ARE THE SECTORS OF THE ECONOMY OF THE SLOVAK REPUBLIC BECOMING GREENER?

Sector indicator report
2022

MINISTRY OF ENVIRONMENT OF THE SLOVAK REPUBLIC

SLOVAK ENVIRONMENT AGENCY

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1. Introduction

The quality of human life depends on a favorable and safe environment. We all need enough clean drinking water, clean air, healthy nature around us, and enough natural resources to meet the basic needs of life. Unfortunately, such conditions are not commonplace even today.

According to the World Health Organization, nearly 1.5 million people die each year in the European region from environment-related diseases. The increasing frequency and intensity of the negative impacts of climate change raise concerns and hints at the increasing threat of loss of life and material damage.

The worrying situation is the result of the long-term consequences of the adverse actions of human society associated with constantly increasing demands on natural resources, excessive pollution of environmental components, the use of energy-intensive technologies that burden the environment, the high production of greenhouse gas emissions, as well as the excessive production and poor disposal of waste.

Addressing this is and will be a long-term process. The document Transforming Our World: The 2030 Agenda for Sustainable Development (2030 Agenda) provides a framework for addressing this internationally, which was adopted at the UN Special Summit in New York in 2015. It sets out a general framework for the world's countries to eradicate poverty and achieve sustainable development by 2030.

The transformative document of the 2030 Agenda at the European level constitutes the European Green Deal (the Deal). It is the European Commission's blueprint for transforming the European Union's economy for a sustainable future. Its primary objective is to make Europe the first climate-neutral continent by 2050. Under the Deal, economic growth will be gradually decoupled from resource consumption, and changes in society should be fair and inclusive for countries, regions, and individuals. Significant reductions in greenhouse gas emissions should be secured by boosting energy production from renewable sources, reducing the use of mainly solid fossil fuels, expanding international cooperation in improving energy infrastructure, and combating energy poverty.

The efficiency of the use and overall need for natural resources should be achieved by more intensive development of the circular economy, especially in resource-intensive sectors (textiles, construction, electronics, and plastics). It is also essential to increase efforts to influence consumer behavior in order to focus on the use of environmentally friendly products, in particular, recyclable products with long service life. The EU's new

Circular Economy Action Plan For a cleaner and more competitive Europe, adopted in 2020, is also working towards these goals.

Countries also face major challenges in transport, construction, and agriculture. ‘From Farm to Fork’ is a new comprehensive European concept that aims to mitigate the environmental and climate footprint of the food system, strengthen its resilience, and guarantee food security vis-a-vis climate change and biodiversity loss, as well as transition to a competitive sustainable system across the spectrum.

Another important follow-up document to the Deal is the eighth Union's General Environment Action Programme to 2030 (8th EAP), adopted in 2022. The 8th EAP aims to accelerate the green transformation fairly and inclusively, in line with the long-term 2050 goal of ‘Living well within the limits of our planet‘. As the global population and demand for natural resources continue to grow, economic activity should be developed in a sustainable way that does not harm but rather reverses climate change. The development of economic activities should be carried out in a way that protects and improves the state of the environment, including by halting and reversing the loss of biodiversity, preventing environmental degradation, and protecting health and well-being from negative environmental risks and impacts. Development should minimize pollution and optimize the use of renewable and non-renewable resources.

As a member country of the European Union, the Slovak Republic acknowledged the necessity of transformational change in the economy and supports the implementation of the European Green Deal, which is part of the EU's strategy for the implementation of the 2030 Agenda. It has recently prepared and adopted a number of national strategic documents whose stated objectives reflect the international documents above to promote sustainable development.

In 2021, the Government of the Slovak Republic has adopted the Vision and Strategy of Slovakia’s Development until 2030 – a Long-Term Strategy for the Sustainable Development of the Slovak Republic – Slovakia 2030. Slovakia is defined in the strategy as ‘a country of successful, sustainably developing regions, providing a quality and safe environment for a healthy and fulfilling life for all residents’. The implementation of this strategy should ensure the transformation of the Slovak economy into a sustainable one, whose competitiveness is based on innovative and efficient use of resources and which generates good wages and prosperity.

The area of environmental care is in full compliance with the Strategy of the Environmental Policy of the Slovak Republic until 2030 ‘A Greener Slovakia’, the Low Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050, the updated Adaptation Strategy of the Slovak Republic on Adverse Impacts of Climate Change. Throughout 2022, two more important documents were added to the documents above, the Concept of Water Policy of the Slovak Republic until 2030 with a View to 2050 and the Water Plan of the Slovak Republic for 2022 – 2027.

We are living through difficult times marked by the COVID-19 pandemic and this year the war in Ukraine. In response to the challenges associated with the pandemic, the Slovak Republic adopted the Recovery and Resilience Plan. In terms of supporting economic development, it is built on Slovakia's global vision as an innovative economy that is the engine of sustainable economic growth and a guarantee of successful management of green and digital transformation.

The path of economic development in Slovakia is therefore laid out. How is the transition to a sustainable, low-carbon, and circular economy working in practice? This is the question that the present indicator report seeks to answer by assessing five sectors: manufacturing, energy, transport, agriculture, and forestry.

Structure of the report

The sectoral report consists of 5 chapters and an annex.

The first chapter defines the basic objective of the publication, characterizes the international and national environmental legislative framework and describes the structure of the report.

The second chapter describes the methodology used in the environmental impact assessments of the selected sectors.

The third chapter, which is the most comprehensive, contains 6 subchapters. The first subchapter provides a brief description of the basic economic characteristics of the Slovak Republic. The next five subchapters provide an assessment of the state of implementation of environmental aspects in the selected sectors and their impact on the environment using sectoral indicators.

The fourth chapter provides a description of the status and assessment of the development of the Slovak economy towards its transformation to low-carbon and circular economy, with examples of good practice presented on the Green Economy Information Platform.

The report includes an annex containing a list of European and national documents relevant to each sector and topic.

2. Methodology

The Organization for Economic Cooperation and Development (OECD) methodology was used for the indicator assessments of the implementation of environmental aspects in the selected sectors and their impact on the environment in Chapter 3. The assessment process consists of two phases: the compilation and development of a set of indicators according to the P-S-R chain and the subsequent development of a sector indicator report.

The causal P-S-R chain is used to describe the interactions between the sectors and the environment and is a methodological tool for integrated environmental assessment. Indicators characterizing the following are evaluated within the individual links of the chain:

- **pressure (P)** on the environment in a negative sense (contamination, depletion of natural resources) or in a positive sense, which is influenced by the social, societal and economic development of society. The latter is the proximate cause of the changes in
- **state of the environment (S)**. Deterioration of the state of the environment, its components leads to
- **response (R)** – the formulation and adoption of measures and tools in society aimed at the elimination or remediation of environmental damage.

Based on the P-S-R chain, the indicators are divided into the following three groups describing:

- sector trends important for the environment,
- interactions of the sector and the environment,
- the related economic and political reactions of the society.

Based on the revision of the Slovak Environment Agency indicators, the following sets of sectoral indicators were compiled in 2020 and used in the assessments in the report:

12 12 13 16 16

The selection of individual indicators is made dynamically, using ongoing analyses, reports and indicators of international organizations, as well as taking into account national needs or requirements. The period assessed is 2005 – 2020. Differences in data availability were reflected in different time series for some indicators. In cases where data for manufacturing are not available, the industry is assessed. Similarly, in the case of agriculture, where data for agriculture are not available, the agricultural sector together with forestry is assessed.

Tables, graphs and maps compiled from data from departmental and non-departmental organizations and their databases, available statistical yearbooks, evaluation reports and other relevant information systems are used in the preparation and assessment.

The set of indicators in terms of the P-S-R chain provides the basis for the development of the so-called indicator report, the priority objective of which is to know the cause-effect relationships between the activities carried out within the individual sectors and the state of the environment, to assess their development and direction, as well as the response of society to the identified facts.

The sector indicator report focuses on answering four key questions:

1. How are the environmental principles and objectives implemented in the sector policy?
2. What is the state and direction of the sector in relation to the environment?
3. What are the interactions of the sector and the environment?
4. What is the response of the society to mitigating or compensating negative consequences of the sector on the environment?

3. Assessing the environmental impact of selected sectors

Today, it would be difficult to find an economic activity that does not have a more or less negative impact on the environment. It is also widely acknowledged that the evolution of human society and the intensive economic development of countries in the past decades has also brought serious environmental degradation (devaluation).

The Slovak Republic is one of the most industrialized countries among EU Member States, resulting in higher industrial emissions than the EU average. **Manufacturing** is also one of the most energy-intensive economic sectors in the economy of the Slovak Republic. In this context, one of the most important challenges is the fourth industrial revolution (Industry 4.0), which has already begun and brings, in addition to digitization, innovations linked to the elimination of the negative impacts of production processes on the various components of the environment.

Human life today is unimaginable without energy supply. The **energy sector** is key not only to the economic development of society, but it also significantly affects the quality of life of the population, particularly in the areas of housing, environment, health and safety. The burden on the environment from energy production and consumption, particularly in the form of greenhouse gas emissions and air pollutants, land use, waste generation and water pollution due to accidents, etc., causes a heavy negative impact on the environment. This negative impact contributes to climate change, it damages the natural ecosystems and the man-made environment, and adversely affects human health. Reconciling the provision of sufficient energy with a quality environment is one of the most important global challenges of our time.

Transport and its quality is one of the basic elements in assessing the level of a particular country and is one of the fundamental sectors that significantly influence socio-economic development and the growth of the standard of living. The transport sector has a significant negative impact on the environment and human health, and is responsible for greenhouse gas emissions, air pollution, noise and habitat fragmentation. In recent years, the demand for transport has been closely linked to the growth in road transport, which has been reflected in a significant increase in the negative impacts of transport on the environment, as well as on the growth of congestion in urban agglomerations. Directing transport towards clean, smart and sustainable transport should be based on the use of an interconnected multimodal transport system in passenger, individual, public passenger and freight transport.

Agriculture forms an important part of the national economy of the country. It is carried out on almost half of the territory of Slovakia, and it is the most spatially extensive human activity in our territory. The situation in Slovak agriculture is significantly influenced by the scientific and technological progress as well as the political and economic situation in the country. The development of the Common Agricultural Policy of the European Union is one of the factors capable of significantly influencing the sustainable development of agriculture. The new Common Agricultural Policy of the European Union, due to be implemented in 2023, will include stronger support for healthy soils in line with the objectives of the European Green Deal, with sustainable land management as a key component of a number of objectives, in particular those focusing on landscape and biodiversity, natural resources and climate action.

The **forest management** cannot be regarded as a typical economic sector, as is the case with industry, energy, transport or agriculture, with their significant negative impact on the environment. Its specific position results from the fact that the basic means of production in forest production is the forest, which is an ecological system influenced by natural factors and is essentially one of the components of the environment and landscape. Forest management is thus generally subordinate to this fact and should therefore apply the principles of sustainability, including the provision of all its functions. Forestry is thus based largely on ecological principles and, when followed, has a positive rather than a negative impact on the environment.

Joint efforts to reconcile the provision of all the needs of human society with the preservation of a healthy environment are bearing fruit and sectors are gradually reducing their negative impact on the environment. The current situation is the result of greater concern for the environment on the part of major polluters, driven by scientific and technological development, international commitments and pressure from the public and conservationists to address the environmental problems.

Basic characteristics of the Slovak Republic (2020)

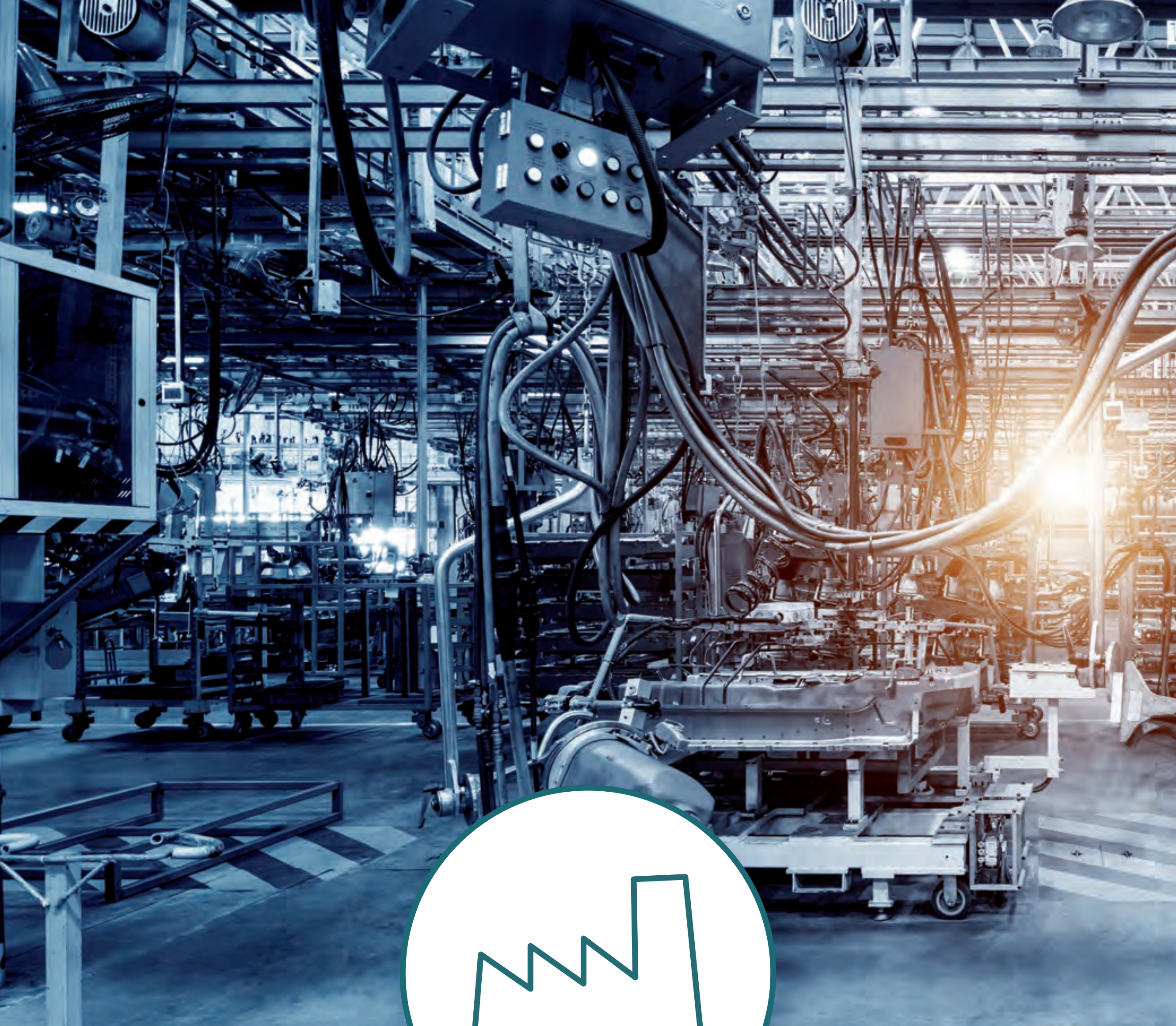
Area	49 034 km^2
Total population (as of 31 December 2020)	5 459 181 inhabitants
Gross domestic product at current prices	91,25 mld. eur
Inflation	2,0%
Registrated unemployment rate	7,6%
National debt	60,6% GDP

Development of GDP (in constant prices 2015)

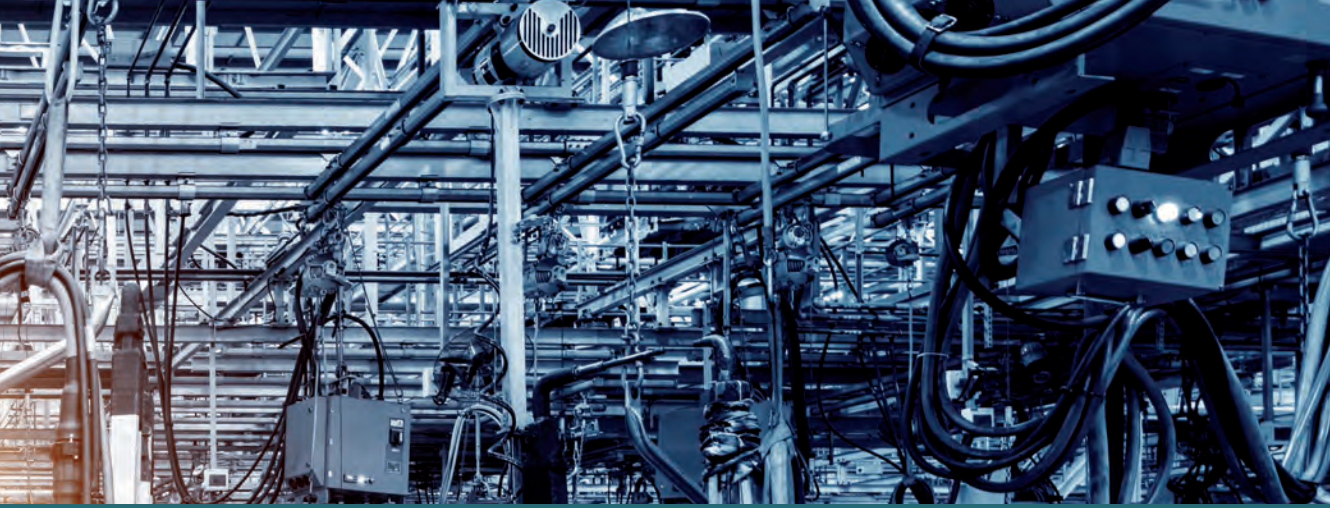
GDP in selected sectors (2020)

Sector	GDP (mil. eur, constant prices 15)	Share of total GDP (%)
Manufacturing	16 089,35	18,6
Energy	2 236,55	2,6
Transport	4 238,64	4,9
Agriculture	1 042,19	1,2
Forest management	708,58	0,8

Source: SO SR



MANUFACTURING



List of the sector indicators in manufacturing

Trends of the sector relevant for the environment

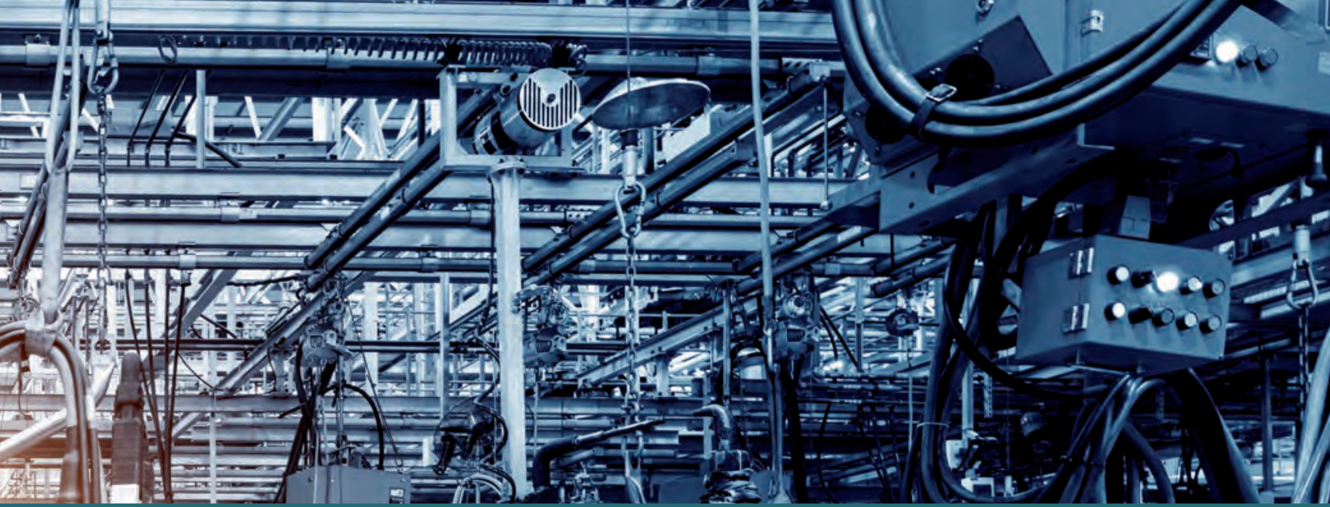
- Share of manufacturing in GDP
- Final energy consumption in manufacturing
- Industrial production index

Interactions of the sector with the environment (demands of the sector in respect of resources and impacts of the sector on the environment)

- Land losses for industrial construction
- Emissions of main pollutants from manufacturing
- Polluting with industrial waste water
- Water consumption in the industry
- Origin of wastes from manufacturing
- Greenhouse gas emissions from industrial processes and use of products

Political, economic and social aspects

- Expenditures of research and development in manufacturing
- Costs of the environmental protection in manufacturing



According to the Statistical Classification of Economic Activities (SK NACE Rev. 2), the manufacturing is included in the Section C – Manufacturing.

It consists of the following divisions:

10 – Manufacture of food products

11 – Manufacture of beverages

12 – Manufacture of tobacco products

13 – Manufacture of textiles

14 – Manufacture of wearing apparel

15 – Manufacture of leather and related products

16 – Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials

17 – Manufacture of paper and paper products

18 – Printing and reproduction of recorded media

19 – Manufacture of coke and refined petroleum products

20 – VManufacture of chemicals and chemical products

21 – Manufacture of basic pharmaceutical products and pharmaceutical preparations

22 – Manufacture of rubber and plastic products

23 – Manufacture of other non-metallic mineral products

24 – Manufacture of basic metals

25 – Manufacture of fabricated metal products,except machinery and equipment

26 – Manufacture of computer, electronic and optical products

27 – Manufacture of electrical equipment

28 – Manufacture of machinery and equipment n.e.c.

29 – Manufacture of motor vehicles, trailers and semi-trailers

30 – Manufacture of other transport equipment

31 – Manufacture of furniture

32 – Other manufacturing

33 – Repair and installation of machinery and equipment

3.1. Summary assessment of the development in the sector of manufacturing

What is the state and direction of manufacturing in relation to the environment?

The industrial production index (average month of 2015=100) increased by 26.9% between 2008 and 2020. There was a significant decrease in 2020 due to the Covid crisis, when IIP decreased by 11.5% year-on-year.

Manufacturing, as the most important component of GDP in the economy of the Slovak Republic, retained its leading position in 2020, despite a decrease in the dynamics of deve-lopment. Its share in GDP in 2020 amounted to 17.5%, which is 2.3 percentage point more than in 2009, when the manufacturing sector experienced the most significant decrease in GDP between 2005 and 2020 due to the economic crisis.

In 2005, industrial sector accounted for 36.8% of final energy consumption in the national economy and experienced a downward trend compared to 2020, when its share decreased to 32.6%.

What are the interactions of manufacturing and the environment?

Demands of manufacturing in respect of resources

There was a 36.9% decrease in water consumption in the sector between 2005 and 2020, with 105,864.72 thousand m^3 of surface water withdrawn by manufacturing in the last monitored year – 2020.

The loss of land for industrial construction in 2005 – 2020 had a downward trend. The lar-gest losses of agricultural land were recorded in 2009 (805 ha) and the largest losses of fo-rest land were recorded in 2008 and 2011 (7 ha).

Impact of manufacturing on the environment

NO_x emissions in the industrial processes and product use sector were relatively stable over the long term, decreasing by 14.1% compared to 2005 – 2020. Compared to the years 2005 – 2020, CO emissions decre-ased by 33.1%. A long-term but slight decrease with fluctuations is observed for NMVOC emissions and they decreased by 29.9% compared to 2005 and 2020. When comparing 2005 – 2020, a 41.9% decrease is also observed for

SO_X emissions. $PM_{2.5}$ and PM_{10} emissions decreased, although the indus-trial process and pro-duct use sector contributes less to these emissions. PCDD/PCDF emissions from industrial processes decreased by 19.6% and PAH emissions by 24.5% when comparing 2005 with 2020. Emissions of heavy metals from industrial processes were on a long-term downward trend, with decreases of 48.4% for lead (Pb), 63.3% for cadmium (Cd) and 7.3% for mercury (Hg) emissions when comparing 2005 to 2020.

Greenhouse gas emissions from industrial processes and product use decreased by 19.4% in 2020 compared to 2005. Despite the decrease, the share of total greenhouse gas emissi-ons increased between 2005 and 2020.

The trend in the amount of wastewater discharged from manufacturing is favorable in the long term and decreased by 64.7% between 2005 and 2020. The largest decrease in pollution, when comparing 2005 to 2020, of almost 88% was recor-ded in the indicator biochemical oxygen demand (BOD_5) .

The production of waste from manufacturing decreased by 31.5% between 2008 and 2020. The share of the amount of waste produced from industrial production in the total amount of waste produced in the economic sectors in 2020 was 30.1%.

What is the response of the society to mitigating or compensating negative consequences of manufacturing on the environment?

Expenditure on research and development in manufacturing increased by 375.4% in 2020 compared to 2006, but gradually decreased since 2017, when it reached its maximum for the 2005—2020 monitored period. The share of expenditure on research and development in manufacturing in total expenditure has decreased by 11.8 percentage point since 2017.

The environmental costs of manufacturing in 2020 decreased by 13.9% compared to 2005.

3.1.1 What is the status and direction of manufacturing in relation to the environment?

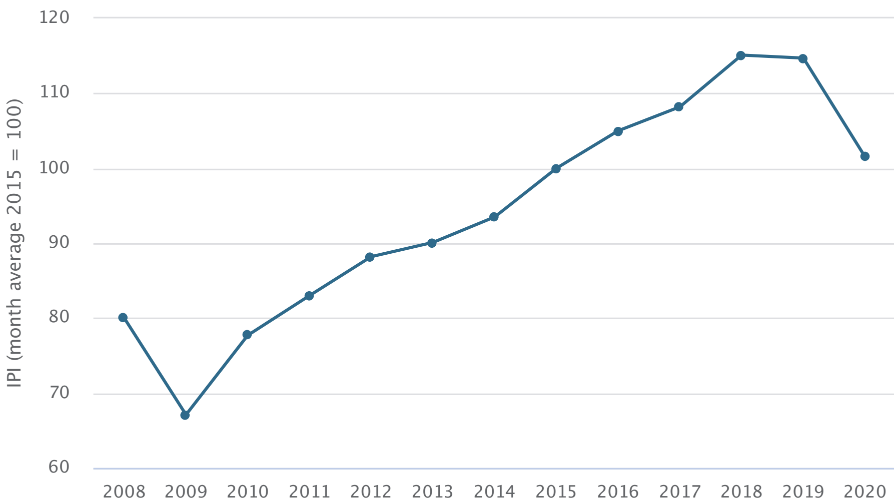
The Slovak Republic is one of the countries with a strong industrial tradition. Manufacturing is currently facing a double transformation, and capturing the current trends resulting from these transformations will be essential for future development and competitiveness. The opportunity for industry is created by the digital and green transformation, for which a full mobilization of the industrial sector is needed.

3.1.1.1 Industrial production index

The decrease in output in manufacturing (average month of 2015=100) in 2020 compared to 2019 is reflected in the decrease in the production of textiles, clothing, leather and leather products (24.1%), in other production areas, repair and installation of machinery and equipment (23.5%), in the production of computer, electronic and optical products (17.1%), in the production of transport equipment (16.4%), in the production of basic pharmaceuticals and pharmaceutical preparations (16.4%), in the production of pharmaceutical products (16,3%), in the production of machinery and equipment (12.7%), in the production of rubber and plastic products and other non--metallic mineral products (9.4%), in the production of electrical equipment (6.7%), in the production of basic metals and fabricated metal products, except for machinery and equipment (6.4%), in the production of wood and paper products (3.7%) and in the production of food, beverages and tobacco products (2.6%).

The industrial production index showed an upward trend when comparing 2008 to 2020, increasing by 26.9%.

Development of the industrial production index (IPI) in manufacturing



Source: SO SR

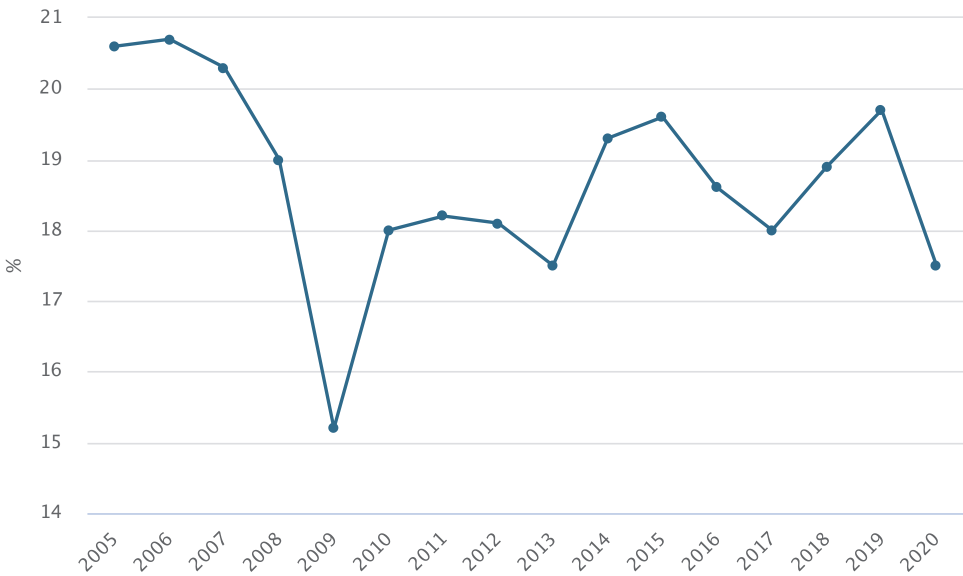
The largest decrease in manufacturing during the COVID-19 pandemic was in textiles, garments, leather and leather products by 24.1%.

3.1.1.2 Share of manufacturing in GDP formation

The share of manufacturing as the most important component of GDP in the economy of the Slovak Republic reached 20.6% in 2005 and decreased to 17.5% in 2020, which is a decrease of 3.1 percentage point.

In the 2005 - 2020 monitored period, there was a significant year-on-year decrease due to the economic crisis in 2009 compared to 2008 (4.1 pp) and in 2020 compared to 2019 (2.2 pp), when the Slovak industry declined the most among the 28 EU countries during the Covid crisis.

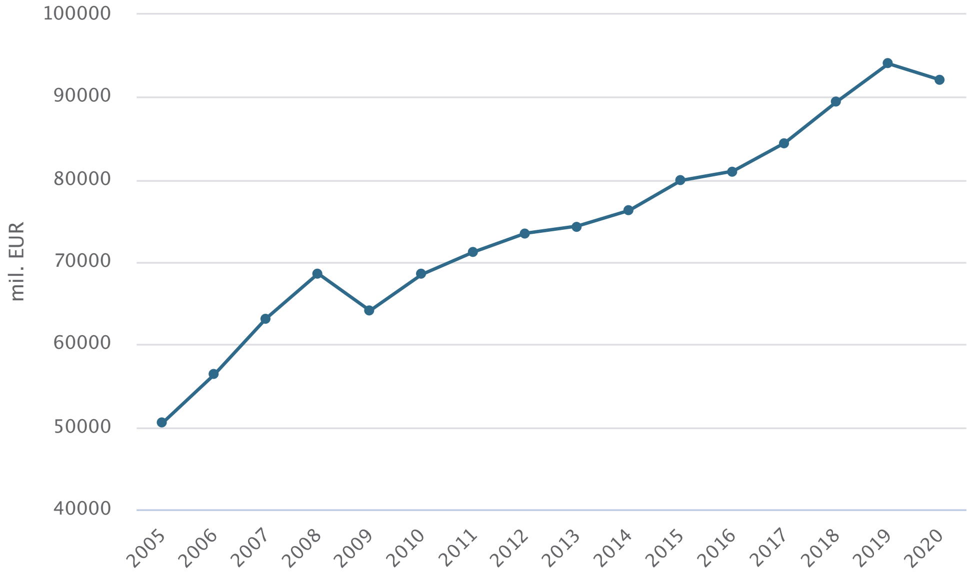
Development of share of manufacturing in GDP formation



Source: SO SR

GDP from manufacturing reached EUR 16,149.6 million in 2020, an increase of 55.2% compared to 2005. In terms of revenues, the production of pharmaceuticals, chemicals and foodstuffs fared best during the 2020 Covid crisis.

Development of GDP in manufacturing (at current prices)



Source: SO SR

Manufacturing was one of the most important components of GDP among other sectors of the economy of the Slovak Republic with a share of 60% in 2020.

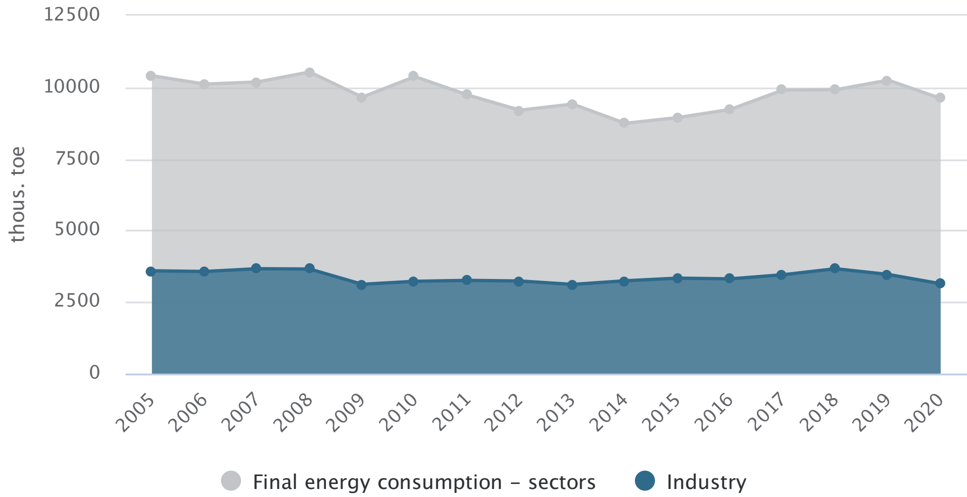
3.1.1.3 Final energy consumption in manufacturing

Final energy consumption (FEC) in manufacturing followed a decreasing trend in the 2005 - 2020 monitored period, reaching 3,138 TJ in 2020, a decrease of 12.6% compared to 2005. The largest decrease in FEC in the industrial sector were recorded in the production of pulp, paper and printing, iron and steel, and machinery and transport equipment.

Within industry, iron and steel had the largest share of the FEC in 2020 (23.9%).

In 2005, industry accounted for 36.8% of final energy consumption in the national economy, decreasing to 32.6% in 2020.

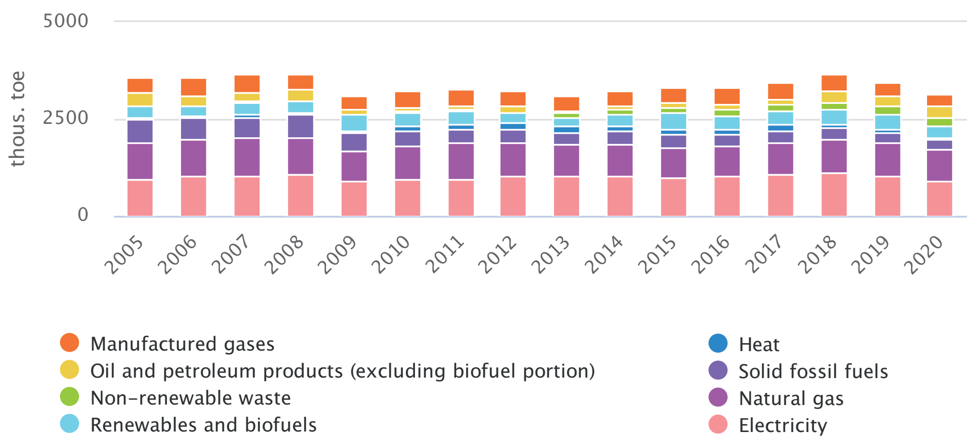
Development of final energy consumption in industry compared to total final energy consumption in the Slovak Republic



Source: Eurostat

In terms of consumption of different types of fuels, industry is one of the sectors with the largest share of fuel use. The total consumption of fuels, electricity and heat from 2005 to 2020 has followed a predominantly decreasing trend, with the most significant decrease in solid fuels of 54.5% over the period, followed by industrial gases of 30.5%, heat of 22.5%, natural gas of 15.2%, electricity of 4.8% and oil and petroleum products of 4.4%. On the contrary, renewable energy sources increased by 8.4% and non-renewable waste increased more than 10-fold in 2020 compared to 2005.

Development of the final energy consumption of fuels, electricity and heat in industry



Source: SO SR

The largest year-on-year decrease (22.1%) in final energy consumption in 2020 was recorded in the production of pulp, paper and printing.

3.1.2. What are interactions of manufacturing and the environment?

In recent years, industries have been reducing their negative impact on the environment by introducing the circular economy, innovating energyintensive businesses or reducing the use of fossil fuels where it is technically and economically efficient to do so.

Resource intensity of manufacturing

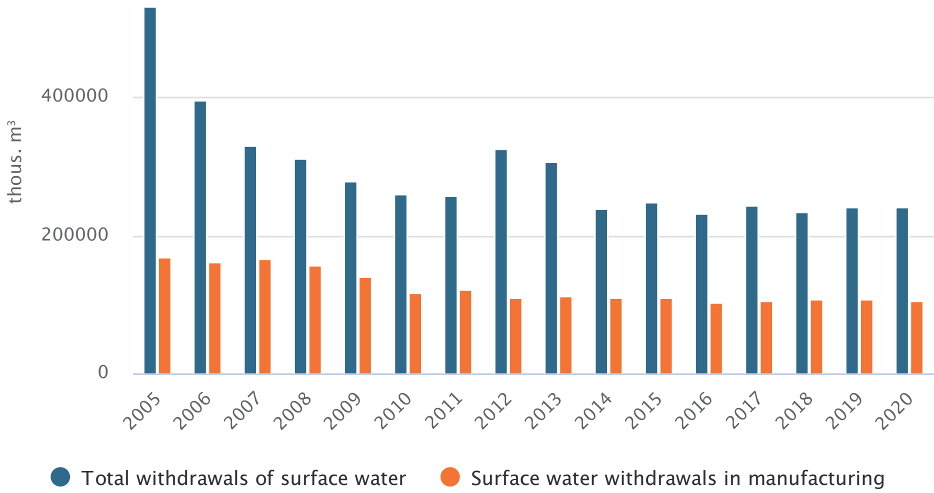
The resource intensity of manufacturing monitors the consumption of surface water in manufacturing and the loss of land to industrial construction.

3.1.2.1 Water withdrawals in manufacturing

Between 2005 and 2011, the most significant surface water withdrawals in manufacturing were recorded. Since 2012, industrial surface water withdrawals have decreased and have maintained more or less the same trend. Between 2005 and 2020, there was a 36.9% decrease in water withdrawals in the sector, with 105,864.72 thousand m^3 of surface water withdrawn in the industrial production sector in the last monitored year – 2020.

The highest share of surface water withdrawals in manufacturing in relation to total surface water withdrawals was recorded in 2007 (50.7%) and the lowest in 2005 (31.5%). In the last monitored year – 2020, the share of surface water withdrawal in manufacturing in relation to total surface water withdrawal was 43.9%.

Development of water withdrawals in manufacturing



Source: SHMI

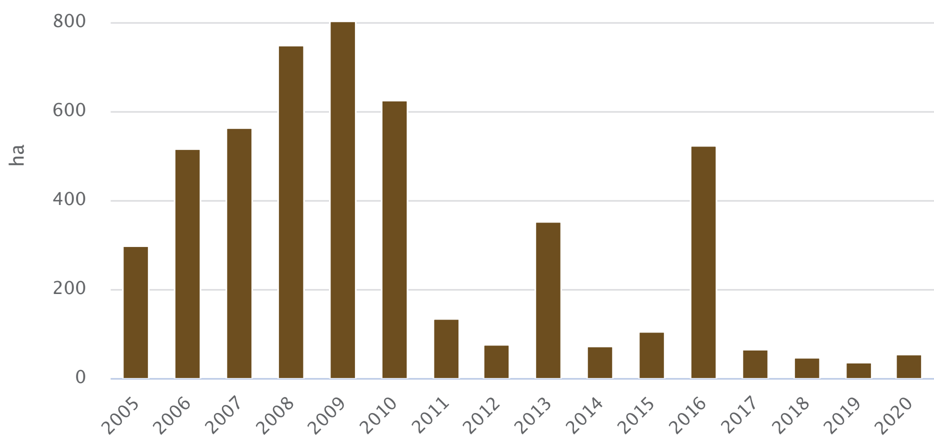
There was a 36.9% decrease in water withdrawal in the industrial production sector between 2005 and 2020.

3.1.2.2 Land losses for industrial construction

The loss of agricultural land and forest land for industrial construction totaled 301 ha in 2005, decreasing to 57 ha in 2020, a decrease of 81.1%.

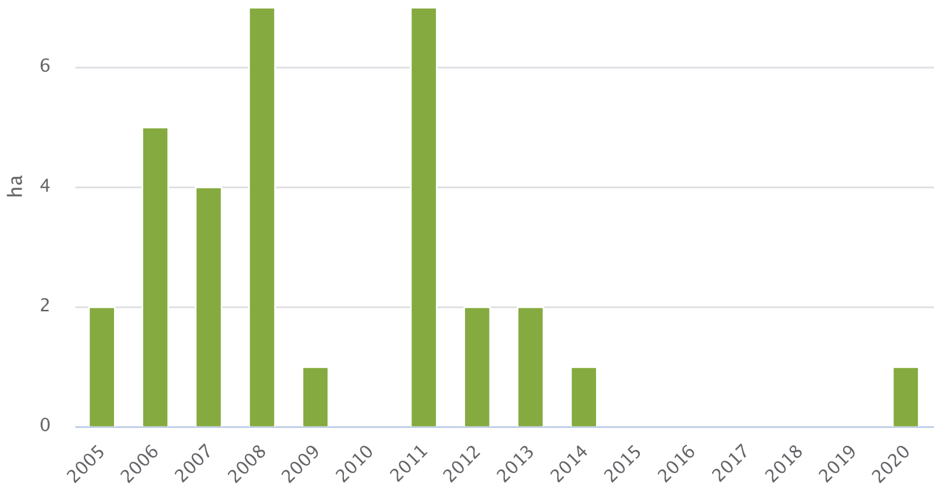
The largest loss of agricultural land for industrial construction was recorded in 2009 (805 ha). Within forest land, the largest losses for industrial construction were recorded in 2008 and 2011 (7 ha). In 2020, the loss of agricultural land for industrial construction accounted for 56 ha and the loss of forest land accounted for 1 ha.

Development of agricultural land losses for industrial construction



Source: GCCA SR

Development of forest land losses for industrial construction



Source: GCCA SR

The largest loss of agricultural land for industrial construction was recorded in 2009.

Impact of manufacturing on the environment

The industrial sectors bring many important economic and social benefits in the form of goods production, job creation or tax revenues. However, the largest industrial enterprises also contribute significantly to the generation of air pollutants, greenhouse gases or waste.

3.1.2.3 Emissions of pollutants from industrial processes and product use

In the Slovak Republic, the most represented industries in the long term are metallurgical production, iron and steel production, production of coke and refinery products, chemical production, construction industry and others.

EU 2020 objectives

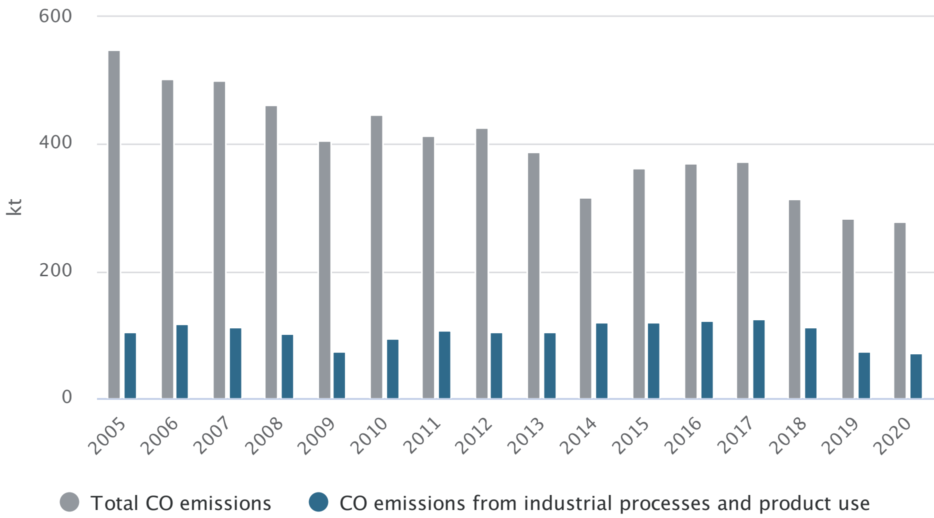
Reduce emissions to air by 2030 compared to 2005:

- SO_2 by 82%
- NO_X by 50%
- NMVOC by 32%
- NH_3 by 30%
- $PM_{2,5}$ by 49%

National Emission Reduction Program – Slovak Republic (2020)

CO emissions from industrial processes and product use accounted for 25.3% of total emissions in 2020 and a 33.1% decrease in emissions compared to 2005.

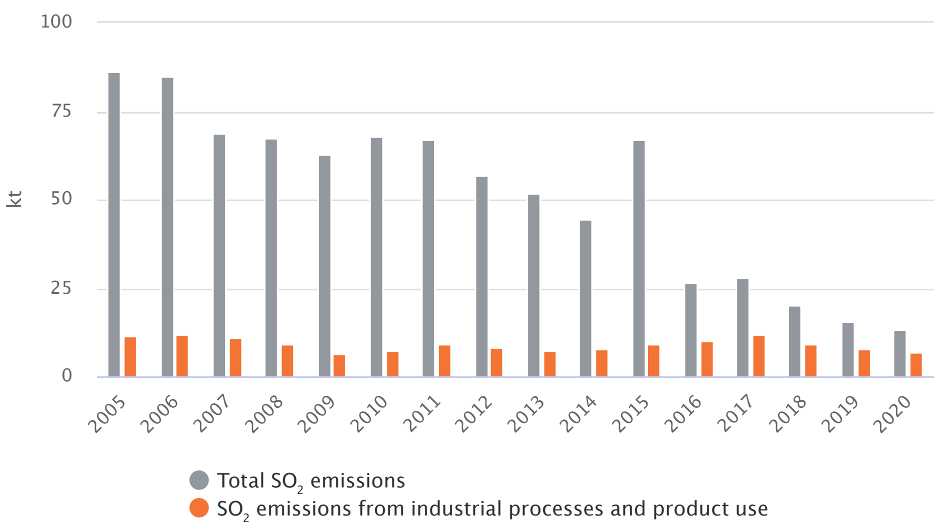
Development of CO emissions from industrial processes and product use compared to total CO emissions



Source: SHMI

SO_2 emissions from industrial processes and product use are released into the air due to the handling, storage and transport of materials. SO_2 emissions accounted for 49.8% of total emissions in 2020 and a decrease of 41.9% compared to 2005.

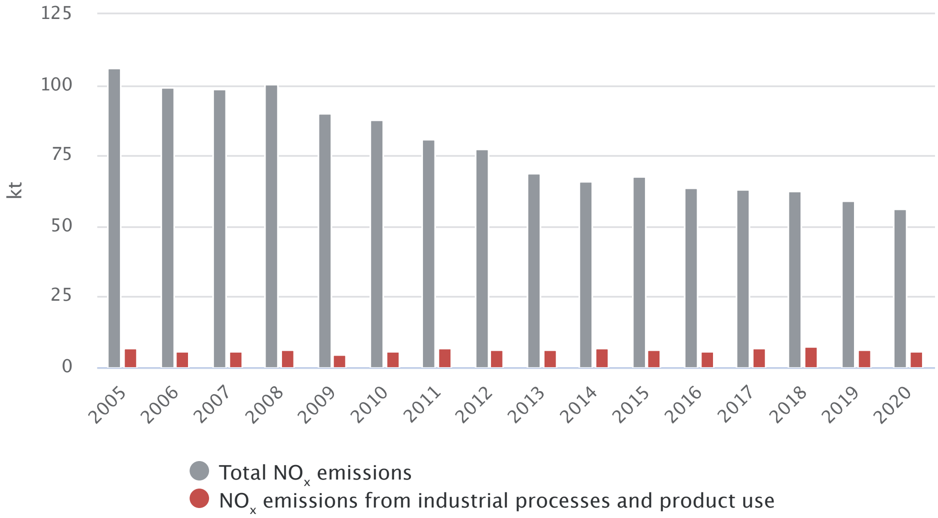
Development of SO_2 emissions from industrial processes and product use compared to total SO_2 emissions



Source: SHMI

NO_x emissions in the industrial process and product use sector were relatively stable over the long term. In 2020, NO_x emissions accounted for 10.3% of total emissions and decreased by 14.7% compared to 2005.

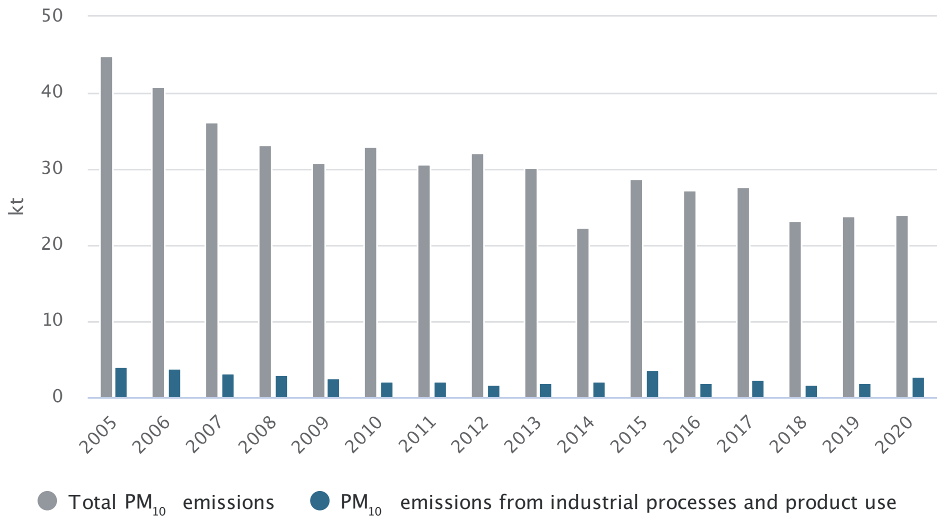
Development of NO_x emissions from industrial processes and product use compared to total NO_x emissions



Source: SHMI

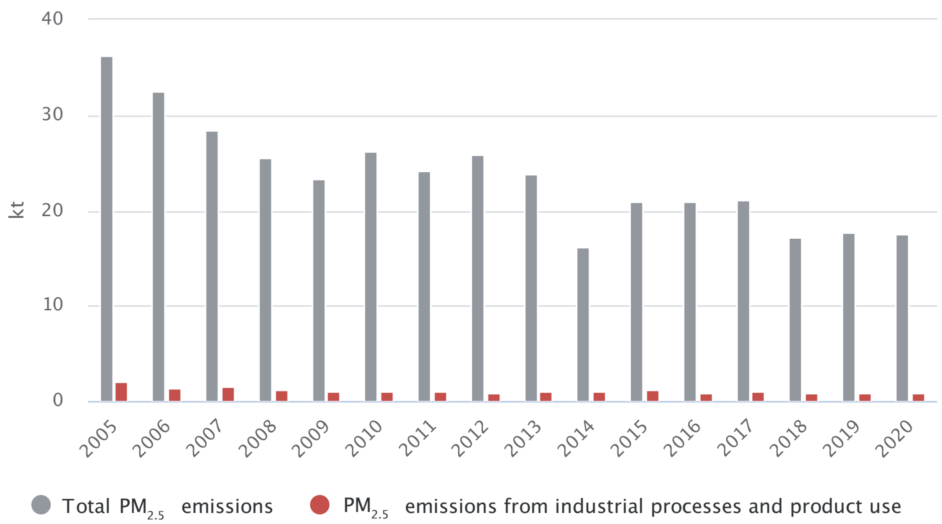
PM_{10} emissions from industrial processes and product use accounted for 11.1% of total emissions in 2020, with a 34.1% decrease compared to 2005. $PM_{2.5}$ emissions from industrial processes and product use account for 4.8% of total emissions in 2020, with a 57.7% decrease compared to 2005.

Development of PM_{10} emissions from industrial processes and product use compared to total PM_{10} emissions



Source: SHMI

Development of $PM_{2.5}$ emissions from industrial processes and product use compared to total $PM_{2.5}$ emissions



Source: SHMI

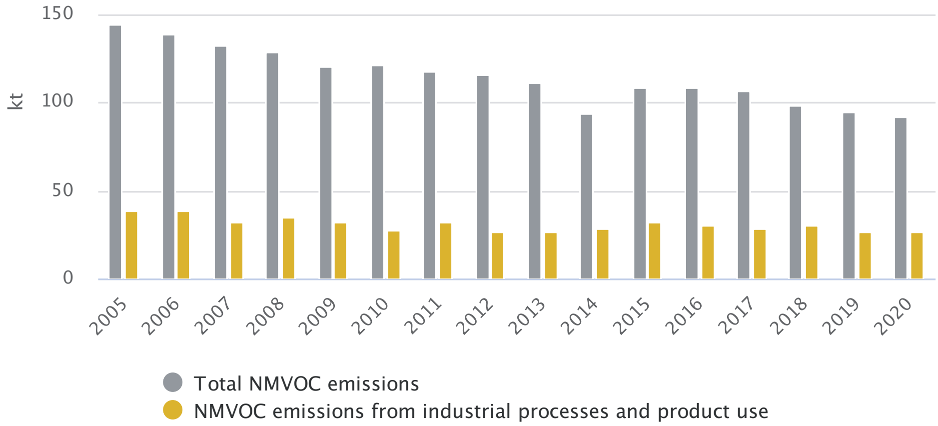
For heavy metal emissions in 2020, there were decreases of 48.4% for lead (Pb), 63.3% for cadmium (Cd) and 7.3% for mercury (Hg) compared to 2005.

Development of the quantity of Pb, Hg and Cd emissions from industrial processes and product use

Source: SHMI

Emissions of non-methane volatile organic compounds (NMVOC) from industrial processes and product use accounted for 29.2% of emissions from economic activities in the economy in 2020 and a 29.9% decrease in emissions compared to 2005.

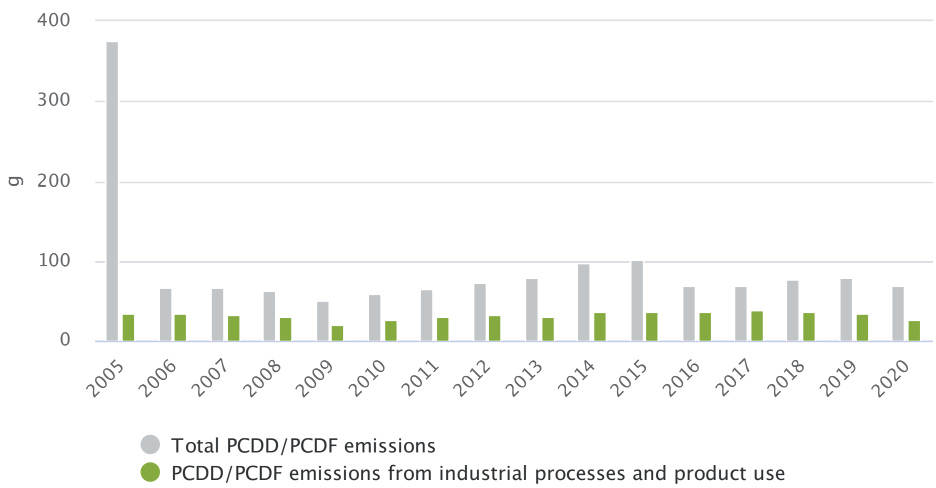
Development of NMVOC emissions from industrial processes and product use compared to total NMVOC emissionsMVOC



Source: SHMI

Polychlorinated dibenzodioxins and dibenzofurans (PCDD/PCDF) emissions in 2020 decreased by 19.6% compared to 2005. Emissions of polycyclic aromatic hydrocarbons (PAH) from the production of coke, aluminum or the use of chlorinated fuels in blast furnaces decreased by 24.5%. PCB emissions have decreased by 25% between 2005 and 2020, with metal production being the most significant source of PCB emissions.

Development of PCDD/PCDF emissions from industrial processes and product uses compared to total PCDD/PCDF emissions

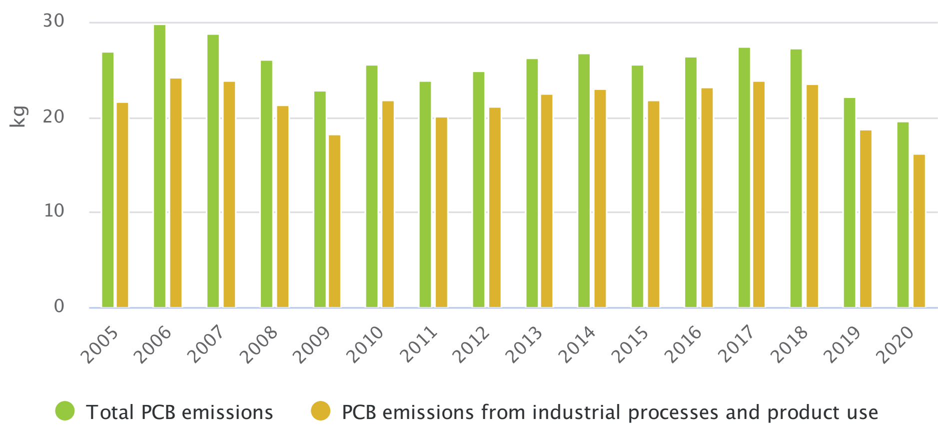


Source: SHMI

Development of PAH emissions from industrial processes and product use in comparison to total PAH emissions

Source: SHMI

Development of PCB emissions from industrial processes and product uses compared to total PCB emissions



Source: SHMI

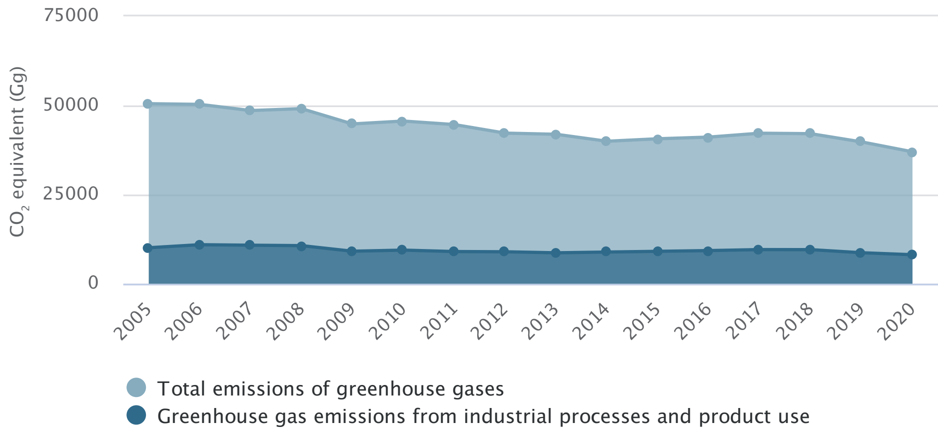
CO emissions from industrial processes and product use accounted for 25.3% of total emissions in 2020.

3.1.2.4 Greenhouse gas emissions from industrial processes and product use

The industrial processes and product use sector is the second largest contributor to total greenhouse gas emissions.

Aggregate greenhouse gas emissions from industrial processes and product use followed a fluctuating trend between 2005 and 2020, decreased by 19.4% in 2020 compared to 2005.

Development of greenhouse gas emissions from industrial processes and product use related to total greenhouse gas emissions



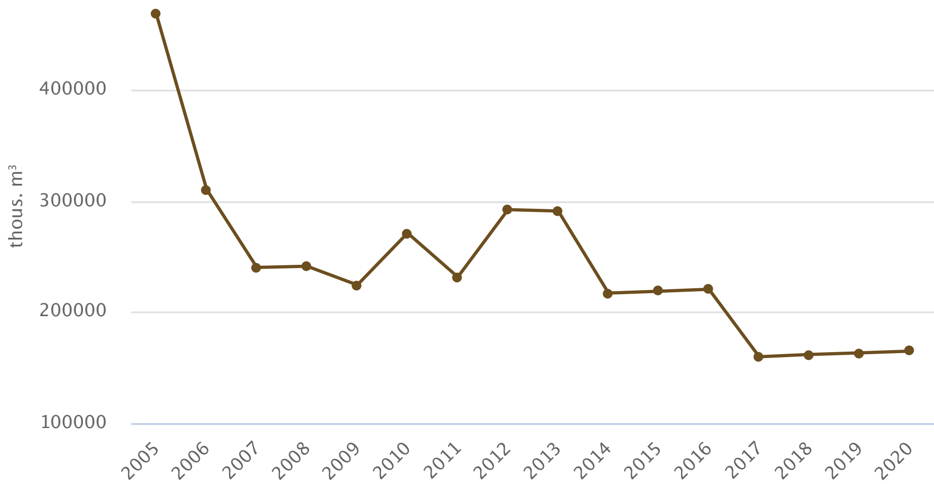
Note: Emissions without the LULUCF sector Emissions determined as of 13 April 2022.
Source: SHMI

The industrial processes and product use sector is the second largest contributor to total greenhouse gas emissions.

3.1.2.5 Waste water from manufacturing

Water is another environmental component significantly affected by industry. Pollution from industrial wastewater has a fluctuating trend, with a 64.7% decrease in discharges in 2020 compared to 2005.

Development of the volume of discharged waste water from manufacturing



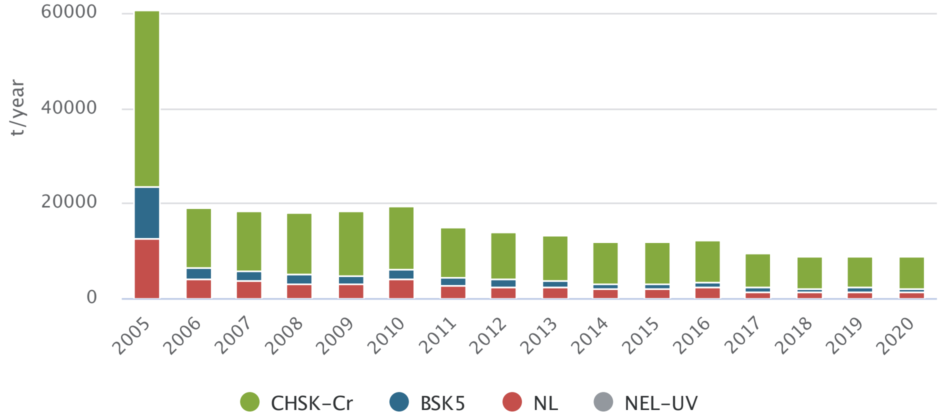
Source: SHMI

The production of pollutants in industrial wastewater has a decreasing trend in terms of BOD_5 (biochemical oxygen demand after 5 days), with a 93% decrease in 2020 compared to 2005.

The production of pollutants in industrial wastewater is on a decreasing trend in terms of COD_{Cr} (chemical oxygen demand by potassium dichromate), with a decrease of 81,7% in 2020 compared to 2005. This indicator had the largest share of the total industrial wastewater pollution in 2020, accounting for 76.6%.

The production of pollutants in industrial wastewater has a decreasing trend in terms of NPE_{UV} (non-polar extractables), decreasing by 78,2% in 2020 compared to 2005.

Development of discharged wastewater from manufacturing according to pollutants



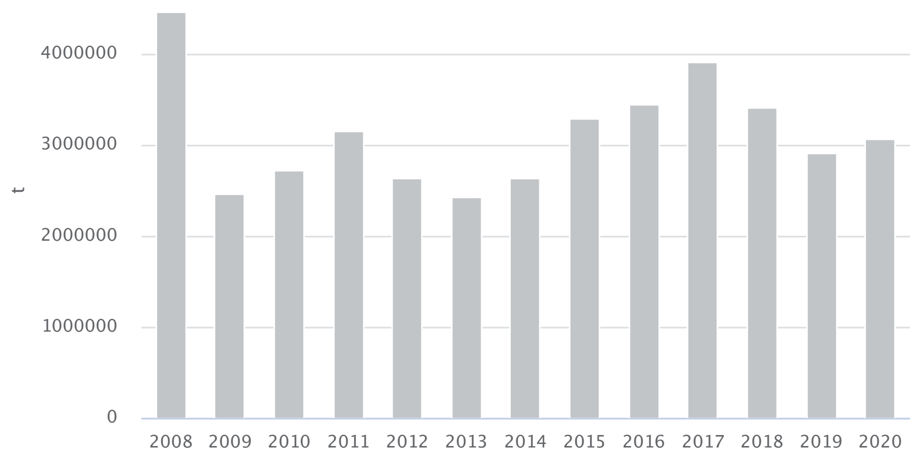
Source: SHMI

In 2020, there was a 64.7% decrease in wastewater discharges compared to 2005.

3.1.2.6 Waste from manufacturing

Manufacturing is the largest contributor to nonmunicipal waste generation among the sectors. In 2020, 3,060,414.9 t of waste was generated in industrial production, including 195,584.3 t of hazardous waste and 2,864,830.6 t of other waste. In 2020, there was a 68.5% decrease in waste produced compared to 2008.

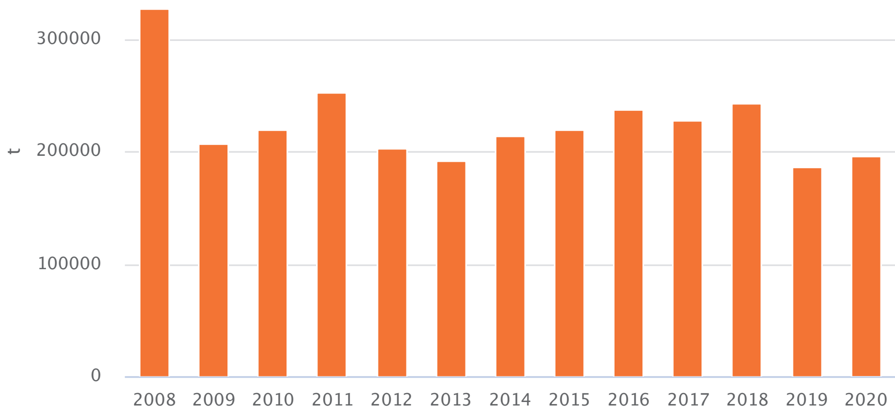
Development of quantity of produced waste from manufacturing



Source: MoE SR

In 2020, there was a 40.2% decrease in the generation of hazardous waste in manufacturing compared to 2008.

