrology in a given period.

For the purposes of calculating import dependency, in addition to the consumption of final customers on the transmission and distribution system, losses on the entire electricity system

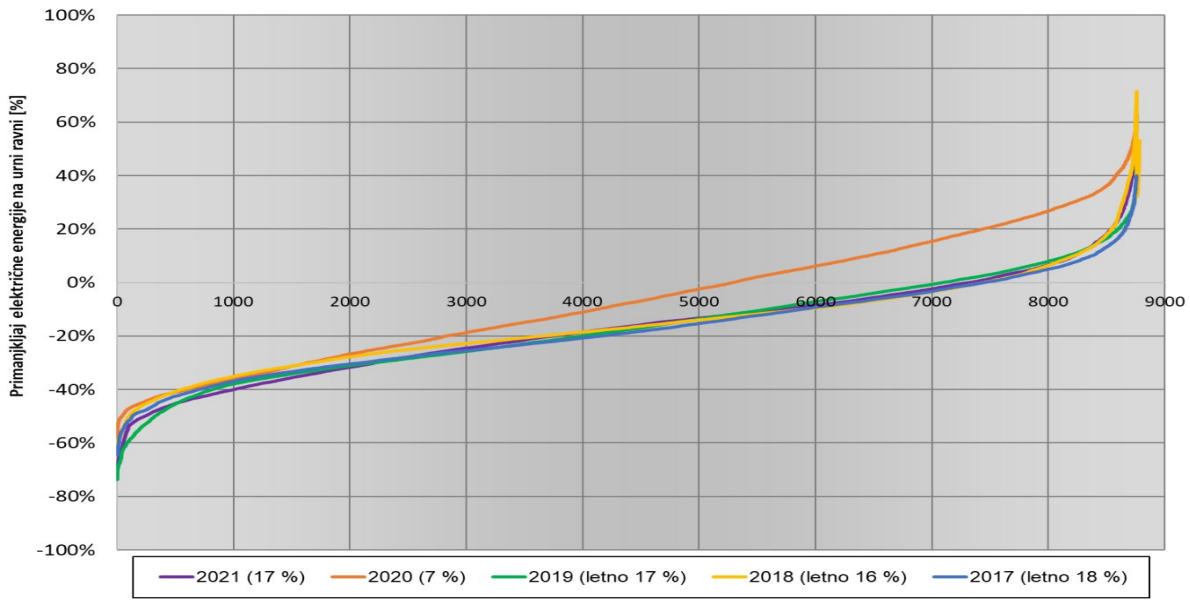
[70] Only half of the electricity generation from the Krško nuclear power plant is taken into account.

shall be taken into account in the total electricity consumption minus EE exported to Italy via the distribution system from RTP Vrtojb and RTP Sežana. In the chapter on electricity balance, these quantities are treated as direct demand on the transmission system.

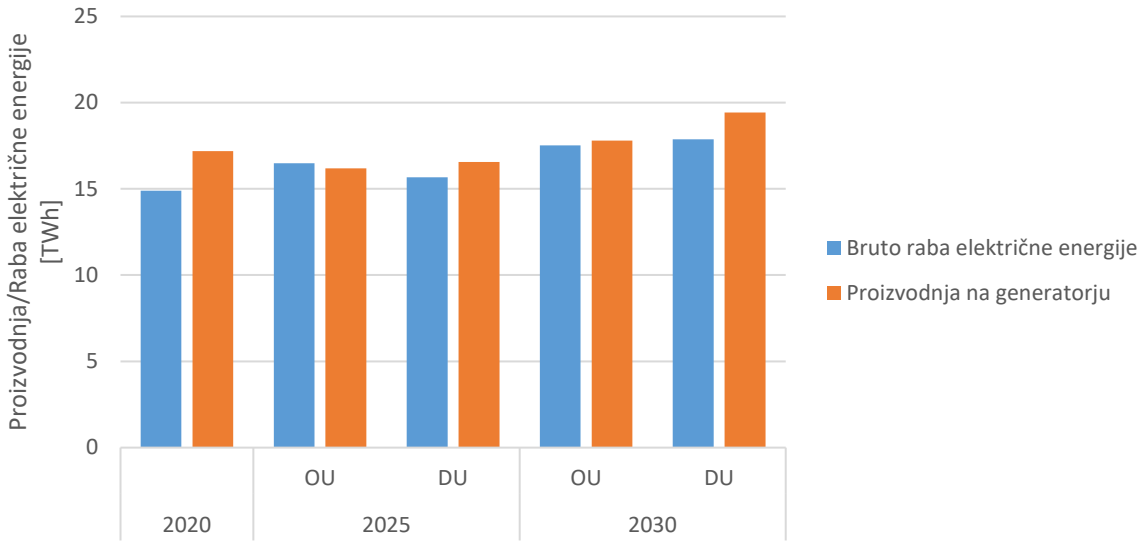
The consumption coverage of electricity produced in Slovenia is determined on the basis of the ratio between the production of electricity in Slovenia and the total use of electricity. During the observed period 2017-2021, import dependency did not change significantly. In addition to the change in generation from indigenous sources, it was also directly affected by the change in electricity consumption. During the observation period, EE supply coverage peaked in 2020, when consumption was lower due to the Covid-19 pandemic, before falling again.

In addition, very important information on import dependency is shown in the figure below, showing the electricity balance deficit over the last five years on the basis of an hourly resolution, which shows that Slovenia is an importer of electricity. This deficit is not due to system inadequacy or lack of generation units, as the existing generation park would still cover its own electricity needs for the time being, but is due to the electricity market, with a significant share of electricity being leased to cheaper generation units abroad. Under normal circumstances, this means lower electricity prices for consumers, but, on the other hand, stopping or halting their own generating units that fail to sell electricity on the market may lead to greater dependence on neighbouring countries in the long term, which should be properly evaluated as a risk. The deficit as a share of final consumption ranges from 17 to 18 % and stands at around 85 % of time in the year. For the safe and secure operation of the transmission system, the import information is given on an hourly basis. This reveals that Slovenia also imported up to 85 % of the electricity needed to meet the needs of domestic customers at certain times.

Figure 52: Share of electricity deficit in Slovenia at hourly level in 2017-2021



52Figure: Electricity generation and use in Slovenia for 2025 and 2030 under scenarios (total electricity generation from Krško nuclear power plant is taken into account)



The scenarios assume that in the future, electricity needs in Slovenia will be covered by self-generation at a similar level to the current situation, as shown in the figure above.

Risks and services to maintain stable and secure operation of the EES

An electricity crisis can occur for several reasons, such as extreme weather conditions, malicious attacks or fuel shortages. When crisis situations occur, these often have a cross-border impact. Major events such as cold spells, heat waves or cyber-attacks can affect several EU countries simultaneously.[71]

foresees the development of a methodology to identify regional electricity crisis scenarios in terms of system adequacy, system security and fuel adequacy; and to assess seasonal and short-term adequacy (monthly and week-ahead and day-ahead sufficiency) of the electricity system in case of extreme weather conditions. The methodology is being developed by the European Network of Transmission System Operators for Electricity (ENTSO-E), a proposal was prepared in January 2020.

The methodology for identifying regional electricity crisis scenarios under Regulation (EU) 2019/941 on risk-preparedness in the electricity sector should take into account at least the following risks: rare and extreme natural hazards; accidental risks; the resulting risks, including malicious attacks and fuel shortages.

In accordance with Regulation (EU) 2019/941,[72] the methodology should include at least the following: taking into account all national and regional circumstances; the interaction of risks across borders and the link between them; simulations of simultaneous electricity crisis

[71] https://eur-lex.europa.eu/legal-content/SL/AUTO/?uri=celex:32019R0941

[72] Regulation (EU) 2019/941 on risk-preparedness in the electricity sector

scenarios; ranking of risks according to their impact and probability; principles on handling sensitive information while ensuring transparency.

Grid support services

System operators shall use system services, in particular voltage and frequency control services, to maintain stable and secure operation of the EES. System services comprise all supporting technical processes that provide support to the transmission of electricity between generators and consumers in the EES. The seamless transmission of electricity is closely linked to the secure operation of the EES at local level, at country level and at the whole European intercooperation. The most important part of system services are frequency services – frequency and active power control services – which compensate for inequalities in generation and consumption and maintain interconection stability in the event of disruptions and major deviations or outages.

The Frequency Maintenance Reserve (RVF) is intended for a rapid frequency change response during the interconection. To this end, with a frequency deviation of 200 mHz in Europe, about 3 000 MW positive or negative balancing capacity is automatically activated, stabilising the frequency. In 2024, the Slovenian system operator will be obliged to provide around ± 15 MW of FCR. The FCR service was mandatory until 2019 for all aggregates connected to the transmission network and later purchased on the basis of market principles. Since 2021, ELES leases FCR services as part of FCR cooperation involving several European countries that lease the most economically advantageous FCR in the single market.

The frequency restoration reserve (RPF), consisting of an automatic frequency restoration reserve (aRPF) and a manual frequency restoration reserve (rRPF), is intended to balance the system and provide balancing energy in the event of balance group imbalances or the failure of a power generating or consumer unit.

According to the Block Operation Agreement of Slovenia, Croatia and Bosnia and Herzegovina (BiH), ELES is required to provide around 250 MW positive and 82 MW negative FRR for 2024. The automatic frequency restoration reserve (aRPF) ensures that the actual exchanges of the control area are matched with the timetables. In 2024, the TSO has to lease around ± 60 MW of the ARPF control reserve. This type of service consists mainly of classic generators and reservoirs (each type of resources provided around half of the reserve in 2022) and it is expected that in the coming years the majority of the provision of aRPF will be taken over by reservoirs, mainly batteries. With a higher share of RES, a partial increase in ARPF needs is expected, but to a lesser extent.

The manual reserve rRPF is defined as the required FRR minus the leased aRPF.

It should be noted that the share of FRR that ELES is obliged to provide under the SHB control block depends primarily on the needs of individual members of the block. This means that in the case of the construction of a new large production unit in the area of Slovenia's regulatory area, the shares and total required FRR of Slovenia could increase significantly. Since conventional production facilities usually do not affect the need for aRPF, it can be estimated that the increase in FRR needs would be mainly reflected in an increase in rRPF.

In the event of a significant increase in RES, in particular a significant increase in wind farms in the control block area, an increase in the need for negative FRR can be expected, whereas

these new sources have no impact on the needs for positive FRR due to the level of the reference incidents.

System balancing services with aRPF and rRPF shall be designed, on the basis of the terms and conditions for balancing service providers, to enable the participation of all appropriate technologies, from conventional generators, reservoirs to resource *and load aggregators (* including DSM).[73]

All subsystems contribute to the overall security of electricity supply. This is achieved by investing in the robustness of the operation of individual parts and in the further automation and digitalisation of processes. With a view to decoupling the activation of ancillary services, the TSO started already in 2013 to implement the so-called imbalance netting mechanism between TSOs, first together with the Austrian TSO, and then more broadly (IGCC co-operation. International Grid Control Cooperation), thereby relieving it from the demand for activated balancing energy in the system by more than 30 %. In 2024 or 2025, ELES further expects to be connected to the aRPF and rRPF co-operatives (PICASSO and MARI) which will provide additional liquidity in the activations of balancing energies aRPF and rRPF.

Flexibility and storage of electricity

The period over the last ten years has been marked by the deployment of the first ČHE, which significantly increased the flexibility of the EES's operation. A large reservoir operating in the electricity market based on market principles contributed to improving the speed and volume of system services and generally increased the flexibility of the operation of large coal installations. In terms of total costs of (positive and negative) operation in the EES, the facility operated neutrally, thus exempting it from paying network charges under the consumer regime.

Taking into account existing measures, we envisage an increase in the share of large savings banks in the EES by 2030. The use of DSM is playing an increasingly important role. It has been successfully used to provide ancillary services, notably in the product of the manual frequency restoration reserve. While keeping track of existing measures, DSM is maintained as a successful bidder until 2030.

ii. Projections of developments with existing policies and measures at least until 2040 (including for 2030) and with additional NECPs policies and measures

The electricity and heat generation sector will have to become decarbonised by the end of the observation period, by 2050, in line with additional measures. Higher decarbonisation intensity is foreseen after 2033 with coal exit. All this requires significant changes across the EES, in particular in the use of fossil fuels, in particular coal, both domestic lignite and imported brown coal. The scenario design shall be separate for:

[73] In accordance with Article 2 of the Decree on measures and procedures for the deployment and connectivity of advanced metering systems (Official Gazette of the Republic of Slovenia No 79/15), DSM is a system which affects the use or production of electricity by network users in such a way as to reduce the need for network reinforcement for consumption or generation on the part of network users.

- Large power and heat generation facilities; and
- distributed electricity generation and heat and cold systems.

Now and in the future, it will be the major facilities that will ensure security and quality of supply, while diffuse resources will ensure optimal generation of electricity according to conditions and thermal needs.

In our hearings, we have envisaged three scenarios:
- scenario with existing measures;
- NECPs – with additional measures – 100 % RES; and
- NECPs scenario – with additional measures – nuclear energy.

