2014

REPORT ON THE ENVIRONMENT OF THE CZECH REPUBLIC

cenia

Ministry of the Environment of the Czech Republic

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Introduction

The Report on the Environment of the Czech Republic (hereinafter the "Report") is drawn up every year on the basis of Act No. 123/1998 Coll., on the right to information on the environment, as amended, Government Resolution No. 446 of 17 August 1994 and Government Resolution No. 934 of 12 November 2014, and submitted for approval to the Government of the Czech Republic and subsequently submitted to the Chamber of Deputies and the Senate of the Parliament of the Czech Republic for discussion.

It is a comprehensive document assessing the state of the environment in the Czech Republic, including its entire context, on the basis of data available in the given assessed year.

Starting with the Report on the Environment of the Czech Republic for the year 2005, CENIA, the Czech Environmental Information Agency, is responsible for drawing it up.

The Report for the year 2014 was discussed and approved by the Government on 20. 11. 2015 and then provided to both the chambers of the Parliament of the Czech Republic. The Report is also published in electronic form (http://www.cenia.cz and http://www.mzp.cz) and it is distributed at the same time on a USB flash drive, along with the Statistical Yearbook of the Environment of the Czech Republic 2014 and Reports on the Environment in the Regions of the Czech Republic 2014.

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*Change since 2009

Key messages of the Report

The state of the environment in the Czech Republic in 2014 was not satisfactory. The positive trend of the previous years has stopped even despite the fact that the negative impact of the national economy on the environment is decreasing. The growing impact of household consumption on the environment represent the main factor of the current development of the state of the environment.

As in the previous years, the fundamental problem of the environment of the Czech Republic in 2014 is low air quality in settlements, especially in the Moravian-Silesian Region and the Ústí nad Labem Region. The major factors affecting air quality in the Czech Republic are particularly household heating, mainly in small settlements, and traffic. The most problematic situation in the long term is in the Ostrava/Karviná/Frýdek-Místek agglomeration where the air quality is affected by the concentration of all pollution effects, the sources of which are significant industrial load, local household heating, transport, adverse dispersion conditions, especially in settlements in inverse positions, and also long-range transmission of pollution. Despite the fact that compared to the previous year there was a reduction in the number of declared smog situations in 2014, about 25% of the population of the Czech Republic is exposed to above-the-limit concentrations of suspended particulate matter of the fraction PM_{10}. Exposure to suspended particles contributes to the increase in overall mortality, and can be the cause of premature death of up to 5.8 thous. inhabitants per year. At the same time, more than 50% of the population of the Czech Republic live in areas where the maximum permitted concentrations of carcinogenic polyaromatic compounds expressed as benzo(a)pyrene are exceeded.

Although the amount of discharged pollution from point sources has decreased, surface water quality is improving only slowly also due to continuing substantial pollution of water resources from agriculture. This pollution is also affected by a large area of intensively farmed arable land on which above average and constant amount of mineral fertilisers is being applied in the European context. The means of agricultural production also affect the state of biodiversity in the Czech Republic which is represented by long-term declining populations of all species of birds and by an unsatisfactory amount of species of animals, plants and natural habitats of Community importance. Landscape fragmentation caused by transport, in particular, is also a long-term issue concerning nature and the landscape in the Czech Republic.

In line with the declining influence of the national economy on the environment, the energy and material intensity of the economy of the Czech Republic is decreasing. The importance of steam power plants, especially of those that burn brown coal, in the energy mix for the production of electricity and heat is gradually decreasing in favour of renewable energy sources and the use of nuclear energy. As a result of these trends, emissions of greenhouse gases and pollutant emissions are slightly decreasing.

In transport, it is possible to observe the reduction of both emissions and energy consumption. The share of renewable energy sources in energy consumption in the transport sector is rising; however, the use of alternative fuels and drives is still negligible. The individualization of personal transport is stalling and on the other hand, the importance of public transport in passenger transport, in particular the railway transport, is increasing. The influence of road freight transport on air quality in sites congested by traffic and urban areas, however, remains significant with regard to increasing performance in the long term.

In 2014, public environmental protection expenditure, especially from the state budget, significantly increased also as a result of the acceleration of measures from the Operational Programme Environment. As part of this programme, 92% of the total financial allocation intended for the programming period 2007–2013 has been divided into projects with an issued Decision to Provide a Subsidy and 71% was paid to the subsidy recipients by the end of 2014. Therefore, in 2014 the whole allocation for the year 2012 was drawn and the drawing of the 2013 allocation started. The positive effects of the accelerated drawing of resources from the Operational Programme Environment in 2014 shall reflect the state of the environment especially in the following years. An important instrument in the field of air quality and climate protection in 2014 was the New Green Savings Programme.

THE MAIN FINDINGS OF THE REPORT:

- **Greenhouse gas emissions** and **emissions of pollutants into the air** (acidifying substances, precursors of ground-level ozone, emissions of primary particles and secondary particulate precursors) are decreasing; the Czech Republic fulfils the currently valid international commitments. The development of emissions reflects the declining energy intensity of the economy, reduction of the share of fossil fuels in the energy mix and technological progress in manufacturing industries. Despite the continuing decline of emissions of pollutants, the air quality in the problematic areas of the Czech Republic is not improving.

- The **total water abstraction** started to stagnate, the proportion of water abstraction slightly changed in favour of surface sources. Compared with the previous year, the abstraction of water for public water supply systems slightly decreased. Water consumption in households stopped declining despite the increasing prices. Restricting water losses in the pipe network had a positive effect on the overall reduction of the abstraction of water for public water supply systems. The proportion of the population connected to water supply systems and to public sewerage systems and the quality of waste water treatment is improving. However, 20.1% of the population is not still connected to a sewerage system ending in a waste water treatment plant. The interannual decrease in the amount of pollution discharged from point sources confirmed the long-term downward trend. In 2014, pollution caused especially by nitrates and cadmium decreased, while an increase occurred in the chlorophyll and total phosphorus indicators.

- About one third of **animal and plant species of Community importance** were marked as species in an unfavourable status and more than half of natural habitat types of Community importance were marked as habitats in an insufficient status. The quantity of bird species in the Czech Republic as well as in Europe is decreasing in the long-term. Over the period 1982–2014, the populations of common bird species decreased by 7.6%, the forest bird species populations by 18.9% and agricultural landscape bird species populations by 27.5%. The development of bird populations is an important indicator of the development of the environment and reflects the changes in land use and overall changes in ecosystems.

- In 2014, about 16% of the territory of the Czech Republic was protected by the state and almost 14% of the total area of the country was protected as part of the Natura 2000 network.

- The **health condition** of **forest stands**, expressed by the degree of defoliation, has been unsatisfactory in the long term, which is a result of long-term air pollution load. After 2000, moreover, deterioration in the condition of forest stands was noted. The **forest species composition** in the Czech Republic is purposefully slowly changing towards a more natural composition of forest stands with a growing proportion of deciduous trees; however, 72.5% of the forests of the Czech Republic still consist of coniferous trees.

- The **build-up of areas** continued to expand in 2014, although at a lower rate than in the previous years. Built-up and other areas occupied 10.7% of the territory of the Czech Republic, the take-up of arable land by construction and expansion of other areas in 2014 represented 2,441 hectares. **Arable land** made up 70.7% of the acreage of agricultural land resources. A gradual increase of areas of permanent grassland is occurring, which is positive change from the environmental perspective.

- The **quality of agricultural land** is not improving, the contents of hazardous substances (e.g. PAHs, DDT) still exceed the permissible limits. Their main cause is particularly residual pollution from the past. At the same time, the consumption of mineral fertilisers is slightly increasing (interannually by 3.9%). On the other hand, the consumption of plant protection products in 2014 fell by 9.1%. The long-term trend of increasing area of **agricultural land under organic farming** and the number of organic farms in the last three years stopped and started stagnating. Moreover one quarter of agricultural land is potentially extremely threatened by water erosion.

- Almost 10,000 **contaminated sites**, which occurred in the period 1938–1989, are recorded in the Czech Republic. Despite the amount of remedial actions already completed on the territory of the Czech Republic, there is still a large number of contaminated sites whose extent of risks to the environment and human health is not known.

- In 2014, the **industrial production** in the Czech Republic increased by 5.0%. The production of electricity in steam power plants that burn especially brown coal is gradually decreasing. The foreign trade with electricity retains its export nature. The balance of electricity exports and imports abroad amounted to –16.3 TWh (28.1 TWh of export and 11.8 TWh of import), which is 18.9% of the total amount of electricity produced in the Czech Republic. As far as household heating in 2014 is concerned, central heat supply (36.0% of households) and heating by natural gas (34.5% of households) prevailed. In 2014, 9,170 GWh of electricity was produced from renewable energy sources, which is the first time a slight decrease (0.8%) was recorded after 6 years of significant development. The cause of this occurrence is a significant decrease in the production of electricity by hydroelectric power stations caused by the extremely low level of watercourses.

- ➜ About one-tenth of the population living in the agglomerations of the Czech Republic are exposed to excessive **noise levels**, which are caused mainly by road transport.

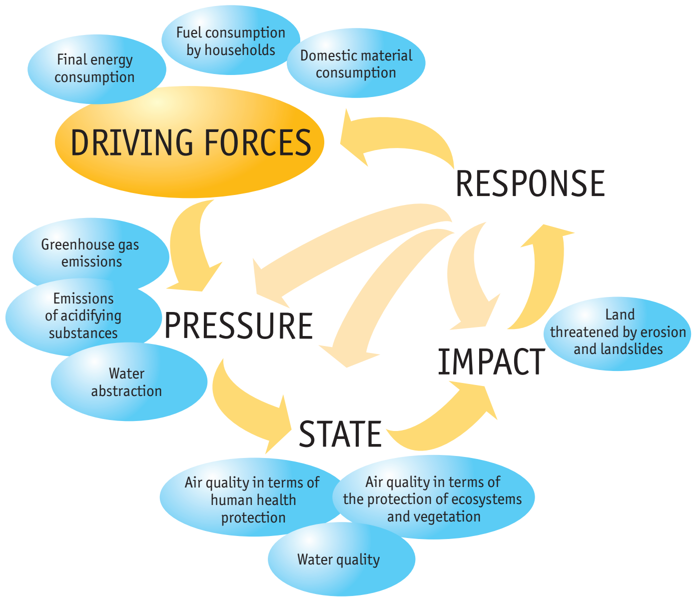
- ➜ The total waste generation as well as the generation of municipal waste is stagnating. The material recovery of waste significantly prevails (79.5% of the total generation of waste) in the **waste treatment** structure. The most common method of waste disposal is landfilling (10.3%) whose share in the total waste generation is, however, decreasing. Landfilling also prevails in the treatment of municipal waste (48.3%). Its share in the total generation of municipal waste is, however, declining in the long-term. 34.7% of municipal waste undergoes material recovery. The generation of packaging waste is increasing, however, on the other hand, the extent of recycled packaging waste is also increasing. The take-back of selected products, especially of portable batteries and accumulators, is increasing. In order to achieve the legislative objective for the year 2016, however, the increase rate of their collection is still insufficient.

- ➜ In 2014, **environmental protection expenditure** from central sources significantly increased by 12.5 bil. CZK, i.e. by 48.4%. The Operational Programme Environment significantly contributed to these expenditures. Within its framework, 92% of the total financial allocation has been divided between projects with an issued Decision to Provide a Subsidy and 71% was paid to the subsidy recipients since the beginning of the programme period until the end of 2014. The expenditure in the field of air protection also significantly increased, particularly in connection with support programmes of insulation and energy savings and the support of heating technologies.

01/ Meteorological conditions

KEY QUESTION

What were the temperature and precipitation conditions on the territory of the Czech Republic in 2014?



KEY MESSAGES

In terms of temperature, the year 2014 was extremely above-normal on the territory of the Czech Republic. The average annual temperature, 9.4°C, was by 1.9°C higher than the 1961–1990 long-term mean. The year 2014, therefore, became the warmest year since 1961 when the average temperatures for the territory of the Czech Republic started to be processed. Only in two years since 1961 did the average annual temperature on the territory of the Czech Republic exceed the threshold of 9°C, namely in 2000 and 2007, when it reached the value of 9.1°C.

In terms of precipitation, the year 2014 was normal; the average rainfall of 657 mm represents 97% of the 1961–1990 long-term mean. The highest rainfall figures were recorded in May. February was the driest month, whose total rainfall of 10 mm reached only 26% of the long-term mean.

INDICATOR SIGNIFICANCE AND CONTEXT

Temperature and precipitation conditions affect the national economy and also have an impact on environmental burdens and on the state of the environment. Energy consumption, therefore even the production of pollution from energy (electricity and heat) generation, is affected by temperature conditions. In the winter, lower temperatures increase the heat consumption, while in the summer; on the contrary, electricity consumption increases due to the use of air conditioning. Agricultural production, electricity generation from renewable sources and also the forestry sector are dependent on the temperature and precipitation conditions. Major impacts on the population and the damage to the national economy are associated with emergency situations caused by hazardous hydrometeorological phenomena, such as floods, droughts, or very strong wind.

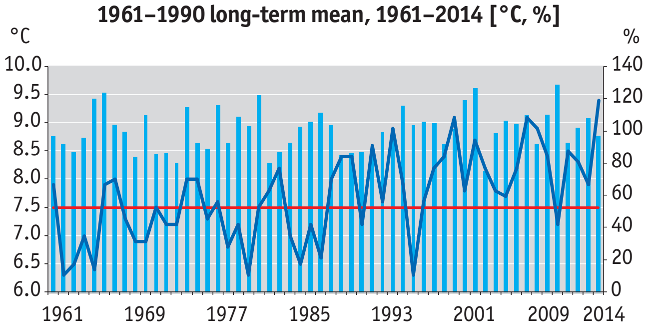
Indirect effects of meteorological conditions consist in affecting the state of the environment. These are, in particular, the conditions for the dispersion of pollutants in the air, which represent, together with the production of emissions of pollutants, the main factors in the fluctuations in air quality. In the summer season, high temperatures and intense sunlight supports the formation of ground-level ozone which adversely affects human health and damages vegetation. Temperature and precipitation conditions affect the quality of surface water; high temperatures promote eutrophication of stagnant water, thus worsening the quality of water for swimming.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The effects of meteorological conditions on human health are associated with the occurrence of extreme temperatures. High temperatures in the summer are a burden for the cardiovascular system and are associated with a higher incidence of heart attacks and with a higher mortality rate from diseases of the circulatory and respiratory system. High temperatures create favourable conditions for the spread of infectious diseases. Exposure to cold temperatures on cold days can also have impacts on health, especially for the elderly and people without shelters. Increased concentrations of ground-level ozone have irritant effects on the respiratory system and damage the green parts of plants, affecting agricultural production and therefore the state of forests. Torrential rainfall (soil erosion), strong wind (damage to forest stands, wind erosion) and long-lasting drought also have negative impacts on ecosystems.

INDICATOR ASSESSMENT

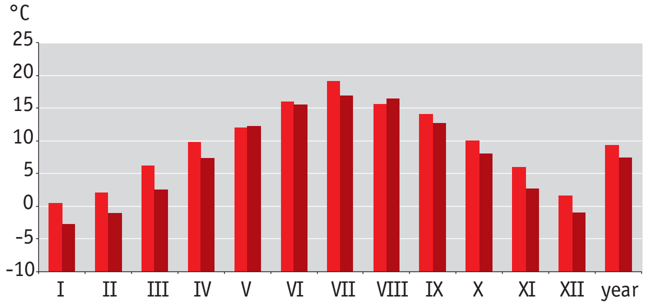
Chart 1 → **Long-term development of annual average air temperature and annual precipitation totals on the territory of the Czech Republic compared with the 1961–1990 long-term mean, 1961–2014 [°C, %]**



- Annual rainfall in % of the mean value
- Long-term temperature mean
- Average annual temperature

Source: Czech Hydrometeorological Institute

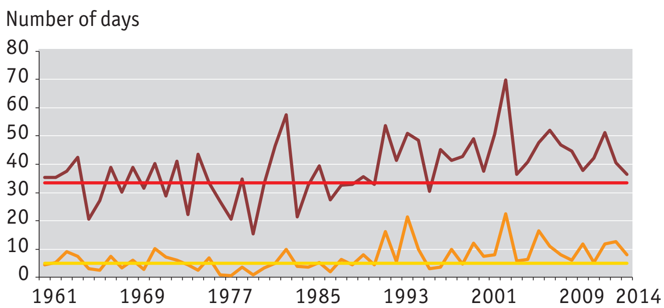
Chart 2 → **Monthly average air temperature in the Czech Republic (areal temperatures) compared with the 1961–1990 long-term mean [°C], 2014**



- Air temperature in 2014
- Mean value of air temperature (1961–1990)

Source: Czech Hydrometeorological Institute

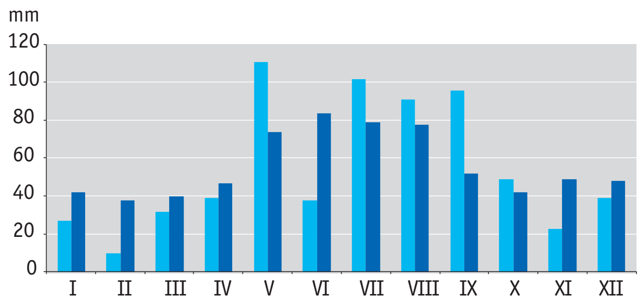
Chart 3 → **Average number of summer and tropical days in the Czech Republic compared with the 1961–1990 long-term mean [number of days], 1961–2014**



Source: Czech Hydrometeorological Institute

- Average annual number of summer days
- Average annual number of summer days (1960–1990)
- Average annual number of tropical days
- Average annual number of tropical days (1961–1990)

Chart 4 → **Monthly precipitation totals on the territory of the Czech Republic (areal values) compared with the 1961–1990 long-term mean [mm], 2014**



Source: Czech Hydrometeorological Institute

- Precipitation total in 2014
- Mean value of the precipitation totals (1961–1990)

In terms of temperature, the year 2014 was extremely above-normal on the territory of the Czech Republic (Chart 1). The average annual temperature, 9.4°C, was by 1.9°C higher than the 1961–1990 long-term mean. The values of monthly average temperature reached or exceeded the monthly average air temperature values of the long-term mean 1961–1990 in all months except for May and August (Chart 2). The values for the months of July and November were extremely above-normal, while the values for February, March, April and December were significantly above-normal.

January was above-normal in terms of temperature. The average January temperature reached the value of 0.5°C which is by 3.3°C higher than the 1961–1990 long-term mean. At the beginning and at the end of the month, a short-term deterioration in the dispersion conditions occurred which led to the declaration of smog situation in the Moravian-Silesian Region. The lowest January minimum air temperature, –24.8°C, was measured on 26th January on the station Kořenov-Jizerka and was also the lowest minimum temperature recorded in 2014.

February , in which the average temperature of 2.1°C was by 3.2°C higher than the 1961–1990 long-term mean, was also significantly above-normal in terms of temperature. **March** and **April** were also included in the significantly above-normal months in terms of temperature. With an average temperature of 6.2°C (a deviation from the long-term mean of 3.7°C), March is still the warmest March recorded on the territory of the Czech Republic since 1961. The warm weather in March during the second decade was associated with deteriorated dispersion conditions in the Moravian-Silesian Region.

May and **June** had average temperatures, warmer and colder periods alternated in the course of both these months. During the very hot season at the end of the first and the beginning of the second ten-day period in June, the daily maximum air temperatures rose above 30°C almost over the entire territory of the Czech Republic. In terms of temperature, **July** was extremely above-normal. The monthly average temperature of 19.2°C was by 2.3°C higher than the 1961–1990 long-term mean. Throughout almost the whole month the average daily temperatures were above the long-term mean, the highest measured maximum temperature reached the value of 36.3°C on July 20 at the station Prague-Karlov. With a monthly average temperature of 15.7°C, which is 0.7°C below the 1961–1990 long-term mean, August was below-normal in terms of temperature and was followed by above-normal months **September** and **October**.

In terms of temperature, **November** was extremely above-normal. The average monthly temperature, 6°C, was by 3.3°C higher than the 1961–1990 long-term mean. It is the second highest temperature recorded in November since 1961. Warm weather prevailed in the first half of the month, when the daily average temperatures fluctuated well above the long-term mean. At the end of the month, deteriorated dispersion conditions were recorded in connection with inversion weather conditions on the territory of the Moravian-Silesian Region. Big problems in transport and power industry and widespread damage to forests were caused by the occurrence of frost and ice almost over the entire territory of the Czech Republic at the turn of November and December. With an average temperature of 1.6°C, which is 2.6°C above the normal 1961–1990, **December** belongs among significantly above-normal months. The period from 11^{th} to 25^{th} December was particularly warm. Deteriorated dispersion conditions associated with the announcement of the smog situation in northern Moravia lasted from 4^{th} to 8^{th} December.