Development of the production of hazardous waste from manufacturing



Source: MoE SR

In 2020, there was a 68.5% decrease in waste produced compared to 2008.

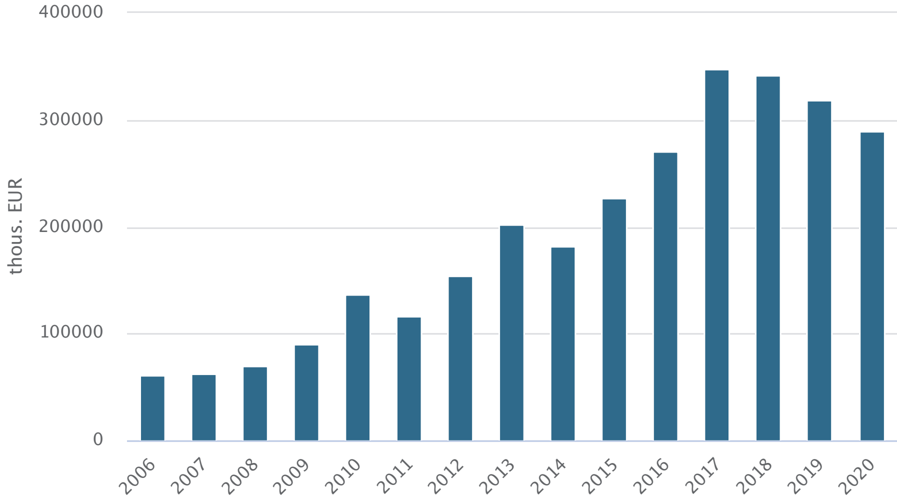
3.1.3 What is the response of the society to mitigating or compensating negative consequences of manufacturing on the environment?

The society can mitigate or compensate for the negative environmental impacts of manufacturing by increasing research and development expenditure in the field of manufacturing or by introducing environmental policy measures, including economic instruments.

3.1.3.1 Expenditures of research and development in manufacturing

The expenditure on research and development in manufacturing in 2020 amounted to EUR 290,081.25 thousand and increased by 373.8% compared to 2006.

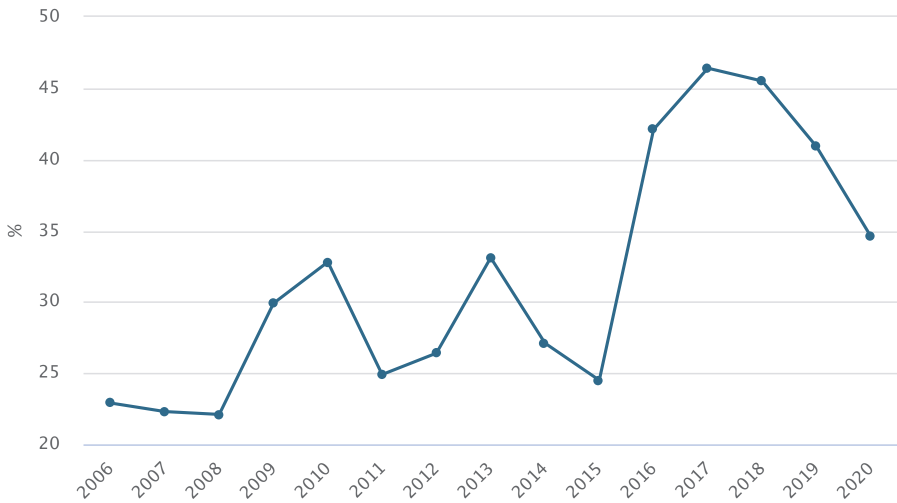
Development of expenditures of research and development in manufacturing



Source: SO SR

The share of expenditure on research and development in manufacturing in the total expenditure on research and development has a fluctuating trend. In 2006, the share of expenditure in manufacturing was 22,9% and in 2020 it increased to 34,6%.

Development of the share of expenditures of research and development in manufacturing in the total expenditures



Source: SO SR

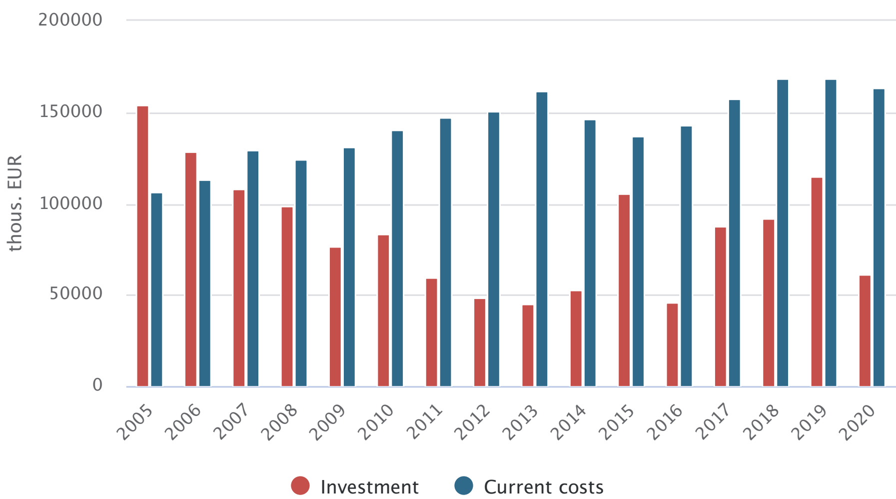
The share of industrial production expenditure in the total expenditure on research and development in 2020 reached 34.6%.

3.1.3.2 Costs of the environmental protection in manufacturing

The environmental protection costs in industrial production were decreasing between 2005 and 2020, reaching EUR 224,540 thousand in 2020, a decrease of 13.9% compared to 2005.

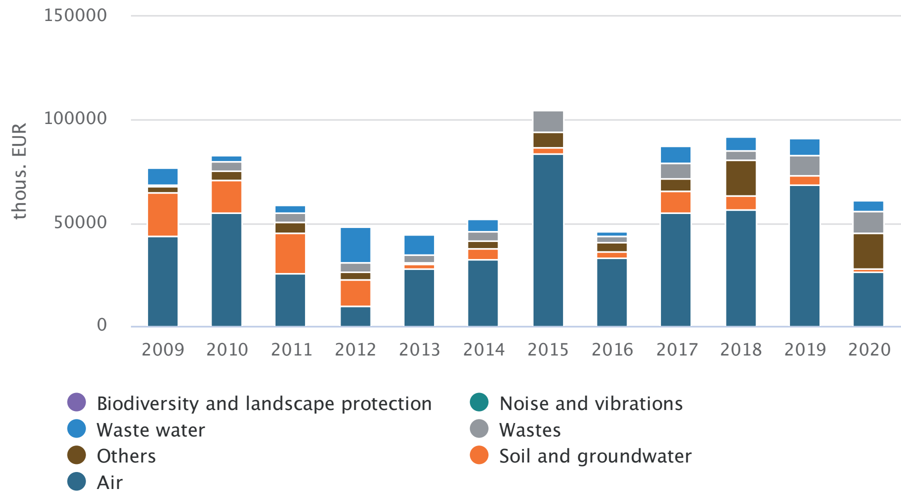
The investments accounted for almost 60% of environmental costs in manufacturing in 2005, decreasing to 27.1% in 2020. The environmental protection costs in manufacturing accounted for 40.1% of total business costs in 2005, increasing to 72.9% in 2020.

Development of costs of the environmental protection in manufacturing



Source: SO SR

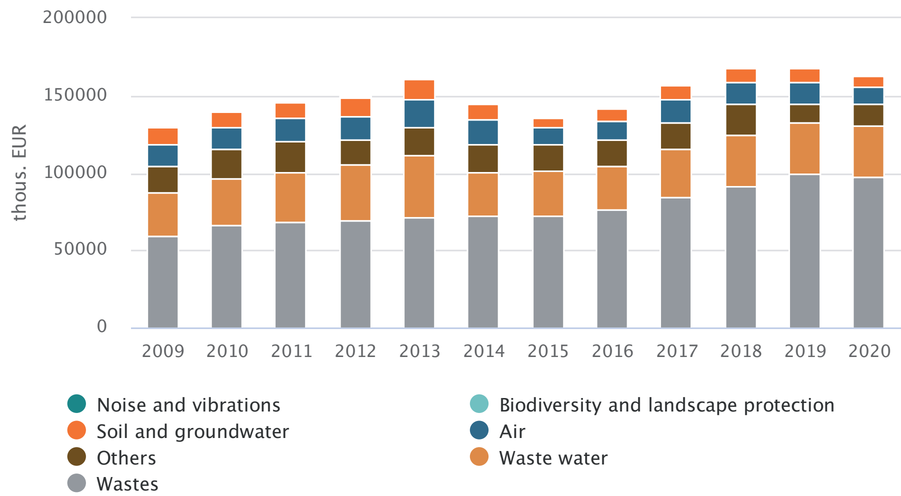
Development of investment for the environmental protection in manufacturing



Source: SO SR

Within investments in environmental protection in manufacturing, the largest growth in 2020 compared to 2009 was in waste management (861.1%) and the largest share in 2020 was in air protection (43.2%).

Development of current costs of the environmental protection in manufacturing



Source: SO SR

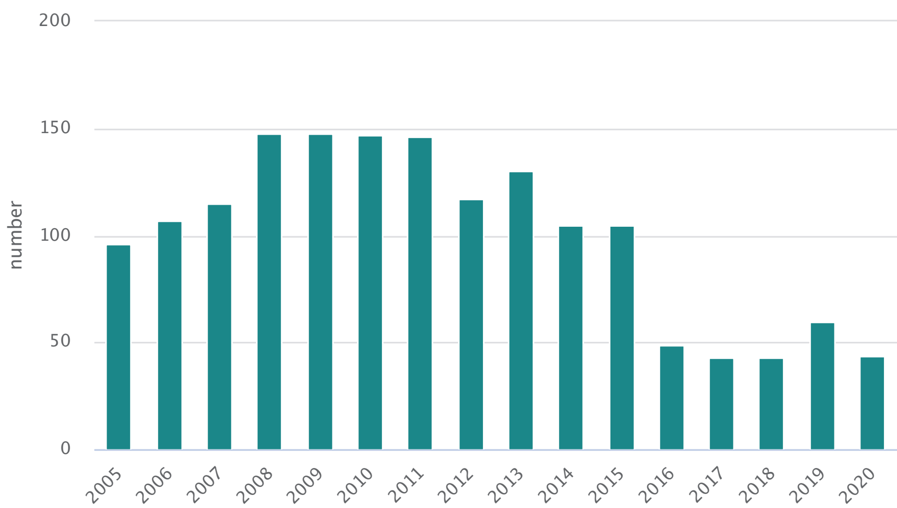
Within **the costs of environmental protection**, the largest **growth in** 2020 compared to 2009 was in costs of waste management (65.5%), which also accounted for the largest share in 2020 (59.9%).

Environmental protection costs in industrial production are decreasing.

3.1.3.3 Environmental labelling of products in manufacturing

Eco-labelling promotes the production and consumption of products that are more environmentally friendly throughout their life cycle and that provide customers with accurate, non-misleading and scientifically based information on the environmental impact of products. Environmental product labelling in the Slovak Republic has been implemented since 1997 through the national scheme for awarding the Environmentally Suitable Product label and since 2004 also through the European scheme for awarding the EU Ecolabel.

Development in environmental labeling of products in manufacturing and in services



Source: SEA

In 2015, there was a significant increase in the number of products with the right to use the EU Ecolabel, bringing the total number of awarded products in the Slovak Republic since 2004 to 136 products, including 3 services. In 2017, there was a significant decrease to 8 products and the downward trend of products with the right to use the eco-label was maintained in 2020, when only 5 awards were granted.

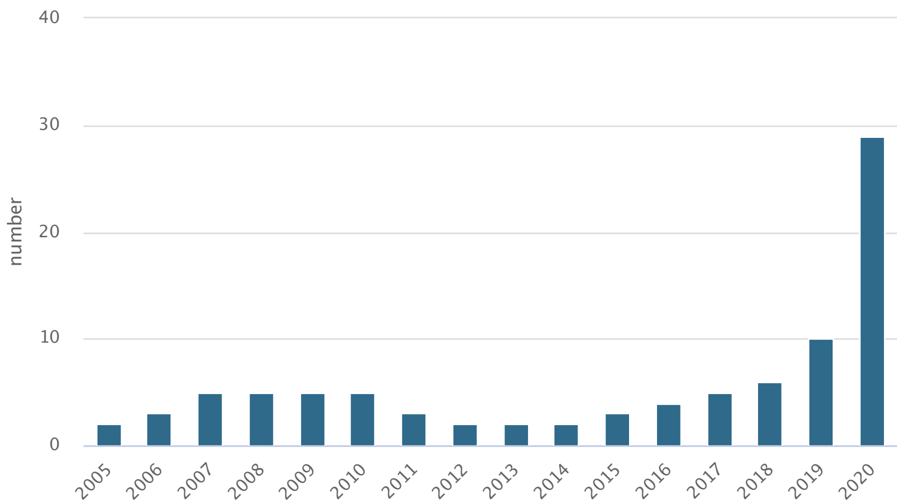
In 2015, there was a significant increase in the number of products with the right to use the EU Ecolabel, bringing the total number of awarded products in the Slovak Republic since 2004 to 136 products.

3.1.3.4 European Community scheme for environmental management and auditing in manufacturing

The European Community Eco-Management and Audit Scheme helps companies to optimize their production processes, reduce their environmental impact and use resources more efficiently.

The interest of companies doing business in the Slovak Republic in the EMAS is growing significantly and by 2020, 29 companies were registered.

Development in the number of registered organizations in EMAS schemes in industrial production



Source: SEA

References

1. Ministry of Economy of the Slovak Republic. *Návrh akčného plánu inteligentného priemyslu SR* [online]. Bratislava: MHSR, 2016. **[Slovak version]**
   Available from: https://www.mhsr.sk/uploads/files/8U6RKSS5.pdf

2. Ministry of Economy of the Slovak Republic. *Rámcová pozícia Slovenskej republiky k európskej priemyselnej politike a revízii pravidiel poskytovania štátnej pomoci.* [online]. 2020. **[Slovak version]**
   Available from: https://www.mhsr.sk/uploads/media/HsGU7BDE.pdf

3. Ministry of finance of the slovak republic. Priemysel v čase korony [online]. 2021. **[Slovak version]**
   Available from: https://www.mfsr.sk/files/archiv/94/Komentar_priem_2020_final.pdf

4. Ministry of Economy of the Slovak Republic. Priemyselná výroba a jej postavenie v hospodárstve SR [online]. 2018. **[Slovak version]**
   Available from: https://www.economy.gov.sk/uploads/files/ezNh8gXF.pdf

5. Ministry of Environment of the Slovak Republic. *Návrh orientácie, zásad a priorít vodohospodárskej politiky Slovenskej republiky do roku 2027* [online]. 2015. **[Slovak version]**
   Available from: https://www.minzp.sk/files/sekcia-vod/navrh-orientacie-zasad-a-priorit-vodohospodarskej-politiky-sr-do-roku-2027.pdf

6. Ministry of Environment of the Slovak Republic. *Vyhodnotenie priebežného plnenia cieľov a opatrení Programu odpadového hospodárstva Slovenskej republiky na roky 2016 – 2020* [online]. 2018. **[Slovak version]**
   Available from: https://rokovania.gov.sk/RVL/Material/23377/1

7. European Commission. 2021 EU Industrial R&D Investment Scoreboard [online]. 2015.
   Available from: https://ec.europa.eu/commission/presscorner/detail/sk/ip_21_6599

8. Energy Portal. *Energetická náročnosť. Priemysel je úpornejší, v doprave spotreba vzrástla*. [online]. 2012. **[Slovak version]**
   Available from: https://www.energie-portal.sk/Dokument/energeticka-narocnost-priemysel-je-upornejsi-v-doprave-spotreba-vzrastla-101066.aspx

9. Slovak Hydrometeorological Institute. *Industry. Greenhouse gas emissions and air pollutant from Industrial Processes*. [online].2022.
Available from: https://oeab.shmu.sk/en/emissions/industry/trends.html

10. Water Portal*. Odbery povrchových vôd klesajú. Ťahúňom je priemysel, ukazujú dáta MŽP* [online]. 2022. **[Slovak version]**
Available from: https://www.voda-portal.sk/Dokument/odbery-povrchovych-vod-klesaju-tahunom-je-priemysel-ukazuju-data-mzp-101457.aspx

11. Kádárová J., Kádár G., Kobulnický J., *Controlling inovacii priemyselných podnikov* [online]. Ostrava. 2018. ISBN 978-80-248-4251-6 **[Slovak version]**
Available from: https://www.researchgate.net/profile/Jaroslava-Kadarova/publication/333133183_Controlling_inovacii_priemyselnych_podnikov/links/5cdd36f9a6fdccc9ddb29a77/Controlling-inovacii-priemyselnych-podnikov.pdf

12. *Commision of the European Economic. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan*. [online]. 2008. **[Slovak version]**
Dostupné: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0397:FIN:SK:PDF

13. Slovak Environment Agency, Odbor environmentálneho manažérstva a Bazilejského dohovoru. *7 + PRE EMAS Schéma pre environmentálne manažérstvo a audit* [online]. Banská Bystrica: MŽP SR, SAŽP, 2022. ISBN 978-80-89503-84-1. **[Slovak version]**
Available from: https://www.emas.sk/wp-content/uploads/2019/06/Preco-zaviest-EMAS_final_web-1.pdf

ENERGY

List of the sector indicators in energy

Trends of the sector relevant for the environment

- Energy sources balance
- Electricity generation and consumption
- Final energy consumption
- Energy intensity of the economy of the Slovak Republic

Interactions of the sector with the environment (demands of the sector in respect of resources and impacts of the sector on the environment)

- Greenhouse gas emissions from energy
- Emissions of pollutants released into the air from energy
- Waste water from energy
- Wastes from energy
- Radioactive waste

Political, economic and social aspects

- Renewable energy sources
- Electricity and natural gas price
- Costs of the environmental protection in energy

According to the Statistical Classification of Economic Activities (SK NACE Rev. 2), energy is included in the Section D – Electricity, gas, steam and cold air supply.

3.2. What is the state and direction of the energy sector in relation to the environment?

What is the state and direction of the energy sector in relation to the environment?

The Slovak Republic is poor in primary energy sources (PES). Consequently, the dependence of the Slovak Republic on imports is high, as almost 90% of PES (including nuclear fuel) is imported. Gross Inland Energy Consumption (GIEC) recorded a decline of 14.1% between 2005 and 2020, with slight fluctuations. In terms of the structure of PES used (the so-called energy mix), the Slovak Republic had a balanced share of individual sources in 2020. The period 2005 – 2020 is characterized by a positive trend of decreasing consumption of gaseous and solid fuels (31.0% and 46.1% respectively) and simultaneous increasing consumption of renewable energy sources (RES) (407.5%).

In 2005 – 2020, **electricity generation** decreased by 7.3%. In terms of the structure of electricity generation resources, the Slovak Republic already had a low-carbon mix of sources in 2020. The share of zero carbon electricity generation was close to 80% in 2020. Traditionally, nuclear power plants had the highest share in electricity generation (53.2%). In the long term, electricity generation in thermal power plants is gradually declining in the Slovak Republic and the importance of nuclear energy and energy from RES is growing.

Final energy consumption (FEC) in the Slovak Republic followed a more or less stagnant trend between 2005 and 2020, with an overall decrease in FEC of 7.6%. This decline was significantly contributed to by a 6.2% year-on-year decline in 2020, which can be attributed to the impact of the COVID-19 pandemic. The FEC of solid fuels (44.5%) and heat sold (42.6%) decreased most significantly. On the positive side, there was a significant increase in the FEC and biofuels (250%).

The industrial sector has long been **the largest consumer of energy** in the Slovak Republic. Its share of the total FEC was 32.7% in 2020. This was followed by households (28.6%), transport (25.9%) and commercial and public services (11.5%). Agriculture and forestry together had the lowest share of just 1.4%. Over the entire 2005 – 2020 period, the FEC trended downwards in all sectors, except for households (8%) and transport (5.7%).

Since 2005, the energy intensity (EI) of the Slovak economy was declining, decreasing by 44.1% by 2020. Despite the favorable development, the

Slovak Republic had the eighth highest EI among the EU-27 countries in 2020.

The development of energy intensity by sector by final energy consumption was generally positive in the 2005 – 2020 period. The EI had a decreasing trend in agriculture (61.9%), industry (48.1%) and transport (8.8%). The increase in EI in this period was recorded in the household sector (6.9%), which was mainly influenced by the increase in the FEC in the sector in the last two years.

What are the interactions between the energy sector and the environment?

Demands of energy in respect of resources

Within the energy sector, surface water is the most used water in electricity generation (almost 95%). This is the water used for technological and cooling purposes. In 2020, the energy sector accounted for 28.8% of total surface water withdrawals.

Impact of energy on the environment

By 2020, greenhouse gas emissions from the energy sector decreased by 64.5% compared to 1990. Most emissions came from the combustion and transformation of fossil fuels. There was also a decrease in the greenhouse gas emissions from 2005 – 2020 (38.5%), mainly due to a decrease in emissions from large and medium-sized sources. Despite this significant decrease, energy accounted for up to 47.4% of total greenhouse gas emissions in 2020.

In the Slovak Republic, the positive trend of gradual reduction of pollutants released into the air from the energy sector persists. In the 2005 – 2020 period, a positive trend was achieved for all emissions assessed. The most significant decreases were observed for SO_2 (92.7%), PM_{10} (87%) and $PM_{2.5}$ (90%) and PCDD/PCDF (93.8%) emissions.

The electricity sector was the largest contributor to the total volume of wastewater from the energy sector in the 2006 – 2020 period. With the exception of the years when it was affected by the Vojany power plant (2012, 2013), the amount of wastewater volume had a decreasing trend (77.7%). The volume of wastewater from the heating industry varied, with a 47.4% decrease in 2020 compared to 2006.

The development of waste production from the energy sector was ambiguous in the 2017 – 2020 monitored period. The share of the energy sector in the total waste production in 2020 was 6.8%. The waste was dominated by other waste.

In the 2005 – 2020 period, there was a significant reduction in the production of solid radioactive waste from the Jaslovské Bohunice Nuclear Power Plant (NPP EBO) (49.9%) and liquid radioactive waste from both nuclear power plants (NPP EMO 90.8%, NPP EBO 68.5%). An increase occurred for solid waste from the Mochovce NPP (NPP EMO) (12.7%).

What is the response of the society to mitigating or compensating negative consequences of energy on the environment?

In the 2005 – 2020 period, the share of energy from RES in the Slovak Republic will increase from 6.4% in 2005 to 17.3% in 2020. Thus, the Slovak Republic met the target of 14% share of RES in 2020. This was mainly due to the year-on-year increase in 2018 and 2019, when the share of RES increased by 5 percentage points compared to the previous year. This overall increase reflected the refined statistics on biomass use and the start of data reporting for heat pumps. Among RES, hydropower (electricity generation) and biomass (heat and cold generation) dominated. In the transport sector, biodiesel was dominant.

The price of electricity for households increased steadily since 2004, except for a few years, and by 2020 it increased by 38.4%. The same upward trend was also observed for the price of natural gas for households, which was 74.8% higher in 2020 than in 2004.

The total costs of the environmental protection in the energy sector had an ambiguous trend in 2009 – 2020, with the highest in 2015 (EUR 86,993 thousand). In contrast, the lowest total costs were in 2017 (EUR 20,563 thousand). Investments dominated.

3.2.1 What is the state and direction of energy in relation to the environment?

Sustainable energy supply is one of the key prerequisites for sustainable economic growth, based on a secure and reliable supply of energy at optimum cost and in the efficient use of energy with rigorous environmental protection. All important sectors of the country's economy are secondarily linked to the energy sector. For this reason, energy policy setting the direction of the sector is directly linked to environmental protection, particularly in the areas of climate change and sustainable development.

Increasing global pressures on the environment in the form of climate change, and unsustainable use of resources have made energy a key issue for the EU since 2005.

The need for a comprehensive approach to energy issues led to the adoption of the Climate and Energy Package at the EU level in 2008, which for the first time provided an integrated and ambitious package of policies and measures to combat climate change by defining the 20 – 20 – 20 targets.

EU 2020 targets:

- Reduce greenhouse gas emissions by at least 20% below 1990 levels by 2020, with a firm commitment to increase this target to 30% if a satisfactory international agreement is reached.
- Achieve 20% renewable energy (as a share of total EU gross final energy consumption) by 2020, complemented by a target of at least 10% renewables in transport.
- Save 20% of total primary energy consumption by 2020 compared to the business-as-usual benchmark scenario.

Climate and Energy Package (2008)

In October 2014, EU leaders agreed on the 2030 Climate and Energy Framework, which builds on the 2020 Climate and Energy Package. It has set three main goals for 2030.

EU 2030 targets:

- Reduce greenhouse gas emissions by at least 40% (compared to the level in 1990). To achieve the reduction, the EU ETS sectors should reduce emissions by 43% (compared to 2005)
- Achieve at least a 27% share of EU energy consumption from renewable energy sources.
- Improve energy efficiency by at least 27%.

2030 Climate and Energy Framework (2014)

As part of the revision of the Energy Efficiency Directive and the Renewable Energy Directive, new, stricter targets for 2030 were agreed upon in November 2018.

EU 2030 targets:

- Energy efficiency is expected to increase by 32.5% in the EU.
- The share of energy produced from renewable sources in gross final energy consumption should reach at least 32%.
- Both targets should be reviewed in 2023, but if they were to be changed, it would only be toward more stringent targets; it would not be possible to reduce the targets.

Directive (EU) 2018/2002 of the EP and the Council amending Directive 2012/27/EU on energy efficiency (2018)

The strategic targets and frameworks for the development of the Slovak energy sector in the long-term outlook are defined by the Energy Policy of the Slovak Republic (EP SR). The targets and priorities of the SR EP are set to meet the targets set at the EU level.

Until 2014, they were defined by the Energy Policy of the Slovak Republic of 2000 and, in particular, the Energy Policy of the Slovak Republic of 2006. Its three basic targets were to facilitate a safe and reliable supply of all forms of energy in the required quantity and quality with maximum efficiency, reduce energy intensity, and ensure self-sufficiency of electricity production to meet demand on an economically efficient basis.

Developments at the EU level after 2009 required an update of Slovakia's energy policy. In 2014, the new Energy Policy of the Slovak Republic was approved, which set the goals and priorities of the energy sector until 2035 with a view to 2050. The strategic targets of the SR EP 2014 is to achieve a competitive low-carbon energy sector facilitating a safe, reliable, and efficient supply of all forms of energy at affordable prices, taking into account consumer protection and sustainable development. At the same time, the policy was to help the Slovak Republic meet the 20 – 20 – 20 climate and energy targets binding on the Slovak Republic. The new, more ambitious targets resulting from the 2030 framework, agreed upon by EU leaders and mandatory for Slovakia, were reflected in the Integrated National Energy and Climate Plan 2021 – 2030, adopted in 2019. This plan updates the existing 2014 energy policy. In addition to the original four pillars that underpinned energy policy (energy security, energy efficiency, competitiveness, and energy sustainability), the plan expands on the decarbonization targets. The plan defines national targets for 2030.

Slovakia's priority in the energy sector is to ensure synergy between sub-policies, cost-effectiveness, enforcement of the principles of sovereignty in the energy mix, and preservation of competitiveness. At the same time, it emphasizes air quality, reducing greenhouse gas emissions, mitigating climate change, and security of supply of all types of energy and their affordability. In 2019, the Slovak Republic signed up to a commitment to achieve carbon neutrality by 2050. This commitment will require an update of the existing strategic and legislative framework in the energy field and the targets derived from them.

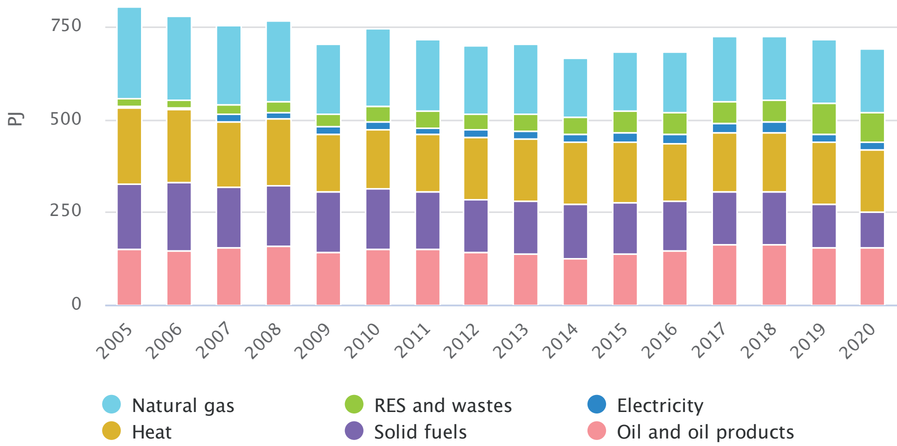
The state and directing of energy in relation to the environment is characterized based on the indicators from the group of trends of the sector relevant for the environment.

3.2.1.1 Energy sources balance

In terms of natural conditions, the Slovak Republic is poor in primary energy sources (PES) and imports almost 90% of them – nuclear fuel 100%, natural gas 98%, oil 99% and coal 75%. The main inland energy sources are renewable energy (mainly biomass and hydro) and lignite.

The consumption of primary energy sources, expressed as gross inland energy consumption (GIEC), showed a decrease of 14.1% in 2005 – 2020, with slight fluctuations. In 2020, it reached a value of 689,372 TJ. The most significant decrease in gross inland consumption in the 2005 – 2020 period was in solid fuels (46.1%) and natural gas (31.0%).

Development of gross inland energy consumption



Source: SO SR

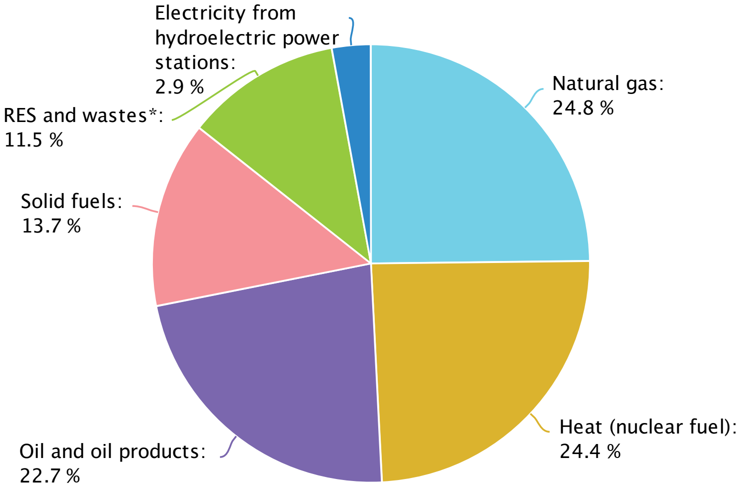
The gross inland energy consumption includes the primary production (brown coal, lignite, crude oil, natural gas, heat and electricity) in the Slovak Republic and it is adjusted for recovered products, import – export balance and stock depletion. It also includes the import – export balance and depletion of stocks, such as black coal, coke, briquettes, crude oil, petrol, light and heavy heating oils, paraffin, coke gas, blast furnace gas, and other solid, liquid and gaseous fuels.

The GIEC decrease was considerably due to the development of sectors with a higher value added, introducing new modern technologies with lower energy demands, but also thermal insulation of buildings, exchanging appliances for low-energy ones, as well as increased savings due to the price deregulation.

In 2020, fossil fuels dominated the energy mix in the Slovak Republic (61.3%).

The Slovak Republic has a long-term balanced structure of the share of individual primary energy sources in gross inland energy consumption, the so-called energy mix, which in 2020 was as follows: natural gas 23.9%, nuclear fuel 23.5%, crude oil and oil products 21.9%, solid fuels 16%, and renewables (including waste and electricity generated at hydroelectric power stations) 14.7% (11.4% and 3.4%).

Energy mix (2020)



Note: RES and waste* – except electricity from hydroelectric power stations
Source: SO SR

Meeting energy needs of the society is one of key factors for the economy functioning of each country. Today, energy security is traditionally perceived as an important part of national security or national sovereignty.

Almost 90% dependence of the Slovak Republic on imports of primary energy sources persists.

The Slovak Republic belongs to countries with a high import dependency, as it has to import the most of the primary energy sources to cover inland consumption. This is also why the development of the Slovak energy sector is aimed at optimizing the energy mix from the point of view of increasing energy security while achieving the individual main reasons of efficiency, affordability of energy and consistent protection of the environment. Emphasis is placed on the use of domestic energy sources, such as renewable sources and nuclear energy and low-carbon technologies, as well as the diversification of sources.

3.2.1.2 Electricity and heat generation

Ensuring the quality of energy supply in the form of electricity and heat at affordable prices and taking into account environmental protection and sustainable growth are among the priorities of the energy policy of the Slovak Republic.

The Slovak Republic needs on average 42.7 TWh for heating (heat) and around 30 TWh of electricity per year.

Electricity

In 2020, 29,010 GWh of electricity was generated in the Slovak Republic. The 2005 – 2020 period is characterized by a downward trend in electricity generation (7.3%). In 2020, as in the previous years, nuclear power plants had the highest share in electricity generation (53.2%), while hydroelectric power plants had the largest share of RES (16.8%).

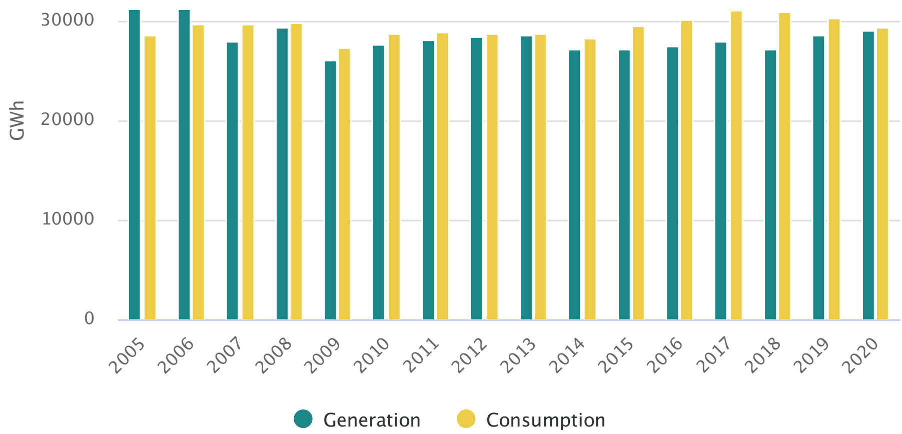
In terms of the structure of electricity generation sources used, the Slovak Republic is one of the leaders in low-carbon electricity generation, as the share of zero carbon electricity generation was almost 80% in 2020.

The Slovak Republic is one of the leaders in low-carbon electricity generation (almost 80%).

In the long-term run, electricity generation at thermal power stations has been gradually decreasing in the Slovak Republic and the importance of nuclear energy and energy from RES has been growing.

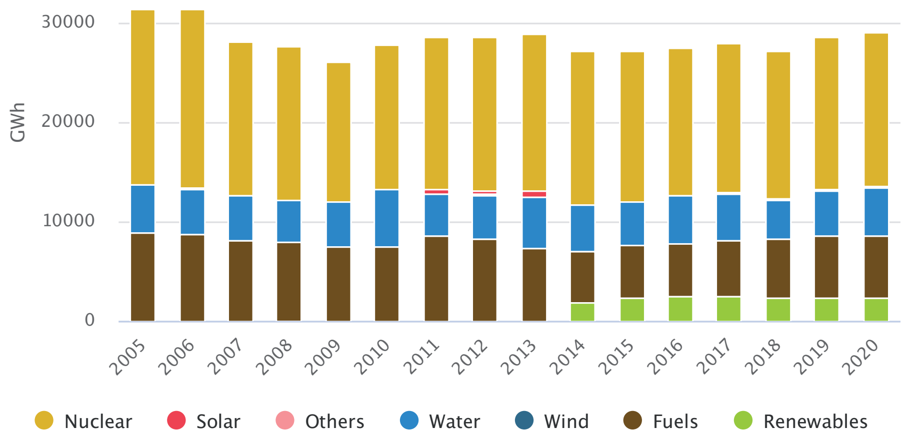
In 2020, after four years, electricity consumption fell below the 30 TWh threshold and the volume of electricity consumption was at 29,328 GWh. Despite a decrease in recent years, electricity consumption increased by 2.6% in the 2005 – 2020 period. The industry and commercial and public services sector accounted for most of the increase in consumption during this period.

Development of electricity generation and consumption



Source: SEPS, a.s.

Development of electricity generation by source



Source: SEPS, a.s.

Heat

The heating and cooling sector in the Slovak Republic is represented by a combination of centralized heat supply (CHS) and individual heating and cooling. Heat from the CHS systems is supplied mainly to the residential, industrial, commercial and service sectors and in the 2010 – 2020 period it covered about 30 – 35% of the total heat demand. The share of different fuel types in heat generation at public facilities has been relatively stable since 2017, with natural gas dominating. In 2020, the share was as follows: natural gas 51.7%, biomass 18.3%, coal 17.3%, oil 9.9% and biogas 2.8%. In 2020, 50% of the heat produced by combined heat and power technology (CHPT) was cogeneration.

Cogeneration is not only an environmentally friendly, but also an economical and highly efficient way of simultaneous combined heat and power generation (50% generated heat).

In individual heating, the heat sources mainly burn natural gas or biomass and are mainly located at the premises of consumption (815,386 occupied family houses and 2,615 residential buildings (2011).

3.2.1.3 Energy consumption and energy efficiency

The environmental impact of the energy sector is proportional to the amount of energy produced and consumed, so reducing energy production and consumption also means reducing the negative impacts. Therefore, the rationalization of energy consumption through its more efficient use with an emphasis on energy savings is the integral part of the energy policy of the Slovak Republic.

The cheapest energy is the energy that does not have to be produced.

Energy efficiency is one of the main factors in meeting long-term energy and climate targets. It is considered to be the most cost effective means for reducing greenhouse gas emissions and other pollutants, improving energy security and competitiveness as well as the way for achieving advantages for citizens in the form of energy savings.

Two types of national targets have been set for energy efficiency by 2020:

1)

a) Slovakia's targets for the period 2007 – 2016 (9 years)

- Achieve the annual savings target of 1% of the average final energy consumption of 2001 – 2005 (3,122 TJ/year) over the reporting period. In 9 years, i.e. by 2016, savings of 9% of the average final energy consumption of 2001 – 2005 (28,098 TJ) had to be achieved in the Slovak Republic.

Directive 2006/32/EC on energy services transposed into the Energy Efficiency Concept

b) Slovakia's targets for the period 2016 – 2020 (4 years)

- Achieve the national indicative energy efficiency target for 2020 expressed in terms of the absolute value of primary energy consumption in 2020 (20% – 686 PJ) and the absolute value of final energy consumption in 2020 (31% – 378 PJ) compared to the 2007 PRIMES benchmark scenario.
- Achieve a building energy savings target corresponding to an annual renovation of 3% of the total floor area of buildings owned and used by Central Government Authorities to at least the minimum energy performance requirements for buildings.
- Achieve the end-user energy savings target set at 1.5% of each energy supplier's annual energy sales to consumers.

Directive 2012/27/EU on energy efficiency transposed into the Energy Efficiency Action Plan 2017 – 2019 with an Outlook to 2020 (2016)

2)

Slovakia's 2020 targets for EF expressed in Mtoe

- Achieve the national indicative energy efficiency target for 2020 expressed in terms of the absolute value of primary energy consumption in 2020 (20% – 16,2 Mtoe) and value of final energy consumption in 2020 (20% – 10,38 Mtoe).

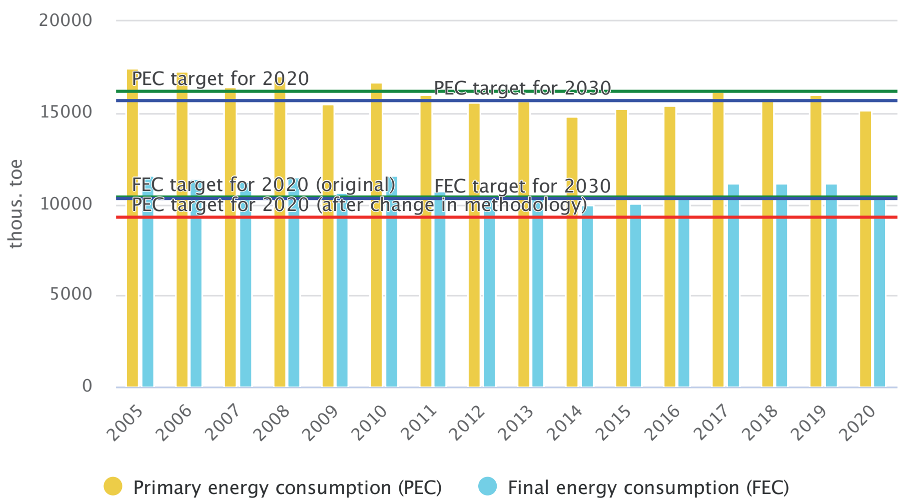
Integrated National Energy and Climate Plan 2021 – 2030 (2019)

Final energy consumption

The final energy consumption (FEC) represents the energy balance of an area.

In the energy environment of the Slovak Republic, a strategic and legislative framework for increasing energy efficiency was set up. On the primary energy consumption side, the Slovak Republic met the target, exceeding it by 7.9%. The originally proposed final energy consumption target of 10,390 ktoe was met by the Slovak Republic. Based on changes in energy statistics in the monitored period, the Slovak Republic reduced the target to 9,243 ktoe. This revised national indicative energy efficiency target for 2020 was not met.

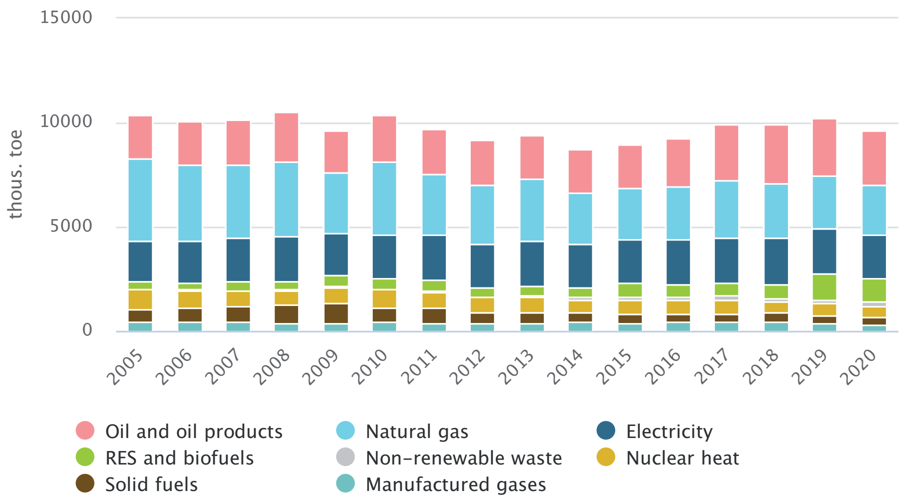
Development of the final energy consumption and primary energy consumption



Source: Eurostat

In 2005 – 2020, the final energy consumption decreased by 7.6%. This decrease was strongly influenced by the COVID-19 pandemic, which had an impact on the 6.2% year-on-year decrease in 2020.

Development of the final energy consumption of fuels and energy

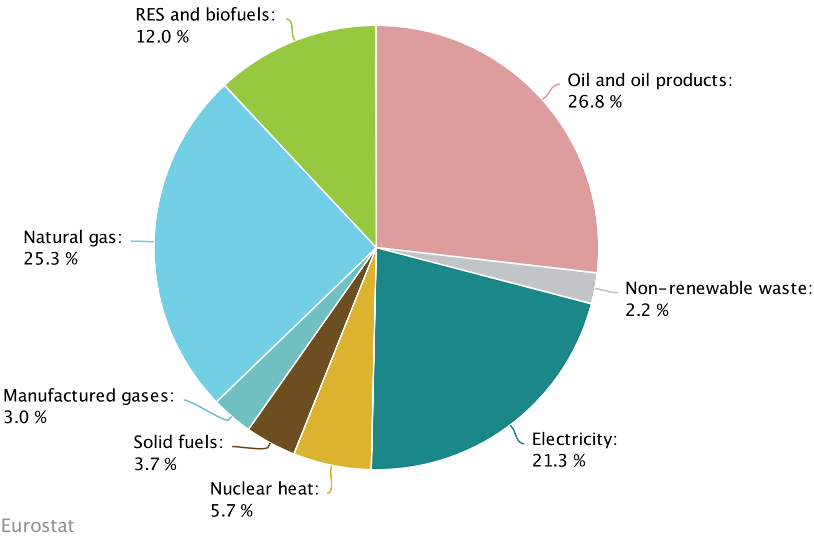


Source: Eurostat

The structure of the fuels used was varied. Fossil fuels dominated the FEC. Of these, liquid fuels had the highest share of the total FEC in 2020 (since 2018).

Since 2018, liquid fuels accounted for the largest share of the FEC.

Share of fuels and energy in final energy consumption (2020)

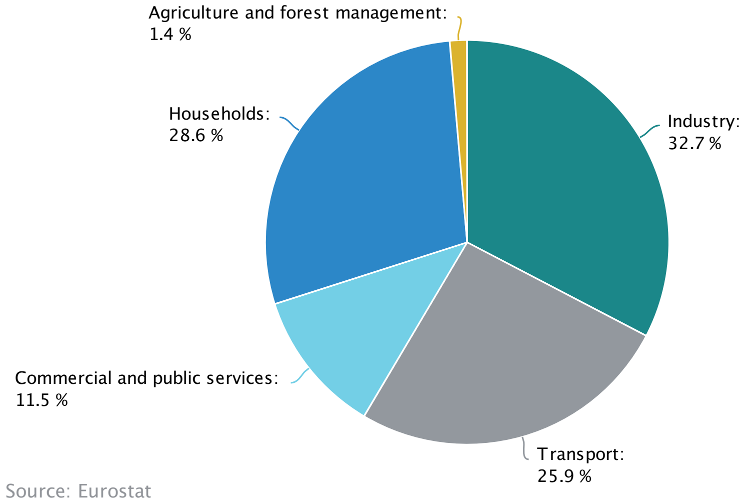


Source: Eurostat

Development of the final energy consumption in the sectors of the economy of the SR

Among the sectors, industry had the largest share of the final energy consumption in 2020 (32.6%), with the highest consumption of solid fuels (71.6%) and electricity (44.1%). This was followed by the household sector (28.6%), with the highest consumption of heat (75%), RES and biofuels (54.5%) and natural gas (47%), the transport sector (25.8%), with a dominant share of liquid fuels (85.6%) and the commercial and public services (11.6%). Agriculture and forestry had the lowest share, only 1.4%.

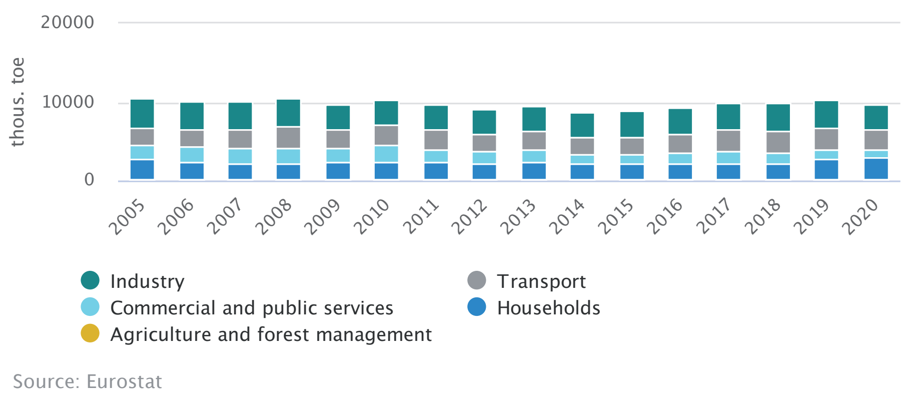
Share of individual sectors in final energy consumption (2020)



The largest energy consumer in the Slovak Republic is the industrial sector.

The situation related to the COVID-19 pandemic was reflected in the year-on-year comparison of energy consumption in the different sectors. Compared to the previous year, in 2020 there is a significant decrease in the FEC in the transport (10.8%), industry (9.4%) and commercial and public services (9.3%) sectors and an increase in the FEC in the household (3.8%) and agriculture and forestry (1.9%) sectors.

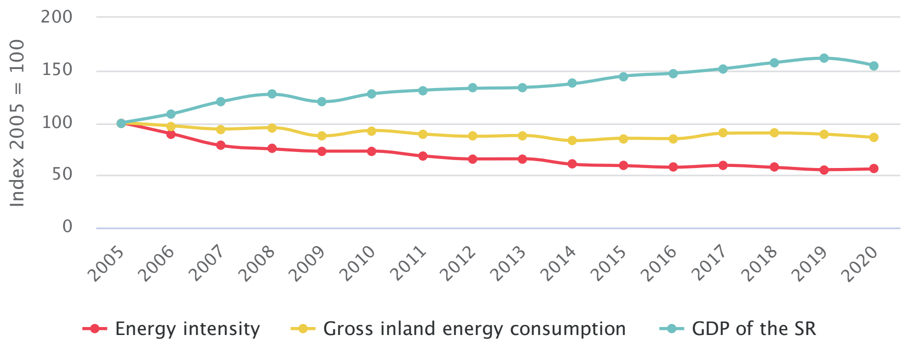
Development of the final energy consumption in the sectors of the economy



3.2.1.4 *Energy intensity*

Energy intensity (EI) is an important economic indicator. It measures energy consumption of the economy and its total energy efficiency. It characterizes demands placed by the given sector of the economy on the energy consumption. Energy intensity is an expression of the share of energy consumption and the value of GDP (at constant prices 2015).

Development of energy intensity, gross inland energy consumption and GDP (at constant prices 2015)



Source: SO SR

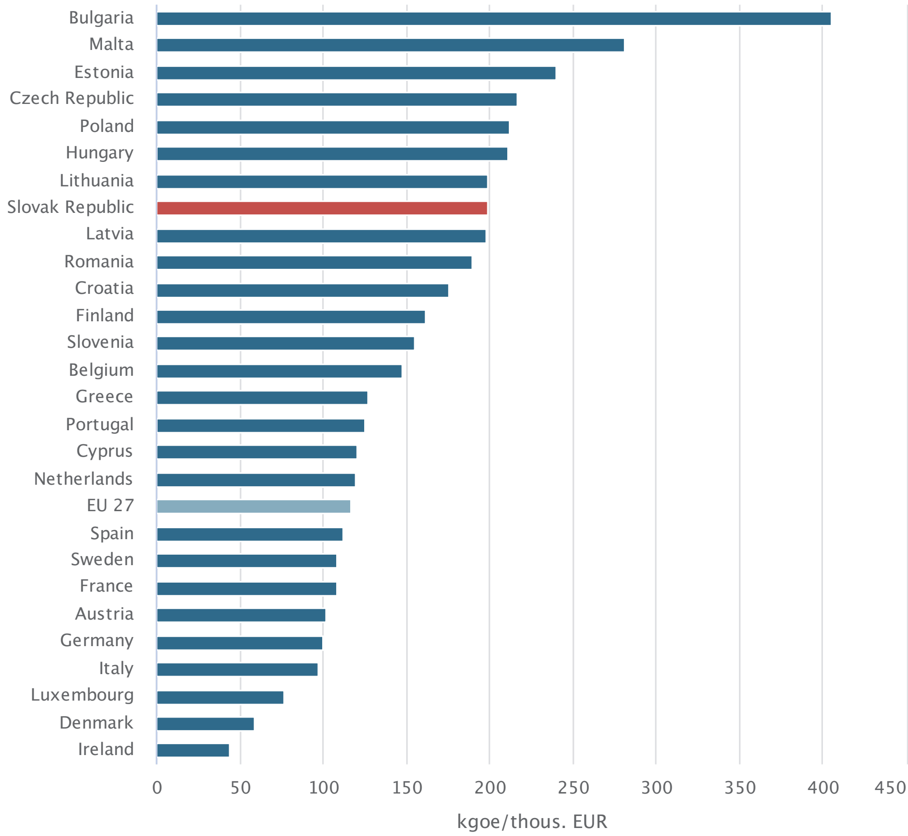
Energy intensity was declining since 2005, decreasing by 44.1% by 2020.

This positive trend is a result of GDP growth expressed at constant prices 2015 that increased by approximately 53.5% for the same period, and a decrease in the gross inland energy consumption that decreased, on the contrary, by 14.1% for the monitored period.

Since 2005, there was a significant 44.1% decrease in the energy intensity of the economy of the Slovak Republic.

In spite of the favourable trend, in 2020 the SR had the eighth highest energy intensity in the EU 27.

International comparison of energy intensity (2020)

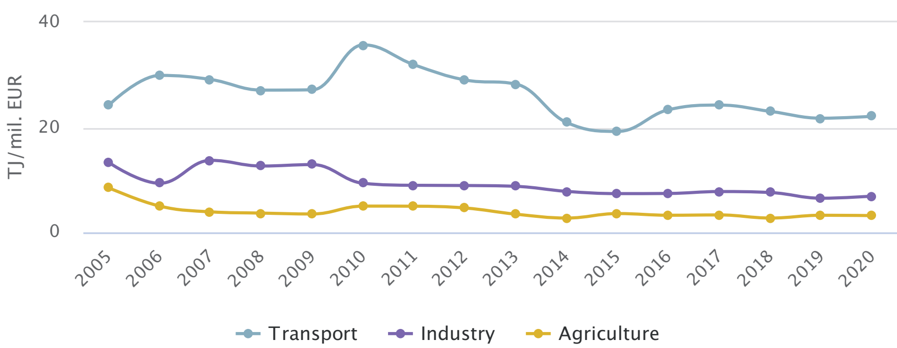


Source: Eurostat

Energy intensity of the final energy consumption in selected sectors

The development of the energy intensity in the sectors monitored by energy consumption is positive overall.

Development of energy intensity in the sectors of the economy



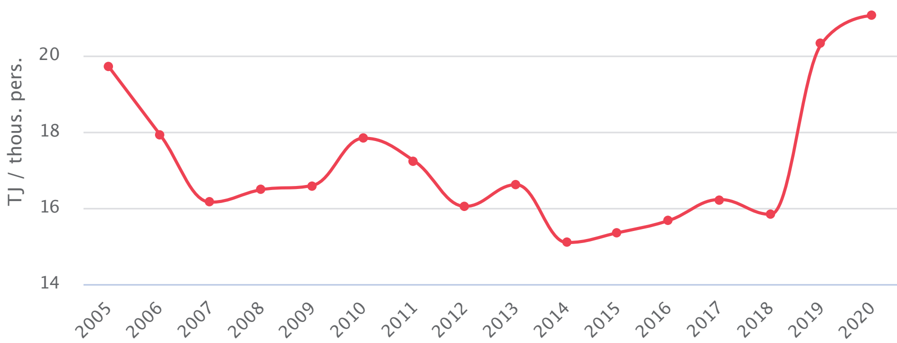
Source: SO SR

In the industry, the energy intensity decreased by 48.1% in 2005 – 2020. Although the positive trend of decreasing final energy consumption of industry was interrupted in 2018 – 2019, in 2020 the FEC will decrease again due to the the Covid crisis (9.2% decrease). Historically, the Slovak Republic was characterized by a significant share of low-processing industries, with high raw material, energy and transport intensity. As the prices of energy resources increase as well as fluctuate, the importance of reducing the energy intensity of industry increases.

The transport showed alternating positive and negative trends in 2005 – 2020, with EI both increasing and decreasing, with peaks in 2010 – 2012, following a decrease in 2009 as a result of the impact of the economic crisis (a decline in both GDP and FEC). The Covid crisis was reflected here as well, with a 1.7% year-on-year increase in the EI of the transport sector in 2020 compared to 2019. The energy intensity of the transport sector decreased by 8.8% in 2005 – 2020. The path to energy savings is focused on prioritizing rail over road and public transport over individual transport.

In the agriculture, energy intensity decreased by up to 61.9% in 2005 – 2020. In 2011 – 2014, the sector experienced the so-called absolute decoupling when the economic growth (GDP) and consumption (FEC) curves split.

Development of energy intensity in the sector of households



Source: Eurostat

The energy intensity of the household sector increased by 6.9% in the 2005 – 2020 period.

The increasing or decreasing trend of energy intensity is influenced mainly by the increasing or decreasing tendency of the electricity consumption in households.

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3.2.2 What are the interactions of energy and the environment?

Energy is essential for creating industrial, commercial and social well-being, and it also provides personal comfort and mobility. However, its production and consumption places a heavy burden on the environment. The overall energy consumption and structure of the energy sector in the Slovak Republic is one of the determining factors of the level of environmental impact of the energy sector.

A necessary part of human development is achieving a balance between ensuring sufficient energy and at the same time preserving a quality environment. The total energy consumption and the structure of the energy sector of the Slovak Republic is one of the determining factors of the degree of impact of the energy sector on the environment. The amount of energy and the impact on the environment are in direct proportion, therefore the most appropriate measure to reduce the negative impact on the environment seems to be the rationalization of energy demand, optimization of the energy mix and energy savings on both the production and consumption side.

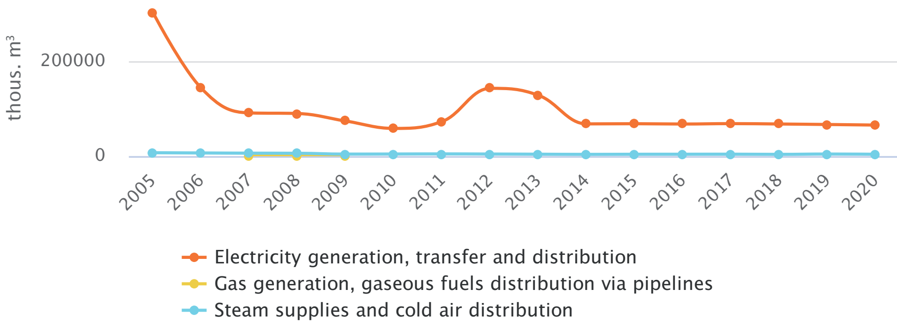
Mutual interactions of energy and the environment are characterized based on the indicators from the group of interactions of the sector with the environment.

Demands of energy in respect of resources

3.2.2.1 Water withdrawals in energy

Water withdrawals for the energy sector put pressure on the water resources themselves, both in terms of quantity and quality. In the energy, this mainly concerns the abstraction of technological and cooling water for the generation of electricity and heat (surface water). Drinking water withdrawals (groundwater) are minimal and are not evaluated in more detail in the sector report.

Development of water withdrawals in energy



Source: SHMI

Most water is used in electricity generation (surface water 94.3%).

In 2020, 69,395.7 thousand m³ of surface water were withdrawn in the energy for technological and cooling purposes in the generation of electricity and heat, which represented 28.8% of the total surface water withdrawals. There was a 77.6% decrease in water withdrawals in the sector in 2005 – 2020. Within the sector, most water is used in electricity generation (94.3%), with the remainder used in steam supplies and cold air distribution (5.7%).

Impact of energy on the environment

Energy is one of the sectors that significantly influence all components of the environment through their activities. These are affected, in particular in a negative sense, in the entire energy chain – from the extraction of energy raw materials, their processing, transport, electricity, heat and cold generation to energy consumption.

The component of the environment the most influenced by the energy generation and consumption is the air. In energy, the biggest share of greenhouse gas emissions originates that are caused by human activities. Energy is also an important contributor of emissions of other pollutants, in particular of sulphur dioxide, nitrogen oxide, carbon monoxide, emissions of PM_{10} and $PM_{2.5}$, emissions of non-methane volatile organic substances, persistent organic pollutants and heavy metals.

The impact of energy on water manifests itself in many spheres. Energy influences the quality of water and participates in water pollution that is connected in particular with the electricity generation in manufacturing facilities.

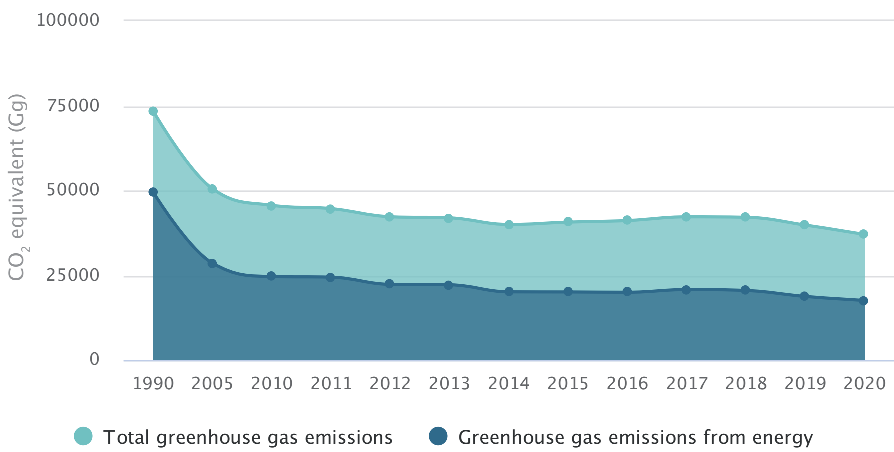
The most waste originates in the sphere of electricity generation, transfer and distribution, followed by steam supplies and cold air distribution; and the lowest share in waste origination is contributed to gas generation and gases fuel distribution via pipelines. Electricity generation at nuclear power plants is connected with radioactive waste production.

3.2.2.2 Greenhouse gas emissions from energy

Despite the significant decrease in greenhouse gas emissions from the energy sector compared to the 1990 baseline year, the energy sector remains one of the largest emitters. In 2020, the sector produced 17,539.31 Gg CO_2 equivalent of greenhouse gas emissions, which represented 47.4% of the total emissions produced in the Slovak Republic.

The energy sector is one of the largest emitters of greenhouse gases (47.4%).

Development of greenhouse gas emissions from energy related to total greenhouse gas emissions



Note: Emissions without the LULUCF sector. Emissions determined as of 13 April 2022.
Source:SHMI

Overall, the greenhouse gas emissions from the energy sector have decreased by 64.5% by 2020 compared to the 1990 baseline year (excluding the LULUCF sector).

A considerable decrease in the creation of greenhouse gas emissions from energy is a result of the total decrease in the industrial manufacture, due to a change in the fuel base to the benefit of clean fuels and fuels with better qualitative features, using new, more efficient technologies, a decrease in the energy consumption in energy intensive sectors as well as a positive impact of direct and indirect legislative measures, among the most effective is the Emissions Trading System (EU ETS).

The year-on-year 6.3% decrease in emissions in 2020 compared to 2019, which was mainly caused by the COVID-19 pandemic, also contributed to this significant decrease.

The energy policy of the Slovak Republic is closely linked with the climate change policy, which supports the reduction of greenhouse gas emissions in all sectors. For more detailed information see p. 235.

The Slovak Republic is committed to achieving climate neutrality in line with the 2050 headline target of the European Union. The Integrated National Energy and Climate Plan (NECP) of the Slovak Republic for the years 2021 – 2030, adopted in 2019, establishes the direction of the Slovak Republic to achieve the obligations arising from EU membership and the participation of the Slovak Republic in international agreements (Paris Agreement). Given the increased climate ambitions of the EU by 2030 and developments related to the invasion of Ukraine, the plan will require updating.

3.2.2.3 Emissions of pollutants released into the air from energy

In addition to greenhouse gas emissions, electricity and heat generation is accompanied, on the basis of fossil fuels, by the production of the socalled indirect greenhouse gas emissions: sulphur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), and other pollutants: PM_{10} and $PM_{2.5}$ emissions, emissions of non-methane volatile organic compounds (NMVOC), emissions of persistent organic pollutants (POPs), specifically PCDD/PCDF, PCB, PAH and heavy metals.

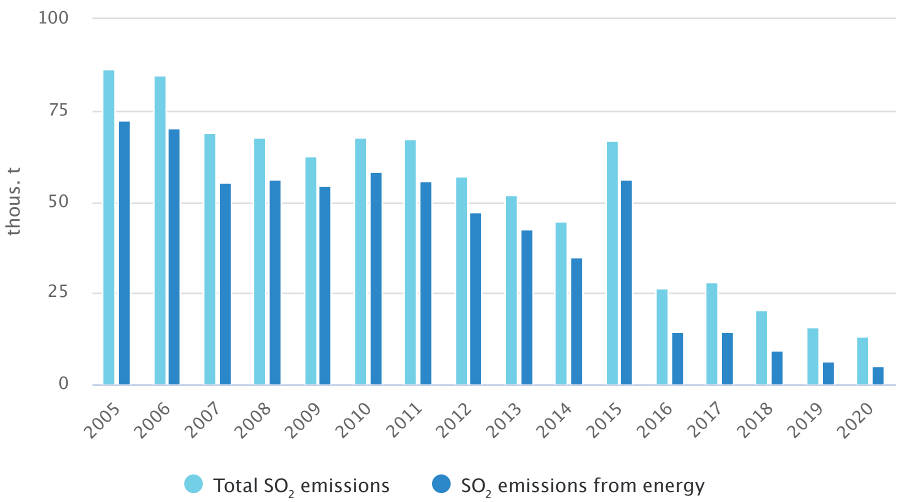
The positive trend of a gradual reduction of pollutants released into the air from the energy sector has been preserved in Slovakia. This decrease is a result of a gradual reduction of the share of the electricity and heat generation from power stations combusting fossil fuels, with a simultaneous increase in using reconstructed sources with progressive fluid technologies of combustion and reliable operation of technologies for cleaning of combustion products, a change in the fuel composition and using fuels with better quality features. The compliance with the emission limits determined by the valid air protection legislation in the SR fully harmonized with the emission limit values accepted in the EU legislation that have to be met by facilities combusting fossil fuels has its share in cutting emissions.