The first scenario, a scenario with existing measures, only serves as a benchmark and covers the minimum development of new capacities. In hydropower, it foresees in addition up to 125 GWh of new large HEs by 2030 and the construction of ČHE Kozjak.
The existing NEK operates up to 2043 subject to the conditions of obtaining the necessary authorisations for the extension of operation.
The cessation of lignite production in HP would end in 2033, followed by the shutdown of the coal units TEŠ 5 and TEŠ 6. Due to the lack of competitiveness of TEŠ 5, it could be stopped prematurely, similarly to TEŠ 6. However, both units are considered to be forced to stop even in the event of a loss of coal production in the mine, as the possible import of coal, even in combination with biomass, would not solve the situation.
In TE-TOL we expect the EPP to start operations in winter 23/24 and replace B1 and B2 operating on imported brown coal. B3 would run on imported coal with biomass co-incineration until 2033. In the TEB, upgrading of existing gas turbines with high-speed MNH is expected.
Even in the scenario with existing measures, we foresee a significant increase in both small and large SEs and VE, of course in relation to SHEE, as well as other RES, e.g. geothermal plants.

The scenarios with additional measures differ in the directions of development: one foresees a focus on 100 % RES and the other on a combination of RES (less intensive) and additional use of nuclear energy for electricity generation (JEK 2). Both scenarios are exclusively development-oriented, i.e. to maximise the use of RES in conjunction with SHEE and units that will provide strategic certainty.
The first NECP scenario – 100 % of RES assumes intensive use of RES, in particular SEs and VEs in relation to SHEE. In addition, it is assumed that up to 250 GWh of large HEs will be built up in the first decad, by 2030, and an additional 250 GWh in the second decad, by 2040. The intensity of RES construction is the most intensive in this scenario. Due to the occasional nature of RES, a connection to SHEE at the site of installation is expected. Analyses show that in order to successfully transmit electricity from day to night, this requires SHEE to be upgraded up to ¼ of the capacity of SE. ČHE, various battery reservoirs and hydrogen conversion systems are the most suitable SHEEs. In conjunction with SHEE, RES in the period

April-September in the EES virtually fully offset daily demand diagrams or cover the full energy needs of the day. We foresee the inclusion of new ČHEs and other reservoirs.
This coal exit scenario in 2033 envisages the establishment of strategic reserves, new power units in the EES based on gas technologies that can switch to the use of synthetic fuels (SNP) or pure H2 in a later period. The analyses show a need of around 500 MW. For these resources, we assume that:

- Enter into operation before the withdrawal date from coal,
- they are technologically diversified;
- existing energy and industrial sites, including TEŠ, TETs, where existing infrastructure is available, shall be used for deployment.
- Geographical dispersion is needed;
- ensure high availability and reliability of operations; and
- they are able to adapt – flexibility (low mins, high power builders, fast start-ups and shutdowns).

This scenario foresees a shutdown of TEŠ coal units up to 2033 while both PTs remain in operation. In TE-TOL, the start of operations of the EPP in the upcoming winters, the shutdown of B3 by 2030 and the replacement by a new BFBC-based biomass unit. A new waste disposal unit is also foreseen. All units shall ensure the operation of CHP. The TEB foresees the inclusion of three high-speed ICEs on gas, hereafter cautiously switching units to renewable gases and hydrogen. For NEK, an extension of up to 2043 is foreseen. It will be the electricity import that closes the annual electricity demand.

Second NECPs scenario – with additional measures using the NSE, it is similar to the first one, but foresees slightly less occasional RES (SE and VE) and the installation of a new JEK 2 by 2040.
The other measures and the development of new installations by power plants are the same as the 100 % RES scenario.

4.5 Dimension Internal energy market

4.5.1 Electricity interconnectivity

i. Current interconnection level and main interconnectors

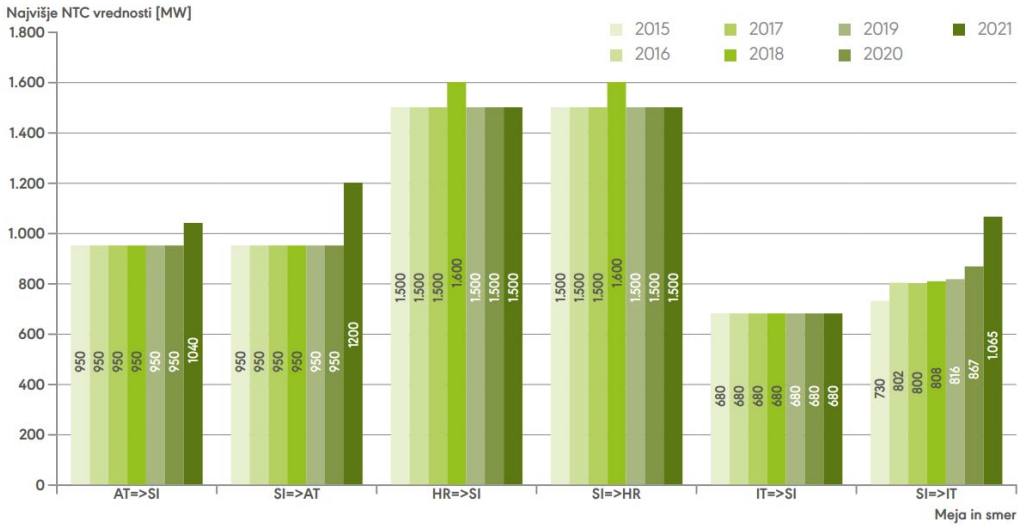
Slovenia's electricity interconnection[74] was 75 % in 2021, well above the 10 % target for 2020 and the 15 % target for 2030. Two 400 kV transmission systems (DV 2x400 kV Maribor-Kainachtal) and 220 kV transmission line (DV 220 kV Podlog-Na selu (Obersielach)), 400 kV (DV 400 kV Divača-Sredipolje (Redipuglia)) and 220 kV line (DV 220 kV Divača-Padriče (Padriciano)) are connected to Austria, with Croatia three 400 kV transmission systems (DV 2x400 kV Krško-Tumbri and DV 400 kV Divača-Melina), two 220 kV transmission lines (DV 220 kV Cirkovce-Žervinec and DV 220 Divača-Pehlin) and three 110 kV transmission lines (DV 110 kV Koper-Buje, DV 110 kV Ilirska Bistrica-Matulji and DV 110 kV Formin-Nedeljanec), and

[74] Source: Slovenia: Energy Union factsheet, 2017, pp. 5-6.

with Hungary a new 400 kV interconnector (DV 2 x 400 kV Cirkovce-Pince).The Slovenian electricity[75]market is part of the SDAC (Engl. Single Day Ahead Coupling), which uses a single PCR solution to calculate the price on the daily market. *Price Coupling of Regions)*and bringing together European day-to-day markets. In practice, this allows for the simultaneous calculation of the electricity price and day-ahead commercial cross-border flows for all those markets. This implies direct welfare for final consumers, as better coordination between electricity markets allows for more efficient use of the transmission network and, in particular, of cross-border interconnections between countries, which is of utmost importance in a context of increasing operational uncertainty and pressure to limit cross-border trade.

As can be seen in the figure below, ELES, in cooperation with neighbouring system operators, has managed in recent years to withstand the relatively high value of cross-border transmission capacity (NCT), despite the extremely challenging operating conditions as a result of the increasing integration of renewables into electricity grids. The high NTC values are considered as an important contribution of ELES to the integration of the electricity market, as ELES allowed as much as 7.4 TWh of transit originating in international electricity trade in 2021 alone.

53Figure: Average daily NTC value 2015-2021



Source: Slovenian Transmission System Development Plan from 2023 to 2032, p. 143.

The average NTC utilisation at each border and the average commercial flow over the period 2018-2021 are shown in the figure below.

[75] Source: Development plan for the transmission system of the Republic of Slovenia from 2023 to 2032

54Figure: Average NTC values and their utilisation between 2018 and 2021

Source: Slovenian Transmission System Development Plan from 2023 to 2032, p. 145.

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)

According to ENTSO-E calculations, Slovenia will retain its transit character and is expected to be even more exposed to cross-border power flows, notably in the north-south direction. As a result of the latter, the borders with Austria and Croatia will be those which should be given greater emphasis in the future, while the Italian and Hungarian borders remain important. To some extent, power flow fluctuations may be managed by means of power limitation devices or other measures, but it should be noted that in Slovenia, if forecasts for the development of the European EES are realised and realised over a few decades, it will be essential to provide an additional internal transmission infrastructure that will have to follow cross-border investments, as pointed out by ENTSO-E in its documents.

As a result of the above assessments and projections, the TSO is already considering various options for developing the network in terms of controlling cross-border power flows or increasing transmission capacity and further opening the electricity market and meeting the necessary conditions for further investment in the Slovenian transmission network. One solution is the GreenSwitch project, under which, inter alia, a power control system at the Slovenian-Austrian border will be installed in the RTP Sublog at 220 kV voltage level. On the other hand, by increasing transmission capacity or increasing import/export capacity in Slovenia on Slovenia's internal transmission network, an increased volume of power flows can be expected, which will burden Slovenia's internal transmission network. To this end, it will be necessary, in the long term, to consider modernising the internal network or to ensure that it is strengthened, i.e. the transition of 220 kV to 400 kV voltage level on the Divača-Beričevo-Podlog-Cirkovca route.

4.5.2 Energy transmission infrastructure

Slovenia has a relatively small electricity system, with a high availability of existing generation units, good integration of the transmission network into international interconnections and a high degree of reliability of the transmission network operation and thus a high level of security of electricity supply. The latter is facilitated by the active modernisation of the transmission system through a number of investments made and important international projects (GreenSwitchitd.), while the electricity TSO projects are seeking responses and modern approaches to the challenges of accelerating the deployment of renewable generation and the need to provide flexibility. Slovenia's electricity and gas transmission network is also in line with comparative studies and is now at the top of the cost-effectiveness of maintenance and operation compared to other European TSOs.

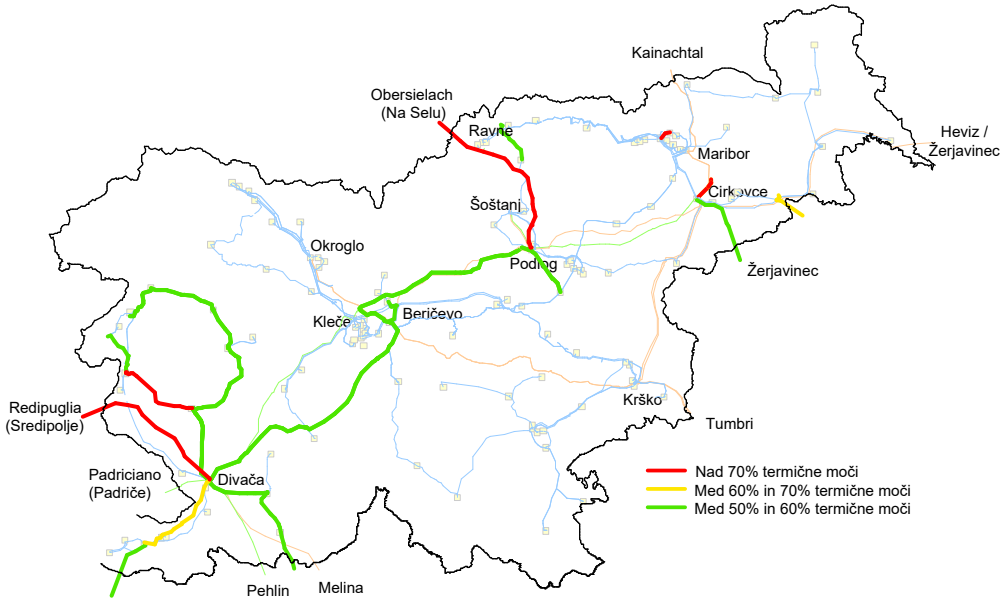
i. Key characteristics of the existing transmission infrastructure for electricity and gas

Electricity transmission infrastructure

At the end of 2021, ELES' total system length of transmission network lines was 2 955.4 km, with 400 kV lines of 669 km, 220 kV lines of 328 km and 110 kV lines of 1.957 km, of which well 30 km. In Slovenia's transmission network, five different types of transformations are installed in transformer stations, namely 400/110 kV, 400/220 kV, 400/400 kV, 220/110 kV and 110/SN kV. The 400/400 kV transverse transformer with a power of 2 x 600 MVA, located in RTP Divača, was integrated into the EES of Slovenia in 2010.

The figure below shows the most heavily loaded lines in 2021 against a 95 % probability limit. The situation shows that inter-state lines are heavily loaded, in particular DV 400 kV Divača-Redipuglia and DV 220 kV Podlog-Obersielach. High loads also occur on 110 kV networks where local bottlenecks occur in certain locations. The sea region as a whole stands out, with the highest loads on the 110 kV network and also with positive upward trends in the load.

55Figure: Most heavily loaded lines relative to the 95 % probability limit



Source: Slovenian Transmission System Development Plan from 2023 to 2032, p. 60.

Electricity distribution infrastructure

Distribution networks account for almost 95 % of all electricity networks in Slovenia, and the figure below shows the topology of 110 kV and medium voltage networks in Slovenia.

56Figure: Topology of 110 kV and medium voltage networks in Slovenia

Source: EIMV, 2019.

The Slovenian electricity distribution network is 31. 12. 2021 comprised 845 km 110 kV, 17.858 km medium and 44.989 km low voltage network, 100 substations, 76 substations, 16.624 SN/NN substations, 19.411 distributed sources of total power of 772 MW were connected to the network. The peak power of the individual ECIs in 2021 was as follows: 744 MW (Elektro Ljubljana), 446 MW (Elektro Maribor), 347 MW (Elektro Celje), 296 MW (Elektro Primorska) and 220 MW (Elektro Gorenjska). Most users, final customers and electricity producers are connected to the electricity distribution network and therefore the role of the distribution operator is crucial in two respects, namely the distribution of electricity and the provision of services to users connected to the distribution network.