In 2014, there were 37 **summer** and 8 **tropical days** on average in the Czech Republic, which are in both cases higher values than in the previous two years, while still exceeding the 1961–1990 long-term mean (Chart 3). On the other hand, only 82 **frosty day**s and 19 **icy days** were recorded. These values are among the lowest numbers of cold typical days that have been recorded since 1961 on the territory of the Czech Republic. In 2014, there was the least amount of frosty days in the whole period. A lower number of ice days were recorded only in 2008 and 1994.

From the perspective of the **synoptic causes of air pollution** in 2014, the average daily PM_{10}concentrations above 50 μg.m^{-3} most often occurred within the synoptic types SEa (southeastern anticyclone), Sa (southern anticyclone), A (anticyclone over Central Europe), Ec and SEc (East and Southeast cyclone) SWc1 and SWc2 (southwest cyclone) and B (low-pressure trough over Central Europe). Cyclonic situations with weak or very weak air flow appear among these in smaller number which do not suffice in dispersing temperature inversion and hence improving the dispersion conditions. The mentioned anticyclonic conditions occurred especially in October and November, SEa prevailed for 9 days in October and for 11 days in November, Sa for 3 days in October and 6 days in November. Cyclonic situation with deteriorated dispersion conditions existed mainly at the beginning of the year (SWc1 SWc2 for 14 days in January and 10 days in February); the SEc situation remained also for 7 days in December.

In terms of **precipitation**, the year 2014 was normal; the average rainfall of 657 mm represents 97% of the 1961–1990 long-term mean. In the course of the year, the precipitation was distributed unevenly. The rainfalls recorded in January, February, June, and November were significantly below-normal or below-normal. Above-normal precipitation totals were recorded in May and September.

Winter was dry; the January precipitation total of 27 mm represents 64% of the 1961–1990 long-term mean (Chart 4), while the February total of 10 mm represents only 26% of the 1961–1990 long-term mean. February was the driest month of the year. Only 6 mm of precipitation fell on average (16% of the long-term mean) in the Czech Republic in February. The months of March and April were normal in terms of precipitation. With an average precipitation total of 111 mm, **May** was above-normal (150% of the 1961–1990 long-term mean). The highest precipitation totals in Moravia on 15^{th} May exceeded 100 mm in some places and caused a short-term rise in the water levels of the river Olše in Český Těšín, reaching the third degree of flood activity. At the end of the month, the occurrence of intense storm activity associated with torrential rain was recorded, which even resulted in the exceedance of the third degree of flood activity in the affected basins of the Czech Republic.

June belonged among very dry months when the rainfall in the Czech Republic reached the value of 38 mm, which is 46% of the 1961–1990 long-term mean. **July** and **September** were above-normal in terms of precipitation. The average July precipitation total of 102 mm on the territory of the Czech Republic represents 129% of the 1961–1990 long-term mean. In September, the average precipitation total reached the value of 96 mm, which is 185% of the 1961–1990 long-term mean. Higher precipitation totals were recorded on the territory of Moravia. The most significant precipitation activity occurred in the period from 11^{th} to 15^{th} September when daily precipitation totals exceeded 50 mm in some places. They reached or exceeded the 100 mm limit in the stations Dolní Věstonice, Miroslav and Branišovice. As a result of intensive precipitation, flash floods occurred on the tributaries of the river Dyje (in particular on the Jevišovka river) and also on the Velička river (tributary of Moravia).

In terms of precipitation, **November** was below-normal and also the second driest month in 2014. The November precipitation total in the Czech Republic of 23 mm represented 46% of the 1961–1990 long-term mean.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

02/ Greenhouse gas emissions

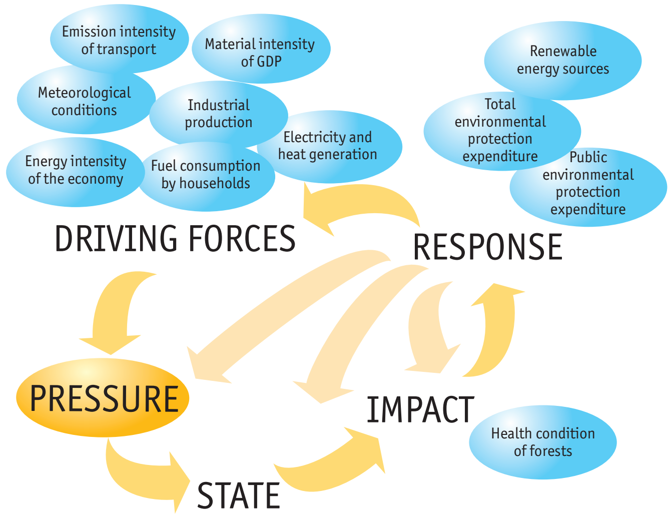
KEY QUESTION

Is the development of greenhouse gas emissions in the Czech Republic heading towards meeting national objectives and international commitments?

KEY MESSAGES

The total aggregated greenhouse gas emissions in the Czech Republic are decreasing[1]. In 2013 they decreased by 2.6% and were 34.2% lower than in 1990. The reduction objectives stipulated by the first and second Kyoto Protocol for the Czech Republic were already met. In the year-to-year comparison in 2013, the emissions from the energy industry significantly decreased, emissions from fuel combustion in the manufacturing industry and construction are decreasing in the long-term and since 2007 greenhouse gas emissions from transport have been decreasing as well. In comparison with the year 1990, the emission intensity of the economy of the Czech Republic is less than half it was and is steadily decreasing.

The objective of the National Programme to Abate Climate Change Impacts in the Czech Republic for the year 2013 has not yet been met. The F-gases emissions are significantly growing as a result of the use of products replacing chlorofluorocarbons (CFCs). Since 2000, the emissions of F-gases have increased more than tenfold and in 2013 they represented 2.2% of the total aggregated emissions.
The emissions from waste are also increasing (they increased by 35.6% between the years 2000–2013), in particular from the landfilling of waste.



OVERALL ASSESSMENT

Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL STRATEGIC AND LEGISLATIVE DOCUMENTS

The Kyoto Protocol, second control period
- 20% reduction of aggregated greenhouse gas emissions in the EU by 2020 compared to 1990

Europe 2020 strategy
- 20/20/20 targets for 2020 – a reduction of greenhouse gas emissions in the EU by 20%, increase in energy efficiency by 20% (both compared to 1990) and increase in the share of RES in the final energy consumption to 20%

Green paper – a 2030 framework for climate and energy policies
- 40 % reduction of aggregated greenhouse gas emissions in the EU by 2030 compared to 1990
- 43% reduction of CO_2 in the EU in the sectors covered by the ETS by 2030 compared to 2005
- 30% reduction of CO_2 in the EU in the sectors not covered by the ETS by 2030 compared to 2005

The National Programme to Abate Climate Change Impacts in the Czech Republic
- 30% reduction of CO_2 emissions per inhabitant in the Czech Republic by 2020 compared to 2000
- 25% reduction of total aggregated greenhouse gas emissions by 2020 compared to 2000

State Environmental Policy of the Czech Republic 2012–2020
- increase in the ability (of the economy, population and landscape) to adapt to climate change
- reduction of greenhouse gas emissions within the EU ETS by 21% and prevention of the increase in emissions outside the EU ETS by more than 9% by 2020 compared to the 2005 level (targets for the Czech Republic stipulated by the EU climate-energy package)

State Energy Policy of the Czech Republic
- achieving a 40% decrease in CO_2 by 2030 compared to 1990 and a further decrease of emissions in line with the EU strategy towards decarbonisation of the economy by 2050 in accordance with the economic possibilities of the Czech Republic

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The production of greenhouse gas emissions and the climate change associated with it is one of the largest global environmental issues of the present, causing significant impacts on ecosystems and the human civilization. Increasing the concentrations of greenhouse gases intensifies the greenhouse effect of the atmosphere, thus disrupting the energy balance of the climate system. The manifestations of climate change, including rising average temperatures, higher spatial and temporal variability in precipitation and more frequent occurrence of hazardous hydrometeorological phenomena, such as extremely high temperatures, floods and droughts, have an impact both on human health and the national economy.

[1] In the year 2015, an exceptional situation arose consisting in the delay of the reporting of emissions and removals of greenhouse gases due to the malfunction of the reporting software. This situation affects all the states in Appendix 1 of the Framework Convention on Climate Change. The greenhouse gas emissions data presented in this indicator have not yet been formally transmitted to the Secretariat of the United Nations Framework Convention on Climate Change. Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

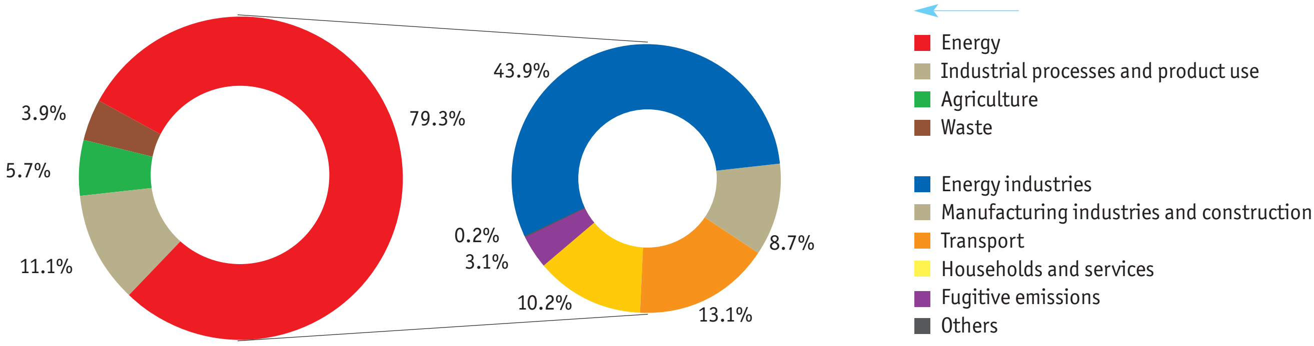
INDICATOR ASSESSMENT

Chart 1 → **Development of aggregated greenhouse gas emissions by sectors [Mt CO_2 eq.], 1990–2013**

Source: Czech Hydrometeorological Institute

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.
The category Energy in total includes all processes of energy transformation in stationary and mobile combustion sources, including the so-called fugitive emissions from extraction and transport of fuels. Data from this category of sources are listed separately in the chart for transport and fugitive (non-combustion) emissions.
LULUCF (Land Use, Land Use Changes and Forestry) – Emissions and removals from the land-use sector, changes in land use and forestry

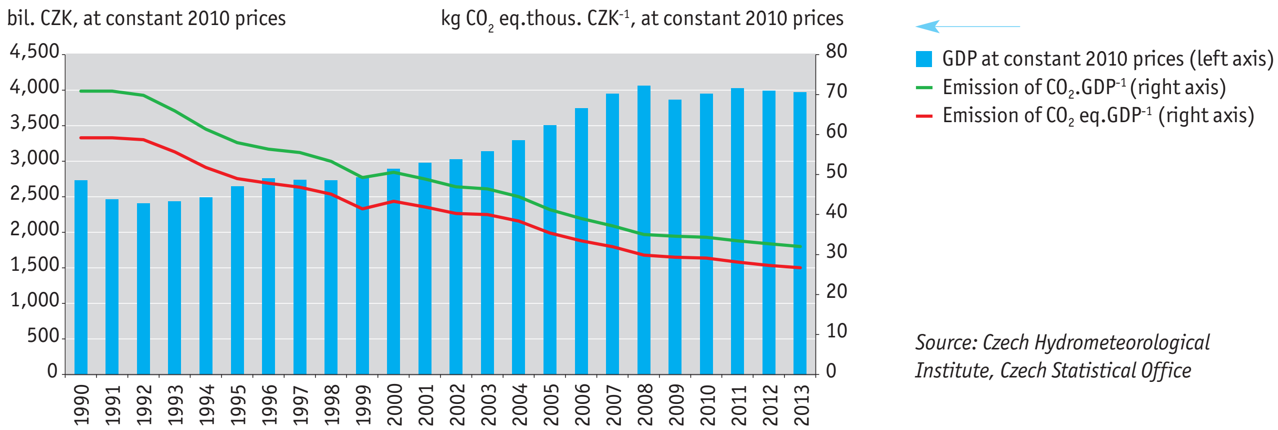
Chart 2 → **Structure of greenhouse gas emissions by major source categories, [%], 2013 (excluding LULUCF)**



Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Source: Czech Hydrometeorological Institute

Chart 3 → **Development of the emission intensity of the Czech economy [kg CO_2 eq.thous. CZK $^{-1}$ at constant 2010 prices] and GDP [bil. CZK at constant 2010 prices], 1990–2013 (excluding LULUCF)**



Source: Czech Hydrometeorological Institute, Czech Statistical Office

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

The total **aggregated greenhouse gas emissions** in the Czech Republic declined in the period 1990–2013[2] by 34.2% to 127.3 Mt CO_2 eq. (without LULUCF), the objective of the second control period of the Kyoto Protocol by the year 2020 was already met. As a result of structural changes in the economy of the Czech Republic, after the initial decline at the beginning of the 1990s emissions stabilized at the level of about 75% of the state in 1990 (Chart 1). Another significant decline in emissions occurred already after the year 2007 when the declining trend of emissions was supported by the recession of the Czech economy. In the period 2000–2013, the total aggregated emissions decreased by 13.0%, of which the decline in the period 2008–2013 amounted to 10.6%. In the year-to-year comparison, they decreased by 2.6%, i.e. by about 3.4 Mt CO_2 eq. The attainment of the objective of the National Programme, which stipulates the decrease of emissions by 25% by 2020 as compared to 2000, is therefore still very remote.

The energy sector, including energy transformation in stationary and mobile combustion sources and extraction and transport of energy resources, has contributed in the greatest degree to the declining trend in greenhouse gas emissions during the assessed period. Within this sector, the largest emission reductions were recorded in the partial sector **Combustion processes in manufacturing and construction**. In the period 1990–2013 they amounted to 40.2 Mt CO_2 eq., i.e. about 78.5%. The contribution of this sector to the total, absolute emission reduction of 66.2 Mt CO_2 eq. was calculated at 60.7%, i.e. almost two-thirds. In the period 2000–2013, emissions from this sector decreased by 53.0%, in the interannual comparison in 2013 by 3.1%. The development of emissions in the industrial power sector clearly demonstrates the reduction of energy intensity of industrial processes and the sectoral restructuring of industrial production.

At the end of the reference period, even the **energy industry** contributed to the declining trend of aggregated emissions, of which the emissions fell by 5.6% in 2013, i.e. by 3.3 Mt CO_2 eq. to the level which is 9.9% lower than in 2000. Significant and prolonged decline in emissions from this sector after 2000, which would correspond to a gradual change in the energy mix with a growing share of nuclear power and renewable energy sources, however, was prevented by a high and further increasing positive balance of international trade in electricity, allowing for the continued operation of coal-fired power plants, despite the growth of electricity production from low-emission sources.

The so called **fugitive emissions** of greenhouse gases from the extraction and transport of fuel are also decreasing. Most of these emissions come from coal mining, which has been going through a recession in recent years. Emissions **from households and services**, in particular, from the local heating of commercial and residential buildings, have experienced a decline too in 1990s and in the beginning of the 21st century. The development was affected by energy savings, changes in the composition of fuels for household heating and the modernization of heating technologies. In 2013, the emissions from this category of sources as compared to 1990 was 58.3% lower; since 2000 they decreased by 18.6%. The greenhouse gas emissions from **industrial processes**, with the exception of metallurgy, and emissions from **agriculture** have been decreasing as well.

In the period 1990–2013, **the transport sector** experienced an increase in emissions. After 2007, the greenhouse gas emissions from transport started to decrease as a result of the decrease in energy consumption in the transport sector. In the period 2007–2013 they decreased by 12.6%, but in the year 2013 they were still more than double they were in the year 1990. **The emissions of F-gases** have shown a significantly rising trend since 2000. Since 2000, the emissions from the use of products replacing chlorofluorocarbons (CFCs), containing the so-called fluorinated hydrocarbons, increased more than tenfold. In 2013 it increased by about 9.8% to 2.7 Mt CO_2 eq.

Emissions from **waste**, which have increased by about 35.6% since 2000, increased interannually in 2013 by 3.6% to 4.9 Mt CO_2 eq. This development was supported, in particular, by the increase of greenhouse gas emissions from landfilling (since 2000 by 24.0%).

In **the structure of the aggregated emissions from each sector**, the largest share is represented by the energy sector, which had a 79.3% share in the total aggregated emissions in the year 2013, and a 93.0% share in CO_2 emissions. The energy industry had the largest share within this sector with a 43.9% share in the emission total in 2013 (Chart 2). In the **structure of the aggregated emissions by greenhouse gases** in 2013, the share of CO_2 was 83.3%, the share of CH_4 was 9.8% and the share of N_2O was 4.7%. The shares of gases in the total emissions are relatively stable in the temporal development, only the share of F-gases is increasing – in 2000 it represented 0.2% of the total and by 2013 it increased to 2.2%. The largest source of CH_4 emissions is waste with a 35.9% share of CH_4 on the total emissions in 2013; the largest source of N_2O emissions is agriculture with a 69.2% share.

CO_2 emissions from the sectors covered by the emission trading system (EU ETS) in 2014 decreased interannually by 3.5% (2.3 Mt CO_2) and were 20.7% lower than in 2005. Therefore, the Czech Republic is successfully heading towards meeting the objective of the EU's climate-energy package for 2020. The share of emissions from the EU ETS in the total CO_2 emissions reported in the national inventory (without LULUCF) in 2013 amounted to 63.8%. The sector of combustion processes has a decisive share in the EU ETS emissions with an 81.4% share in 2014. The faster pace of decline of emissions in the EU ETS in comparison with the total aggregated emissions demonstrates that the installations covered by the EU ETS are the main driving force behind the decline of total emissions of greenhouse gases after 2005.

[2] Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

The **greenhouse gas emissions per capita** in the year 2013 reached 12.1 t.capita^{-1} (without LULUCF) and were 14.9% lower than in 2000 and 35.1% lower than in the year 1990. **The emission intensity of the economy of the Czech Republic** is decreasing steadily. The specific emissions per unit of GDP decreased in the period 1990–2013 to less than a half (53.8%). Since 2000, they decreased by 35.3% and in 2013 they decreased interannually by 2.1% to 32.0 kg CO_2 eq. thous. CZK^{-1} in 2010 constant prices (Chart 3). The development of emission intensity is consistent with the decline in energy intensity of the Czech economy and the gradual shift from fossil fuel energy sources.

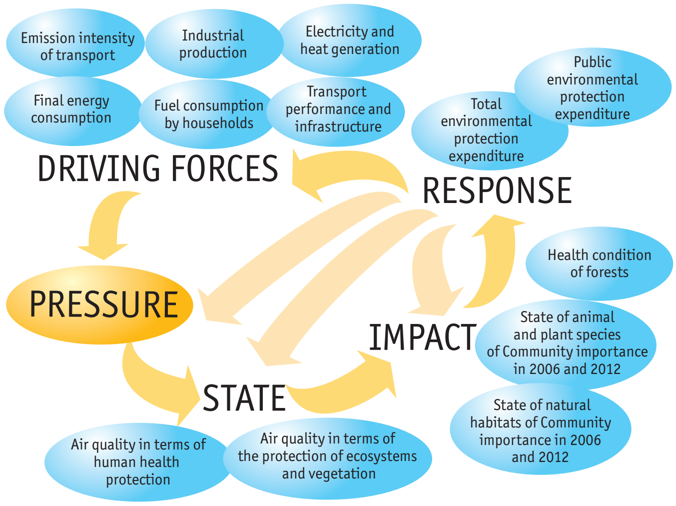
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

03/ Emissions of acidifying substances

KEY QUESTION →

Have we succeeded in reducing air pollution with acidifying substances that adversely affect human health and ecosystems?



KEY MESSAGES →

Emissions of acidifying substances (SO_2, NO_x and NH_3) in the air have been decreasing steadily since 1990. Since 1990, the total emissions of acidifying substances decreased by 85.1%. Since 2000, they dropped by 35.9% and in 2013–2014 interannual comparison they decreased by 4.1%. In the long term, the amounts of emissions of acidifying substances have been below the national emission ceilings for the year 2010.