The positive trend of gradual reduction of pollutants released into the air from the energy sector in the Slovak Republic persists.

The SO_2 emissions are mainly emitted from electricity and steam production. The SO_2 emissions from the energy sector had a positive downward trend in 2005 – 2020 with a few fluctuations (2010, 2015), with a maximum in 2005 and a minimum in 2020. Overall, the SO_2 emissions were 92.7% lower in 2020 compared to 2005. The considerable share in this significant decline was the decrease in electricity and heat generation during the COVID-19 epidemic, when there was an 18.9% year-on-year decrease in emissions (2019 – 2020).

The share of the energy sector in the total SO_2 emissions was 39.6% in 2020.

Development of SO_2 emissions from energy related to total SO_2 emissions



Source: SHMI

In period 2005 – 2020, the energy sector achieved a 53.8% continuous decrease in the NO_x emissions. The share of the NO_x emissions from the energy sector in the total NO_x emissions was 29.9% in 2020.

Development of NO_x emissions from energy related to total NO_x emissions

Source: SHMI

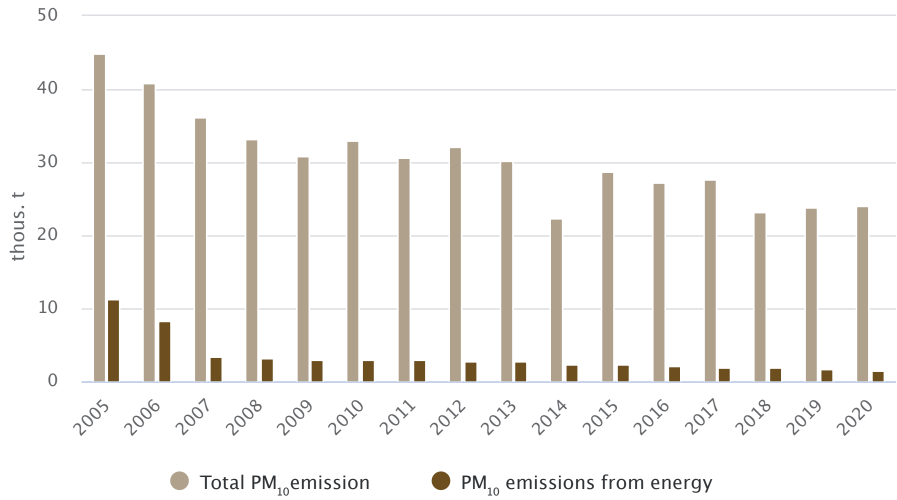
By 2020, the CO emissions from the sector decreased by 10.4%. Their share of the total CO emissions in 2020 was 11.8%.

Development of CO emissions from energy related to total CO emissions

Source: SHMI

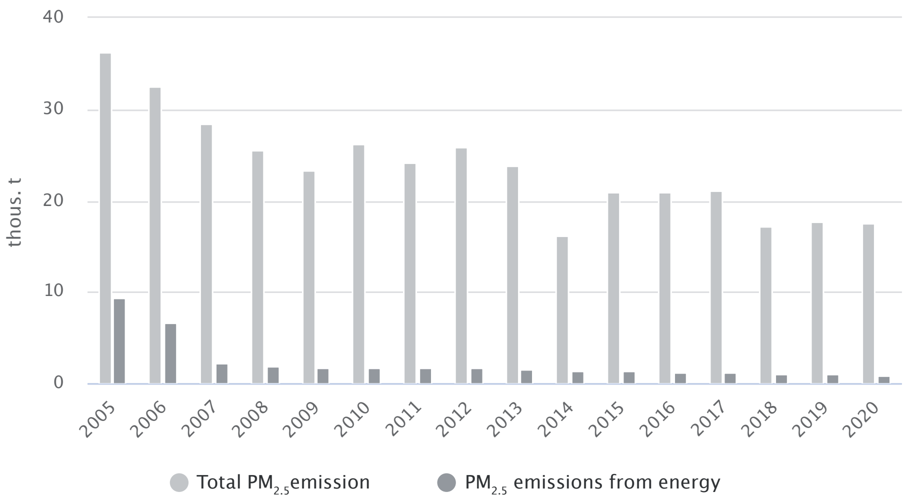
For PM_{10} and $PM_{2.5}$ emissions, there was a significant downward trend for both PM_{10} and $PM_{2.5}$ emissions in the 2005 – 2020 period (PM_{10} by 87%, $PM_{2.5}$ by 90%). In 2020, the PM_{10} emissions from the energy sector accounted for 6.1% and the $PM_{2.5}$ emissions only 5.3% of the total PM_{10} and $PM_{2.5}$ emissions.

Development of PM_{10} emissions from energy related to total PM_{10} emissions



Source: SHMI

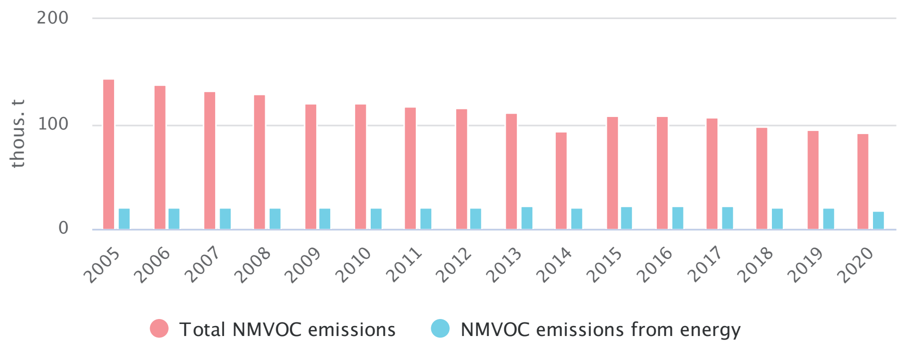
Development of $PM_{2.5}$ emissions from energy related to total $PM_{2.5}$ emissions



Source: SHMI

The emissions of NMVOC followed a slightly decreasing trend in 2005 – 2020 and were 15.9% lower in 2020 than in 2005. The energy sector accounted for 19.7% of the total NMVOC emissions in 2020.

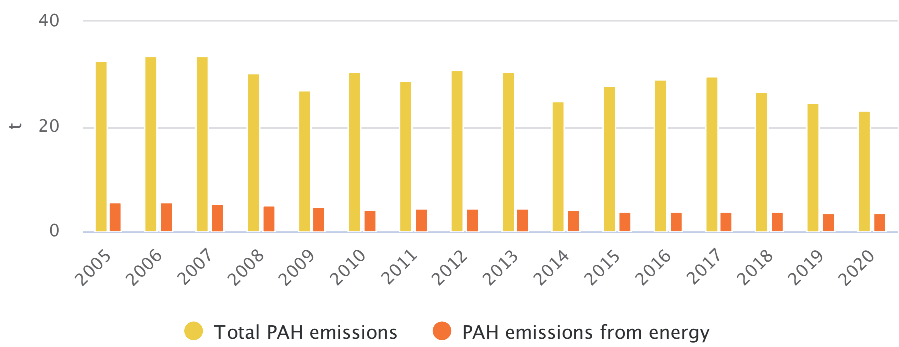
Development of NMVOC emissions from energy related to total NMVOC emissions



Source: SHMI

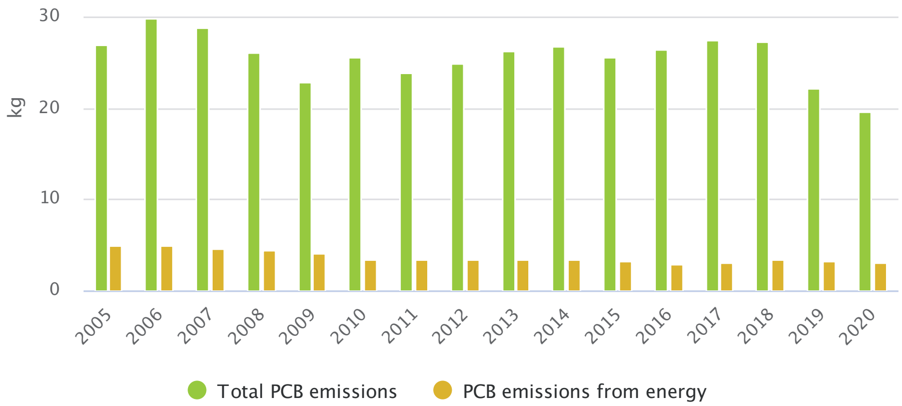
For the POP emissions from the energy sector, a decrease in emissions was achieved for all POP assessed in the 2005 – 2020 period – the emissions of (PCDD/PCDF), (PCB) and (PAH) decreased by 93.8%, 38.6% and 38.5% respectively. The share of the PCDD/PCDF emissions from the energy sector in the total emissions in 2020 was 25%, PCB emissions 15.3% and PAH emissions 14.9%.

Development of PAH emissions from energy related to total PAH emissions



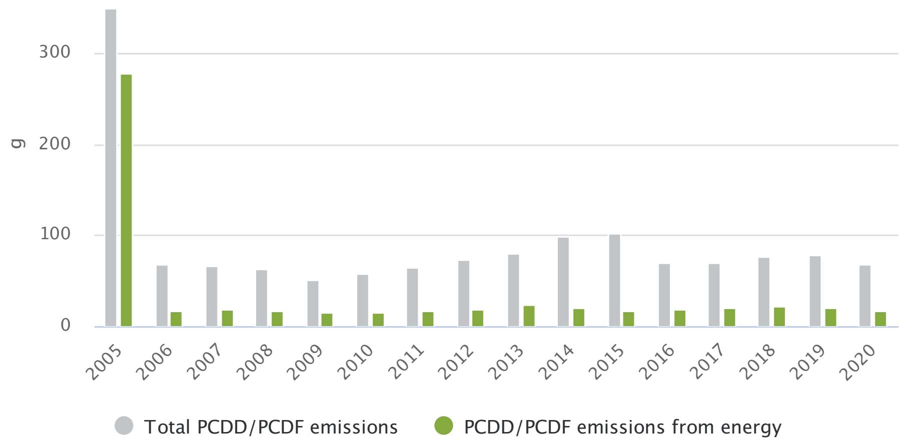
Source: SHMI

Development of PCB emissions from energy related to total PCB emissions



Source: SHMI

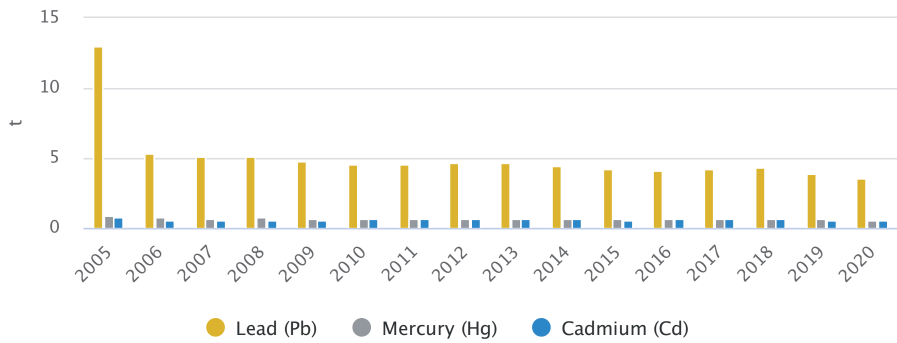
Development of PCDD/PCDF emissions from energy related to total PCDD/PCDF emissions



Source: SHMI

Heavy metal emissions from the energy sector in the 2005 – 2020 period followed a decreasing trend for all assessed heavy metals (Pb 72.4%, Hg 39.3%, Cd 21.4%). In 2020, mercury accounted for the largest share of total emissions from the energy sector (70.4%), followed by cadmium at 59.7% and lead at 43.6%.

Development of the quantity of Pb, Hg and Cd emissions from energy



Source: SHMI

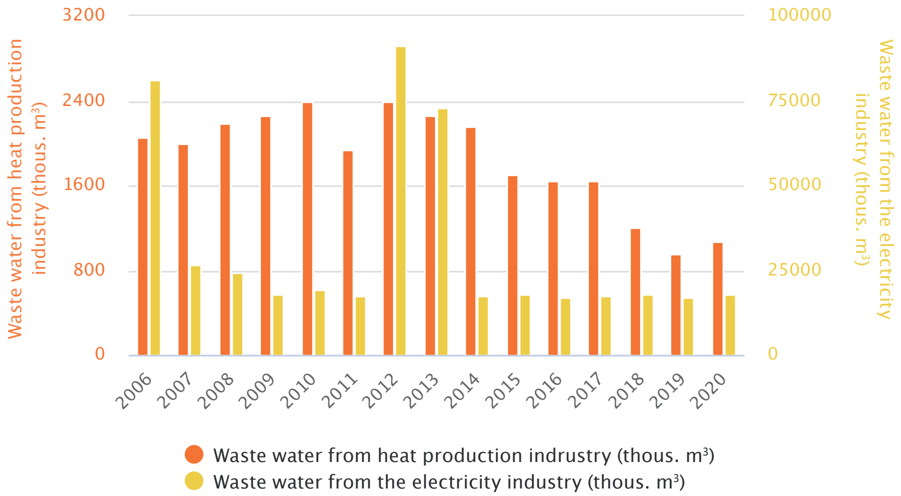
3.2.2.4 Waste water from energy

Waste water produced by power stations has mainly the character of water from technological and cooling processes, sewage water participate in waste water to a lesser extent. Waste water from technologies are contaminated chemically, in the case of nuclear power plants in the primary circle also in a radio chemical way. In the case of water used for cooling, thermal pollution mainly occurs. Pollution of sewage waste water is predominantly biological. These waters are cleaned in mechanical and biological waste water treatment plants.

In the 2006 – 2020 period, the amount of wastewater from the electricity sector experienced two peaks, the first in 2006 and the second in 2012 – 2013, which was influenced by the Vojany power plant. In other years, the amount of wastewater was more or less balanced, which was interrupted in 2020, when there was an increase of 7.5% compared to 2019.

The volume of wastewater from the heating industry for the 2006 – 2012 period has an ambiguous pattern. There was a significant decrease since 2012, this slowed down significantly in the next years and a 12.1% year-on-year increase in volume was recorded in 2020 compared to 2019.

Development of the volume of discharged waste water from energy



Source: SHMI

3.2.2.5 Waste from energy

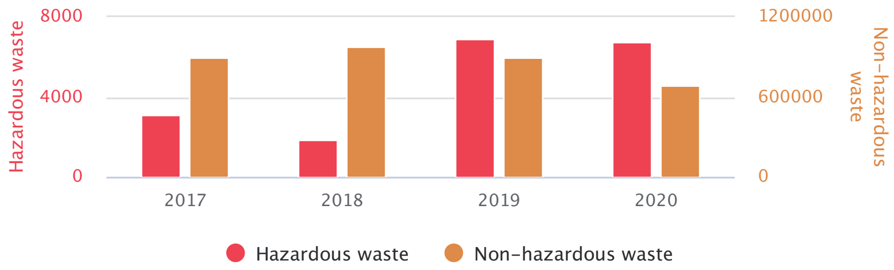
Wastes from energy originate mainly during combustion of coal in the form of ash, debris, slag, and fly ash. They represent more than 95% of all waste produced during the electricity and heat generation in power plants and heating plants. The amount of this waste, as a result of lower generation of electricity and heat from coal, is gradually decreasing.

In the gas industry, more than 50 types of waste are handled originating both in the operational activities (such as repairs and maintenance of gas pipelines, repairs and maintenance of buildings and technological equipment, disposal of technological equipment, cleaning of the transit system, etc.), as well as from servicing and supporting activities (transport, administration, cleaning of water management works, etc.).

In 2020, 695,914.3 tonnes of waste was generated in the energy sector. Overall, the waste production from the energy sector in the 2017 – 2020 monitored period was ambiguous. A more significant decrease (22.6%) was achieved year-on-year in 2019 – 2020. The waste was dominated by non-hazardous waste. Its share in 2020 was 99.04% (689,191.5 t), with hazardous waste representing only 0.96% (6,722.8 t).

This sector accounted for 6.8% of the total waste production by economic activity classification in 2020.

Development of production of wastes in energy according to the wastes category



Note: Due to inconsistent data between 2008 and 2016, the indicator is evaluated for the 2017-2020 period.
Source: SO SR

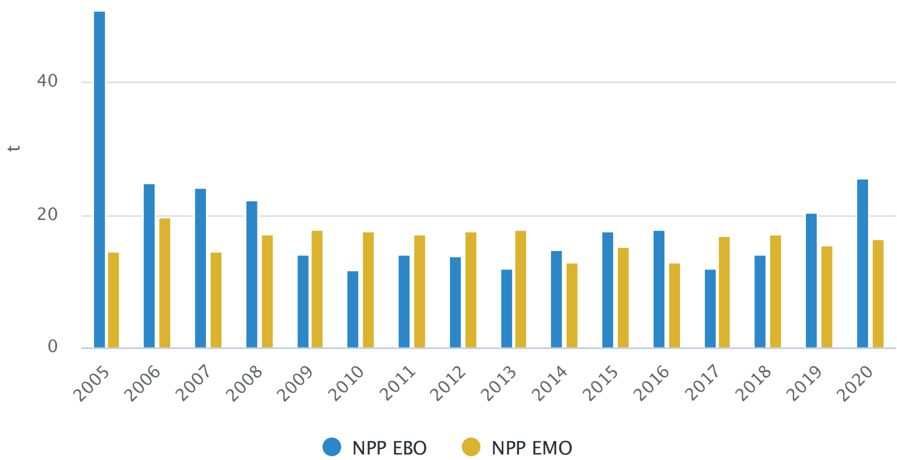
Within the energy sector, most waste in 2020 was generated by electricity production, transmission and distribution (about 2/3).

Radioactive waste

At present, nuclear power plants (NPP) represent the most important source of electricity generation in the electrification system of the Slovak Republic. An inevitable consequence of the electricity generation at NPPs is the production of radioactive waste in both solid and liquid forms.

The production of solid RAO had an increasing trend in the 2005 – 2020 period at the Mochovce NPP (NPP EMO), where it increased by 12.7%. In contrast, the Jaslovské Bohunice NPP (NPP EBO) showed a significant downward trend over the same period, with the solid RAO production decreasing by 49.9%, despite a 25.0% year-on-year increase in 2020 compared to 2019.

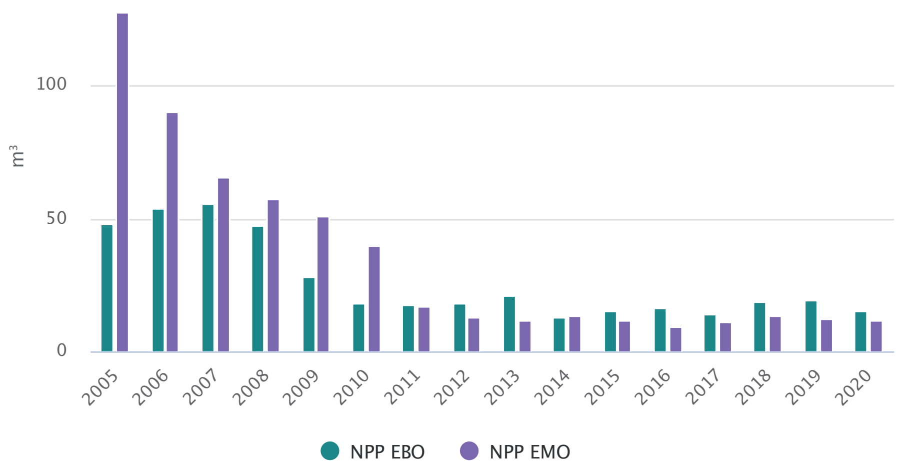
Development of solid radioactive waste



Source: SE, a. s.

There was a significant reduction in the generation of liquid RAO in 2005 – 2020. A 90.8% decrease was achieved at NPP EMO and a 68.5% decrease was achieved at NPP EBO.

Development of liquid radioactive waste



Source: SE, a. s.

The systematic approach to solving the RAO management problem is reflected in the decrease of solid and liquid waste production from NPP.

3.2.3 What is the response of the society to mitigating or compensating negative consequences of energy on the environment?

In order to achieve the main targets of the energy policy, both at the EU level and the SR level, various supporting mechanisms are being adopted. Ones of them are adopted political measures for the support of using renewable sources. Other very frequently used instruments are various economic instruments (costs, investment, etc.) and adopted legislation with limits for pollution. In energy, important instruments are energy prices themselves: electricity and gas prices that can have both a negative and positive impact on consumption, demand or energy efficiency.

The response of the society to mitigating or compensating negative consequences of the energy sector on the environment is described based on the indicators from the group of political, economic and social aspects.

3.2.3.1 Renewable energy sources

Renewable sources are an important part of the country's energy mix, as they are an alternative to fossil fuels that contributes to reducing greenhouse gas emissions, diversifying energy supplies and decreasing dependence on non-stable fossil fuel markets, especially oil and gas, as energy generated from them comes from the own territory. With some technologies (using e.g. water, solar, wind energy, etc.) no emissions even occur during operation. Increasing the share of RES thus contributes to the reduction of environmental pressures, and thus at the same time to the reduction of negative effects on human health.

On the other side, using RES brings, except for the aforementioned advantages, also certain risks. The most important risk results from the nature of these sources. The electricity generation from solar and wind energy is characterized by fluctuation of generation that influences negatively safety and reliability of operation of the electrification system. Other risks include different availability and possibilities of use, direct dependence on hydrometeorological conditions, high financial demands of technological processes, etc. In addition to these risks, there are also environmental negative impacts unfavourably influencing the landscape appearance, the impact on habitats and ecosystems, watercourses, etc. These negative impacts can be minimized by the careful selection of the place and considering all possible negative impacts of the given technology using RES. The positive aspects of using RES overweigh negative aspects and using RES is one of the priorities of the energy policy of the SR.

EU legislation on the promotion of renewable energy sources has seen significant development in the last 15 years. The EU as well as the SR pay a high attention to the development of using energy from renewables. The Commission has submitted more documents in order to strengthen RES using. In 2008, the EU adopted the climate and energy package that represents a complex of regulations. The EU undertakes there, among other things, to increase the RES share in the final energy consumption and the biofuels share in transport until 2020.

The EU Directive (EU) 2018/2001 on the promotion of the use of energy from renewable energy sources determined mandatory national targets for the total share of energy from RES in the gross final energy consumption for the individual states of the EU. The member states had the duty to prepare national action plans for energy from RES where they set their national targets for the share of energy from RES in three sectors: electricity generation, heat and cold generation, and transport.

Slovakia's targets for RES until 2020:

- Achieve a 14% share of energy from RES, which represents 1,572 ktoe (66 PJ) of energy from RES.

Sectoral targets:

- Production of heat and cold: 14.6% share of RES
- Electricity production: 24.0% share of RES
- Transport: 10.0% share of RES

National Action Plan for Energy from RES (2010)

Act No. 309/2009 Coll. on the Promotion of Renewable Energy Sources and High Efficiency Combined on the promotion of renewable energy sources and high efficiency cogeneration was approved in the Slovak Republic in 2009 to support the production of electricity from RES. This Act has improved the functioning of the electricity market in the RES sector and created a stable business environment. It secured a long-term guarantee of feed-in tariffs for 15 years and also set the direction for electricity generation from RES by favouring the construction of small and decentralised plants. The Act also guarantees priority transmission and priority distribution of electricity from RES. Since 2014, a change in legislation has significantly simplified the process of connecting a small source up to 10 kW for households that cover a large part of their energy consumption with the electricity they generate.

In 2018, the revised Renewable Energy Directive came into force as part of the Clean Energy for All Europeans package to help meet emission reduction commitments under the Paris Agreement. The Directive sets a new binding EU target in the area of RES energy for 2030 of at least 32% of final energy consumption and includes a clause allowing for an upward adjustment of this share by 2023 and an increased target of 14% for the share of renewable fuels in transport by 2030.

The Slovak Republic has signed up to the commitment to achieve carbon neutrality by 2050. This led to the adoption of the Integrated National Energy and Climate Plan, which updates the Energy Policy of the Slovak Republic from 2014 and defines targets until 2030. The optimal use of RES is one of the key factors for achieving a low-carbon economy, and emphasis will be given to the development of RES, especially in heat production.

Slovakia's targets for RES until 2030:

- Achieve a 19.2% share of energy from RES.

Sectoral targets:

- Production of heat and cold: 19.0% share of RES
- Electricity production: 27.3% share of RES
- Transport: 14.0% share of RES

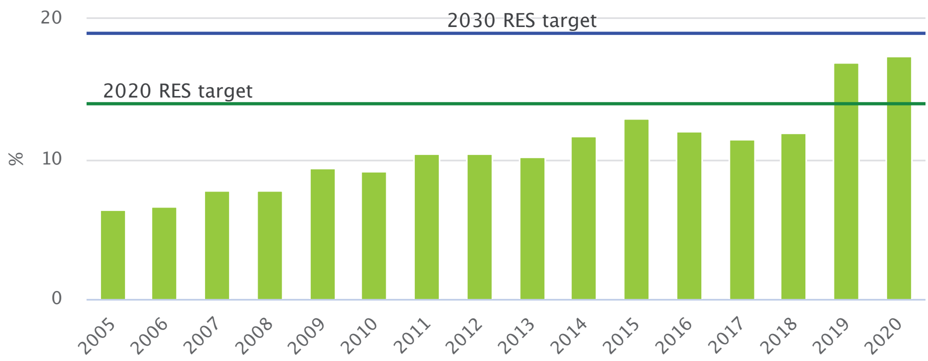
Integrated National Energy and Climate Plan (2019)

In December 2019, the European Green Deal was adopted as the overarching framework for EU clean energy policy. This is a new growth strategy which aims to make Europe the world's first climate-neutral continent in the world. All this in a fair, resource-efficient, cost-effective and competitive way.

In July 2021, as part of the implementation of the European Green Deal package, the Commission published a new legislative package on climate and energy entitled "Fit for 55": meeting the EU's 2030 climate target on the road to climate neutrality. The package represents one of the most comprehensive sets of proposals on climate and energy ever put forward by the Commission. Among other things, it will contribute to the development of the clean energy system over the next decade by stimulating innovation, investment and creating new market demand in the EU, while ensuring a socially just transition. The package also includes a proposal to revise the RES Directive in order to align its RES energy targets with the new climate ambitions. In order to reach the 2030 target, the Directive proposes to increase the overall binding target from the current 32% to a new level of 40% RES energy in the EU energy mix. These efforts will be complemented by indicative national contributions showing how each Member State should contribute to achieving the collective target. The post – 2030 energy policy framework is currently under negotiation.

The share of energy from RES has slowly increased since 2005. In the 2005 – 2020 period, the total share of energy produced from RES increased to 17.3%. Thus, the Slovak Republic met the targets of 14% share of RES in 2020. Meanwhile, the share of RES stagnated around 10 – 12% between 2010 and 2018 and meeting the national commitment seemed unlikely.

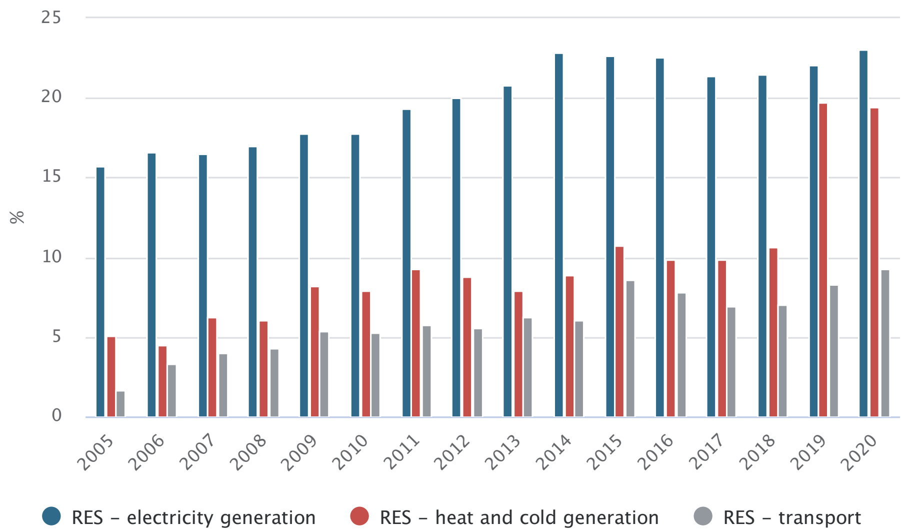
Development of the share of energy from renewable sources in terms of meeting national targets



Source: Eurostat

The Slovak Republic met the national targets for RES energy to reach 14% RES energy share by 2020, which it exceeded by 3.3 percentage points.

Development of the share of energy from RES by sectors



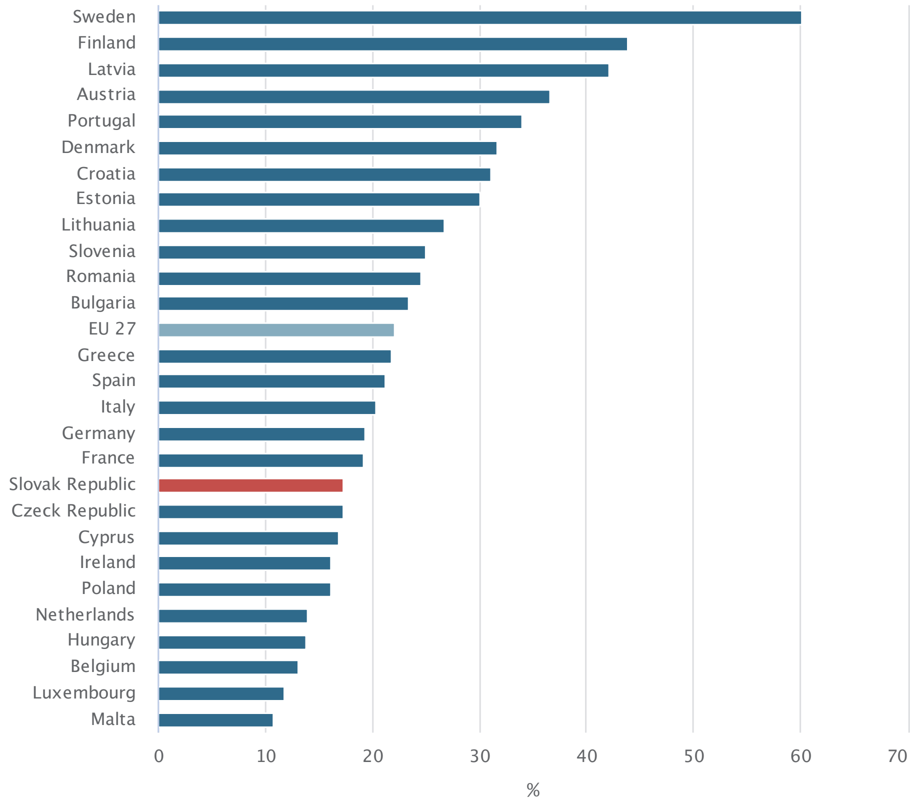
Source: Eurostat

This was mainly due to the year-on-year increase in 2019, when the share of RES increased by 5 percentage points compared to the previous year 2018. This overall increase reflected a significant increase in the share of RES in the heating and cooling sector, where gross biomass consumption almost doubled (from 10.6% to 19.7%). The jump in the heating and cooling sector was due to the refinement of statistics on biomass use and the start of data reporting for heat pumps. On the other hand, the share of RES in the other two monitored sectors increased relatively less significantly, with the share of RES in electricity production reaching 23.1% in 2020 and 9.3% in the transport sector.

The amount of energy from RES in the Slovak Republic depends, to a large extent, on suitable hydropower conditions (electricity production) and biomass consumption (heat production).

The increase in the share of renewable energy in the monitored period is a positive signal for meeting the renewable energy objectives.

International comparison of the share of energy from RES (2020)



Source: Eurostat

3.2.3.2 Prices of energy for households

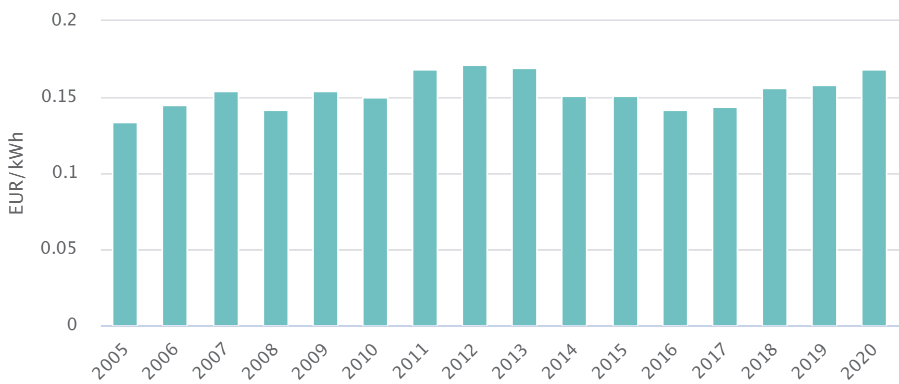
From the perspective of the energy market functioning, the current period can be characterized as a combination of consequences of the world financial and economic crises and gradual liberalization. In the recent years, the number of alternative electricity suppliers to the Slovak market has increased and a year-on-year increase in the number of citizens, who have changed their electricity suppliers, had been recorded, whereby the competitive environment is established. There are new actors in the gas supply market, which is a positive fact for the development of gas market competitiveness and transparency in the Slovak Republic.

Electricity and gas prices has on an upward trend from 2004 to 2020.

Electricity

The price of electricity in the Slovak Republic follows the development on the world and European markets. The price of electricity increased by 26% from 2005 to 2020.

Development of the electricity price for households

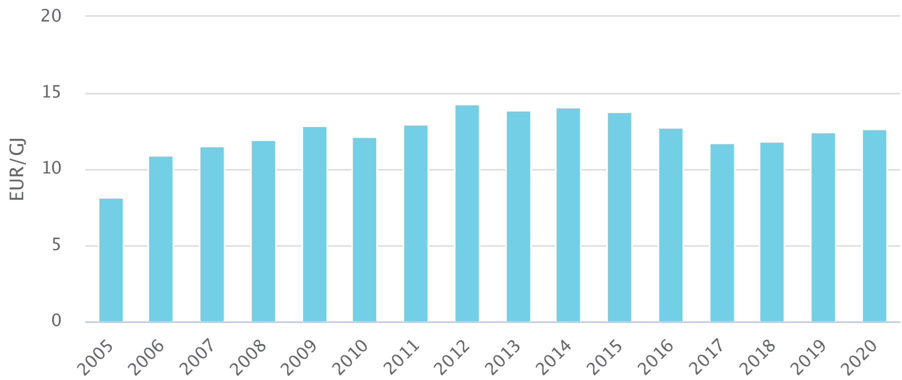


Source: Regulatory Office for Network Industries

Natural gas

Overall, the price of natural gas had an upward trend over the last 15 years, and in 2020 it was more than half the price in 2005 (56.1%).

Development of the gas price for households



Source: Regulatory Office for Network Industries

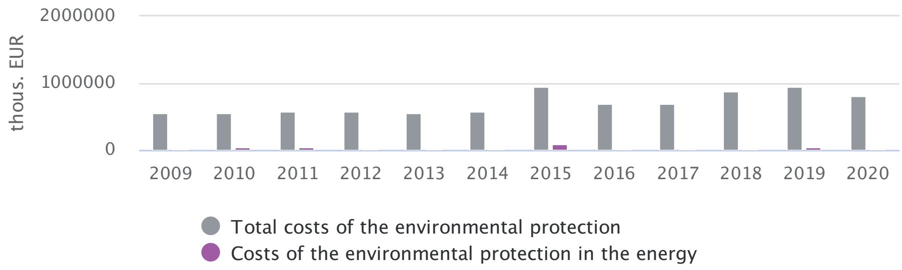
3.2.3.3 Costs of the environmental protection in energy

The total sum of costs of the environmental protection is the total sum of investment and current costs of enterprises.

In 2009 – 2020, the total costs spent for the environmental protection in energy had an ambiguous trend, while for the whole monitored period they had the highest level in 2015 (EUR 86,993 thousand). In contrast, the lowest total costs were in 2017. In 2020, they reached a level of EUR 23,414 thousand.

The share of costs spent in energy for the environmental protection in the total costs of the environmental protection in enterprises together was 2.9% in 2020.

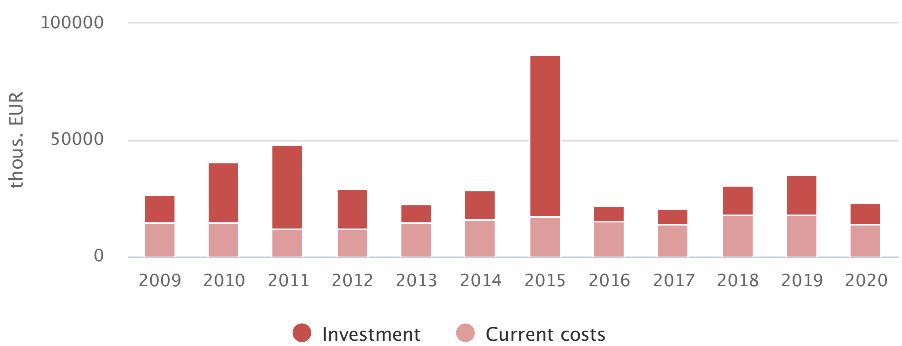
Development of costs of the environmental protection in energy and the total costs of the environmental protection



Note: The costs of environmental protection in the energy sector are made up of environmental protection costs from enterprises with 20 or more employees.
Source: SO SR

Out of funds spent for the environmental protection in energy in 2020, approximately 40% was investment and approximately 60% were current costs. The volume of investments in the 2009 – 2020 period ranged from EUR 6,751 thousand (2016) to EUR 69,813 thousand (2015), when investments were the highest. The current costs followed a more balanced path in the monitored period, with a peak in 2019 (EUR 18,085 thousand).

Development of costs for the environmental protection in energy



Source: SO SR

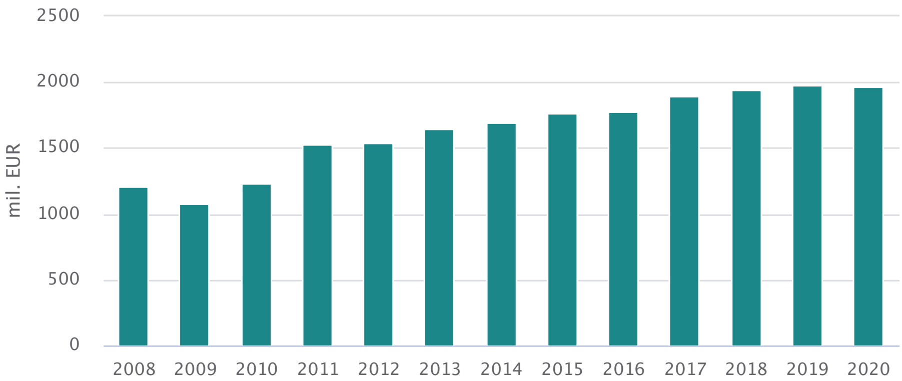
3.2.3.4 *Tax on energy*

Generally, the tax is defined as a mandatory tax, determined by law, usually as a repeated payment made by natural persons and legal entities to the state in the specified amount and defined date. It is collected by the state, municipalities, or any other publicly-owned entities.

The tax on energy is one of taxes with the environmental aspect, which is a tax the tax base of which is made up of a physical unit (or replacement of a physical unit) of something which has a negative impact on the environment. In the Slovak Republic, the tax on energy includes: tax on mineral oils, tax on electricity, tax on coal, tax on natural gas, tax on placement of nuclear facility, tax on payments for storing gases and liquids, tax on emission quotas, tax on green energy and tax on the consumption of electricity intended for the disposal of nuclear facilities.

In 2020, the tax on energy reached EUR 1,965.13 million and it increased by 63% compared to 2008. In 2020, the share of the tax on energy in GDP reached 2.13% of GDP and it decreased by 0.38 percentage point compared to 2008. The share of the tax on energy in the total taxes with the environmental aspect reached 89.7% and it decreased by 4.5 percentage points compared to 2008.

Development of the tax on energy



Source: SO SR

References

1. Bezpečnostná Rada SR. Správa o bezpečnosti SR za rok 2020 [online]. Bratislava: BR SR, 2021. Available on: https://www.slov-lex.sk/legislativne-procesy/-/SK/LP/2021/247 **[Slovak version]**

2. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal (COM/2019/640 final)

3. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A policy framework for climate and energy in the period from 2020 to 2030 (COM/2014/15 final)

4. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM/2015/80 final)

5. The European environment – state and outlook 2020 Knowledge for transition to a sustainable Europe [online]. Copenhagen: European Environment Agency, 2020. ISBN 978-92-9480-091-6. Avai-lable on: https://www.eea.europa.eu/soer/2020 Available on: https://www.eea.europa.eu/soer/2020

6. European Environment Agency: Energy [online]. Copenhagen. Available on: http://www.eea.europa.eu/themes/energy/

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

8. Eurostat: database. Available on: http://ec.europa.eu/eurostat/data/database

9. Ministerstvo hospodárstva SR. Energetická politika SR [online]. Bratislava: MH SR, 2014. Available on: https://rokovania.gov.sk/RVL/Material/11327/1 **[Slovak version]**

10. Ministerstvo hospodárstva SR. Integrovaný národný energetický a klimatický plán [online]. Bratislava: MH SR, 2019. Available on: https://rokovania.gov.sk/RVL/Material/24390/1 **[Slovak version]**

11. Ministerstvo hospodárstvo SR. Koncepcia energetickej efektívnosti SR [online]. Bratislava: MH SR, 2007. Available on: https://www.mhsr.sk/energetika/energeticka-politika/koncepcie-a-akcne-plany **[Slovak version]**

12. Ministerstvo hospodárstva SR. Správa o plnení národných cieľov v oblasti energetickej efektívnosti a v oblasti obnoviteľných zdrojov energie do roku 2020 Bratislava: MH SR, 2021. **[Slovak version]**

13. Ministerstvo hospodárstva SR. Národný akčný plán pre energiu z obnoviteľných zdrojov [online]. Bratislava: MH SR, 2010. Available on: https://www.mhsr.sk/energetika/obnovitelne-zdroje-energie/koncepcie-akcne-plany **[Slovak version]**

14. Ministerstvo hospodárstva SR. Správy o výsledkoch monitorovania bezpečnosti dodávok elektriny a plynu [online]. Bratislava: MH SR, 2021. Available on: https://www.economy.gov.sk/uploads/files/C3BT8Jnt.pdf **[Slovak version]**

15. Slovenská agentúra životného prostredia, 2022. Sektorové indikátory [online]. Enviroportál, 2022. Available on: https://www.enviroportal.sk/indicator/125?langversion=sk **[Slovak version]**

16. Ministerstvo životného prostredia SR, Slovenská agentúra životného prostredia, 2022. Správa o stave životného prostredia Slovenskej republiky v roku 2020 [online]. Bratislava: Ministerstvo životného prostredia SR. 194 s. ISBN 978-80-8213-052-5. Available on: https://www.enviroportal.sk/spravy/detail/11203 **[Slovak version]**

17. Ministerstvo životného prostredia SR. Zelenšie Slovensko – Stratégia environmentálnej politiky Slovenskej republiky do roku 2030 (Envirostratégia 2030) [online]. Bratislava, 2019. Available on: https://rokovania.gov.sk/RVL/Material/23592/1 **[Slovak version]**

18. Slovenský hydrometeorologický ústav, Ministerstvo životného prostredia SR. National inventory report 2022 [online]. Bratislava: SHMÚ, MŽP SR, 2022. Available on: https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=105&cmsDataID=0 **[Slovak version]**

19. Slovenský hydrometeorologický ústav, Ministerstvo životného prostredia SR. Odbor emisie a biopalivá, Energetika [online]. Bratislava: SHMÚ, MŽP SR, 2022. Available on: https://oeab.shmu.sk/emisie/energetika/trendy.html **[Slovak version]**

20. Slovenská inovačná a energetická agentúra. Available on: http://www.siea.sk/bezplatne-poradenstvo/ **[Slovak version]**

21. Slovenský plynárenský priemysel, a. s. Výročná správa 2020 [online]. Bratislava: SPP, a. s., 2021. Available on: https://www.spp.sk/sk/vsetky-segmenty/o-spp/profil-a-struktura/archiv-vyrocnych-sprav/ **[Slovak version]**

22. Slovenské elektrárne, a. s. Výročná správa 2020 [online]. Bratislava: SE, a. s., 2021. Available on: https://www.seas.sk/o-nas/publikacie-a-dokumenty **[Slovak version]**

23. Štatistický úrad SR. Štatistická ročenka SR Energetika 2015 – 2020 [online]. Bratislava: ŠÚ SR, 2015 – 2022. Available on: https://slovak.statistics.sk/wps/portal/ext/products/publikacie/!ut/p/z1/jY_LDoIwFEQ_qVPLoy4vRktNQ2yIC-N2YrgyJogvj96vErcDdTXJOZi4LrGVhiK_-Ep_9fYjXT-5CdiZr7dE0DVSz-2kELrlB5D9QZO42AzbUsCk6QldtC13RQbp9wJCkLS_wJ4OvjzxF-_kZRmeQ-GkEal0FR6t7ZCgMSy_omCWT-MyNSCuR8eN-99i_4NJXt5fw!!/dz/d5/L2dJQSEvUUt3QS80TmxFL1o2X0FRUVFTTFZWMEdWMkYwSTMxRzBOVVU-wMFI3/ **[Slovak version]**

24. Úrad pre reguláciu sieťových odvetví. Výročná správa 2020 [online]. Bratislava: ÚRSO, 2021. Available on: http://www.urso.gov.sk/?q=content/%C3%BArad--spr%C3%A1vy-%C3%BAradu **[Slovak version]**

25. Energie-portal.sk. Available on: https://www.energie-portal.sk/ **[Slovak version]**

26. Euractiv, Energetika. Available on: https://euractiv.sk/ **[Slovak version]**

TRANSPORT

List of the sector indicators in transport

Trends of the sector relevant for the environment

- Number of transported passengers and transport performance in passenger transport
- Quantity of transported goods and transport performance in freight transport
- Length of transport infrastructure
- Size of vehicle fleet according to transport types
- Final energy consumption in transport
- Use of ecological fuels in transport

Interactions of the sector with the environment (demands of the sector in respect of resources and impacts of the sector on the environment)

- Greenhouse gas emissions from transport
- Emissions of main pollutants from transport
- Confiscation of land by transport infrastructure
- Wastes from transport
- Noise load of inhabitants
- Number of accidents and number of killed and injured persons due to traffic

Political, economic and social aspects

- Fuel prices and taxes on fuel prices
- Tax on transport
- Costs of the environmental protection in transport

According to the Statistical Classification of Economic Activities (SK NACE Rev. 2), the transport is included in the Section H – Transportation and storage.

3.3. Summary assessment of the development in the sector of transport

What is the state and directing of transport in relation to the environment?

In the number of transported passengers and transport performance in the passenger transport, a decreasing trend was recorded, except for the individual car transport that recorded year-on-year increases in the monitored period of 2005 – 2020. The biggest share in transportation of passengers in the passenger transport related to the individual motorism (73%), followed by the public road transport (12%), rail transport (12%) and public transport (3%). The amount of goods transported by freight transport decreased by 13.3% in the 2005 – 2020 monitored period, while the performance increased by 21%, despite its fluctuating nature. In 2020 the biggest shares in the number of transported goods had road freight transport (80%), followed by railway transport (18%) and water transport (2%).

The length of road transport infrastructure, including roads and motorways, grew by only 1.8%, despite a 60% increase in the length of motorways; the length of railways declined marginally and there were no changes in the water transport infrastructure.

The decrease in the number of means of transport between 2005 and 2020 was 46% for rail and water transport and 36.3% for air transport, despite the slight year-on-year increase. Only road transport recorded a significant increase (86%).

The final energy consumption in the transport sector for the period 2005 – 2020 increased by 38%, despite a year-on-year decrease of 7.8%. The biggest share in fuel consumption related to the road transport; electricity consumption prevailed in the railway transport.

In spite of its fluctuating trend, the consumption of ecological fuels LPG (Liquefied Petroleum Gas) and CNG (Compressed Natural Gas) saw an increase in the monitored period of 2005 – 2018, the LPG consumption increased by 6.23% and CNG consumption by 35.3%. The LPG and CNG consumption has not been tracked since 2018.

What are interactions of transport and the environment?

Demands of transport in respect of resources

Land take by the transport infrastructure in 2018 was 0.56% of the total area of the Slovak Republic. Land take data by the transport infrastructure has not been tracked from 2018.

Impact of transport on the environment

The development of greenhouse gas emissions is influenced by the environmentally-unfriendly road transport. CO_2 emissions increased by 4.9% between 2005 and 2020, N_2O emissions increased by 29.9% and CH_4 emissions decreased by 83.7%.

Transport also participates in the production of basic pollutants and heavy metals. Significant decreases of more than 90% were recorded in CO emissions and 60% in NO_x emissions. A decreasing trend was also observed for SO_2 (17.4%), PM_{10} (42.2%) and $PM_{2.5}$ (51.8%) emissions. Heavy metal emissions recorded an increase – Cu (21.1%), Zn (24.1%) a Pb (23.9%).

The wastes production in 2008 – 2020 had a fluctuating character with significant increases since 2017. The biggest number of old vehicles was processed in 2009, and it had a fluctuating trend after this year.

The total length of noise barriers in 2020 in road transport was 180,151 m and in rail transport 64,099 m.

There has been a decrease in the number of traffic accidents between 2005 and 2020 and since 2009 this decrease has been 45.1%, which has been influenced by legislative changes. There has also been a 60% decrease in the number of persons killed and a 50% decrease in the number of persons injured. The number of rail accidents has fallen by 70% since 2009.

What is the response of the society to mitigating or compensating negative consequences of transport on the environment?

In the monitored period of 2005 – 2020, a considerable fluctuating trend was recorded for the average prices of motor fuels. The diesel and petrol prices were the highest in 2012 and, conversely, the lowest in 2016 and 2020. The LPG prices fell by 23.8% between 2005 and 2020.

The environmental protection costs in transport accounted for only 0.99% of total environmental protection costs in the 2009 – 2019 monitored period. Since 2020, investments for environmental protection in the transport sector have not been reported separately.

3.3.1 What is the state and direction of transport in relation to the environment?

In 2011, the European Commission published the White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource-efficient transport system (Transport 2050) with the vision of creating a single European transport area with a fully integrated transport network linking different modes of transport. The main objective of the strategy is to reduce Europe's dependence on oil imports and reduce greenhouse gas emissions by at least 60% by 2050 compared to 1990. In relation to the European strategic documents defined by the White Paper, several key strategic and conceptual documents have been adopted at the national level since 2005, which served as the basis for the adoption of the Strategic Transport Development Plan of the Slovak Republic until 2030 – Phase II in 2017. It is a strategic document of a long-term nature, which aims to set an effective direction for the development of the transport sector and it determines the way of implementation of its development vision – a sustainable integrated multitransport system. The implementation of this vision is structured into several levels – global strategic objectives, specific objectives and measures.

Selected objectives for 2030

Strategic Global Objective 1:

- Ensuring equivalent accessibility of settlements supporting economic growth and social inclusion within all regions of the Slovak Republic (at a national and European level) through non-discriminatory access to transport infrastructure and services.

Strategic Global Objective 3:

- Increasing the competitiveness of transport modes in passenger and freight transport (counterparts of road transport) by setting appropriate operational, organizational and infrastructural parameters leading to an efficient integrated multimodal transport system supporting the economic and social needs of the Slovak Republic.

Strategic Global Objective 5:

- Reducing the negative environmental and negative socio-economic impacts of transport (including climate change) through environmental monitoring, effective infrastructure planning/implementation and reduction of conventionally powered means of transport or use of alternative fuels.

Strategic Transport Development Plan of the Slovak Republic until 2030 – Phase II (2017)

The state and direction of transport in relation to the environment is characterized on the basis of indicators from the group of sector trends relevant to the environment.

3.3.1.1 Number of transported passenger a transport performance in passenger transort

The massive development of individual car transport at the expense of public passenger transport creates a great burden on the environment, especially in the settlement centers with a significant concentration of population and productive activities. The COVID-19 pandemic in 2020 has had a major impact on all sectors of the national economy and has also significantly affected developments in the transport sector. In contrast to the economic crisis of 2008 – 2009, the Covid crisis has had a more serious impact on road passenger transport which has been reflected in a decline in the number of people transported as well as transport performance.

The number of passengers transported in passenger transport (without individual transport) decreased by 45.6% in the period 2005 – 2020, the significant year-on-year (2019 – 2020) decrease caused by the occurrence of the disease COVID-19 amounted to 30.3%. In 2020, the share of people transported by public transport was 58%, road public transport 32% and rail 10%.

Passenger transport performance in the period 2005 – 2020 decreased by 53.5% and the year-on-year decrease was 42.3%.

Transport of passengers and transport performance by the individual types of transport

Since 2005, the development in passenger transport by public road transport (excluding public transport) has recorded long-term year-on-year decrease. In 2020, passenger transport by road fell by 34.6% year-on-year, and compared to 2005, the decrease was 65.2%. (Public transport includes entities with predominantly national and international passenger transport activities, including ancillary and auxiliary transport activities.)

The performance of road passenger transport in the period 2005 – 2020 saw a significant decrease until 2010. After this year, there was a gradual year-on-year increase in the performance of road passenger transport and in the years 2015 – 2019 it was at the level of 5,300 mill. passkm, with minimal year-on-year increases and decreases. In 2020, performances were at the level of 3,100 million passenger-kilometers.

Development in the number of transported persons and performances in road passenger transport

Source: SO SR

Rail passenger transport recorded a slight increase in passenger numbers in the 2005 – 2020 monitored period (e.g. also through preferential rail travel for the retired and student passengers with free transport, but this was temporarily restricted during the 2020 lockdown). In 2020, the year-on-year decrease was 39.1% and the number of transported passengers reached 49,500 thousand. persons, which is approximately at the level of 2005.

In 2017, Regulation (EU) No. 2016/2338 of the European Parliament and of the Council amending Regulation (EC) No. 1370/2007 of the European Parliament and of the Council of 2007 on public passenger transport services by rail and by road entered into force. The European Union seeks to liberalize the market for rail transport services as a means of promoting competition that contributes to the development of rail transport and the use of its capacity potential. The expected benefits include an increase in the efficiency of the railway system, an increase in the level of services provided, greater flexibility as well as a shift of the travelling public from a less environmentally friendly modes of transport to rail transport and a consequent reduction in the negative external costs of transport.

The performance of railway transport in 2020 decreased by 46% year-on-year and reached the level of 2005.

Development in the number of transported persons and performances in railway passenger transport

Source: SO SR

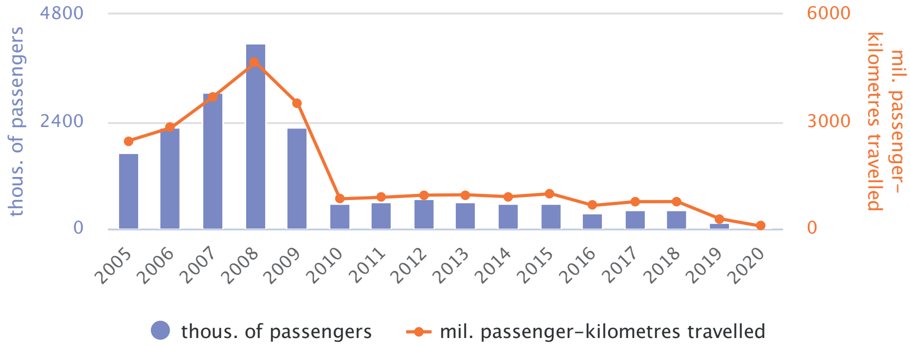
The number of persons transported by water transport in 2020 recorded a significant year-on-year decrease of 70.8% and a 71.7% decrease compared to 2005. A similar development was also noted transport performance in water transport.

Development in the number of transported persons and performance in inland water passenger transport

Source: SO SR

In the period 2005 – 2020, the number of transported persons and transportation services in air passenger transport decreased significantly (from 1,716 thousand transported persons in 2005 to 39 thousand transported persons in 2020). The highest number of transported passengers and performance in air transport was recorded in 2008.

Development in the number of transported persons and performances in air passenger transport

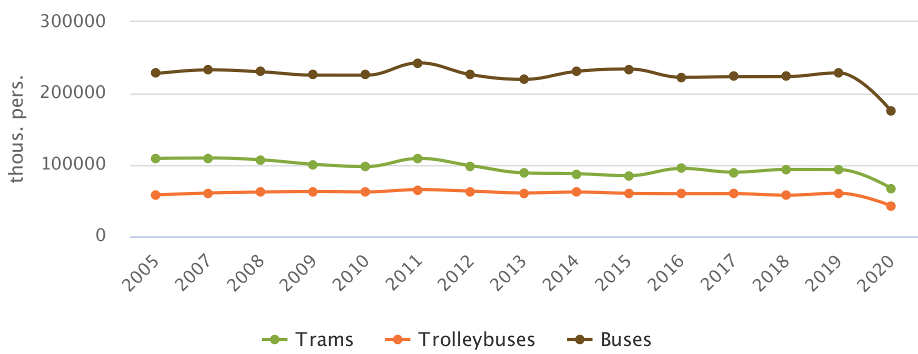


Source: SO SR

Passengers transported by city public transport

Urban public transport (public transport) is provided by urban transport companies in Bratislava, Košice, Banská Bystrica, Prešov and Žilina. In other cities of the Slovak Republic, transport is provided without the ownership participation of the city, usually by the Slovak Automobile Transport (SAD) companies or private companies, and part of the transport operated in this way is recorded as public transport. The number of **passengers transported by public transport** has been fluctuating. Due to the COVID-19 pandemic and related measures, there has also been a drop in mobility using public transport. In the period 2005 – 2019, there was an 8.3% decrease in the number of transported passengers in transport companies. In 2020, a year-on--year decrease in the number of passengers transported by public transport buses, trams and trolleybuses was recorded at the level of 30%. During the monitored period, bus transport retains the leading place in passenger transport, followed by trams and trolleybuses transport.

Development of the number of passengers transported by public transport



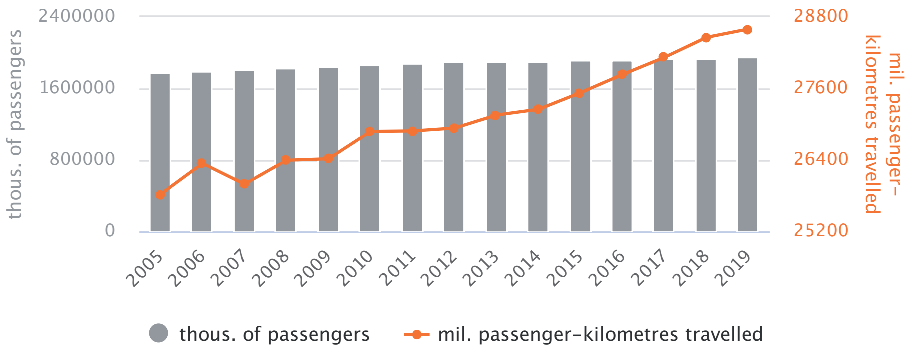
Source: SO SR

One of the basic problems of passenger (public) transport is the long-term unfavorable development of passenger transport in favor of individual (non-public) transport. The decrease in passenger transported by public transport was 8%, while individual transport increased by 10.6% since 2005.

Transport by individual car transport

In addition to the public transport, individual car transport, which was increasing in a year-on-year comparison, also participates in meeting transport needs. In the monitored period of 2005 – 2020, the number of passengers transported by individual transport and transport performance increased by 10.6%. From 2020, data for the passenger transport by individual car transport is not tracked.

Development in the number of transported persons and performances in individual passenger transport



Source: MoTaC SR

Note: Data for individual car transport are not collected in the framework of a statistical survey but are made by expert estimation.

3.3.1.2 Quantity of transported goods and outputs in freight transport

Within the Slovak Republic, the highest demand for transport services is for road freight transport which also has the highest share in transport performance in the long term. The advantage of road transport is its flexibility, reliability and wide service area which guarantees the provision of the "door-to-door" services. The second most used transport mode is rail transport which, however, accounts for a significantly lower share of transport performance. The use of water and air freight is negligible. The combination of these modes of transport (so-called intermodal or combined transport) is coming to the fore to minimize negative environmental impacts.

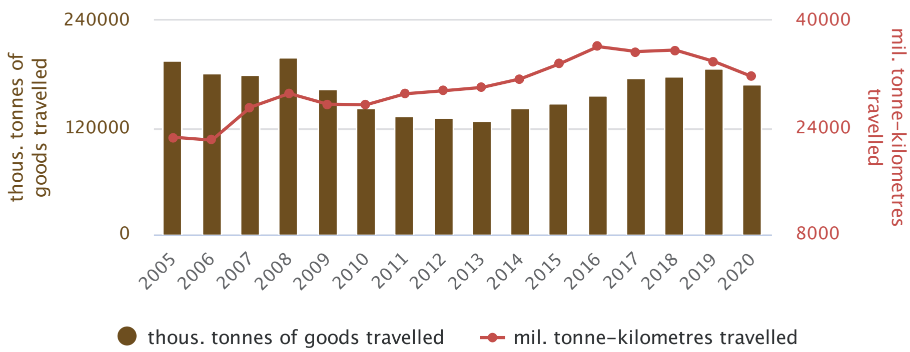
The trend in **freight transport** in the 2005 – 2020 was significantly affected by the economic crisis (2008 – 2012) which was reflected in a decrease in the amount of goods transported by 2012. From 2012, freight traffic started to increase slowly until 2019 when it reached the level of 235,585 thousand tons. In 2020, the shutdown of the economy, the decline in production and demand for goods due to the COVID-19 pandemic caused a decrease in freight transport which was reflected in a 9.7% year--on-year decrease.

Transport performance in freight transport had a fluctuating charac-ter in the moni-tored period of 2005 – 2020, while their lowest value was reached in 2005. After 2010, performances increased until 2016, and after this year we observe a gradual decline that continued until 2020.

Transport of goods and transport performance in freight transport by the mode of transport

The amount of goods transported by road freight transport in the period 2005 – 2020 had a fluctuating character. From 2005, freight transport recorded year-on-year decre-ases until 2013. From 2014, a gradual increase in the transport of goods began, which lasted until 2019. In 2020, the year-on-year decrease was 9.9% and compared to 2005, it decreased by 13.7%. The transport performance of road freight transport, expressed in ton-kilometers, increased by 40.1% in the period 2005 – 2020, the year--on-year decrease was minimal.

Development in the transportation of goods and performance in road freight transport



Source: SO SR

In 2020, 76% of goods were transported domestically by road freight transport, while the transport of goods by rail freight transport accounted for only 13%.

Rail freight transport maintained a balanced character in the transportation of goods for the entire monitored period of 2005 – 2020, with the exception of 2020, when it decreased by 9.3% year-on-year. The composition of goods transported by rail is diverse, but generally reflects the needs and preferences of industrial enterprises in the Slovak Republic.

The performance of rail freight transport recorded a fluctuating trend with a significant decrease in 2009. Since 2010, the performance has been at the level of 8,500 million tkm. In the observed period of 2005 – 2020, the decrease was 23.2%, and year-on--year performance decreased by 14.3%.

Development in the transportation of goods and performance in rail freight transport

Source: SO SR

In the period 2005 – 2020, the transportation of goods by inland water transport recorded a significant increase until 2010 (by 100%), but after that year it started to decrease and in 2020 it was approximately at the level of 2005.

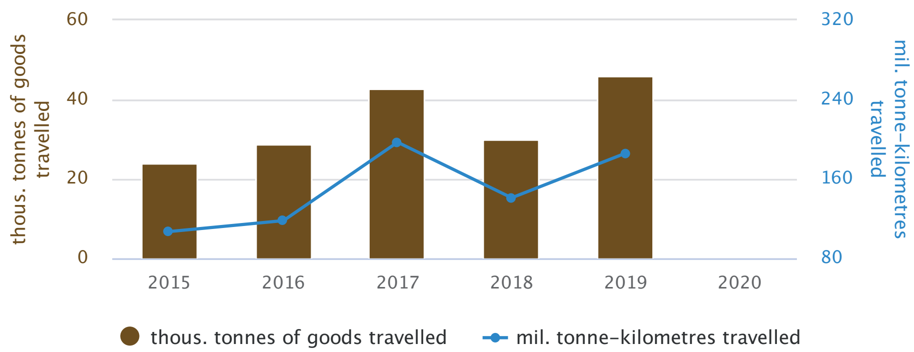
The performance of water freight transport in the period 2005 – 2020 did not significant fluctuations, except for a significant increase in 2010 (by 218%). The performance of water freight transport in 2020 was at the level of 2005 and the year-on-year decrease was minimal.

Development in the transportation of goods and performance in inland water freight transport

Source: SO SR

A more significant increase in the transport of goods (by 91.6%) and transport performance (by 73.8%) in air freight transport was recorded in 2015 – 2019. No goods were transported by air in 2020.

Development in the transportation of goods and performance in air freight transport



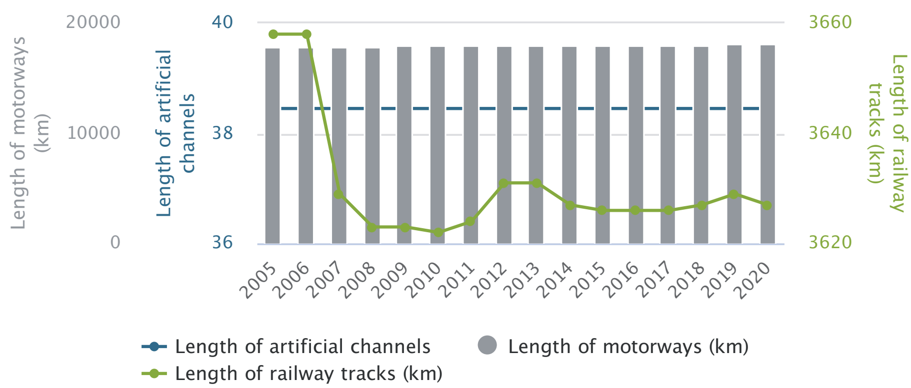
Source: SO SR

Combined transport, as part of intermodal transport, is a sophisticated transport system based on the transport of freight in one and the same freight unit, alternating different means of transport on different transport routes from the consignor to the consignee, “door to door”. Intermodal transport uses all means of the main modes of transport, such as road, rail, inland waterway or sea. For the Slovak Republic, there are no comprehensive aggregated data on the routing of flows and types of transported commodities (in all modes of transport) on the basis of which it would be possible to accurately assess the current state of intermodal transport in relation to other modes of transport.