Natural gas transmission infrastructure

The Slovenian gas transmission system comprises 1 200 km of pipelines, compressor stations in Kidričevo and Ajdovščina and 257 metering stations or stations. At key locations of the transmission system, facilities shall be installed to enable the system to be monitored and maintained. Remote control and control functions shall be performed by means of an information and telemetric system. The gas transmission system connects most of Slovenia's industrial and urban centres, with the exception of the coastal region, the Bela Krajina and the works of Notranjska and Dolenjska. Control and management of the transmission system shall be carried out from a dispatching centre connected to the transmission system operators' dispatch centres of neighbouring countries, as well as distribution system operators and major natural gas customers. The majority of the existing gas transmission network is more than 30 years old.

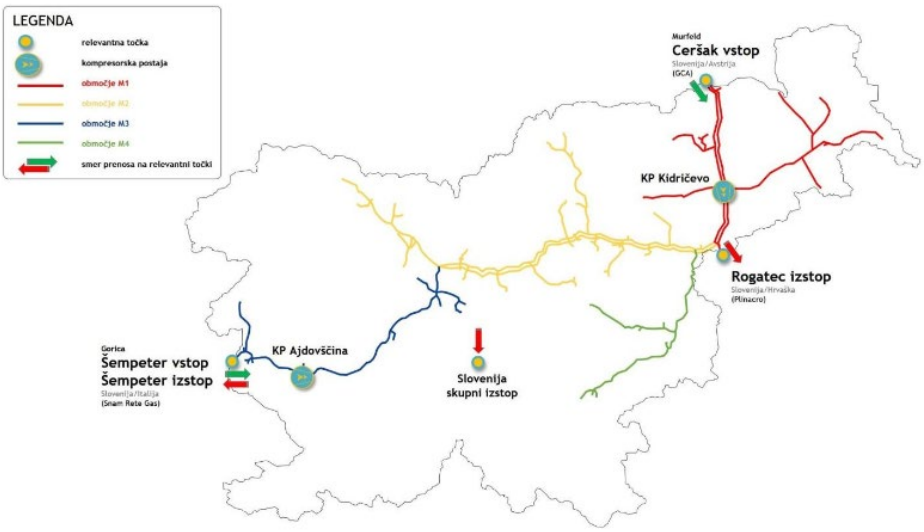
The Slovenian gas transmission system is connected through the border interconnection points to the transmission systems of neighbouring countries, which is under the management of different TSOs.

The border interconnection points of the Slovenian transmission system operator with neighbouring transmission systems are:

- connection to Austrian OPS Gas Connect Austria at the Ceršak border interconnection point,
- connection with the Italian Snam Rete Gas OPS at the Šempeter border interconnection point and
- connection to Croatian SCI Plinacro at the border interconnection point Rogatec;
- a connection with the Hungarian SCI is also envisaged.

An integral part of the transmission system is the entry points where natural gas enters the transmission system and the exit points where natural gas leaves the transmission system. The key entry and exit points of the transmission system are referred to as 'relevant points' and have been approved by the Energy Agency. For these, TSOs publish data on the capacity of the transmission pipeline system and are shown in the figure below. Five points are shown, of which four are border interconnection points which are relevant points for the publication of data, and the fifth relevant point is the aggregated total exit/transmission data for users in the Republic of Slovenia.

57Figure: Schematic diagram of the transmission pipeline system with 'relevant points'



Source: Pipeline d.o.o., 2019.

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)

Transmission of electricity

The development plan for the transmission system of the Republic of Slovenia up to 2032 is drawn up on the basis of a long-term forecast of growth in the takeover of electricity from the transmission network, the planned construction of new generation units, the extension of the distribution network and the planned and projected changes to the European transmission network. As a result, account shall be taken of the state of the network, the technological renewal needs of the transmission system facilities, the needs of electricity generators and consumers, the criteria for reliable and secure operation of the transmission system and international agreements and contracts. The general guidelines to be taken into account in the production of new and refurbishment investments shall include: connecting with neighbouring electricity systems, controlling power flows and ensuring adequate voltage conditions throughout Slovenia's electricity system, ensuring reliable and secure operation in line with ENTSO-E recommendations and criteria, and deploying smart grids to make better use of existing infrastructure and achieve adequate stability and efficiency in the context of meeting European energy requirements. As a result of the above facts, the list of most important investments to be made by 2032 is set out below in order to ensure the safe and secure operation of Slovenia's transmission network in the future[76].

400 kV and 220 kV voltage level:

- DV 2 x 220 kV Castle-Rave and RTP 220/110 kV Levels;
- TR 400/110 kV to RTP Beričeva (new TR 411) and the gradual transition of RTP Beričevo to a direct transformation of 400/110 kV;

[76] Source: Slovenian Transmission System Development Plan from 2023 to 2032, p. 104.

- TR 400/110 kV in RTP Maribor (replacement TR 41);
- the renewal of TR 220/110 kV in RTP Divača;
- TR 220/110 kV in RTP Sublog (replacement TR 212);
- TR 220/110 kV in RTP hailing (replacement TR 211).

In the context of the development of the network at 400 kV voltage level, the implementation of ČHE Kozjak remains an issue. If this project proves economically viable and the investor decides to implement it, this will entail the construction of an additional 400 kV connection for the connection of ČHE Kozjak.

110 kV voltage level:

- DV 2 x 110 kV Divača-Gorica (completion of the missing section in the village of Renče);
- DV 2 x 110 kV Divača-Pivka-Ilirska Bistrica;
- 110 kV Koper-Izola-Lucia connection;
- connection line 2 x 110 kV for HE Mokrice;
- DV 2 x 110 kV Brestanica-Hudo;
- connection 110 kV line for Luka Koper RTP;
- DV 2 x 110 kV Dravograd-Velenje (calculation from SM 126 to RTP Velenje);
- DV 2 x 110 kV Divača-Koper (replacement of single-system DV by two-system system);
- DV + KBV 110 kV Moste-steel-iron-Jesenice;
- connection 110 kV line for RTP Lakonca;
- the creation of the new facilities RTP 110/20 kV Izola, RTP 110/20 kV Hržee, RTP 110/20 kV Zruce, RTP 110/20 kV Luka Koper, RTP 110/20 kV and RTP 110/20 kV LCL through co-investment with various distribution companies;
- the creation of a new connection infrastructure for the fields of SE and VE;
- the other parts are 110 kV voltage level in accordance with the development plan of the transmission system of the Republic of Slovenia.

In addition to the above-mentioned investments, ELES will continue its mission and place a strong emphasis on energy infrastructure projects which will, inter alia, make an important contribution to the implementation of national and European energy policies. To this end, in addition to investing in conventional solutions in transmission infrastructure, many activities will focus on alternative solutions and development-research orientations, which complement conventional solutions and enable, inter alia, their better exploitation.

Challenges for the integration of solar power plants: The rapid growth of SE will result in major changes in the transmission system. The provision of a N-1 security criterion of 4.400 MW SE in 2040 will require additional investment. If only conventional measures are used, it is estimated, on the basis of analyses, that an additional 300 km 110 kV connections and at least 10 new energy transformers on the transmission level will need to be built for this purpose, which poses a major challenge in terms of location in particular. By 2030, when 1.650 MW SE is planned, there are no explicit needs for reinforcements or new connections due only to SEs, but these will start to grow in the next ten-year period, when SE growth is

exceptionally high. The more serious need for upgrades of transformations starts to exceed 2 000 MW of installed SEs, and the planning of new 400/110 kV RTP in areas with high SE production will need to be considered, as not all closures should be addressed by only the construction of 110 kV DV. If we also use more advanced measures, such as the construction of SE in combination with savings banks in the output of 25 % of the new built capacity (in MW), these needs can be reduced by a small half, which in turn increases production costs or investment in storage tanks. In the light of past experience in locating new transport routes in space which are time-consuming, it will therefore be necessary to encourage investment in storage tanks of all kinds, including hydrogen technologies.

Distribution of electricity

The electricity distribution network development plan in the Republic of Slovenia for the ten-year period 2023-203277 defines the scope of the infrastructure to be first built or upgraded to ensure a reliable, safe and efficient electricity distribution system in the country in the long term. The content of the development infrastructure that needs to be first built or upgraded for the decarbonisation of infrastructure, which is to be considered in the forecasts of the development of the distribution system. It also takes into account the impact of the pandemic, and in particular the war in Ukraine, which has led to or updated energy prices and raised questions about the security of future energy supply. In order to achieve the ambitious energy and climate policy objectives, Slovenia will need to provide better conditions for the accelerated development of the electricity distribution network, which is the cornerstone of the future transition into a low-carbon society and allows for the accelerated integration of renewable energy installations, greater integration of heat pumps and compliance with the requirements related to the accelerated deployment of e-mobility. The objective is to increase the capacity, resilience to disruption, advancedness and exploitation of the flexibility of resources and burdens of the electricity distribution network, in line with the sustainable needs of distribution system users.

The DSO development plan pays particular attention to the construction of a new medium-voltage network and the reconstruction of the existing medium-voltage and low-voltage network, as these are the weakest links in the EES from the point of view of continuity of supply, especially in the case of above-ground implementation. New constructions and reconstructions are therefore dominated by underground implementation of networks.

In order to accelerate the development of the electricity distribution network to integrate heat pumps, accelerate the deployment of e-mobility and integrate RES power generation devices, we will need to provide significantly more financial and human resources. In all analysed NECPs scenarios, we expect the necessary societal changes and associated changes in financial flows to be implemented over the next decade, which will significantly accelerate urgently needed investments in upgrading and strengthening the electricity distribution network with a view to

[77] The development plan for the electricity distribution network in Slovenia can be accessed at: Electricity distribution system development plan in the Republic of Slovenia from 2023 to 2032

ensuring the conditions for achieving the objectives of the NECPs. Further development of theregulatory framework towards supporting the transition to a climate-neutral society is needed in order to ensure consistency between the approved network development plans and investment plans of network operators and to ensure that the share of investment provided for the implementation of the approved development plans of electricity network operators is 100 %.

Smart/advanced distribution networks

The deployment of smart or advanced grids in the electricity transmission and distribution system requires an accelerated digitalisation of the electricity transmission and distribution grid. Digitalisation means linking all energy elements of the transmission and distribution network to digital energy and service platforms. Energy and digital services must be available twenty-four hours a day and seven days a week (24/7).

Today, energy services, sometimes exclusively a transmission network domain, are also migrated to distribution networks. Digitised energy networks will enable near-real-time control of energy networks and response and implementation of measures in near real time. To respond adequately, we need adequate energy services based on open supply and demand from the energy market and the digitalised grid.

The TSO is active and successful in acquiring EU funds to implement advanced projects – in recent years it has led and participated (or is still involved) in several different EU projects directly related to the smart management of electricity grid technology areas. Slovenian electricity distribution companies are also successfully involved in international projects. All of this provides Slovenia with leadership in the deployment of modern technologies in the wider region and in the EU. In the future, there is a need to further develop platforms that connect local smart grids at national level and guarantee security, grid stability and electricity supply.

Development of a smart metering system in Slovenia

Advanced measuring devices are also being installed intensively in Slovenia. By the end of 2021, a total of 868.255 electricity meters were installed in compliance with NMS requirements, representing 91 % of all low voltage household and other metering points of customers. In addition to a functioning advanced metering system, the operation of an advanced meter requires the establishment of appropriate high-performance and reliable communication links between advanced meters and advanced metering centres. According to the Plan (prepared in 2016), the indicator for 2021 was set at 83 % of the users involved in the NMS, which would represent 768.719 users. Over the last five years, the number of end-users in the distribution area has grown, with connected users currently increasing by 4 % compared to the 2016 forecast. However, the share is still above the guidelines set out in the NMS. In accordance with the Decree on measures and procedures for the deployment and connectivity of advanced metering systems (Official Gazette of the Republic of Slovenia No 79/15), system meters must

be installed by 2025 to enable the operation and management of the distribution system using advanced systems.[78]

Looking ahead, even greater attention will need to be paid to efforts to provide measurement data in (near) real-time (nearly) real time to all those actors in the energy markets, including the upcoming flexibility market, which will have a legal basis for accessing user measurement data, in a technically easy and affordable way. The use of such user metering data will increase the possibility of developing new innovative energy services for both end-users and network operators, and will allow users to have a better graphical representation of their electricity consumption (access to data).

Development of telecommunications infrastructure

Adequate development of telecommunications infrastructure also plays an important role in supporting the operation of the electro-distribution network and the development of the internal market for electricity. In the future, it will be necessary to ensure the establishment of dedicated machine-to-machine (M2M) communications networks for the distribution telecommunications infrastructure. A dedicated network for this purpose means a closed network offering M2M electronic communications services and not sharing resources or offering a service to end-users. A dedicated network for this purpose should be based on optical and radio technologies.