Of total emissions of acidifying substances in 2014, the emissions of NH_3 comprised 34.4%, SO_2 emissions 33.4% and NO_x emissions 32.2%.

OVERALL ASSESSMENT →

Change since 1990	positive
Change since 2000	positive
Last year-to-year change	positive

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)
- establishment of national emission ceilings for SO_2: 265 kt.year^{-1}, i.e. 8.28 kt.year^{-1} weighed by the acidifying equivalent[1]
- establishment of national emission ceilings for NO_X: 286 kt.year^{-1}, i.e. 6.22. kt.year^{-1} weighed by the acidifying equivalent
- establishment of national emission ceilings for NH_3: 80 kt.year^{-1}, i.e. 4.71. kt.year^{-1} weighed by the acidifying equivalent

Convention on Long-Range Transboundary Air Pollution (CLRTAP)
- prevention of the spread of transboundary air pollution on long distances

Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)
- reduction of areas with an excessive degree of acidification in Europe
- establishment of new emission ceilings for the year 2020 set as a percentage reduction in emissions compared to the state in 2005: for SO_2 the emission reduction is set to 45%, for NO_x it is 35% and for NH_3 it is 7%

State Environmental Policy of the Czech Republic 2012–2020
- meeting the national emission ceilings valid since 2010 and the reduction of the total emissions of SO_2, NO_x, NH_3 by 2020 in line with the commitments of the Czech Republic

National Emission Reduction Programme of the Czech Republic
- meeting the values set by the national emission ceilings for SO_2, NO_x and NH_3
- reduction of the environmental burden by the substances damaging ecosystems and vegetation

The Potential to Reduce Emissions of Pollutants in the Czech Republic by the Year 2020
- quantification of the reduction of pollutant emissions that the Czech Republic is able to achieve by 2020, if it takes the measures arising from the applicable national and European legislation, without the need for implementation of additional measures

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

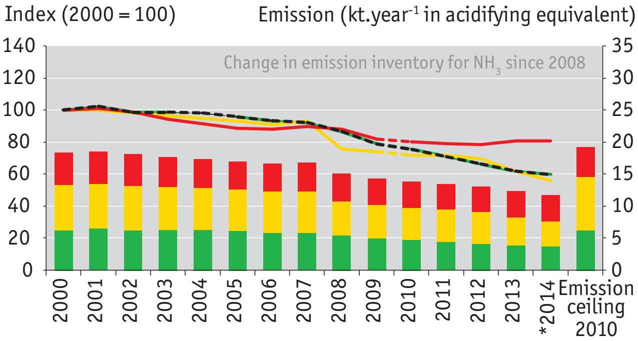
Even a short-term exposure to acidifying substances causes irritation of the respiratory system which may limit its functions and also reduce the organism's resistance to infectious diseases. Exposure to acidifying substances worsens the problems of people suffering from asthma (bronchoconstriction) and allergies, particularly of those who experience increased sensitivity to additional allergens. Long-term exposure to high concentrations of NO_x may increase the number of patients with acute respiratory problems, especially in sensitive groups of the population (people suffering from allergies, children, the elderly, etc.).

Emissions of acidifying substances increase the hydrogen ion concentration in water and soil, which leads to the reduction of pH and the leaching of toxic metals (Al, Cd, Pb and Cu). Furthermore, the flow of nutrients may deteriorate, which can lead to the disruption of the root system and, consequently, to the disruption of the runoff regime and to increased erosion. Increased acidity of the environment alters the representation of nutrients, which leads to the reduction of biodiversity and to the disruption of the balance among the single ecosystems.

[1] *All the data on emissions, presented both in the texts and charts are based on the values expressed using the so-called acidifying equivalent (acidification). The acidifying equivalent factors are as follows for the below substances: for NO_x = 0.02174; for SO_2 = 0.03125 and for NH_3 = 0.05882. The total emissions equal the sum of total annual emissions of the individual substances expressed in tonnes and multiplied by their respective acidifying equivalent factors.*

INDICATOR ASSESSMENT

Chart 1 → **Development of total emissions of acidifying substances in the Czech Republic and the level of national emission ceilings for 2010 [index, 2000 = 100]; [kt.year⁻¹ in acidifying equivalent], 2000–2014**

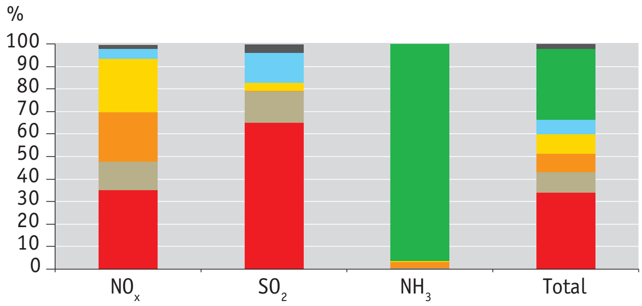


Source: Czech Hydrometeorological Institute

** Preliminary data*

Emissions from the use of nitrogen fertilisers have been included in the NH_3 emission balance since 2008.
The correction of emission inventories was carried out for the presented period 2000-2014 due to the adjustments of emission factors.

Chart 2 → **Sources of emissions of acidifying substances in the Czech Republic [%], 2013**



Source: Czech Hydrometeorological Institute

Emissions of NH_3 from agriculture come from livestock breeding and the use of mineral nitrogen fertilisers.
Emissions in the sector of services, households and agriculture come from mobile and stationary combustion sources (excluding household heating).
A correction of emission inventories was carried out for the period 2000–2014 due to the adjustments of emission factors.
Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Emissions of acidifying substances (SO_2, NO_x and NH_3) have been declining in the long-term; between the years 1990–2014 they experienced an overall decrease by 85.1%, i.e. from 79.0 to 11.7 kt.year^{-1} in acidifying equivalent. In the period 1990–2014 the biggest drop in SO_2 emissions was recorded, namely by 93.2% to 3.9 kt.year^{-1} in acidifying equivalent. Therefore, during this period the emissions dropped to less than their tenth. NO_x emissions decreased by 68.4% to 3.8 kt.year-1 in acidifying equivalent, the smallest decline was recorded for the NH_3 emissions – by 56.0% to 4.0 kt.year^{-1} in acidifying equivalent. The most significant decrease took place in the 1990s, mainly due to the structural changes in the economy. Since 2000, the decline has been slowing down.

Between the years **2000–2014** emissions of acidifying substances decreased by 35.9%, while the most significant decrease was recorded for SO_2 emissions, i.e. by 44.0%, NO_x emissions decreased by 40.3% and NH_3 emissions decreased by 19.1% (Chart 1). The most significant interannual decline in this period occurred between 2007 and 2008, namely by 10.1%, which was mainly the result of the recession of the national economy caused by economic crisis.

In the **interannual 2013–2014 comparison**, a decrease in emissions of acidifying substances by 4.1% was tracked. This decrease was mainly caused by the reduction of SO_2 emissions, namely by 9.0%. NO_x emissions fell by 3.3% and NH_3 emissions stagnated.

Based on the 2013 data, **the main sources of emissions of acidifying substances** in the Czech Republic (Chart 2) were the sector of public electricity and heat production (34.0%, i.e. 4.0 kt.year^{-1} in acidifying equivalent), agriculture (31.6%, i.e. 3.9 kt.year^{-1} in acidifying equivalent) and industrial energy sector (9.2%, i.e. 1.1 kt.year^{-1} in acidifying equivalent). The representation of individual emissions of acidifying substances is, however, different. SO_2 emissions come mainly from combustion processes of fossil fuels containing sulphur. Therefore, the most significant source in 2013 was the sector of public electricity and heat production (65.1%), industrial energy (14.0%) and household heating (13.6%). NO_x emissions are produced during fuel combustion and also chemical-technological processes. In 2013, the main sources of these emissions were public electricity and heat production (34.9%); a significant source of NO_x emissions in the long-term is also the transport sector (a total of 21.9% in 2013) and combustion processes in the sector of services, households and agriculture (23.7% in 2013). The main producer of NH_3 emissions is the sector of agriculture, particularly livestock breeding and the use of nitrogen fertilizers (comprising the total of 96.4% in 2013), 3.0% of NH_3 emissions were produced in 2013 by the transport sector.

SO_2 emissions are steadily decreasing, which is, in particular, the result of desulphurization of coal power plants in the 1990s, the use of fuels with a lower sulphur content and the gradual reduction of energy intensity of the economy. The amount of emissions produced by the household heating sector greatly depends on temperature conditions in the heating season in the given years. Emissions of acidifying substances SO_2 and NO_x are also slightly decreasing due to the reduction of the consumption of solid fuels in the sector of public electricity and heat production, where the importance of nuclear energy and of energy from renewable energy sources is growing, and also due to legislative obligations on meeting emission ceilings. The export nature of electricity production in the recent years, however, counteracts even stronger drops in emissions, making electricity production in the Czech Republic significantly exceed its consumption.

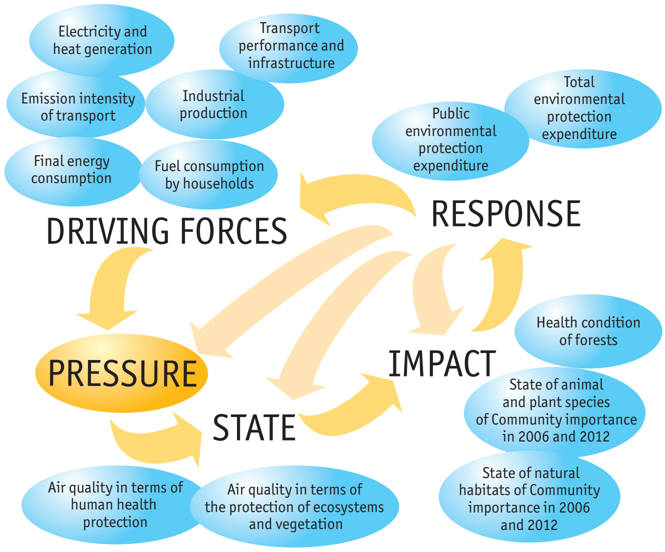
Reduction of the total emissions of **NO_x** acidifying substances is significantly related to the decrease in these emissions from the transport sector. This change can be attributed to the renewal of the car fleet, fulfilment of EURO emission standards, introduction of modern technologies of removing emissions, such as three-way catalytic converters and the system of selective catalytic reduction (SCR), and also to the reduction of energy consumption in the transport sector.

The decline in emissions of **NH_3** acidifying substances is associated with a decrease in the quantity of livestock (mostly pigs) resulting from the agricultural policy of the Czech Republic and further with the implementation of the plans of good agricultural practice and the change in the means of financing agriculture after the entry of the Czech Republic into the EU.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

04/ Emissions of ozone precursors



KEY QUESTION

Have we succeeded in reducing the emissions of ground level ozone precursors that adversely affects human health and vegetation?

KEY MESSAGES

Emissions of ozone precursors (VOCs, NO_x, CO and CH_4) decreased by 53.9% in the years 1990–2014. in the 2000–2014 period, a decrease of 41.2% was recorded. Between 2013 and 2014, the emissions of ground-level ozone precursors declined by 3.2%. In 2014, NO_x emissions accounted for 52.1% of the ground-level ozone precursor emissions, VOC emissions for 33.6%, CO emissions for 12.6% and CH_4 emissions for 1.7% In the long-term, the amounts of ozone precursor emissions have been below the national emission ceilings for the year 2010.

OVERALL ASSESSMENT

Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)
- establishment of national emission ceilings for NO_X: 286 kt.year^{-1}, i.e. 349 kt.year^{-1} in TOFP[1]
- establishment of national emission ceilings for VOC: 220 kt.year^{-1}, i.e. 220. kt.year^{-1} in TOFP

Convention on Long-Range Transboundary Air Pollution (CLRTAP)
- prevention of the spread of transboundary air pollution on long distances

The Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)
- reduction of the number of days with high ozone concentrations to a half and a subsequent reduction of the effects of ground-level ozone on human health
- establishment of new emission ceilings for the year 2020 as a percentage reduction in emissions compared to the state in 2005: for VOC the emission reduction is set to 18%, for NO_x it is 35%

State Environmental Policy of the Czech Republic 2012–2020
- meeting the national emission ceilings valid since 2010 and the reduction of the total emissions of NO_x and VOC by 2020 in line with the commitments of the Czech Republic

National Emission Reduction Programme of the Czech Republic
- meeting the values set by the national emission ceilings for NO_x and VOC
- reduction of the environmental burden caused by substances damaging ecosystems and vegetation

The Potential to Reduce Emissions of Pollutants in the Czech Republic by the Year 2020
- quantification of the reduction of pollutant emissions that the Czech Republic is able to achieve by 2020, if it takes the measures arising
- from the applicable national and European legislation, without the need for implementation of additional measures

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

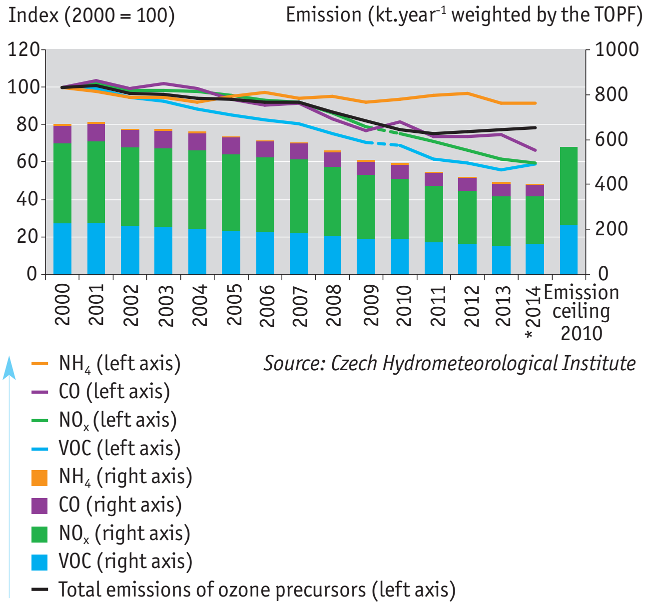
The existence of ozone in the atmosphere is of vital importance for living organisms. While stratospheric ozone protects the earth's surface and the living organisms against negative influence of ultraviolet solar radiation, tropospheric ozone, resulting from the chemical reactions of so called ground-level ozone precursors with participation of solar radiation, is considered, together with their precursors, an important pollutant. Exposure to increased concentrations of ground-level ozone can cause breathing problems, headaches, and increases cardiovascular and respiratory problems. The emissions of ground-level ozone precursors may cause nervous system disorders and liver and kidney damage, they prevent oxygenation of the blood and generally reduce immunity of the organism. Ground-level ozone also disrupts artificial materials, surfaces of buildings and art works and therefore causes damage to property. Health risks are caused not only ground-level ozone, but also by its precursors.

Ground-level ozone is a powerful oxidizing agent that harms the assimilation organs of plants. By doing so, it negatively affects all types of vegetation, including forest stands and agricultural crops. As a result of ground-level ozone effects, vegetation is less resistant to biotic and abiotic factors such as insect pests or climatic effects.

[1] *All data on emissions presented in the charts and texts are based on emission values expressed as the so-called tropospheric ozone formation potential (TOFP). The tropospheric ozone formation potential factors are as follows for the following substances: VOC = 1; NO_x = 1.22; CO = 0.11 and CH_4 = 0.014.*

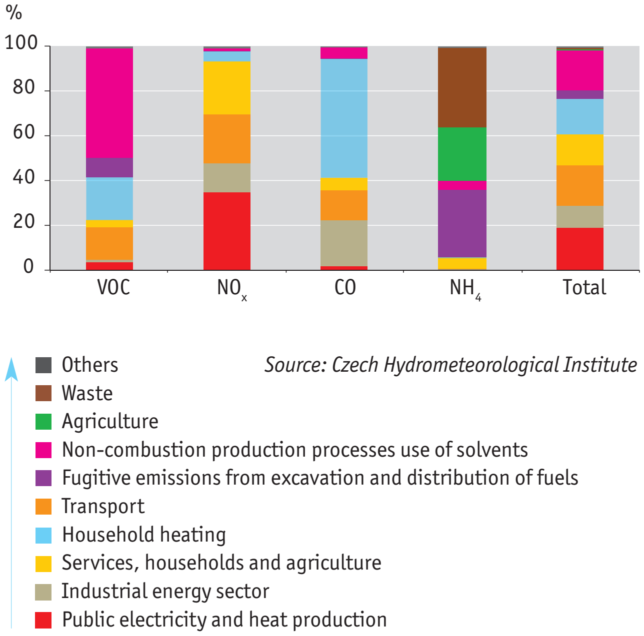
INDICATOR ASSESSMENT

Chart 1 → **Development of total emissions of ozone precursors in the Czech Republic and the levels of the national emission ceilings (for VOC and NO_x) for 2010 [index, 2000 = 100]; [kt.year^{-1} weighed by the TOPF], 2000–2014**



** Preliminary data*
The correction of emission inventories was carried out for the presented period 2000-2014 due to the adjustments of emission factors.

Chart 2 → **Sources of ozone precursors emissions in the Czech Republic [%], 2013**



CH_4 emissions from agriculture come from manure manipulation and enteric fermentation.
Emissions in the sector of services, households and agriculture come from stationary and mobile combustion sources (excluding household heating)
A correction of emission inventories was carried out for the period 2000–2014 due to the adjustments of emission factors.
Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Between the years **1990–2014** emissions of ozone[2] precursors dropped by 53.9%, from 1,265.8 to 403.3 kt.year^{-1} in TOFP. In the period 1990–2014, the most significant decline was recorded for VOC emissions, i.e. by 69.0% to 136.9 kt.year^{-1} in TOFP, which was followed by a decrease in NO_x emissions by about 68.4% (212.3 kt.year^{-1} in TOFP). CO emissions decreased by 63.5% (to 51.2 kt.year^{-1} in TOFP). The least significant decline was recorded for CH_4 emissions which declined by 43.5% to 7.0 kt.year^{-1} in TOFP. The most significant decreases occurred between the years 1990 and 2000. After 2000 the decreases of ground level ozone precursor emissions started to slow down.

In the years **2000–2014, a reduction in the emissions of ground-level ozone precursors** by 41.2% was accomplished (Chart 1), while the most significant decline by 40.7% was recorded for VOCs, NO_x emissions decreased by 40.3% and CO emissions by 33.4%. The amount of CH_4 emissions decreased by 8.3%. The most significant decrease in emissions of ground-level ozone precursors in this period occurred between the years 2007–2008 and 2010–2011 (in both cases by 7.6%).

In the **interannual 2013–2014 comparison**, a 3.2% decrease was recorded in the overall emissions of ground-level ozone precursors. This interannual decrease was mainly caused by the reduction of CO emissions by 11.0% and NO_x emissions by 3,3%.

Based on data from the year 2013[3],**the main sources of ozone precursors emissions** (Chart 2) in the Czech Republic are the sectors of public electricity and heat production (19.2%, i.e. 83.2 kt.year^{-1} in TOFP), non-combustion production processes and the production of solvents (18.1%, i.e. 78.7 kt.year^{-1} in TOFP), and the transport sector (17.9%, i.e. 77.7 kt.year^{-1} in TOFP). The representation of individual emissions of ozone precursors is, however, different. The most significant source of VOC is the use and application of solvents, including the

[2] Volatile organic compounds, nitrogen oxides, carbon monoxide and methane are among the so-called precursors of ground-level ozone, which is formed secondarily in the atmosphere. It has been proved that ground-level ozone has adverse effects on human health and vegetation.
[3] Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

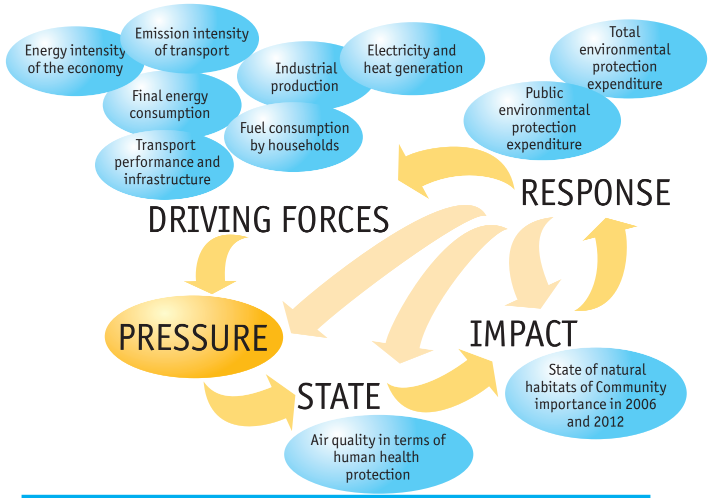
application of paints. Therefore 48.8% of VOC emissions n 2013 came from the sector of non-combustion production processes and from the manufacture of solvents. The second most significant producer of the VOC in the Czech Republic is imperfect combustion of fossil fuels, namely household heating (19.0%) and the transport sector (14.5%). NO_x emissions are produced in the combustion of fuels and their largest producer in 2013 was the sector of public electricity and heat production (34.9%), then combustion processes in the service sector, households and agriculture (23.7%) and the transport sector (21.9%). CO emissions are produced by the combustion of fuels containing carbon under low temperatures and lack of combustion air; their main source in the long term is household heating (53.1%) and industrial energy – emissions from iron and steel production (20.6%). CH_4 emissions are emitted particularly by the landfilling of waste (35.7%) and by the sector of fugitive emissions of fuels (30.3%).