3.3.1.3 Lenght of transport infrastructure

Road transport is the most used form of transport in the Slovak Republic and therefore a good quality extensive road network is essential for the smooth functioning of road transport.

Development along the length of the transport infrastructure



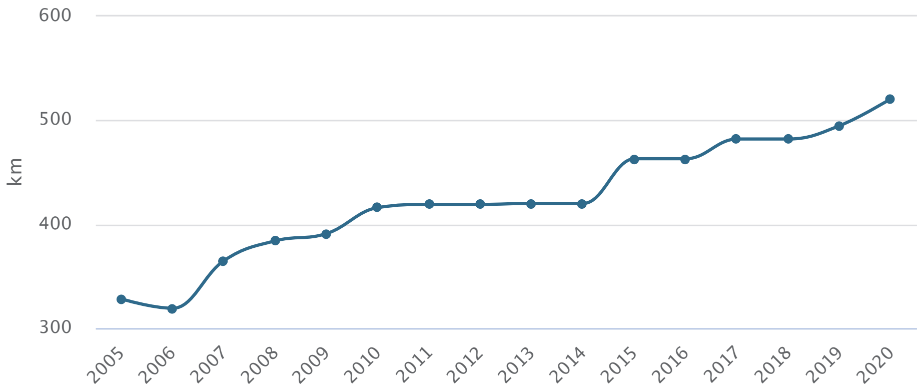
Source: SO SR

The current condition of the road infrastructure is characterized by a relatively dense network of roads, but with a low share of motorways and expressways, while the existing road capacity is exceeded especially on the main international road connections.

The basic backbone of the road network is formed by motorways together with class I roads and, although they account for less than 20%, they are roads of international and national importance.

The transport network of the SR in 2020 was made up of 18,130 km roads and motorways. For the period of 2005 – 2020, the length of motorways in the Slovak Republic increased by approximately 60%. The biggest increase in the length of motorways was recorded in 2007.

Development in the length of highways

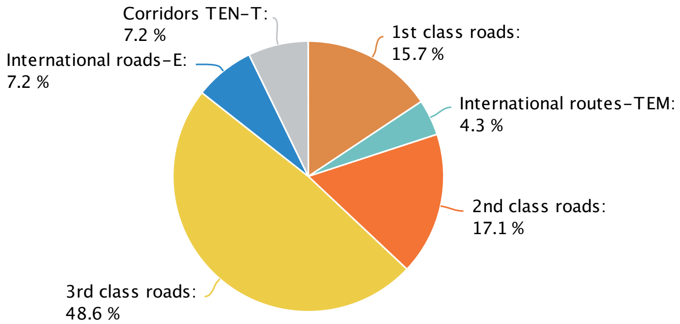


Source: SO SR

Motorways together with 1st class roads make up only 20% of the total length of state roads, despite the increase in the length of motorways by 60% between 2005 and 2020.

3rd class roads accounted for the largest share by **road category in the Slovak Republic** in 2020. These are roads of regional to local importance and provide a link between rural municipalities and the higher-level road network. 2nd class roads connect the centers of the regions and thus complement the network of motorways and class I roads; in exceptional cases they perform a function in international transport (especially in border areas). The territory of the Slovak Republic is also crossed by roads of international significance (designated by letter E), which are mainly on 1st class roads, exceptionally on 2nd class roads. The network of the most important international road routes (the Trans-European Highway and the Trans-European Transport Network) in the territory of the Slovak Republic is gradually overlapped by motorways and expressways.

Share of length of the individual categories of roads in SR (2020)



Source: SO SR

In terms of urban connectivity, Slovakia also has a dense **rail network**. The density of railway lines is 74 km/1000 km^2 and ranks Slovakia above the average among the European countries. The provision of modern and high-quality services, whether for passenger or freight transport, requires modernization and adaptation to international standards. The most important lines have become part of important international corridors and are being modernized, while many local lines are being neglected and are becoming physically and morally obsolete. A serious problem is the line speed which only reaches 120 km/h in a small part.

The length of railway lines decreased in the monitored period of 2005 – 2020, also due to the can-cellation and demise of railway lines. In 2020, the Railways of the Slovak Republic (ŽSR) managed 3,627 km of tracks, of which 1,585 km were electrified. The length of the managed lines also included lines with suspended operation due to unsatisfactory technical condition, with a total length of 46.7 km.

With respect to the area of the country, the air transportation infrastructure is made up of a relatively dense network of airports of a various character. In 2020, 29 airports were operated, namely 15 public and 11 non-public and 3 military. The importance of air transport in terms of the volume of transported persons and costs is insignificant compared to road and rail transport.

The water transport infrastructure reaches approximately 250 km, of which 172 km are navigable and 38.5 km of artificial channels. Inland waterway transport in accordance with the rules of the European Agreement on Main Waterways of International Importance (AGN) is currently carried out on the monitored waterways of the Danube River – European Waterway of International Importance and Váh – National Waterway of International Importance, as it is a tributary of the Danube. There are three Danube ports in Slovakia, which according to the AGN document are classified as inland ports of international importance: Bratislava, Komárno and Štúrovo. In our conditions, freight transport (transportation of petroleum products, ores, concentrates, metallurgical coke, construction raw materials, agricultural products) is important, and these ports serve as transshipment points for intermodal transport.

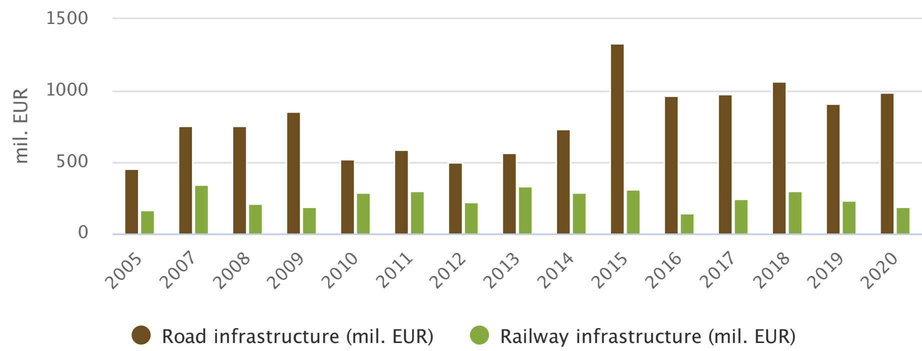
The basic criterion for the development of urban and inter-urban cycling is a network of **cycling infrastructure** that interconnects settlements and also runs through the settlement. At present, the construction of long cycle paths of supra-regional to international importance, the so-called "cycle main line", is favored in Slovakia. In 2020, around 800 cycling routes with a total length of 16,000 km were designated. The main axes are national long-distance cycle routes of 4,290 km, while international and EuroVelo routes account for 268 km.

Investment expenditures for the transport infrastructure

The infrastructure investment expenditure represents expenditure incurred for the construction or complete reconstruction of the existing infrastructure. They account for roughly ¾ of the total expenditure on road infrastructure; their amount depends on the possibilities of the state budget, the amount of loans taken, the possibility to draw resources from the European Union funds and, last but not least, on the economic development of the country.

Investment expenditures in transport infrastructure between 2005 and 2020 had a fluctuating character and in 2020 amounted to 1,186.4 mil. EUR. The largest volume of investments during the monitored period was directed to road infrastructure. In 2020, a year-on-year increase of 8.7% was recorded. Investments in railway infrastructure in the period 2005 – 2020 were at the level of 300 mil. EUR with slight year-on-year increases and decreases. In 2020, investments in railway infrastructure recorded a year-on-year decrease and accounted for less than a quarter of investments in road infrastructure.

Investment expenditures in road and rail transport infrastructure

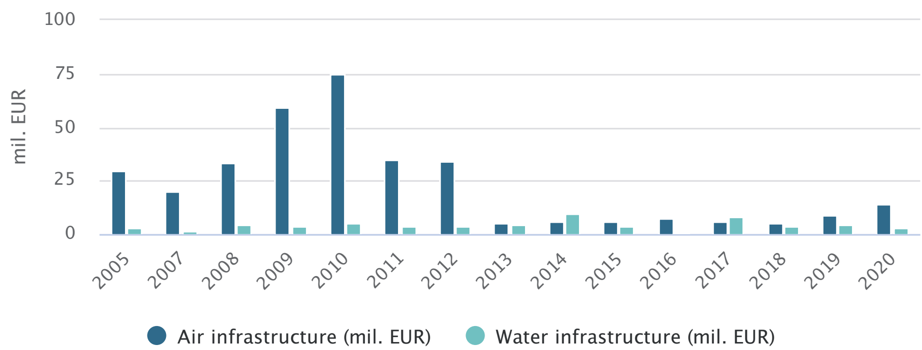


Source: SO SR

Investment expenditures in transport infrastructure in 2020 amounted to 1,186.4 mil. EUR, while the largest investment volume was 938.8 mil. EUR was directed to road infrastructure.

The increase in investments in aviation infrastructure occurred in the years 2005 – 2012, while the highest increase was recorded in 2010 (74.7 mil. EUR). After this year there was a significant decrease, but from 2015 they started to increase again slightly. The year-on-year increase (2019 – 2020) was 52.7%. The least amount of investment was directed to water infrastructure, which in 2020 amounted to only 3.1 mil. EUR.

Investment expenditures in air and water transport infrastructure



Source: SO SR

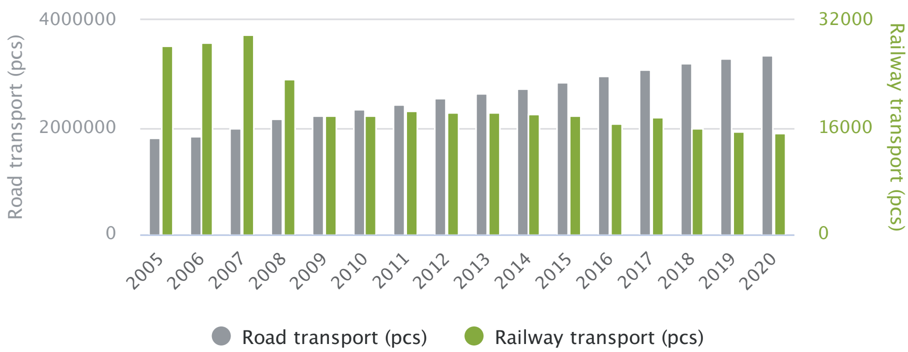
3.3.1.4 Size of the vehicle fleet by the mode of transport

The increase in the number of registered cars over the last 15 years reflects the rising standard of living of the population, but also the fact that the prices of used cars are falling so much that even people from lower income groups can afford them. The number of motor vehicles per 1,000 inhabitants reached 447 in 2020, which is an increase of almost 85% compared to 2005. For the assessment of the increase in road transport and individual car transport, the important indicators are the degree of motorization (the number of inhabitants of a given territorial unit per one motor vehicle) and the degree of automobilization (the number of inhabitants of a given territorial unit per one passenger car). These indicators point to the increasing number of cars and trucks and the renewal of the vehicle fleet, but also to the negative consequences in the form of increased emissions, noise, accidents or even parking problems.

The number of road motor vehicles in the observed period of 2005 – 2020 increased by 86% in all categories of road vehicles, the increase in the category of trucks and vans was 86.6%, and for passenger cars 87.2%. On the contrary, in 2020, the number of vehicles in the bus category decreased significantly by 13.5% compared to 2005, while the year-on-year decrease was 12.3% and was related to the COVID-19 pandemic, where most carriers ended their operations.

The economic and industrial development is closely linked to the increase in the standard of living of the population which is also reflected in the increase in car ownership. The value of the motorization rate indicator in 2020 was 1.8 inhabitants per motor vehicle, while in 2005 it was 3.3 inhabitants per motor vehicle.

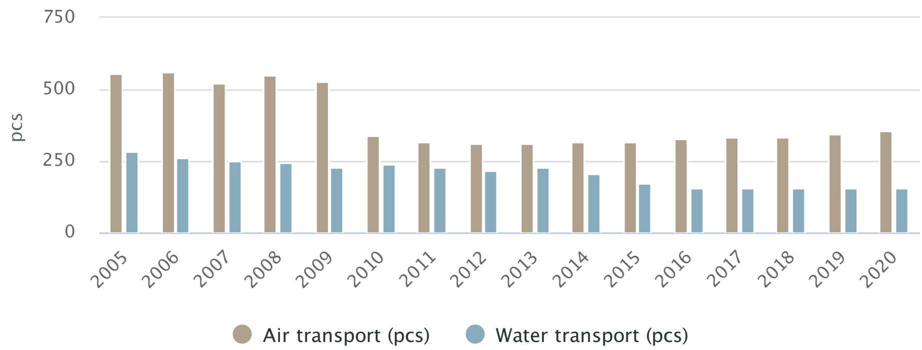
Development in the size of the vehicle fleet in road and rail transport



Source: SO SR

The number of means of transport in rail and water transport (the most environmentally suitable modes of transport in the transport of people and goods) decreased by approximately 45% in the monitored period of 2005 – 2020. The number of civil aircraft in air transport decreased by 36.2%, despite a gradual increase since 2017.

Development of the size of the fleet in air and water transport



Source: SO SR

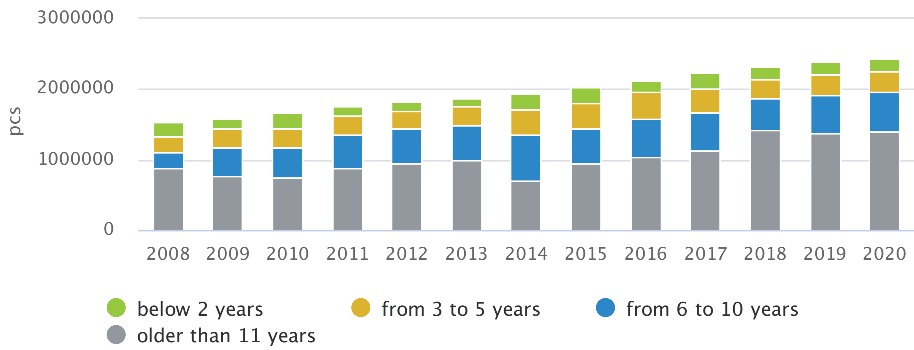
Size of the vehicle fleet in the road transport

The average age of cars is a long-monitored factor as it corresponds to the “emission” composition of the car fleet, it gives an indication for the safety parameters of cars and, last but not least, it is an indicator of the preferences and purchasing power of the population. The average age of a country's fleet is, among other things, one of the economic indicators of the level of the economy.

The biggest problem related to the increase in the number of passenger motor vehicles in road transport is that public modes of transport are not able to compete with individual car transport to a greater extent in the transport of people. Despite the increase in new passenger car registrations, the average age of the fleet was 14.3 years in 2020, while the EU average was 11.8 years. According to the type of fuel and energy consumed in 2020, up to 51% of the total number of cars were with gasoline engines, 44.8% of cars were with diesel engines and 4.2% were other cars (electric, hybrids, LPG).

The level of motorization in 2005 was 4.1 inhabitants per passenger car and in 2020 it has decreased to 2.24 inhabitants per passenger car, which is a critical value and points to the increasing number of passenger cars and the consequent problems with e.g. road congestion in the morning rush hour or evening parking in housing estates.

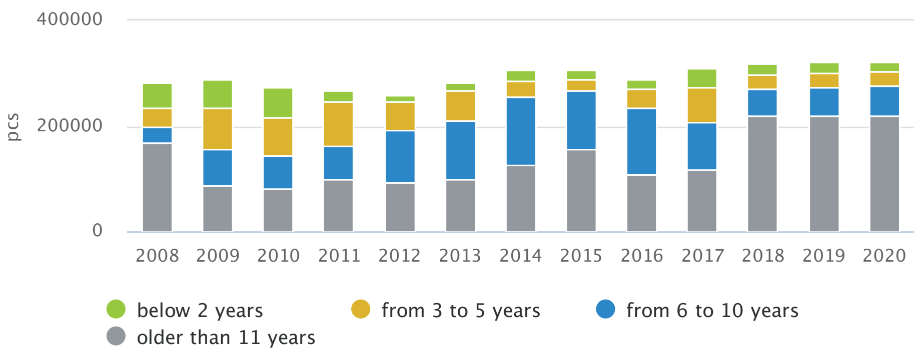
Development in the number of passenger cars registered in SR by age category



Source: MoI SR

Since 2017, the renewal of the vehicle fleet has been moving in an unfavorable direction, mainly concerning vehicles in road freight transport, where the percentage representation of vehicles older than 11 years (2006 and older) is constantly increasing, while in 2020 they were more than 68% and 18% vehicles were between 6 and 10 years old. In 2020, there were only 6% of newer motor vehicles (up to 2 years old). The average age of trucks in 2020 was 14.7 years, while the EU average was 14.1 years.

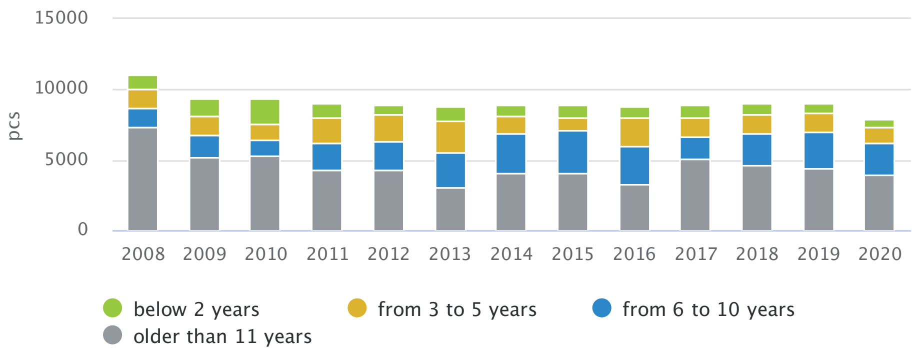
Development in the number of trucks registered in SR by age category



Source: MoI SR

By modernizing the bus fleet, the quality and comfort of travel is increased, the safety of passen-gers is also increased, and the quality of the environment is improved at the same time. The good news is that in 2020, the average age of buses in the Slovak Republic was 11.3 years, and compared to the average age of buses in the EU, they are "younger" by 1.5 years (the EU average is 12.8 years). The year-on-year decrease (2019 – 2020) in the number of buses was 12.3%.

Development in the number of coaches, buses and trolleybuses registered in SR by age category



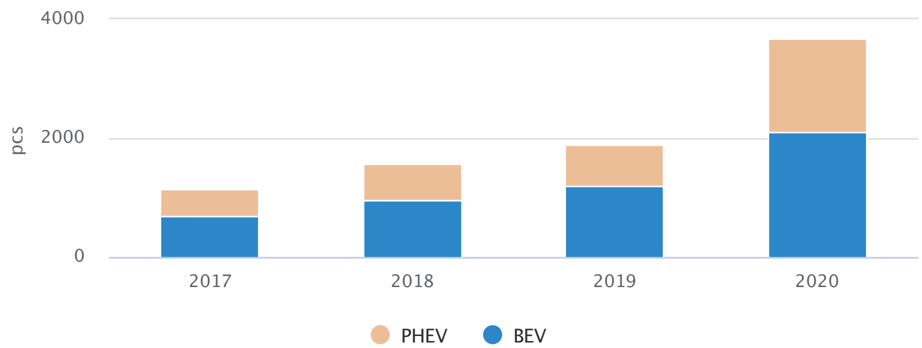
Source: MoI SR

Electromobility

Electromobility enables transport without direct emissions, independent of fossil fuels and is becoming an important element of a new, modern energy system based on renewable energy sources, smart grids and local energy storage. Among the most used are fully electric vehicles (BEVs) and plug-in hybrids (PHEVs). Although Slovakia cannot compare with Western European countries in sales of electrified models, a significant increase in interest in these vehicles was recorded in 2020.

2020 was a specific year in terms of electric vehicles sales as it reflected the govern-ment subsidies granted at the end of 2019. Interest in fully electric vehicles increased by 456%, representing 918 units sold and a total market share of 1.2%. The share of growth in the segment of plug-in hybrid models saw a similar increase. A total of 863 vehicles with plug-in hybrid engines were sold, which corresponds to a market share of 1.3%.

Development in the total number of electric cars (BEV and PHEV)



Source: MoI SR

In 2020, the number of electric vehicles increased by 1,781 units, which represents only a 3% market share, while in the EU this share represents 18.9%.

Size of the vehicle fleet in the railway transport

A serious problem of the vehicle fleet of the railway transport is its both technical and moral obsoleteness related to a high age structure of driving vehicles, freight wagons as well as passenger wagons, they have a high failure rate, high costs of operation and maintenance, while they do not meet requirements laid on security and culture of travelling.

Despite the renewal of the vehicle fleet with subsidies from European funds, the vehicles cover only part of the traffic and Železničná spoločnosť Slovensko, a.s. (ZSSK) is unable to guarantee transport by modern low-floor vehicles on most lines. In the monitored period of 2005 – 2020, there was a decrease in the number of rail vehicles by 16.5%, freight and passenger cars by 29.1%, and motor and electric motor cars increased by 52.6%. Year-on-year increases were minimal.

Size of the vehicle fleet in the water transport

The ship fleet in inland water transport is for the most part suitable only for Danube navigation. In inland navigation in the area of means of transport – vessels, there is a clear unification of vessels in terms of length, width, draft and carrying capacity to the corresponding European modules. In the monitored period of 2005 – 2020, the number of inland water transport vessels decreased by 41.6%. The biggest decrease is in the number of motor cargo ships and liquid cargo tankers. Since 2017, the state of vessels has been stable, with 93 freighters and 33 tugboats. Passenger ships also recorded a decrease, while in 2005 17 units were registered, in 2020 there were 13 units. The age of the current fleet of inland water transport ships registered in the Slovak Republic is 48 years, which indicates a significant obsolescence of the fleet.

Size of the vehicle fleet in the air transportation

In the observed period of 2005 – 2020, the number of civil aircraft decreased by 33.1% compared to 2005, despite the recorded year-on-year increase since 2015. In 2020, 354 aircraft with a weight of up to 9,000 kg were registered in the Slovak Republic.

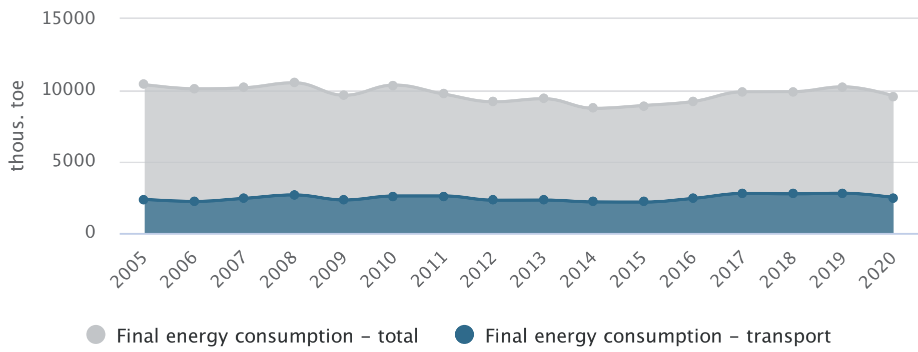
3.3.1.5 Final energy consumption in the sector of transport

Energy consumption has traditionally been considered a key element of economic development, with transport accounting for 25 – 30% of energy consumed. The final energy consumption (FEC) in transport includes energy consumption in all modes of transport (rail, road, urban public transport, air transport and inland water transport). The predominant source of energy in transport is fossil fuels, which has a significant negative impact on the environment.

The final energy consumption in the transport sector in the observed period of 2005 – 2020 increased despite a slight decrease in 2009 and 2020. The FEC recorded a more significant increase in the years 2017 – 2019. In 2020, the FEC decreased year-on-year, which could be the result of a reduced number of transported persons in passenger transport due to the COVID-19 pandemic. However, this does not mean a general trend.

Road transport accounts for the largest share of energy consumption in the transport sector, where an increase in the consumption of fuels – mainly gasoline and diesel fuel – can be observed. The final consumption of liquid fuels in road transport is up to 98%, the share of final consumption of solid fuels, gaseous fuels and electricity is small. The opposite trend can be observed in rail transport, where electricity consumption prevailed in 2020 – 92%, while diesel consumption represented only 8%. Other types of transport (air and water) contributed minimally to the final consumption of fuel and electricity. The share of transport in the final energy consumption in 2020 was 28.5%.

Development of final energy consumption in transport compared to total final energy consumption



Source: Eurostat

Final energy consumption decreased by 11% year-on-year, which could also be due to the reduced number of transported persons, mainly in passenger transport, as a result of the COVID-19 pandemic.

If the energy consumption in transport is to decrease, the demand for transport must decrease or slow down, and it is necessary to promote more energyefficient alternatives or shift transport performance to more ecological modes of transport.

Slovakia's objective for renewable energy sources (RES) by 2020:

- Increasing the share of RES in the transport sector to 10%

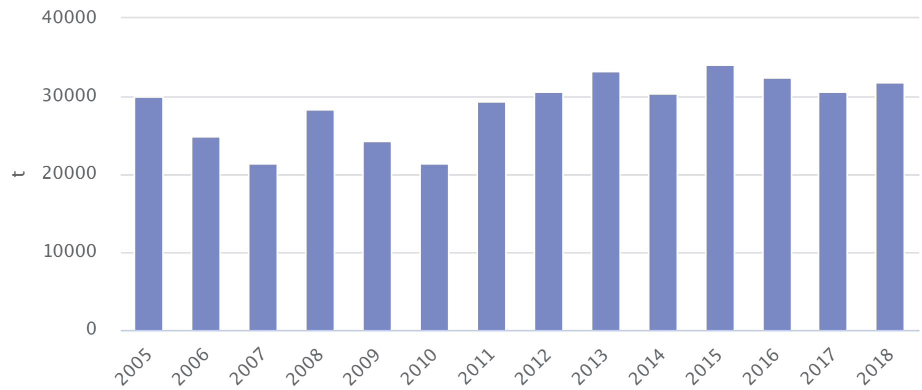
National RES Energy Action Plan (2010)

3.3.1.6 Use of ecological fuels in transport

The popularity of alternative fuel vehicles has been on the rise in recent years, based on efforts to maximize fuel efficiency and minimize negative impacts on the environment. Alternative fuels are fuels or energy sources that serve at least partially as a substitute for fossil oil sources in the supply of energy to transport, and which have the potential to contribute to its decarbonisation and improve the environmental characteristics of the transport sector. Alternative fuels include electricity, hydrogen, biofuels, synthetic and paraffinic fuels, natural gas including biomethane in gaseous (CNG) and liquid form (LNG), liquefied petroleum gas (LPG).

LPG consumption in the monitored period of 2005 – 2018 had a fluctuating nature and hovered around 31 thousand tons, despite a significant decrease in the period 2006 – 2010 by 29%. In 2018, LPG consumption increased by 6.23% compared to 2005, the year-on-year increase in 2017 – 2018 was 4.2%.

Development of LPG consumption in transport

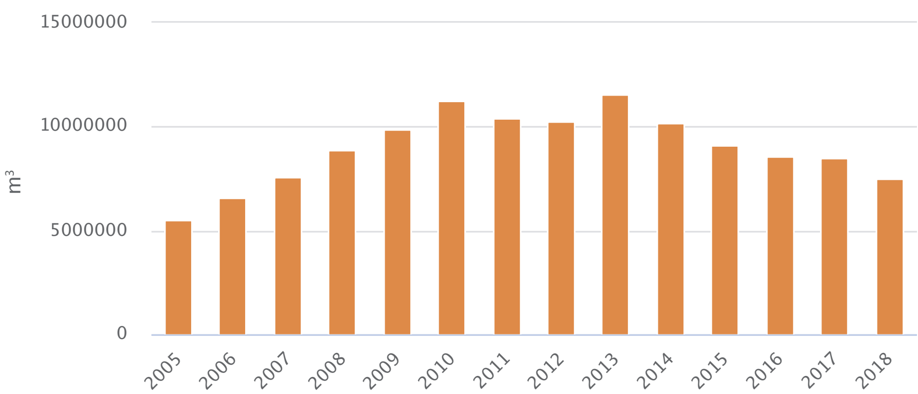


Source: TRI, joint-stock company

Note: LPG consumption has not been monitored since 2018.

CNG consumption increased by 35.3% in the monitored period of 2005 – 2018. The increase in consumption of this fuel culminated in 2010 and in 2015, when CNG consumption was at the level of 11 million m^3 and after this year only year-on-year decreases were recorded.

Development of CNG consumption in transport



Source: TRI, joint-stock company

Note: CNG consumption has not been monitored since 2018.

3.3.2 What are the interactions of transport and the environment?

The evaluation of the environmental impact of transport includes a number of elements with which transport has an impact on its surroundings, i.e. inanimate items, such as soil, air, buildings as well as on live organisms, flora, fauna, and mainly on human beings. Transport produces mainly emissions polluting the air, causes a higher noise level and occupies land with its infrastructure. There is a big number of accidents, mainly in the road transport, that are reflected in human and material losses as well as congestions that manifest themselves in loss of time.

Road safety in Slovakia is linked not only to national transport safety, but also to safe transport on European roads. In 2010, the Road Safety Enhancement Strategy 2011 – 2020 (BECEP) was adopted, which includes new measures in nine objectives and takes into account the ongoing initiatives defined by the White Paper on Road Safety.

The BECEP 2020 objective:

- Reducing road deaths by 50% by 2020 compared to the reference year 2010.

Road Safety Enhancement Strategy 2011 – 2020 (BECEP) (2011)

Mutual interactions of transport and the environment are characterized based on the indicators from the group of interactions of the sector with the environment.

Demands of transport in respect of resources

3.3.2.1 Land taken by the transport infrastructure

Changes in land use represent losses or gains of land to other land use categories. At present, there is a decline in the agricultural land fund in connection with the take-up of agricultural land for construction purposes (industrial, civil, residential, agricultural, water works, other investment purposes), afforestation and other purposes.

Land taken by transport infrastructure in 2018 from the total area of the Slovak Republic (4,903,407 ha) represented 29,458 ha (0.56%). Road transport infrastructure covered an area of 14,196 ha (excluding local roads), railway infrastructure 12,211 ha, aviation infrastructure 1,525 ha and water transport infrastructure 175 ha.

Land use by transport infrastructure has not been monitored since 2018.

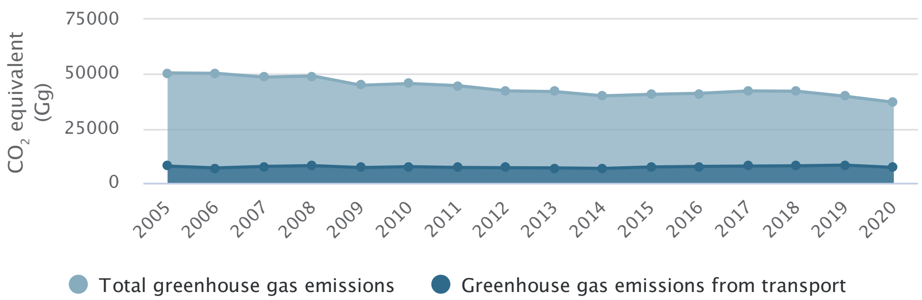
Impact of transport on the environment

3.3.2.2 Greenhouse gas emissions from transport

Vehicles are classified as mobile sources of greenhouse gas emissions (CO_2, CH_4, N_2O). The resulting emissions are the result of the combustion of fuel in the combustion engines of vehicles and, together with other gaseous and solid pollutants, such as exhaust gases, escape into the air, which subsequently pollutes it.

In the transport sector, there has been a continuous increase in greenhouse gas emissions since 1990, while this increase intensified in the years 2014 – 2019. In 2020, the share of transport emissions in the total greenhouse gas emissions of the Slovak Republic was 19%, despite a year-on-year decrease of 13%. In 2020, total greenhouse gas emissions in transport fell to 7,069.2 Gg CO_2 eq., with CO_2 emissions accounting for 98.9%, while CH_4 and N_2O emissions were negligible. Within transport, road transport accounted for 96.4% of greenhouse gas emissions, pipeline transport 2.3%, rail transport 1.2%, domestic shipping 0.1% and domestic air transport 0.01% (in CO_2 eq.).

Development of greenhouse gas emissions from transport related to total greenhouse gas emissions



Note: Emissions without the LULUCF sector Emissions determined as of 13 April 2022.
Source: SHMI

Vehicles are classified as mobile sources of greenhouse gas emissions. Emissions from transport are associated with an increase in individual car transport, as well as an increase in the share of transit heavy goods road transport. The European Commission's latest proposals under the European Green Deal include stricter CO_2 emission standards for new vehicles, with the aim of phasing out traditional internal combustion engines and switching to zero- or low-emission vehicles. Another option to reduce the increasing transport emissions is to reduce the number of vehicles on the road and switch to more environmentally friendly forms of transport, i.e. prioritizing the use of public transport, cycling or car-sharing.

In 2020, the share of emissions from transport in the total greenhouse gas emissions of the Slovak Republic was 19%, despite a year-on-year decrease of 13%.

3.3.2.3 Emissions of pollutants released into the air from transport

Since 1990, the SR has been performing the regular annual complex stocktaking of the production of emissions of some selected pollutants that also includes the annual stocktaking of the operation of road, railway, water and air transportation. For determining the quantity of production of the individual monitored harmful substances, the CORINAIR methodology is applied, used in the EU countries, whose special programme product COPERT is intended for stocktaking of the annual production of emissions from the road transport. The main pollutant emissions produced by internal combustion engine vehicles include particulate matter (PM), NO_X (mainly NO and NO_2), CO and NMVOCs (non-methane volatile organic compounds). A key role in reducing the carbon footprint in the transport sector is played by the pressure to tighten the emission standards of cars and trucks.

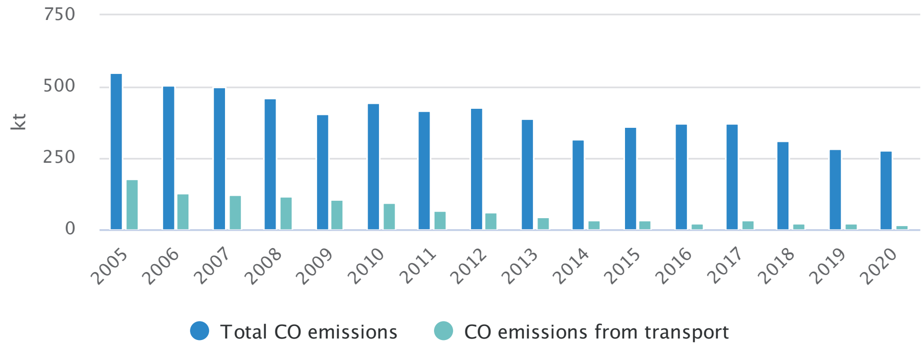
In the monitored period of 2005 – 2020, emissions of pollutants from transport decreased significantly. The trend of decreasing emissions continued in 2020, which could also be related to the reduced mobility of the population in connection with the spread of the COVID-19 disease.

In 2020, emissions of pollutants decreased compared to 2005. In the total emissions of reviewed pollutants in 2020, a significant share of NO_x emissions was recorded – 40.8%, the share of other pollutants is small.

The following shares were important in the total emissions of reviewed pollutants in 2020: 5.7% share of transport in CO emissions, 40.8% share of NO_X, and 4.1% share of NMVOC and SO_2 emissions with 1.3%. The share of non-exhaust emissions of solid particles (PM_{10} and $PM_{2.5}$), making up a large part of the total emissions of solid particles from vehicles, was 6.8% of $PM_{2.5}$ and 6.7% of PM_{10}.

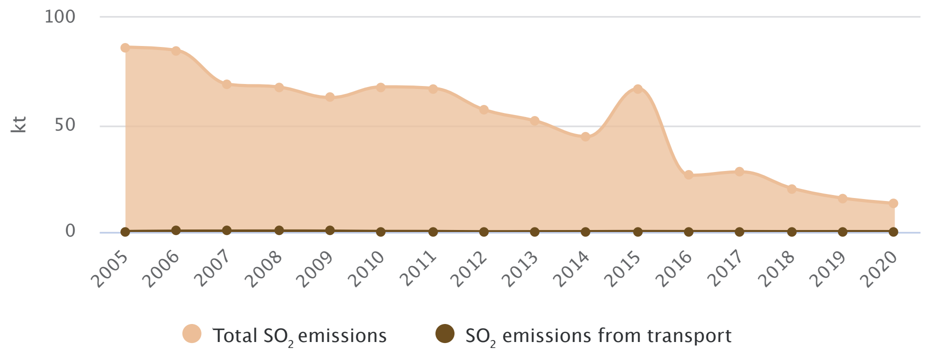
In the period from 2005 to 2020, CO emissions decreased several times, and the most fluctuating trend was for SO_2 emissions.

Development of CO emissions from transport related to total CO emissions



Source: SHMI

Development of SO_2 emissions from transport related to total SO_2 emissions



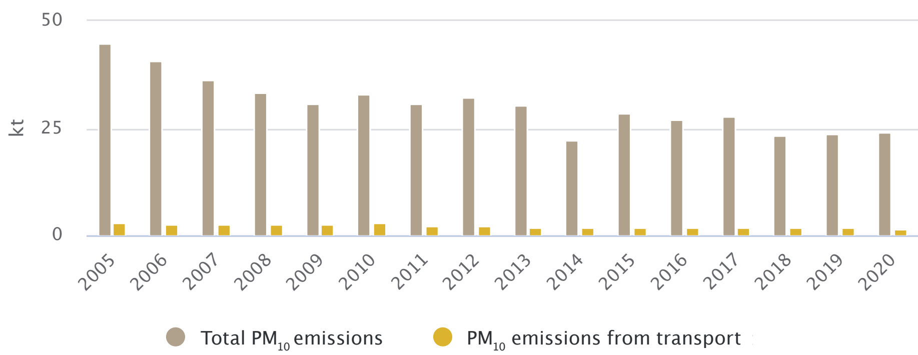
Source: SHMI

Emissions of NO_x, $PM_{2.5}$ and PM_{10} had a gradual decline, despite slight year-on-year increases in 2008 – 2010 and in 2015.

Development of NO_x emissions from transport related to total NO_x emissions

Source: SHMI

Development of PM_{10} emissions from transport related to total PM_{10} emissions



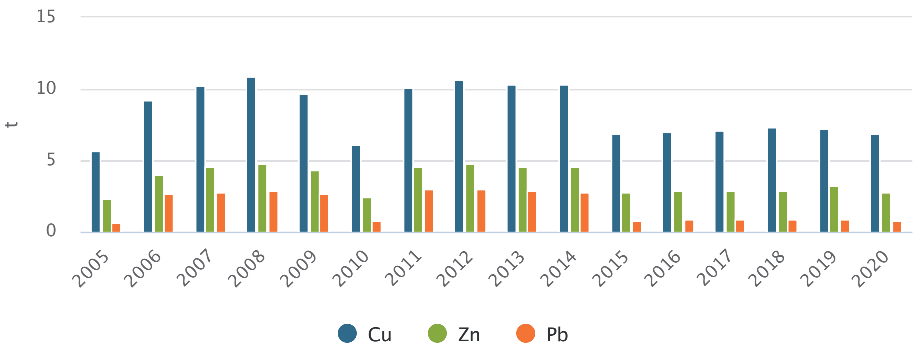
Source: SHMI

Development of $PM_{2.5}$ emissions from transport related to total $PM_{2.5}$ emissions

Source: SHMI

In 2020, the share of transport in the total emissions of heavy metals was 16.9%. In the period from 2005 to 2020, emissions of heavy metals (Cu, Pb, Zn) increased, with the highest increase recorded by lead (Pb) emissions by 23.9%, followed by zinc (Zn) emissions by 24.1% and copper emissions (Cu) by 21.1%. Of the monitored emissions of heavy metals (Cu, Pb, Zn, Ni, Cd, Cr), the highest share in the transport sector in 2020 was copper (Cu) – 70.6%, lead (Pb) – 8.9% and zinc (Zn) – 7.7%, while the share of other heavy metals was low.

Development of heavy metal emissions in the transport sector



Source: SHMI

3.3.2.4 Waste from transport

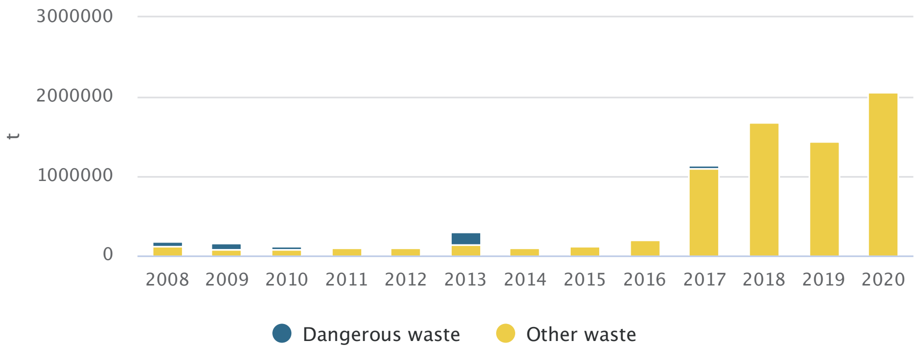
Transport waste represents the total amount of waste generated by the transport and communications sector. The transport sector is one of the major sources of waste generation, with hazardous waste accounting for approximately 2% of all transport waste.

Waste produced by transport with a negative impact on the environment includes waste from petroleum products (lubricants, propellants), affecting the pollution of soil and surface water unfavourably. A considerable part of waste from discarded means of transport is waste from discarded road motor vehicles and trailers. Analyses of the waste composition show that waste from discarded road vehicles mainly consists of ferrous metals, non-ferrous metals, tyres, ferrous metals, non-ferrous metals, accumulators prevail in waste from discarded rail vehicles. With respect to the type of waste (metal, municipal waste of various types of products from crude oil, sediments from waste water treatment plants, contaminated soil, etc.), the production of waste in the railway transport is solved by recycling, combustion or storing at waste dumps.

In the 2008 – 2020 monitored period, transport waste has been fluctuating, with a significant increase from 2017 which continued in 2020. By waste type, more than 95%

is made up of construction and demolition waste, which has multiplied several times since 2008. In 2020, waste from transport recorded a year-on-year increase of 43.9%, which could also be related to the renewed construction of highways, expressways and other constructions. Hazardous waste from transport in the period 2008 – 2020 decreased by 72.2%, the year-on-year increase (2019 – 2020) was 41.1%.

Development of the production of waste in the sector of transport and communications



Source: MoE SR, SO SR

Waste tires

Act No. 79/2015 Coll. on waste, as later amended, effective from 2016, introduced new rules in the management of waste tires. Landfilling of waste tires is prohibited under the Waste Act.

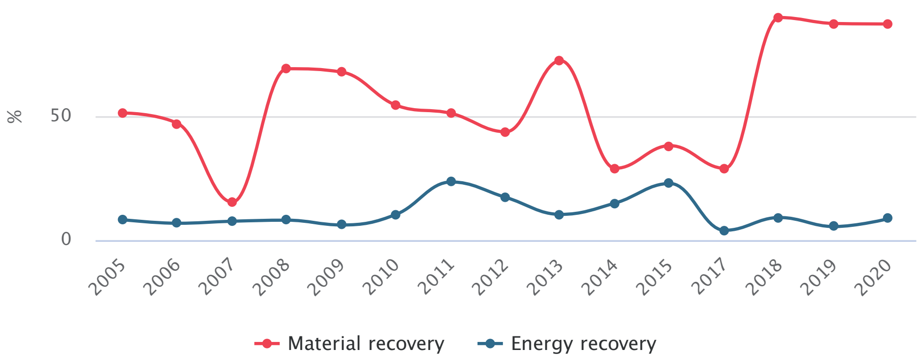
Objective for waste tires by 2020:

- Achieving a material recovery rate of 80% with 15% energy recovery and a gradual reduc-tion of landfilling to a maximum of 1%.

Waste Management Program of the Slovak Republic for 2016 – 2020 (2015)

The management of waste tires has long been dominated by material recovery. Material recovery of waste tires increased by 35.9 percentage points (p.p.) over the 2005 – 2020 monitored period. Energy recovery in 2020 was at the level of 2005, despite increases in 2011 and 2015. In 2020, material recovery of waste tires reached 87.2% and energy recovery 8.7%.

Developments in waste tire management



Source: MoE SR, SO SR

In 2020, the material recovery of waste tires increased by 35.9 percentage points compared to 2005, the energy recovery was at the level of 2005.

Collection of old vehicles

The handling and disposal of old vehicles may only be carried out by an authorized old vehicle recycler. At present (2020), there are 52 authorized plants operating in the Slovak Republic within the complex collection and processing of old vehicles.

Objectives for old vehicles by 2020:

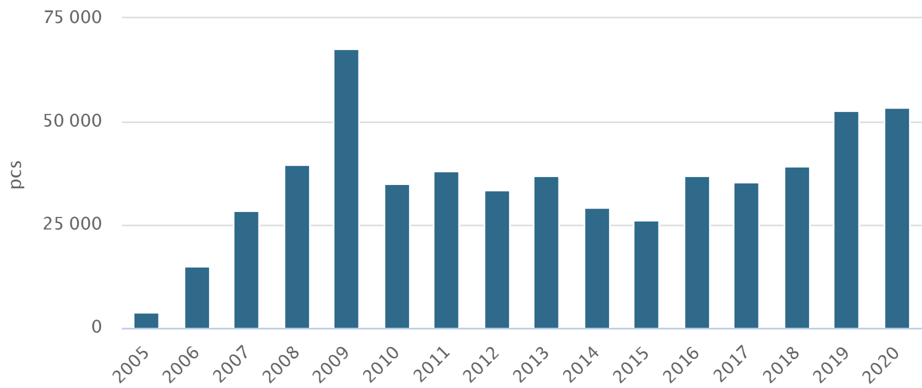
- Between 2016 and 2020, achieving binding limits for the extent of reuse of parts of old vehicles, recovery of waste from the treatment of old vehicles – 95%* and reuse of parts of old vehicles and recycling of old vehicles – 85%*.

*(*Activity limits on the average weight per vehicle valid for all vehicles since 2015.)*

Waste Management Program of the Slovak Republic for 2016 – 2020 (2015)

A fluctuating trend persisted in the number of processed old vehicles in the period 2005 – 2020, with the exception of 2009 and 2019, when there was an increase in the collection of old vehicles. In 2020, the number of old vehicles reached 53,355 pieces. The highest number of old vehicles was processed in 2009 (67,795 units), the least was processed in 2005 (3,922 pieces). In the case of reuse of parts of old vehicles and recycling of old vehicles, the SR achieved a share of 95.6% and thus met the prescribed limit. The rate of reuse and recovery of old vehicles reached the level of 97.1% in 2020.

Development of the collection of old vehicles



3.3.2.5 Noise load of inhabitants

Environmental noise is a natural part of every person's life activities. Its presence in the environment is inextricably linked to various forms of transport, but also to many work and non-work activities. Noise has an adverse effect on living organisms depending on the intensity and frequency.

The noise map presents data on the noise situation using a noise indicator that monitors the noise load on the area around these roads and also shows the exceedance of any relevant applicable limit values. The number of persons affected in each noise zone is also analyzed from these maps. Common noise indicators L_{day} have been introduced across the EU Member States to assess overall noise nuisance and L_{night} to assess sleep disturbance.

In accordance with the law, strategic noise maps and action plans from road, rail, air transport and from industrial activity of large-scale sources of noise in the territory were updated for the situation in 2016 – for the Bratislava and Košice agglomerations. In 2016, noise maps were also prepared in the vicinity of highways and expressways, which are managed by Národná diaľničná spoločnosť, a.s. and on which the passage of vehicles was higher than 6 million, for the vicinity of 1st class roads that are managed by the Slovak Road Administration and for regional 2nd and 3rd roads classes in the Bratislava agglomeration. Strategic noise maps were also drawn up for selected sections of railway tracks (in the administration of the Railways of the Slovak Republic) on which the intensity of the movements of train sets was higher than 30,000 movements per year.

The construction of anti-noise walls minimizes the noise burden of the population. The total length of anti-noise walls in 2020 in road transport was 180,151 m and in rail transport 64,099 m.

Strategic noise maps are updated every 5 years, and currently (2020) the fourth round of noise mapping is being prepared according to a unified European methodology

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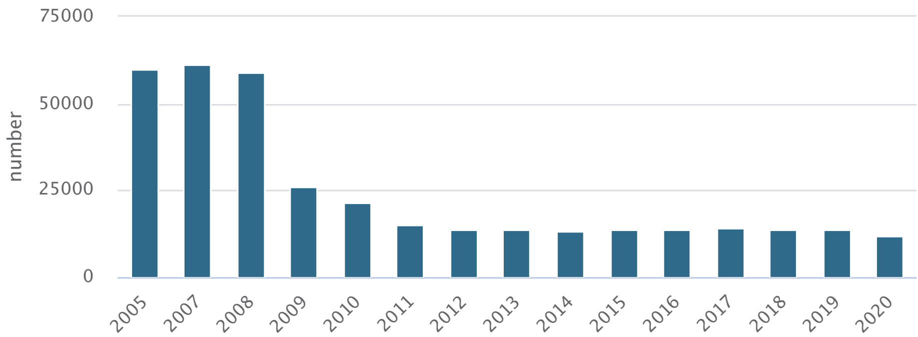
3.3.2.6 Number of accidents and number of killed and injured persons due to traffic operation

Direct impacts immediately affecting the human population and all components of the environment also include the transport accident rate. The transport accident rate in extravilan sections is mainly connected with the car transport. In intravilans, the pedestrian transport has also a considerable share. With the increased transport accident rate, direct costs related to elimination of damages are not the only ones growing, but there are also costs of the medical care.

The basic indicator of traffic accidents is the number of traffic accidents, which recorded a decreasing trend during the observed period (2005 – 2020). In the monitored period of 2005 – 2008, the number of accidents had a fluctuating character and fluctuated at the level of 60,000 accidents each year. Since 2009, the number of accidents has seen a decreasing trend (due to legislative changes). In 2020, this decrease was 80.21% compared to 2005, and compared to 2009, it is a decrease of 45.1%.

The decrease in traffic accidents (including the decrease in the number of killed, seriously and lightly injured persons) in 2020 was to some extent also caused by the reduced mobility of the population, caused by measures to prevent the spread of the COVID-19 pandemic. However, the extent of this impact cannot be quantified.

Development in the number of traffic accidents



Note: After 2009, there was a change in methodology
Source: SO SR

Target for the number of people killed by 2020:

- Reduce the number of people killed as a result of road traffic accidents (deaths within 30 days of the accident) by half compared to the reference year 2010.

Road Safety Enhancement Strategy 2011-2020 (BECEP) (2011)

The development in the number of persons killed, seriously and lightly injured in traffic accidents has a downward trend. The lowest values were recorded in 2020 and compared to 2019, there was a decrease in the number of persons killed by 8.6%, slightly injured by 19.1% and severely injured by 13%. The set intention of reaching the level of 173 persons killed in traffic accidents in 2020 could not be fulfilled. The number of victims of traffic accidents in the years 2011 – 2020 decreased by 121 persons (35.1%) compared to their number in the reference year 2010.

Development in the number of persons killed as a result of traffic accidents

Source: SO SR

The number of traffic accidents in 2020 decreased by more than half compared to 2009 and the number of people killed, slightly and seriously injured also decreased. The set goal of reducing the number of fatal traffic accidents by 50% by 2020 compared to 2010 was not achieved.

The number of accidents in the railway transport in 2009 – 2015 fluctuated at the level of approximately 60 accidents per year.

In connection with accidents, there is mainly leakage of crude oil substances (diesel oil and oils) into the surroundings of transport road, from where leaked substances can subsequently get into a watercourse or the rock environment where they can cause pollution of underground water. Road transport have the biggest share in extraordinary deterioration of water.

In 2020, there were 119 cases of extraordinary deterioration of water (EDW), of which 51 (42.8%) were caused by transport, among which three by railway transport and 48 by road transport, while 26 were caused by the Slovak carriers and haulers. Such EDW are much more dangerous if they occur in protective zones of waterworks resources of groundwater, natural healing resources, natural resources of mineral water or watercourses.

From 2020, the data on the extraordinary deterioration of waters is not monitored.

A considerable risk factor in the environment is also the fire rate. In 2020, there were 944 fires in the sector of transport with direct material damages amounting to EUR 5,677 thousand, in which 3 persons were killed and 13 persons were injured.

3.3.3 What is the response of the society to mitigating or compensating negative consequences of transport on the environment?

Reducing the negative impact of transport on the environment is possible by switching to a sustainable transport system. In addition to fuel prices and fuel taxes, innovative solutions that can change some consumption habits of the population will be an effective tool and incentive for the transition to more ecological modes of transport.

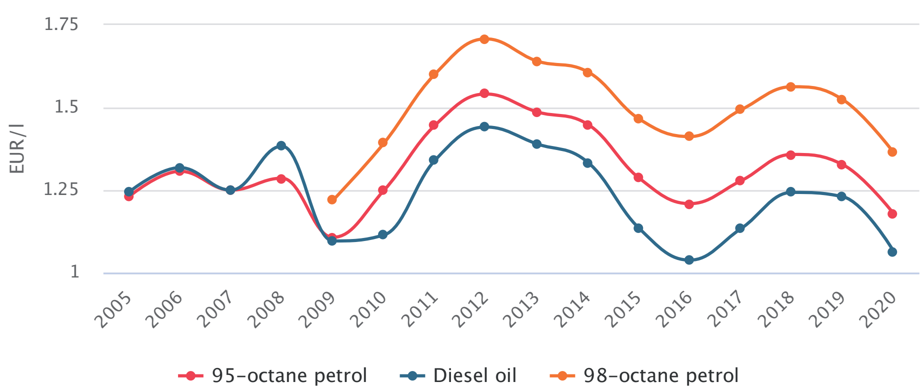
The company's response to mitigation, or compensation of the negative consequences of transport on the environment is described on the basis of indicators from the group of political, economic and social aspects.

3.3.3.1 *Fuel prices and fuel price taxes*

There are a number of items that affect fuel prices. Fixed items include excise duty on mineral oils and VAT, which account for around 60% of the fuel price. Another item is the wholesale price of fuel, which is based on the price of diesel and petrol itself at the Rotterdam stock exchange and is dependent on oil prices. The last part of the price is the retail price, which includes the costs and margins of the retailer and amounts to 1 – 4% of the total price.

The average prices of all motor fuels during the monitored period of 2005 – 2020 had a fluctuating trend. The decline in the years 2008 – 2010 was caused by several factors, the most significant of which is the drop in the price of oil, as a side effect of the global economic crisis in the oil and refining industry. The year 2010 was marked by a strike by truckers at the beginning of the year and the subsequent reduction of excise duty on diesel fuel by 9 cents. In 2011, VAT was increased to 20%, a contribution to emergency oil stocks was added, and the zero consumption tax on bio-components in fuel was abolished, which was generally reflected in fuel prices. Between 2012 and 2020, average fuel prices fell – petrol by 22% and diesel by 7%, while the lowest were in 2016 (1.04 – 1.41 EUR/l) and in 2020 (1.06 – 1.36 EUR /l).

Development of the average prices of motor fuels in SR

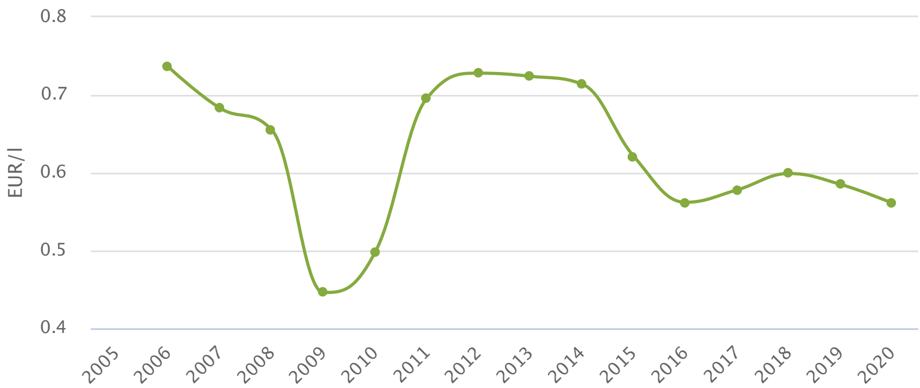


Source: SO SR

LPG (Liquid Petroleum Gas) is a liquid by-product of oil refining and is the most widely used alternative fuel for passenger cars. Despite the fact that LPG prices follow the trend of ups and downs in petrol prices, they still stick to around half their price level. LPG prices in the monitored period of 2005 – 2020 recorded a fluctuating trend with a significant decrease until 2009. The price decrease in 2020 was 23.8% compared to

2005, and the year-on-year decrease was at the level of 4.2%. In 2020, the average price of LPG was at the level of 0.561 EUR/l.

Development of the LPG average prices



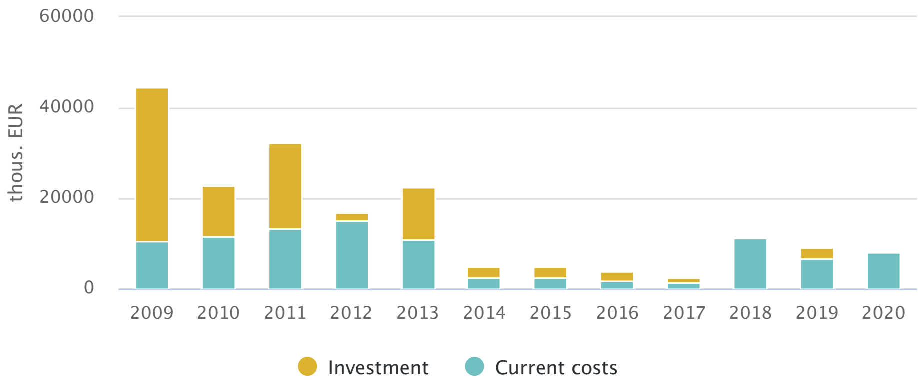
Source: SO SR

3.3.3.2 Costs of the environmental protection in transport

The environmental protection costs (EPC) track the investments made to protect and improve the quality of the environment, and the ongoing costs incurred by individual entities to operate, maintain and repair environmental protection facilities. The environmental protection costs are the sum of investment and running costs of enterprises with 20 or more employees.

In the monitored period of 2009 – 2019, the costs of environmental protection in transport recorded a decrease and in 2019 they made up less than a percent (0.99%) of the total costs spent on environmental protection, while in 2009 it was 7.8%. Investments for environmental protection in the transport sector had a fluctuating nature, while they reached their highest value in 2009, on the contrary, they were at their lowest level in 2018. From 2020, investments for environmental protection in the transport sector are not reported separately. Current costs for environmental pro-tection in the monitored period of 2009 – 2020 decreased by 22.2% and increased by 19.2% year-on-year. The least financial resources were spent on environmental protection in transport in the period 2014 – 2017.

Development of environmental protection costs in transport



Source: SO SR

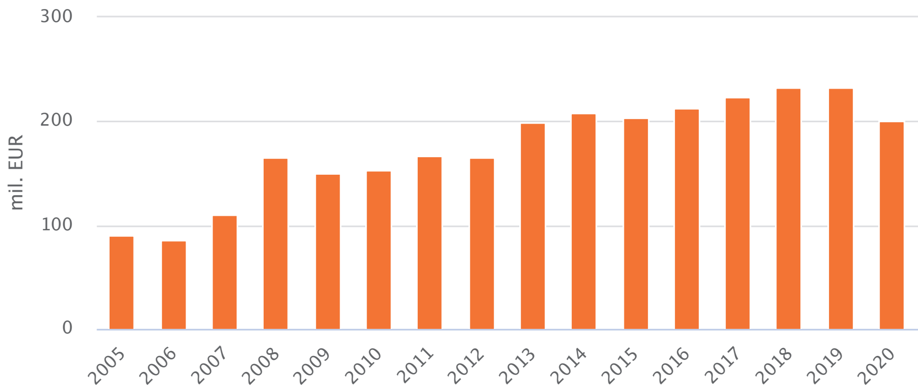
The costs of environmental protection in transport constitute only 0.99% of the total costs spent on environmental protection.

3.3.3.3 Tax on transport

The tax on transport is one of the taxes with an environmental aspect, which is a tax, the tax base of which is made up of a physical unit (or a replacement of a physical unit) of something which has a negative impact on the environment. Transport tax includes taxes related to the ownership and use of motor vehicles, including taxes on other means of transport (e.g. airplanes) and includes road tax, motor vehicle registration fee, tax for entering and staying of a motor vehicle in the historic part of the city.

The share of taxes with an environmental aspect in total tax revenues in the Slovak Republic in the evaluated period 2005 – 2020 has a growing trend. In 2020, compared to the previous year, there was a decrease in the share of taxes with an environmental aspect on GDP and on total tax revenues. The share of transport tax in total taxes with an environmental aspect was 9.1%. The share of transport tax in GDP in 2020 reached 0.2% of GDP and was at the level of 2005.

Development of transport tax



Source: SO SR

In 2020, transport tax increased by 123% compared to 2005.