Investments in the natural gas transmission system

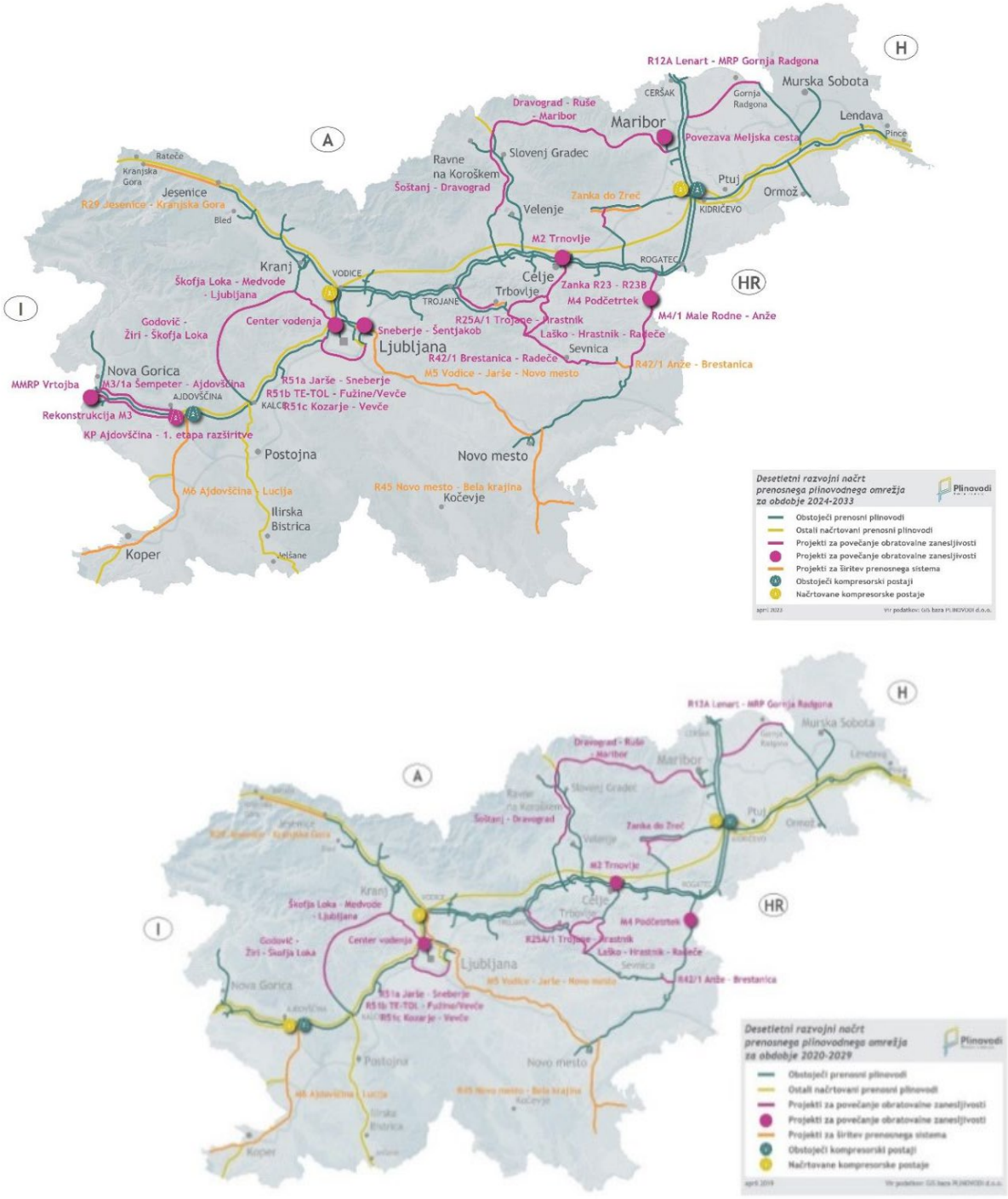
Depending on the purpose of the planned infrastructure, there are three groups of projects:

- projects to increase operational security and extend the transmission system,
- connecting new natural gas customers,
- the establishment of interconnection points with neighbouring operators; and
- hydrogen transport projects.

Energy loops, the transfer of pipeline sections due to specific settlement adjustments and the avoidance of landslides are part of the set of projects that allow for increasing operational security and expanding the transmission system. In several cases, these projects can also be used to expand and connect new municipalities.

[78] Advanced systems and the meaning of terms are defined in Article 2 of the Decree on measures and procedures for the deployment and connectivity of advanced metering systems (Official Gazette of the Republic of Slovenia No 79/15).

58Figure: Projects to increase security of operations

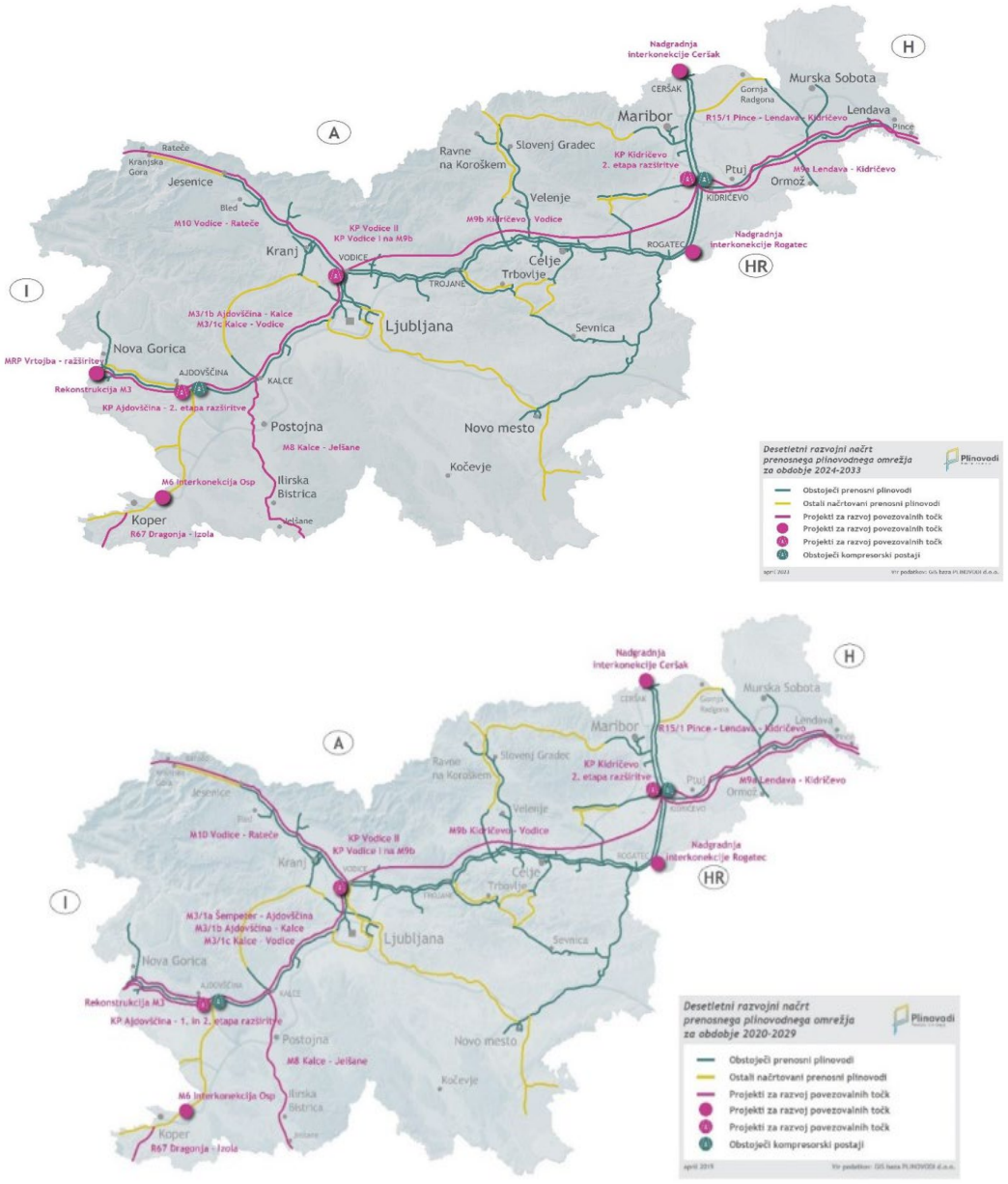


Source: Gas transmission system operator development plan 2024-2033, p. 59.

Interconnection projects (interconnections) with neighbouring transmission systems aim at creating new interconnection points with neighbouring systems, increasing already existing

transmission capacities, establishing reverse flows and meeting the N-1 infrastructure standard.

59Figure: Projects for the development of interconnection points with neighbouring transmission systems



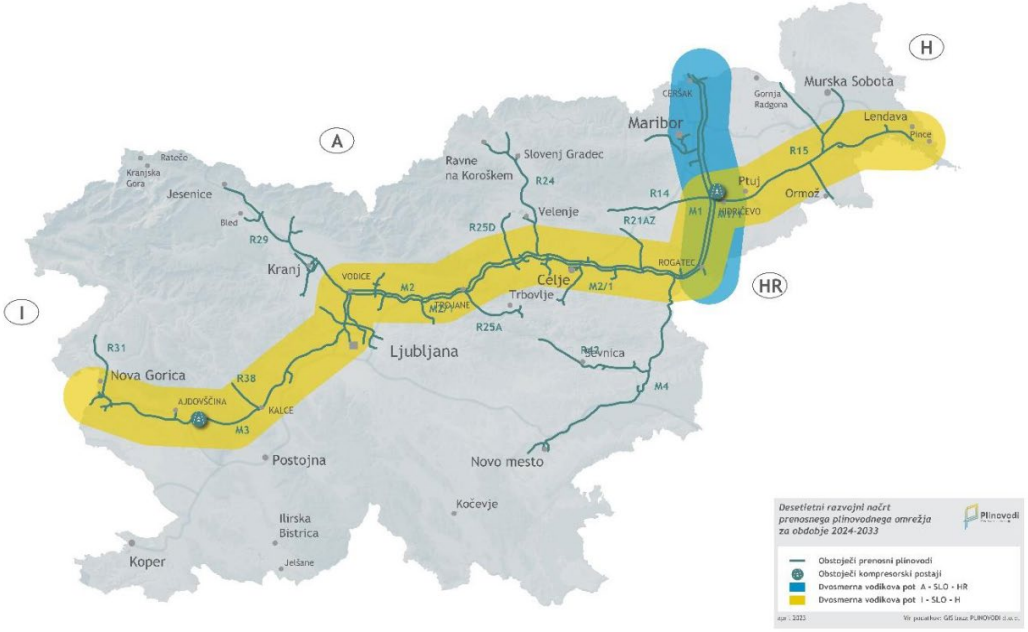
Source: Gas transmission system operator development plan 2024-2033, p. 66.

Preparing the hydrogen transmission system and hydrogen transport projects

The transmission system operator shall have in its plan a list of measures and activities to prepare the existing transmission system for the blending of hydrogen to natural gas. Measures and actions are foreseen for 2 %, 5 % and 10 % of hydrogen in natural gas. For higher shares, the establishment of a dedicated hydrogen system allowing for the transfer and refuelling of clean hydrogen is envisaged. The actions and measures consist of the preventive replacement of the oldest equipment, as well as equipment that is more vulnerable to hydrogen operation, the installation of additional equipment and systems to track the gas composition by the system and the upgrading of compressor stations. More detailed measures will be known after a thorough analysis of the system for operation with the selected share of hydrogen. All measures and activities will be coordinated with both system users and neighbouring operators, and the System Operating Instructions will be updated.

As the limit hydrogen concentration in Zemelsj gas must not be exceeded, the location of the injection of hydrogen into the transmission system has a significant impact on the amount of hydrogen that the transmission system can accept at each location. The dynamics of injection depend on the gas flows in the system, so the plan contains a list of locations in Slovenia indicating the maximum rated power of electrolysis that can be connected to the transmission system at an individual point. The rated electrolysis power may be further raised in case of installation of a hydrogen storage tank at the injection site.

Slovenia is planning two two-way hydrogen corridors: HU-SI-IT and HR-SI-AT, which will consist partly of existing gas and partly of new hydrogen infrastructure. Duplicate gas backbone pipelines will be used to create corridors, allowing for the creation and simultaneous separate operation of two parallel transmission systems, one for gas and one for hydrogen. This will make it possible, in particular for industrial gas consumers, to replace gas with hydrogen without interrupting energy supply and in the case of industrial customers without interrupting production processes.



Source: Gas transmission system operator development plan 2024-2033, p. 51

Gasification and synthetic gas production challenges

Gasification and synthetic methane production technologies have been in use for a long time, different gasification technologies are developed for both wood biomass gasification and combustible and plastic waste. These technologies shall be commercially available and suitable for the implementation of higher rated power. Plants for gasification of wood biomass of more than 100 MW are already in operation in Europe and beyond. Synthetic methane production technology is also already developed and exists in a number of applications, both in catalytic reactors and in biological reactors, which are commercially available and suitable for use in high rated power plants.

Gasification and methaneation technologies have already been tested in a variety of pilot projects in Europe and beyond, where the technology has proven to be suitable and mature enough for wider commercial use in higher rated power plants comparable to the rated power of larger existing thermal power plants. As the decarbonisation of the gas sector is expected in the future with a view to achieving climate objectives and the integration of the electricity and gas sectors, and as the need for the storage of redundant RES will increase and hence the volumes of renewable gases in pipeline networks, further research and solutions are needed to integrate gasification and methaneation technologies into energy systems. These cover both the gas and the electricity sectors (power-to-gas technologies) and, above all, further research into the impact of the increasing share of hydrogen and synthetic gas (SNG) will be essential. *Synthetic Natural Gas*) to parts of the pipeline network and related security of supply. Synthetic gas and hydrogen have different impacts on parts of the network due to their different composition and chemical and physical characteristics. Parts of the gas networks therefore need to be monitored and further specified and investigated with a view to making full use of the gas infrastructure even in a carbon-free future, as the gas sector offers the possibility of seasonal storage of surplus electricity from RES and transport of CO_2 neutral gases at minimal cost, as the construction of new transmission and distribution infrastructure will not be necessary and the power sector will be relieved.