The long-term decline in the emissions of ozone precursors is related with the structural changes in the economy of the Czech Republic, the change in the energy mix, the growing importance of nuclear energy and energy from renewable energy sources and the reduction of energy intensity of the economy. The slight interannual fluctuations in the production of **CO** are related also to industrial production, namely iron and steel production. The amount of **VOC and CO** emissions in the household heating sector in particular is dependent on the temperature conditions and the nature of the heating season in the given years and last but not least, also on the quality of the fuel material. The reduction of the total emissions of the **NO_x** ozone precursor substances are significantly related to a decrease in these emissions from the transport sector, in particular, with the renewal of the fleet and the introduction of modern technologies in end devices, as well as with the reduction of energy consumption in the transport sector. CH_4 emissions are reduced as a result of changes in the waste management structure, as the share of landfilling on the total production of waste has been declining since 2009.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

05/ Emissions of primary particulate matter and precursors of secondary particles



KEY QUESTION

Have we succeeded in reducing air pollution caused by suspended particles that adversely affect human health?

KEY MESSAGES

Emissions of primary particulate matter and secondary particulate matter precursors (NO_x, SO_2, NH_3)[1] have been decreasing since 1990s. In the period 1990–2014, the emissions of secondary particulate matter precursors decreased by 72.9%; between the years 2000–2014 these emissions decreased by 39.6%. The emissions of primary particulate matter of the fraction PM_{10} in 2013 decreased by 5.9%. In the long-term, the amounts of emissions of secondary particulate matter have been below the national emission ceilings set for the year 2010.

OVERALL ASSESSMENT

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)

- establishment of national emission ceilings for SO_2: 265 $kt.year^{-1}$, i.e. 143. $kt.year^{-1}$ weighted by the particulate matter formation potential[2]
- establishment of national emission ceilings for NO_X: 286 $kt.year^{-1}$, i.e. 252. $kt.year^{-1}$ weighted by the particulate matter formation potential
- establishment of national emission ceilings for NH_3: 80 $kt.year^{-1,}$ i.e. 51. $kt.year^{-1}$ weighted by the particulate matter formation potential

Convention on Long-Range Transboundary Air Pollution (CLRTAP)

- prevention of the spread of transboundary air pollution on long distances

The Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)

- establishment of new emission ceilings for the year 2020 set as a percentage reduction in emissions compared to the state in 2005: for SO_2 the emission reduction is set to 45%, for NO_x it is 35% and for NH_3 it is 7%

State Environmental Policy of the Czech Republic 2012–2020

- meeting the national emission ceilings valid since 2010 and the reduction of the total emissions of SO_2, NO_x, NH_3 by 2020 in line with the commitments of the Czech Republic

National Emission Reduction Programme of the Czech Republic

- meeting the values set by the national emission ceilings for SO_2, NO_x and NH_3
- reduction of the environmental burden caused by substances damaging ecosystems and vegetation

The Potential to Reduce Emissions of Pollutants in the Czech Republic by the Year 2020

- quantification of the reduction of pollutant emissions that the Czech Republic is able to achieve by 2020, if it takes the measures arising from the applicable national and European legislation, without the need for implementation of additional measures

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

From the health perspective, the suspended particles are among the most dangerous pollutants. Despite their proven negative impacts, however, no threshold concentration of these substances has been established yet. The severity of the health effect of particles depends on their size, composition and origin. Depending on their size, suspended particles penetrate to the upper and lower respiratory tract and into alveoli, causing overall higher sickness and death rates, in particular for heart and vascular diseases. Exposure to suspended particles also increases the risk of respiratory diseases (including infectious diseases), exacerbates the problems of asthma and allergies, and has negative impacts on infant mortality and fertility of the population. Children, the elderly and those with chronic diseases of the respiratory and circulatory systems are the vulnerable groups. PAH or heavy metals, which have mutagenic and carcinogenic effects, bind to suspended particles.

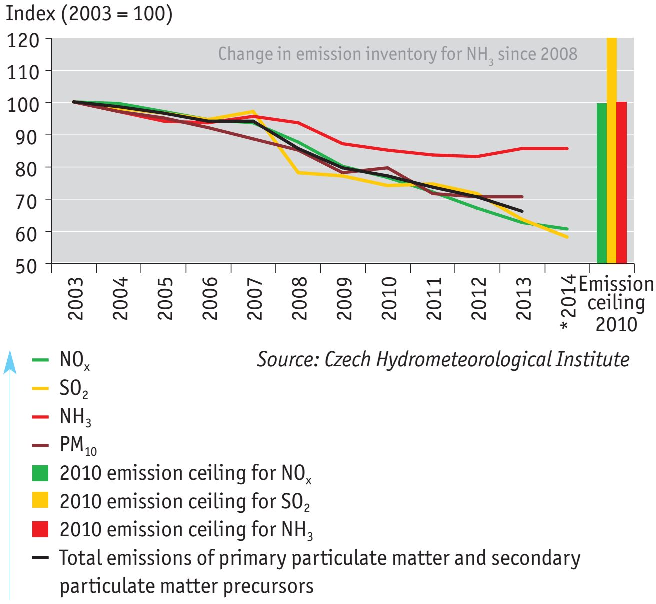
Suspended particulate matter also affects ecosystems. It causes mechanical dusting which reduces the plants' active area, thereby decreasing photosynthesis. It also enters the respiratory tracts of animals. Ecosystems can be influenced by the toxic effects of substances which are bound to the particulate matter. Solid particles in the upper atmosphere layers also affect the Earth's energy balance because they counteract the effect of greenhouse gases by reflecting and scattering solar radiation back into space. They also work as condensation nuclei on which condensation takes place in the atmosphere, taking part in the formation of clouds.

[1] Primary particulate matter PM_{10} represents particles emitted directly from a source, both from natural (e.g. volcanic activity) and anthropogenic sources (e.g. burning fossil fuels, abrasion of tyres). Precursors of secondary particulate matter (NO_x, SO_2 and NH_3) are pollutants of anthropogenic origin, from which these particles can be formed in the atmosphere.

[2] All data presented in the charts and the text are based on emissions expressed as the particulate matter formation potential. The particulate matter formation potential factors are as follows for the below substances: $PM_{10} = 1$; $NO_x = 0.88$; $SO_2 = 0.54$ and $NH_3 = 0.64$. The value of the indicator equals to the sum of total annual emissions of primary PM_{10} and secondary particulate matter precursors in tonnes, multiplied by their respective particulate matter potential factors.

INDICATOR ASSESSMENT

Chart 1 → **Development of emissions of primary particulate matter and secondary particulate matter precursors in the Czech Republic and the national emission ceilings (for NO_x, SO_2 and NH_3) for 2010 [index, 2003 = 100], 2003–2014**



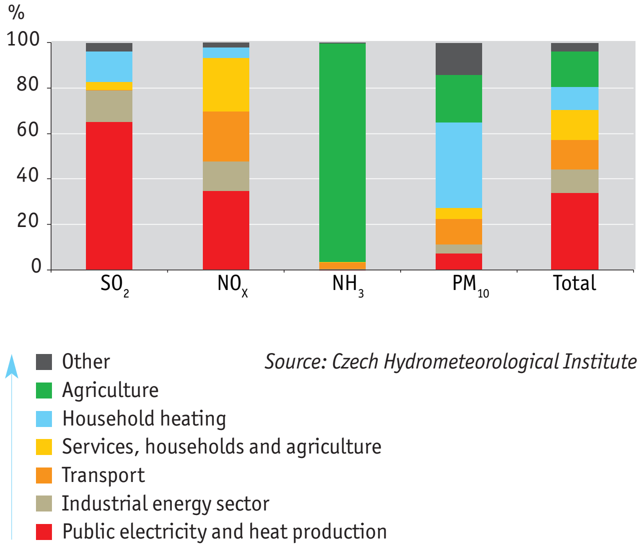
Source: Czech Hydrometeorological Institute

**Emissions from the use of nitrogen fertilisers have been included in the NH_3 emission balance since 2008.*

The correction of emission inventories was carried out for the presented period 2000–2014 due to the adjustments of emission factors.

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 → **Emission sources of primary particulate matter and secondary particulate matter precursors in the Czech Republic [%], 2013**



Source: Czech Hydrometeorological Institute

PM_{10} emissions in the agricultural sector come from livestock breeding and field work.

NH_3 emissions come from livestock breeding and the use of mineral nitrogen fertilisers. Emissions in the sector of services, households and agriculture come from stationary and mobile combustion sources (excluding household heating).

A correction of emission inventories was carried out for the period 2000–2014 due to the adjustments of emission factors.

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Between the years **1990–2014** there was a reduction of emissions of secondary particulate matter precursors (NO_x, SO_2 and NH_3) by 72.9% from 1,583.7 to 264.7 kt.year^{-1} in particulate matter formation potential. The largest declines during this period were recorded in the emissions of SO_2 by 93.2%, NO_x emissions decreased by 68.4% and NH_3 emissions by 56.0%. The biggest decline in emissions of precursors of secondary particles had been recorded before 2000.

Between the years **2000–2014**, the emissions of secondary particulate matter precursors decreased by 39.6%, while the most significant decrease was recorded for SO_2 emissions, i.e. by 44.0%; NO_x emissions decreased by 40.3%, NH_3 emissions decreased by 19.1% and PM_{10} emissions decreased by 33.5% between the years 2003–2013 (Chart 1). The largest interannual decrease in emissions of secondary particulate matter precursors in this period occurred between 2007–2008 (by 9.3%), caused by the recession of the national economy as a result of the economic crisis.

In the **interannual 2013–2014 comparison**, a decrease in emissions of secondary particulate matter precursors by 4.3% was recorded. Emissions of SO_2, which decreased by 9.0%, and emissions of NO_x, which decreased by 3.3% contributed most to the interannual decrease. The emissions of NH_3 stagnated. Emissions of primary particulate matter of the fraction PM_{10} decreased by 5.9% in 2013[1].

Based on 2013 data, **the main sources of emissions of primary particulate matter and secondary particulate matter precursors** in the Czech Republic (Chart 2) include public electricity and heat production (33.8%, i.e. 106.9 kt.year^{-1} in particulate matter formation potential) and the sector of agriculture (15.9%, i.e. 50.2 kt.year^{-1} in particulate matter formation potential). The representation of emissions of primary

[3] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*

particles and secondary particulate matter precursors differs. PM_{10} emissions are produced mainly by the combustion of fuels and other industrial activities, and their main source is household heating (37.8%), followed by agriculture, where emissions of PM_{10} are emitted mainly from field work (20.8%) and the transport sector (11.2%) which represents the fundamental agent in terms of effects on human health. Emissions from the transport sector come not only from combustion processes, but also from resuspension and tire and brake abrasion. SO_2 emissions come mainly from combustion processes, from fossil fuels containing sulphur. Their most important source in 2013 was the sector of public electricity and heat production (65.1%), industrial energy sector (14.0%) and household heating (13.6%). NO_x emissions are produced during fuel combustion and chemical-technological processes. In 2013, the main sources of these emissions were public electricity and heat production (34.9%); a significant source of NO_x emissions in the long-term is also the transport sector (a total of 21.9% in 2013) and combustion processes in the sector of services, households and agriculture (23.7% in 2013). The main source of NH_3 emissions is the sector of agriculture, particularly livestock breeding and application of nitrogenous fertilizers (a total of 96.4% in 2013). NH_3 emissions of 3.0% were produced in 2013 in the transport sector.

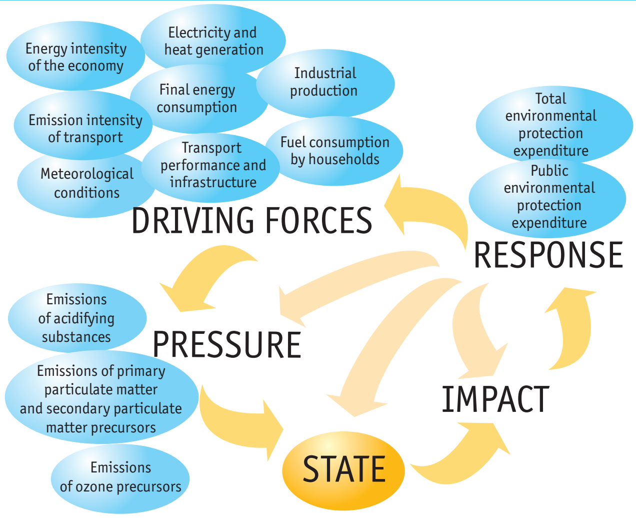
The long-term decline in emissions of precursors of secondary particulate matter is the consequence of structural changes in the economy and the reduction of energy intensity of the economy.

SO_2 emissions are steadily decreasing, which is, in particular, the result of desulphurization of coal power plants in the 1990s and the use of fuels with a lower sulphur content. The reduction of the total NO_x emissions is significantly related to the decrease in these emissions from the transport sector, in particular, to the renewal of the car fleet, the introduction of modern technologies in end devices, as well as with the reduction of energy consumption in the transport sector. SO_2 as well as NO_x emissions and **PM_{10}** emissions are also slightly decreasing due to the reduction of solid fuel consumption in the sector of public electricity and heat production, where the importance of nuclear energy and of energy from renewable energy sources is growing, and also due to legislative obligations on meeting emission ceilings. Current weather conditions have a significant impact on emissions of secondary particulate matter precursors and emissions of primary particles, followed by the length of the heating season and the quality of the burnt material. Industrial production (mainly related to construction works, for example cement works) and construction works, which in 2013 experienced an annual decline, significantly affect the production of PM_{10} emissions. The decline in emissions of **NH_3** acidifying substances is associated with a decrease in the quantity of livestock (mostly pigs) resulting from the agricultural policy of the Czech Republic and further with the implementation of the plans of good agricultural practice and the change in the means of financing agriculture after the entry of the Czech Republic into the EU.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

06/ Air quality in terms of human health protection



KEY QUESTION

Are the limit values that have been set for air pollutants in order to protect human health being met?

KEY MESSAGES

The limit values for arsenic, nickel, lead and benzene were not exceeded in 2014 at any of the monitored sites. The limit values for sulphur dioxide and carbon monoxide have not been exceeded in the assessed year. Compared to 2013, in 2014 the number of declared smog situations decreased due to high concentrations of PM_{10} and ground-level ozone.

Despite the continuing decline in emissions since 2000, the air quality on the territory of the Czech Republic is not improving. The Moravian-Silesian Region still belongs among the most polluted regions. Limit values for suspended particulates, benzo(a)pyrene and ground-level ozone are repeatedly being exceeded. In areas with heavy traffic load the limit value for NO_2 was exceeded in 2014, too, just as the limit value for cadmium.

OVERALL ASSESSMENT

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

7th Environmental Action Programme until 2020
- protection of the Union's citizens from environment-related pressures and risks to their health and living conditions
- promotion of a high level of environmental protection and higher quality of life and social well-being of citizens
- achievement of a level of air quality that does not have significant negative impacts or poses a risk to human health and environment

Health for All in the 21st Century
- reduction of the exposure of the population to health risks associated with the pollution of water, air and soil, and the systematic monitoring and assessment of the air quality indicators and indicators of the state of health (implementation of the programme is monitored in yearly intervals)

State Environmental Policy of the Czech Republic 2012–2020
- improvement in air quality in places where pollution limits are exceeded and at the same time maintaining air quality in the territories where pollution levels are not being exceeded

Act No. 201/2012 Coll., on air protection
- full adoption of air pollution limits provided for by the Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe and by the Directive 2004/107/EC of the European Parliament and of the Council relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

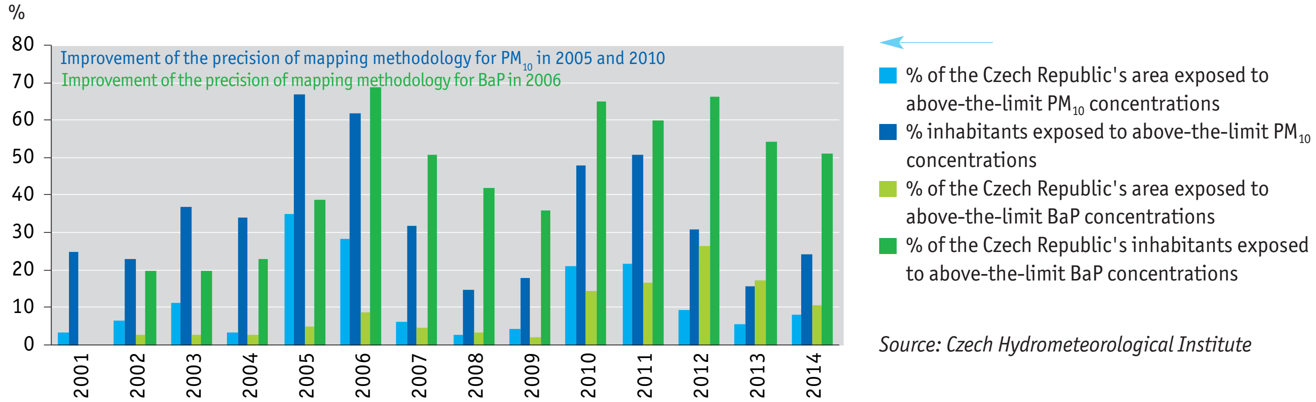
Decree No. 330/2012 Coll. on the method to assess and evaluate the level of pollution, the extent of information provided to the public about the level of pollution and smog situations
- establishment of upper and lower limits for the assessment of pollution levels for the protection of health

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Suspended particulate matter (PM_{10}, $PM_{2.5}$), including ultra-fine particulate matter of fractions smaller than 1 µm belong among the most serious pollutants in relation to human health. PAHs, expressed as benzo(a)pyrene, are bound to the fine fraction of suspended particulates. The main source of these substances is imperfect combustion of fossil fuels, namely emissions from local furnaces, operation of coke, and iron production technologies, transport and processes associated with it (resuspension, abrasion of tires, corrosion). Exposure to a mixture of suspended particles corresponds to the extent of air pollution and the population's lifestyle and its severity depends on the size, shape and chemical composition of the particulates. Despite the demonstrable negative effects of suspended particulates on human health, no threshold concentration has been determined yet. The effects of short-term increased daily concentrations of all suspended particles of all PM fractions include the rise of general sickness and death rates, especially in relation to heart and blood vessels diseases, diseases of the respiratory system, and increase of infant mortality and worsened problems of asthmatics. Ultrafine particles can penetrate into the blood stream, from where they can further get into all the organs. Moreover, carcinogenic effects have been proven for benzo(a)pyrene. Ground-level ozone is another substance that negatively affects human health and ecosystems. It damages especially the respiratory system and irritates the respiratory tract. A short-term effect of high NO_x concentrations causes respiratory problems; long-term exposure to NO_x is associated with an increase in overall cardiovascular and respiratory mortality and the worsening of asthmatic problems. The impact of benzene, arsenic, nickel and cadmium consists in their toxic, mutagenic, and carcinogenic properties and in their ability to accumulate in environmental media and in living organisms.