References

1. Cykloportál. Available on: https://www.cykloportal.sk/ **[Slovak version]**

2. Dopravný úrad. Zoznam letísk a heliportov [online]. Available on: http://letectvo.nsat.sk **[Slovak version]**

3. Euroakustik, s. r. o. Strategické hlukové mapy [online]. Available on: http://www.hlukovamapa.sk/ **[Slovak version]**

4. European Automobile Manufacturers´Association (ACEA). Vehicles in use, Europe 2022 [online]. Available on: www.acea.auto

5. European Environment Agency. The European environmnet – state and outlook 2020. Knowledge for transition to a sustainable Europe [online]. Copenhagen: EEA, 2019. ISBN 978-92-9480-090-9. Available on: https://www.eea.europa.eu/publications/soer-2020

6. European Environment Agency. Decarbonising road transport – the role of vehicles, fuels and transport demand, TERM 2021 – transport and envitonment report, NO 2/2022 [online]. Copenhagen: EEA, 2022. ISBN 978-92-9480-473-0. Available on: https://www.eea.europa.eu

7. European Environment Agency. Towards clean and smart mobility – Transport and environment in Europe. EEA Signals 2016 [online]. Copenhagen: EEA, 2016, 35 pgs. ISBN 978-92-9213-739-7. Available on: https://www.eea.europa.eu/signals/signals-2016

8. European Parliament. Directive 2014/94/EU on the deployment of alternative fuels infrastructure. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0094&from=SK

9. European Parliament. Regulation (EU) 2016/2338 amending Regulation (EC) No 1370/2007 concerning the opening of the market for domestic passenger transport services by rail [online]. Brusel 2016. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R2338&from=CS

10. European Parliament. Regulation (EU) 2016/2338 of the European Parliament and of the Council of 14 December 2016 amending Regulation (EC) No 1370/2007 concerning the opening of the market for domestic passenger transport services by rail [online]. Strasbourg: EP, 2016. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R2338

11. Eurostat. Available on: http://ec.europa.eu/eurostat

12. Eurostat. Energy, transport and environment statistic – 2020 Edition. [online]. Luxemburg: Eurostat, 2020, pgs. 50 – 83, ISBN: 978-92-76-20736-8. Available on: https://ec.europa.eu/eurostat/en/web/products-statistical-books/-/ks-dk-20-001

13. European Commission. WHITE PAPER, Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system COM(2011) 144 final [online]. Brussels, 2011. Available on: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:en:PDF

14. Jirsáková J., Kým nie je neskoro – Emisie CO_2 z cestnej dopravy a možnosti ich mitigácie, [online]. Bratislava: Inštitút dopravnej politiky, MDVRR, 2021, 44 pgs. Available on: https://www.mindop.sk/ministerstvo-1/doprava-3/institut-dopravnej-politiky **[Slovak version]**

15. Kováč L., (Ne)Máš na výber? Modelovanie výberu dopravného prostriedku, [online]. Bratislava: Inštitút dopravnej politiky, MDVRR, 2022, 30 pgs. Available on: https://www.mindop.sk/uploads/media/d80501ba9a911d0a10f1351df52d5e7210098b92.pdf **[Slovak version]**

16. Ministerstvo dopravy, pôšt a telekomunikácií SR. KURS 2001 (Územný generel cestnej dopravy Slovenskej republiky) [online]. Bratislava: MDVRR SR, 2001. Available on: https://www.mindop.sk/ **[Slovak version]**

17. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Koncepcia rozvoja vodnej dopravy SR (uznesenie vlády SR č. 469/2000) [online]. Bratislava: MDVRR SR, 2000. Available on: https://www.mindop.sk/ministerstvo-1/doprava-3/vodna-doprava/vnutrozemska-vodna-doprava/koncepcie **[Slovak version]**

18. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Program rozvoja inteligentných dopravných systémov. Národný systém dopravných informácií (uznesenie vlády SR č. 22/2009) [online]. Bratislava: MDVRR SR, 2009. Available on: https://www.mindop.sk/ **[Slovak version]**

19. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Program revitalizácie železničných spoločností (uznesenie vlády SR č. 188/2011) [online]. Bratislava: MDVRR SR, 2011. Dostupné z: https://www.mindop.sk/ministerstvo-1/doprava-3/zeleznicna-doprava/program-revitalizacie-zeleznicnych-spolocnosti **[Slovak version]**

20. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Stratégia rozvoja verejnej osobnej a nemotorovej dopravy SR do roku 2020 (uznesenie vlády SR č. 311/2014) [online]. Bratislava: MDVRR SR, 2014. Available on: https://rokovania.gov.sk/RVL/Material/10978/1 **[Slovak version]**

21. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Protokol o trvalo udržateľnej doprave k Rámcovému dohovoru o ochrane a trvalo udržateľnom rozvoji, (uznesenie vlády SR č. 447/2014) [online]. Bratislava: MDVRR SR, 2014. Available on: http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=23853 **[Slovak version]**

22. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Operačný program Integrované infraštruktúra 2014 – 2020, (rozhodnutie EK z 28. októbra 2014) [online]. Bratislava: MDVRR SR, 2014. Available on: http://www.telecom.gov.sk/index/index.php?ids=169044 **[Slovak version]**

23. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Programové vyhlásenie vlády SR na obdobie rokov 2016 – 2020 v oblasti dopravy, výstavby a regionálneho rozvoja (uznese-nie vlády SR č. 141/2016) [online]. Bratislava: MDVRR SR, 2016. Available on: http://www.vlada.gov.sk/programove-vyhlasenie-vlady-sr-na-roky-2016-2020/ **[Slovak version]**

24. Ministerstvo dopravy, výstavby a regionálneho rozvoja SR. Strategický plán rozvoja dopra-vy Slovenskej republiky do roku 2030 – fáza II (Uznesenie vlády SR č.13/2017) [online]. Bratislava: MDVRR SR, 2017. Available on: https://www.mindop.sk/ **[Slovak version]**

25. Ministerstvo dopravy a výstavby SR. Koncepcia rozvoja intermodálnej dopravy Slovenskej republiky do roku 2030 [online]. Bratislava: MDV SR, 2021. Available on: https://www.mindop.sk/ministerstvo-1/doprava-3/strategia/intermodalna-doprava **[Slovak version]**

26. Ministerstvo dopravy a výstavby SR. Plán dopravnej obslužnosti Slovenska pre železničnú osobnú dopravu [online]. Bratislava: MDV SR, 2022. Available on: https://www.mindop.sk/ministerstvo-1/doprava-3/strategia/verejna-osobna-doprava/plan-dopravnej-obsluznosti-slovenska-pre-zeleznicnu-osobnu-dopravu **[Slovak version]**

27. Ministerstvo dopravy a výstavby SR. Národná Stratégia Slovenskej republiky pre bezpečnosť cestnej premávky na roky 2021 – 2030, (uznesenie vlády SR č. 700/2021) [onli-ne]. Bratislava: MDV SR, 2021. Available on: https://rokovania.gov.sk/RVL/Material/26646/1 **[Slovak version]**

28. Ministerstvo hospodárstva SR. Návrh integrovaného národného energetického a klimatického plánu na roky 2021 – 2030 (uznesenie vlády SR č. 606/2019) [online]. Bratislava: MH SR, 2019. Available on: https://rokovania.gov.sk/RVL/Material/24390/1 **[Slovak version]**

29. Ministerstvo hospodárstva SR. Revízia a aktualizácia Národného politického rámca pre roz-voj trhu s alternatívnymi palivami (uznesenie vlády SR č. 557/2019) [online]. Bratislava: MH SR, 2019. Available on: https://rokovania.gov.sk/RVL/Resolution/18044/1 **[Slovak version]**

30. Ministerstvo hospodárstva SR. Akčný plán rozvoja elektromobility v Slovenskej republike (uznesenie vlády SR č. 110/2019) [online]. Bratislava: MH SR, 2019. Available on: https://rokovania.gov.sk/RVL/Material/23601/1 **[Slovak version]**

31. Ministerstvo životného prostredia SR, Slovenská agentúra životného prostredia. Správa o stave životného prostredia Slovenskej republiky v roku 2020 [online]. Bratislava : MŽP SR, SAŽP, 2021, 194 s. ISBN 978-80-8213-052-5. Available on: https://www.enviroportal.sk/spravy/kat21 **[Slovak version]**

32. Ministry of environment of the Slovak republic. Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) [online]. Bratislava, 2019. Available on: https://www.minzp.sk/files/iep/greener_slovakia-strategy_of_the_environmental_policy_of_the_slovak_republic_until_2030.pdf

33. Ministerstvo životného prostredia SR. Stratégia adaptácie Slovenskej republiky na zmenu klímy – aktualizácia, 2018 (uznesenie vlády SR č. 478/2018) [online]. Bratislava: MŽP SR, 2018. Available on: https://rokovania.gov.sk/RVL/Material/23275/1 **[Slovak version]**

34. Ministerstvo životného prostredia SR. Nízkouhlíková stratégia rozvoja Slovnskej republiky do roku 2030 s výhľadom do roku 2050, (uznesenie vlády SR č. 104/2020) [online]. Bratisla-va: MŽP SR, 2020. Available on: https://www.minzp.sk/klima/nizkouhlikova-strategia/ **[Slovak version]**

35. Prezídium hasičského a záchranného zboru. Štatistiky – požiarovosť [online]. Bratislava: MV SR, 2022. Available on: https://www.minv.sk/?pozriarovost **[Slovak version]**

36. Prezídium policajného zboru. Štatistické prehľady agendy vozidiel [online]. Bratislava: MV SR, 2022. Available on: https://www.minv.sk/?statisticke-prehlady-agendy-vozidiel **[Slovak version]**

37. Slovak Hydrometeorological Institute. National Inventory Report 2021 [online]. Bratislava: MoE SR, SHMI, 2022. Available on: https://unfccc.int/ghg-inventories-annex-i-parties/2021

38. Slovak Hydrometeorological Institute. TRANSPORT – Greenhouse gas emissions and air pollutant from transport [online]. Bratislava: MoE SR, SHMI, 2022. Available on: https://oeab.shmu.sk/en/emissions/transport/trends.html

39. Slovenská inšpekcia životného prostredia. Správa o mimoriadnom zhoršení vôd na Slovensku v roku 2019 [online]. Bratislava: SIŽP, 2020. Available on: http://www.sizp.sk/ **[Slovak version]**

40. Slovenská správa ciest. Štatistické výstupy [online]. Bratislava: SSC, 2022. Available on: https://www.cdb.sk/sk/statisticke-vystupy.alej [Slovak version]

41. Svet dopravy. Vedecký – recenzovaný online časopis [online]. Available on: www.svetdopravy.sk **[Slovak version]**

42. Statistical Office of the SR. Yearbook of transport, posts and telecommunication 2005 – 2020 [online]. Bratislava: SO SR, 2006 – 2021. Available on: https://slovak.statistics.sk

43. Štatistický úrad SR. Databáza DATAcube [online]. Bratislava: ŠÚ SR, 2021. Available on: http://datacube.statistics.sk/TM1WebSK/ **[Slovak version]**

44. Štatistický úrad SR. Energetika 2006 – 2020 [online]. Bratislava: ŠÚ SR, 2007 – 2021. Available on: https://slovak.statistics.sk **[Slovak version]**

45. Výskumný ústav dopravný. Spracovávanie monitoringu a analýzy životného prostredia v doprave, Záverečná správa – časť B. Žilina: VÚD, 2019. **[Slovak version]**

AGRICULTURE

List of the sector indicators in agriculture

Trends of the sector relevant for the environment

- Share of agriculture in GDP formation
- Structure of agricultural land use
- Plant and animal production
- Consumption of farmyard manure
- Consumption of industrial fertilizers and pesticides
- Final energy consumption in agriculture and forestry

Interactions of the sector with the environment (demands of the sector in respect of resources and impacts of the sector on the environment)

- Water withdrawals in agriculture
- Greenhouse gas emissions from agriculture
- Emissions of pollutants released into the air from agriculture
- Nitrogen and phosphorus balance in agricultural soils
- Waste from agriculture
- Waste water from agriculture
- Soil reaction of agricultural soils

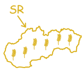
Political, economic and social aspects

- Organic farming
- Costs of the environmental protection in agriculture
- Contributions for the withdrawal of agricultural land

According to the Statistical Classification of Economic Activities (SK NACE Rev. 2), agriculture is included in the Section A – Agriculture, forestry and fishing. It is included in the following division: 01 – Crop and animal production, hunting and related service activities

3.4. Summary assessment of the development in the sector of agriculture

What is the state and directing of the agriculture in relation to the environment?



Between 2005 and 2020, the area of agricultural land decreased by 2.4%, mainly in favor of built-up areas. Except for hop fields, the area of all types of agricultural land decreased.

Between 2005 and 2020, the production of most agricultural crops showed a decreasing trend. A decrease of 44.8% was recorded for potatoes, 27.2% for legumes, 26.5% for sugar beet and 1.7% for annual forage crops. On the other hand, cereal and oilseed production increased by 27.8% and 57.9% respectively over the period. Since 2005, livestock numbers have decreased for all species kept. Between 2005 and 2020, the number of cattle decreased by 16.3%, pigs by 51.4%, poultry by 24.7% and sheep by 8.1%.

From 2005 to 2020, manure consumption showed a largely downward trend, reflecting the decrease in livestock numbers. It decreased by 45.6% in the monitored period.

Between 2005 and 2020, nitrogen fertilizer consumption increased by more than 66.9%, phosphate fertilizer consumption by 62% and potassium fertilizer consumption by 20.8%. There was also an increase in individual pesticide groups, with total pesticide consumption increasing by 54.6% over the period.

The development of the final energy consumption of fuels and energy in agriculture and forestry as a whole had a predominantly decreasing course from 2005 to 2020, while the most significant decrease in the given period was the final energy consumption of solid fuels by 84.5%, followed by heat by 82.1%, gas by 40.4%, electricity by 36.5% and oil and oil products by 28.6%. On the contrary, the final energy consumption of RES and biofuels recorded a more than 11-fold increase compared to 2005.

What are the interactions of agriculture and the environment?

The largest withdrawals of surface water in agriculture are for irrigation purposes. Between 2005 and 2020, there was an increase in surface water withdrawals by 36.6% and groundwater withdrawals by 5.9% in agriculture.

Between 2005 and 2020, greenhouse gas emissions from agriculture remained roughly constant, with slight fluctuations in some years. Their value expressed in CO_2 equivalent decreased by 5.4% in the monitored period.

Agriculture is the largest producer of ammonia (NH_3) of all economic sectors. Between 2005 and 2020, ammonia emissions in agriculture decreased by 15.8%, non-methane volatile organic compounds (NMVOC) emissions by 33.2%, PM_{10} emissions by 13.6%, $PM_{2.5}$ emissions by 19.1% and vice versa NO_X emissions from agriculture increased by 11%.

As a result of the increase in fertilization with nitrogen fertilizers, a positive balance of nitrogen in agricultural soils was recorded between 2005 and 2019, which in 2019 represented a value of 63.3 kg/ha of agricultural land. In the monitored period, the phosphorus balance reached a negative value of -3.1 kg/ha of agricultural land in 2019.

From 2005 to 2020, the total production of agricultural waste had a fluctuating nature. Over the period, the amount of waste from agriculture decreased by almost 40%.

The amount of wastewater from agricultural activities decreased by 87.9% between 2005 and 2020.

A comparison of the results of the monitoring cycle (2006 – 2011) of agrochemical soil testing and the most recently completed cycle (2012 – 2017) showed an increase in the representation of agricultural soils with an acidic soil reaction by 0.5 p.p. and alkaline soil reaction by 2.9 percentage point. On the contrary, there was a decrease in the proportion of agricultural soils with slightly acidic and neutral soil reaction, both by 1.7 percentage point.

What is the response of the society to mitigating or compensating negative consequences of agriculture on the environment?

Between 2005 and 2020, organic agricultural production recorded a gradual increase, and in the given period the share of agricultural land managed in this way increased by 7.67 percentage point.

The cost of environmental protection in agriculture decreased by 46.5% compared to 2009 – 2020.

Contributions for the withdrawal of agricultural land for the purpose of using it mainly for non-agricultural purposes showed a fluctuating trend between 2009 and 2020, with a higher level in 2020 than in 2009, amounting to EUR 3,109,880.

3.4.1 What is the state and directing of the agriculture in relation to the environment?

Agriculture, as a sector of the economy whose main task is to provide food for the population, has an irreplaceable role in our society. The Common Agricultural Policy (CAP) of the European Union has a significant influence on its direction.

In 2013, the CAP underwent a major reform, bringing about significant changes to its direction in response to the challenges of food sovereignty, climate change, growth and employment in rural areas. In accordance with the Europe 2020 strategy and the overall objectives of the CAP, three long-term strategic objectives were set for rural development policy for the 2014 – 2020 period:

- to support the competitiveness of agriculture,
- to ensure sustainable management of natural resources and climate measures,
- to achieve a balanced territorial development of rural economies and communities including the creation and maintenance of employment.

In 2014, the Action Plan for the future of organic production in the European Union was adopted, the task of which was to contribute to the fulfillment of the goals set in the Europe 2020 strategy, in the new Common Agricultural Policy of the EU, as well as in the 7th Environmental Action Program until 2020.

At the national level, the Rural Development Program of the Slovak Republic (RDP SR) 2014 – 2020 was adopted that year with the aim of sustainable development of the agricultural sector with an emphasis on improving the state of the environment and the landscape, in terms of introducing new, environmentally friendly agricultural and forestry practices as well as efficient use of resources. After the end of the given programming period, with the intention of enabling continuous payments to farmers and other beneficiaries of the CAP (Common Agricultural policy) from the European Agricultural Fund for Rural Development (EAFRD) and the European Agricultural Guarantee Fund (EAGF) until the new CAP is approved, the so-called transitional EU regulation. In accordance with the regulation, the programming period was extended by modifying the RDP SR 2014 – 2020 in 2021 and 2022.

In accordance with the Government Manifesto of the Slovak Republic for 2021 – 2024, in 2021 the Vision of common procedures for building modern agriculture until 2035 was approved, the aim of which is the transition to efficient and competitive agriculture based on ecologically acceptable solutions. Subsequently, the Common Agricultural Policy Strategic Plan 2023 – 2027 was adopted at the beginning of 2022. It is a basic program document of the CAP to support the sustainable development of agriculture, food production, forestry and rural areas, which the Slovak Republic is obliged to develop to be able to get support from the EAFF and EPZF in the 2023 – 2027 programming period through a set of measures grouped under 9 specific objectives and 1 cross-sectional objective, the purpose of which is:

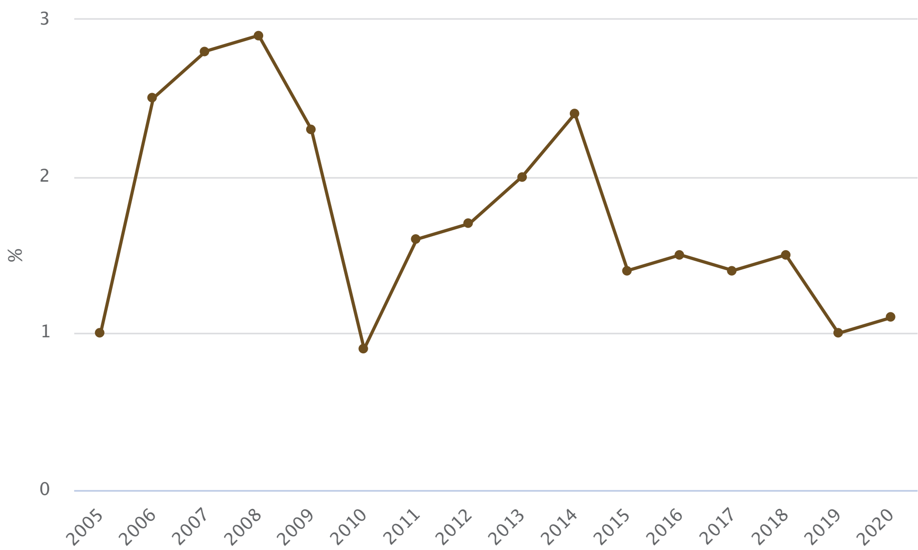
- to contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration, as well as to promote sustainable energy;
- to support sustainable development and efficient management of natural resources such as water, soil and air, including by reducing dependence on chemicals,
- to contribute to halting and reversing the loss of biodiversity, improving ecosystem services and preserving habitats and landscape areas
- to improve the response of Union agriculture to societal demands on food and health, including demands for high-quality, safe and nutritious food produced in a sustainable manner, demands for reducing food waste, as well as demands for improving animal welfare and combating antimicrobial resistance.

The state and directing of agriculture in relation to the environment is characterized based on the indicators from the group of trends of the sector relevant for the environment.

3.4.1.1 Share of agriculture in GDP formation

In 2020, the share of agriculture in the country's gross domestic product was 1.1%. Since 2005, this share showed a fluctuating trend of 1 – 3% and in 2020 it was approximately the same as in 2005.

Development of share of agriculture in GDP formation



Source: SO SR

3.4.1.2 Structure of agricultural land use

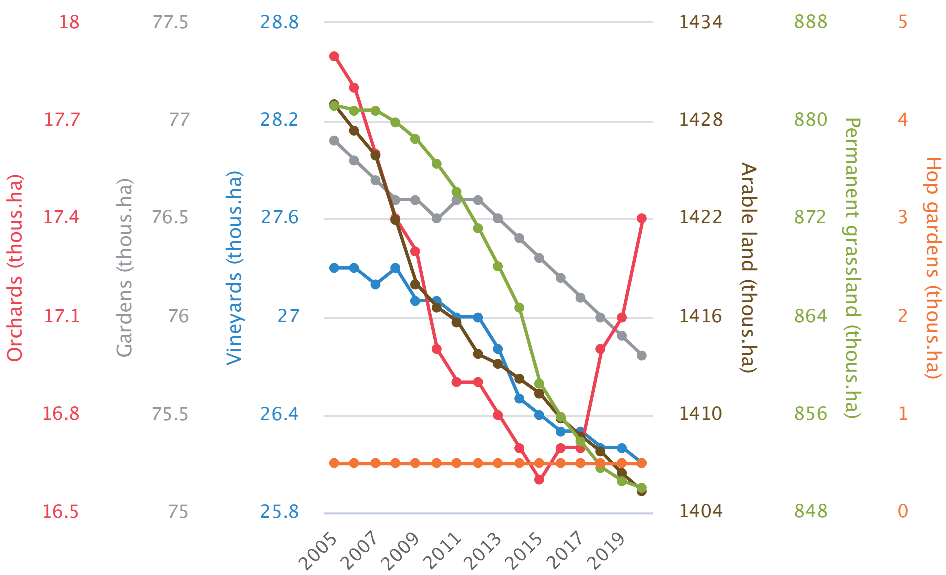
Between 2005 and 2020, the area of agricultural land decreased by 2.4% (-57,954 ha), while there was a decrease in the area of all types of agricultural land except for hop fields, the area of which was the same as in 2005.

Structure of agricultural land (AL) as of 31 December 2020

Land type	Area (ha)	Share in AL (%)
Agricultural land, total	2,375,025	100.00
Arable land	1,405,263	59.17
Hop gardens	503	0.02
Vineyards	26,080	1.10
Gardens	75,763	3.19
Orchards	17,389	0.73
Permanent grassland	850,027	35.79
Total area of the SR	4,903,405	–

Source: GCCA SR

Development of agricultural land structure

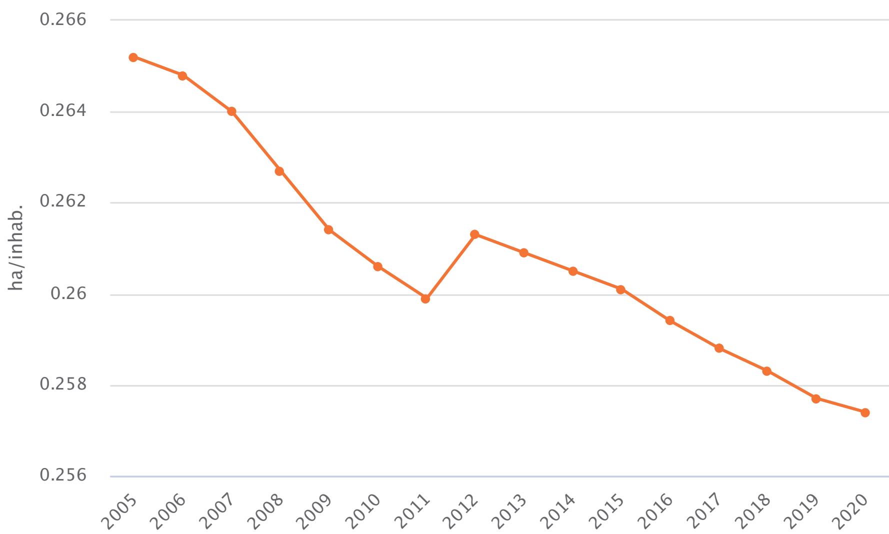


Source: GCCA SR

There is a constant downward trend in the area of agricultural land, which often involves the removal of arable soil from the agricultural land fund and its subsequent reclassification into the category of built-up areas.

Arable land is a part of the agricultural land fund. The area of arable land per capita was 0.265 ha in 2005 and 0.2574 ha in 2020. This decreasing trend is mainly negative from the environmental perspective if it concerns taking arable land off from the agricultural land fund and subsequent removing to the category of built-up areas.

Development of the area of arable land per capita

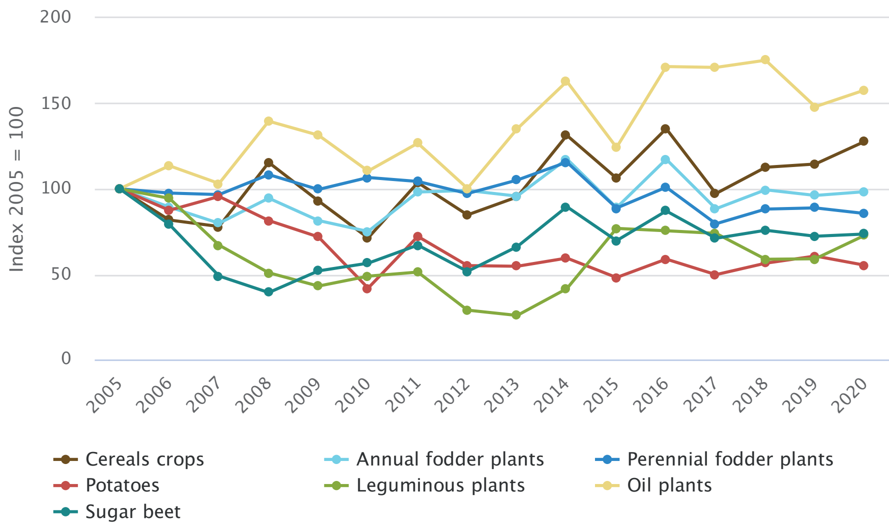


Source: GCCA SR

3.4.1.3 Plant and animal production

Between 2005 and 2020, the production of most agricultural crops showed a decreasing trend. A decrease was recorded in potatoes by 44.8% (-134,973 t), in legumes by 27.2% (-9,434 t), in sugar beet by 26.5% (-459,643 t) and in annual forage crops by 1.7% (-43,352 t). On the contrary, in the given period, the production of cereals increased by 27.8% (+995,633 t) and oilseeds by 57.9% (+262,624 t).

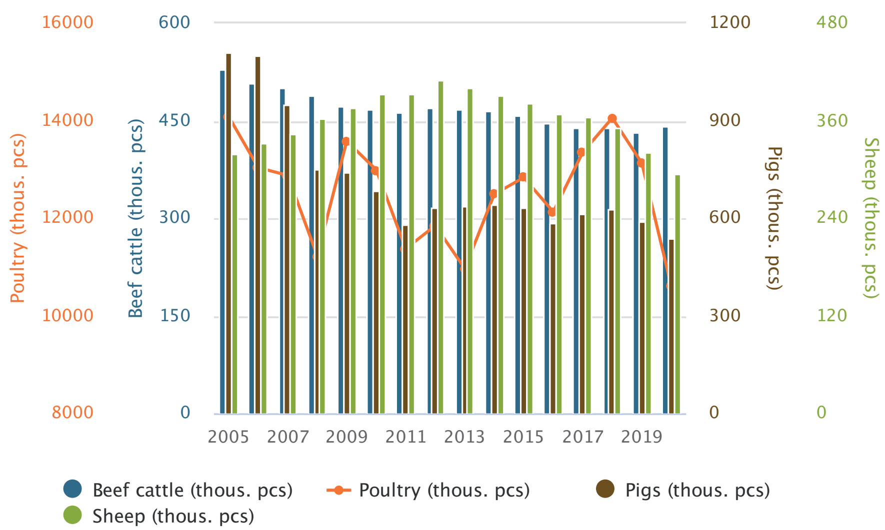
Development of yield of agricultural crop plants



Source: SO SR

Between 2005 and 2020, the number of farm animals decreased for all farmed species. The number of cattle decreased by 16.3%, pigs by 51.4%, poultry by 24.7% and sheep by 8.1% in the given period.

Development of the number of farm animals



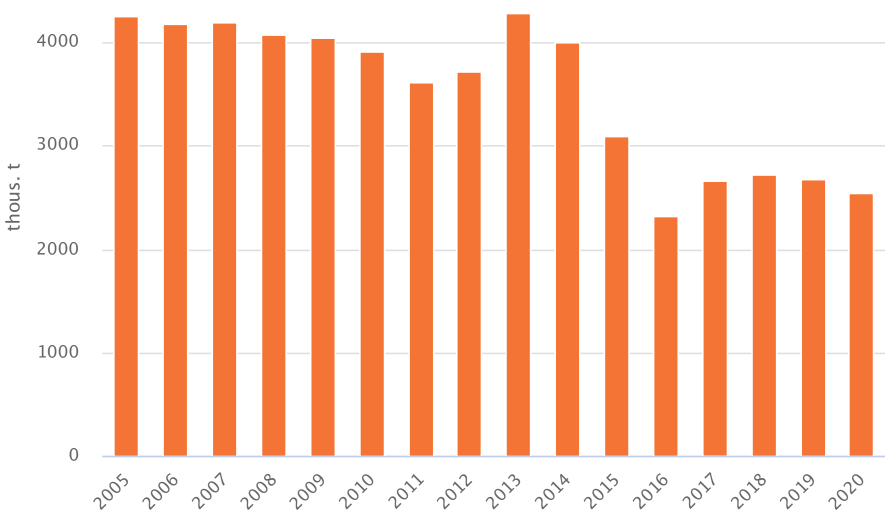
Source: SO SR

3.4.1.4 Consumption of farmyard manure

In 2020, 2 541.2 thousand tonnes of manure were consumed in agriculture. From 2005 to 2020, with the exception of some years, the consumption of farmyard manure showed a predominantly downward trend, reflecting the decrease in the number of livestock, including cattle, and decreased by 45.6% over the period.

In the last 15 years, the consumption of manure in agriculture decreased by almost half, which is one of the reasons for the increase in the consumption of industrial fertilizers.

Development of manure consumption



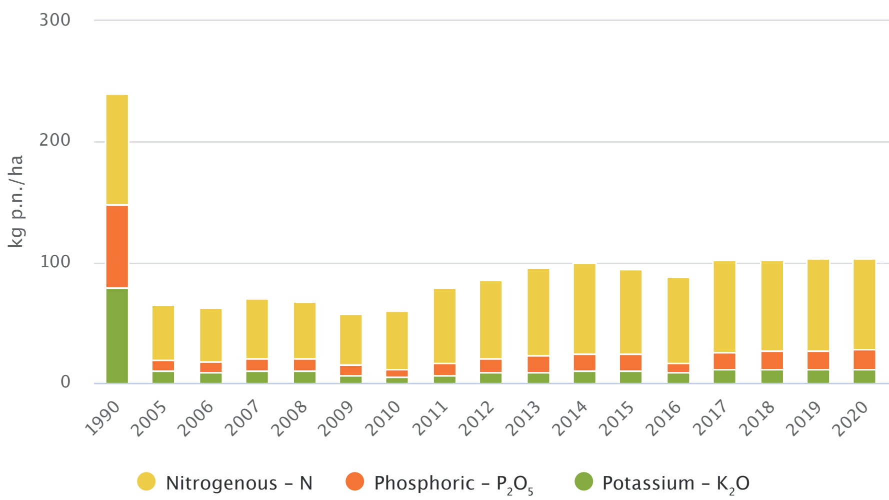
Source: CCTIA

3.4.1.5 Consumption of industrial fertilizers and pesticides

With the changes after 1989 in the agricultural sector (land restitution, increase in prices, reduction of intensification, legislative measures), there was a significant decrease in industrial fertilizers consumed in agriculture. In 2020, the consumption of industrial fertilizers in agricultural production amounted to 103.4 kg of pure nutrients per hectare (kg of pure nutrients/ha) of agricultural land. Between 2005 and 2020, the consumption of industrial fertilizers showed an increasing trend with minor deviations, with the consumption of nitrogen fertilizers increasing by more than 66.9%, the consumption of phosphorus fertilizers by 62%, and the consumption of potassium fertilizers by 20.8%.

Despite the fact that agricultural production did not increase, there was an almost 55% increase in pesticide consumption between 2005 and 2020.

Development of consumption of industrial fertilizers converted to N, P_2O_5 and K_2O



Source: CCTIA

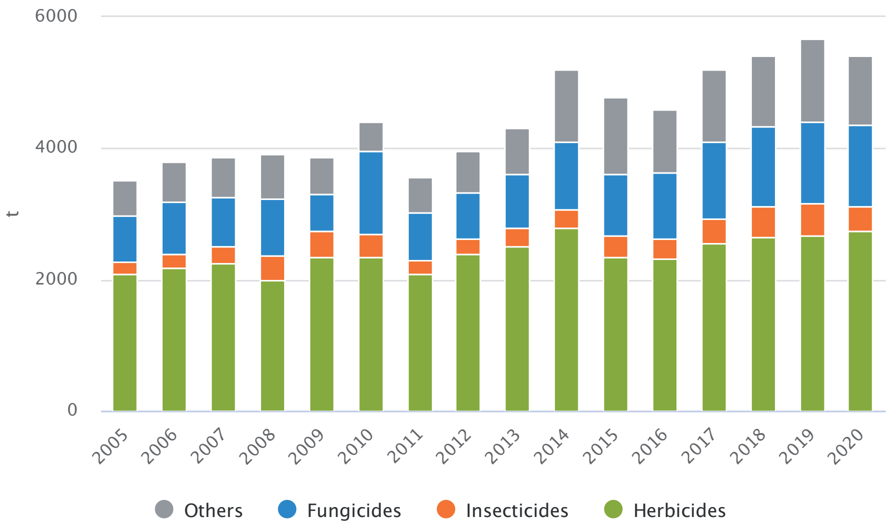
In 2020, a total of 5,421.5 t of pesticides were applied in agriculture, of which approximately 2,741.9 t were herbicides, 1,245 t fungicides, 378 t insecticides and 1,056.6 t other preparations. Since 2005, pesticide consumption followed an increasing trend with slight fluctuations in some years. There was an increase in the individual groups of pesticides compared to 2005 and 2020, while the total consumption of pesticides increased by 54.6% for the given period.

Objectives of the Slovak Republic until 2030:

- Reducing the consumption of pesticides in agriculture and ensuring their continuous decrease.

Greener Slovakia – Environmental Policy Strategy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)

Development of the pesticide consumption by groups

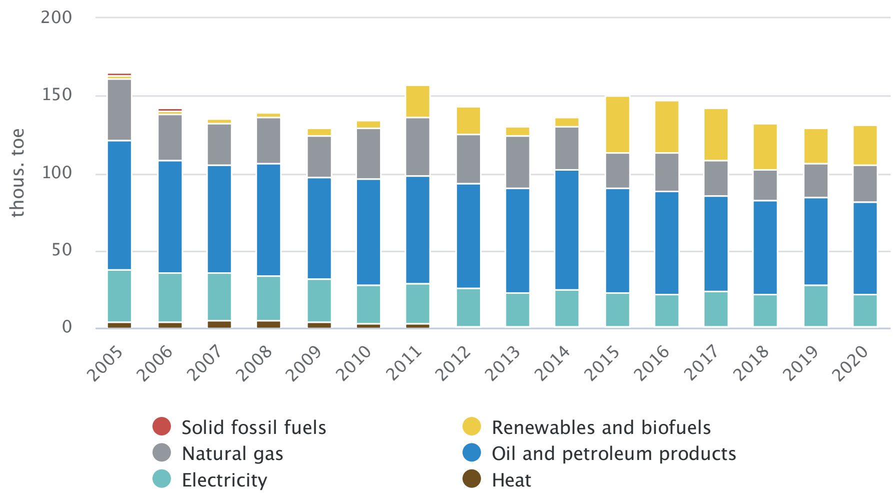


Source: SO SR

3.4.1.6 Final energy consumption in agriculture and forestry

Among the other sectors of the economy, agriculture and forestry have the lowest share of final energy consumption (FEC). In 2020, the final energy consumption in the agriculture and forestry sector was 131.8 ktoe, which represented 1.4% of final energy consumption in the Slovak Republic. FEC in the sectors concerned followed a largely decreasing trend from 2005 to 2020, with the most significant decreases over the period in final energy consumption of solid fuels of 84.5%, followed by heat of 82.1%, natural gas of 40.4%, electricity of 36.5% and oil and petroleum products of 28.6%. On the contrary, the final energy consumption of RES and biofuels in the agriculture and forestry sectors together recorded a more than 11-fold increase compared to 2005.

Development of the Final Energy Consumption of fuels, electricity and heat in agriculture and forestry



Source: SO SR

3.4.2 What are interactions of agriculture and the environment?

On one side, the sustainable agriculture is directly dependent on natural resources and their quality, on the other side, agricultural activities represent risks reflected in the quality of the individual components of the environment, such as water, soil, and the air.

Processes of intensification and specialization of agriculture considerably contribute to acceleration of environmental problems. In spite of the fact that farmers realize the necessity of the good quality of the environmental components for healthy and effective growing of crop plants and successful breeding of animals, agriculture also impacts negatively and participates in deterioration of their quality.

Agriculture contributes to the air pollution as well as to the ongoing climate change. It is the biggest producer of ammonia (more than 96% of the total quantity produced in the Slovak Republic). It contributes to the greenhouse gas production, mainly of methane, nitrous oxide; and to a lesser extent of carbon dioxide, and halogen hydro-carbons. On the other hand, agriculture participates in catching of carbon dioxide and its subsequent storing in the form of organic carbon in soil.

High concentration of agricultural activities can represent both a point and global reso-urce of water sources pollution. Risks for the water quality include surpluses of nutrients supplied into soil by agricultural activities, waste as well as waste water discharged from agriculture.

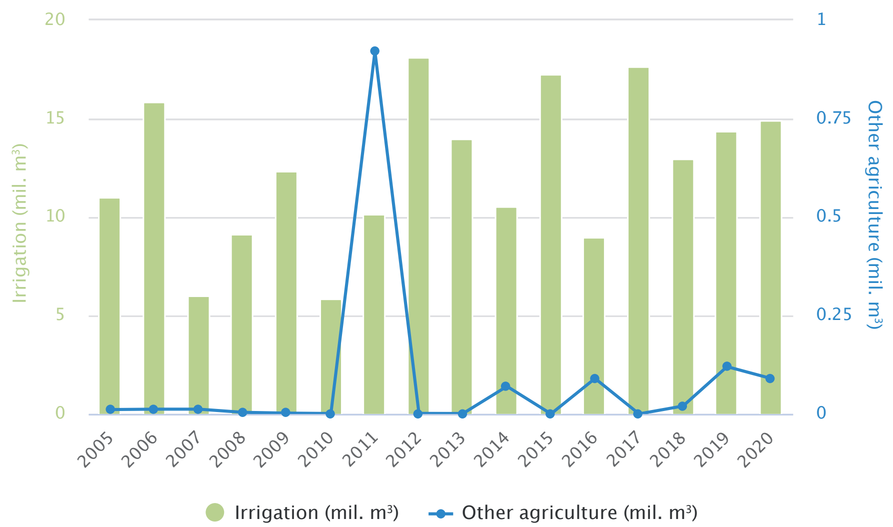
Mutual interactions of agriculture and the environment are characterized based on the indicators from the group of interactions of the sector with the environment.

Demands of agriculture in respect of resources

3.4.2.1 Water withdrawals in agriculture

In 2020, the share of surface water used in agriculture represented 6.3% of total surface water withdrawals in the Slovak Republic, while 15.05 million m^3 of surface water were withdrawn in agriculture that year which was an increase of 36.6% compared to 2005. The largest withdrawals of surface water in agriculture are for irrigation purposes, which depend on the extent and temporal distribution of natural precipitation in the growing season.

Development of surface water use in agriculture

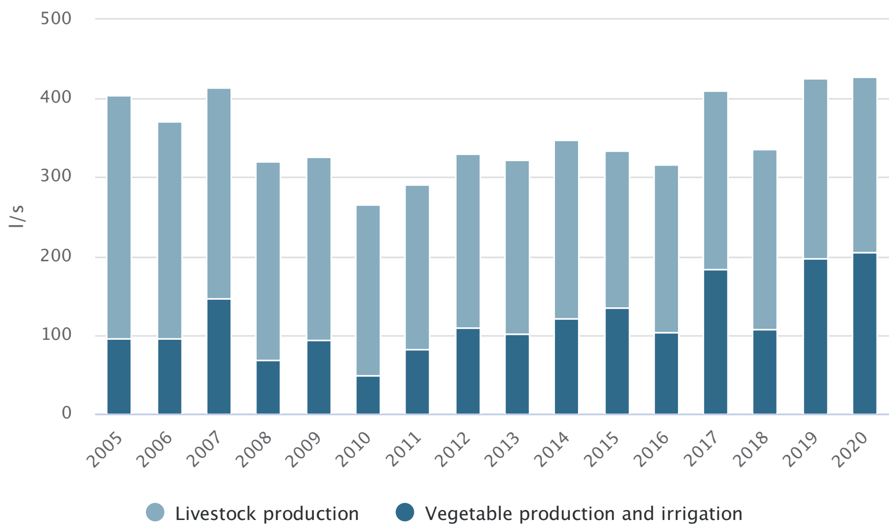


Source: SHMI

In 2020, the share of groundwater used in agriculture represented 4% of the total withdrawals of groundwater in the Slovak Republic. In this year, the withdrawal of groundwater in agriculture slightly increased compared to 2005 by 5.9% to the value of 427.8 l.s^{-1}.

Since 2005, there was a gradual decrease in groundwater withdrawals for livestock production and, on the contrary, an increase in withdrawals for plant production and irrigation. While in 2005 groundwater withdrawals for animal production amounted to 308.8 $l.s^{-1}$, in 2020 it was 222.4 $l.s^{-1}$. Groundwater withdrawals for crop production and irrigation increased by up to 116.1% to 205.5 $l.s^{-1}$ in the given period.

Development of using underground water in agriculture



Source: SHMI

Impact of agriculture on the environment

3.4.2.2 Greenhouse gas emissions from agriculture

Agriculture contributes to greenhouse gas emissions, mainly methane (CH_4) and nitrous oxide (N_2O). In 2020, the emissions produced by it, expressed as CO_2 equivalent, represented about 7% of all greenhouse gas emissions in the Slovak Republic (excluding the LULUCF sector), which means that agriculture is only a minor producer of greenhouse gas emissions.

Between 2005 and 2020, greenhouse gas emissions from agriculture remained roughly constant, with slight fluctuations in some years. Compared to 2005, greenhouse gas emissions from agriculture expressed in CO_2 equivalent decreased by 5.4%.

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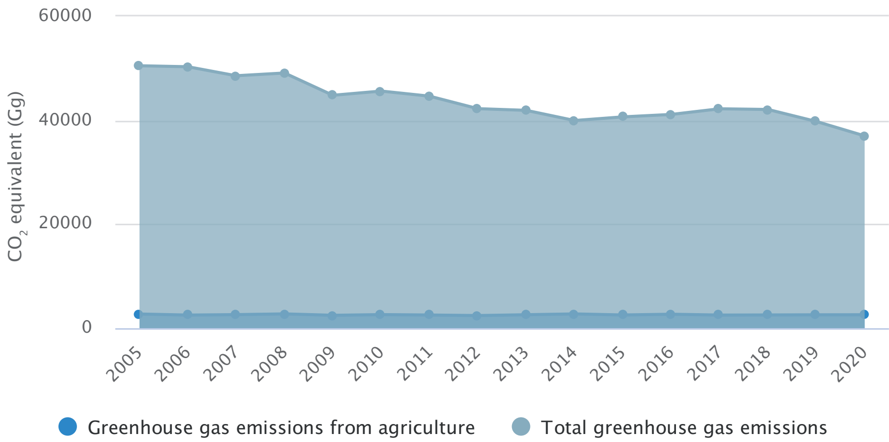
Development of greenhouse gas emissions from agriculture related to total greenhouse gas emissions

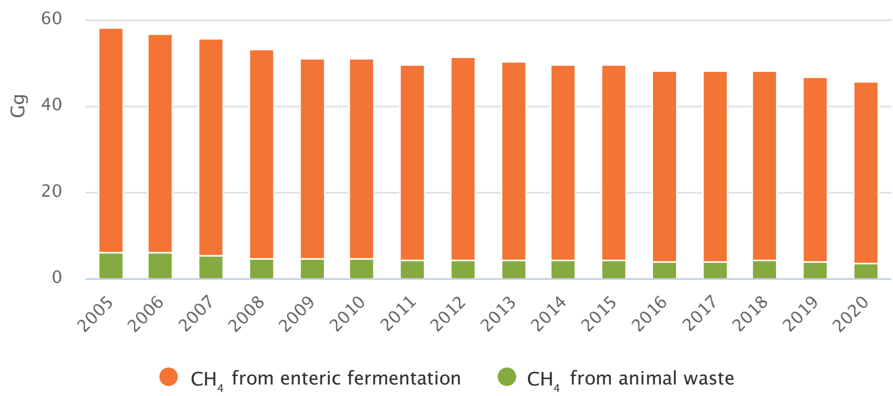


Note: Emissions without the LULUCF sector Emissions determined as of 13 April 2022.
Source: SHMI

The largest producers of methane (CH_4) are livestock production – cattle and pig farms. Methane is produced as a direct product of metabolism in herbivores (enteric fermentation) and as a product of the breakdown of animal excrement.

The share of agriculture in the total production of methane has mainly decreased since 2005 due to the reduction of livestock numbers. In 2020, 42.13 Gg of methane were produced from agriculture, which represented 32.5% of the total methane emissions produced in the Slovak Republic.

Development of methane emissions from agriculture



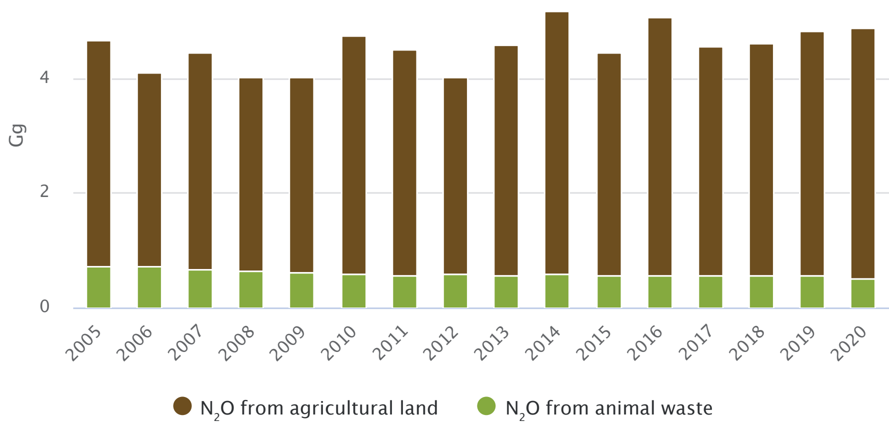
Note: Emissions determined as of 13 April 2022
Source: SHMI

The main source of nitrous oxide (N_2O) is plant production – excess mineral nitrogen in the soil (result of intensive fertilization) and unfavorable soil air regime (soil compaction).

Nitrous oxide production from agriculture had a fluctuating pattern after 2005. In 2020, 4.88 Gg of nitrous oxide were produced from agriculture, which represented 73.3% of the total emissions of nitrous oxide produced in the Slovak Republic.

With the reduction in livestock numbers, the amount of methane emissions produced by agricultural activities also decreased.

Development of nitrous oxide emissions from agriculture



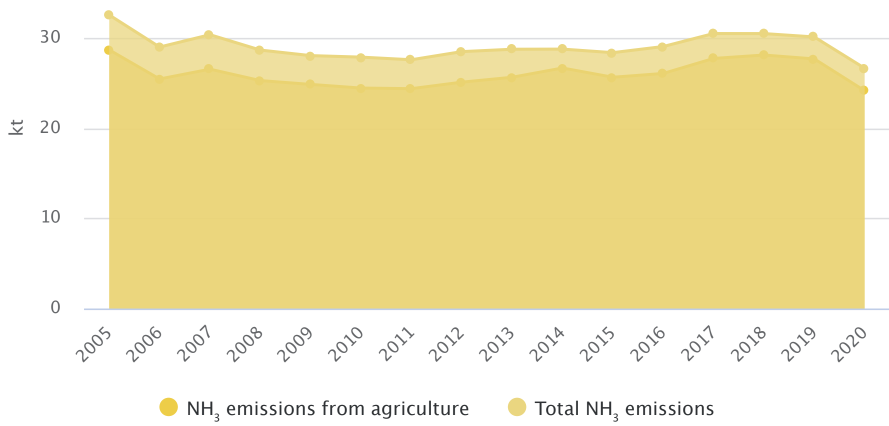
Note: Emissions determined as of 13 April 2022
Source: SHMI

3.4.2.3 Emissions of pollutants released into the air from agriculture

Agriculture (growing crops and raising animals, hunting and related services) is the largest producer of ammonia (NH_3) of all sectors. In agriculture, total ammonia emissions consist of emissions from animal production and agricultural land. The major producer of ammonia is animal production – livestock breeding, especially its intensive form. Between 2005 and 2020, NH_3 emissions from agriculture recorded a fluctuating trend, with 24,103 tons of ammonia produced in 2020, which accounted for 90.6% of total ammonia emissions in Slovakia.

More than 90% of total ammonia emissions in Slovakia in 2020 were produced in agriculture.

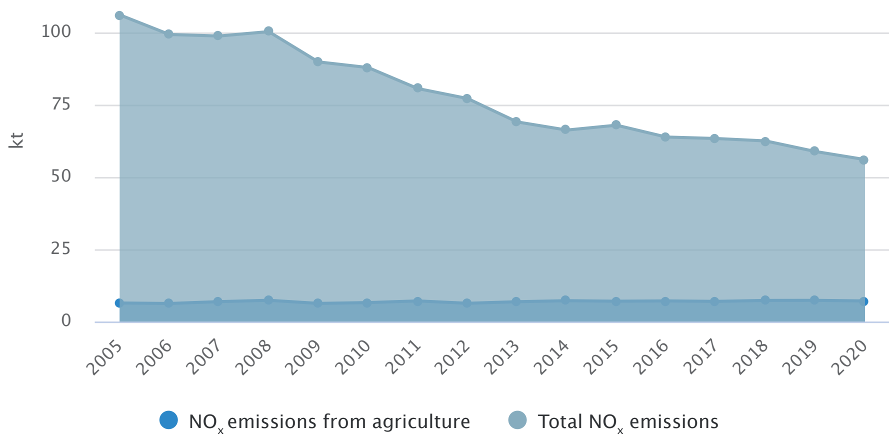
Development of NH_3 emissions from agriculture related to total NH_3 emissions



Source: SHMI

NO_x emissions from agriculture accounted for 12.7% of total NO_x emissions in 2020, an 11% increase compared to 2005. In 2020, 7,119 t of NO_x emissions were produced from agriculture.

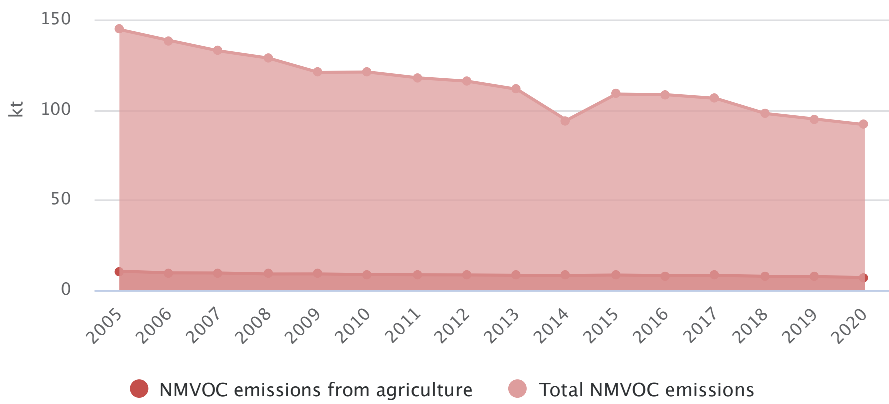
Development of NO_x emissions from agriculture related to total NO_x emissions



Source: SHMI

Emissions of non-methane volatile organic compounds (NMVOC) from agriculture in 2020 accounted for 7.7% of total NMVOC emissions, and compared to 2005, a decrease of 33.2% was recorded. In 2020, 7,021 t of NMVOC emissions were produced from agriculture.

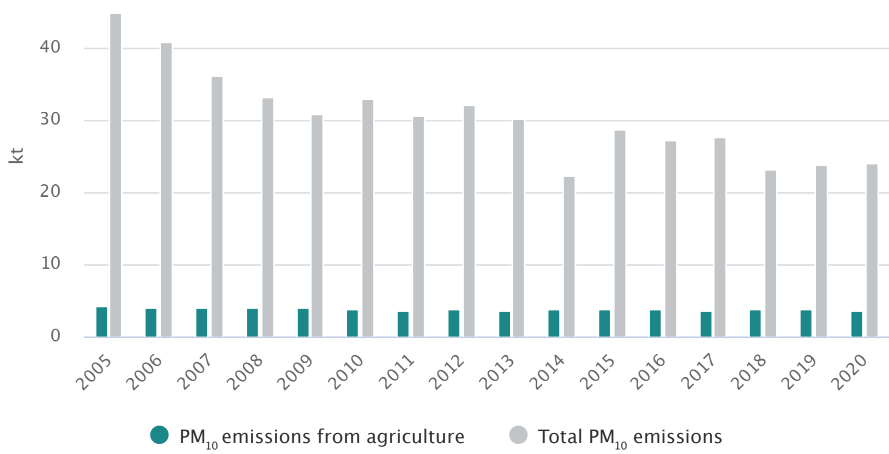
Development of NMVOC emissions from agriculture related to total NMVOC emissions



Source: SHMI

PM_{10} emissions from agriculture in 2020 accounted for 15.1% of total PM_{10} emissions, and compared to 2005, a decrease of 13.6% was recorded. In 2020, 3,622 t of PM_{10} emissions were produced from agriculture.

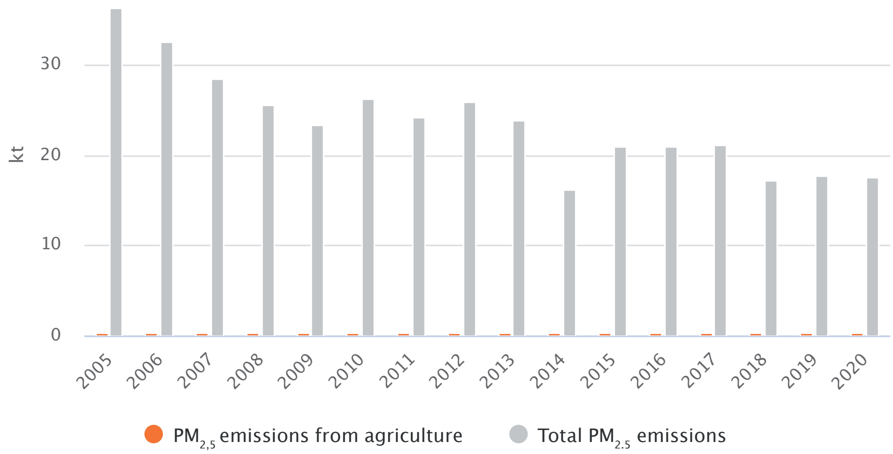
Development of PM_{10} emissions from agriculture related to total PM_{10} emissions



Source: SHMI

PM$_{2.5}$ emissions from agriculture in 2020 accounted for 1.6% of total PM$_{2.5}$ emissions, and compared to 2005, a decrease of 19.1% was recorded. In 2020, 284 t of PM$_{2.5}$ emissions were produced from agriculture.

Development of PM$_{2.5}$ emissions from agriculture related to total PM$_{2.5}$ emissions

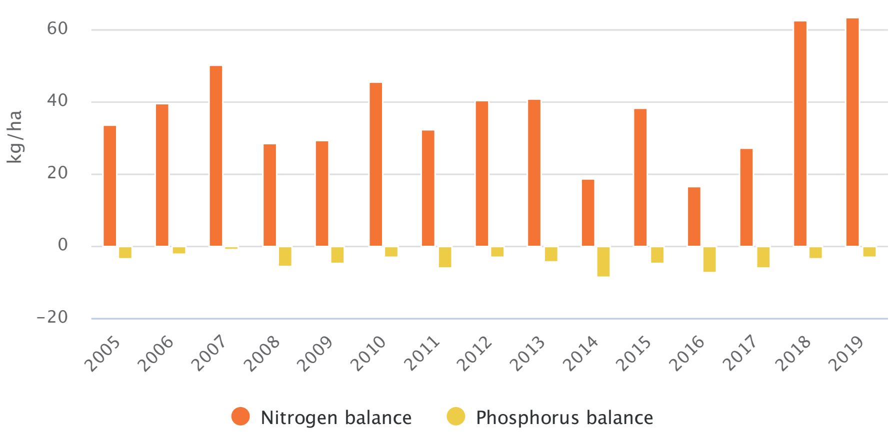


Source: SHMI

3.4.2.4 Nitrogen and phosphorus balance in agricultural soils

Between 2005 and 2019, the positive balance of nitrogen in agricultural land almost doubled and in 2019 represented a value of 63.3 kg/ha of agricultural land. In the monitored period, the phosphorus balance reached a negative value, which represented -3.1 kg/ha of agricultural land in 2019.

Development of the total balance of nitrogen and phosphorus in agricultural soils



Source: Eurostat (CCTIA)

3.4.2.5 *Waste from agriculture*

In 2020, 530,735.5 t of waste was produced from agriculture, while the largest share of 99.4% (527,452.8 t) was other waste. Hazardous waste represented only 0.6% (3,282.6 t). Between 2005 and 2020, the total production of agricultural waste fluctuated, and when comparing the monitored years, the amount of agricultural waste decreased by almost 40%.

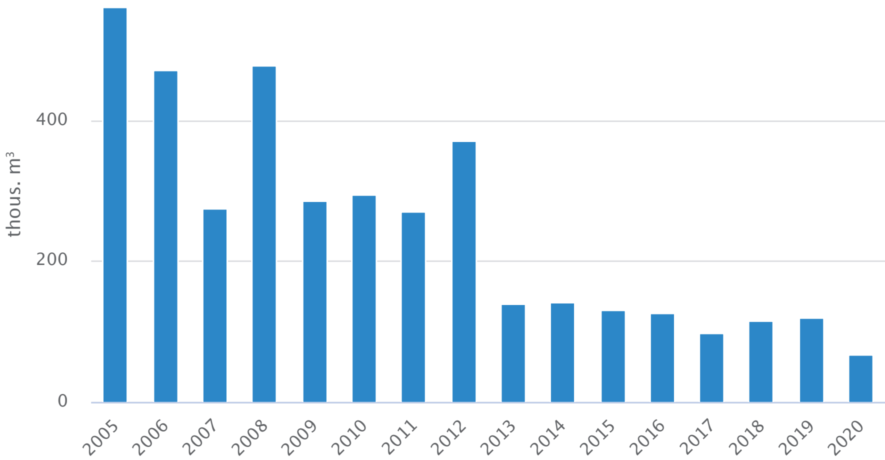
Development of quantity of waste produced by agricultural activities

Source: MoE SR

3.4.2.6 *Waste water from agriculture*

Since 2005, the amount of wastewater from agriculture was decreasing significantly, except for some years when increased values were recorded. In total, between 2005 and 2020, their amount decreased by 87.9%, and in 2020, 68,056 m^3 of wastewater related to agricultural activity was discharged.

Development of the volume of discharged waste water from agricultural



Source: SHMI

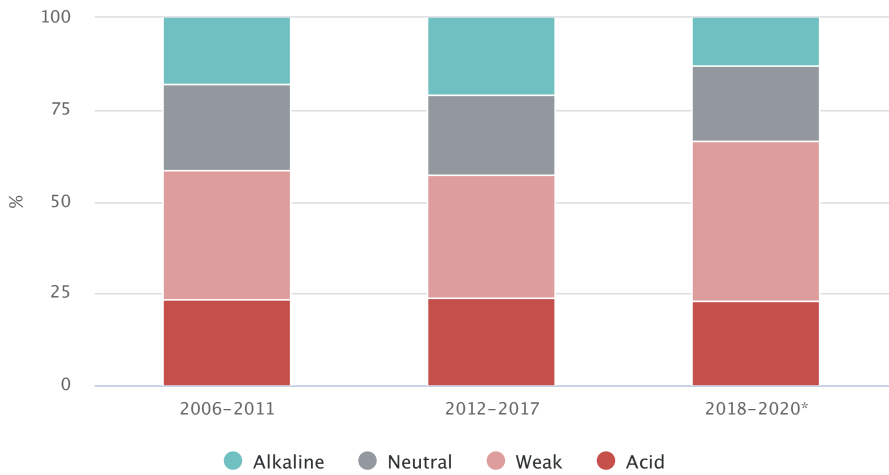
3.4.2.7 Soil reaction of agricultural soils

The use of physiologically acidic fertilizers as well as acidic atmospheric pollutants contributed to increased acidification of agricultural soils.

Based on the evaluation of the last completed monitoring cycle (2012 – 2017), it appears that almost 60% of agricultural soils show a slightly acidic or acidic soil reaction. The results of agrochemical testing of soils during the cycles (2006 – 2011) and (2012 – 2017) indicated an increase in the representation of agricultural soils with an acidic soil reaction by 0.5 percentage point and alkaline soil reaction by 2.9 percentage point. On the contrary, there was a decrease in the proportion of agricultural soils with slightly acidic and neutral soil reaction, both by 1.7 percentage point.

In the long term, the increase in soils with an acidic soil reaction prevails.

Distribution of agricultural lands of the sr by soil reaction prevails



Note: *Partial values – statistically processed for years 2018–2020
Source: CCTIA

3.4.2.8 Erosion of agricultural soils

The current water erosion expresses the risk of soil mass loss, while its modeling and calculation in the structure of the USLE erosion prediction model takes into account, in addition to erosion factors, the current vegetation coverage. In 2020 in the Slovak Republic, 15.75% of the total area of agricultural land registered in the LPIS land register, which represents 301,166 ha, was threatened by current water erosion of varying intensity (erodibility categories from moderate to extreme).

3.4.3 What is the response of the society to mitigating or compensating negative consequences of agriculture on the environment?

Mitigating negative impacts of agriculture on the environment is supported by introducing agri-environmental measures, financial compensations and funds spent for the environmental protection.

The response of the society to mitigating or compensating negative consequences of agriculture on the environment is described on the basis of the indicators from the group of political, economic and social aspects..

3.4.3.1 Organic farming

In 2020, a total of 1,037 entities managing an area of 222,896.1 ha of agricultural land were registered in the system of organic agricultural production in the Slovak Republic, which represented 12.07% of the total area of agricultural land. Between 2005 and 2020, the area of land managed in this way recorded an increasing trend and increased by 130,706 ha in the given period.

More than 12% of agricultural land in the Slovak Republic is managed by the system of organic farming

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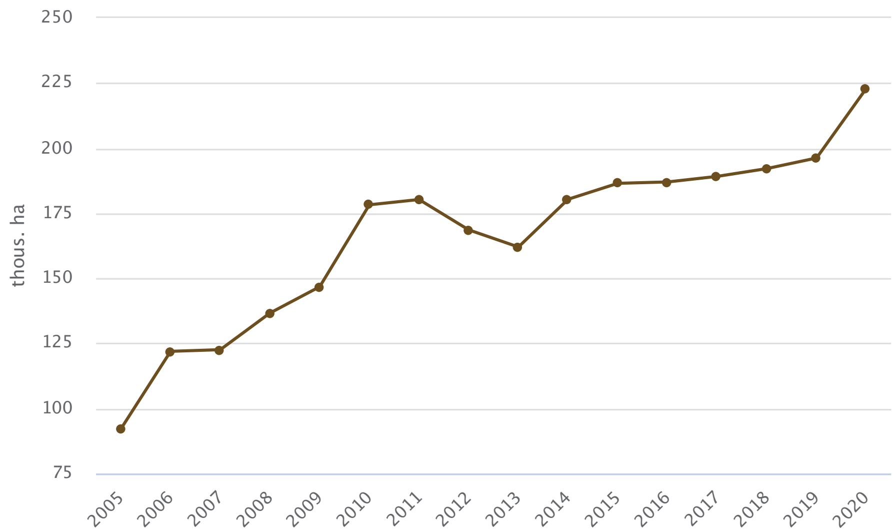
Objectives of the Slovak Republic until 2030:

- Organic agricultural production will occupy at least 13.5% of the land.

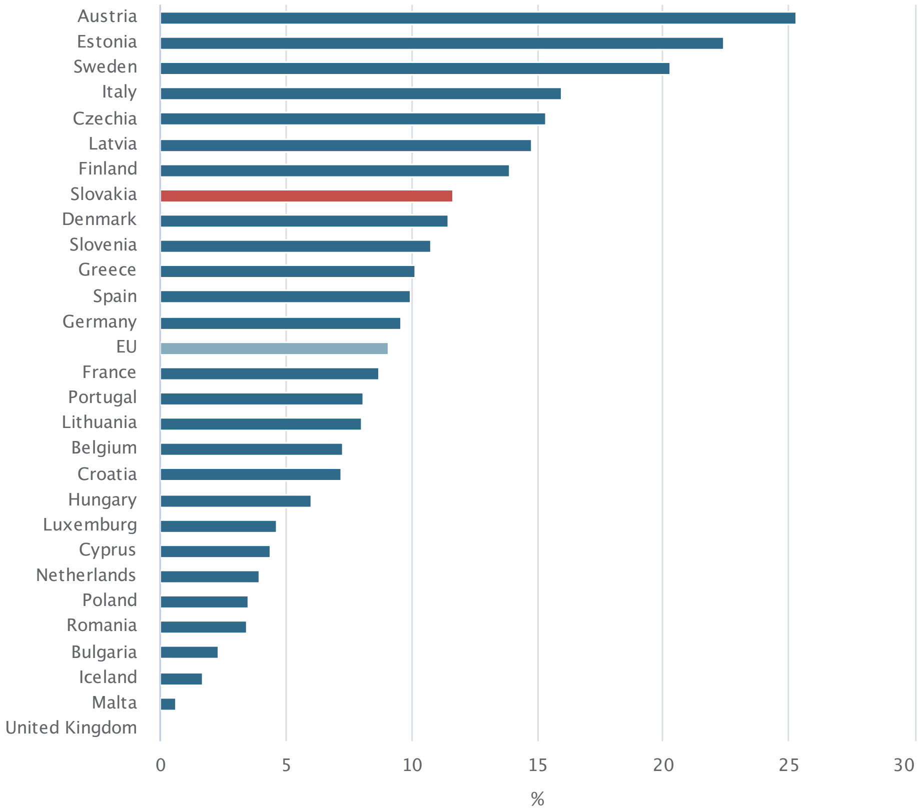
Greener Slovakia – Environmental Policy Strategy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)

Development of agricultural land area under organic farming



Source: CCTIA

International comparison of the share of land area under organic farming (2020)



Source: Eurostat

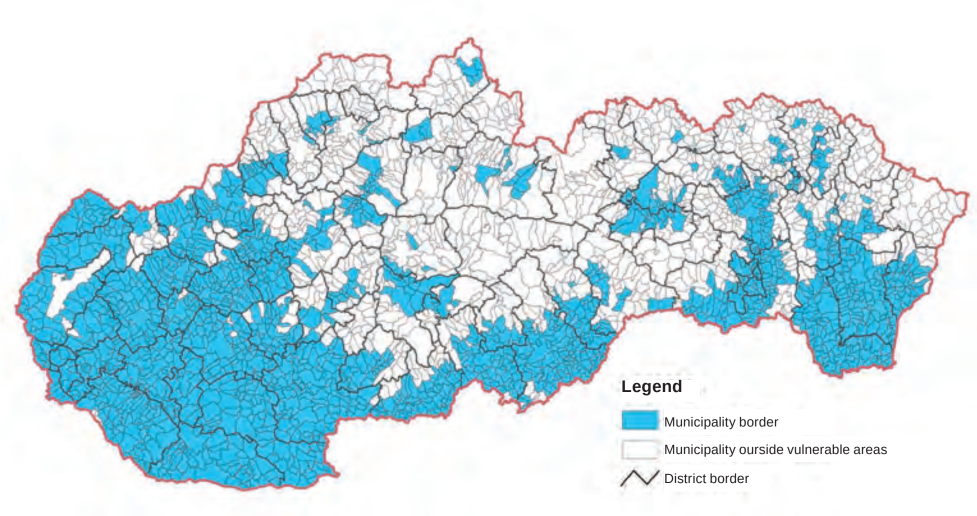
3.4.3.2 Vulnerable areas

In the territory of the Slovak Republic, vulnerable areas are defined by Regulation No. 174/2017 Coll. od the Government of the Slovak Republic, establishing sensitive and vulnerable areas.

The current list of vulnerable areas represents 1,395 municipalities with an area of 12,336.18 km^2, which represents 63.9% of the area of used agricultural land.

Vulnerable areas of the Slovak Republic represents 63.9% of the area of used agricultural land.

Vulnerable areas of the Slovak Republic



Source: Annex 2 of Government Regulation No. 174/2017 Coll

3.4.3.3 Costs of the environmental protection in agriculture

The costs of environmental protection in agriculture had a fluctuating trend in 2009 – 2020, while their value in 2020 was EUR 2,066 thousand.