R & D in the production and use of renewable gases in gas pipeline systems should focus primarily on analysing the impact of different compositions of renewable gases on pipeline networks and different types of end-users. Wider application requires a comprehensive view of the functioning of the whole sector. At the same time, it provides the basis for active action in determining the criteria, shares and acceptable compositions of renewable gases in the systems.

4.5.3 Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

Electricity Market

The Slovenian electricity market is at the crossroads of the three major European markets, the German-Austrian, Italian and south-eastern European markets, which also have the greatest impact on the pricing of electricity in Slovenia. The first two have seen a rapid

increase in production in wind and solar power plants in recent years, which are unpredictable and weather-dependent sources of energy. A further impact on the market situation has been the fact that most wind and solar power generation facilities are covered by national support schemes and can therefore offer very low electricity prices on the market in the past.

The situation has changed significantly with Russia's aggression against Ukraine, and in the second half of 2022 we started to face the biggest energy crisis in decades due to the curtailment of gas supplies from Russia and the consequent surge in electricity prices.

The single European electricity market, of which Slovenia has been an integral part since 2015, has proved to be one of the important measures to address this in practice. Finally, the newly established link with Hungary was also included in the mechanism in June 2022.

Wholesale market

The wholesale market in Slovenia is fully open and liberalised. Electricity producers, traders and suppliers meet on the market.

Borzen d.o.o. performs the role of electricity market operator and records all electricity transactions or contracts. This will record all contractually agreed commitments where electricity is purchased or sold in Slovenia, or energy is transferred across the border of the control area. Individual participants may enter into transactions bilaterally or on energy exchanges in Slovenia or abroad.

The power exchange in Slovenia is operated by BSP energa Borza d.o.o. The exchange carries out day-ahead and intraday trading. It is also possible to register transactions in the OTC clearing and settlement system. BSP is a nominated electricity market operator (NEMO).

The Energy Agency (AE) monitors the performance of the wholesale market in Slovenia. The AE performs, inter alia, market transparency oversight based on REMIT, which is a key basis for ensuring the integrity and transparency of the energy market and an integrated regulatory framework for monitoring and supervising the European wholesale electricity market.

Market concentration

In 2021, 20 domestic and foreign companies traded on the BSP. The combined market share of the three traders as an indicator of the concentration rate – CR3 was 80 % and the combined market share of five traders – CR5 slightly below 90 % 63.4 %.

Bilateral market

Bilateral trading takes place on an over-the-counter (OTC) market. It is carried out between two parties who determine the terms and conditions of the purchase or sale. Since the content of the bilateral contract is agreed, this is the most common form of trade. The contracts are closed and the records are carried out by the market operator. In 2021, the market operator recorded 105.920 closed contracts and operating forecasts with a total volume of 82.8 TWh. Compared to the previous year, the total number of closed contracts and operational forecasts recorded was 5.1 % lower in 2020, with trade volumes almost unchanged, with the total amount of energy from contracts falling by 0.7 %.

Day-ahead trading

The execution of day-ahead trading takes place by means of auction trading via a trading application. Products in this market segment shall be capped by a price range and a minimum

volume interval. Multi-regional Ahead Coupling (SDAC) is also involved in trading, which also allocates available cross-zonal transmission capacity (IPZ).

The total day-ahead trading volume in 2022 was 9.437 GWh, up from the previous year.

Day-to-day trading on stock exchange

Intraday auction volumes were 1.455 GWh in 2022.

The balancing market is also part of the day-to-day trading, allowing the electricity system operator to procure electricity to balance the system. On-going trading takes place in the balancing market. For ease of implementation, the Slovenian balancing market is linked to the intraday market.

Wholesale market liquidity

The liquidity of the wholesale market is determined by the Energy Agency on the basis of the calculation of the Churn factor. In 2021, the index appreciated slightly compared to the previous year, maintaining its value above 3, pointing to a well-developed Slovenian wholesale electricity market with a moderate degree of liquidity.

The final average price of electricity supplied for business demand at the end of 2021 was EUR 97.9/MWh, an increase of 11.3 % compared to the previous year. Business demand prices increased in most demand groups, but to varying degrees.

The total electricity price for a typical business customer in Slovenia in 2021 was markedly below the EU average at nominal level and at the same time lower than in Austria, Italy, Hungary and Croatia.

Based on the price average of the 27 EU countries for the five-year period observed (2017-2021), the analysis shows that the final price for household demand in Slovenia grew by around 7 percentage points in the last year compared to the previous year, moving to the ratio it reached in 2017-2019 to the EU-27. On the other hand, in Slovenia, business demand shows a drop in the final price vis-à-vis the EU-27, which indirectly suggests that the price growth for a typical business customer in the EU-27 was higher than in Slovenia.

Retail market

The retail market is fully liberalised and there is no regulation of retail prices. The data in the table below show that the Slovenian retail electricity market is well developed and that there are no systemic obstacles to its functioning. Market concentration (HHI) is reasonably low and has been increasing slightly in recent years (HHI in 2020: 1236, 2021: 1.259). Information on the situation on the electricity market is publicly available on the AE's website, which further contributes to the transparency of the functioning of the electricity market in Slovenia.

Table32: Basic information on the functioning of the retail electricity market in Slovenia (2021 data source: report of the Energy Agency)

Parameter	Year 2021
Number of customers (household and business customers)	971.7494
Number of all suppliers EE	23
Number of suppliers to household customers	17
Share of consumers with regulated price EE	0 %
Share of household EE consumers with a socially adjusted price EE	0 %
EE demand of business customers with regulated price EE (GWh)	0 %
HHI – Market concentration index for household and business customers EE	1259
Market share of the three largest suppliers to household and business customers	57.8 %
Proportion of modern measuring devices (NMI); 100 % planned by 2025	88 %
Number and share of suppliers offering dynamic price contracts EE	0
Total number of aggregators in the retail market EE	0
Volume and percentage of peak load that can be activated as active demand	No information
Share of prosumers (consumers and producers at the same time – self-supply)	0.23 %

Natural gas market

As Slovenia does not have its own natural gas resources, natural gas storage facilities or LNG terminals, the wholesale market for natural gas in Slovenia is limited by imports of natural gas through neighbouring natural gas transmission systems. The traders, who are also importers of natural gas, supply the Slovenian transmission system from neighbouring transmission systems. The natural gas traded on the wholesale market comes from the transmission systems of neighbouring countries that have their own sources of natural gas. The Slovenian wholesale market can obtain gas supplies from Austria, Italy and Croatia.

Market liberalisation has led to a reduction in the number of long-term contracts concluded directly with natural gas producers from Russia. They were replaced by short-term contracts concluded at gas hubs, exchanges and other points in the EU. In 2021, 77.3 % of natural gas was purchased under short-term contracts. The duration of the contracts – or the relative proportion of short-term and long-term contracts – may have an impact on security of supply, as a shortage of gas may lead to an insufficient supply if the necessary quantities cannot be purchased on the existing markets.

The distribution of natural gas is carried out as an optional local public utility service (GJS) the activity of a distribution system operator to supply household customers in urban and urban areas and as distribution to industrial and commercial customers in areas of closed distribution systems. According to the Energy Agency, in 2021[79], the distribution of natural gas in the form of GJS took place in 85 municipalities in most urban areas of Slovenia, with the exception of Primorska. The distribution of natural gas was carried out by 13 distribution system operators.

[79] Source: Agen RS, Report on the situation of energy in Slovenia in 2021.

Situation on the wholesale market for natural gas

Wholesale market for natural gas

The natural gas market in Slovenia is open and liberalised. There is no stock exchange for natural gas trading in Slovenia, trading of products 'within-day' and 'day ahead' takes place via the virtual point service offered to market participants by the natural gas transmission system operator.

Natural gas market concentration

There are 18 companies in Slovenia that transport gas to the country. The market share of the company with the largest share of natural gas imports into Slovenia is 49.9 %. 95 % of total natural gas imports into Slovenia are provided by the eight companies with the largest market shares, while 60 % of total imports are covered by only the two companies with the highest market share.

23 companies supply natural gas to system users. The maximum market share of each company is 43.7 %. 95 % of the total consumption of system users is supplied by the nine largest companies and 60 % of total consumption is covered by the three largest companies.

The combined market share of the four largest gas companies (Four-Firm Concentration Ratio – CR4) is 75.2 %.

Liquidity of the natural gas market

12 traders participate at the virtual point through which natural gas is traded. In 2021, there were 1.867 TWh of trading volumes at the virtual point, while there were no trading volumes via the intermediary trading platform. The Churn factor for 2018 is 1,01.

Imports and exports

In 2021, 12.015 TWh of natural gas were imported into Slovenia, while exports amounted to 1.829 TWh. Imports into Slovenia can be made via three border points and exports over two. The technical capacity in MWh/day is shown in the table below.

Table33: Background information on technical capacity to import and export natural gas to Slovenia

Border post	Entry technical capacity in MWh/day	Exit technical capacity in MWh/day
Ceršak (Austria/Slovenia)	139.867	/
Rogatec (Slovenia/Croatia)	7.697	98.922
Šempeter (Slovenia/Italy)	38.992	25.769

Demand and supply

In 2021, the demand for natural gas in Slovenia was 10.127 TWh. The total volume was imported from abroad, 85.1 % from Austria, 13.6 % from Russia, 1.1 % from Croatia and 0.2 % from Italy. Slovenia does not have its own natural gas production units and thus production for 2021 was 0 TWh. There are also no production units of biogas, hydrogen or

synthetic gas in Slovenia that would be connected to the pipeline network and the production of gas from renewable sources was also 0 TWh.

Slovenia also does not have at its disposal natural gas storage facilities and facilities for the production of LNG.

The crisis in Ukraine has led to diversification of supply routes and sources, leading to an increase in the share of gas supplied from Italy and a reduction in the share of raw gas from Russia.

Other relevant factors

The gas transmission system operator shall provide certain support mechanisms to promote the use of renewable gases and alternative fuels in transport:

- with a view to promoting the use of gas from renewable sources, the transmission system operator shall take into account the factor of renewable sources in the network charge calculation and shall take it into account as a discount in the calculation of the network charge;
- in order to promote the alternative use of gas in transport, the transmission system operator shall take the compressed natural gas factor into account when calculating the network charge and shall take it into account as a discount in the calculation of the network charge.

Situation on the retail market for natural gas

The Slovenian retail market comprises final customers on the distribution and transmission systems. Retail prices are unregulated for all types of customers. The distribution system comprises 122.400 household customers, 49 customers in closed distribution systems and 14600 utilities. 143 business customers are connected to the transmission system. The average consumption of household customers is 10.700 kWh per year. The Herfindahl-Hirschman Index for the natural gas market is 2364. The market share of the three largest suppliers is 66 %. The share of customers switching natural gas suppliers is 3.2 %.

Customers on the gas distribution system shall be measured mainly by conventional gas meters read at least once a year by the distribution system operator, while the customer shall be able to report the meter reading at any time to the distribution system operator or supplier. The share of smart meters is negligible.

Objectives of the development of the natural gas market

In order to achieve the objectives of the climate agreements, we will also take into account the guidelines and recommendations of the European Commission and ENTSO-G for the progressive replacement of natural gas by renewable gases such as synthetic natural gas (SNG), hydrogen and biomethane. The appropriate transformation of renewable gases into the energy balance will require the development of a market for renewable gases, which may exist within the natural gas market or as a stand-alone market. Renewable gases available on the market will be made available to suppliers that will deliver renewable gases to final customers in different sectors, thereby contributing to the decarbonisation of each sector and to a lower carbon footprint of each final customer. The development of a liquid market for renewable gases will contribute to increasing the share of renewable gases in natural gas and

thus reducing the price of such gases, making renewable gas production more commercially attractive. This increases the potential for developing domestic renewable gas production as a market activity that domestic unregulated energy companies will be able to engage in.

The transmission system operator will continue to contribute to the development of the renewable gas market by taking into account the network discount in case of transmission of renewable gas. The gas system operator will only be able to participate in pilot projects for the production of renewable gases with the consent of the Energy Agency. Such pilot projects will seek answers to questions concerning the conditions for connection of larger production facilities to the gas pipeline system, which will be built by unregulated companies following the penetration of renewable gases. This will enable gas system operators to continue to ensure a safe and secure supply of natural gas with varying shares of renewable gases.

The development of a market for refurbishing gases will require the establishment of a system of certification of flux gases, allowing manufacturers and buyers to trade in hydrogen, synthetic methane and biomethane.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Projections for energy prices are given in Chapter 4.1. The projected evolution of the main external factors affecting the energy system and GHG emission trends, sub-chapter iii. Global energy trends, international fossil fuel prices, carbon price in the EU-ETS system.

4.6 Dimension research, innovation and competitiveness

i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

Promoting the transition to a climate-neutral society (PND)

In order to reduce GHG emissions, increase energy efficiency and the use of renewable resources, several operational programmes have been adopted in Slovenia, which provide for various measures to encourage companies to switch to PND. Key instruments in the area of green economic growth are: promoting research and innovation for the transition to PND, promoting entrepreneurship for the transition to PND and demonstration projects.