INDICATOR ASSESSMENT

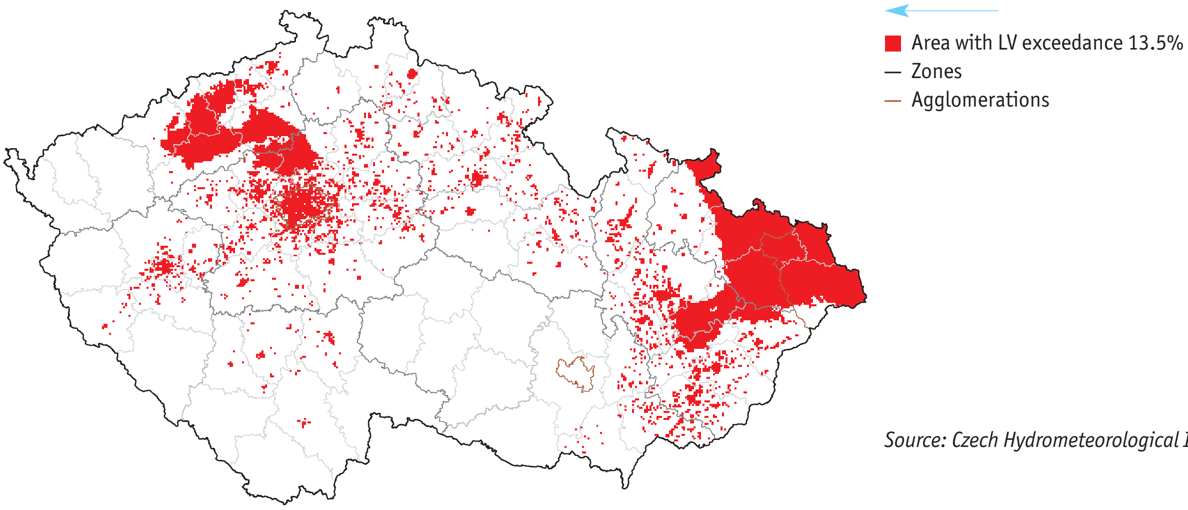
Chart 1 ➜ **Percentage of the Czech Republic's area and population exposed to above-the-limit 24-hour concentrations of PM_{10} and above-the-limit annual concentrations of BaP [%], 2001–2014**



Source: Czech Hydrometeorological Institute

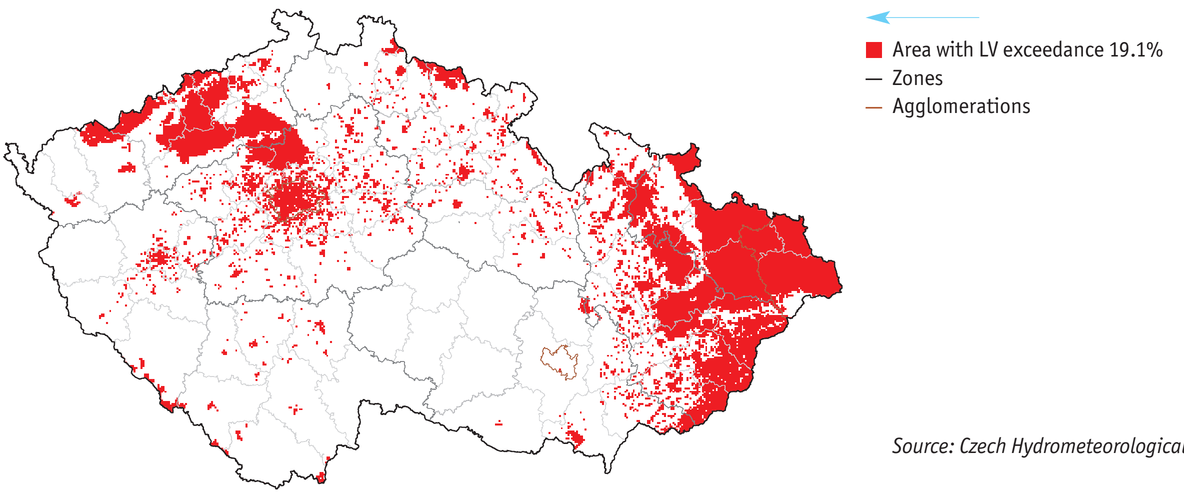
In 2005, a refinement of the mapping methodology was carried out and a model that combines the SYMOS model, the European EMEP model and the altitude data with the measured concentrations at rural background stations was first used in the construction of maps of PM_{10} concentration fields. In the year 2009, the methodology was refined again by applying the CAMx model. The SYMOS model includes emissions from primary sources. Secondary particulate matter and resuspended particulate matter that are not included in the emissions from primary sources, are taken into account within the EMEP and CAMx models. Between the years 2002–2007, the benzo(a)pyrene mapping methodology was gradually refined. In addition to the increase in the number of monitoring stations, a refinement in the mapping methodology was carried out in 2006. In 2006, a number of cities and towns were subsequently included in the territory with an exceeded BaP target value.

Figure 1 ➜ **Areas within the Czech Republic where health protection limit values were exceeded (excluding ground-level ozone), 2014**



Source: Czech Hydrometeorological Institute

Figure 2 ➜ **Areas within the Czech Republic where health protection limit values were exceeded (including ground-level ozone), 2014**



Source: Czech Hydrometeorological Institute

Table 1 ➜ **Increase in the total annual mortality by "premature death" [an estimate of the number of premature deaths] – the span and mean urban value for the Czech Republic, 2006–2014**

PM_{10} (75% representation of the $PM_{2,5}$ fraction)	2006	2007	2008	2009	2010	2011	2012	2013	2014
Estimated mean value for the Czech Republic	8,189	5,726	5,224	5,540	6,108	6,815	5,888	6,040	5,842
Estimated mean value for normal urban environment *	6,842	4,623	4,306	4,816	5,346	6,354	5,888	6,040	5,371

Source: State Health Institute

** Excluding stations extensively burdened by traffic and industry.*

The total mortality increase was calculated from the span of values measured in the Czech Republic and from the estimate of values in unburdened urban areas of the Czech Republic. The annual average PM_{10} values ≤ μ 13.3 g.m^{-3} for 75% representation of the $PM_{2.5}$ fractions) were evaluated as 0. The values of the total annual death rate in 2013 were taken from the Czech Statistical Office and "cleaned" – deaths caused by injury and those of people under 30 years were deducted.

The WHO recommendations were used for the conversion of the PM_{10} effects; supposing the estimated mean value of representation of $PM_{2.5}$ fraction in the PM_{10} fraction for the Czech Republic to be 75%.

Accuracy of the estimate is in the order of 10^2.

Table 2 ➜ **Range of values of individual carcinogenic risk (ILCR) for benzo(a)pyrene in evaluated types of sites with over 5,000 inhabitants*, 2009–2014**

Carcinogenic substances	2009		2010		2011		2012		2013		2014	
Number of additional cases per 100,000 inhabitants	min	max	min	max	min	max	min	max	min	max	min	max
Cities (over 5,000 to 5 mil. inhabitants)	5.3	80.0	4.4	62.6	3.1	88.5	4.6	94.2	5.7	81.7	3.3	81.1
Sites without traffic and industrial burden	5.6	13.0	5.2	15.7	4.6	13.7	4.7	9.7	5.9	39.0	5.0	31.8
Sites with traffic burden	5.3	39.0	4.4	37.4	5.4	11.1	5.3	13.0	7.0	25.7	5.7	25.0
Industrial sites	15.0	80.0	14.8	62.6	15.7	88.5	9.8	98.8	11.0	81.7	13.8	81.8

Source: State Health Institute

** Concerns approximately 5 mil. inhabitants.*

For the purposes of health risk assessment, the data were processed in a form of span intervals for the Czech Republic, for all urban stations (about 5 mil. inhabitants in total) and for selected types of urban sites (housing sites without transport burden and urban transport burden). Due to lack of data, this procedure cannot be used to make a more detailed resolution for the evaluation of burden imposed on population in small settlements (< 5,000 inhabitants to approximately 5 mil. inhabitants).

BaP, which contributes with the highest share to the burden (its ILCR moves within the range of 10^{-4} to 10^{-3}), was selected as the indicator for the assessment.

In the 1990s, there was a major drop in emissions of all the basic pollutants and a subsequent drop in air pollution. Despite the continuing decline in emissions at the beginning of 21st century, the concentrations of pollutants in the air, especially of suspended particulate matter and benzo(a)pyrene, are not decreasing in the areas where deterioration in air quality was identified and the development is accompanied by variations which are related mainly with the dispersion conditions.

A significantly larger number of exceedances of the **PM_{10}** daily limit values were achieved in relation to deteriorated dispersion conditions, which were associated with specific synoptic situations in January and February and in the period October–November 2014.

In 2014, a total of 20 **smog situations** were declared due to high PM_{10} concentrations, with a total duration of 20 days and 21 hours (501 hours), and 1 regulatory notice which lasted 1 day and 13 hours. The smog situations were most often declared in the territory of the Ostrava/Karviná/Frýdek-Místek agglomeration without the Třinec region (a total of 5 of the declarations) and in the area of the Moravian-Silesian Region (total of 2 declarations). The most significant declaration in 2004 lasted from 4 to 8 December 2014 when the smog situation was declared simultaneously in 4 territories all over the Czech Republic. The declaration of smog situations is closely related to the occurrence of specific synoptic situations (see the indicator Meteorological conditions). Compared to the year 2013, the number of smog situations decreased (20 smog situations were declared in 2013), however, their duration shortened (in 2013 they were declared for 56 days and 5 hours, i.e. a total of 1,349 hours).

In 2014, **the exceedance of the 24-hour limit value for PM_{10}** was recorded at 57 out of a total of 133 stations, i.e. in 42.9% of the stations. As in the previous year, most of the stations exceeding the limit values, were located in the Moravian-Silesian region, the Ústí nad Labem region and also in Prague. In the previous assessed year 2013, the limit value was exceeded at 32.6% of stations, i.e. at 42 stations from a total of 129 stations. In 2014 the annual limit value for PM_{10} was exceeded at 7.1% of the stations, i.e. 10 stations of a total of 141, in 2013 the annual limit value was exceeded at 7.4% of the stations (10 from a total of 136 stations).

In 2014, the limit value for the 24-hour concentration of PM_{10} (Chart 1) was exceeded in 8.1% of the territory (in 2013 in 5.7% of the territory). Approximately 24.4% of the Czech population was exposed to above-the-limit concentrations in 2014 (in 2013 a total of 15.9% of the population), therefore the situation deteriorated compared to the year 2013. The limit value for the annual average concentration of PM_{10} was exceeded in 0.5% of the territory of the Czech Republic (in 2013 in 0.7%) in the year 2014.

According to the estimate carried out by the State Health Institute, **exposure to suspended particulate matter** contributed to the premature death rate of the population in the range between units of percent to approximately 10% in the industrially burdened areas of Ostrava-Karviná in the period 2006-2014. This risk is not evenly distributed within the population, as it concerns sensitive population groups, particularly the elderly and chronically ill people. It can be estimated from these data that the increase of the total death rate to which the exposure to PM_{10} contributed (with the estimated 75% representation of $PM_{2.5}$), has been ranging from 6,000 to more than 8,000 people per year in long terms; in 2014 this concerned approximately 5,800 thous. persons. In ordinary urban environment, this concerned about 5,400 persons in 2014 (Table 1).

The limit value for annual concentrations of **suspended particulate matter of $PM_{2.5}$ fractions** in the year 2014 was exceeded at 11 of a total of 52 (i.e. 21.2%) stations. Compared to the year 2013 there was a slight increase, as the limit value was exceeded at 9 out of 46 stations in 2013 (i.e. 19.6% stations). The highest average concentrations were, as in previous years, recorded in the sites of the Moravian-Silesian Region.

No limit value has been set for the rate of air pollution in the case of suspended particulate matter **PM_1**. The highest annual average concentrations in 2014 were achieved at the station Brno-Svatoplukova (24.1 $\mu g.m^{-3}$), and the maximum 24-hour concentration was achieved at Otrokovice-město (151.9 $\mu g.m^{-3}$), while both of these sites are traffic sites. For fractions smaller than 1 µm, incremental data obtained from case studies and projects also exist, which, however, point to increased and above-the-limit concentrations, especially in the Moravian-Silesian Region and Ústí nad Labem Region, where their main source is, in particular, road transport and local furnaces.

The ground-level ozone concentrations are influenced by the meteorological conditions (the intensity of sunlight, temperature, and the occurrence of rainfall) in the period from April to September when the highest concentrations are usually measured. In 2014, the concentrations of ground-level ozone have decreased compared with the previous year 2013. The limit value for ground-level ozon for the protection of human health was exceeded in 5.6% of the territory and 0.8% of the population were exposed to above-the-limit concentrations (in 2013 the air pollution limit value was exceeded in 25.6% of the territory of the Czech Republic with 8.2% of the population).

In 2014, a total of 2 **smog situations** were declared with a total duration of 42 hours (i.e. 1 day and 18 hours) due to high ground-level ozone concentrations. The smog situations were declared in the territory of Prague and in the Ostrava/Karviná/Frýdek-Místek agglomeration. This is an improvement compared to 2013 when 16 smog situations were declared with the duration of 553 hours. Occurrence of smog situations is related to high air temperatures and to clear or partly cloudy weather with low wind speed. While in 2013, smog situations were declared in April, June, July and August, in 2014 both smog situations were declared only in June.

As in 2013, in 2014 a number of towns and smaller settlements were classified as areas with exceeded limit values for **benzo(a)pyrene**. This concerns about 10.7% of the territory where 51.1% of the population live (Chart 1).

The limit value (1 $ng.m^{-3}$) for annual average BaP concentration was exceeded at 74.2% stations (i.e. 23 out of a total of 31). Therefore a slight deterioration took place compared to 2013 when the annual average concentration was exceeded at 67.7% stations (i.e. 23 out of a total of 31). The highest annual average concentration was measured, similarly to the previous years, in Ostrava-Radvanice (9.3 $ng.m^{-3}$).

The total **increase of the individual lifelong risk of new cancer diseases in urban localities** of the Czech Republic with over 5 thous. inhabitants due to BaP has been stagnating in the long term; in 2014 it ranged from 3.3 to about 14 occurrences of the disease per 100,000 inhabitants according to the type of urban localities. In localities with traffic load the impact of BaP emissions could lead to an increase in health risks by about 1 case per 100,000 inhabitants compared to the values measured in urban areas without major traffic and industrial pollution. In localities affected by large industrial sources, the value of the individual risk was higher than in other urban localities and in theory could represent an increase of up to 8 additional cases per 100,000 inhabitants (Table 2).

The **map of areas with exceedance of at least one air pollution limit value, excluding ground-level ozone,**[1] provides comprehensive information on ambient air quality in the territory of the Czech Republic in 2014. In this year, 13.5% of the territory of the Czech Republic (Figure 1) was marked. In 2014, the air pollution limit value was exceeded for PM_{10}, $PM_{2.5}$ (see above), NO_2 (at 4 locations with traffic burden from a total of 94 monitored stations). The limit value for BaP was also repeatedly exceeded (see above). In 2014, the limit value for cadmium (Cd) was exceeded at 1 of 52 monitored stations. The limit values for benzene, SO_2 and CO, for arsenic (As), nickel (Ni) and lead (Pb) in 2014 were not exceeded at any of the monitored stations.

After the inclusion of ground-level ozone[2], 19.1% of the area of the Czech Republic (Figure 2), where the limit values were exceeded for at least one or more pollutants, were delimited.

Information about air pollution in the individual small settlements is missing, due to legislatively provided positions of the stations. The issue of small settlements is only mentioned in case studies and, as far as BaP is concerned, in measurements taken manually in rural locations whose numbers are not, however, large. Increased or above-the-limit concentrations of pollutants were measured in the air in small settlements (with up to 10,000 inhabitants), where almost half of the population in the Czech Republic live (in 2014 this concerned 48.0% of the population). This concerns, in particular suspended particulates, PAH and heavy metals. Therefore, air pollution in the most affected small settlements can be comparable with the burden of large urban agglomerations. The reason behind the poor air quality in small settlements consists in the morphology of the territory, the weather conditions and traffic burden, namely transit traffic without the existence of detour routes and traffic flow. However, emissions from the burning of solid fuels mainly in local furnaces, which in 2013[3] comprised 37.9% of all PM_{10} emissions, have the major impact on air pollution in Czech rural areas. If waste is burnt in local furnaces, hazardous dioxins are emitted.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

[1] Act No. 201/2012 Coll., on air protection, Annex no. 1, Articles 1, 2 and 3: exceedance of the air pollution limit value excluding ground-level ozone for at least one of the listed pollutants (SO_2, CO, PM_{10}, $PM_{2.5}$, NO_2, Benzene, Pb, As, Cd, Ni, benzo(a) pyrene)

[2] Act No. 201/2012 Coll., on air protection, Annex no. 1, Articles 1, 2 and 3: exceedance of the air pollution limit value including ground-level ozone for at least one of the listed pollutants (SO_2, CO, PM_{10}, $PM_{2.5}$, NO_2, Benzene, Pb, As, Cd, Ni, benzo(a)pyrene)

[3] Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

07/ Air quality in terms of the protection of ecosystems and vegetation

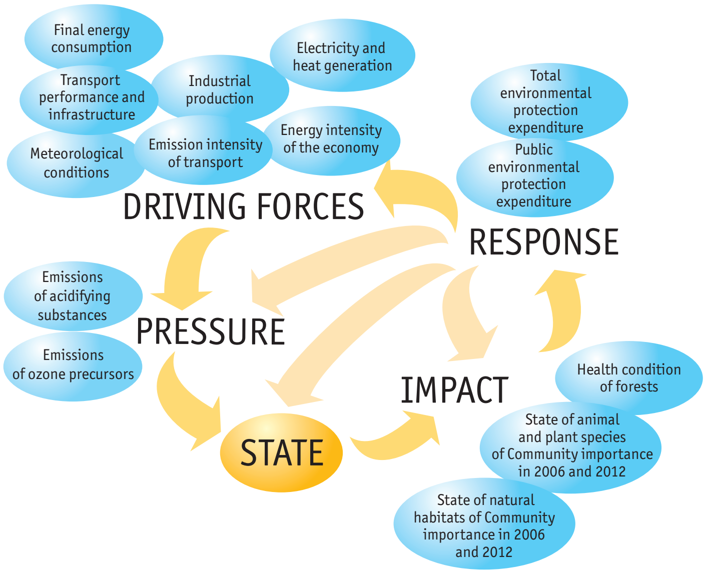
KEY QUESTION

Have limit values for the protection of ecosystems and vegetation been exceeded?

KEY MESSAGES

In 2014, the limit value for the annual average concentration of NO_x was not exceeded at any rural station and neither the limit values for annual, nor winter average concentrations of SO_2 were exceeded.

In 2014, the limit value for ground-level ozone for the protection of ecosystems was exceeded at 3 from a total of 35 stations rated as rural or suburban. Compared to the year 2013, there was increase in the number of sites with an exceeded limit value. The total atmospheric deposition of sulphur, nitrogen, and hydrogen ions has not been decreasing significantly in the last decade.



OVERALL ASSESSMENT

Change since 1990	N/A
Change since 2000	:)
Last year-to-year change	:)

REFERENCES TO CURRENT CONCEPTUAL STRATEGIC AND LEGISLATIVE DOCUMENTS

The protocols to the Convention on Long-range Transboundary Air Pollution (CLRTAP), the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone

- limitation of ground-level ozone precursor emissions (NO_x and VOC)

Decree No. 330/2012 Coll. on the method to assess and evaluate the level of pollution, the extent of information provided to the public about the level of pollution and smog situations

- establishment of limit values and the upper and lower limits for the assessment of pollution levels to protect ecosystems and vegetation for ground-level ozone (expressed as AOT40 exposure index)[1], SO_2 and NO_x

National Emission Reduction Programme of the Czech Republic

- reduction of the environmental burden by the substances damaging ecosystems and vegetation

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

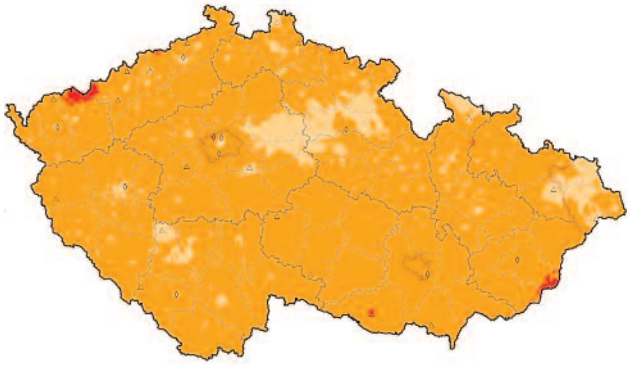
Polluted air, together with atmospheric deposition, has a negative impact not only on humans, but also on ecosystems and vegetation. Increased concentration of ground-level ozone causes headaches, burning eyes and negatively affects the respiratory system.

The effects of ground-level ozone on vegetation are serious too. Ground-level ozone affects the vegetation on the biochemical, cellular and physiological levels. The result of vegetation's exposure to ground-level ozone consists in negative impacts on the state of health of entire ecosystems, which can consequently have an impact on human society, for example by reducing the yields of agricultural crops and by decreasing the health of forest stands. Extensive areas of the Czech Republic are threatened by acidic atmospheric deposition. As a result of direct exposure to high concentrations of pollutants in the air, the acidification of soils and the subsequent extensive acidification of aquatic ecosystems takes place which leads to the disruption of the health of ecosystems. Atmospheric deposition and ground-level ozone reduces the resistance of vegetation to adverse external influences and also affect the water regime and biodiversity.