Development of costs of the environmental protection (EP) in agriculture (Thous. EUR)

	2009	2010	2015	2016	2017	2018	2019	2020
Investments to EP	1,674	1,952	132	502	D	47	D	45
Current costs of EP	2,189	2,273	1,368	1,527	D	2,340	2,424	2,021
Total	3,863	4,225	1,500	2,029	1,870	2,387	D	2,066

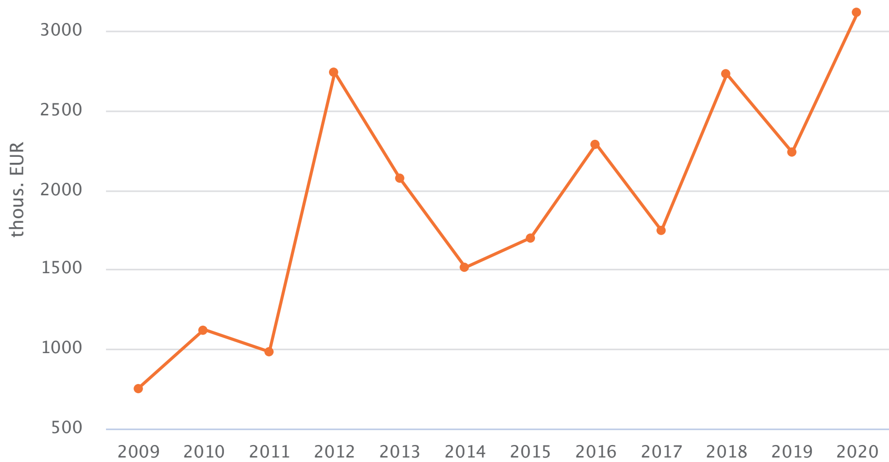
Note: D – data cannot be published due to its confidential nature

Source: SO SR

3.4.3.4 *Contributions for the withdrawal of agricultural land*

Since 2009, contributions for permanent and temporary withdrawal of agricultural land had a fluctuating trend with a tendency of gradual increase, and their value increased by more than four times between 2009 – 2020. In 2020, contributions for the permanent and temporary withdrawal of agricultural land amounted to EUR 3,109,880.

Development of payments for agricultural land confiscation



Source: MARD SR

References

1. BIELEK, Pavol, 1996. Ochrana pôdy: Kódex správnej poľnohospodárskej praxe v SR. Bratislava: Ministerstvo pôdohospodárstva SR a Výskumný ústav pôdnej úrodnosti. 54 s. ISBN 8085361213. **[Slovak version]**

2. BIELEK, Pavol, 1998. Dusík v poľnohospodárskych pôdach Slovenska. Bratislava: Výskumný ústav pôdnej úrodnosti, 256 s. ISBN 8085361442. **[Slovak version]**

3. KOVÁČ, K., SABO, P. a kol., 1999. Agroenvironmentálne programy pre Slovensko: Programy ochrany a obnovy poľnohospodárskej krajiny. Piešťany: Občianske združenie Živá planéta. 44 s. ISBN 808-574-00-44. **[Slovak version]**

4. BUJNOVSKÝ, Radoslav, 2000. Zásady správneho používania hnojív: Kódex správnej poľnohospodárskej praxe v SR. Bratislava: Ministerstvo pôdohospodárstva SR a Výskumný ústav pôdoznalectva a ochrany pôdy, 68 s. ISBN 808536171X. **[Slovak version]**

5. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Towards a Thematic Strategy on the Sustainable Use of Pesticides (COM/2002/349 final)

6. European Environment Agency. Agriculture and environment in EU-15 – the IRENA indicator report [online]. Copenhagen: EEA, 2005. ISBN 92-9167-779-5. Available on: https://www.eea.europa.eu/publications/eea_report_2005_6

7. KOBZA, Jozef a kol., 2010. Monitoring pôd Slovenska (venované 50. výročiu založenia ústavu) [online]. Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, Bratislava, 2010. ISBN 978-80-89128-73-0. Available on: http://www.vupop.sk/dokumenty/rozne_monitoring_pod_slovenska.pdf **[Slovak version]**

8. BLAAS, G., BIELEK, P., BOŽÍK, M. 2010. Pôda a poľnohospodárstvo. Úvahy o budúcnosti. Bratislava: VÚPOP, 2010. 36 s. ISBN 978-80-89128-63-1 **[Slovak version]**

9. Organisation for Economic Co-operation and Development. OECD Compendium of Agri-environmental Indicators [online]. Paris: OECD, 2013. ISBN 9789264186217. Available on: http://www.oecd-ilibrary.org

10. Sobocká, J., Šurina, B., Torma, S., Dodok, R. 2005. Klimatická zmena a jej možné dopady na pôdny fond Slovenska, Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, 48 s. ISBN 80-89128-15-7. **[Slovak version]**

11. ŠIMKOVIČ, Jakub. Spoločná poľnohospodárska politika – neustála reforma? In: Euractiv.sk [online]. 14. 5. 2012. Available on: http://euractiv.sk/potravinarstvo/reforma-spolocnej-polnohospodarskej-politiky-2014-2020-000303/ **[Slovak version]**

12. Rozvoj vidieka 2014 – 2020 In: Europa.eu [online]. Available on: http://ec.europa.eu/agriculture/rural-development-2014-2020/index_sk.htm **[Slovak version]**

13. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Potreba poplatkov za vyňatie pôdy [online]. Bratislava: MPRV SR, 2008. Available on: https://www.mpsr.sk/potreba-poplatkov-za-vynatie-pody/59---762/ **[Slovak version]**

14. Communication from the Commission to the European Parliament, the Council, the6. European Economic and Social Committee and the Committee of the Regions. A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system (COM/2020/381 final)

15. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Správa o poľnohospodárstve a potravinárstve v SR za rok 2020 (Zelená správa) [online]. Bratislava: MPRV SR, 2021. Available on: https://www.mpsr.sk/zelena-sprava-2021/122---17379/ **[Slovak version]**

16. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Výročná správa o vykonávaní PRV SR 2014 – 2020 za rok 2020 [online]. Bratislava: MPRV SR, 2021. Available on: https://www.mpsr.sk/vyrocna-sprava-o-vykonavani-prv-sr-2014-2020-za-rok-2020/1192-43-1192-17092/ **[Slovak version]**

17. European Environment Agency. Healthy soil [online]. Available on: https://agriculture.ec.europa.eu/sustainability/environmental-sustainability/natural-resources/soil_en

18. Ministerstvo pôdohospodárstva SR. Vízia spoločných postupov pri budovaní moderného pôdohospodárstva v horizonte roku 2035 [online]. Bratislava: MPRV SR, 2021. Available on: https://www.enviroportal.sk/polnohospodarstvo/vizia-spolocnych-postupov-pri-budovani-moderneho-podohospodarstva-v-horizonte-roku-2035 **[Slovak version]**

19. Ministerstvo životného prostredia SR, Slovenská agentúra životného prostredia, 2022. Správa o stave životného prostredia SR v roku 2020 [online]. Bratislava: MŽP SR, SAŽP. 194 s. ISBN 978-80-8213-052-5. Available on: https://www.enviroportal.sk/spravy/detail/11203 **[Slovak version]**

20. Ministerstvo životného prostredia Slovenskej republiky, Výskumný ústav vodného hospodárstva, 2022. Oznámenie o vykonaní revízie zraniteľných oblastí v SR v súlade s čl. 3 smernice Rady 91/676/EHS [online], MŽP SR, VÚVH. Available on: https://cdr.eionet.europa.eu/sk/eu/nid/envyontzq/NVZ_DES_GIS_SK2022.pdf **[Slovak version]**

FOREST MANAGEMENT

List of the sector indicators in forest management

Trends of the sector relevant for the environment

- Forest health
- Trend in area of forest land
- Timber felling
- Forests damage
- Share of forestry on GDP production

Interactions of the sector with the environment (demands of the sector in respect of resources and impacts of the sector on the environment)

- Deadwood in forests
- Primary forests area
- Sustainable forest management
- Forest categories
- Spring stock and hunting of game
- Carbon sequestration by forest ecosystems
- Forests and protected areas

Political, economic and social aspects

- Forest certification
- Costs of the environmental protection in forest management
- Payments for the exclusion of forest land
- Compensations for restricted forest management

According to the Statistical Classification of Economic Activities (SK NACE Rev. 2), the forest management is included in the Section A – Agriculture, forestry and fishing. It is included in the following division: 02 – Forestry and timber felling.

The sector report also includes the sub-chapter regarding spring stock and hunting of game, which is included in SK NACE Rev. 2 in the division 01 – Crop and animal production, hunting and related service activities; Group 01.7 – Hunting, trapping and related service activities.

3.5. Summary assessment of the development in the sector of forest management

What is the state and direction of forest management in relation to the environment?

With a forest cover of 41.3%, the Slovak Republic is one of the most forested countries in Europe. The area of forest land (FL), as well as of forest crop land, has been increasing slightly over the long term (by 1.1% since 2005), according to data from both the forest care programs and the land register.

Felling had an increasing trend in the long run which mainly resulted from a large extent of accidental felling due to effects of harmful agents, but also from the gradual transfer of the presently abnormally represented age levels to the age of felling maturity. Since 2018, there has been a decline in timber felling (by about 24% towards 2020).

Abiotic and biotic harmful agents largely participated in forest damaging. For abiotic factors, wind is the dominant factor (up to 80%). Out of biotic harmful agents, the most important group included bark beetles (in particular spruce bark beetle), with a gradual increase in their occurrence and harmful effect (up 329% from 2005 to 2018, respectively 101% to 2020). However, in the last two years, there has been a renewed decline. The contribution of anthropogenic factors to forest damage is decreasing significantly. Compared to the 1990 – 2005 average (318 thousand m^3 of damaged trees), damage in 2020 was down to 3.6% (11.3 thous. m^3), of which timber theft accounted for 35%. Imissiondamage has decreased by up to 98% since 2002.

The forest condition characterized by the defoliation rate continued to be considered as unfavourable, while it was still worse than the pan-European average. In 2020, the condition of broadleaved trees has again slightly improved, while the condition of conifers and forests in general has worsened. Within the individual tree species, there is a long-term slightly improving trend of defoliation in fir, stabilized in spruce and worsening in pine, oak, beech and hornbeam.

What are the interactions of forest management and the environment?

Forests, by their very nature, fulfil both productive (economic) and non-productive (public utility) functions or services at the same time. The most represented category of forests were production forests (72.7%) followed by protection forests (17.4%), and the lowest representation related to special-purpose forests (9.9%). Since 2000, there has been a renewed increase in the area of production forests at the expense of special-purpose forests.

The share of felling in the annual increment could still be evaluated as sustainable, as felling was lower than its annual total current increment. Between 2005 and 2020, this proportion fluctuated between 65% and 88% (exceptionally after the 2004 calamity), but has decreased more sharply in the last 2 years, reaching 62.7% in 2020. Growing stock in forests of the SR have been continually increasing (10.4% between 2005 and 2020). At the present, due to the age composition of forests in the Slovak Republic, growing stocks are historically the highest, but their volume is already peaking. In 2020, they amounted to 484.5 million m^3 of timber inside bark, of which conifers accounted for 40.2%. The share of natural regeneration of forest stands has been on an increasing trend in the long term and by 2020 accounted for more than a third of total regeneration (39.8%). This represents an increase of 5.9% compared to 2005. In forests of the SR, tree species composition generally prevailed, suitable from the stand and ecological perspective, i.e. a favourable and varied species structure. The gradual decrease in the area representation of coniferous trees (from 41% in 2005 to 36.1% in 2020) versus broad-leaved trees (from 59% to 63,9%) was positive. Beech (34.6%), spruce (21.8%), oaks (13%) and pine (6.6%) have long been the most abundant species.

Based on the first ever comprehensive mapping of primary forests and their remnants in the Slovak Republic (2009 – 2015), a total of 123 primary forest sites and 138 primary forest remnant sites were identified with a total area of 10,583 ha (0.49% of the forest area and 0.21% of the area of the Slovak Republic). Since 1 December 2021, some nature reserves have been declared as Slovak Primary Forests (76 sites with an area of 6,462.42 ha in the 5th level of protection) by a decree of the Government of the Slovak Republic No. 427/2021 Coll.

In total, more than 80 million m^3 of dead wood have been identified in the Slovak Republic, almost 95% of which is located on forest land. The hectare stock of dead wood amounts to 38 m^3.

The annual capture of CO_2 emissions by forest ecosystems in the Slovak Republic is quite variable (3,290 – 7,610 Gg CO_2, which represents a reduction of 6.5 – 20.5% of total CO_2 emissions in the Slovak Republic). Consequently, forests are able to fix this carbon in the long term, and in the Slovak Republic, the carbon stock in forest ecosystems continues to increase gradually, amounting to 507.79 million tonnes in 2020.

After a long-term undesirable upward trend, spring stock (SS) of ungulates decreased slightly in 2020, but remain very high. In 2020, deer, fallow deer, mouflon and wild boar exceeded their target standardized SS 1.8, 2.7, 1.5 and 1.7 times, respectively. This is also linked to the high proportion of forest stand damage caused by game species. The decrease in the stock of a rare species, the capercaillie, is also continuing.

What is the response of the society to mitigating or compensating negative consequences of forest management on the environment?

The forest certification in the Slovak Republic is carried out by means of two most wide-spread schemes in Europe – PEFC and FSC. The area of certified forests has fluctuated over the long term (up 3.8% between 2007 and 2017), but in recent years their cumulative area has decreased to 66.2% of the area of the forest crop land in 2020 (although both schemes have seen an increase in their area, there has been an increase in their overlap).

From 2009, there has been a rapid decrease in costs of forestry of the environmental protection up to 2015 (due to lack of funding), with a subsequent increase. Their trend is generally fluctuating.

From 2008, there has been a decrease in payments for the exclusion of forest properties from the land register of up to 70.3% by 2020, which is a positive trend (i.e. fewer exemptions from fulfilling forest functions).

In 2018 – 2020, only non-state forest enterprises were compensated for the forest management restrictions. Compared to 2005, there was an increase of approximately 436% in compensation paid.

3.5.1. What is the state and direction of forest management in relation to the environment?

Forest management (FM) is a wide sector of human activities dealing with preserving and improving forests and using their benefits in favour of their owners and the society. FM has its important specifics – it must respect natural relations and it must ensure its long-term development for successful functioning.

The current position of the forestry sector within the national economy of the Slovak Republic, as well as in the wider international context, is the result of historical development, which changed fundamentally after 1990. There has been a shift in the understanding of the use of forest resources from production (timber felling) to an increasing demand for all forest services, including non-production services. The forestry sector is increasingly becoming not only a manufacturing sector but also an environmental sector.

Positive aspects of forestry in the Slovak Republic also include: the continuously increasing area of forests, stabilization of the non-state sector of forest management, all forests on forest lands are cultivated according to the valid forest management programmes and they are accessible to the public without any difference in the ownership.

On the other hand, at present the existential problem of forestry is raising funds for its needs in order to ensure the fulfilment of all economic, environmental (ecological) and social functions of forests.

In addition to the aforementioned problems, negative aspects of forestry mainly include:

- High extent of incidental felling (salvage felling timber),
- Massive decomposition of spruce forest covers,
- Continuing impact of immission load of forest land from the past,
- Anticipated negative impacts of the climate change on forest ecosystems,
- Obsolete and worn out technical equipment in mechanized activities.

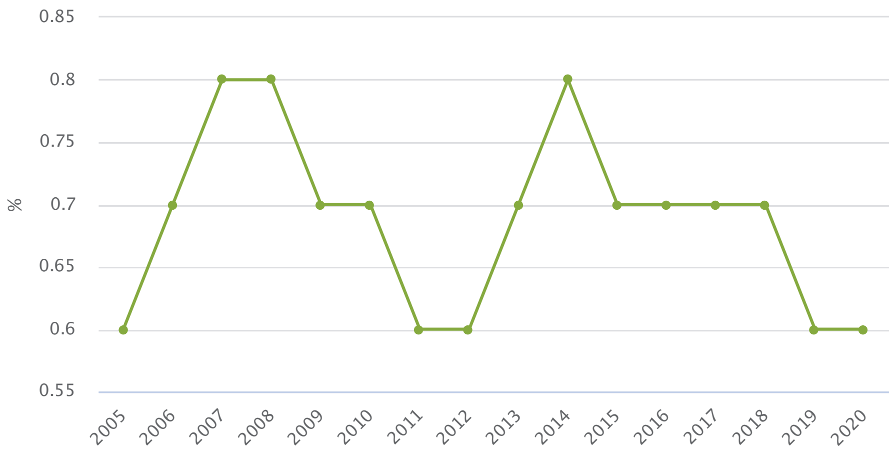
A key solution for stabilizing the volume and structure of timber production under climate change is the close-to-nature forest management (CNFM), which, according to knowledge and experience, is at least equivalent to conventional management. In the Slovak Republic, according to the prepared concept, conversion to the CNFM should be developed on 25% of the forest area by 2030.

3.5.1.1 *Share of forest management in GDP formation*

The share of forestry in the gross domestic product (GDP) in the Slovak Republic has fluctuated between 0.6 and 0.8% since 2005 and is currently (2020) at the same level as in 2005 (0.6%).

When taking into consideration benefits of functions of forests beneficial to the society (introducing payments for ecosystem services of the forest) and the wood-processing industry in GDP of the economy of the SR (which is not currently included) it would be, however, around 3%.

Development of the share of forest management in GDP formation of the SR



Source: SO SR

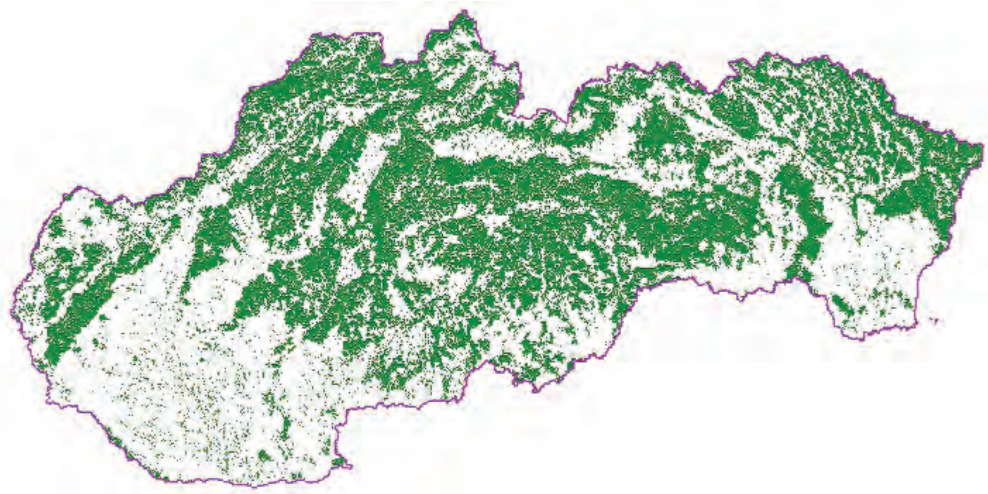
3.5.1.2 *Trend in area of forest land*

Forest cover

The Slovak Republic is one of the European countries with the high forest coverage. The forest land area is relatively stable in Slovakia and compared to 2005, it increased by 0.5% to the current 2,024,6 ha (41.3%).

According to the international criteria and indicators for sustainable forest management, on the basis of which the State of Europe's Forests 2020 Report (FOREST EUROPE 2020) was prepared, the forest cover of the Slovak Republic is lower (40.1%). This is due to a different calculation, where it is calculated from the area of forest stands without including the dwarf pine.

Forest cover of Slovakia



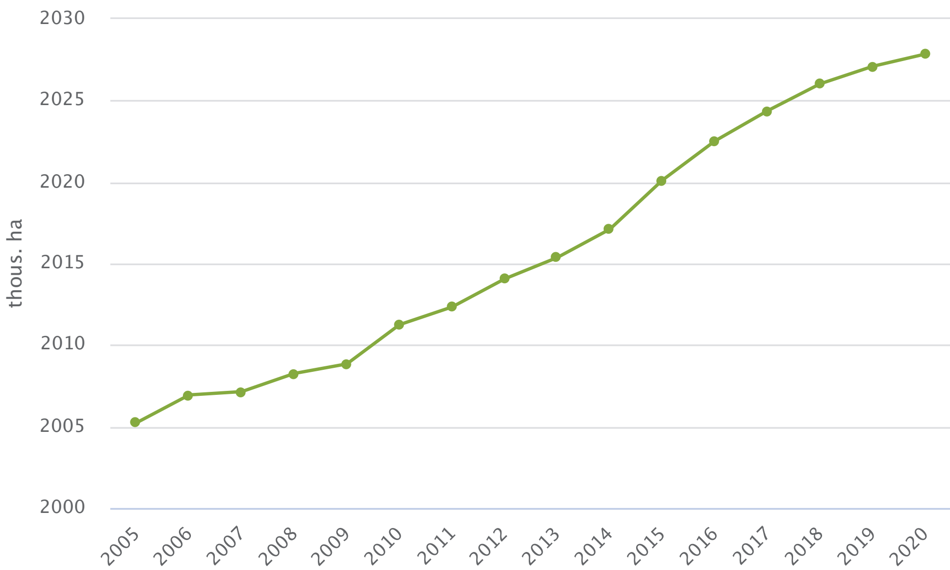
Processed: SEA

The forest land area is relatively stable in Slovakia and it was approximately 41.3% of the total area of the country in 2020.

Afforestation of agriculturally not used lands, transfer of agricultural lands covered with forest tree species (the so-called white areas), as well as gradual harmonization of the current numbers with the numbers registered in the Land Registry and in the forest management programmes mainly participate in a gradual increase in the forest land area.

In addition to the forest land, forest tree species also occur on agricultural and other land (the so-called white plots). According to the results of the second cycle of the National forest inventory and monitoring of the Slovak republic 2015 – 2016, the area of such plots reaches 288 ± 39 thousand ha, which, after taking it into account, represents an area of forests of 2,239.5 ± 43 thousand ha (45.7 ± 0.9%).

Development of forest land area



Source: GCCA SR

Corine Land Cover

Land cover satellite images in the context of the European landscape cover mapping program Corine Land Cover (CLC), which is part of the pan-European component of the COPERNICUS activity, offers a different perspective on land changes in forest stands.

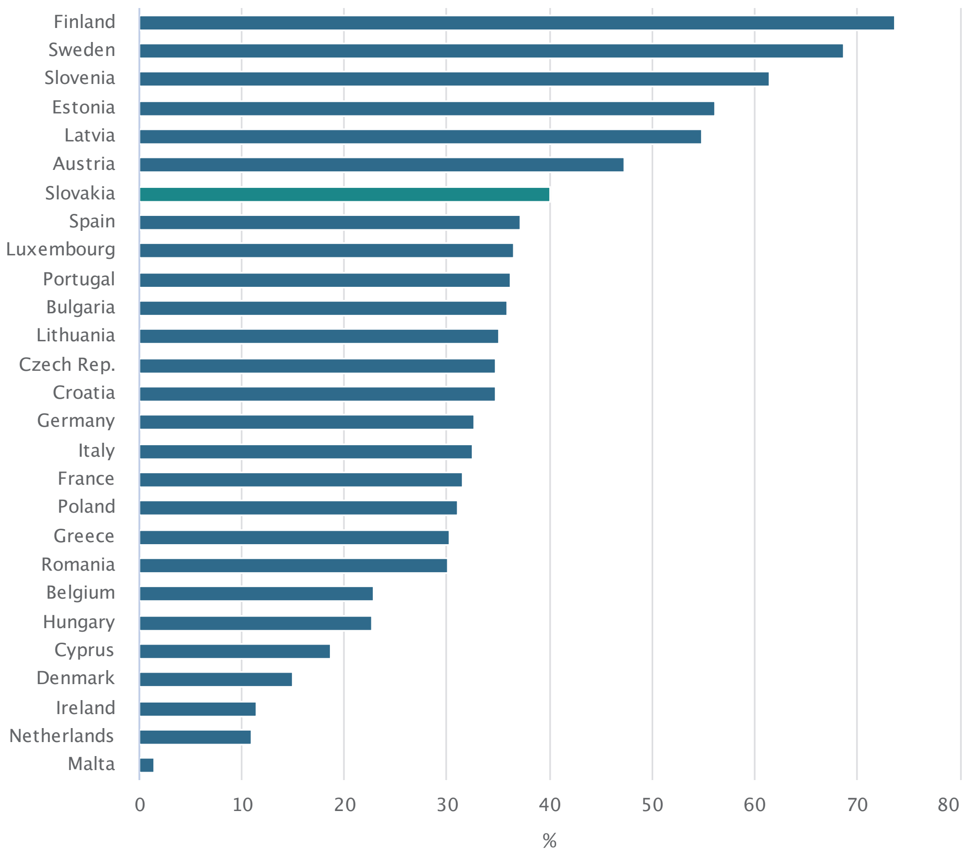
According to them, there is a decrease in the area covered by mature forest (CLC categorization code 31x), with an average annual loss of 11,000 hectares of such mature forest (over 5 m) since 2000. This is mainly due to the currently high proportion of older forests, which results in high opportunities for timber felling, as well as a high incidence of calamities with subsequent incidental felling and the creation of temporary cleared forest areas.

International comparison

In terms of a comparison of European countries, only Belarus (42%), Bosnia and Herzegovina (43%), Lichtenstein (43%), Austria (47%), Russian federation (49%), Estonia (56%), Latvia (55%), Slovenia (62%), Montenegro (62%), Sweden (69%) and Finland (74%) has a higher forest cover than the Slovak Republic.

According to the State of Europe's Forests 2020 Report (FOREST EUROPE 2020), the Slovak Republic is the 13th most forested among 43 European countries.

International comparison of the forest coverage of the EU states (2020)



Source: FAO (GFRA 2020)

Strategic outlook and models

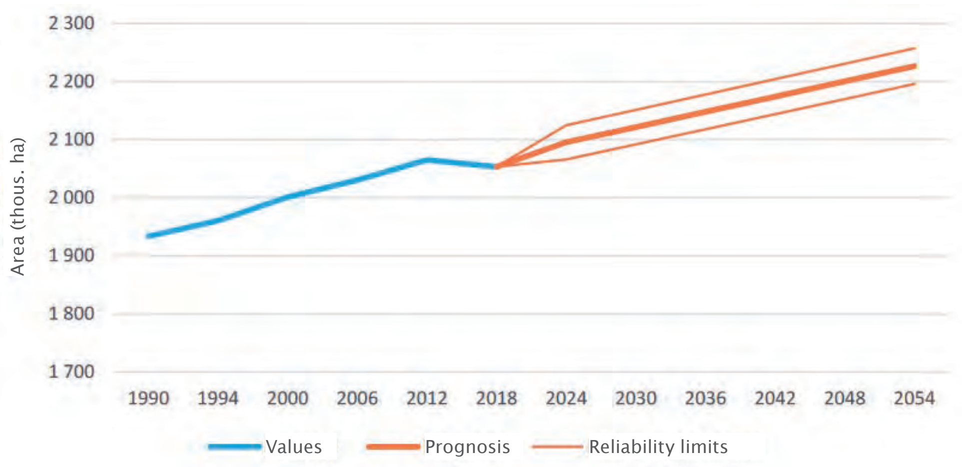
In the framework of the Slovak Republic, the publication Scenarios for Slovak Nature until 2050 (Považan & Filčák (eds.), 2020) was prepared in 2020, exploring possible trajectories for the development of Slovak nature until 2050.

This largely qualitative assessment was followed up in 2022 by a quantitative pilot study, Models for Biodiversity until 2050, which outlined a new view of the future of the Slovak nature in terms of changes in land use (including forest use) in the medium term (until 2030) and long term (until 2054), based on 5 historical CLC time horizons (1990, 2000, 2006, 2012, 2018).

The models of forest land cover until 2030 and 2054 show the following:

For forests overall (code from CLC: 31x) is likely to increase by 0.99% until 2030 and by 2.88% until 2054 compared to the 2018 reference year, but the publication does not assess the quality of the increase. Areas with coniferous forests are shifting towards broadleaved and mixed forests.

Development and forecast of forest area change (31x)



Source: MoE SR, SEA

3.5.1.3 Structure of ownership and utilisation relationships in forestry

The structure and development of forests (forest crop land, FCL) by ownership and use is still changing, as the ownership and use of forests under the restitution laws has not yet been finalized.

In 2020, 40% of FCL (781,536 ha) was in the state ownership, a decrease since 2005 (807,753 ha). However, in 2020, up to 50.9% of FCL was used by state organizations. Since 2005, its share decreased by 15.2%.

3.5.1.4 Timber felling

Timber felling takes place in sustainably managed forests, according to the strict rules of forest management programs and the Forest Act. Ensuring sustainable timber felling is also one of the objectives of the Envirostrategy 2030.

Timber felling in the forests of the Slovak Republic had an increasing trend in the 2005 – 2020 period, which resulted mainly from the large scale of incidental felling, but also from the gradual shift of the currently normal to above-normal representation of the 8th and higher age classes to the age of harvest maturity.

In 2020, 7,510.5 thousand m³ of timber were harvested, which was the lowest volume since 2005. The actual timber felling was lower than the planned (acceptable) one by 2.3 million m³. Less than half of the total felling (3.53 million m³ or 47.1%) was calamity felling.

Calamity felling complicates the implementation of the planned annual intentional timber felling, which has a negative impact on the even and sustainable use of the production potential of forests

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Development of acceptable and real timber felling

Source: NFC

More productive natural conditions of Central Europe allow for higher yields than in boreal or Mediterranean forests. Officially reported data for 2005, 2010, 2015, 2020 (State of Europe's Forests 2020 Reports) show that Slovakia is far from being one of the countries with excessive timber felling. Despite the high share of calamity felling, in most indicators, we ended up not only behind the most advanced forestry countries with the highest timber stocks or forest areas, such as Sweden or Germany, but also compared to the neighboring countries, we harvested less than Austria or the Czech Republic.

3.5.1.5 Forest damage

Over the last two decades, the forests in the Slovak Republic were exposed to an abnormal frequency and intensity of abiotic and biotic harmful agents, largely due to climate change.

Abiotic agents

Abiotic agents (wind, snow, draughts, glazed frost, and others) have the greatest impact on forest damage, causing long-term damage to forest stands in the range of 1 to 3 million m^3 of timber.

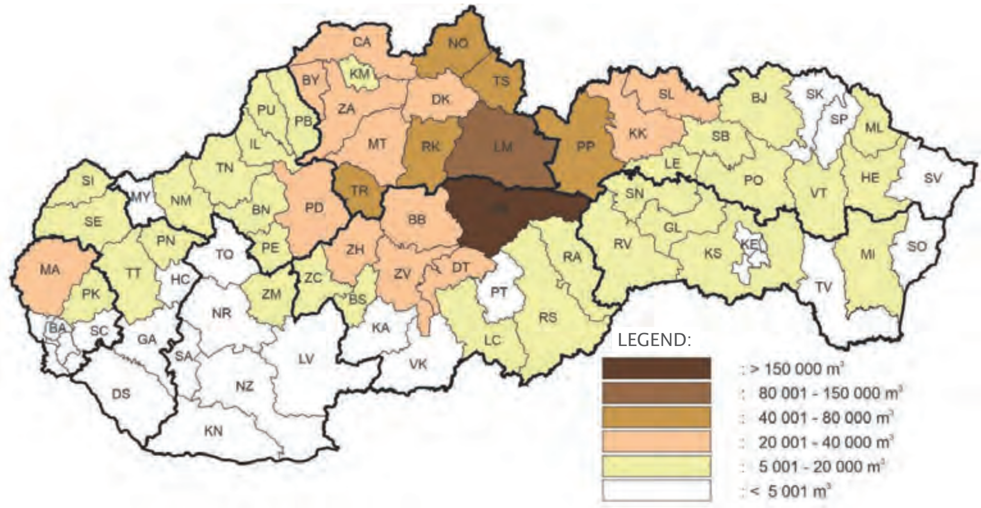
However, wind calamities accounted for the largest proportion of these. A significant increase in the damage to forests by wind calamity was recorded mainly in 2004 – 2005 (storm Alžbeta in the High Tatras on 19 November 2004 with an affected area of about 12,600 ha), and also in 2014, when another major wind calamity occurred (storm Žofia on 15 May 2014 with damage of up to 5.23 million m^3 of timber).

The occurrence of abiotic agents and their effects on forest stands cannot be predicted more accurately, but an increase in damage can be predicted in the longer term.

In 2020, 1,645,228 m^3 of timber was damaged due to the harmful effects of abiotic agents, of which 120,619 m^3 was the unprocessed volume from the previous year. The total damage was:

- up to 79.9% caused by wind,
- 72.4% coniferous timber,
- 88.2% of processed timber.

Damage of coniferous and broadleaved trees by abiotic agents (2020)



Source: MARD SR, NFC

In the longer term, it can be predicted that the damage caused by abiotic factors will increase, with spruces being particularly susceptible to damage.

Biotic agents

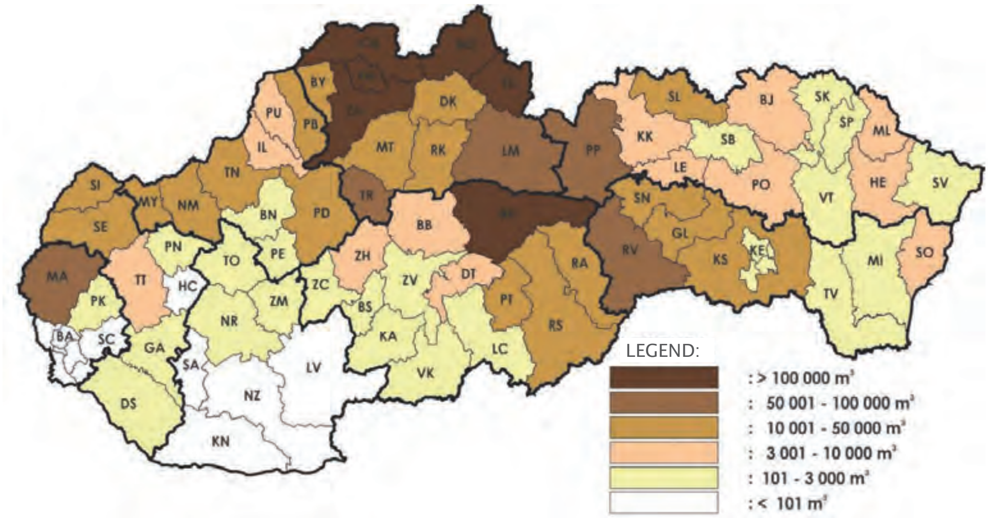
Damage by biotic agents was also fluctuating between 2005 and 2020, with high peaks in 2009 and 2018.

In the case of biotic harmful agents, in 2020, an increase in damage to forest stands of over 1,875 thousand m^3 of timber was recorded which, together with the initial situation (remnant from the previous year) represented a damage of 2,203.315 thousand m^3 of timber.

Bark beetles saw a gradual increase in their occurrence in the long term and are one of the most serious problems in forest protection.

Out of biotic harmful agents, the most important group includes bark beetles (mainly Ips typographus), the situation in damaging of forest stands by bark beetles and wood borers can still be generally called as very unfavourable. The volume of calamity timber caused by bark beetles and wood-boring insects in 2020 amounted to 1,730,842 m^3 (together with the remainder from the previous year, this was a volume of 2,034,942 m^3 of timber). Of this, 94% was processed.

Damage of coniferous and broadleaved trees by bark beetles and wood borers (2020)



Source: MARD SR, NFC

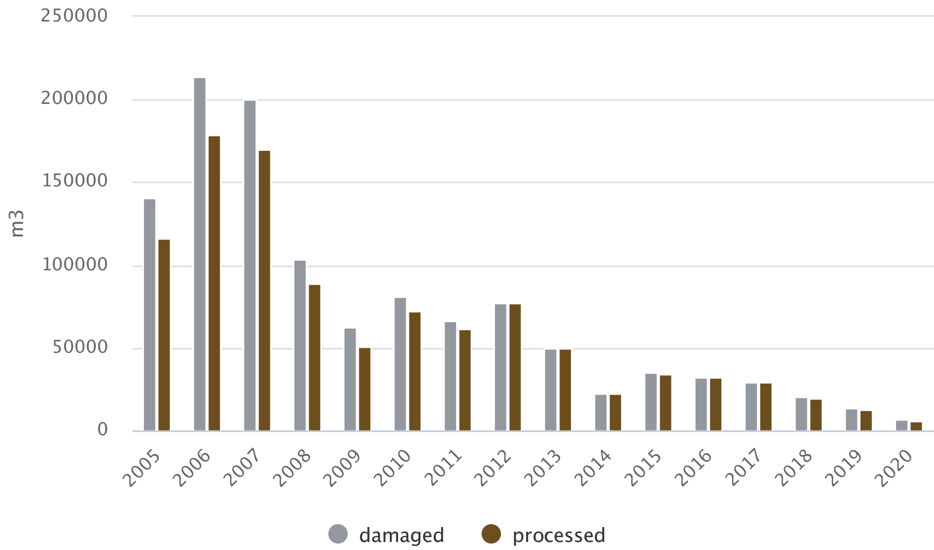
Other important harmful agents also include game species. In 2020, the damage caused by ungulates game in forestry was EUR 642.5 thousand, while since 2011 it was between EUR 360 – 900 thousand annually. The actual numbers of game stock have a long-term increasing trend, therefore the construction and use of small-area fencing appears to be an effective and efficient measure to prevent damage to forest stands by game.

Anthropogenic factors

The extent of anthropogenic factors is very low compared to biotic and abiotic agents. The volume of trees damaged in this way represents only 0.3% of the total damage caused by all harmful agents in 2020.

Out of anthropogenic agents damaging forests, the most important are immissions. Immission damage of forests, however, has been gradually decreasing over the long term. A high share in anthropogenic damage of forests could also be seen in wood stealing.

Development of covers damage by immissions



Source: NFC

In 2020, 12,782 m^3 of timber was damaged by anthropogenic factors, of which 1,347 m^3 was unprocessed volume from the previous year.

In 2020, 221 forest fires were registered in the Slovak Republic with the total burnt down area of 477 ha and the direct calculated damage of EUR 574.6 thousand.

Forest damage and its protection

However, the most appropriate summary indicator of forest damage is the volume of incidental felling. It is still high (also in spite of its fluctuating trend) and limits possibilities of planned forest management which perspectively creates further danger of forest damage, mainly by abiotic agents and subsequently by biotic agents.

3.5.1.6 Forest health

The current state of forest health is still unfavorable and continues to be worse than the European average.

In the Slovak Republic, there is a high representation of forest ecosystems in the country, but their condition (fores health) can still be considered to be unfavourable, while it continues to be worse than the pan-European average. This condition is caused by the synergistic action of various harmful agents.

In the Slovak Republic, defoliation assessment is carried out annually on 107 permanent Level I monitoring plots across Slovakia within the framework of the Partial Monitoring System – Forests.

Defoliation trends for both groups of trees (coniferous and broadleaved) show a similar pattern, with an increase from 2005 to 2020, with coniferous defoliation being higher than broadleaved defoliation (with the exception of 2013).

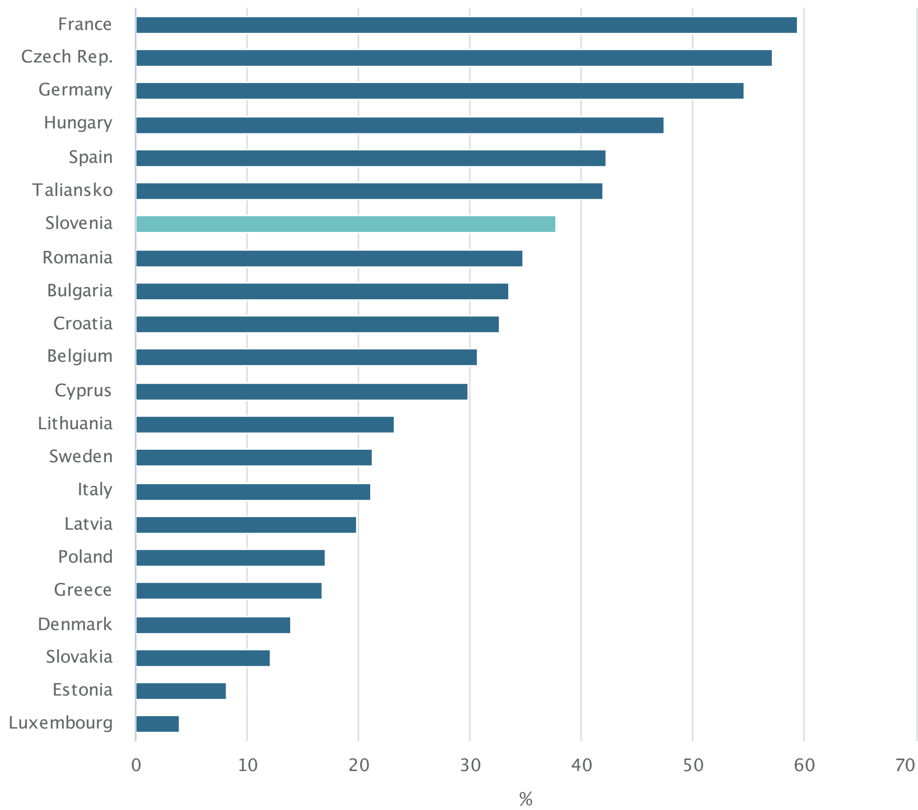
In 2020, the forest condition of broadleaved trees improved again slightly, while that of conifers deteriorated again.

Development of tree defoliation in 2 – 4 damage degrees

Source: NFC

Among the conifers, defoliation was decreasing for fir between 2005 – 2020 , is stable for spruce, and was significantly worsening in the long term for pine since about 2005. For all the most abundant broadleaved trees (oak, beech and hornbeam), defoliation has an increasing (worsening) trend. The most damaged broadleaved tree is oak.

International comparison of tree defoliation in 2 – 4 damage degrees (2019)



Source: 2020 Technical Report of ICP Forests

3.5.2 What are the interactions of forest management and the environment?

Forests belong to one of the most varied and widespread ecosystems in the world. They have not only a high economic potential in the landscape, but they are also the most important component of the environment. Forests are therefore poly-functional and serve for economic (mainly as a source of wood), social and environmental purposes.

Impact of forest management on the environment

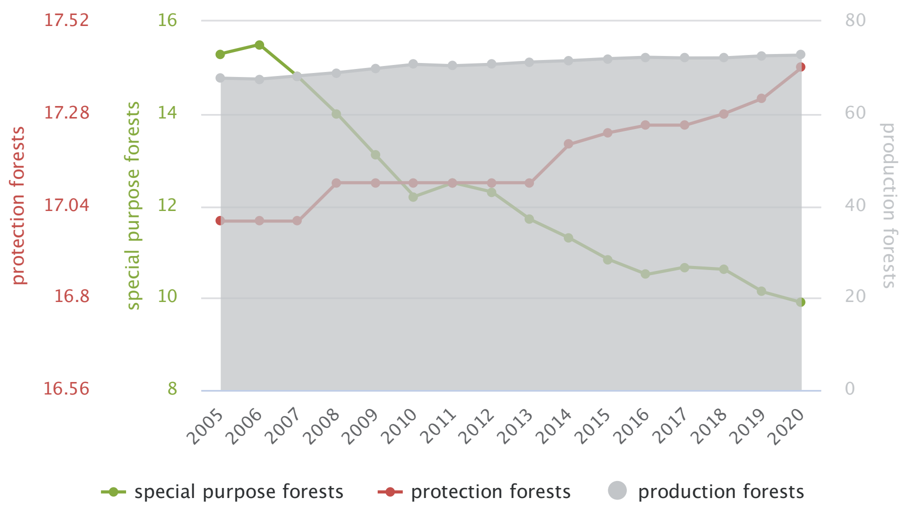
Forest ecosystems play a key role and have an irreplaceable place in creating and protecting the environment in the landscape and in keeping the ecological stability of the territory. Management of forests is subjected or related to this fact, and therefore it is linked to the sustainability principles with ensuring all its functions. From the fundamental perspective it is not very relevant to speak of the impact of forest management on the environment in a negative sense (as it is justified in any other economic sectors).

3.5.2.1 Forest categories

In terms of prevailing functions, forests are divided into the individual categories (forest categorization). The most represented category of forests are production forests, followed by protection forests (PF), and the least representation have special purpose forests (SPF).

In the trend in forest categorization, from 2000 there is again an increase in the production forest area (72.7% of forest stands area in 2020) after the previous decrease to the detriment of SPF (9.93%). There is also a slight increase in the area of PF (17.35%).

Development of representation of forest categories from forest crop land



Source: NFC

3.5.2.2 Sustainable forest management

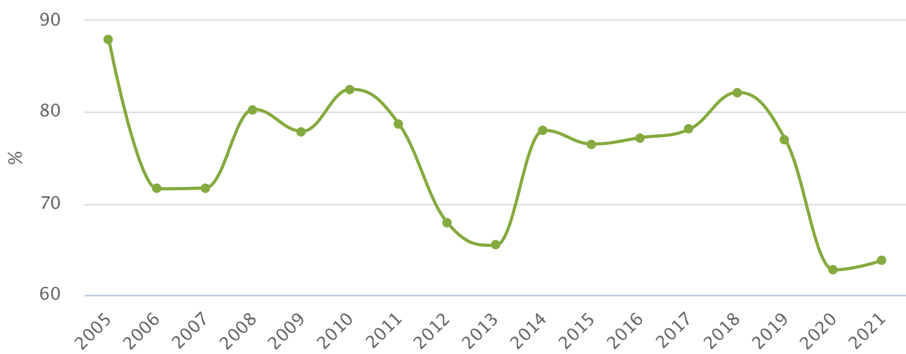
The share of timber felling in the increment can be assessed as sustainable in the long term.

Forest utilization

It is the share of timber felling in the increment that can be assessed as sustainable in the long term, because felling is lower than its annual total current increment. However, it did not decrease below 60% since 2004, which is mainly due to the implementation of excessive incidental felling caused by calamities.

It reached 62.7% in 2020, a decline that continued since 2018.

Development of share of felling and total current increment (utilization of forests)



Source: NFC

Growing stock

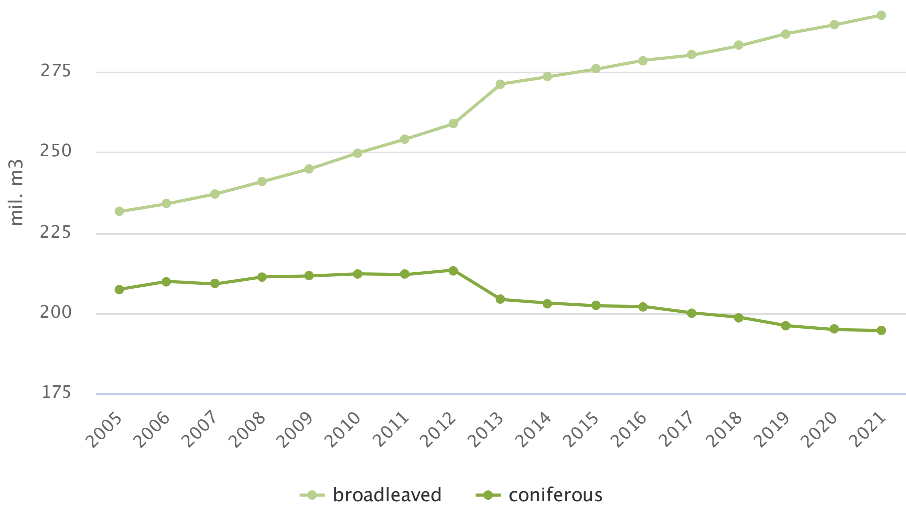
The growing stock is the second most important data, after the area of forests, which expresses the state of our forests. At present, the forests of the Slovak Republic have the highest historical growing stock for at least the last century, and the trend of increasing growing stock has persisted so far. But their volume is already peaking. This situation results from the current age structure of forests, which is characterized by a higher representation of older forest stands in age stages 8 – 15+, in which high growing stock is accumulated.

In the coming years and decades, growing stock will decrease due to a gradual change in the age structure of forests.

Growing stock in forests reached 484.5 million m^3 timber inside bark. The stock of coniferous timber was 194.8 million m^3 (40.2% of the total stock).

The average growing stock per hectare was 249 $m^3.ha^{-1}$ in 2020 and increased by 20 $m^3.ha^{-1}$ since 2005.

Development of growing stock



Source: NFC

In addition to the above-mentioned timber stock, there is a timber stock of 46±7 million m^3 in non-forest land (so-called white plots).

Share of natural regeneration

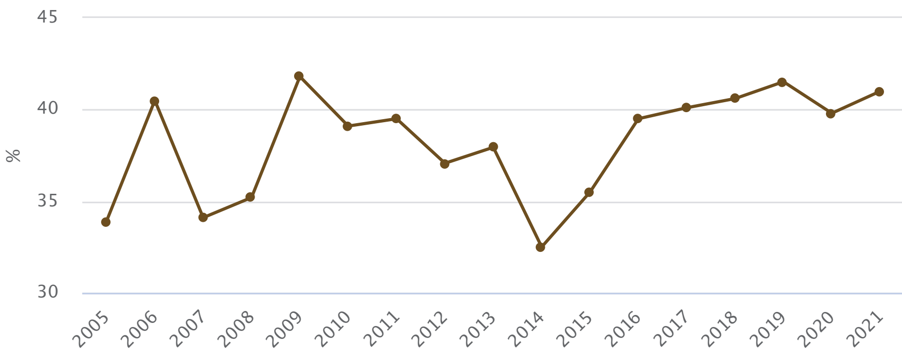
At present, in enforcing the sustainable management in forests, the special emphasis is laid on the natural regeneration and increase in its share.

Increasing the share of natural regeneration of forest stands is also a result of the trend of forestry towards close-to-nature management, accounting for 39.8% of the total regeneration in 2020.

The share of natural regeneration in total forest stands is increasing, but fluctuating too. This increase is also a result of the trend towards close-to-nature forest management, which should result in more species- and age-differentiated forests that are generally more stable.

Natural regeneration accounts for more than a third (39.8%) of the total forest stands by 2020, amounting to 14,998.26 ha. This represents an increase of 5.9% compared to 2005.

Development of share of natural regeneration of forest stands in the total regeneration



Source: NFC

Tree species composition of forests

The tree species composition of forest covers and its proximity to the natural or target condition is a long-term indicator of the rate of influencing forests by the economic activity. Therefore, the requirement of variedness of forest covers has been enforced for a long time.

In forests of the SR, the appropriate tree species composition prevails from the stand-ecological perspective, i.e. the favourable and varied species structure.

The current tree species composition of the forests (2020) in the Slovak Republic has partly changed, which is related to several centuries of human use of forests, especially in favor of more productive and economically desirable tree species (spruce, pine, larch), as well as to the natural spread of some tree species (e.g. hornbeam, cerium, acacia).

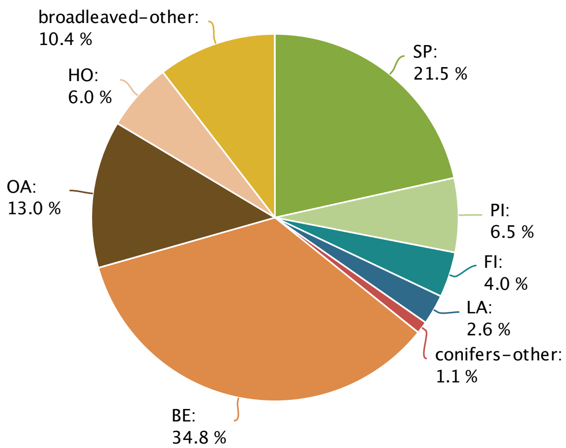
In forests of the SR, however, the appropriate tree species composition prevails from the stand-ecological perspective, i.e. the favourable and varied species structure. On the positive side, global representation of conifers (mainly spruce) are gradually decreasing, compared to broadleaved and the rate of the decrease is accelerating.

In 2020, there was a continued increase in the proportion of broadleaved trees compared to conifers, with broadleaved trees reaching 63.9% and conifers 36.1%.

In the long run, the highest representation have beech (34.6%), spruce (21.8%), oaks (13%) and pine tree (6.6%).

From the production and ecological point of view, an unfavorable trend of decrease of the oak share is observed. Oak was replaced by hornbeam and acacia.

Share of tree species representation in forests of the SR (2020)



Note: SP - spurce, PI - pine, FI - fir, LA - larch, BE - beech, OA - oak, HO - hornbeam
Source: NFC

Introduced tree species

In forests of Slovakia, there are also newly introduced tree species. Their share is approximately 2.9% (57.1 thous. ha), however, their area has not been increasing for a long time.They are 25 species (e.g. white locust, Euro-American poplars, black pine as well as Douglas fir, giant fir, eastern white pine or red oak, sweet chestnut, horse-chestnut and boxelder), of which white acacia (34.75 thous. ha) is the most abundant, and the most promising is Douglas-fir (1.12 thous. ha).

3.5.2.3 Primary forests area

In 2009 – 2015, the first ever comprehensive spatial inventory (mapping) of primary forests and their remnants in the Slovak Republic took place. In total, the following were identified:

- 123 localities of primary forests (sites over 20 ha) with total area of 8,921 ha,
- 138 localities of primary forest remnants (sites with 5 – 20 ha) with total area of 1,662 ha.

A total of 10,583 ha of primary forests and their remnants have been preserved in the Slovak Republic to this day (0.49% of the area of all forests and 0.21% of the SR area).

Until 2021, the primary forests of the Slovak Republic were insufficiently protected (only about one third of them). Since December 1, 2021, their protection was improved when the Government Regulation No. 427/2021 Coll. declaring some nature reserves such as Primary forests of Slovakia (76 localities in various parts of the SR with area of 6,462.42 ha and 5th level of protection) entered into force.

3.5.2.4 Deadwood in forests

In total, stocks of deadwood in the amount of more than 80 million m^3 were found in the Slovak Republic, of which almost 95% is located on forest land. Hectare stock of deadwood amount to 38 m^3, which represents almost 15% of the total stock of live trees (timber inside bark).

3.5.2.5 Carbon sequestration by forest ecosystems

One of the important functions of forests as ecosystems is CO_2 captures and long-term carbon sequestration.

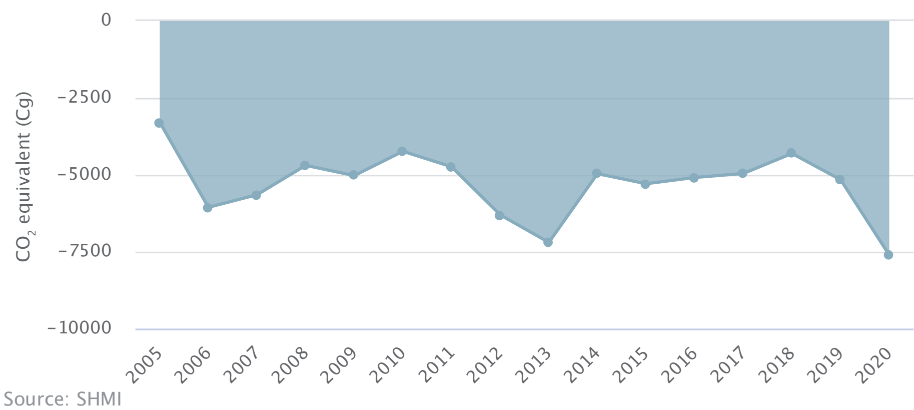
CO_2 captures

The share of forest management in the production of carbon dioxide (CO_2), getting into the air mainly during the conversion of forest areas into arable land, is negligible. On the contrary, forest covers largely participate in captures of atmospheric carbon dioxide.

The annual captures of CO_2 emissions by forest ecosystems in the territory of the Slovak Republic is relatively variable and ranges from 3,290 to 7,610 Gg of CO_2 , which represents cutting total emissions of carbon dioxide in Slovakia by 6.5 – 20.5%.

In 2020, the LULUCF sector showed net removals of -8,746.5 Gg CO_2 equivalents, while the forests (forest ecosystems) category showed removals of -7,608.6 Gg CO_2 equivalents (7.6 mill. tonnes).

Development of CO_2 captures by forest ecosystems



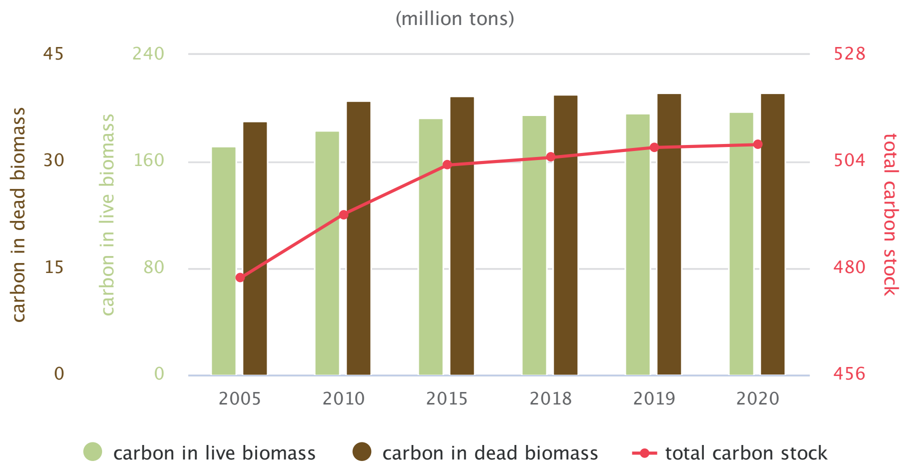
Carbon stock

Forests are able to accumulate large volumes of carbon in forest biomass and forest soil (in soil humus) for a long time.

Carbon stock in soil humus of forests are higher than in biomass and, in the Slovak Republic, these stock are about 271 megatonnes (million tonnes).

Carbon stock in forest ecosystems continue to grow gradually, which is a consequence of the extension of afforested area, and mainly increased hectare stock of wood matter. As of 2020, carbon stock bound in forests reached 507.79 million tonnes.

Development of carbon stock in forest ecosystems



Note: In addition to live and dead biomass, the total carbon stock includes soil carbon, which represents a stock of around 271 megatons (million tons).
Source: NFC

3.5.2.6 Spring stock and hunting of game

Hunting

Part of the forest management is also hunting, which is a naturally occurring activity in our territory resulting from suitable natural conditions and the abundance of wild game of high genetic value.

Stock of game

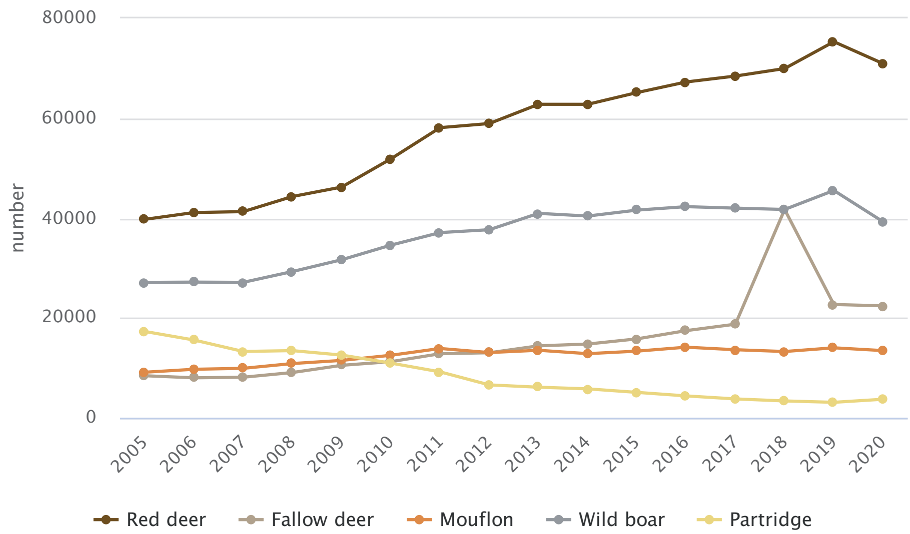
The actual game stock in the Slovak Republic have a long-term upward trend. In the long term, an undesirable increase in the spring stock (SS) of wild boar can be observed, but also an unfavorable decrease in the populations of capercaillie and black grouse. On the other hand, stock of large predators is assessed as stable.

In 2020, there was a slight decrease after a continuous undesirable trend of increasing the SS of ungulates.

Roe deer are currently being displaced by an overpopulation of wild boar and therefore the decision to reduce the planned roe hunt is justified. For red deer, the chamois hunt is again planned to be higher in 2020 than the deer hunt, which is a positive step as in the previous year

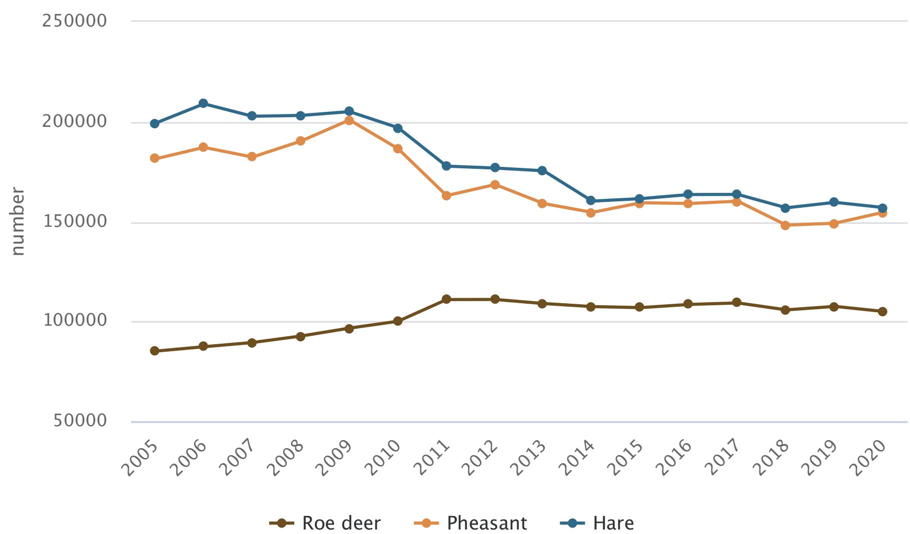
Undesirable high levels of ungulates can be observed in the long term.

Development of stock of selected game (1)



Source: SO SR

Development of stock of selected game (2)



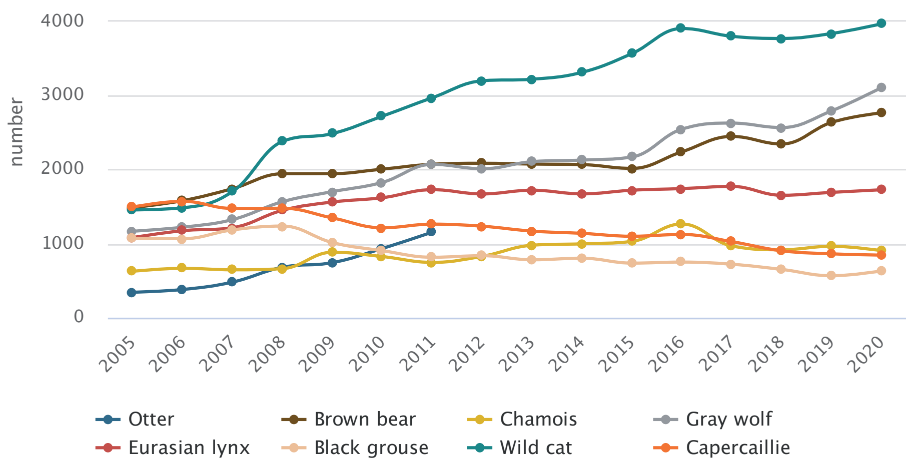
Source: SO SR

For small game, a reduction in the SS of the hare was noted in 2020.

For rare species, only the capercaillie showed a decrease in the SS. Their recorded number was 843, while in 1990 the SS of capercaillie was as high as 1,871.

Hunting of rare species of wide animals is strictly regulated. 39 wolves and 3 bears were caught.

Development of stock of rare game

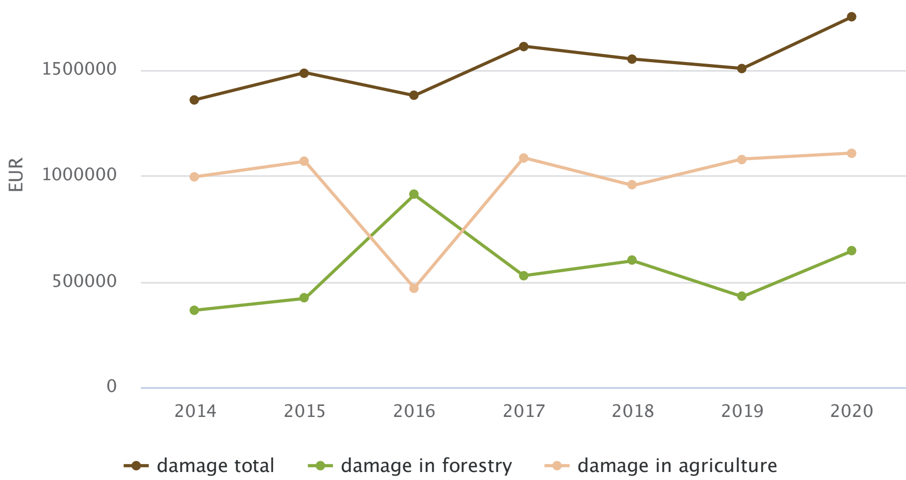


Source: SO SR

Damage caused by game

The abundance of ungulates is at historic highs and the damage they cause is also at an all-time high.

Development of damage caused by ungulates



Source: MARD SR

Damage caused by large carnivores was estimated at EUR 2,314 thousand, of which the greatest damage was caused by wolves (81%).

3.5.2.7 Forests and protected areas

Protected areas

Due to big geographical diversity of Slovakia, greatly varied natural and cover conditions can be found on a relatively small territory, and therefore many natural communities or communities close to nature, with a wide range of forest vegetation degrees and within them a varied palette of forest types. Most forests in Slovakia can be classified as natural and mainly natural. Such conditions with the respective biodiversity conditioned the origin of protected areas and also provide suitable and varied stands for wild animals

According to the geographical significance or level of designation of protected areas (PA), the following distinctions are made:

- National network of PA – specially protected areas designated by Act No. 543/2002 Coll. on Nature and Landscape Protection,
- European network of PA (Natura 2000)
- other international PA (UNESCO – MaB biosphere reserves, Ramsar sites, nature lokalities of UNESCO world herritage.