The European Cohesion Policy (Cohesion Policy) programme 2021-2027 in Slovenia (2022) aims at promoting the green and digital transitions, with a focus on measures to make the economy and society more resilient, accelerating the transition to a highly productive, low-carbon and circular economy, with the ultimate objective of quality of life for all. Cohesion funding for Slovenia over the 7-year period amounts to EUR 3.2 billion. A policy objective 1, a more competitive and smarter Europe, EUR 727 million, of which EUR 436.5 million for research and development, EUR 183.2 million for small and medium-sized enterprises and EUR

107 million for digitalisation. Policy objective 2 "A greener, low-carbon Europe" foresees EUR 793 million of investments, of which EUR 103 million to improve energy efficiency and reduce greenhouse gas emissions, with a focus on energy renovation of buildings, EUR 168 million for investments in RES and the related development of smart energy systems, grids and storage, and for other projects of EUR 194 million to promote the transition to a circular economy and sustainable urban mobility. Improving sustainable (cross-)regional mobility and connectivity is at the heart of policy objective 3, A more connected Europe by improving mobility, for which EUR 511 million will be allocated. Furthermore, under the Cohesion Fund, EUR 294 million will be dedicated to the restructuring and green transition of two coal regions in Slovenia (Policy Objective 6, Europe for Just Transition). During operations of strategic importance for Slovenia in 2021-2029, one of the seven operations highlights the upgrading of key research infrastructures, with the measure consisting of upgrading RIUM, upgrading HPC capacities and acquiring cutting-edge research equipment, setting up the INNOVUM Technological Innovation Centre and building a new Faculty of Machinery.

In 2021, Slovenia adopted a **Recovery and Resilience Plan (RRP**, 2021), which foresees as much as EUR 1053.8 million or 42.45 % of grants and loans to achieve the objectives of the green transition by 2030. EUR 40 million will be allocated to research, development and innovation (R & D & I). Comparatively, EUR 532,75 million, i.e. 21.46 %, will be allocated to the area of digital transition, of which EUR 10 million will be allocated to research, development and innovation. In the area of smart, inclusive and sustainable growth, EUR 132,22 million will be allocated to R & D & I out of EUR 737,36 million. Including the fourth area of health and social security, the RRP foresees EUR 2.48 billion in investment, of which EUR 1.78 billion in grants. Adjustments to the RRP are currently under preparation to enable the achievement of the objectives of the European REPowerEU plan in relation to ending dependence on Russian fossil fuels and accelerating the green transition.

Table34: Planned allocation in the RRP for green transition by component

Component	Amount of resources (EUR million)	Share (%)
RES and EE in the economy	143,00	5,76
Sustainable building renovation	62,02	2,50
Clean and safe environment	365,16	14,71
Sustainable mobility	282,05	11,36
Circular Economy – Resource Efficiency	24,72	1,00
Research, development and innovation	40,00	1,61
Raising productivity, a business-friendly environment for investors	55,40	2,23
Sustainable development of Slovenian tourism, including cultural heritage	13,80	0,56
Strengthening competences, in particular digital competences and those required by new occupations and the green transition	67,65	2,72
Total	1.053,80	42,45

Source: RRP, 2021

It follows from the **Climate Change Fund spending programme for** 2022 and 2023 (OJ RS 138/2022) that EUR 542.8 million will be allocated to the fight against climate change, of which EUR 15.5 million will be allocated to research, innovationand competitiveness:

technological innovation, development and demonstration in the field of low-carbon (EUR 2.1 million), digital transformation of space and environment (EUR 5.1 million), green jobs (EUR 2.9 million), implementation of the Comprehensive Strategic Project Decarbonising Slovenia through the transition to a circular economy (EUR 2.3 million), climate objectives and content in education (EUR 2.75 million), LIFE BioTHOP (EUR 0.16 million), LIFE Turn to e-Circular (EUR 0.283 million) and LIFE HIDAQUA (EUR 0.074 million).

Accelerating clean energy innovation and the Innovation Fund

In its resolution of 6 February 2018 on accelerating clean energy innovation (2017/2084(INI)), the European Parliament noted that clean energy R & D & I is highly dependent on a stable market and the predictability and reliability of the regulatory framework. However, a stable regulatory framework requires a demanding and realistic long-term policy vision, including energy and climate targets and commitments, sustainable targeted incentives and equity, in order to create a level playing field between technologies, thereby stimulating innovation, facilitating energy supply, reducing barriers to market entry and enabling clean energy innovation to reach the necessary critical mass for market deployment.

The resolution stresses the need to pay more attention to cross-cutting cross-sectoral system innovation in the field of energy, as well as to promoting education and entrepreneurship, as innovation is not only driven by technology. The European Parliament's resolution foresees the development of a systemic approach in such a way that it can effectively integrate the various solutions available or under development, in particular with regard to energy efficiency and the integration of RES, and calls for the use of European Technology and Innovation Platforms to identify future clean energy innovations suitable for targeted support.

The amended EU Emissions Trading System Directive (Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (OJ L 76, 19. 3. 2018, p. 3)) in 2018 the legal basis for a new Innovation Fund was provided to provide funding for innovative low-carbon industrial and energy technologies in the period up to 2030. Technologies supported by the Innovation Fund should prepare breakthrough solutions or be sufficiently mature for pre-commercial demonstration. By 2030, the fund is expected to distribute around 10 billion to smaller projects (up to EUR 7.5 million) and larger projects (above EUR 7.5 million). In 2023, a third call was launched under **EUR 100 million in grants** for small-scale projects with capital expenditure of between EUR 2.5 million and EUR 7.5 million in the areas of renewable energy, decarbonisation of energy intensive industries, energy storage and carbon capture, utilisation and storage. In Slovenia, the BEAR project Steklarne Hrastnik and the Slovenian Institute of Ljubljana have been pre-selected for funding from the Innovation Fund in 2021. The project in the energy intensive industry aims to develop a new hybrid electric furnace for the production of packaging glass with 40 % of electricity and 170 tonnes of glass per day. The project is expected to contribute to more than 50 % reduction in natural gas consumption compared to existing technology and to 35 % greenhouse gas emissions savings (96.384 tonnes of CO_2 in the first 10 years of operation).

Innovative energy projects that contribute to the EU's low carbon energy transition require a better investment climate. In this context, the Regulation on the Governance of the Energy Union was adopted in 2018, which aims to ensure that all elements of the Energy Union are coordinated and coherently pursued and that climate and environmental objectives are achieved by 2030 as part of international commitments. The Regulation foresees that Member States will prepare and submit to the Commission national long-term development strategies for a low carbon economy supported by stable policies and regulations to promote and support the use of renewable energy and further emission reductions.

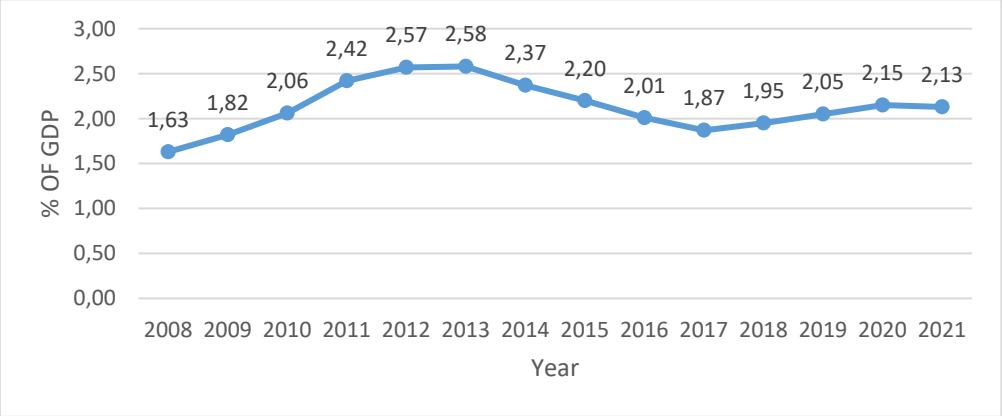
For major innovative low-carbon energy demonstration projects, in line with the recommendations of the Special Report of the European Court of Auditors80, in cases where the proposed Innovation Fund and other relevant centrally managed EU funding programmes present large, capital-intensive projects requiring a combination of national and EU support, the Commission should assess their consistency with the National Climate and Energy Plans and obtain clear and transparent commitments from Member States prior to the allocation of EU funds.

II. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

Research and development (R & D) data for 2021 show that in 2021 Slovenia spent EUR 1113 million or 2.13 % of GDP on RRD in all sectors combined where this activity took place. Compared to the previous year (i.e. 2020), these assets increased in nominal terms by 10.4 % or EUR 105 million and, when expressed as a share of GDP, decreased by 0.02 percentage points. In absolute terms, the increase in RRD funding was most pronounced in the business sector (although it spends most on the implementation of the RRD); in nominal terms, RRD funding in the business sector was EUR 77.2 million, or 10.5 % higher than in the previous year (SURS, 2023).

[80] Special report of the European Court of Auditors: Demonstrating carbon capture and storage and innovative renewables at commercial scale in the EU: the planned progress over the past decade has not been achieved, 2018.

60Figure: Share of gross domestic R & D expenditure in gross domestic product, Slovenia



Source: SURS, 2023

The table below, showing gross domestic expenditure on RRD by sources of financing in 2021, shows that the largest share of RRD goes to companies (almost 50 %), followed by sources from abroad (26 %) and State sources (24 %).

Table35: Gross domestic expenditure on RRD by sources of financing in 2012-2021 in Slovenia

(v 1000 EUR)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2021 (v %)
Vir financiranja - SKUPAJ	928.306	935.006	890.231	853.067	811.953	802.291	892.724	990.698	1.007.493	1.112.490	100,00%
Gospodarske družbe	577.610	596.981	608.828	590.398	562.259	433.766	462.689	514.421	498.709	542.094	48,73%
Državni viri	266.190	251.263	193.930	169.644	163.940	183.339	211.630	244.903	252.570	270.405	24,31%
Visoko šolstvo	4.021	3.236	4.572	2.893	3.204	3.630	4.086	4.662	7.490	5.769	0,52%
Zasebne nepridobitne organizacije	994	194	422	66	46	3.568	1.389	339	590	459	0,04%
Viri iz tujine	79.491	83.330	82.479	90.066	82.505	177.988	212.929	226.373	248.135	293.764	26,41%

Source: SURS, 2023

The table below, showing Slovenia's gross domestic expenditure on RRD coming from State sources over the period 2012-2021, shows that since 2012 the share of state resources in gross domestic expenditure on RRD declined until 2015, when it started to increase gradually. In 2021, the share decreased by 0.76 percentage points compared to the previous year.

Table36: Gross domestic expenditure on RRD in Slovenia coming from state sources in 2012-2021

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Vir financiranja - SKUPAJ (v 1000 EUR)	928.306	935.006	890.231	853.067	811.953	802.291	892.724	990.698	1.007.493	1.112.490
Državni viri (v 1000 EUR)	266.190	251.263	193.930	169.644	163.940	183.339	211.630	244.903	252.570	270.405
Državni viri (v %)	28,67%	26,87%	21,78%	19,89%	20,19%	22,85%	23,71%	24,72%	25,07%	24,31%

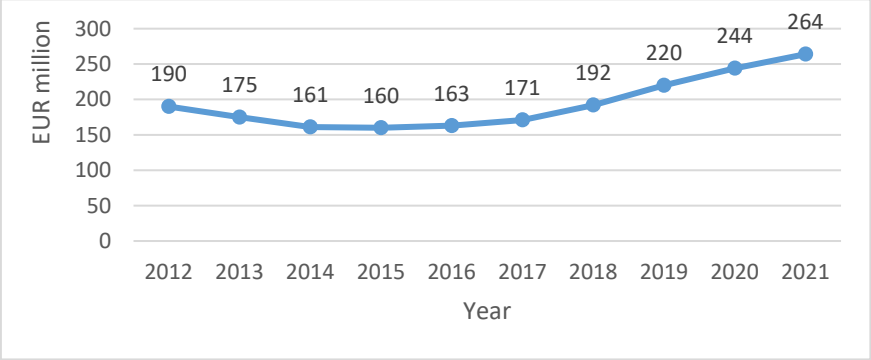
Source: SURS, 2018

According to the final budget, Slovenia allocated EUR 264.4 million of state budget resources to R & D activity in 2021, an increase of EUR 20.8 million or 8.5 % compared to the previous

year. The RRD budget has thus been increasing since 2015. In doing so, the RRD government budget-to-GDP ratio remained virtually unchanged in 2021 compared to 2020 – at 0.51 % of Slovenia's GDP. The initial budget for 2022 foresaw more resources than in 2021 for the RRD. The initial funds from the State budget foreseen for the implementation of the RRD in 2022 amounted to EUR 314,2 million, which is EUR 50 million more than the State actually committed to the RRD in 2021 (SURS, 2022).[81]

Of the state budget allocated in 2021 to the RRD, almost half (48.1 %) were dedicated to the overall progress of knowledge. The next ones in terms of allocations were for health (12.4 %) and for industrial production and technology (11.3 %). The vast majority of the state budget for the RRD for 2021, more specifically 91.6 %, was earmarked for the implementation of the RRD in the state and higher education sectors; 52.8 % were received by the State and 38.9 % by the higher education sector. The remaining tenth of the RRD funding in 2021 was directed to the business (6.8 %) and the private non-profit sector (0.8 %) as well as to the rest of the world (0.8 %) (SURS, 2023).

61Figure: State budget for RRD in Slovenia 2012-2021



Source: SURS, 2023

In 2021, 16.282 (or 64 %) of the 25.363 natural persons regularly employed by the RRD were researchers. If the volume of work performed in the RRD in 2021 is expressed in terms of full-time equivalents (FTEs), thus avoiding an underestimation or overestimation of RRD employee data, we see that the total number of people working in the RRD has worked 17.396 full-time, of which 11.068 researchers (64 %) (SURS, 2023).