[1] *For the purposes of the Act No. 201/2012 Coll., AOT40 means the sum of the differences between the hourly concentration greater than 80 μg.m^{-3} (= 40 ppb) and the value 80 μg.m^{-3} in the given period using only the hourly values measured every day between 08:00 and 20:00 CET, calculated from hourly values during the summer season (May 1–July 31).*

INDICATOR ASSESSMENT

Figure 1 → **Field of AOT40 exposure index values, average of 5 years [µg.m^{-3}.h], 2010–2014**

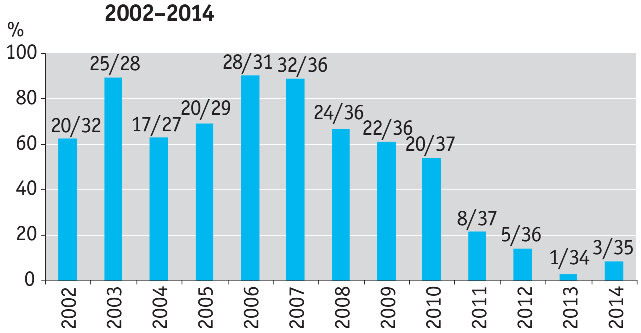


Classification of stations
◊ Suburban background
△ Rural

AOT40
≤ 14 000 (≤ LV)
> 14 000–18 000 ≥ LV
≥ 18 000 (> LV)

Source: Czech Hydrometeorological Institute

Chart 1 → **Percentage of stations at which the limit values, expressed as AOT40 (5-year average) – for the protection of ecosystems and vegetation was exceeded [%], 2002–2014**

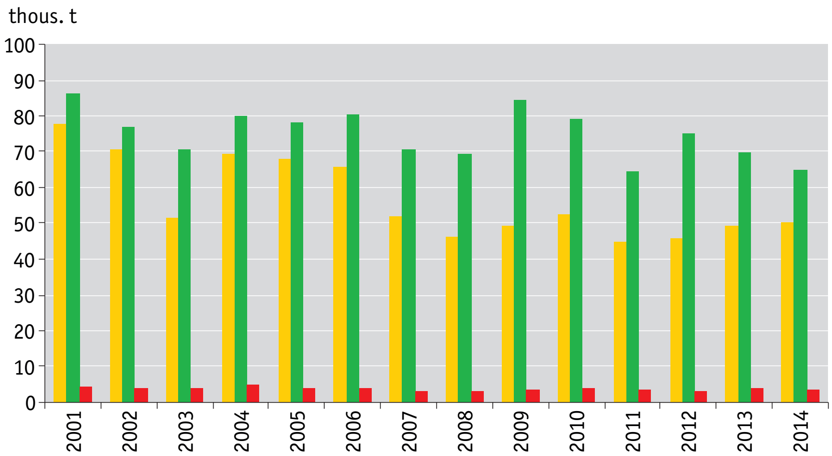


Number of stations where the limit value expressed as AOT40 was exceeded

Source: Czech Hydrometeorological Institute

The number in the chart indicates the number of stations at which the limit value was exceeded (before the slash) out of the total number of stations (after the slash). These are rural and suburban stations for which the AOT40 calculation is relevant under the legislation.

Chart 2 → **Development of the total atmospheric deposition of sulphur, nitrogen, and hydrogen ions in the Czech Republic [thous. t], 2001–2014**



S
N
H+

Source: Czech Hydrometeorological Institute

In 2014, the **ozone (AOT40) limit value** for the protection of ecosystems and vegetation (the relevant calculation was made according to the legislation) was not exceeded in most of the territory of the Czech Republic (Figure 1). In comparison with the previous assessed period 2009–2013, the situation has not changed significantly.

Based on the assessment for the year 2014 (average for the years 2010–2014) the ozone limit value for the protection of ecosystems and vegetation was exceeded at three stations (one of which is Štítná n. Vláří, where the highest exceedance of 20,134.6 $g.\mu m^{-3}.h$ was recorded) out of the total of 35 rural and suburban stations. Compared to the year 2013 (average for the years 2009 to 2013), there was an increase in the number of sites where exceedance was recorded, because in 2013 the ozone limit value for the protection of ecosystems and vegetation was exceeded only at 1 of the total 34 stations (Chart 1).

Interannual changes in the values of the AOT40 exposure index are affected not only by ozone precursor emissions, but more particularly by the meteorological conditions (temperature, precipitation, solar radiation) in the period from May to July for which the indicator is calculated. Compared with the previous assessed year, the decline in the value of the AOT40 exposure index for the year 2014 was recorded only in 8.6% of the localities (in 2013 in 91.2% of localities), while the increase was recorded in 91.4% of the localities (in 2013, on the contrary, in 8.8% of the localities due to less favourable conditions affecting the formation of AOT40). From the period 2010–2014, the highest values were reached in the year 2010 (if individual years are assessed).

In 2014, the limit value for annual average concentrations of NO_x was not exceeded at any of the 14 localities classified as rural. The limit values for annual or winter average concentrations of SO_2 were not exceeded at any rural locality (out of a total of 14 localities) in 2014.

The field of total atmospheric deposition (Chart 2) is the sum of wet and dry atmospheric depositions. The burden of ecosystems caused by atmospheric deposition remains high in many areas of the Czech Republic. This is caused by the emissions from industrial sources and emissions from the transport sector (especially NO_x emissions); however, the long-range transmission from Central Europe (Germany, Poland and Slovakia) also contributes to it. In 2014, the total atmospheric deposition of sulphur amounted to 50,148 t of sulphur for the total area of the Czech Republic and has not changed significantly since 2007. In the years 2000–2006, the total deposition of sulphur remained in the range of approximately 65,000–75,000 t per year, with the exception of the year 2003, which was significantly below the normal in terms of precipitation. The total deposition of sulphur has its maximum in the Ore Mountains (Krušné hory) where the maximum values of the throughfall deposition of sulphur are also achieved.

In the last decade, the value of the total nitrogen deposition remains in the range of 70,000–80,000 t per year as a result of the production of NO_x emissions from transport, industrial production and energy generation. In 2014, the total deposition of nitrogen (oxidized + reduced forms) amounted to 64,931 $t.year^{-1}.km^{-2}$. Therefore, a slight annual decline occurred. The highest values of the total nitrogen deposition were measured in the Ore Mountains (Krušné hory).

In 2014, the total deposition of hydrogen ions was 644 $t.year^{-1}$ per the area of the Czech Republic. The highest values of the total atmospheric deposition of hydrogen ions are recorded in the territory of the Ore Mountains, too.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

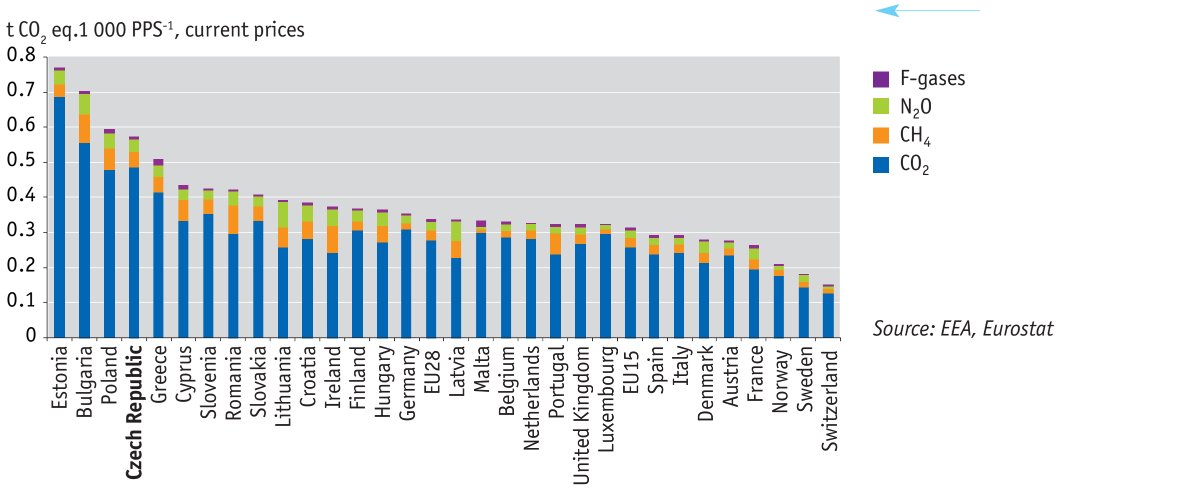
Air and climate in the European context

KEY MESSAGES

- The total aggregated greenhouse gas emissions decreased by 19.2% in the EU28 countries in the period 1990–2012 which are therefore successfully heading towards meeting the objectives of the Kyoto Protocol and the climate-energy package for 2020. The drop in emissions in the Czech Republic in this period reached 33.0%. The Czech Republic reached a reduction of emissions of the entire EU28 that exceeds its share on the total emissions of the EU28.
- The greenhouse gas emissions per capita and per unit of GDP in the Czech Republic are above-average in the European context. The emission intensity of the Czech economy in 2012 was 69.3% higher than the EU28 average.
- Emissions of acidifying substances, ground-level ozone precursor emissions and emissions of primary particles and precursors of secondary particles in the EEA member countries in the period 1990–2011 declined significantly, while in the Czech Republic the most significant positive change occurred for individual pollutants.
- Despite the long-term decline of emissions of pollutants into the air, the Czech Republic ranks among the most polluted regions of the EU28 as far as the air quality in some of its parts is concerned. In the European context, the population of the Czech Republic is affected by local exceedances of air pollution health-protection limits for PM_{10}, benzo(a)pyrene and ground-level ozone.
- Ground-level ozone causes severe damage to vegetation. In 2011, the air pollution limit for AOT40 was exceeded in 18% of agricultural land in EEA countries; no exceedance occurred in the majority of the Czech Republic's territory.

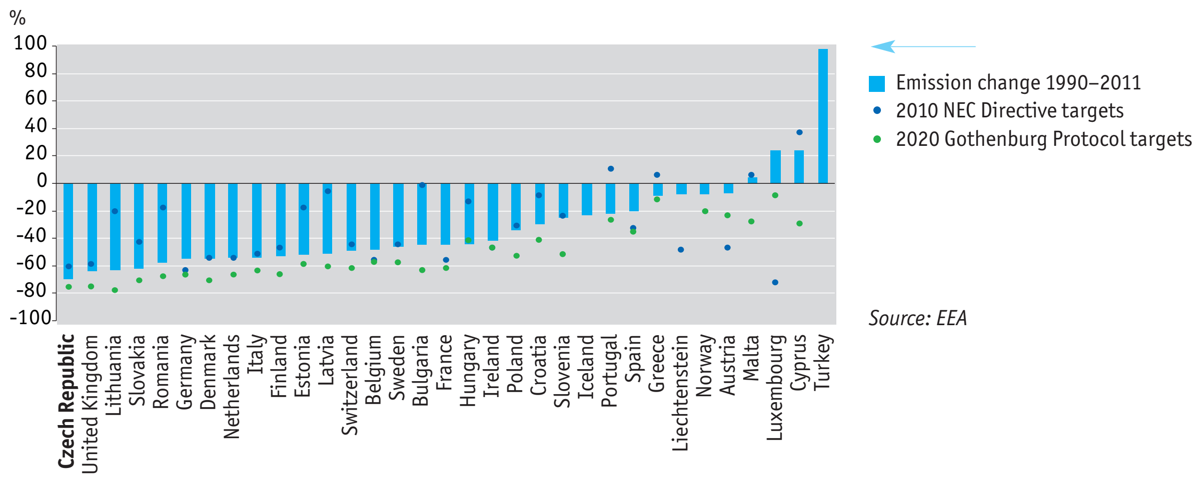
INDICATOR ASSESSMENT

Chart 1 → **Emission intensity of GDP generation according to the individual greenhouse gases without LULUCF sector [t CO_2 eq.1,000 PPS^{-1}, current prices], 2012**



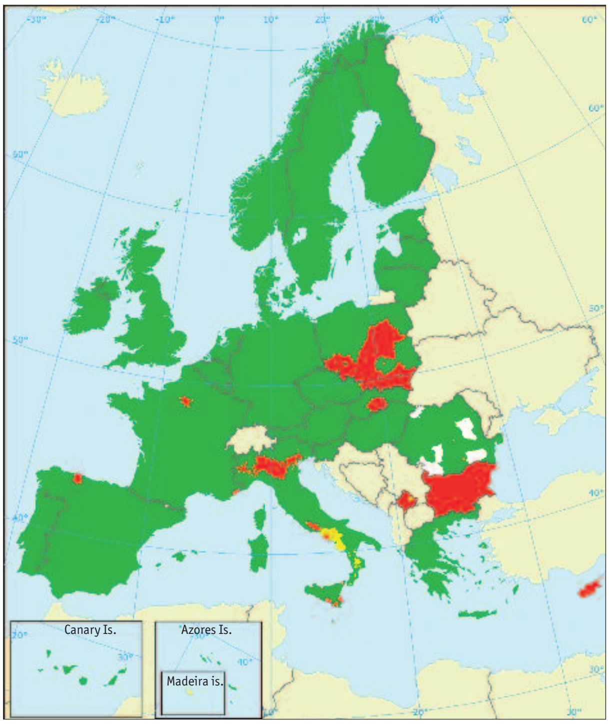
Source: EEA, Eurostat

Chart 2 → **Change in NO_x emissions between the years 1990–2011 [%]**



Source: EEA

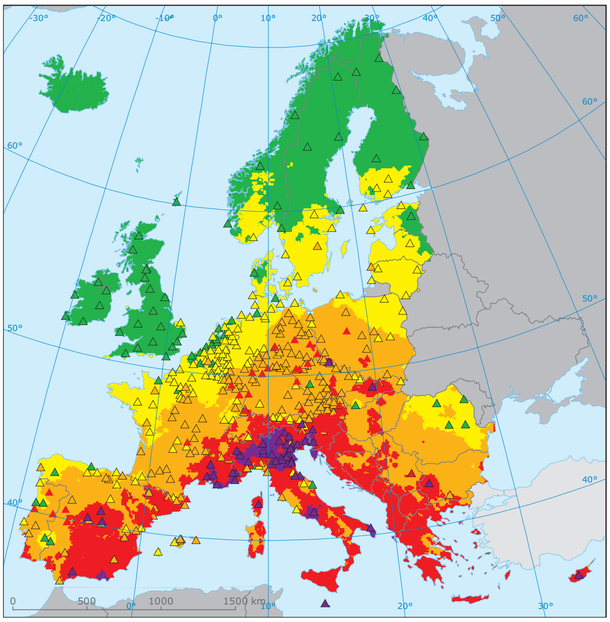
Figure 1 → **Exceedance of the limit value for average annual concentration of suspended particles to protect human health in Europe [μg.m^{-3}], 2012**



- ≤ limit value (green colour)
- ≥ limit value (red colour)
- > limit value + margin of tolerance (violet colour)
- Non-reporting Countries
- Zone designated, Data missing
- Area not designated

Source: EEA

Figure 2 → **Fields of the AOT40 index values in Europe [μg.m^{-3}.h], 2011**



- < 6 000
- 6 000–12 000
- 12 000–18 000
- 18 000–27 000
- > 27 000
- Data missing
- Area with poor data coverage
- △ Rural background station

Source: EEA

According to the WMO report on the state of the climate, the **global temperature of the Earth's surface** was by about 0.57°C ± 0.09°C higher in 2014 compared to the long-term mean (1961–1990) which is 14.0°C. This temperature anomaly makes 2014 the first warmest year in the last 165 years, in which the instrumental measurement has been carried out. The year 2014 in Europe was extremely warm. It was the warmest year ever recorded in 19 European countries (including the Czech Republic). January of 2014 was the warmest in France since 1900 – the whole winter in the United Kingdom was the warmest in its history. Unusual fluctuations in weather occurred even in the case of precipitation totals. Floods in Croatia, Serbia and Bosnia and Herzegovina hit up to 1.6 mil. people and extremely high precipitation totals were recorded in July and August in France, Switzerland and Luxembourg.

The total aggregated greenhouse gas emissions of the EU28 countries decreased in the period 1990–2012 by 19.2% (1,083.8 Mt CO_2 eq., without LULUCF). The EU is therefore on the way to successfully meeting the objectives of the second control period of the Kyoto Protocol and the climate-energy package. The largest absolute declines in emissions in this period were recorded by Germany (by 309.0 Mt CO_2 eq.) and the United Kingdom (by 197.2 Mt). Together, these two states produce about one-third of the total emissions of the EU28. The greenhouse gas emissions in the Czech Republic decreased by 64.7 Mt CO_2 eq. (33.0%). The Czech Republic therefore contributed to the overall emission reduction in the EU28 by more (6.0%) than its share represents in the total emissions (2.9%) of the EU28 in 2012. Interannually in 2012, the emissions declined by 1.3% in the EU28 and by 2.8% in the Czech Republic. CO_2 constitutes an absolute majority in the composition of aggregated emissions according to individual greenhouse gases in all countries of the EU28. Higher shares of CH_4 and N_2O are held by states with a lower carbon intensity of the economy and a more important position of agriculture in the economy (Ireland, Lithuania, Latvia).

In 2012, the **greenhouse gas emissions per capita in the Czech Republic** were the fourth highest in the EU28 when they reached 12.5 t CO_2 eq.capita^{-1}, which is 39.4% above the European average. The emission intensity of the economy in the Czech Republic (0.6 t CO_2 eq.1,000 PPS^{-1}, in current prices) was 69.3% higher than the average of the EU28 in the year 2012 (Chart 1). The countries of Western and Northern Europe with high economic performance have economies with the smallest emission intensity. On the contrary, most emissions per unit of GDP are produced especially by Bulgaria, Estonia and Poland. In the case of Bulgaria, high emission intensity is influenced particularly by lower economic performance. The high emissions of greenhouse gases per capita in Poland and Estonia are due to the specifics of the economy and the composition of the energy mix.

Emissions of acidifying substances (NO_x, SO_2 and NH_3) in most of the EEA Member states (25 of 33) significantly decreased in the period 1990–2011. In the reference period, the emissions of SO_2, which contributed most significantly to the overall decline, decreased by 73.5%, emissions of NO_x by 44.0% and emissions of NH3 decreased by 24.8%. The Czech Republic ranks among the countries in which the decline in emissions of pollutants was most substantial, especially in NO_x emissions – by about 70% (Chart 2) and in SO_2 emissions by 91.1%. The reason for this decline consists in the solution to high environmental burdens resulting from intensive industrial production and mining in the 20th century. In 2011, the main sources of emissions of acidifying substances in EEA member states were agriculture (93.6% of NH_3 emissions), generation and distribution of energy (58.1% of SO_2 emissions) and road transport (40.5% of NO_x emissions). These sectors, however, also contributed most to the overall decrease in emissions of acidifying substances. The transition to better quality fuels with a lower sulphur content, both in the industrial and household production, participated in the reduction of SO_2 emissions. The NO_x emissions decreased mainly due to the introduction of end technologies in the transport sector. Reduction of the number of livestock and a change in the use of nitrogenous and organic fertilisers contributed to the decline in NH_3 emissions.

In the EEA member states, there was also a decline in the production of **ground-level ozone precursors** (NO_x, VOC, CO, CH_4), emissions in 1990–2011, while the main substances with the largest share in the total emissions of ground-level ozone precursors continue to be NO_x and VOC, which decreased in the period by approximately 44% and 57%, CH_4 emissions, which decreased by approximately 29%, and CO emissions which decreased by approximately 61%. In 2011, the main sources of ground-level ozone precursor emissions were agriculture (48.0% of CH_4 emissions), activities aimed at the use of solvents (43.1% of the VOC emissions) and the transport sector (40.5% of emissions of NO_x emissions, 26.5% of CO emissions). Despite the increase in road transport, the largest decrease in emissions of ozone precursor since 1990 was recorded in this sector, i.e. by 47.3% in the case of NO_x and 51.8% in the case of VOC.