As of 2020, the national network of PA consisted of 9 national parks, 14 protected landscape areas and 1,089 ”small-size“ PA (SSPA). The total area of specially protected nature was 1,147,582 ha, which accounted for 23.4% of the territory of Slovakia.

Natura 2000 network occupies 29.8% of the SR area (1,462,820 ha in 2020) (overlapping sites of SCI and PLA are counted only once).

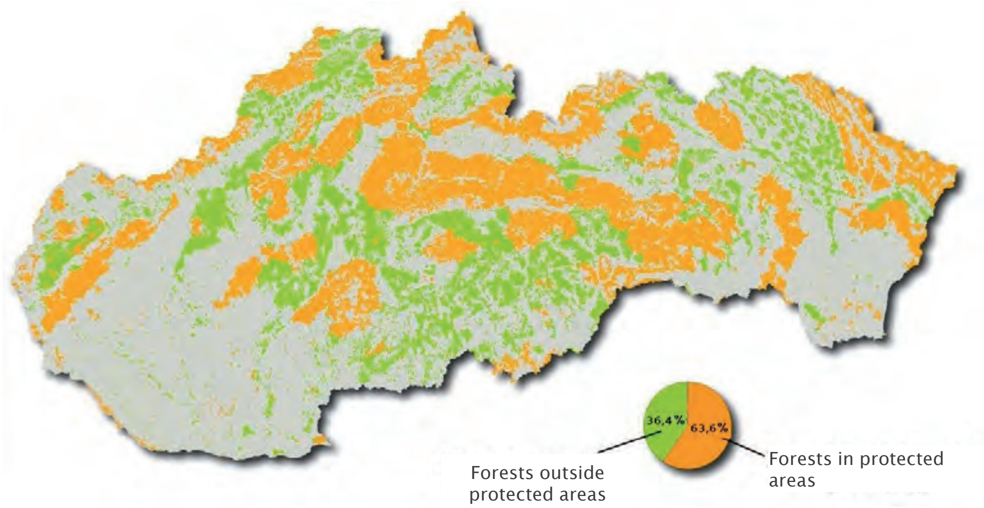
The overlap between the sites of the European Natura 2000 network and the national PA network is 776 656 ha.

Forests in PA

In the national and European network of PA in Slovakia, there are forest lands with an area of 1.24 million ha, which is 63.6% of the total area of forest coverage in Slovakia. The increase in the area of forest lands in PA can be noted mainly after 2004 in connection with the approval of new European protected areas (Natura 2000) related to the accession of the Slovak Republic to the EU.

Small-size protected areas on forest lands represent remnants of the best preserved forest habitats of national and European importance.

Forests with management restricted by one or more categories of PA (2020)



Source: MoE SR, NFC

SSPA on forest land represent remnants of the most preserved forest communities of both the national and European importance. They can be found from bottomland forests up to the zone of dwarf mountain pines.

The area of forests in the SPA is more or less stable and by 2020 amounted to about 896 thousand ha. The area of forests in the SCI amounts to 516 thousand ha. In total, without overlaps, the area of forest crop land in the Natura 2000 area in the Slovak Republic was about 951 thousand ha in 2020.

Restrictions on forest management

According to the Act on Nature and Landscape Protection, human activities in individual protected areas (with the exception of SPA) are regulated mainly by the restrictions detailed for levels of protection 2 to 5. Forest management is completely excluded only in the strictest protection level 5, which covers an area of 87,334 ha.

At levels 2 to 4, the use of pesticides and fertilizers, the construction of forest roads and other objects, the collecting of forest fruits and the exercise of hunting rights are mainly restricted.

In SPA, the first level of protection is formally in force, but management restrictions are mainly set by a specific management program for each individual SPA.

The SCI not overlapping with the national network areas are mostly declared in the second level of protection.

From the perspective of the forestry sector, this whole nature protection system is very complicated and opaque for forest managers.

3.5.3 What is the response of the society to mitigating or compensating negative consequences of forest management on the environment?

The basic and main instrument of the sustainable management of forests based on fulfilment of all their functions as well as their protection is forest management legislation

In 2019, the amended Act of SNC SR No. 326/2005 Coll. on forests, as later amended, introduced the close-to-nature forest management as the main method of forest management in the Slovak Republic. This requires, among other things, the use of environmentally suitable and environmentally friendly technologies.

One of the basic implementation tools for achieving sustainable forest management is the financing of forestry. In this respect, there is a long-standing need for additional financing of forestry to ensure sustainable and, in particular, close-to-nature forest management in line with the government's “Value for Money” project.

However, the equally important instruments are also economic instruments by using of which environmental principles in management in forests are, among other things, enforced or supported.

3.5.3.1 Forest certification

Forest certification represents the direct economic instrument for enforcing certain principles of forest management into practice, i.e. whether forest management corresponds to environmental, economic and social standards according to the internationally recognized criteria.

In the Slovak Republic, forest certification is implemented by means of two most wide-spread schemes in Europe:

- Programme for the Endorsement of Forest Certification schemes (PEFC)
- Scheme FSC (Forest Stewardship Council).

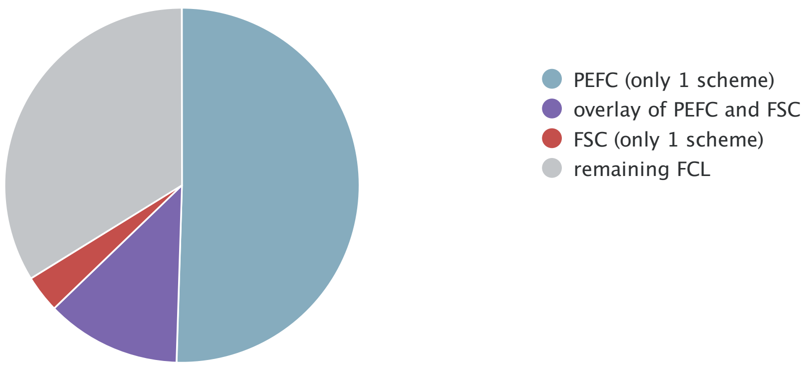
Compared to 2007, the area of certified forests increased, but has been on a fluctuating downward trend since 2009. Although the area of PEFC-certified forests, as well as FSC-certified forests, has increased in recent years, their total area has decreased (due to an increase in their overlap).

As of 2020, a total of 1,291,177 ha of forests (66.2% of the area of forest coverage in the Slovak Republic) were certified.

64.6% of forests area were certified according to the PEFC scheme. From 2007, their area increased by 7.2%.

According to the FSC scheme, forests with the area of 305,808 ha were managed (15.7% of the forest crop land), which represents a increase of 88.5% compared to 2007.

Share of the area of certified forests in the SR (2020)

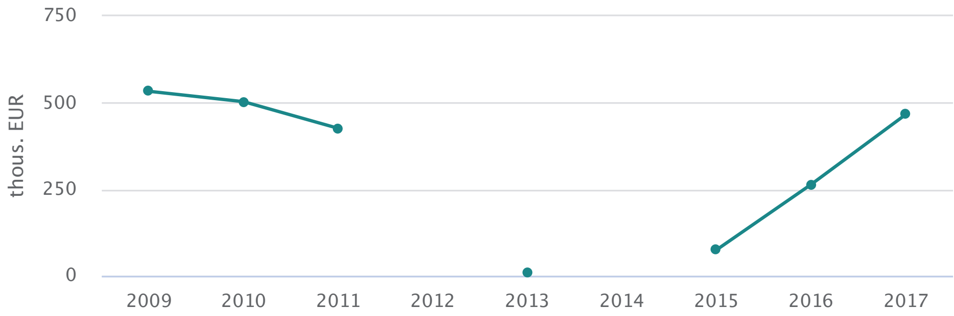


Source: NFC

3.5.3.2 Costs of the environmental protection in forest management

From 2009, there was a rapid decrease in forestry costs of the environmental protection until 2015, with their subsequent increase. However, a number of cost trend figures are confidential and the overall trend is fluctuating.

Development of costs for the environmental protection in forest management



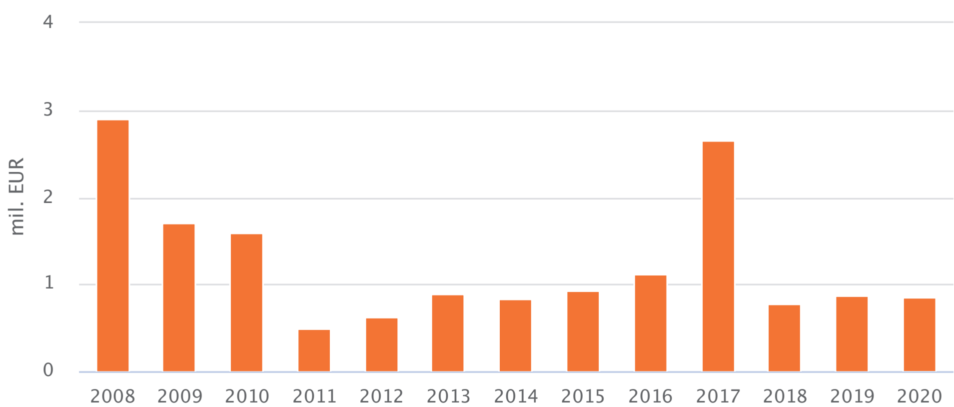
Note: Data for 2012 and 2014 are unavailable (confidential).
Source: SO SR

3.5.3.3 Payments for the exclusion of forest land

Since 2008, payments for the exclusion of forest land decreased by up to 70.3%, which represents a positive trend from the environmental perspective (fewer payments = generally fewer exclusions from forest functions or restrictions on forest use, beyond payments exemptions).

In 2020, the State Forestry Administration prescribed payments of EUR 0.86 million for the exclusion of forest land, of which 85% was paid.

Development of payments for the exclusion of forest land



Source: NFC

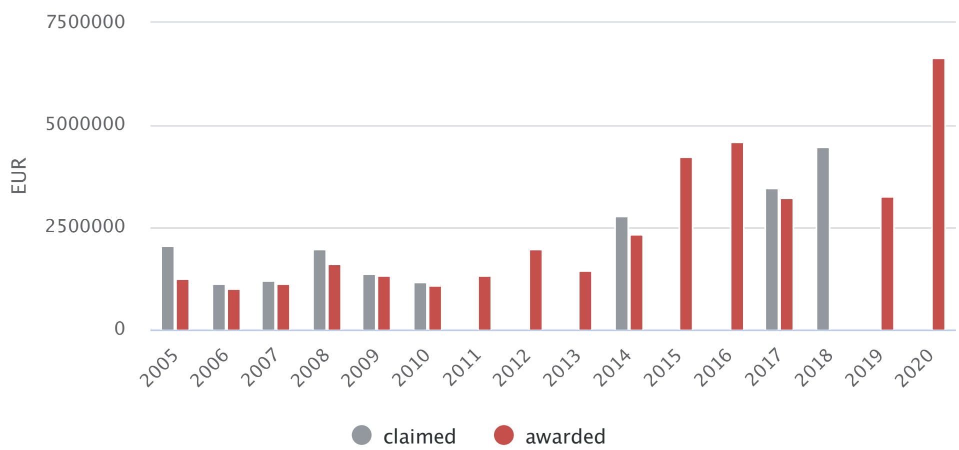
3.5.3.4 Compensations for restricted forest management

Due to the fulfilment, implementation of any other interests on forest land resulting from various legal regulations, there is restricted forest management or implementation of ownership rights in forests.

In 2020, compensations for the restricted forest management were paid only to non-state forest enterprises, amounting to EUR 6,666 million. The state enterprises had no legal right to reimbursement of compensation incurred in previous years. Compared to 2005, an increase of approximately 436% in paid compensation was recorded in 2020.

However, other compensatory instruments should also be used more in nature conservation – purchase, exchange, lease of land, contractual care, or payments in the form of a simple annual annuity. At present, however, compensation for property detriment is the only tool that works in any way to compensate for the constraints imposed by the state in the interests of nature protection.

Development of compensations for restricted forest management



Note: Not all data are available, the available data are according to the documents of the MoE SR and MoI SR.
Source: NFC

References

1. Chránené územia Slovenska, 97/2021 [online]. Štátna ochrana prírody SR, Banská Bystrica, 2021. 135 s., ISSN 2453-6423. Available on: https://www.sopsr.sk/publikacie/chus/chus97_final.pdf **[Slovak version]**

2. Inštitút environmentálnej politiky. Tri výzvy životného prostredia na Slovensku [online]. IEP, 2017. Available on: https://www.minzp.sk/files/iep/01_2017_tri-vyzvy_zivotneho_prostredia.pdf **[Slovak version]**

3. Konôpka, B., 2010. Výskum smrečín destabilizovaných škodlivými činiteľmi. Zvolen: NLC Zvolen. 339 s. ISBN 978-80-8093-124-7 **[Slovak version]**

4. Les & Letokruhy, 2020/07. Bratislava: Lesmedium SK, s. r. o. Považská Bystrica, ISSN 1337-9712. **[Slovak version]**

5. Les & Letokruhy, 2020/12. Bratislava: Lesmedium SK, s. r. o. Považská Bystrica, ISSN 1337-9712. **[Slovak version]**

6. Les & Letokruhy, 2021/01. Bratislava: Lesmedium SK, s. r. o. Považská Bystrica, ISSN 1337-9712. **[Slovak version]**

7. Les & Letokruhy, 2021/02. Bratislava: Lesmedium SK, s. r. o. Považská Bystrica, ISSN 1337-9712. **[Slovak version]**

8. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Koncepcia rozvoja poľovníctva v Slovenskej republike – národný program rozvoja poľovníctva a zachovania genofondu voľne žijúcej zveri [online]. MPRV SR, 2017. Available on: https://rokovania.gov.sk/RVL/Material/22144/1 **[Slovak version]**

9. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Národný lesnícky program Slovenskej republiky [online]. Bratislava: MPRV SR, 2007. Available on: http://www.mpsr.sk/sk/?navID=1&id=481 **[Slovak version]**

10. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Vízia spoločných postupov pri budovaní moderného pôdohospodárstva v horizonte roku 2035 [online]. MPRV SR, 2021. 194 s. Available on: https://rokovania.gov.sk/RVL/Material/26781/1 **[Slovak version]**

11. Ministerstvo pôdohospodárstva a rozvoja vidieka SR. Zelená správa 2001 – 2021 (Správa o lesnom hospodárstve v SR) [online]. Bratislava: MPRV SR. Available on: http://www.mpsr.sk/sk/index.php?navID=123 **[Slovak version]**

12. Ministerstvo životného prostredia SR. Náhodná ťažba ohrozuje biotopy v národných parkoch [online]. MŽP SR, 2021. Available on: https://minzp.sk/spravy/nahodna-tazba-ohrozuje-biotopy-narodnych-parkoch.html **[Slovak version]**

13. Ministerstvo životného prostredia SR, Slovenská agentúra životného prostredia. Indikátory [online]. Available on: www.enviroportal.sk/indikatory **[Slovak version]**

14. Ministerstvo životného prostredia SR, Slovenská agentúra životného prostredia. Správa o stave životného prostredia SR v roku 2020 [online]. MŽP SR, SAŽP, 2022. 194 s. ISBN 978-80-8213-052-5. Available on: https://www.enviroportal.sk/spravy/detail/11203 **[Slovak version]**

15. Naturae tutela, ročník 21, číslo 2 [online]. Slovenské múzeum ochrany prírody a jaskyniarstva, Liptovský Mikuláš, 2017. 296 s., ISSN 1336-7609. Available on: https://www.smopaj.sk/sk/documentloader.php?id=1793&filename=Naturae%20tutela%2021_2.pdf **[Slovak version]**

16. Národné lesnícke centrum. Forestportál [online]. Available on: www.forestportal.sk **[Slovak version]**

17. Národné lesnícke centrum, 2021. Poľovnícka štatistická ročenka Slovenskej republiky 2020 [online]. Zvolen: NLC, 2021. Available on: http://www.forestportal.sk/lesne-hospodarstvo/polovnictvo/Documents/Polovnicka%20statisticka%20rocenka%202020.pdf **[Slovak version]**

18. Slovenský hydrometeorologický ústav, Ministerstvo životného prostredia SR. National inventory report 2022 [online]. Bratislava: SHMÚ, MŽP SR, 2022. Available on: https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=105&cmsDataID=0 **[Slovak version]**

19. Považan, R. (ed.), Pastorek, P., Nováček, J., Balážovič, Ľ.. Modely pre biodiverzitu do roku 2050 [online]. Banská Bystrica: MŽP SR, SAŽP, 2022. 59 s. ISBN 978-80-8213-059-4. Available on: https://www.enviroportal.sk/uploads/report/11361.pdf **[Slovak version]**

20. Pralesy.sk. Available on: http://www.pralesy.sk/ **[Slovak version]**

21. Slovak Hydrometeorological Institute, Ministry of Environment of the SR. National inventory report 2022 [online]. Bratislava: SHMI, MoE SR, 2022. Available on: https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=105&cmsDataID=0

22. Zákon č. 326/2005 Z. z. o lesoch v znení neskorších predpisov **[Slovak version]**

23. Zákon NR SR č. 543/2002 Z. z. o ochrane prírody a krajiny v znení neskorších predpisov **[Slovak version]**

4. Toward the transformation to a circular and low-carbon economy

Increasing environmental pollution is causing global problems that are manifested in changes in the quality of air, water, soil and ecosystems and they directly affect human health and well-being. The current linear model of economic growth no longer meets the needs of the current society. Smarter, more sustainable use of resources is needed to ensure sustainable growth both globally and at the EU level. The economic model that requires constant extraction of raw materials and is characterized by short product lifetimes, rapid obsolescence and the constant need to "renew" goods is called linear economy.

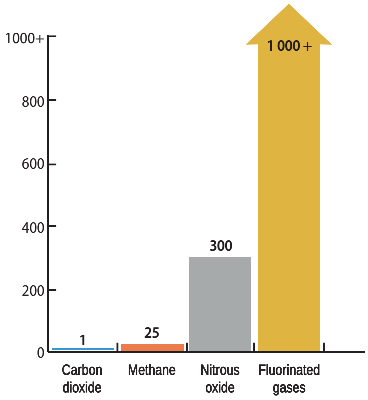
Source: SEA

The opposite of this model is circular economy. It is an economic model in which the value of products, materials and resources is retained in the economy for as long as possible. Waste generation is minimized while reducing the need to extract raw materials. Typical elements of the circular economy are product reuse, product sharing and repair, refurbishment, remanufacturing and, when a product can no longer be reused, recycling. This creates a closed system in which the need to use primary resources is minimized, minimizing waste, pollution and carbon emissions.

Source: SEA

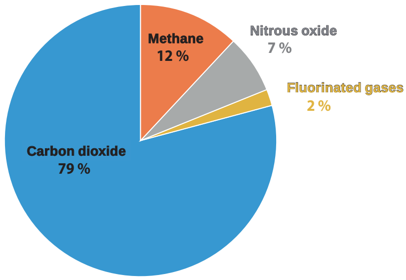
The impact of climate change is already being felt around the world, including Europe. Extreme weather events such as droughts, heavy rains, floods and landslides are becoming more frequent. They result in rising sea and ocean levels, ocean acidification and loss of biodiversity. As the debate on climate change becomes increasingly urgent, the topic of sustainable development also requires constant attention. According to the Intergovernmental Panel on Climate Change (IPCC), we must do everything we can to ensure that the world's temperature does not rise by more than 1.5 degrees Celsius, otherwise the effects of climate change will be irreversible. To achieve this, we need to reach carbon neutrality by the middle of the 21st century. This target is set by the 2015 Paris Climate Agreement, signed by 195 signatories, including the EU. Carbon neutrality is about achieving a balance between carbon emissions and removing them from the atmosphere into the so-called carbon sinks. Carbon sinks are any natural or man-made systems that absorb more carbon than they produce. At the present, these natural sinks absorb between 6 – 8 Gt of CO_2 per year. However, they are not enough to absorb all the emissions emitted in a year; in 2020, up to 37 Gt of CO_2 was emitted into the atmosphere globally. One way to achieve carbon neutrality is to transform the economy to a low-carbon one. This is based on sustainable measures that focus mainly on reducing or even capturing the so-called sequestration (the binding of atmospheric CO_2 to the soil of the terrestrial ecosystem) of greenhouse gases generated in the production chain, leading to a lower environmental impact.

HOW GREENHOUSE GASES WARM OUR PLANET



The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.

Greenhouse Gas	Global Warming Potential (GWP)
Carbon dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous oxide (N_2O)	298
Hydrofluorcarbons (HFCs)	124 - 14,800
Perfluorocarbons (PFCs)	7,390 - 12,200
Sulfur hexafluoride (SF_6)	22,800
Nitrogen trifluoride (NF_3)	17,200



How much each human-caused greenhouse gas contributes to total emissions around the globe.

Source: SEA

There are a number of measures that can be taken to implement a low-carbon economy and that need to be taken to reduce carbon emissions. They include, for example:

- the implementation of the European Emissions Trading Scheme (EU ETS);
- the increase of the share of energy produced from renewable sources;
- the adoption of reverse logistics, i.e. collecting, recycling and reusing materials which in turn reduce the exploitation of natural resources;
- the research and development on the recovery of generated waste, transforming it into new products;
- the more sustainable management of land used for farming and grazing;
- the prioritizing the reuse of products;
- the regeneration of degraded areas and the protection of forests;
- the reduction or even replacement of fossil fuels;
- the raise of awareness and information on the benefits of recycling, etc.

Responding to the threat of climate change represents a profound transformation with the aim to reduce greenhouse gas emissions over the course of this century, especially CO_2 from the production and consumption of fossil fuels, which poses significant structural, economic, financial, social and environmental challenges.

In the coming decade, the EU will continue to build on its strong results of measures related to climate action and parallel economic growth. By 2020, the EU emissions fell by an estimated 33% compared to 1990, while the economy grew by 57.5% over the same period. This proves that it is possible to combat climate change while ensuring sustainable economic growth and job creation. The background studies on climate legislation show that a 55% reduction in emissions by 2030 compared to 1990 levels will be economically feasible and beneficial for Europe, using appropriate policies.

The current EU policy framework would not be sufficient to achieve the 2050 objectives and meet the commitments of the Paris Agreement. Projections suggest that the EU would achieve a 60% reduction in greenhouse gas emissions by 2050 if it simply continued to implement the current legislation. The EU needs to raise its ambition for this decade and to ensure that future generations do not have to bear a greater part of the burden. The less action the EU takes in the next ten years, the steeper and more challenging the path to emissions reductions after 2030 will be.

The Commission is therefore proposing to change the current emissions reduction pathway to achieve climate neutrality by 2050 and to take it into account in the development of climate legislation.

4.1 How does the development in the assessed sectors support the transition to a circular economy in the Slovak Republic?

Summary assessment of the development of the Slovak economy towards a circular economy

What is the state and direction of the circular economy in Slovakia?

Domestic material consumption decreased by approximately 14.8% in the monitored period (2005 – 2020) and resource productivity increased by 78.7% in the same period.

Between 2005 and 2020, waste generation increased by more than 20%. In the same period, however, gross domestic product (in current prices) increased by up to 82%.

Between 2008 and 2020, the share of industrial production in total waste generation decreased from 46.8% to 28.1%.

The rate of landfilling of waste excluding municipal waste increased year-on-year (2019 – 2020) (from 16.6% to 17.9%). Between 2005 and 2020, it decreased by 13 percentage points.

“Other management” of waste remains a problem – in 2020, the share of this waste management method ranged from 12.4% (energy) to 65.5% (forestry), making it impossible to assess the trends in each sector more accurately.

Circular material use rate increased only slightly between 2010 and 2020, from 5.1% to 6.4%.

Employment in the circular economy has been stagnant over the long term (2011 – 2019) – since 2011, it did not exceed 2% of total employment.

The level of implementation of green public procurement remained low in the last years (2016 – 2020).

Which sectors are moving towards a circular economy? Which sectors are lagging behind or deteriorating? Is the Slovak Republic as a whole moving towards a circular economy?

Waste generation in most of the five monitored sectors (manufacturing, energy, agriculture) declined in the monitored period.

Manufacturing was the largest producer of waste in the Slovak Republic for a long period of time, according to the SK NACE classification of economic activities. However, in the monitored period (2008 – 2020), its share is significantly decreasing, which is due to the change in the structure of the Slovak economy. Since 2008, the production of waste from manufacturing decreased by more than 30%.

The second largest waste producer in 2020 was the water supply; sewerage; waste managment and remediation activities sector. Compared to 2008, there was an increase of more than 100% in this sector.

Waste production in the electricity, gas, steam and air conditioning supply sector decreased by 40% in the long term. Most of the waste from this sector was from thermal processes.

In the field of waste management, a number of important legislative changes were adopted in the Slovak Republic in the last years: charging for plastic bags, introduction of a deposit return scheme for single-use plastic beverage packaging and for single--use metal beverage packaging, gradual increase of landfilling fees, gradual abolition of exemptions from the introduction of separate collection of biodegradable kitchen waste between 2021 and 2023, introduction of a legal obligation to treat waste before landfilling (to be fully applicable from 2024), ban on landfilling of mixed waste and bulky waste treatment outputs if their calorific value exceeds 6.5 MJ/kg from 2027.

The European Union presented its vision for a circular economy in 2015 (The Circle is Closing - An EU Action Plan for a Circular Economy), then in 2020 the EU adopted a new EU Action Plan for a Circular Economy – Towards a Cleaner and More Competitive Europe. The legislative proposals on waste adopted alongside the 2015 Action Plan included long-term objectives to reduce landfilling and increase preparation for the reuse and recycling of key waste streams such as municipal waste and packaging waste. Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability (2020) is a document that highlights that access to resources and sustainability are key to the resilience of the European Union in raw materials. The European Green Deal (2019) is the plan of the European Commission for transforming the EU economy for a sustainable future.

At the national level, the document Greener Slovakia — Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) was approved by a resolution of the Government of the Slovak Republic on 27 February 2019.

In the Slovak Republic, the issue of circular economy was not covered by one specific document, but it was addressed in parts in various documents – these were the Waste Prevention Programmes of the Slovak Republic for the years 2014 – 2018, respectively 2019 – 2025, or the Waste Management Programme of the Slovak Republic for the years 2016 – 2020, respectively 2021 – 2025. The work on a document that would more comprehensively cover the issue of the circular economy in Slovakia began in October 2020 through the project "Technical support for the preparation of circular economy roadmap for the Slovak Republic". The outputs of the project were presented in May 2022.

Priorities and objectives in the field of waste management in the Slovak Republic:

- Shift from material recovery as the only priority declared in the waste management programmes of the Slovak Republic until 2010 to waste prevention.

Waste Prevention Programme of the Slovak Republic for the years 2014 – 2018 (2013)

- Minimizing the negative effects of waste generation and management on human health and environment by 2020.
- Major diversion of waste away from landfill disposal, especially for municipal waste.

Waste Management Programme of the Slovak Republic for the years 2016 – 2020 (2015)

- Shift from material recovery as the only priority in the waste management of the Slovak Republic to waste prevention in accordance with the waste management hierarchy of the Slovak Republic.

Waste Prevention Programme of the Slovak Republic for the years 2019 – 2025 (2019)

- Diverting waste away from landfill disposal, especially for municipal waste.

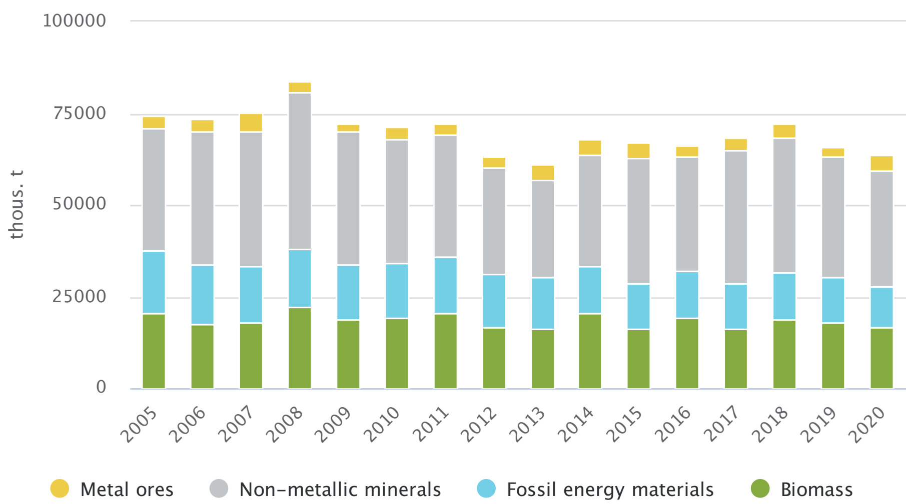
Waste Management Programme of the Slovak Republic for the years 2021 – 2025 (2021)

To assess whether the Slovak Republic is moving towards a circular economy, indicators are used that are part of the monitoring framework set by the European Commission. The indicators are divided into four thematic areas, each area consisting of several indicators. The selected indicators are expanded to include additional indicators related to waste management and circular economy.

4.1.1 Production and consumption

4.1.1.1 Domestic material consumption

Development of domestic material consumption by material groups



Source: Eurostat

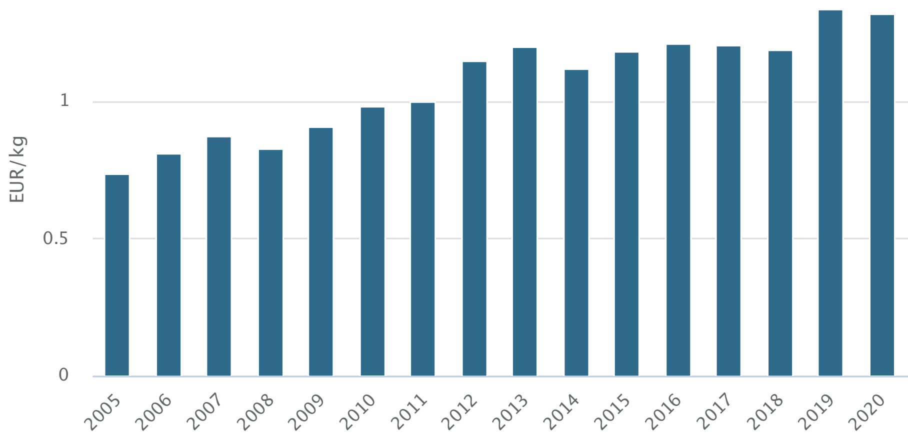
Domestic material consumption measures the total amount of materials consumed directly in the economy, excluding hidden material flows. The indicator is calculated as a direct material input (domestic extraction plus imports) minus exports. Reducing material consumption or increasing resource productivity leads to a reduction in the overall material requirements of the socio-economic system and to a reduction in the environmental burden. Total domestic material consumption decreased by approximately 14.8% in the monitored period (2005 – 2020).

The domestic material footprint decreased by less than 15% in the monitored period (2005 – 2020).

4.1.1.2 Resource productivity

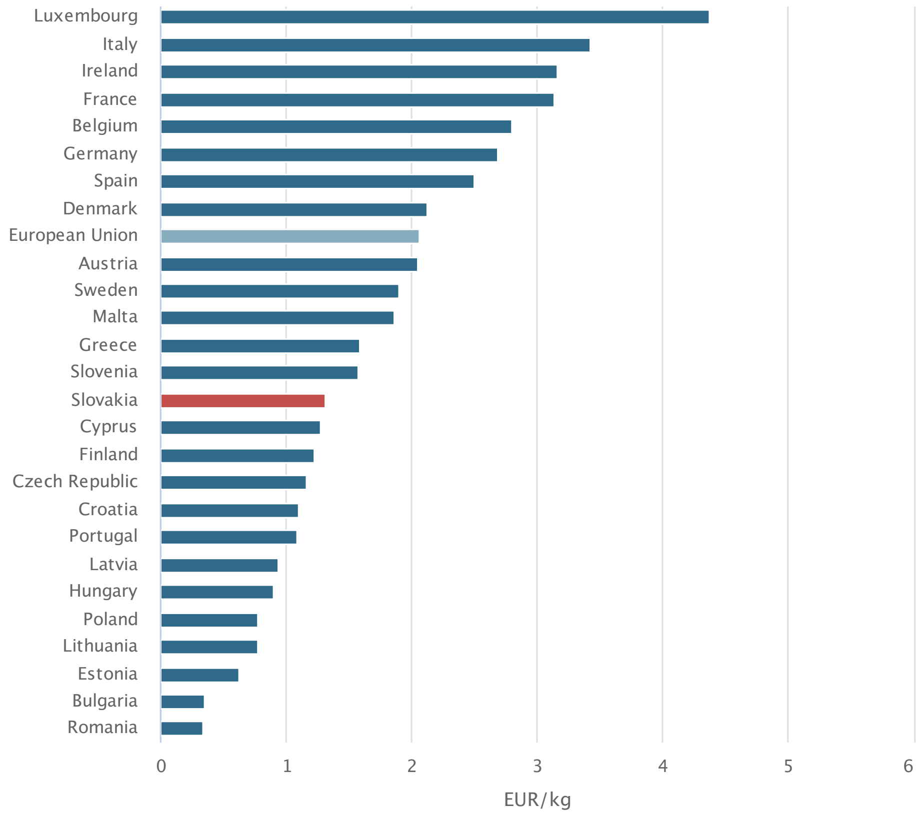
Resource productivity quantifies the relationship between economic growth and resource/material depletion. It is calculated as the ratio of gross domestic product (GDP) in PPS (purchasing power stadard) or EUR to domestic material consumption in kg. Resource productivity increased by 78.7% in the monitored period (2005 – 2020). However, the resource productivity of the Slovak Republic remains below the EU average – in 2020, the resource productivity of the Slovak Republic was only approximately 64% of the EU average.

Development of resource productivity



Note: Productivity of resources (measured as DMC to GDP c.p.2015)
Source: Eurostat

International comparison of resource productivity (2020)



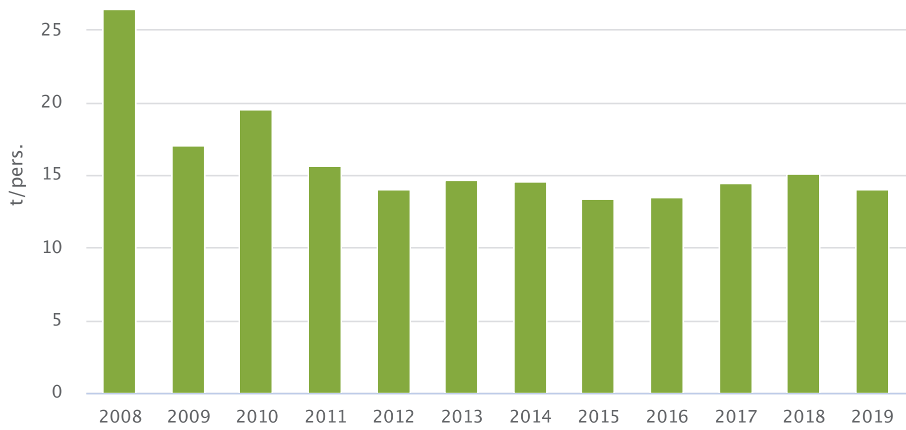
Source: Eurostat

4.1.1.3 Material footprint

Both the European Union and the Slovak Republic account for a larger share of world consumption and investment than of world production, because a large proportion of the goods consumed in Europe are produced in Asia. Material footprints make the responsibility of the EU and individual Member States for the environmental pressures visible, they arise as a result of products imported into the EU.

The material footprint indicator quantifies the global demand for extracted materials (biomass, metal ores, non-metallic minerals and fossil fuels) driven by consumption and investment by households, governments and businesses in the EU. A 47% decrease in the material footprint was observed between 2008 and 2019. Stagnation was observed in the shorter period (2012 – 2019).

Development of the material footprint

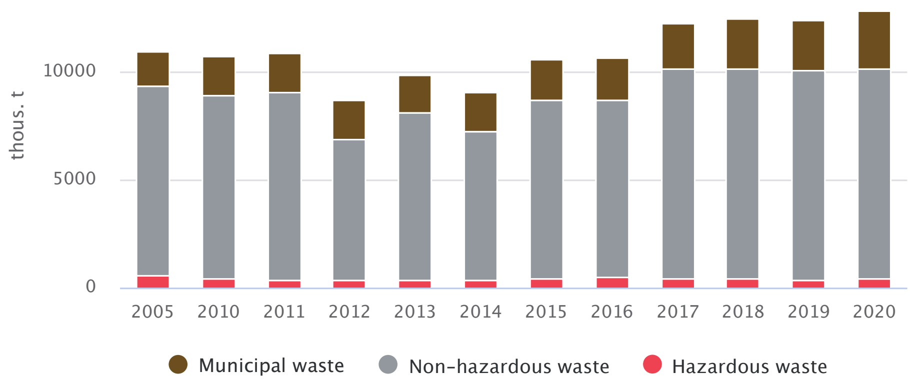


Note: The data are Eurostat estimates.
Source: Eurostat

4.1.1.4 Generation of waste

The overall trend in waste generation (municipal waste, non-hazardous waste and hazardous waste) was increasing in the monitored period. Between 2005 and 2020, the total waste production increased by more than 20%. In the same time period, however, gross domestic product (expressed in current prices) increased by over 82% (up from EUR 50,485.7 million to EUR 92,079.3 million).

Development of waste generation



Note: Municipal waste includes both categories of waste (non-hazardous and hazardous).
Data for 2020 have been revised due to a change in methodology as well as a retrospective revision of the data provided (they do not match the originally published data).
Source: MoE SR, SO SR

In the monitored period (2005 – 2020), an increase in the amount of waste produced was observed, which is often linked to GDP growth and overall growth in the standard of living.

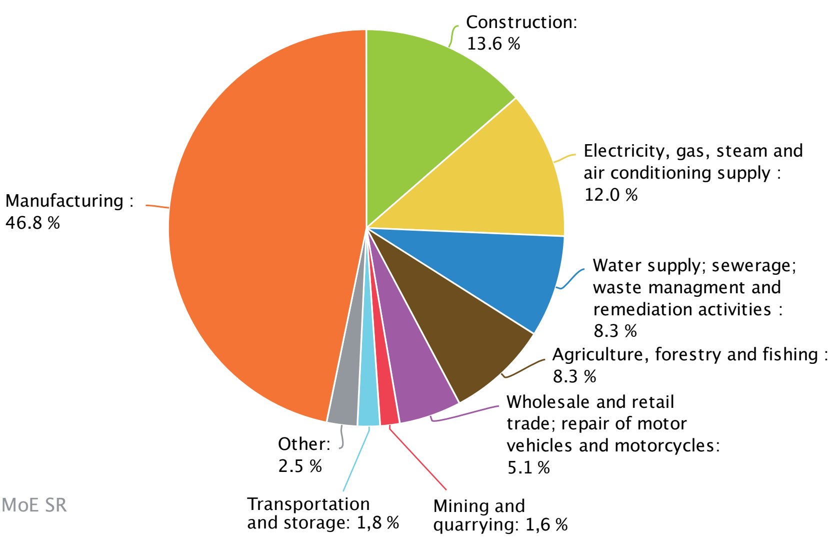
The objective of waste prevention was not met, as can be seen in the graph above, where an increase in total waste generation was observed over the long term (with the exception of the 2012 – 2014 period).

4.1.1.5 Waste generation by sector

The following two graphs show how the share of each sector in total waste production changed between 2008 and 2020.

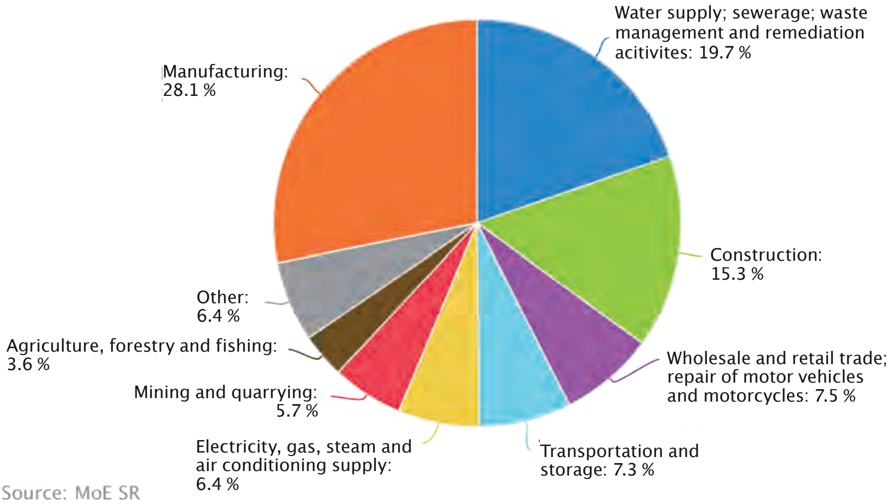
In 2008, industrial production was the largest producer of waste, accounting for almost 47% of total waste production. This was followed by construction sector with over 13%, electricity, gas, steam and air conditioning supply accounted for 12%, followed by water supply; sewerage; waste management and remediation activities with over 8%; agriculture, forestry and fishing also accounted for over 8%.

Generation of waste according to Slovak Statistical Classification of Economic Activities (2008)



Source: MoE SR

Generation of waste according to Slovak Statistical Classification of Economic Activities (2020)



Source: MoE SR

Also in 2020, manufacturing was the largest producer of waste, but accounted for just over 28% of total waste production, followed by water supply; sewerage; waste managment and remediation activities with almost 20%. The construction sector was in the third place with 15.3%.

As can be seen from the graphs, there was a significant change in the structure of waste production according to the sectoral classification of economic activities SK NACE in the monitored period. A significant change was recorded in the manufacturing sector, but also in agriculture, which is probably related to the change in the structure of the Slovak economy and the strengthening of the service sector.

There was a significant change in the structure of waste production according to the sectoral classification of economic activities SK NACE in the monitored period, which is probably related to the change in the structure of the Slovak economy and the strengthening of the service sector.

4.1.1.6 Municipal waste generation per capita

It is important to note that the amount of municipal waste generated is not the most important indicator by which to assess the state of waste management in a particular country. More important indicators are often the recycling rate and the landfilling rate of municipal waste.

Development of the generation of municipal waste per capita

Source: Eurostat

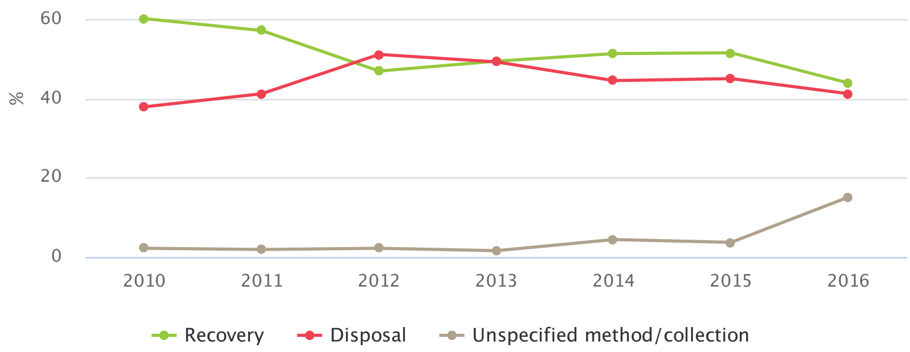
In the monitored period (2005 – 2020), there was an increase in municipal waste generation per capita of more than 58%. In the same period, the decrease at the EU level was less than 1.5%.

4.1.2 Waste management

4.1.2.1 Waste management by sector

The waste management method presents how the waste is further treated. The following activities are included under waste recovery: material recovery, energy recovery (incineration with energy recovery), recovery of organic matter including composting, use of waste for backfilling, other recovery. Three activities are classified under waste disposal: landfilling, incineration without energy recovery and other disposal. In general, one of the objectives of the circular economy is to ensure that as little waste as possible is generated, as much waste as possible is recovered and disposed of as little as possible. “Other management”, with an increase since 2016, currently includes the following activities: waste collection (temporary storage of waste prior to further management), transfer of waste for household use, collection, acceptance/transfer to a dealer, acceptance/transfer to a broker, temporary storage of excavated soil, temporary storage of waste at a municipal waste transfer station.

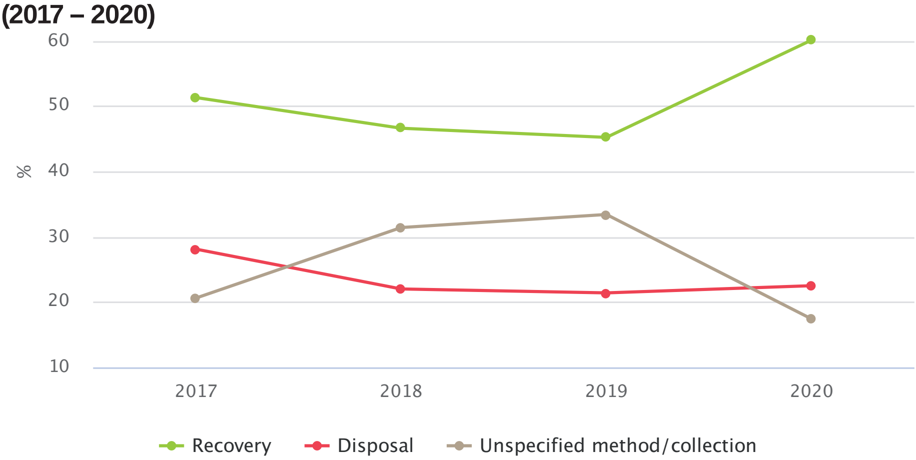
Development in the method of waste management from manufacturing, electricity, gas and water supply, wastewater treatment sector (2010 – 2016)



Note: Management of waste from manufacturing, electricity, gas and water supply, wastewater treatment (2010 – 2016)
Source: SO SR, MoE SR

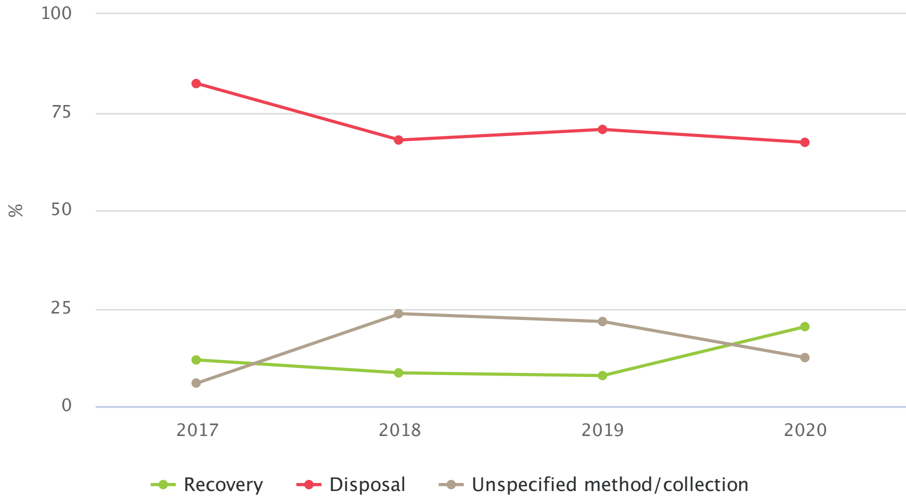
As sectors C, D and E were combined in the "Waste in the Slovak Republic" publications between 2010 and 2016, it is not possible to precisely assess trends in recovery and disposal for the individual sectors in this period. However, since 2017, sectors C (Manufacturing) and D (Electricity, gas supply) were separated and industrial production, the largest waste producer of all sectors, showed a significant increase in recovery, reaching 60.1% in 2020. A year-on-year (2019 – 2020) improvement is also observed for waste from the energy sector, but the disposal rate in this sector remains too high – up to 67.3%. It should be noted, however, that in 2017 it was as high as 82.3%, so there is a gradual improvement there as well.

Development in the method of waste management from manufacturing sector (2017 – 2020)



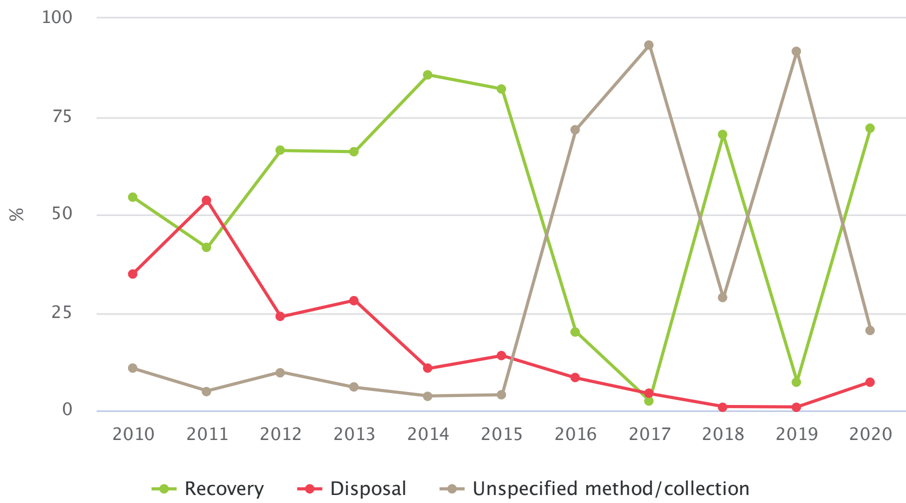
Source: SO SR, MoE SR

Development in the method of waste management from electricity, gas supply sector (2017 – 2020)



Source: SO SR, MoE SR

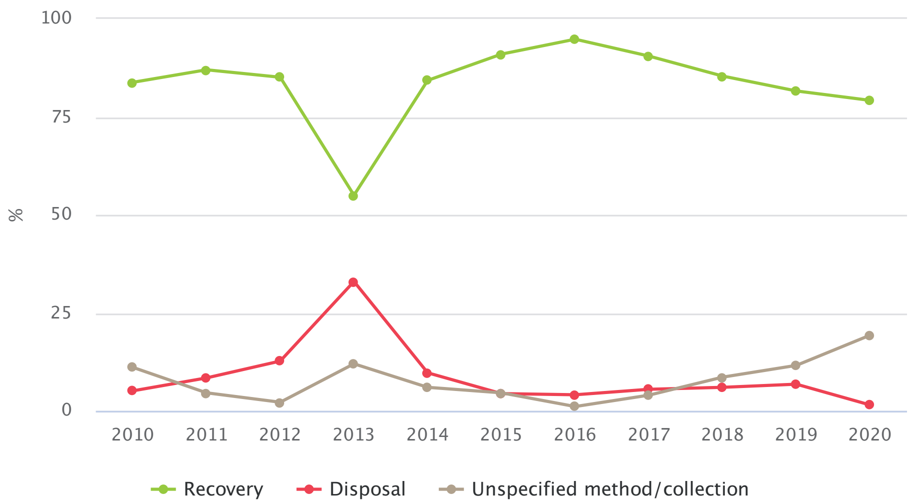
Development in the method of waste management from transportation and storage sector (2010 – 2020)



Source: SO SR, MoE SR

Sector H (Transportation and storage) is also a significant waste producer. However, it is difficult to assess the overall trend in this sector, as most of the waste from this sector was reported under the management method "collection" or "other management" since 2016. In 2019, "other management" accounted for 91.7% of the management of these wastes. By contrast, in 2020, "other management" decreased to 20.5% and recovery was up to 72.2%.

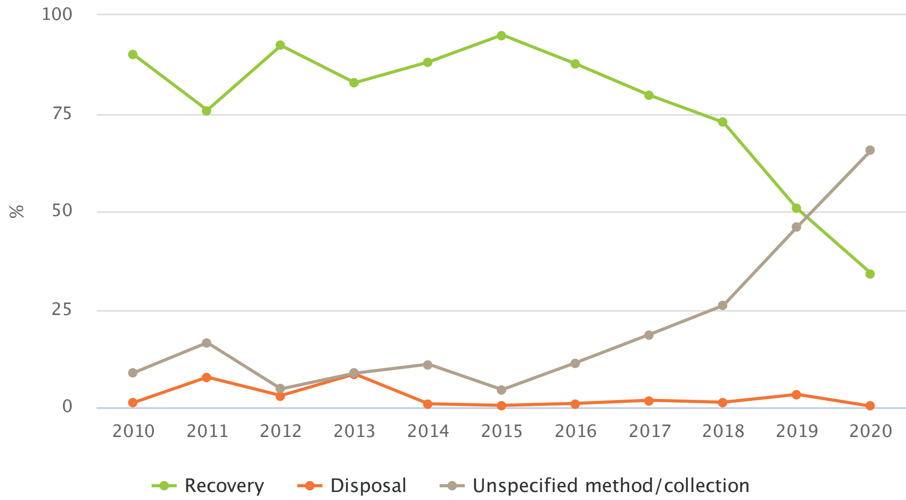
Development in the method of waste management from agriculture sector (2010 – 2020)



Source: SO SR, MoE SR

In sector A Agriculture, forestry and fishing – 01 Crop and animal production sector, with the exception of 2013, a high level of waste recovery was observed over the long term. However, there was a significant increase in "other management" since 2016 – reaching 19.3% in 2020.

Development in the method of waste management from forestry sector (2010 – 2020)



Source: SO SR, MoE SR

Forestry is the smallest waste producer of all five sectors assessed. In terms of waste management, a similar trend is observed for forestry as for crop and animal production, with a significant increase in the amount of waste reported as "other management" since 2016 – even surpassing the recovery rate in 2020, reaching a share of 65.5%.

In 2020, sector D Energy (Electricity, gas supply) had the highest landfilling rate, with almost 66% of the 898,773.4 tonnes of waste disposed of by landfilling. In contrast, the lowest landfilling rates in 2020 were recorded in the forestry (0.13%) and agriculture (0.86%) sectors.

The highest recovery rate (material recovery + reclamation of organic substances and composting) was recorded in the agriculture sector in 2020 (75.1%), followed by sector H Transportation and storage (71.6%). The lowest recovery rate was recorded in sector D Energy (Electricity, gas supply) – 19.2% and, rather surprisingly, a low recovery rate (material recovery + reclamation of organic substances and composting) was also recorded in the forestry sector – only 27.4%.

However, "other management" remains a problem – in 2020, this accounted for between 12.4% (energy) and 65.5% (forestry) of waste management, making it impossible to assess sectoral trends more precisely.

A more precise assessment of trends in individual sectors is prevented by the fact that since 2016, part of the waste was reported under the "other management" method. It is therefore not possible to assess exactly how much waste was recovered and how much was disposed of.

4.1.2.2 Landfilling of waste

Landfilling is one of the worst ways to manage waste – it is at the lowest level in the waste hierarchy. Dumping waste in landfill deprives us of a lot of usable materials that could have been recycled and put back into the economy. By not using waste as a material, the need to extract primary raw materials is constantly increasing. Last but not least, landfills are a source of greenhouse gas emissions (methane) – mainly due to the landfilling of biodegradable waste. One of the challenges of waste management in the Slovak Republic is to reduce the high proportion of landfilling.

Objectives of the Slovak Republic for municipal waste:

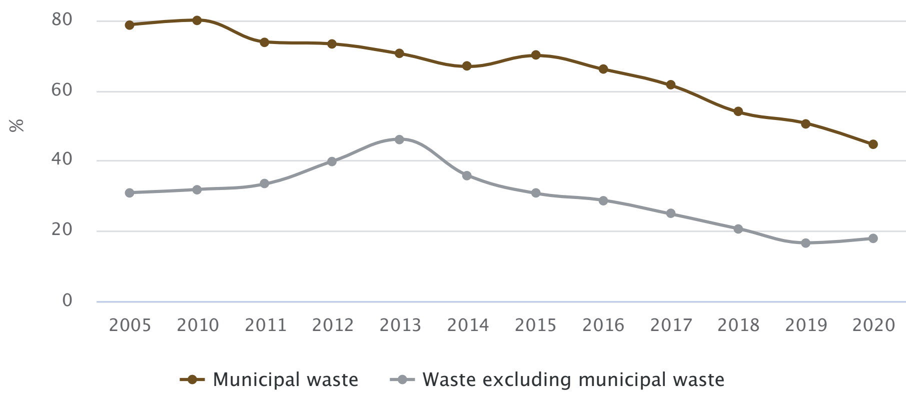
- Reducing the rate of municipal waste disposed to landfill to 10% of total municipal waste by 2035 (Strategy of the Environmental Policy of the Slovak Republic until 2030 sets an objective of 25% in this area).

Act No. 79/2015 Coll., on waste, as later amended

- Increasing the rate of separate collection of municipal waste to 60% and the rate of preparation for reuse and recycling of municipal waste to 55% by 2025

Waste Management Programme of the Slovak Republic for the years 2021 – 2025 (2021)

Development of the rate of landfilling of waste



Note: Data for 2020 have been revised due to a change in methodology as well as a retrospective revision of the data provided (they do not match the originally published data).
Source: MoE SR, SO SR

The rate of municipal waste landfilling in Slovakia had a downward trend in the period 2005 – 2020 (down from 78.7% to 44.5%)*. In the same period, a decrease was also observed for waste excluding municipal waste (from 30.9% to 17.9%). In this case, however, it should be noted that in 2020, almost 15% of all waste was reported under the „other management" method, so it is not possible to determine what the exact rate of landfilling of non-hazardous waste was. However, improvements in data quality, including traceability of waste streams, are generally expected from the full implementation of the Waste Management Information System.

* *Data for 2020 have been revised due to a change in methodology as well as a retrospective revision of the data provided (they do not match the originally published data).*

The total amount of waste (municipal waste and waste excluding municipal waste) landfilled between 2005 and 2020 decreased from 4,114,942 tonnes to 3,015,276 tonnes (a decrease of 26.7%).

According to Eurostat, 215 kg of municipal waste per capita was landfilled in Slovakia in 2020. For comparison, it was 3 kg for Finland and 7 kg for the Netherlands. In contrast, for example, in Croatia it was 233 kg and in Portugal 263 kg.

A frequently discussed topic related to waste management is the energy recovery of waste. It is the use of combustible waste to generate energy through direct combustion with or without other waste, using heat. The current list of incineration and co-incineration plants (Slovak version) is available online. In 2020, there were only two municipal waste incinerators in operation in Slovakia – one in Bratislava, operated by Odvoz a likvidácia odpad a.s., and the other one in Košice, operated by KOSIT a.s. In addition to these plants, there are incinerators for industrial waste, hazardous waste, wastes from human or animal health care and/or related research, as well as waste co-incineration plants in the territory of the Slovak Republic.

In 2020, 126,431.76 tonnes of municipal and non-hazardous waste were recovered by the Waste to Energy Plant (WTEP) in Bratislava. WTEP Košice recovered 108,135 tonnes of municipal and non-hazardous waste in 2020.

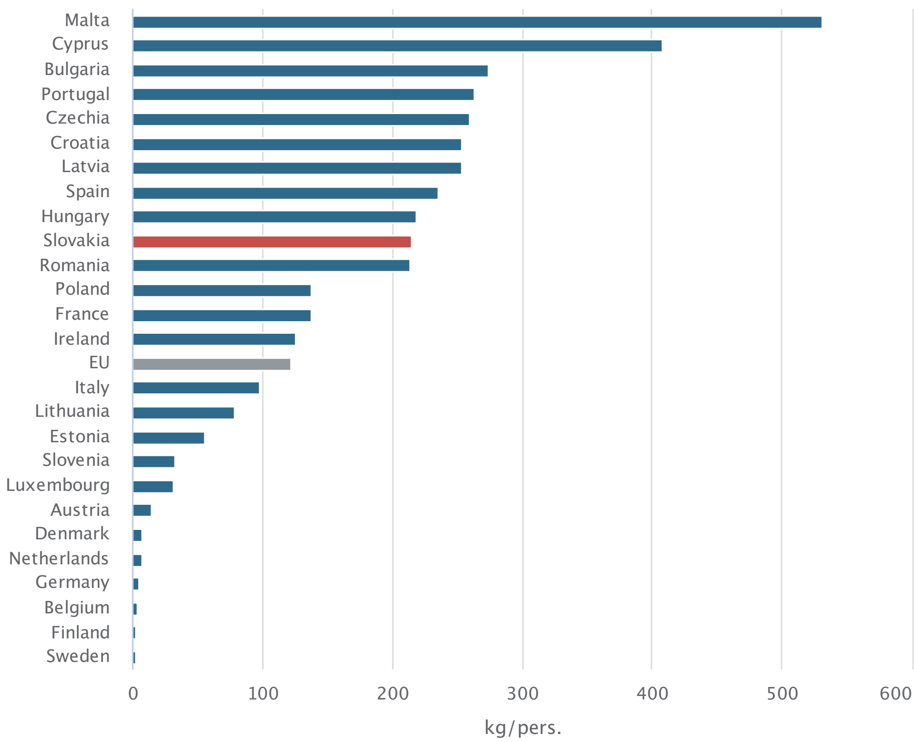
In 2020, a total of 2,684,485 tonnes* of municipal waste was generated in Slovakia, of which 192,652 tonnes (less than 7.2% of total municipal waste generation) were energy recovered.

* *Data for 2020 have been revised due to a change in methodology as well as a retrospective revision of the data provided (they do not match the originally published data). The following types of waste are not included in the municipal waste outputs from the 2020 reference year onwards: 20 02 02 – Soil and stones, 20 03 06 – Waste from sewage cleaning and 20 03 08 – Minor construction waste, as according to the Eurostat methodology these types of waste do not fall under municipal waste. In accordance with the change of methodology proposed by the Ministry of Environment of the Slovak Republic, from the 2020 reference year onwards, data for municipal waste from municipalities (data collected by the Slovak Statistical Office from towns and municipalities in the Environment Report 6-01) are added to data for municipal waste from other sources (data collected by the Ministry of Environment of the Slovak Republic). .*

In the following two graphs, it can be seen that the EU countries with the highest landfilling rates per capita also have the lowest energy recovery rates and vice versa.

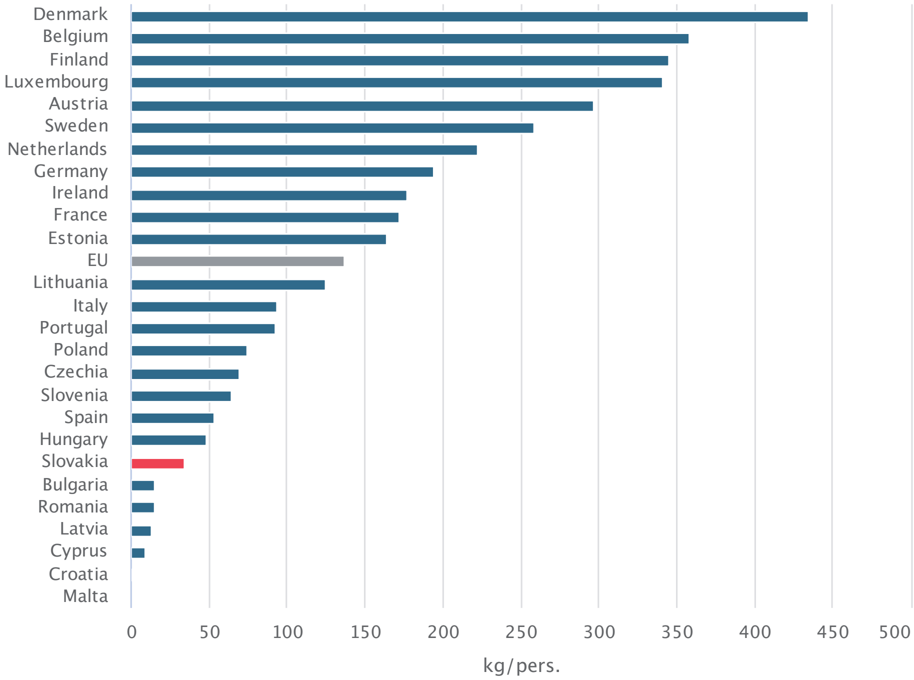
The rate of municipal waste landfilling has decreased significantly since 2005, but still remains too high. In 2020, almost 45% of municipal waste generated ended up in landfills.

International comparison of municipal waste landfilling (2020)



Note: Waste disposal – landfill and others (D1 – D7, D12). The data for Austria, Belgium, Bulgaria, EU, France, Germany, Ireland, Luxembourg, Spain and Sweden are estimates.
Source: Eurostat

International comparison of municipal waste disposal – incineration (D10) and recovery – energy recovery (R1) (2020)

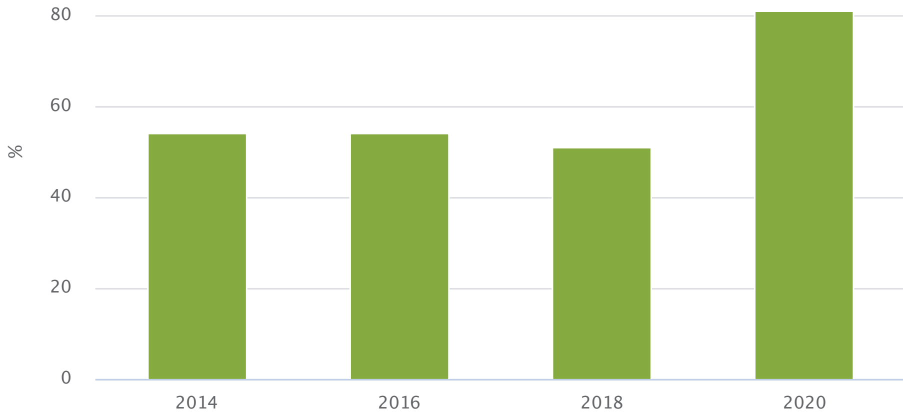


Note: Recovery, respectively disposal: R 1 (recovery – energy recovery) and D 10 (incineration). Data for Denmark, Bulgaria, Cyprus, EU, France, Ireland, Luxembourg, Malta, Germany, Austria, Slovenia, Spain and Sweden are estimates.
Source: Eurostat

4.1.2.3 Recycling of construction and demolition waste

Simply put, the higher the recovery rate of construction and demolition waste, the less of this waste is landfilled and the need for extraction or production of new construction materials is reduced. Recycling of these wastes saves costs for the builders and at the same time reduces the amount of emissions that are generated during the extraction or production of individual building materials.