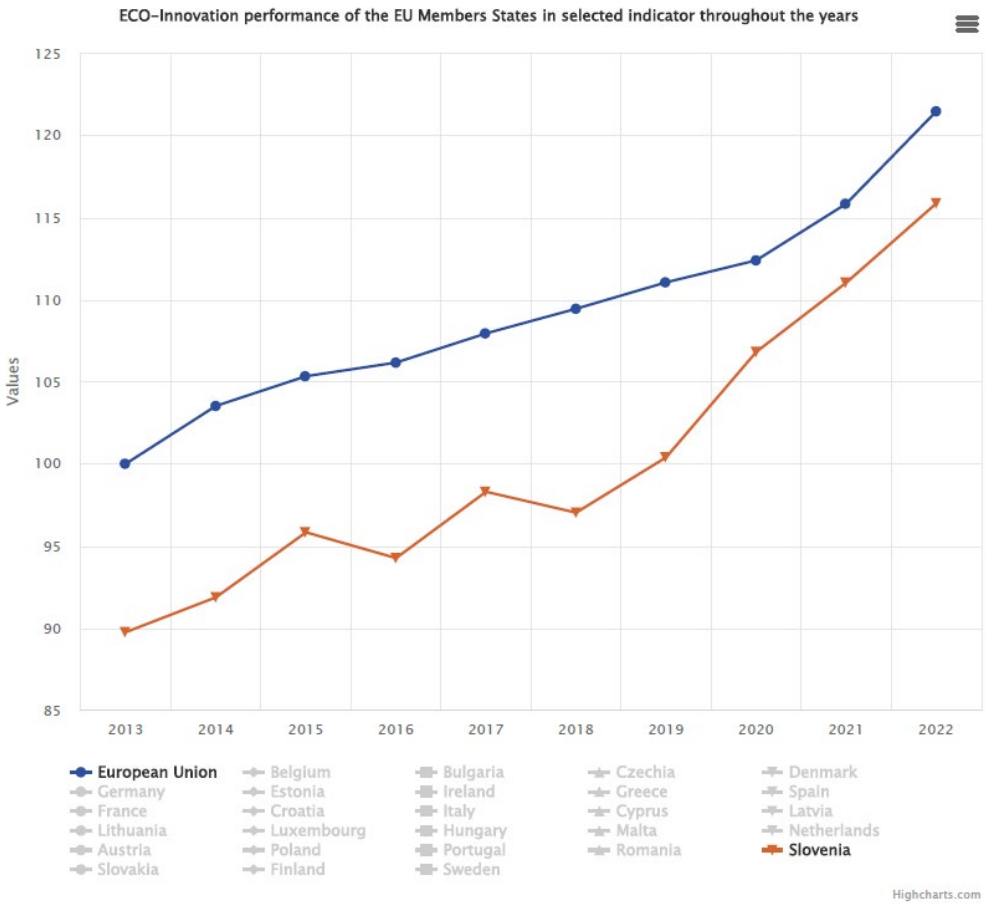
Data also show that women are still in a minority of researchers. Of the total number of people working as researchers in 2021 (expressed in natural persons), 34 % were women. Analysis of 2021 recruitments of female and female researchers in the three most important sectors shows that the highest proportion of female researchers in the state sector (50 %), 45 % of female researchers were in the higher education sector and the proportion of female researchers in the business sector (25 %) was again markedly low (SURS, 2023).

[81]SURS, 2022, National budgets for R & D activity, realised budget 2021 and initial budget 2022 (correction), available at https://www.stat.si/StatWeb/News/Index/10668.

Slovenia does not have precise data on the number of patents in the field of low-carbon technologies. As a result, only some partial information, which is publicly available, is listed below.

The Eco-Innovation Index for Slovenia shows tangible progress in Slovenia and a catching-up for the EU-27 after 2018 (EC, 2022). Slovenia belongs to the group of average innovators in 2022.

62Figure: Eco-innovation index for the EU and Slovenia in 2013-2022



Source: EC (2022). Erupean Eco-Innovation Scoreboard, 2022.

Out of the five elements of the index, it scores the best relative to the EU for eco-innovation activities (index 138.2 relative to the EU and relative worst for socio-economic outcomes (index 97.1 versus the EU) (Upper and Hranilovic, 2022). Slovenia performs best on eco-innovation indicators in terms of eco-innovation scientific publications and employment in the areas of environmental protection and management of natural resources. However, it ranks worst in eco-innovation patents and added value in the field of environmental protection and management of natural resources.

Table37: Eco-innovation index by component for Slovenia and comparison with the EU in 2022

ANNEX II -Eco-innovation performance overview

Indicator	Indicator value[1]	Performance relative to EU[2]
Eco-Innovation Index	0.480	115.9
1. Eco-innovation inputs (normalised score)	0.672	122.3
1.1. Governments environmental and energy R&D appropriations and outlays (% of GDP)	0.05%	105.7
1.2. Total R&D personnel and researchers (% of total employment)	1.66%	146.2
2. Eco-innovation activities (normalised score)	0.459	138.2
2.1. Number of ISO 14001 certificates (per million population)	234.2	138.2
3. Eco-innovation outputs (normalised score)	0.551	133.4
3.1. Eco-innovation related patents (per million population)	12.3	41.3
3.2. Eco-innovation related academic publications (per million population)	30.3	433.4
4. Resource efficiency outcomes (normalised score)	0.375	102.6
4.1 Material productivity (GDP/Domestic Material Consumption, €/kg)	2.0	132.2
4.2 Water productivity (GDP/total fresh water abstraction, €/m³)	61.3	108.9
4.3 Energy productivity (GDP/gross inland energy consumption, €/toe)	6.4	85.8
4.4 GHG emissions productivity (GDP/CO2e)	3.8	126.1
5. Socio-economic outcomes (normalised score)	0.406	97.1
5.1 Exports of products from eco-industries (% of total exports)	1.97%	81.0
5.2. Employment in environmental protection and resource management activities (% of total workforce)	3.21%	163.4
5.3. Value added in environmental protection and resource management activities (% of GDP)	1.61%	60.1

Source: Vrabec, N., Hranilovic, M. (2022): ECO-Innovation Country Profile 2022: Slovenia. Ecorys.

III. Breakdown of the current price elements comprising the three main price components (energy, network, taxes/levies)

Structure of the electricity price

As the electricity market is open and competitive, final electricity prices are influenced by market conditions and factors. The Energy Agency monitors prices in the markets for household and small business customers on a monthly basis, as it obtains data on prices or offers on the retail market from suppliers on a monthly basis. The market for large business customers is analysed on a semi-annual and annual basis by the Agency on the basis of data from EPOS (reporting e-reporting system for energy service providers) managed by the Ministry of Infrastructure.

The figure below provides an analysis of the final price structure of electricity supplied to typical household consumers. The final amount for the payment of the electricity supplied to the customer consists of (Report on the energy situation in Slovenia in 2021, p. 110):

- the price of electricity freely formed on the market;
- network charges (transmission network charges and distribution network charges);

- contributions (contribution to providing support for the production of electricity from high-efficiency cogeneration and from RES, contribution to energy efficiency and contribution to the functioning of the market operator);
- excise duties on electricity and value added tax (VAT).

63Figure: Evolution of final electricity price in Slovenia for typical household customers (Dc – 2,500 to 5 000 kWh per year) in 2017-2021

Source: Report on the energy situation in Slovenia in 2021, 110.

The final price for this typical household customer increased by 7.4 % in 2021 compared to 2020, mainly due to the removal of government measures in 2021 (non-invoicing of the billing power tariff line and RES contribution in the first wave of the epidemic in 2021), leading to a 12.4 % increase in network charges in 2021, while the electricity price also increased (by 2.9 %). Compared to the pre-pandemic year 2019, network charges decreased by 7.4 % in 2021 and the electricity price increased by 12.4 % (Report on the energy situation in Slovenia in 2021, p. 111).

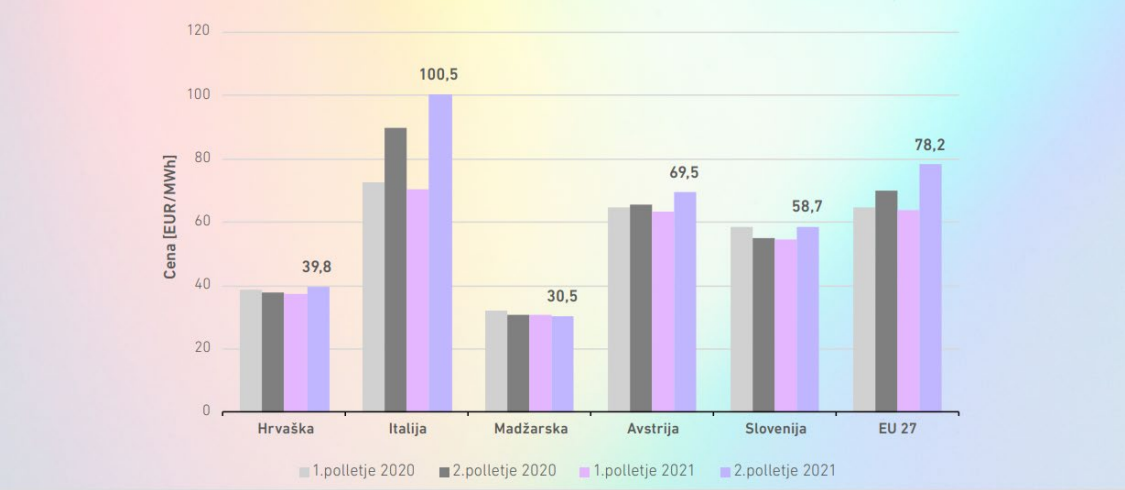
The final price of electricity supplied excluding value added tax for average business consumption was EUR 97.9/MWh, an increase of 11.3 % compared to 2020 (Report on the energy situation in Slovenia in 2021, p. 113).

A typical household decoder in Slovenia paid a lower final electricity price than the average price in the EU, as well as less than consumers in Austria and Italy, but more than in Croatia and Hungary. However, business consumers paid a markedly lower average price than in the EU and also lower than all neighbouring countries. Lower prices than in Slovenia were paid only in Luskiburg and Finland (Report on the energy situation in Slovenia in 2021, pp. 114-116).

Structure of the price of natural gas

Thefigure below shows final natural gas prices in 2020 and 2021 for typical household consumers of natural gas D2 with annual consumption of between 5.556 and 55.556 kWh in Slovenia and EU countries. In Slovenia, final natural gas prices in 2021 remained at the same level as in 2020, unlike neighbouring countries, with the exception of Hungary, where there is a price increase, the highest in Italy (by 5 %). However, a comparison with the EU shows that final natural gas prices for typical household consumers in Slovenia continue to lag behind the EU average. In all neighbouring countries, with the exception of Hungary, natural gas prices increased on an annual basis. The largest price increases were recorded in Italy, where the price increased by more than 5 % on an annual basis compared to 2020 (Report on the energy situation in Slovenia in 2021, p. 221).

64Figure: Final natural gas prices for a typical household customer D2 with all taxes and levies for Slovenia and EU neighbouring countries in 2020 and 2021

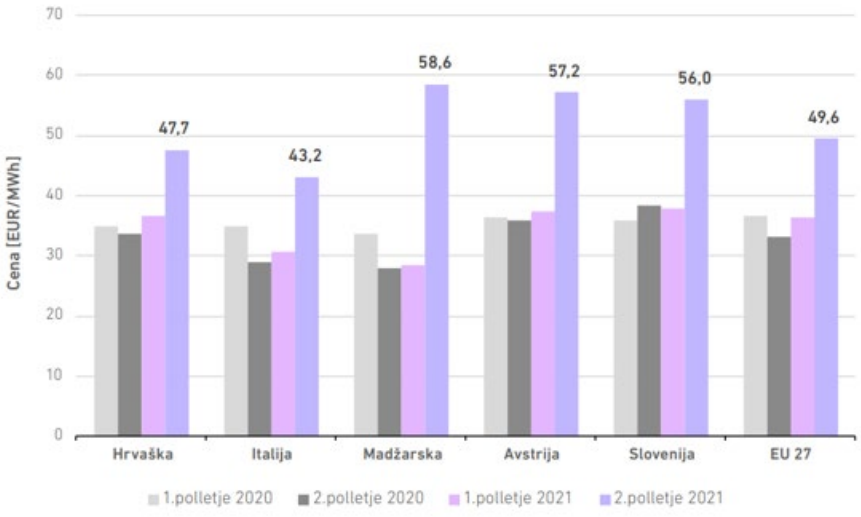


Source: Report on the energy situation in Slovenia in 2021, p. 222.

Thefigure below shows the biannual evolution of natural gas prices with all taxes and levies in 2020 and 2021 in Slovenia and EU countries for large industrial consumers of natural gas I3 with annual consumption of 2.777.800 to 27 778 000 kWh. The price for this group of business customers increased by more than 26 % over the whole year 2021 compared to 2020 and increased by 48.1 % in the second half of the year compared to the first half of the year. Final prices also increased in all neighbouring countries, most notably in Hungary, which experienced the highest biannual growth in 2021 (by 106 %). For these consumers, Slovenia's final price for natural gas increased by more than 26 % per year, compared with 48.1 % in the second half of the year compared with the first half of the year. The final price of natural gas for typical business customers was 8.9 % above the EU average. Compared to the previous year, final prices were also higher in all neighbouring countries. The highest annual increase in final natural gas prices in Hungary was around 41 %; the latter also suffered the highest

biannual growth, as final prices more than doubled in the second half of the year. Price increases were lowest in Italy (Report on the energy situation in Slovenia in 2021, p. 223).