In the period 1990–2011, the **emissions of primary particles** dropped by about 24% and the **emissions of precursors of secondary particulate matter precursors** also decreased. In the assessed period, emissions of primary particles in the Czech Republic decreased by 43.4%, and therefore the Czech Republic joined the countries that have contributed most significantly to the decline. The sector of services and households altogether (a total of 35.0% of emissions) was the main source of emissions of primary particles and secondary particulate matter precursors in 2011 in the EEA Member States, while home heating from local furnaces followed by industrial processes (28.6%) and road transport (10.8%) remain the most significant sources of PM_{10} emissions.
Despite the continuing trend of declining air pollutants, it has been estimated that approximately 21% **urban population** in the EU28

countries were exposed to exceeded limit values for suspended particulate matter PM_{10} in 2012. The most affected areas were Central Europe – the Czech Republic, Poland and Slovakia, and the northern Italy and Bulgaria (Figure 1). The population of Central Europe (the agglomeration of Ostrava, Karviná, Třinec together with the Katowice agglomeration) and Eastern Europe are also affected by exceeded limit values for benzo(a)pyrene and it is estimated that approximately 25% of the urban population was affected in 2012. This pollution is not only caused by industrial focus and transport burden in the areas concerned, but also by long-range transmission of pollutants. The population of the Czech Republic, together with the population of the countries of Southern and Central Europe, is negatively affected by exceeded air pollution limits of ground-level ozone.

Production of pollutant emissions into the atmosphere, in particular of acidifying substances, is associated with **eutrophication and acidification of the natural environment**. In 2010, approximately 7% of the EU28 member states were affected by acidification of the natural environment and approximately 63% of the EU28 countries were affected by eutrophication. However, since 1990 the burden on ecosystems has been considerably reduced throughout the entire Europe. The reason for this burden is the pollution from industrial and transportation sources; long-range transmission of pollutants also plays an important role. Severe damage to vegetation is caused by ground-level ozone; its limit value is exceeded due to favourable climatic conditions and high emissions of ozone precursors, especially in Southern and Eastern Europe. For this reason, the interannual variability is very significant. In 2011, the air pollution limit for AOT40 was exceeded in 18% of agricultural land of 33 EEA member states; no exceedance occurred in the majority of the Czech Republic's territory.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

08/ Water abstraction

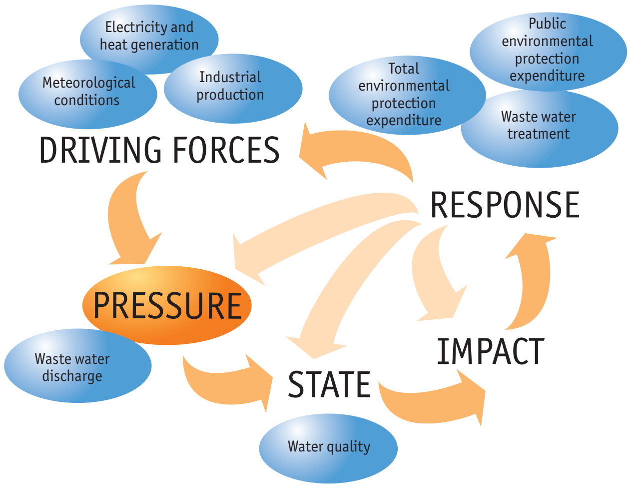
KEY QUESTION →

Is water use in the Czech Republic sustainable, with regard to maintaining the availability of water sources in the future?

KEY MESSAGES →

Of the total water abstraction, the highest abstraction is in the energy sector (43.2%). Compared with the previous year, water abstraction for public water supply systems which constitutes 36.5% of the total abstraction slightly decreased. The downward trend also continued in the total quantity of water produced, invoiced drinking water and in loss of water in the pipe networks (16.6% in 2014 compared to 17.9% in 2013). Concurrently, year-to-year, the number of inhabitants connected to the water supply systems successfully increases.

After the period 2011–2013, when water abstraction repeatedly decreased, a stagnation set in, with only slightly changed proportion in sources of water abstraction in favour of the surface sources. Water abstraction for the industry grew by 5.3% in relation to the increase in industrial production. A slight increase in water abstraction was also recorded the agricultural sector.
In 2014 the decrease of overall water consumption in households stopped (87.3 $l.inhabitant^{-1}.day^{-1}$) and also of the quantity of water invoiced to the households. The price of water continues to rise.



OVERALL ASSESSMENT →

Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (the Water Framework Directive)
- promote sustainable water use

Development Plan for Water Supply and Sewerage systems of the Czech Republic
- presents the drinking water supply concept until 2015, including the definition of drinking water sources

Plans for Development of Water Supply and Sewerage on the territory of Czech Republic regions
- construction and renovation of water management infrastructure

The Plan for Main River Basins
- ensure smooth supply of the population and other consumers by safe and quality water

Management Plans of National Parts of International River Basins
- support connecting residents in outlying areas of municipalities and residents of small villages to the public water supply systems
- accelerate renewal of leaking and outdated water supply networks and thereby reduce drinking water losses in water networks to 5,000 $l.km^{-1}.day^{-1}$ and reduce the number of piping system failures

Sub-basin Water Management Plans
- summary of the program measures for the gradual elimination of the most significant water management issues

Conception of Water Management Policy of the Ministry of Agriculture until 2015
- ensure the development of drinking water supply and address the sufficiency of water resources for water supply systems

State Environmental Policy of the Czech Republic 2012–2020
- ensure prudent management of water in residential areas by supporting measures leading to the capture and subsequent use of storm water and non-drinking quality water on site

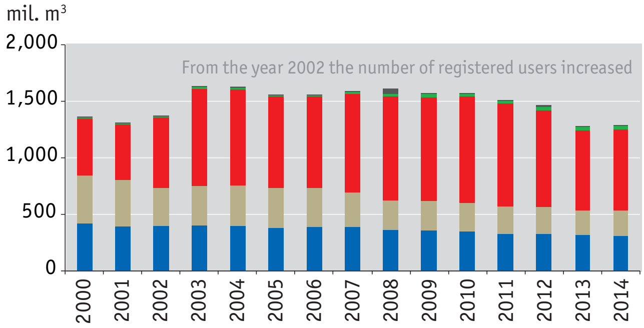
Operational Programme Environment 2014–2020
- ensure supply of drinking water in adequate quantity and quality (increase share of the population supplied by water from the public water supply systems to 94% by 2023)

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Water abstraction must respect the requirements for good status and ecological limits of water bodies, so that overexploitation does not damage these resources and adjacent aquatic ecosystems and to ensure such conditions that ecosystems need for functioning and support of human prosperity and health. In relation to climate change, the future will increase the pressure on water sources, especially in the context of increasing demands for water abstraction for agriculture, due to the frequent occurrences of drought episodes. At the same time, however, the recharge of water into the soil decreases and thus also the long-term replenishment of groundwater reserves. In this case, both the negative impact of drought solidifying the parched land and hindering the infiltration of subsequent intense rainfall and of the growing proportion of built-up areas prevent infiltration and accelerate surface runoff. The long-term nationwide monitoring shows that the quality of drinking water in public water supply systems in the Czech Republic does not, with a few exceptions, represent a health risk. The relatively numerous findings of non-compliance with the limit values of certain indicators, however, occur in samples from public and commercial wells, where the effect of runoff of pollutants from agriculture takes place.

INDICATOR ASSESSMENT

Chart 1 → **Surface water abstraction by individual sectors in the Czech Republic [mil. m³], 2000–2014**

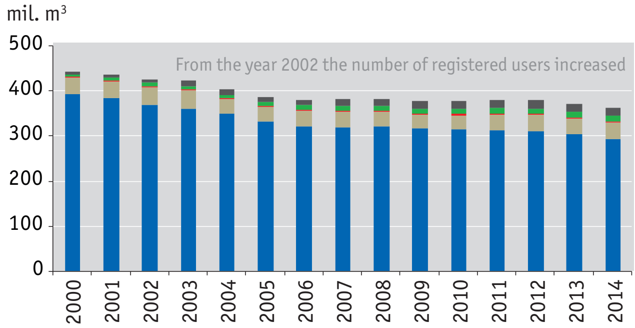


- Other (incl. construction)
- Agriculture, forestry and fishery
- Energy sector
- Industry (incl. mining)
- Public water supply systems

Sources: Ministry of Agriculture, Povodí, state enterprises, T.G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Until the year 2001 water abstraction exceeding 15,000 m³ per year or 1,250 m³ per month was registered. From the year 2002 abstraction by users over 6,000 m³ per year or 500 m³ per month was registered – pursuant to Section 10 of the Decree of the Ministry of Agriculture No. 431/2001 Coll.

Chart 2 → **Groundwater abstraction by individual sectors in the Czech Republic [mil. m³], 2000–2014**

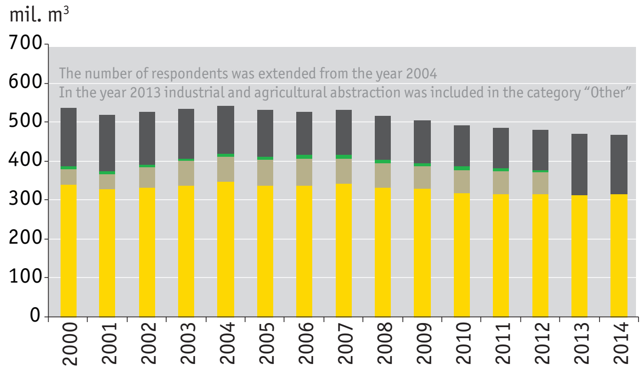


- Other (incl. construction)
- Agriculture, forestry and fishery
- Energy sector
- Industry (incl. mining)
- Public water supply systems

Sources: Ministry of Agriculture, Povodí, state enterprises, T.G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Until the year 2001 water abstraction exceeding 15,000 m³ per year or 1,250 m³ per month was registered. From the year 2002 abstraction by users over 6,000 m³ per year or 500 m³ per month was registered – pursuant to Section 10 of the Decree of the Ministry of Agriculture No. 431/2001 Coll.

Chart 3 → **Drinking water use from public water supply systems for public use by individual groups of users in the Czech Republic [mil. m³], 2000–2014**

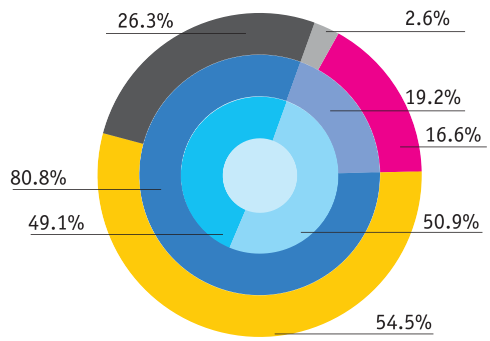


- Other (incl. construction)
- Agriculture, forestry and fishery
- Industry
- Households

Source: Czech Statistical Office

Until 2003, only data for the main operators are provided. In 2013, reporting of invoiced water was simplified (industrial and agricultural abstraction is included in the category "Other" which includes construction, services and other users connected to the public water supply systems).

Chart 4 → **The use of produced water from water supply systems for public use in the Czech Republic [mil. m³], 2014**



Source: Czech Statistical Office

- Produced water intended for user consumption 579.7 mil. m³

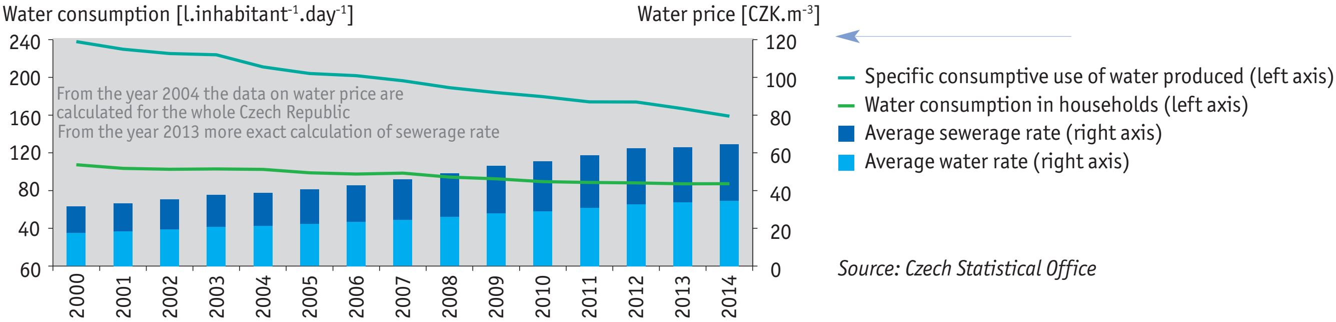
- Groundwater 292.7 mil. m³
- Surface water 282.7 mil. m³

- Non-invoiced water 111.0 mil. m³
- Invoiced water 468.7 mil. m³

- Water invoiced to households 316.0 mil. m³
- Water invoiced for other users 152.7 mil. m³
- Other non-invoiced water 15.1 mil. m³
- Losses in the distribution network 96.0 mil. m³

The diagram shows the use of produced water intended for user consumption. Data on the proportion of non-invoiced and invoiced drinking water are determined from the total volume of produced drinking water intended for user consumption. The non-invoiced water includes losses in the distribution network, own water consumption etc. The data on abstracted groundwater and surface water are related to the total production of drinking water (575.4 mil. m³ in the year 2014).

Chart 5 ➜ **Water consumption in the Czech Republic [l.inhabitant^{-1}.day^{-1}] and the price of water [CZK.m^{-3}], 2000–2014**



Source: Czech Statistical Office

Until 2003 (including 2003), the water rates are provided for the main operators only. From the year 2004, the water prices are calculated for the entire Czech Republic. The water prices are provided without VAT. In 2013, the calculation of the sewerage rate was made more precise by including rain water discharges in the rate and also due to cooperation of the respondents. The resulting sewerage rate per m^3 is not fully comparable with the previous years.

The **total abstraction of surface water and groundwater** already declines since the early 80s of the 20th century. More significantly, this trend was manifested in the early 90s, when it first was associated primarily with the changes in the structure of the industrial and agricultural production as a result of the restructuring of the national economy, subsequently to the decreasing demand of industrial technologies for water and the reduction of water consumption in households. After the sudden increase in abstraction between the years 2002 and 2003 (change in the scope of reported data and concurrent abstraction of cooling water for the Temelín nuclear power plant), water abstraction stagnated. After the period 2011–2013, when there were repeated declines in abstraction, a stagnation occurred again. In 2014, the total water abstraction was 1,649.7 mil. m^3. Compared to the year 2013, there was a slight increase in surface water abstraction, which was compensated by a decrease in groundwater abstraction. Out of the total volume of water abstracted, 78.1% share of abstraction was from surface sources.

The **structure of abstraction of surface water and groundwater** by groups of users (CZ-NACE classification) since the year 2003 remains more or less stable (Chart 1, Chart 2). Of the total water abstraction, the highest abstraction is made by the **energy sector** (43.2%, 713.0 mil. m^3 in 2014, identical to 2013). In the vast majority of these cases the abstraction is for water in flow through cooling of steam turbines, so 99.6% of the abstraction for the energy sector (710.4 mil. m^3) is drawn from surface waters. Most of the abstracted cooling water is again returned to watercourses, with a slightly altered quality (temperature increase, decrease of oxygen content), part of the water is not returned to the stream due to evaporation.

Conversely, the biggest abstracted volume is from underground sources 292.4 mil. m^3, 81.0% of groundwater abstraction (vs. 24.0% of surface water abstraction) is used by the **public water supply systems** as a source of drinking water, because of the higher quality of groundwater and thus the lower needs for treatment. In the year 2014, 50.9% of the drinking water in the Czech Republic was produced from underground sources. Generally, 36.5% of all abstractions in the country are carried out for the purpose of water collection, treatment and supply by public water supply systems. This abstraction has decreased by 25.5% since the year 2000 which is associated with the overall reduction in the quantity of produced water, respectively with the reduction of water losses and the decline in demand for drinking water caused by the introduction of environment-friendly technologies and savings in households and industry. Year-to-year decrease, compared to 2013, reached 2.6%.

Overall, the third largest consumer of water (respectively of surface water) in the year 2014 was the **industry** (15.9%, i.e. 261.7 mil. m^3). Water abstraction for the industry accounted for 17.5% of the abstraction from surface sources and only 9.9% from groundwater sources. The abstraction for the industry (including mining and quarrying) exhibits a long-term decline (since 2000 by 42.8%). In the year-to-year comparison, in connection with the increase in industrial production compared to 2013, the abstraction increased both from surface sources (by 5.4%) and from underground sources (by 4.7%). The water abstraction for the industry is generally influenced by the economic development in the sectors with the highest abstraction (food, chemical and paper industry) and the introduction of new environment-friendly technologies of production, because of environmental and economic reasons. Consistently low abstraction is in the conditions of the Czech Republic exhibited by the **agriculture** (2.9% of total abstractions in 2014), while the annual variation of abstraction for crop production is dependent on the course of temperatures and precipitation during the growing season. In the last year-to-year comparison, water abstraction for agriculture increased by 10.2%, which in absolute terms represents an increase of 4.5 mil. m^3. The year 2014 was the warmest year in the last 40 years, but with normal precipitation and the growing season was (like the past year) slightly above-average in temperature and precipitation (except June) also above average. The annual fluctuations may not accurately reflect the real abstraction, which is related to the fact that by law only part of the abstracted water is subject to fees. However, for the purposes of compiling the water balance all abstracted water has to be reported and the fluctuations are partly caused by the reporting discipline.

The water companies are amongst the major water users in the Czech Republic. In the year 2014, 579.7 mil. m^3 of water intended for consumption were produced. **Drinking water** invoiced to households and other customers accounted for 468.7 mil. m^3 (Chart 3, Chart 4). Since 2007, the quantity of invoiced drinking water continuously declines (a decline of 11.8% between 2007 and 2014). For households, which in 2014 accounted for 67.4% of the abstraction of drinking water (316.0 mil. m^3), the decreasing trend has stopped in 2014 (Chart 3). The reduction in the quantity of produced water occurs despite the current increase of the number of inhabitants supplied by water from public water supply systems, which is associated with the relatively massive construction of new family houses. In the year 2014, 9.92 mil. inhabitants, respectively 94.2% of the Czech Republic population were supplied by water from public water supply systems. The decreasing quantity of produced water is mainly related to the reduction of **drinking water losses in the water supply systems** caused by accidents and leaks from public water supply systems. These losses in 2014 accounted for 16.6% of the total volume of produced water for consumption (in the year 2000 they accounted for 25.2%). This means that in the year 2014 a loss of 26.5 litres of water per day per inhabitant was incurred, i.e. 3,417.2 $l.km^{-1}.day^{-1}$.

Water consumption per inhabitant supplied by water from the public water supply system, out of the total quantity of produced water, was 158.9 $l.inhabitant^{-1}.day^{-1}$ and reflects the trends in water abstraction (Chart 5). The households in 2014 consumed 87.3 $l.inhabitant^{-1}.day^{-1}$, which represents 81.3% of the total in the year 2000. The decline of water consumption in households stopped in 2014 and probably reached the limits of water savings achieved by the use of efficient appliances. In the long-term, **water and sewerage rates** continue to increase. The price increase is, in addition to the effect of inflation, caused by the oversized water infrastructure that was largely built in the days when water abstraction amounted to much larger values, so the fixed depreciation of the water companies at decreasing water abstraction represents a still increasing percentage of the water rate prices.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

09/ Waste water discharge

KEY QUESTION

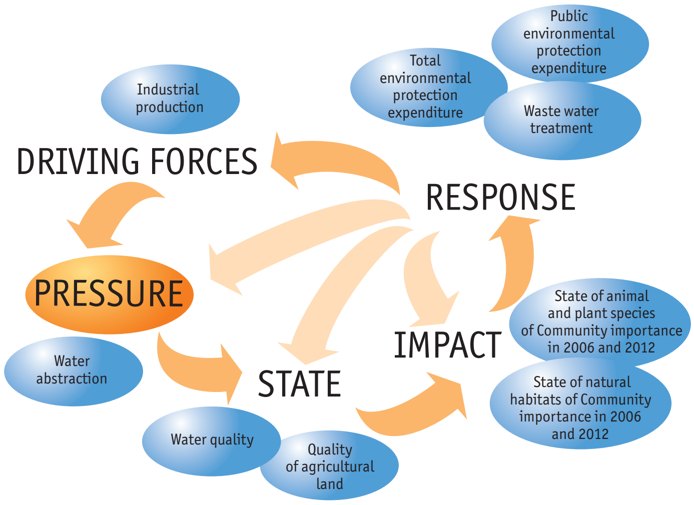
Are we successful in reducing the quantity of pollution discharged from point sources into surface waters?

KEY MESSAGES

Compared to the year 2013, which was richer in precipitation, in the year 2014 the total quantity of discharged waste water was reduced by 7.0%, mainly due to the decrease in the volume of waste water discharged from public sewerage systems by 12.3%.