Development of the recovery rate of construction and demolition waste



Source: Eurostat

Objective of the Slovak Republic in the field of construction waste management:

- By 2020, increasing the preparation for reuse, recycling and recovery of construction and demolition waste, including backfilling, as a substitute for other materials in a single calendar year to at least 70% of the weight of such waste generated in the previous calendar year.

Act No. 79/2015 Coll., on waste, as later amended

- Increasing the preparation for reuse and recycling of construction waste, including backfilling, to 70%.

Waste Management Programme of the Slovak Republic for the years 2021 – 2025 (2021)

The Slovak Republic has long been among the worst EU Member States in terms of construction and demolition waste recycling. However, it should be noted that the actual recycling rate of construction and demolition and demolition waste may be higher, as part of the construction waste under “temporary” disposal codes is not included in the statistics published by Eurostat. The actual recycling rate of this waste is therefore probably higher than the rate published by Eurostat. According to another methodology (calculated according to Annex III of Commission Decision No.

2011/753/EC, as the ratio of recovered construction and demolition waste to the total generated construction and demolition waste, excluding hazardous waste and codes 17 05 04 and 17 05 06), the recovery rate of construction and demolition waste in Slovakia was 89.2% in 2020. More precise data could be provided in the future by a fully functional waste management information system.

* *In 2022, there was a significant change related to this type of waste – when an amendment to the Waste Act was adopted, an amendment to the Government Regulation regulating landfilling fees and a new Decree on Construction and Demolition Waste. The aim of these changes is to encourage recycling and discourage landfilling.*

In the area of construction and demolition waste, the Slovak Republic managed to meet the 2020 objective for reuse, recycling and recovery.

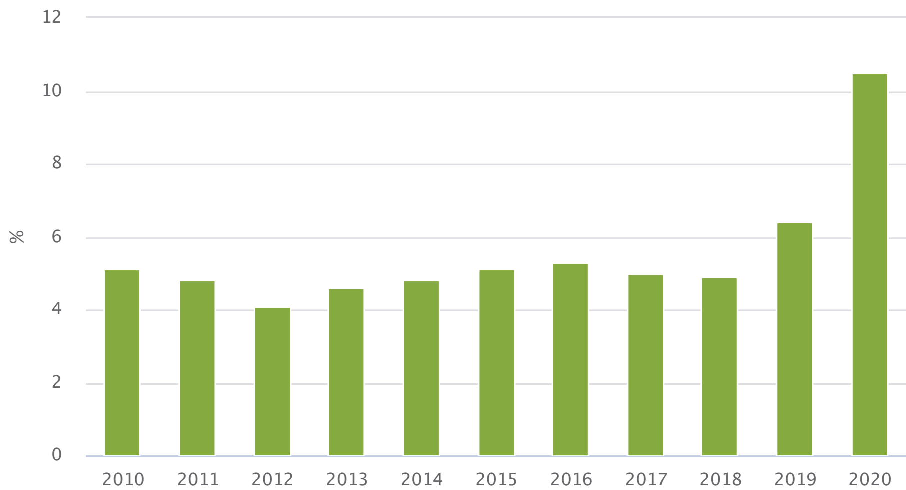
4.1.3 Secondary raw materials

4.1.3.1 Circular material use rate

One of the benefits we achieve by preventing waste is that a material or product that would normally become waste is reused or repaired. Whether recycled material is being fed back into the economy is evaluated by the indicator " circular material use rate ". Simply put, as the use of recycled materials increases, the need for extraction of primary raw materials decreases, thereby reducing the potential negative environmental impacts of extraction.

Thanks to better design, products can contain a significant amount of recycled materials and reusable components can be integrated into new products. The design of products and materials itself has a significant impact on the cost of subsequent steps to use waste as a resource and thus on the competitiveness of recycled materials compared to virgin materials.

Development of the circular material use rate



Note: Data for 2011, 2013, 2015, 2017 and 2019 are Eurostat estimates.
Source: Eurostat

For this indicator, data are only available from 2010 onwards. Between 2010 and 2019, the circular material use rate increased only slightly. A more significant increase was recorded between 2019 and 2020, when the circular material use rate increased by 4.1 percentage points. At the EU level, only a slight increase was recorded in the monitored period – from 11.2% in 2010 to 11.8% in 2020. No specific goals were set for this indicator by 2020. However, the EU has set a non-binding objective to double circular material use rate by 2030 (compared to 2020). The non-binding target for the circular material use rate in EU is thus 23.6% and for the Slovak Republic it is 21 %. Increasing of the circular material use rate can help us significantly in the successful transition towards a circular economy.

A non-binding objective for the circular material use rate set by the EU:

- Doubling the circular material use rate by 2030 (compared to 2020.

New EU action plan for a circular economy (2020)

Between 2010 and 2019, the circular material use rate increased only slightly. A more significant increase was recorded between 2019 and 2020. To reach the non-binding 2030 objective, the Slovak Republic needs to achieve an increase of 100% in 10 years.

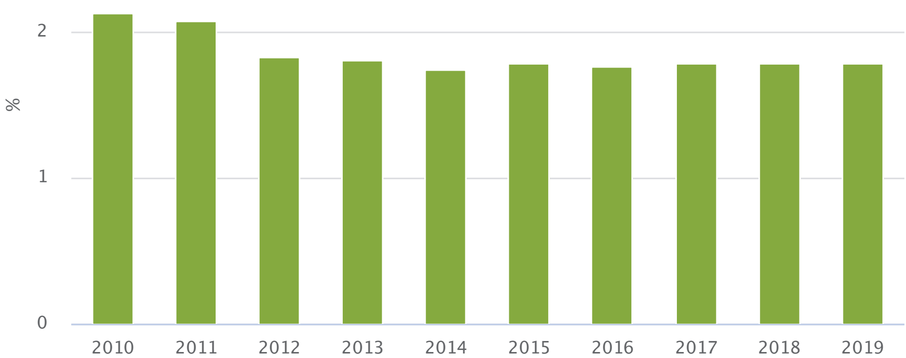
4.1.4 Competitiveness and innovations

4.1.4.1 Persons employed in circular economy sectors

One of the benefits of moving towards a circular economy is that, in addition to the environmental benefits it brings, it can be a source of new jobs and thus boost employment growth as well as the economy as a whole.

This indicator describes the percentage of jobs in the circular economy to total employment, focusing on two areas – the recycling sector and the repair and reuse sector.

Development of employment in the circular economy



Note: Unit used: % of total employment.
Source: Eurostat

Employment in the circular economy has been stagnating both in the Slovak Republic and the EU since 2010. This indicates that there are still not enough jobs at the EU and national levels in areas such as repair of electronic and optical equipment, repair of consumer electronics, waste collection, etc.

The highest ratio of employment in the circular economy to total employment in the Slovak Republic was reached in 2010 – 2.13%, followed by a decrease and stagnation. Long-term stagnation is also observed at the EU level. With no data available beyond 2019, it will be interesting to see whether employment in the circular economy will increase significantly following several initiatives at the EU level, such as the 2019 European Green Deal or the 2020 New Circular Economy Action Plan.

4.1.4.2 Green Public Procurement

Green Public Procurement (GPP) is one of the voluntary instruments of environmental policy that play an important role in the transition towards a circular economy. Other similar tools include environmental labeling of products or Eco-Management and Audit Scheme (EMAS).

In December 2016, the Resolution of the Government of the Slovak Republic no. 590 approved National Action Plan for Green Public Procurement in the Slovak Republic for the years 2016 – 2020 (hereinafter referred to as NAP GPP III). Monitoring GPP development is carried out annually based on two quantitative indicators, namely:

- Indicator 1: percentage share of GPP in total procurement in relation to the number of contracts per calendar year;
- Indicator 2: percentage share of GPP in total public procurement in relation to the value of executed contracts (in euros without VAT) per calendar year.

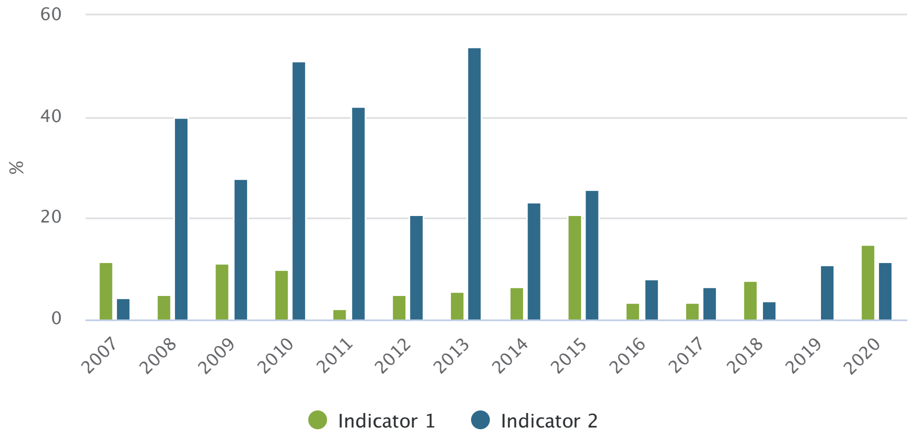
The strategic goal of NAP GPP III was to achieve a 50 % share of green procurement by state authorities in the total volume of contracts concluded by them for selected product groups. However, this goal was not achieved.

The objective of the Slovak Republic in the green public procurement:

- To achieve that the Slovak Republic provides at least 70% of the total value of public procurement and 70 % of total number of contracts of public procurement through green public procurement.

Envirostrategy 2030 (2019)

Development of application of green public procurement



Note: Indicator 1: percentage share of GPP in total procurement in relation to the number of contracts; Indicator 2: percentage share of GPP in total public procurement in relation to the value of executed contracts.
Source: Slovak Environmnent Agency

Despite improvements in recent years, the rate of green public procurement remains low. In doing so, it is possible to achieve both the efficient use of financial resources and the environmental protection.

4.1.5 Examples of best practices

Dozens of companies and non-governmental non-profit organizations operating in the territory of the Slovak Republic, as well as self-governments, bring all kinds of green solutions that are in line with the transition towards a circular economy. On the website https://zelene-hospodarstvo.enviroportal.sk/en, one may search for individual solutions, which are classified into seven categories: climate change adaptation, circular economy and sustainable use of resources, sustainable transport, energy efficiency, green buildings and housing, sustainable landscape management, sustainable bioeconomy. Examples of best practices in the area of circular economy:

- **Tritech, concrete using recyclate from construction and demolition waste – Považská cementáreň, a. s.** – https://zelene-hospodarstvo.enviroportal.sk/detail-en/3721

With TRITECH technology, construction waste is recycled into next-generation concrete instead of being disposed of by landfill. The technology is based on a detailed analysis of the properties of brick recyclate and recycled brick dust to have an internal activation in the concrete to improve the microstructure of the concrete, increasing long-term mechanical properties and chemical resistance. The patented TRITECH eco-technology was extensively confirmed by the Concrete Institute in Germany and special and ecotoxicological analyses at the Mining University in Ostrava, and the certification and final confirmation of the results were carried out by the Technical and Testing Institute of Construction Bratislava.

- **ERcuper® Water and ERcuper® Air – ENERGIA REAL, s. r. o.** – https://zelene-hospodarstvo.enviroportal.sk/detail-en/5961

The sewage heat recovery system (ERcuper® Water), developed and operated by ENERGIA REAL, consists of a collection tank at the foot of the building into which all sewage water from the building is collected through the sewage system. A set of heat exchangers is immersed in the collection tank, which forms the primary circuit of the heat pump. Sewage water represents a primary energy source that exactly replicates the power requirements for water heating, with the proviso that, in addition to meeting the energy requirements for hot water preparation, it generates an energy reserve of about 20%, which can be achieved by cooling the sewage water significantly (to a temperature below the temperature of cold drinking water) and using this energy source to facilitate heating.

The exhaust air heat recovery system (ERcuper® Air) uses the heat from the exhaust air from the roof ventilation of a building or apartment building. The system will use heat to prepare hot water or heat the building.

- **Smart waste management – SENSONEO j. s. a.** – https://zelene-hospodarstvo.enviroportal.sk/detail-en/2841

Sensoneo is changing the way waste is managed – providing intelligent, enterprise-level waste management solutions that support the digital transformation of waste management to achieve efficiency, transparency, and sustainability. The solution combines ultrasonic sensors that monitor waste with intelligent software for data display and evaluation – predicting container fullness, evaluating collection efficiency, automating the planning of optimal collection routes, and other functions. We let cities and companies make strategic decisions based on real data and optimize waste collection logistics. Sensoneo has been proven to reduce the cost of waste collection, while also reducing emissions in cities.

References

1. BARTEKOVÁ Eva, 2020. Organisation for Economic Co-operation and Development. Technical support for the preparation of circular economy roadmap for the Slovak Republic, Activity 1.2 Analysis of national circular economy roadmaps and strategies across selected EU Member States, Final background report (November 2020)
2. Ellen MacArthur Foundation [online].
Available on: https://ellenmacarthurfoundation.org/
3. European Environment Agency. The European environment — state and outlook 2020 Knowledge for transition to a sustainable Europe [online]. Copenhagen: EEA, 2019. ISBN 978-92-9480-090-9.
Available on: https://www.eea.europa.eu/soer/publications/soer-2020
4. GUŠTAFÍKOVÁ Tatiana, KOSTÚRIKOVÁ Alena, LIESKOVSKÁ Zuzana, 2019 [online]. Circular Economy – Future of the Development of Slovakia.
Slovak Environment Agency. ISBN: 978-80-8213-001-3, 2019. Available on: https://www.enviroportal.sk/uploads/report/9202.pdf **[Bilingual version]**
5. Ministry of environment of the Slovak republic . Slovak Environment Agency. Information Platform Green Economy [online].
Available on: https://zelene-hospodarstvo.enviroportal.sk/en
6. Ministerstvo životného prostredia SR. Slovenská agentúra životného prostredia. Kľúčové indikátory [online]. Available on: https://www.enviroportal.sk/indicator/129?langversion=sk **[Slovak version]**
7. Ministerstvo životného prostredia SR. Slovenská agentúra životného prostredia. Kľúčové indikátory [online]. Available on: https://www.enviroportal.sk/indicator/128?langversion=sk **[Slovak version]**
8. Ministerstvo životného prostredia SR. Slovenská agentúra životného prostredia. Sektorové indikátory [online]. Available on: https://www.enviroportal.sk/indicator/123?langversion=sk **[Slovak version]**
9. Ministerstvo životného prostredia SR. Slovenská agentúra životného prostredia. Indikátory zeleného rastu [online]. Available on: https://www.enviroportal.sk/indicator/111?langversion=sk **[Slovak version]**
10. Ministerstvo životného prostredia SR. Slovenská agentúra životného prostredia. Indikátory obehového hospodárstva [online]. Available on: https://www.enviroportal.sk/indicator/321?langversion=sk **[Slovak version]**

11. Ministerstvo životného prostredia SR. Program predchádzania vzniku odpadu SR na roky 2014 – 2018 [online]. Bratislava: MŽP SR, 2013. Available on: https://www.minzp.sk/odpady/program-predchadzania-vzniku-odpadu/ **[Slovak version]**

12. Ministerstvo životného prostredia SR. Program predchádzania vzniku odpadu Slovenskej republiky na roky 2019 – 2025 [online]. Bratislava: MŽP SR, 2018. Available on: https://www.minzp.sk/odpady/program-predchadzania-vzniku-odpadu/ **[Slovak version]**

13. Ministry of environment of the Slovak republic. Waste Management Programme of the Slovak Republic for 2016 – 2020 [online]. Bratislava: MOE SR, 2015. Available on: https://www.minzp.sk/odpady/poh/poh-sr-2016-2020/

14. Ministerstvo životného prostredia SR. Program odpadového hospodárstva SR na roky 2021 – 2025 [online]. Bratislava: MŽP SR, 2021. Available on: https://www.enviroportal.sk/odpady/program-odpadoveho-hospodarstva-slovenskej-republiky-2021-2025 **[Slovak version]**

15. Ministry of environment of the Slovak republic. Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) [online]. Bratislava, 2019. Available on: https://www.minzp.sk/files/iep/greener_slovakia-strategy_of_the_environmental_policy_of_the_slovak_republic_until_2030.pdf

16. MONTI Norbert, 2021. Organisation for Economic Co-operation and Development. Technical support for the preparation of circular economy roadmap for the Slovak Republic, Activity 1.3 Socio-economic and circular economy-related past trends and current developments in the Slovak Republic, Final Background Report (April 2021)

17. Organisation for Economic Co-operation and Development, 2022 [online]. Closing the loop in the Slovak republic, A roadmap towards circularity for competitiveness, eco-innovation and sustainability. Available on: https://www.oecd-ilibrary.org/environment/closing-the-loop-in-the-slovak-republic_acadd43a-en

18. Organisation for Economic Co-operation and Development, 2022 [online]. OECD.stat. Available on: https://stats.oecd.org/index.aspx?queryid=61433

19. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Closing the loop – An EU action plan for the Circular Economy (COM/2015/614 final)

20. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal (COM/2019/640 final)

21. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A new Circular Economy Action Plan For a cleaner and more competitive Europe (COM/2020/98 final)

22. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability (COM/2020/474 final)

23. Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030

24. SVATIKOVA, Katarina, 2021. Organisation for Economic Co-operation and Development. Technical support for the preparation of circular economy roadmap for the Slovak Republic, Activity 1.2 Stocktake of Slovak policy landscape relevant to the circular economy, Final Background Report (April 2021)

25. Štatistický úrad SR. Odpady v Slovenskej republike 2010 – 2015 [online]. Bratislava: ŠÚ SR, 2011 – 2016. Available on: https://slovak.statistics.sk/wps/portal/ext/products/publikacie/!ut/p/z1 **[Slovak version]**

26. Štatistický úrad SR. Odpady v Slovenskej republike za roky 2016 – 2020 [online]. Bratislava: ŠÚ SR, 2017 – 2021. Available on: https://slovak.statistics.sk/wps/portal/ext/products/publikacie/!ut/p/z1 **[Slovak version]**

27. Úrad vlády Slovenskej republiky. Programové vyhlásenie vlády SR na roky 2021 – 2024 [online]. Available on: https://rokovania.gov.sk/RVL/Material/25943/1 **[Slovak version]**

28. WAUTELET Thibaut, 2018 [online]. The Concept of Circular Economy: its Origins and its Evolution. Available on: https://www.researchgate.net/publication/322555840_The_Concept_of_Circular_Economy_its_Origins_and_its_Evolution

4.2 How does development in the evaluated sectors support the transition to a low-carbon economy in Slovakia?

Summary assessment of the development of the Slovak economy towards a low-carbon economy

Is the Slovak Republic moving towards a low-carbon economy?

The total GHG emissions (excluding LULUCF) decreased significantly year-on-year, mainly due to the decrease in the energy and industry sectors. As a percentage, this is a 7% decrease compared to 2019 and almost a 50% decrease compared to the 1990 baseline year.

Between 2005 and 2020, the greenhouse gas emissions in the ETS sectors decreased by 28%.

The non-ETS sectors managed to reduce emissions by 18.4% in 2020 compared to 2005. For the first time since 2008, the percentage of emissions produced in the ETS sectors was lower than the percentage of emissions produced outside the ETS sectors

Are sectors moving towards a low-carbon economy?

The trend in the energy sector is significantly decreasing. From 1990 to 2020, the greenhouse gas emissions in the energy sector fell by up to 64.5%, down from 38.5% in 2005.

The second most significant decrease of up to 56.9% is observed in the agricultural sector, and this is due to the reduction in production since 1990. The trend has been only slightly decreasing in recent years, and since 2005 it has been 5.4%.

In the long term (1990 – 2020), the greenhouse gas emissions in the transport sector increased slightly by 3.6%, but in the medium term (2005 – 2020) they decreased by 8.2%.

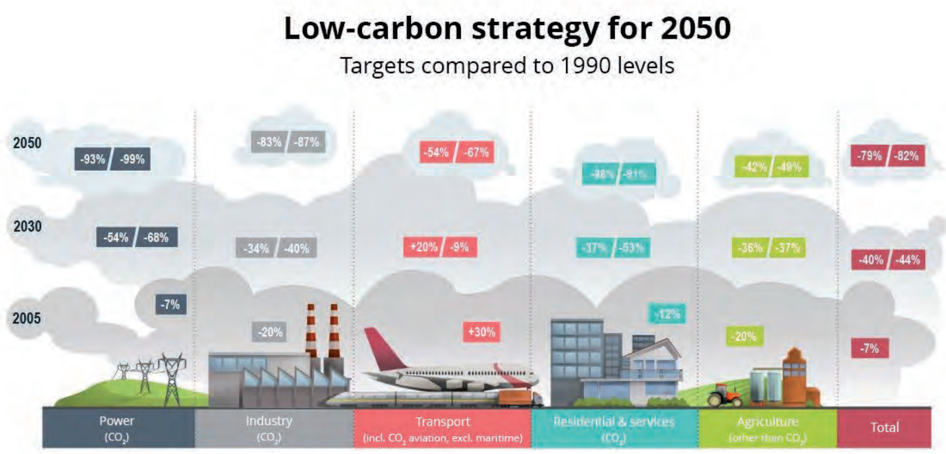
Emissions from industrial processes and product use decreased by 16.2% from the 1990 reference year to 2020. Since 2005, the decline has been 19.4%.

Emissions of the waste sector increased by less than 20% between 1990 and 2020, and the trend since 2005 has also been increasing, with an increase of 15.6%.

The Kyoto Protocol (KP) was adopted as one of the most important international legal tools to address climate change. It contained a commitment of the industrialized countries to reduce emissions of those greenhouse gases that cause global warming. The total emissions were to be reduced by at least 5% over the period 2008 – 2012 compared to 1990 levels. In December 2012, an amendment to the Kyoto Protocol was approved in Doha, Qatar, which decided on the continuation of the Protocol and established the second commitment period of eight years (2013 – 2020). The reduction commitments of the EU and Member States (including the Slovak Republic) for the second KP period were the same as the adopted 2020 emission reduction objectives under the climate and energy package, i.e. a 20% reduction in greenhouse gas emissions compared to 1990 levels.

Climate change and the urgent need to reduce greenhouse gas emissions, including the transformation of EU Member States' economies to a low-carbon competitive economy, as well as the need to implement adaptation measures to the adverse effects of climate change, are among the political priorities of the European Union. For this reason, a separate Directorate-General for Climate Action (DG CLIMA) was created within the European Commission in February 2010. In 2013, the European Commission published the EU Climate Change Adaptation Strategy together with several accompanying documents. The Strategy set out a framework and mechanisms to enhance the preparedness of the EU and to improve the coordination of adaptation activities. At the same time, it represents a long-term strategy to increase the resilience of the EU to the adverse impacts of climate change at all levels and in line with the Europe 2020 objectives. It is based on the view that innovative solutions are needed to mobilize investment in energy, transport, industry and information and communication technologies, and that greater emphasis needs to be placed on energy efficiency policies. The Europe 2020 strategy for smart, sustainable and inclusive growth set out five headline targets to position Europe for 2020.

Low-carbon strategy for 2050



Source: European Commission

The Paris Agreement, adopted at the Conference of the Parties to the Convention in 2015, recognized, for the first time, the obligation to prepare not only mitigation but also adaptation measures. In the effort to improve collective action at the global level towards the transition to a low-carbon society and to limit global temperature rise to no more than 2°C by the end of the century, and possibly well below that (1.5°C), this Agreement is considered a milestone in the climate negotiations. The global adaptation objective defined in Article 7 is about increasing adaptive capacity, building resilience and reducing vulnerability to climate change with the aim to contribute to sustainable development and to ensure an adequate adaptive response in the context of the temperature objective.

In December 2019, the European Commission presented its detailed plan of key policies and actions to achieve climate neutrality, called the European Green Deal. This is the plan of the European Commission for a green transformation of the EU economy for sustainable future.

The main objective of the European Green Deal is to make Europe the first ever climate-neutral continent by 2050, with the aim of reducing greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. The main objective of the European Green Deal is to make Europe the first ever climate-neutral continent by 2050, i.e. that net greenhouse gas emissions produced by EU Member States are zero. The Agreement sets an interim objective to reduce greenhouse gas emissions by at least 35% by 2030. To achieve this, the EU has adopted a series of proposals in the areas of climate, energy, transport and taxation.

In the Slovak Republic, in addition to the adoption of the Environmental Strategy 2030 (2019) which defines the objectives for reducing greenhouse gas emissions in the Slovak Republic by 2030, it was approved by the Slovak Government in 2020 and submitted to the European Commission and the UNFCCC.

Low-Carbon Development Strategy of the Slovak Republic until 2030 with a view to 2050. It did not set more stringent objectives for greenhouse gas emission reduction, but only confirmed the more stringent objectives adopted in the 2030 Environment Strategy.

Binding objectives of the Slovak Republic for a low-carbon economy

- Reduction of greenhouse gas emissions by at least 40% compared to 1990
- Reduction of greenhouse gas emissions in the ETS sector by 43% compared to 2005
- Reduction of greenhouse gas emissions outside the ETS sector by at least 12% (20%) compared to 2005

Low-Carbon Development Strategy of the Slovak Republic until 2030, with a view to 2050 (2020)

- Reduction of greenhouse gas emissions outside the ETS sector by at least 20% compared to 2005

Greener Slovakia Strategy for the Environmental Policy of the Slovak Republic until 2030 (2019)

4.2.1 Development of greenhouse gas emissions

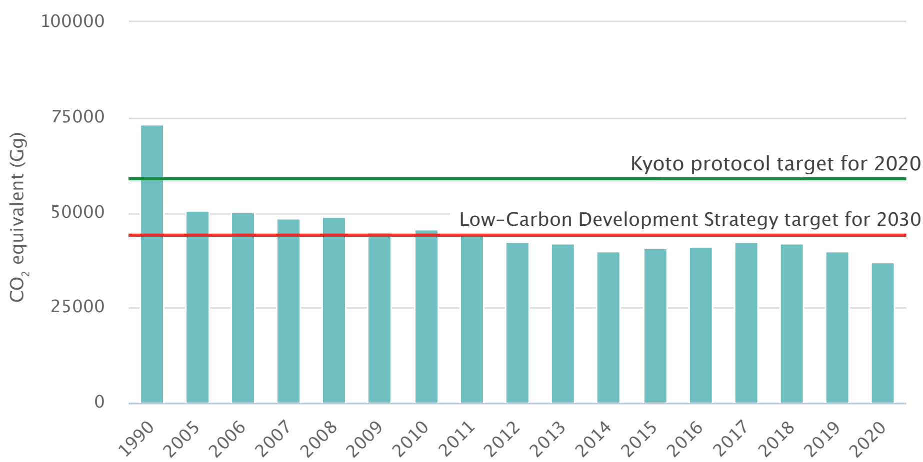
Greenhouse gas emissions in 2020 were the lowest ever since 1990. This trend was driven by a year-on-year decline in emissions due to the COVID-19 pandemic (14%).

The total anthropogenic greenhouse gas emissions for 2020 amounted to 37,002.71 Gg CO_2 equivalents, not including the removals from the LULUCF sector and not including the indirect emissions from industrial solvents and agriculture. The total greenhouse gas emissions including the removals from LULUCF fell to 28,256.1 Gg CO_2 equivalents. As a percentage, this is a 14% decrease compared to 2019 and almost a 50% decrease compared to the 1990 baseline year. The total GHG emissions decreased significantly year-on-year, mainly due to the decrease in the energy and industry sectors.

Greenhouse gas emissions in 2020 have been at their lowest level since 1990. This significant decrease was caused by the COVID-19 pandemic, the reconstruction of a blast furnace at the U.S. Steel, a. s. and the phasing out of fossil fuels at Slovenské elektrárne, a. s. (ENO and EVO). This can be seen in the distribution of the share of individual activities in the overall decrease of emissions. The most significant contributors were manufacturing, road transport, steel and iron production, production of mineral products (related to the decline of the construction industry) and electricity and heat production.

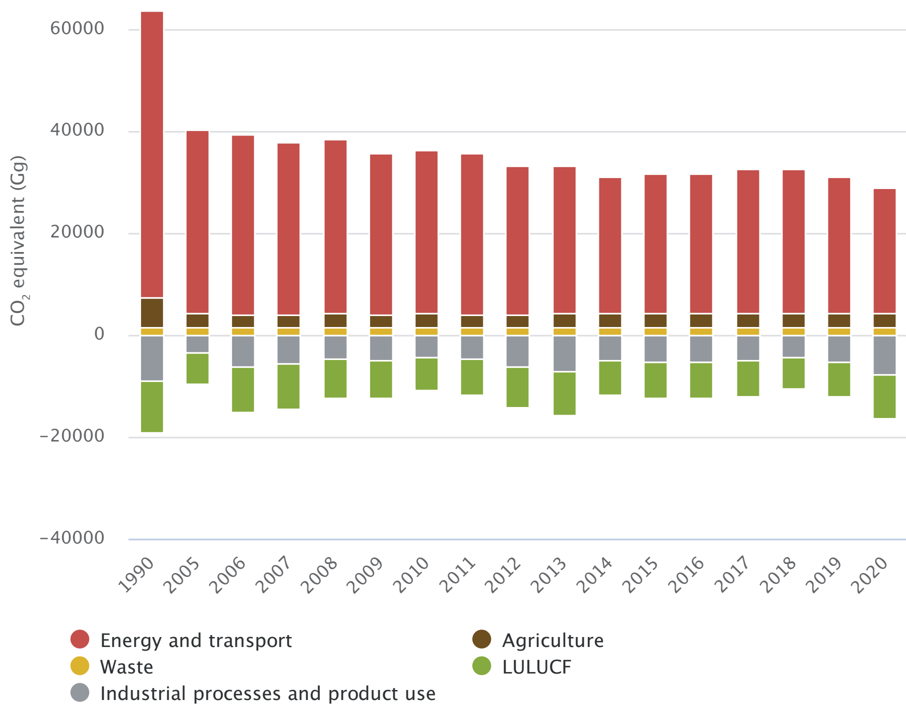
More detailed information in the chapters 3.1.2.4., 3.2.2.2 and 3.3.2.2

Development of greenhouse gas emissions in connection with fullfilment of Kyoto protocol targets



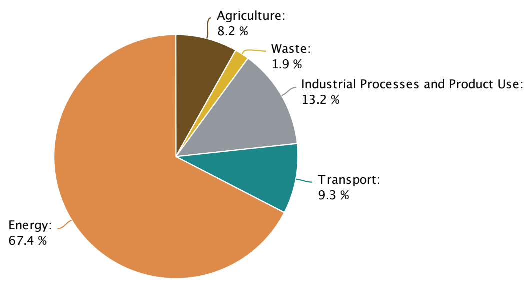
Note: Emissions without LULUCF determined as at 15 April 2022
Source: SHMI

Development in aggregated GHG emissions by sectors



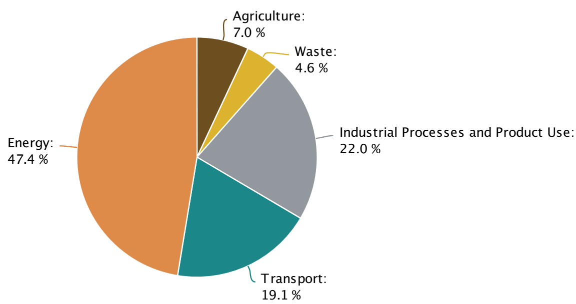
Note: Emissions determined as at 15.4.2022
Source: SHMI

Share of individual sectors in GHG emissions 1990



Note: Emissions determined as at 15. 4. 2022
Source: SHMI

Share of individual sectors in GHG emissions 2020



Note: Emissions determined as at 15. 4. 2022
Source: SHMI

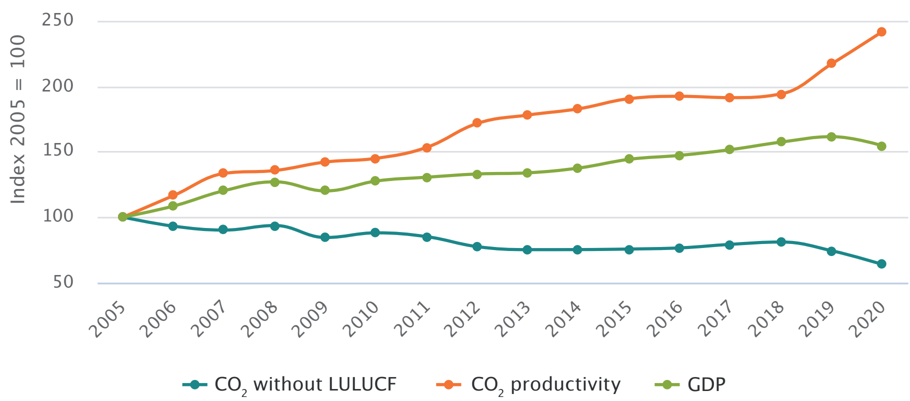
The shares of individual sectors in the total greenhouse gas emissions have not changed significantly compared to the 1990 baseline year. Nevertheless, there has been a noticeable increase in transport emissions in the trend since 1990 and a decrease in the share of stationary sources of pollution in the energy sector. The most significant anthropogenic source of CO_2 emissions is the combustion of fossil fuels, which accounts for about 76% of the total CO_2 emissions in the Slovak Republic (excluding LULUCF). .

4.2.2 CO_2 productivity

Carbon productivity defines a mutual dependency between carbon and climatic cycles with connection to the environmental and economic effectiveness as the result of policies promoting low-carbon and cleaner technologies while exploiting energy resources. The main objective is to limit CO_2 emissions and other greenhouse gases emissions, and stabilize greenhouse gases atmospheric concentrations to the level that would limit their negative impact on the climatic system.

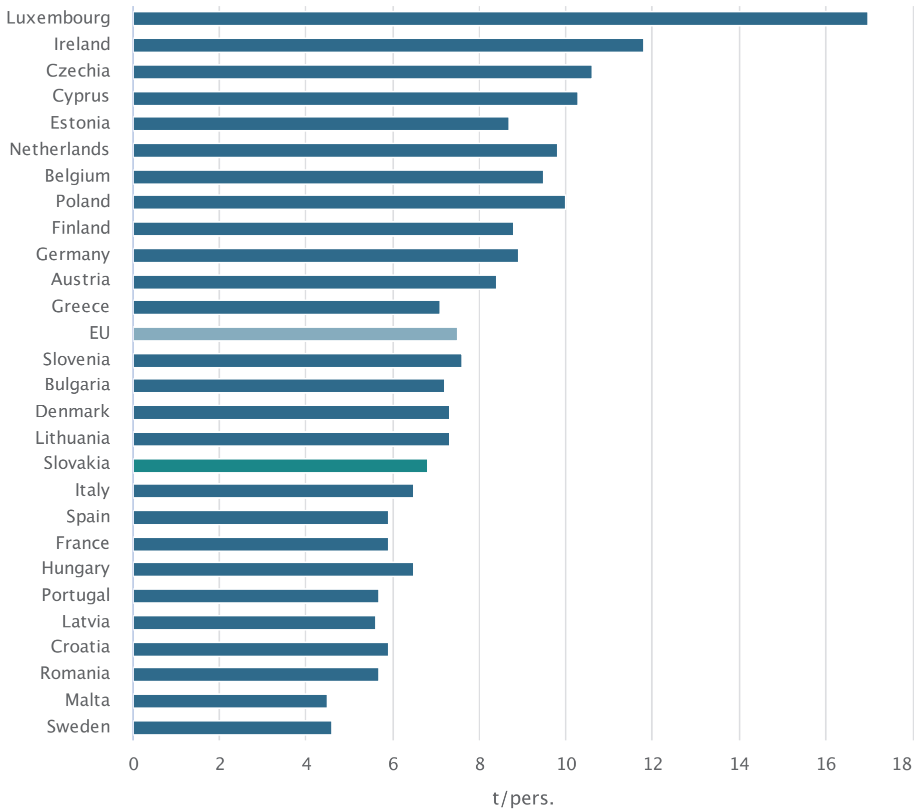
In 2020, CO_2 emissions fell by 36.2% compared to 2005, while GDP increased by 54%. As CO_2 emissions are decreasing while gross domestic product is increasing, we can speak of absolute decoupling, which is a positive trend.

CO_2 productivity



Note: LULUCF – Land use, land use change and forestry, emissions determined as at 15.4.2022, GDP in constant prices, reference year 2015.
Source: SHMI, SO SR

International comparison of GHG emissions (CO_2 equivalent) per capita in 2020



Source: Eurostat

4.2.3 European Emissions Trading System

The European Emissions Trading Scheme (EU ETS) is the key tool of the EU for reducing greenhouse gas emissions from large installations in the energy and industrial sectors, as well as in the aviation sector.

The EU ETS covers the following sectors:

- carbon dioxide (CO_2) from electricity and heat production, energy-intensive industries including oil refineries, steel mills, and the production of iron, aluminum, metals, cement, lime, glass, ceramics, pulp, paper, paperboard, acids, and bulk organic material chemicals;
- commercial aviation within the European Economic Area;

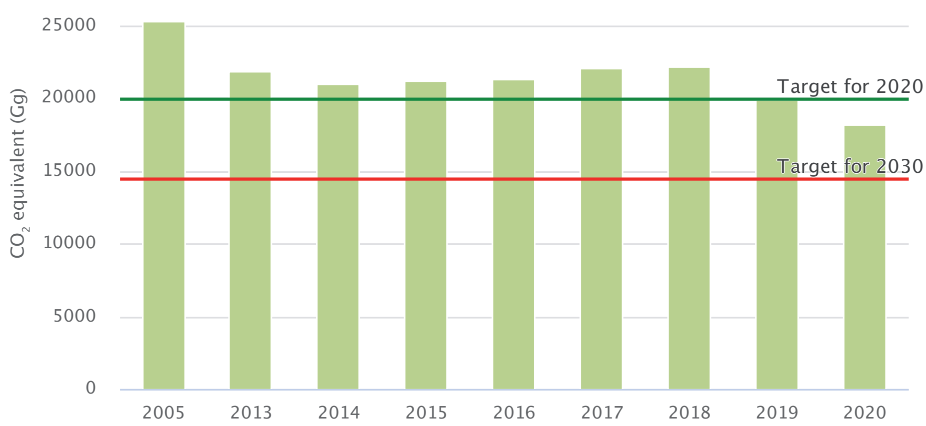
- nitrous oxide (N_2O) from the production of nitric acid, adipic acid, glyoxylic acid and glyoxal;
- perfluorocarbons (PFCs) from aluminum production.

The participation in the EU ETS is mandatory for companies in these sectors, but in some sectors only installations above a certain size are covered. Certain small installations may be excluded if fiscal or other measures are in place to reduce their emissions by an equivalent amount.

The EU ETS covers around 45% of the greenhouse gas emissions of the EU. The EU ETS is based on Directive No. 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading, which was amended by Directive No. 2009/29/EC to improve and extend the Community scheme for greenhouse gas emission allowance trading.

The current ETS legislation was revised in 2018 with the aim of achieving a 43% reduction in EU ETS emissions by 2030 compared to 2005, in line with the EU economy-wide objective of at least a 40% reduction in emissions by 2030 compared to 1990. However, a recent analysis by the Commission services shows that, if the legislation remains unchanged, the sectors currently covered by the EU ETS would instead achieve a 51% reduction in emissions in 2030 compared to 2005. However, we must not forget the effect of the effective policies and measures implemented recently in the field of climate change.

Development of GHG emissions in ETS sectors

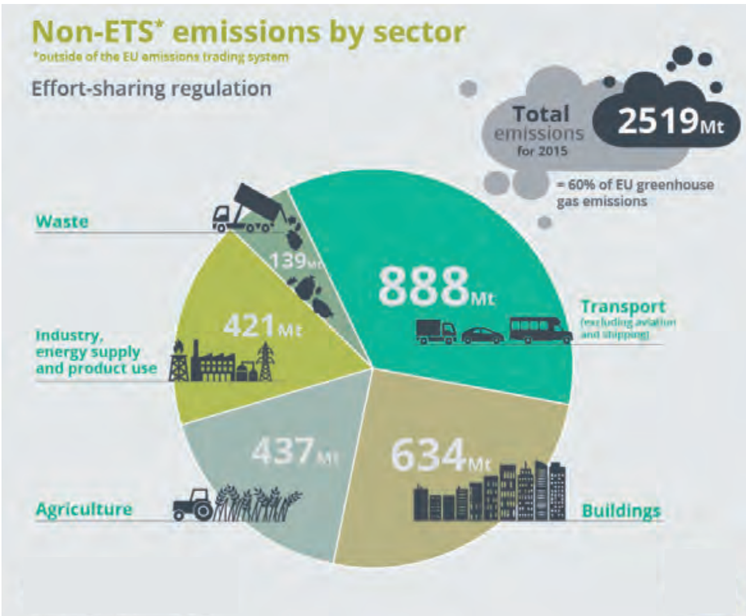


Note: Emissions determined as at 15.4.2022
Source: SHMI

Between 2005 and 2020, the greenhouse gas emissions in the ETS sectors decreased by 28%.

In 2020, emissions from the ETS sectors were lower as a percentage of GDP than emissions from the non-ETS sectors, this has happened for the first time since 2008.

The Effort Sharing Decision (ESD) sets binding annual greenhouse gas emission objectives for the Member States for the periods 2013 – 2020 and 2021 – 2030. These objectives cover emissions from most sectors not covered by the EU Emissions Trading Scheme, such as transport, buildings, non-ETS industry, agriculture and waste.

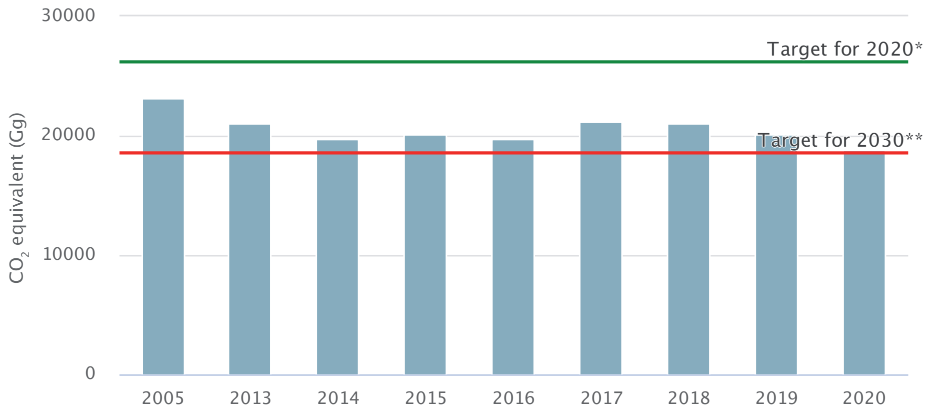


All numbers are in megatons.
Source: EEA

The Effort Sharing legislation forms part of a set of climate change and energy policies and measures that will help move Europe towards a low-carbon economy and increase its energy security.

Together with a 21% reduction in emissions covered by the EU ETS by 2020 and 43% by 2030, this will enable the EU to meet its 2020 and 2030 climate objectives.

Development of GHG emissions in non-ETS sectors



Note: Emissions determined at 15.4.2022 * Target according to Decision of the European Parliament and of the Council no. 406/2009 / EC on the Joint Effort (ECJ) ** Ambitious national targer 2030.
Source: SHMI

Sectors not covered by the EU ETS are covered by Decision No. 406/2009/EC of the European Parliament and of the Council on the Effort Sharing Directive (ESD). By 2020, Slovakia can increase its greenhouse gas emissions in these sectors by 13% compared to their 2005 level, which corresponded to a specific amount of annually allocated emission allowances (the so-called AEA units). However, Slovakia still managed to reduce them by 18.4% in 2020.

4.2.4 *Examples of good practise*

Dozens of companies and non-governmental non-profit organizations that operate in the territory of the Slovak Republic, as well as local governments, bring a variety of green solutions that are in line with the transition to a circular economy. On the website https://zelene-hospodarstvo.enviroportal.sk/ it is possible to find individual solutions, which are included in seven categories: adaptation to climate change, circular economy and sustainable use of resources, sustainable transport, energy efficiency, green buildings and housing, sustainable land management, sustainable bioeconomy. Examples of good practice in the field of low-carbon economy:

- Krtkodom – a self-sufficient "green" house – https://zelene-hospodarstvo.enviroportal.sk/detail/3601

„Krtkodom“ is a project of an energy-passive family house in which nature provides smart solutions. The earth-protected house represents a luxurious combination of nature and a well-thought-out building system. It is an effective low-carbon ecological housing solution with maximum use of natural resources. „Krtkodom“ will not overheat, hypothermia, blow off the roof or flood it with water. It does not need air conditioning in the summer, nor huge heating costs in the winter. It is an ideal solution for sloping plots with a wonderful view. „Krtkodom“ keeps a stable temperature between 18°C and 24°C without heating. The house offers healthy, ecological, sustainable housing that significantly saves resources and costs.

- Street Lighting Management via power line – https://zelene-hospodarstvo.enviroportal.sk/detail/1981

Using this technology, the municipality can remotely control the lighting by groups, configure it anywhere and anytime with one click in a simple application, set dimming schedules. The system enables transparent communication with sensors (motion, pollution, noise, etc.) and other devices within the IoT platform through existing power lines. Thanks to this technology, it is possible to fully utilize the transmission capacity of the existing electrical cabling for public lighting and for charging electric cars.

- Utilization of geothermal energy for power production with the possibility to utilize residual heat – https://zelene-hospodarstvo.enviroportal.sk/detail/5461

After the completion of the geological survey and the administrative preparation of the assignment, in March 2021, the company PW Energy has introduced the project for the utilization of geothermal energy for power production within two geothermal centers in the Žiar nad Hronom region, and has recently introduced a second project of such a kind in the region of Prešov. Geothermal energy from wells is used for the production of electricity and heat. Green energy is generated for households and industries, producing no burden for the environment.

References

1. Ministry of Environment of the Slovak Republic, Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050, [online]. 2020. Available on: https://www.minzp.sk/files/oblasti/politika-zmeny-klimy/nus-sr-do-roku-2030-finalna-verzia.pdf **[Slovak version]**
2. Ministerstvo životného prostredia SR, Správa o stave životného prostredia v SR v roku 2020, [online]. 2021. Available on: https://www.enviroportal.sk/spravy/detail/11203 **[Slovak version]**
3. Ministry of Environment of the Slovak Republic, Integrated National Energy and Climate Plan for 2021 to 2030, Available on: https://energy.ec.europa.eu/system/files/2020-03/sk_final_necp_main_en_0.pdf
4. OECD, OECD – Press release [online]. 2013. https://www.oecd.org/env/the-climate-challenge-achieving-zero-emissions.htm
5. Euractiv, Press release [online]. 2020. https://euractiv.sk/section/klima/news/ako-slovensko-dosiahne-uhlikovu-neutralitu-nova-strategia-ma-navrhy-ale-stare-cisla/ **[Slovak version]**
6. Ministry of Environment of the Slovak Republic, A low-carbon growth study for Slovakia: Implementing the EU 2030 climate and energy policy framework, [online]. 2019. Available on: https://www.minzp.sk/files/oblasti/politika-zmeny-klimy/2019_01_low-carbon-study.pdf
7. Slovenský hydrometeorologický ústav, Správa o emisiách 2022, [online]. 2022. Available on: https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=107&cmsDataID=0 **[Slovak version]**
8. Slovak Hydrometeorological Institute, Report on Emission projection Re-submission according to the Article 18 (1) (b) of the Regulation (EU) 2018/1999 [online]. 2021, Available on: https://oeab.shmu.sk/app/cmsSiteBoxAttachment.php?ID=8&cmsDataID=0
9. Ministry of Environment of the Slovak Republic, Slovak Environment Agency, Key indicators [online]. Available on: https://www.enviroportal.sk/indicator/detail?id=1745
10. European commission, European commission – Climate action [online]. 2021. Available on: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en
11. MacroTrends, European Union Economic Growth 1970 – 2022 – database, [online]. 2022. Available on: https://www.macrotrends.net/countries/EUU/european-union/economic-growth-rate

5. List of used abbreviations

AEA	Annual emission allocations
BEV	Fully electric vehicles
BECEP	Road Safety Enhancement Strategy
CCTIA	Central Control and Testing Institute in Agriculture
CLC	Corine Land Cover
CNFM	Close-to-nature forest management
CNG	Compressed Natural Gas
DG CLIMA	Directorate-General for Climate Action
E	Environment
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EDW	Extraordinary Deterioration of Water
EEA	European Environment Agency
EI	Energy Intensity
EMAS	Eco-Management and Audit Scheme
ENO	Nováky Power Plant
ESD	Effort Sharing Decision
EU ETS	European Union Emission Trading Scheme
EU	European Union
EUROSTAT	Statistical Office of the European Communities
EVO	Vojany Power Plant
FCL	Forest crop land
FEC	Final energy consumption
FSC	International non-profit-making organisation (Forest Stewardship Council)
GCCA SR	Geodesy, Cartography and Cadastre Authority of the Slovak Republic
GDP	Gross domestic product
GIC	Gross inland consumption
GPP	Green Public Procurement
IEP	Institute for Environmental Policy
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IPI	Industrial production index
kg	Kilogram
KP	Kyoto protocol
L_{night}	Noise indicators sleep disturbance
LPG	Liquefied petroleum gas
LPIS	Land Parcel Identification System

LULUCF	Sector of land use, land use change and forestry
MARD SR	Ministry of Agriculture and Rural Development of the Slovak Republic
MoE SR	Ministry of Environment of the Slovak Republic
MoI SR	Ministry of Interior of the Slovak Republic
MJ	Megajoule
MoToC SR	Ministry of Transport and Construction of the Slovak Republic
MW	Municipal waste
NAP	Natioanl action plan
NC SR	National Council of the Slovak Republic
NFC	National Forest Centre
NMVOC	Non-methane volatile organic substances
NPP	Nuclear power plant
NPP EBO	Nuclear power plants Jaslovské Bohunice
NPP EMO	Nuclear power plants Mochovce
OECD	Organisation for Economic Co-operation and Development
PA	Protected area
PAH	Polycyclic aromatic hydrocarbons
p.p.	Percentage point
PCB	Polychlorinated biphenyls
PEFC	Programme for the Endorsement of Forest Certification schemes
PES	Primary energy sources
PFC	Perfluorinated Compounds
PHEV	Plug-in hybrid
POPs	Persistent organic pollutants
PPS	Purchasing power stadard
RDP SR	Rural Development Programme of the Slovak Republic
RES	Renewable energy sources
SCI	Sites of Community interest
SEA	Slovak Environment Agency
SE, a.s.	Slovenské elektrárne, joint-stock company (Slovak Power Stations)
SHMI	Slovak Hydrometeorological Institute
SK NACE	New Classification of Economic Activities
SO SR	Statistical Office of the Slovak Republic
SPA	Special protection areas
SR	Slovak Republic
SS	Spring stock
SSPA	(the so-called) Small-size protected area
TEN-T	Trans-European Transport Network
TEM	Trans-European Highway
UNFCCC	United Nations Framework Convention on Climate Change

ÚRSO	Regulatory Office for Network Industries
WTEP	Waste to Energy Plant
ZSSK	Železničná spoločnosť Slovensko, a. s.
ŽSR	Railways of the Slovak Republic

6. Annex

European and national strategic documents

Manufacturing

Strategic documents at the EU level

Strategies

A hydrogen strategy for a climate-neutral Europe (2020)
A New Industrial Strategy for Europe (2020)
Investing in a smart, innovative and sustainable Industry A renewed EU Industrial Policy Strategy (2017)
A European strategy for micro- and nanoelectronic components and systems (2013)
"Preparing for our future: Developing a common strategy for key enabling technologies in the EU" (2009)

Concepts

Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing – towards amore integrated approach for industrial policy (2005)

Programs

General Union Environment Action Programme to 2030 (2022)
Proposal for a new European Consensus on Development Our World, our Dignity, our Future (2016)
Next steps for a sustainable European future European action for sustainability (2016)
Towards a circular economy: A zero waste programme for Europe (2014)
For a European Industrial Renaissance (2014)
Industrial Policy: Reinforcing competitiveness (2011)
An integrated industrial policy for the globalisation era (2010)
Directive of the European parliament and of the council on industrial emissions (integrated pollution prevention and control) (2007)
A lead market initiative for Europe (2007)

Plans

EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' (2021)
Action Plan for a competitive and sustainable steel industry in Europe (2013)
Roadmap to a Resource Efficient Europe (2011)
Sustainable Consumption and Production and Sustainable Industrial Policy (2008)
Stimulating Technologies for Sustainable Development: An Environmental Technologies (2004)

Other

European Green Deal (2019)

A Stronger European Industry for Growth and Economic Recovery – Industrial Policy Communication Update (2012)

Mid-term review of industrial policy A contribution to the EU's Growth and Jobs Strategy (2007)

Strategic documents at the SR level

Strategies

Vision and Strategy for the Development of Slovakia until 2030 – Long-term Strategy for the Sustainable Development of the Slovak Republic – Slovakia 2030 (202) (Slovak version)

Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050 (2020)

Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)

Climate Change Adaptation Strategy of the Slovak Republic – update (2018) (Slovak version)

Strategy of the economic policy of the Slovak Republic until 2030 (2018) (Slovak version)

Draft procedure for the national implementation of the 2030 Agenda (2017) (Slovak version)

Concepts

Concept of intelligent industry for Slovakia (2016) (Slovak version)

Plans

Action plan for wetlands for the years 2022 – 2024 for the updated- Wetland Care Programs of Slovakia until 2024 (2022) (Slovak version)

Water Plan of the Slovak Republic for 2022 – 2027 (2022) (Slovak version)

Recovery and Resilience Plan of the Slovak Republic (2021) (Slovak version)

Common Agricultural Policy Strategic Plan 2023 – 2027 (2022) (Slovak version)

Action plan for a competitive and sustainable steel industry in Slovakia (2014) (Slovak version)

Other

Program statement of the Government of the Slovak Republic for the years 2021 – 2024 (2021) (Slovak version)

Energy

Strategic documents at the EU level

Strategies

Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change (2021)
Powering a climate-neutral economy: An EU Strategy for Energy System Integration (2020)
A hydrogen strategy for a climate-neutral Europe (2020)
EU strategy for liquefied natural gas and gas storage (2016)
An EU Strategy on Heating and Cooling (2016)
A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (2015)
European Energy Security Strategy (2014)

Programs

General Union Environment Action Programme to 2030 (2022)
Proposal for a new European Consensus on Development Our World, our Dignity, our Future (2016)

Plans

REPowerEU Plan (2022)
EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' (2021)
Energy Roadmap 2050 (2011)
A Roadmap for moving to a competitive low carbon economy in 2050 (2011)

Other

Fit for 55 (2021)
European Climate Law (2020)
The European Green Deal (2019)
Regulation (EU) 2018/1999 of the European Parliament and of the council of 11 December 2018 on the Governance of the Energy Union and Climate Action (2018)
Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU A framework for energy labelling and repealing Directive 2010/30/EU (2017)
Clean Energy For All Europeans (2016)

Strategic documents at the SR level

Strategies

National Hydrogen Strategy: Ready for the Future (2021)

Vision and Strategy for the Development of Slovakia until 2030 – Long-term Strategy for the Sustaina-ble Development of the Slovak Republic – Slovakia 2030 (2020) (Slovak version)
Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050 (2020)
Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)
Strategy of Electromobility Development in the Slovak Republic and its Effect on National Economy of the Slovak Republic (2015) (Slovak version)
Strategy of final stage of peaceful use of nuclear energy (2014) (Slovak version)
Strategy for Further Development of Nuclear Safety (2008) (Slovak version)

Concepts
Updated Concept of Utilizing the Hydropower Potential in Slovakia till 2030 (2016) (Slovak version)
Concept of Development of Electricity Generation from Small Renewable Energy Sources in Slovakia (2013) (Slovak version)
The concept of using renewable energy sources (2003) (Slovak version)

Programs
Rural Development Programme of SR 2014 – 2020 (2014) (Slovak version)
Integrated regional operational programme 2014 – 2020 (2014)
Operational Programme Quality of Environment (2014)

Plans
Common Agricultural Policy Strategic Plan 2023 – 2027 (2022) (Slovak version)
Recovery and Resilience Plan of the Slovak Republic (2021) (Slovak version)
Integrated National Energy and Climate Plan for 2021 – 2030 (2019)

Other
Program statement of the Government of the Slovak Republic for the years 2021 – 2024 (2021) (Slovak version)

Transport

Strategic documents at the EU level

Strategies
A hydrogen strategy for a climate-neutral Europe (2020)
Sustainable and Smart Mobility Strategy – putting European transport on track for the future (2020)
A European Strategy for Low – Emission Mobility (2016)

WHITE PAPER, Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system (2011)
Green paper TEN-T: A policy review – Towards a better Intergrated Transeuropean Transport Network at the Service of the common Transport Policy (2009)

Programs
General Union Environment Action Programme to 2030 (2022)

Plans
EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' (2021)
Towards the broadest use of alternative fuels – an Action plan on Alternative Fuels Infrastructure (2017)

Other
The European Green Deal (2019)
Europe on the move – Sustainable mobility for Europe: safe, connected and clean (2018)
Europe on the move – An agenda for a socially fair transition towards clean, competitive and connected mobility for all (2017)
A sustainable future for transport: Towards an integrated, technology-led and user friendly system (2009)

Strategic documents at the SR level

Strategies
National strategy of the Slovak Republic for traffic safety for the years 2021 – 2030 (2021) (Slovak version)
National Hydrogen Strategy: Ready for the Future (2021)
Vision and Strategy for the Development of Slovakia until 2030 – Long-term Strategy for the Sustaina-ble Development of the Slovak Republic – Slovakia 2030 (2020) (Slovak version)
Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050 (2020)
Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)
Revision and update of the National Policy Framework for the Development of the Alternative Fuels Market (2019) (Slovak version)
Strategic plan for the development of transport in the Slovak Republic until 2030 (2017) (Slovak version)
Strategy of Electromobility Development in the Slovak Republic and its Effect on National Economy of the Slovak Republic (2015) (Slovak version)

National strategy for the development of bicycle transport and bicycle tourism in the Slovak Republic (2013) (Slovak version)

Concepts

The concept of the development of water transport in the Slovak Republic (2000) (Slovak version)

Concept of territorial development of Slovakia (KURS 2001) (Slovak version)

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Operational Programme Integrated Infrastructure 2014 – 2020 (2014)

Revitalization programme of railway companies (2011) (Slovak version)

Program for supporting the development of intelligent transport systems – National system of transport information (2009) (Slovak version)

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Recovery and Resilience Plan of the Slovak Republic (2021) (Slovak version)

Integrated National Energy and Climate Plan for 2021 – 2030 (2019)

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Program statement of the Government of the Slovak Republic for the years 2021 – 2024 (2021) (Slovak version)

Agriculture

Strategic documents at the EU level

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A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system (2020)

EU Biodiversity Strategy for 2030 Bringing nature back into our lives (2020)

Programs

General Union Environment Action Programme to 2030 (2022)

Plans

EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' (2021)

A new Circular Economy Action Plan For a cleaner and more competitive Europe (2020)

European Action Plan for Organic Food and Farming (2004)

Other

The European Green Deal (2019)

Strategic documents at the SR level

Stratégie

Vision of joint procedures in building modern agriculture in the horizon of 2035 (2021) (Slovak version)

Vision and Strategy for the Development of Slovakia until 2030 – Long-term Strategy for the Sustainable Development of the Slovak Republic – Slovakia 2030 (2020) (Slovak version)

Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050 (2020)

Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)

Climate Change Adaptation Strategy of the Slovak Republic – update (2018) (Slovak version)

Long-term strategy of using agricultural and non-agricultural crops for industrial purposes (2009) (Slovak version)

Strategy for Higher Utilization of Renewable Energy Sources in the Slovak Republic (2007) (Slovak version)

Concepts

Concept of the water policy of the Slovak Republic until 2030 with a view to 2050 (2022) (Slovak version)

Concept of the development of agriculture in the Slovak Republic for the years 2013 – 2020 (2013) (Slovak version)

Concept of using agricultural and forestry biomass for energy purposes (2004) (Slovak version)

Programs

Operational Programme Quality of Environment (2014)

Rural Development Programme of SR 2014 – 2020 (2014) (Slovak version)

Plans

Action plan for wetlands for the years 2022 – 2024 for the Slovak Wetlands Care Program until 2024 (2022) (Slovak version)

Water Plan of the Slovak Republic for 2022 – 2027 (2022) (Slovak version)

Common Agricultural Policy Strategic Plan 2023 – 2027 (2022)

Recovery and Resilience Plan of the Slovak Republic (2021) (Slovak version)

Action plan for the implementation of the Slovak Climate Change Adaptation Strategy

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National Action Plan to Achieve Sustainable Use of Plant Protection Products, 2021 – 2025, rev. 2
Action plan of agricultural development of the SR for 2014 – 2020 (2014) (Slovak version)

Other
Program statement of the Government of the Slovak Republic for the years 2021 – 2024 (2021) (Slovak version)
Prognoses and visions of the development of Slovak agriculture, food industry, forestry and the countryside (2007) (Slovak version)
Principles of the State Land Policy (2001) (Slovak version)

Forest management

Strategic documents at the EU level

Strategies
EU Biodiversity Strategy for 2030 Bringing nature back into our lives (2020)
A new EU Forest Strategy: for forests and the forest-based sector (2013)

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General Union Environment Action Programme to 2030 (2022)

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The European Green Deal (2019)
Policy of rural development 2014 – 2020 (2013)
Green Paper On Forest Protection and Information in the EU: Preparing forests for climate change (2010)

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Vision and Strategy for the Development of Slovakia until 2030 – Long-term Strategy for the Sustainable Development of the Slovak Republic – Slovakia 2030 (2020) (Slovak version)
Greener Slovakia – Strategy of the Environmental Policy of the Slovak Republic until 2030 (Envirostrategy 2030) (2019)
Climate Change Adaptation Strategy of the Slovak Republic – update (2018) (Slovak version)

Updated National Strategy for the Protection of Biodiversity to 2020 (2014)
Vision, prediction and strategy of forestry development in Slovakia (2009) (Slovak version)
Forestry Development Strategy (2008) (Slovak version)

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Concept of development of hunting in the Slovak Republic – national program of development of hunting and preservation of the gene pool of wild animals (2017) (Slovak version)
Concept of the development of agriculture in the Slovak Republic for the years 2013 – 2020 (2013) (Slovak version)

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National programme for utilization of wood potential (2013) (Slovak version)
National Forest Programme of the Slovak Republic (2007)

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Action Plan of National Forest Programme of the Slovak Republic 2015 – 2020 (2015)
Action Plan of Agricultural Development of the SR for 2014 – 2020 (2014) (Slovak version)
Action Plan of National Programme for Utilization of Wood Potential of the Slovak Republic (2014) (Slovak version)

Other
Program statement of the Government of the Slovak Republic for the years 2021 – 2024 (2021) (Slovak version)
Prognoses and visions of the development of Slovak agriculture, food industry, forestry and the countryside (2007) (Slovak version)
Green Report Brochures

Circular economy

Strategic documents at the EU level

Strategies
Taking sustainable use of resources forward: A Thematic Strategy on the prevention and recycling of waste (2005)

Investing in a smart, innovative and sustainable Industry – A renewed EU Industrial Policy Strategy (2017)
A European Strategy for Plastics in a Circular Economy (2018)
EU Strategy for Sustainable and Circular Textiles (2022)

Programs
Towards a circular economy: A zero waste programme for Europe (2014)
General Union Environment Action Programme to 2030 (2022)

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Closing the loop – An EU action plan for the Circular Economy (2015)
A new Circular Economy Action Plan – For a cleaner and more competitive Europe (2020)
EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' (2021)

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Green paper – On the management of bio-waste in the European Union (2008)
Directive of the European Parliament and the Council of establishing a framework for the setting of ecodesign requirements for energy-related products (2009)
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Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability (2020)
Ecodesign and Energy Labelling Working Plan 2022 – 2024 (2022)

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Strategy for limiting the landfilling of biodegradable waste (2020) (Slovak version)
Strategy of the economic policy of the Slovak Republic until 2030 (2018) (Slovak version)
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Waste prevention program of the Slovak Republic for the years 2014 – 2018 (2014) (Slovak version)
Waste Management Plan of the Slovak Republic for 2016 – 2020 (2015)

Waste prevention program of the Slovak Republic for the years 2019 – 2025 (2019) (Slovak version)
Waste Management Plan of the Slovak Republic for 2021 – 2025 (2021) (Slovak version)

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Closing the Loop in the Slovak Republic – A roadmap towards circularity for competitive-ness, eco-innovation and sustainability (2022)

Low-carbon economy

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A hydrogen strategy for a climate-neutral Europe (2020)
A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (2018)

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A Roadmap for moving to a competitive low carbon economy in 2050 (2011)

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Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality (2021)
Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change (2021)
European Climate Law (2020)
The European Green Deal (2019)
A policy framework for climate and energy in the period from 2020 to 2030 (2014)
White paper – Adapting to climate change: Towards a European framework for action (2009)

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Climate Change Adaptation Strategy of the Slovak Republic – update (2018) (Slovak version)

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H2VALUE IS WATER Consequence Action Plan Drought and Water Shortages (2018) (Slovak version)

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Content

ARE THE SECTORS OF THE ECONOMY OF THE SLOVAK REPUBLIC BECOMING GREENER?

Sector indicator report

2022

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Publisher:	Ministry of Environment of the Slovak Republic Námestie Ľudovíta Štúra 1, 812 35 Bratislava Slovak Environment Agency Tajovského 28, 975 90 Banská Bystrica
Co-operation:	The publication has been drawn up while using data and information provided by institutions specified as sources.
Acknowledgement for co-operation:	Representatives of the Ministry of Agriculture and Rural Development of the Slovak Republic, representatives of the Ministry of Transport and Construction of the Slovak Republic, representatives of the Ministry of Economy of the Slovak Republic, and representatives of the Environmental Policy Institute.
Proof-reading:	The publication has not been proofread
Graphics:	Stanislav Hupian, Tatiana Hamranová
Photographs:	Freepik.com
Rozsah:	265 p.
Year of publication:	2022
ISBN:	978 – 80 – 8213 – 090 – 7

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