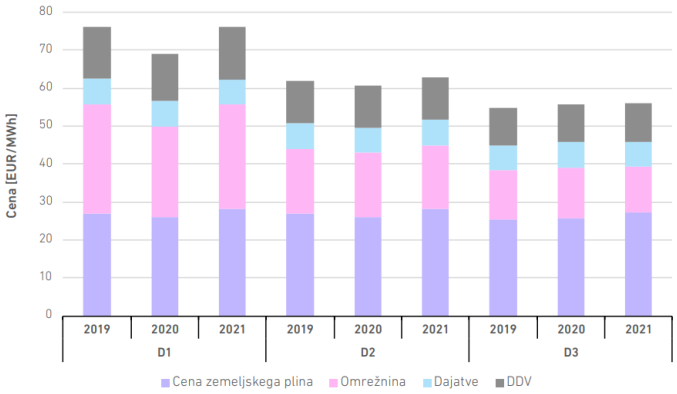
65Figure: Final price of natural gas with all taxes and levies for a typical I3 industrial customer for Slovenia and individual EU countries in 2020 and 2021



Source: Report on the energy situation in Slovenia in 2021, p. 223.

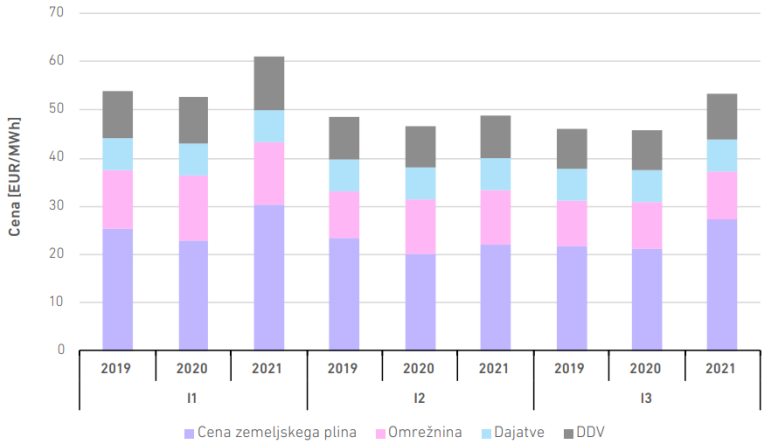
The following two figures show the structure of the final price for typical household and business customers connected to distribution systems in 2019-2021. The change in all price components for all consumer groups of household customers was not the same. While for the consumer groups D2 and D3 the share of Earth's gas increased, it slightly decreased by D1. For all consumer groups of business customers, the share of natural gas (energy) price in the price structure increased in 2021 and the share of network charges and charges decreased.

66Figure: Structure of the final price of natural gas for household customers in 2019-2021



Source: Report on the energy situation in Slovenia in 2021, p. 224.

67Figure: Structure of the final price of natural gas for business customers 2019-2021



Source: Report on the energy situation in Slovenia in 2021, p. 225.

IV. Description of energy subsidies, including for fossil fuels

Subsidies in the energy sector

Subsidies in the energy sector amounted to EUR 128 million (current prices) in 2021. They relate only to support for the production of electricity from RES and CHP. A tabular presentation of the structure of subsidies paid per year in the period 2010 to 2021 is given in the table below.

Table38: Subsidies granted in the energy sector 2010-2021

EUR million in current prices	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
RES and EE	49	70	90	119	131	147	146	144	135	123	125	128

Source: Analysis of IJS – CEU, database Ministry of Infrastructure – Energy Directorate[82]

Incentives contrary to the objective of reducing GHG emissions

Incentives that run counter to the objective of reducing GHG emissions fluctuate over the years. These incentives continued to grow until 2017, before gradually declining thereafter. In 2021, however, there is again growth in incentives that run counter to the objective of reducing GHG emissions. Excise duty refunds on diesel are still the highest in 2021 in terms of share (74 %), of which the largest destination is for the reimbursement of excise duty for the commercial transport of goods and passengers, refunds of excise duty for industrial-commercial purposes and others (53 % for commercial diesel). Their level also varies according to the level of the excise duties themselves per individual energy product. In 2021, incentives contrary to the GHG emission reduction target totalled EUR 81 million (current prices). The content in this chapter is summarised on the basis of[83]OECD statistics, which

[82] Source: Subsidised electricity generation from renewable energy sources and high-efficiency cogeneration, Slovenia – Ministry of Infrastructure – Energy Directorate

[83] OECD Statistics – Fossil Fuels Support; SVN: https://stats.oecd.org/Index.aspx?DataSetCode=FFS_SVN#

collects data on incentives that run counter to the GHG reduction target for several countries, including Slovenia.

5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

Chapter "5 POLICY POLICY POLICY AND ACTIONS" will be updated in the final phase of the update of the document.

5.1 Effects of planned policies and measures on energy systems and emissions

5.1.1 Projections of the evolution of the energy system up to 2040

5.1.2 Projections of the evolution of greenhouse gas emissions and removals by 2050

5.1.3 Energy savings

5.1.4 Renewable energies

5.2 Macroeconomic and other effects of the NECPs

5.2.1 Macroeconomic effects of energy-climate scenarios

5.2.2 Environmental and social impacts of energy-climate scenarios

Impacts on environmental well-being

Effects on consumer welfare

Effects on employment

Health impacts

Effects on education

5.3 Overview of investment needs

5.3.1 Existing investment flows and future investment assumptions, taking into account planned policies and measures

5.3.2 Sectoral or market risk factors or barriers in the national or regional context

5.3.3 Analysis of additional public support or resources to fill the gap

5.4 Impacts of planned policies and measures on other Member States and regional cooperation by 2030

5.4.1 Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

5.4.2 Effects on energy prices, energy services and energy market integration

5.4.3 Impacts on regional cooperation

Abbreviation list

AE	Energy Agency
AKIS	Agricultural Knowledge and Innovation System, *Agricultural Knowledge and Innovation Systems*
AN	Action plan
AN RES	Renewable Energy Action Plan
AN HOUR	Energy efficiency action plan
AP AGvP	Action Programme on Alternative Fuels in Transport
aRPF	automatic frequency restoration reserve (secondary frequency regulation), ang. *Automatic Frequency Restoration Reserve*
ARM	sufficiency of capacity, ang. *Adequacy Reference Margin*
ARRS	Slovenian Research Agency
BAT	BAT, a.k.a. *Best Available Technology*
GDP	gross social product
BiH	Bosnia and Herzegovina
B2B	"*Business to Business*" – Business-to-business sales of goods and services
B2C	"*Business to Consumer*" – selling goods and services directly to the customer
CCS	Carbon Capture and Storage (CCS) *Carbon Capture and Storage*
CCU	Carbon Capture and Utilisation (CCU) *Carbon Capture and Usage*
CNG	ang. *Compressed Natural Gas*, Compressed Natural Gas
CPVO	integrated environmental impact assessment
CDE	targeted research project
ČHE	pumped hydropower plant
VAT	value added tax
DEES	electricity distribution system
UNTIL	district heating
DOH	district heating and cooling
DSEPS	Long-term strategy to boost investment in energy renovation of buildings
DU	scenario with additional measures
DUA	scenario with additional measures – ambitious
DV	transmission line
DZ	national Assembly Republic of Slovenia
EDP	electric distribution company
EE	electricity
EES	Slovenia's electricity system
EFTI	electronic documents in transport, ang. *Electronic Freight Transport Information*
EGDIP	European Green Investment Plan *European Green Deal Investment Plan*
EIMV	Milan Vidmar Electrical Institute

EIO	Eco-innovation Observatory, *ECO Innovation Observatory*
EIP	A European Innovative Partnership
EC	European commission
ECS	Energy concept of Slovenia
ELENA	ang. *European Local Energy Assistance*
ELES	Slovenian Transmission System Operator
ENTSO	European Network of Transmission System Operators for Electricity, *European Network of Transmission System Operators for Electricity*
FTE	full-time equivalent
EPO	energy contracting
EPOS	reporting system for e-reporting of energy service providers' data
ESD	GHG emissions not covered by the EU-ETS scheme aNGL*. Emission scenario documents*
ERDF	European Fund for Regional Development
ETS	EU Emissions Trading Scheme, a.k.a. *EU Emission Trading Scheme*
EU	European Union
EUCO	EC Scenario Group for assessing the impacts of environmental policies, *European Commission, core policy scenarios using the PRIMES Model*
EV	electric vehicle
EZ	Energy Act
FBC	fluidised bed combustion flaring
GE	geothermal energy
GGO	forest management areas
GJS	commercial public service
HE	hydroelectric power plant
HHI	market concentration, *Herfindahl-Hirschman Index*
HWP	Harvested wood products, aNGL*. Harvested Wood Products*
IARC	International Agency for Research on Cancer, *International Agency for Research on Cancer*
IEA	International Environment Agency, ang. *International Energy Agency*
IJPP	integrated public passenger transport
ILUC	direct land-use change, *Indirect Land Use Change*
IPCC	Intergovernmental Group on Climate Change, Ang. *Intergovernmental Panel on Climate Change*
JPP	public passenger transport
JT	Just Transition Fund *JUST Transition*
KGZS	Chamber of Agriculture and Forestry of Slovenia
LEA	local energy agencies
LIFE	European Programme – Environment Funding Instrument, fr. *"L'Instrument Financier pour l'Environnement"*
LOLE	Expected duration of power supply failure, ang. *"Loss of Load Expectation"*
LNG	natural Gas – in liquefied state

LULUCF	land-use change and forestry, *Land Use Land Use Change and Forestry*
M2M	machine-to-machine communication *Machine to machine*
MF	Ministry of Finance of Slovenia
MGRT	Ministry of the Economy of the Republic of Slovenia
mHE	small hydro-electric power plant
MIZŠ	Ministry of Education, Science and Sport of the Republic of Slovenia
MJU	Ministry of Public Administration of the Republic of Slovenia
MKGP	Ministry of Agriculture, Forestry and Food of the Republic of Slovenia
MOP	Ministry of the Environment and Spatial Planning of the Republic of Slovenia
MOPE	Ministry of the Environment, Climate and Energy of the Republic of Slovenia
IMPZ	inter-zonal transmission capacity
MRC	collaboration to calculate the price on the daily market, *Multi Regional Coupling*
SMES	small and medium-sized enterprises
MZI	Ministry of Infrastructure of the Republic of Slovenia
SOMEONE	Krško nuclear (nuclear) power plant
NIPH	National Institute of Public Health
NN	low voltage
NODE	low carbon society
NTC	net transmission capacity, *NET transfer capacity*
OECD	Organisation for Economic Cooperation and Development, ang. *The Organisation for Economic Co-operation and Development*
OiH	heating and cooling
PO	Operational Programme
OP ECP	Operational Programme for the Implementation of the European Cohesion Policy 2014-2020
OP NGP	Operational programme for the implementation of the National Forest Programme
OP GHG	Operational programme of measures to reduce greenhouse gas emissions by 2020
TSOS	transmission system operator (gas)
MA	mitigation measure
MA	scenario with existing measures
P+R	arky and ride, angle. *Park & Ride*
pan RES	update of the Renewable Energy Action Plan 2010-2020 – draft
PCR	a single solution for calculating the price on the daily market, *Price Coupling of Regions*
DOCK	European Commission recommendations
PM	emissions of particulate matter
SPO	Waste prevention programme

PRIMES	a set of EU models to simulate the generation and consumption of energy. *Price-Induced Market Equilibrium System*
RDP	Rural development programme
PRzO	Waste management programme
PURES	Rules on energy efficiency
PSC	environmental impact assessment
QA/QC	*Quality assurance and/or quality control system, ang. Quality Assurance/Quality Control*
FRR	FRR – Frequency restoration reserve (Engl. FRR)
RC	residual capacity, ang. *Remaining Capacity*
REES-SLO	reference Energy and Emission Model of Slovenia
REMIT	Regulation (EU) No 1227/2011 on wholesale energy market integrity and transparency
ReNPRP30	Resolution on the National Transport Development Programme in Slovenia for the period up to 2030
RRD	R & D activity
RTP	substation
FCR	frequency maintenance reserve (primary frequency control), ang. *Frequency Containment Reserve*
AGvP	Strategy for market development for the deployment of an alternative fuels infrastructure in the transport sector of the Republic of Slovenia
S4	Slovenian Smart Specialisation Strategy
SCENIHR	Scientific Committee on Emerging and Newly Identified Health Risks, *Scientific Committee on Emerging and Newly Identified Health Risks*
SE	solar power plant
SFE	solar photovoltaic
SHEE	Fill in electrical energy storage
SINCRO.GRID	investment project on smart grids of European importance in Slovenia and Croatia
CAP	Common agricultural policy
SN	medium voltage
SNG	synthetic natural gas, Angle. *Synthetic Natural Gas*
DSO	electricity distribution system operator
SOPPS	Strategic framework for adaptation to climate change
AM	Spatial development strategy
SPRS	Spatial Development Strategy of Slovenia
CHP	cogeneration of heat and power
ODR	Slovenia's development strategy
SSE	solar energy receivers, collectors
SURS	Statistical Office, Republic of Slovenia
SVRKS	Government Department for Development and European Cohesion Policy
PT	heat pump

TEB	Brestanica thermal power plant
TEN-T	trans-European Transport Network, ang. *Trans-European Transport Network*
TEŠ	Šoštanj thermal power plant
GHG	greenhouse gases
TP	transformer Station
CLOCKS	efficient use of energy
LNG	natural Gas – in liquefied state
KNOW	wind farm
VN	high voltage
WEO	ang. *World Energy Outlook*
WHO	World Health Organisation, a.k.a. *World Health Organisation*
ZERO	Reducing energy poverty among citizens
ZGS	Forests Institute of Slovenia
ZV	Water Act
ŽOLP	Ljubljana Railway Station Area