In the 2014/2013 year-to-year comparison, all monitored quantity indicators of discharged pollution from point sources decreased, for BOD_5 by 12.2%, COD_{Cr} by 8.8%, suspended solids by 15.3%, $N_{inorg.}$ by 13.1% and P_{total} by 8.0%. The year-to-year development confirmed the long-term trend in reducing the pollution. BOD_5 emissions decreased from the year 2000 by 72.4%, COD_{Cr} by 55.3%, suspended solids by 67.6%. The emissions of $N_{inorg.}$ since 2003 decreased by 31.6% and P_{total} by 36.1%.

A major source of water pollution is represented, besides the point sources, by the diffuse areal pollution by runoff from agricultural land.



OVERALL ASSESSMENT

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (the Water Framework Directive)
- measures for focused decrease in the discharge, emissions and releases of priority pollutants

Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive)
- reduce and prevent water pollution by nitrates originating from agricultural sources

Directive 2006/11/EC of the European Parliament and of the Council on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
- reduce and prevent water pollution by hazardous substances provided in the Annex to the Directive

Development Plan for Water Supply and Sewerage systems of the Czech Republic
- minimize nutrient and hazardous substances water pollution by establishing emission limits for the individual pollution indicators

The Plan for Main River Basins
- introduce best available techniques (BAT) in production processes and best available technologies in waste water treatment

Management Plans of National Parts of International River Basins
- decrease pollution by hazardous substances, nutrients and organic substances and prevent their introduction from diffuse sources
- stopping or gradual elimination of emissions, discharges and releases of hazardous priority pollutants
- preventing or limiting the introduction of pollutants into groundwater

Sub-basin Water Management Plans
- summary of the specific objective and program measures for the improvement of surface water and groundwater quality
- identification of important water management problems found in the parts of international river basins on the territory of the Czech Republic

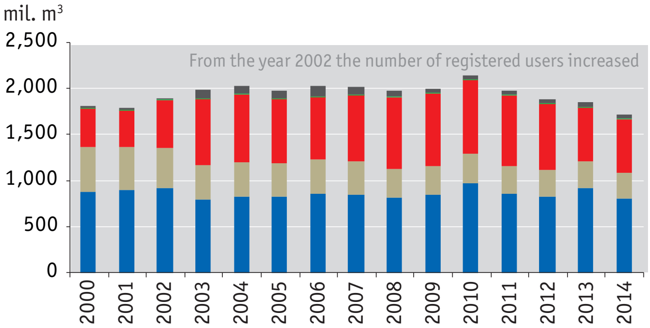
Operational Programme Environment 2014–2020
- decrease the quantity of discharged pollution from municipal sources and decrease the introduction of pollutants to surface water and groundwater (for indicator P_{total} to 1,100 t by the year 2023 and for indicator COD_{Cr} to 39,100 t by the year 2023)

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The quantity of waste water, produced pollution and pollution discharged into surface water directly affects its quality, and thus also the ecosystems bound to the aquatic environment. The most important components of waste water pollution are the organic compounds, nutrients (especially phosphorous and nitrogen) and hazardous substances. The nutrients (particularly phosphorus) contained in waste water contribute together with the diffuse sources to the excessive eutrophication of watercourses and reservoirs. The polluted water can also be a source of infectious diseases such as viral hepatitis A, dysentery, salmonella, etc. The aquatic environment is every year affected by pollution releases which are dangerous primarily because of their unpredictability and high level of hazard from the released substances. Of importance are mainly those toxic substances that pollute drinking water sources (especially groundwater), and substances that accumulate in the soil and sediments from where they get into plant and animal tissues, and thus into the food chain of animals and humans, where they can occur even a long time after their release.

INDICATOR ASSESSMENT

Chart 1 → The quantity of waste water discharged into surface water in the Czech Republic [mil. m^3], 2000–2014

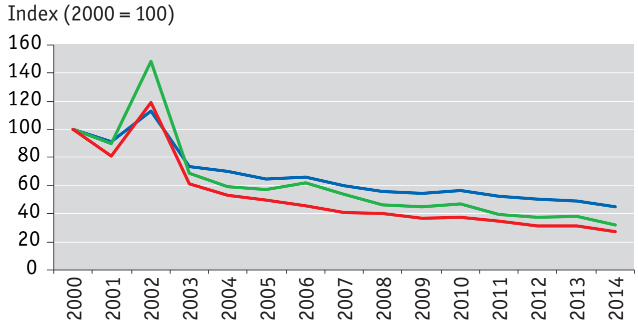


- Other (incl. construction)
- Agriculture (incl. irrigation, excl. fish farming)
- Energy sector
- Industry (incl. mining)
- Public sewerage

Sources: Ministry of Agriculture, Povodí, state enterprises, T.G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Until the year 2001 waste water and mine water discharges exceeding 15,000 m^3 per year or 1,250 m^3 per month were recorded. From the year 2002 discharges exceeding 6,000 m^3 per year or 500 m^3 per month are recorded - pursuant to Section 10 of the Decree of the Ministry of Agriculture No. 431/2001 Coll.

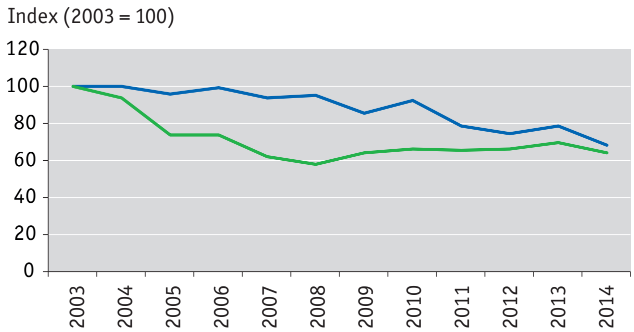
Chart 2 → Relative representation of pollution discharged from point sources expressed in BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 2000 = 100], 2000–2014



- COD_{Cr}
- Suspended solids
- BOD_5

Sources: Ministry of Agriculture, Povodí, state enterprises, T.G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

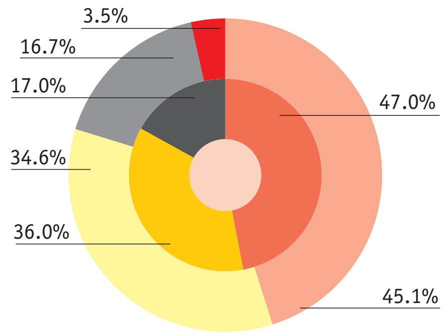
Chart 3 → Relative representation of pollution discharged from point sources expressed in $N_{inorg.}$ and P_{total} indicators in the Czech Republic [index, 2003 = 100], 2003–2014



- $N_{inorg.}$
- P_{total}

Sources: Ministry of Agriculture, Povodí, state enterprises, T.G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Chart 4 → The quantity of water discharged from sewerage systems into surface water in the Czech Republic [mil. m^3] 2014



Source: Czech Statistical Office

- Water discharged from sewerage systems into watercourses 841.9 mil. m^3

- Rain water and other water discharged into sewerage systems 395.9 mil. m^3
- Sewerage water from households discharged into sewerage systems 303.3 mil. m^3
- Industrial and other water discharged into sewerage systems 142.8 mil. m^3

- Treated rain water 380.0 mil. m^3
- Treated sewerage water from households 291.5 mil. m^3
- Treated industrial and other water 140.8 mil. m^3
- Untreated waste water and rain water 29.7 mil. m^3

As with water abstraction, the **total volume of discharged waste water** exhibits since the 80s and 90s of the 20th century a downward trend, with only occasional occurrence of a year-to-year increase in volume. The change in the trend occurred in 2002, when compared to the previous year, the quantity of waste water discharged increased. This was also the case in the following two years (Chart 1). The sudden increase at the beginning of the 21st century is related to the change of limits for reporting the quantity of water discharged and with the increase in waste water discharges from the energy sector. This sector contributed to the increase by more than two thirds, caused by the start of abstraction of water for the cooling of the Nuclear Power Plant Temelín and by the repeated increase of abstraction for the power plant Mělník. After the year 2004 the total volume of discharged waste water stagnated at around 2 bil. m^3 per year. An exception was the year 2010, when there was a significant increase in discharges (7.4% to 2,142.1 mil. m^3), mainly from the public sewerage systems. This was caused by higher precipitation which increased the volume of discharged rain water. After 2010, the volume of discharged waste water decreases every year. In 2014, the total volume of waste water discharges from point sources was already only 1,716.9 mil. m^3, compared to the previous year it fell by 7.0%, mainly due to the decrease in the volume of waste water discharged from public sewerage systems (12.3%).

The **structure of the waste water discharges** reflects the structure of the customers, while a certain quantity of water abstracted for agriculture and energy is lost by evaporation, and has not significantly changed over the past 10 years. The largest share of discharges is from the public sewerage systems (47.1%, i.e. 807.9 mil. m^3) and energy (34.2%, i.e. 587.2 mil. m^3). In 2014 there was a decrease in the volume of **municipal waste water** (sewerage and rain water) by 12.3%. The volume of water discharged returned below 831.3 mil. m^3, as recorded in 2012. The year 2013 had more precipitation than the years 2012 and 2014, which led to a greater volume of discharged rain water and the so called ballast water. The municipal waste water discharges represent significant point sources of pollution, mainly organic. In contrast, the **water discharged by energy sector** consists almost exclusively of waste water from flow through cooling which influence the temperature and oxygen regime of water. Regarding the year-to-year development, the volume of waste water discharged by the energy sector in 2014 remained virtually the same (decrease by 0.4%).

Another important source of pollution is the **industrial waste water** (15.8%, i.e. 272.1 mil. m^3), which is a source of not only organic pollution, but also of pollution by e.g. heavy metals and specific organic substances. Discharges from the industry (including mining), compared with the previous year decreased by 3.6%. Among the largest producers of industrial waste water are the chemical, paper, mining, and food industries. A specific surface water polluter is the **agriculture**, which discharged in 2013 only 0.4% of the volume of waste water discharged from point sources (6.5 mil. m^3), but even then it belongs in the Czech Republic among the major sources of pollution. Most of the pollution from agriculture to surface waters is not from point sources, but from **diffuse pollution** by runoff from farmland or scattered herds of animals or fish farming. This type of pollution is not recorded overall, but is significantly reflected in the resulting quality of surface water and groundwater. The diffuse pollution is a major source of nitrates, pesticides and causes acidification. The quantity of these substances that get introduced into the water is influenced, among other factors, by the application and dosing of ferilisers and plant protection products in agricultural production and the conditions for the erosion of agricultural soils. In the year 2014, in absolute terms, a slight decrease in the volume of waste water discharges from point sources of the category “**other**” was registered (by 7.1%), which includes also the construction industry.

A harbinger of potential water pollution is mainly represented by the quantity of pollution discharged in waste water. Since the 90s of the 20th century, the monitored indicators exhibited a significant decrease in the **quantity of discharged organic pollution from point sources**. Since 2000 the decline was less pronounced, yet the organic pollution expressed by the indicator **BOD_5** decreased to 5,310 t, representing a decrease of 72.4%, for **COD_{Cr}** to 36,561 t, i.e. a decrease of 55.3%, and for **suspended solids** to 9,627 t, i.e. a decrease of 67.6% (Chart 2). While in the 90s the reduction of pollution reflected the decline in industrial production and the increasing volume of treated water, in recent years, the effect is primarily caused by the extensive construction and modernization of municipal and industrial WWTPs. The deviation in 2002 was caused by the extreme floods. The period after the year 2003 shows a trend of gradual decline, with occasional annual increase of pollution discharged, which was related, inter alia, to the occurrence of precipitation extremes (e.g. in 2010 and partly in 2013) and was reflected in the volume of water discharged from public sewerage systems (Chart 1). Thus influenced increased quantity of pollution discharged in 2013 helped to highlight its decrease in 2014, particularly in terms of BOD_5 by 12.2%, COD_{Cr} by 8.8% and the suspended solids indicator by 15.3% (Chart 2). The produced pollution expressed in the above indicators displayed a slight decline.

Likewise, the **quantity of discharged nutrients**, compared to 2013, for **nitrogen** ($N_{inorg.}$) decreased by 13.1% to 10,233 t, **phosphorus** (P_{total}) by 8.0% to 1,157 t (Chart 3), while the quantity of produced pollution remained essentially the same. In the longer term perspective, since 2003, the quantity of $N_{inorg.}$ decreased by 31.6% and P_{total} even by 36.1%. The long-term decrease is influenced by the reduction of the quantity of phosphates used in detergents and in recent years especially by fact that the waste water treatment technology in the new and reconstructed WWTPs focuses on biological nitrogen removal or chemical phosphorus removal. The vast majority of waste water discharged into watercourses in the Czech Republic passes at least through a basic treatment (Chart 4).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

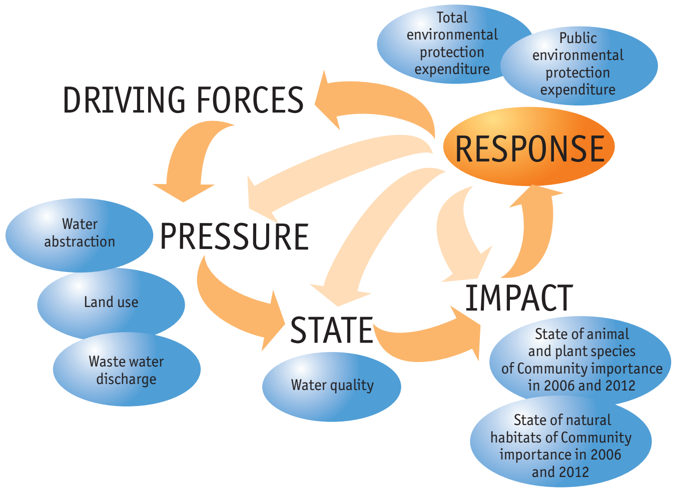
CENIA, key environmental indicators

http://indicators.cenia.cz

10/ Waste water treatment

KEY QUESTION →

How many Czech inhabitants are connected to the public sewerage systems and waste water treatment plants and what is the proportion of treated waste water?



KEY MESSAGES →

The gradual long-term increase in the number of inhabitants connected to public sewerage systems continues. In 2014, 83.9% of the population was connected to public sewerage systems, of which 95.3% were connected to a WWTP.

Compared to the previous year, the reduction in the volume of waste water discharged into the sewerage systems (excluding rain water subject to discharge fees) was 2.0%. A total of 96.9% of the waste water discharged into the sewerage systems was treated.

The number of WWTPs with tertiary treatment stage continues to increase. The average efficiency of WWTPs, measured by the concentration of the basic indicators of pollution, ranges from 76.9% for N_{total} up to 98.2% for BOD_5.

Although the number of inhabitants connected to public sewerage systems and the number of new and intensified WWTPs gradually increases, 20.1% of the population is not yet connected to sewerage systems connected to a WWTP.

OVERALL ASSESSMENT →

Change since 1990	🙂
Change since 2000	🙂
Last year-to-year change	🙂

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Council Directive 91/271/EEC concerning urban waste water treatment
- obligation to connect communities over 2,000 inhabitants to WWTP

State Environmental Policy of the Czech Republic 2012–2020
- finalize construction and reconstruction of missing WWTPs in communities over 2,000 population equivalents
- ensure support to the construction and reconstruction of WWTPs with sewerage systems in communities below 2,000 population equivalents

Operational Programme Environment 2014–2020
- increase the quantity of treated waste water to 321 mil. m^3 by the year 2023

Management Plans of National Parts of International River Basins
- increase the number of inhabitants connected to public sewerage networks with emphasis on small communities
- ensure quick finalization of capital investment projects related to the connection of communities over 2,000 population equivalents to a WWTP

Development Plan for Water Supply and Sewerage systems of the Czech Republic
- support of construction and reconstruction of WWTPs in communities over 2,000 population equivalents
- increase the proportion of inhabitants connected to public sewerage systems and to public sewerage systems connected to a WWTP

Development Plans for Water Supply and Sewerage Systems of the Czech Republic's regions
- construction and renovation of water infrastructure

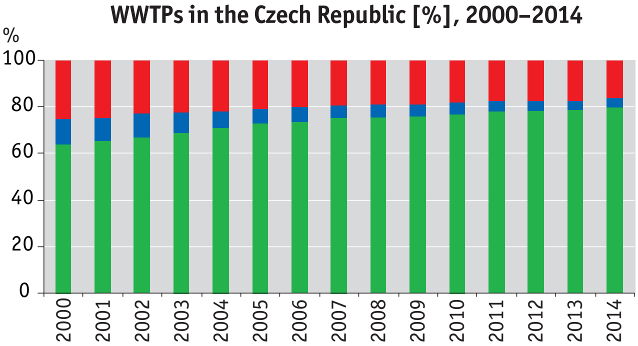
Conception of Water Management Policy of the Ministry of Agriculture until 2015
- ensure secondary treatment of municipal waste water in the so called sensitive areas according to the Nitrate Directive, mainly by the construction of missing WWTPs and sewerage systems, reconstruction and improvement of technology for waste water treatment in all agglomerations over 2,000 population equivalents

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The reduction of pollution discharged in municipal and industrial waste water is an essential element for achieving the decoupling of pressure on the aquatic environment and human society development. The availability of sewerage systems for the residents and waste water treatment represents a measure of the maturity of the society and its relationship to the environment. Developed water management infrastructure ensures safe sewerage drainage and reduces the health risk of infections and epidemics of infectious diseases. The degree of treatment of drained waste water which affects the quantity and nature of the discharged pollutants has a direct impact on water quality and the related ecosystems. Inadequate drainage of sewerage and its treatment may result in an impairment of the use of water for drinking purposes or for recreation.

INDICATOR ASSESSMENT

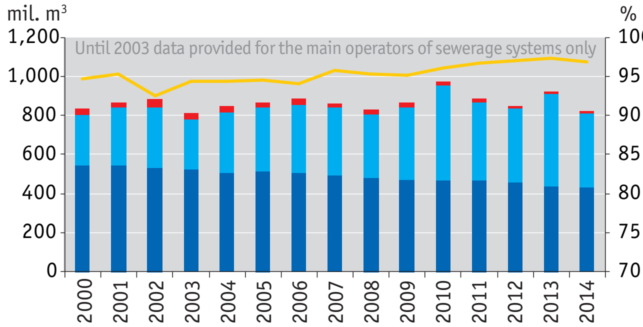
Chart 1 → **Proportion of the population connected to sewerage systems and to sewerage systems connected to WWTPs in the Czech Republic [%], 2000–2014**



Source: Czech Statistical Office

- Proportion of the population without connection to sewerage systems
- Proportion of the population connected to sewerage systems without a WWTP
- Proportion of the population connected to sewerage systems with a WWTP

Chart 2 → **Treatment of waste water discharged into sewerage systems in the Czech Republic [mil. m^3, %], 2000–2014**

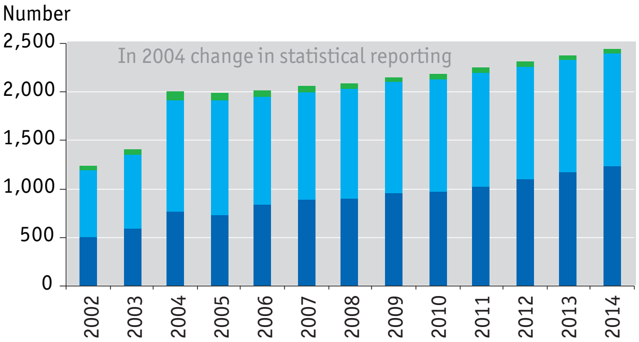


Source: Czech Statistical Office

- Untreated waste water – sewerage, industrial and other water (left axis)
- Treated waste water – rain water (left axis)
- Treated waste water – sewerage, industrial and other water (left axis)
- Proportion of treated waste water without rain water (right axis)

Until the year 2003 (including 2003) the data are provided for main operators only. From 2004 the number of respondents increased. The data series shown is impacted by changes in statistical reporting and the transformation of the former water supply and sewerage companies into the ownership of towns and communities.

Chart 3 → **Number of waste water treatment plants according to treatment stages in the Czech Republic, 2002–2014**



- Primary treatment
- Secondary treatment
- Tertiary treatment

Source: Czech Statistical Office

Primary treatment = mechanical WWTPs, secondary treatment = mechanical-biological WWTPs without nitrogen and phosphorus removal, tertiary treatment = mechanical/biological WWTPs with additional removal of nitrogen and/or phosphorus.

The accession of the Czech Republic to the EU had a major impact on the development of infrastructure for the collection and treatment of sewerage and the subsequent compliance with the European legislation and the drawing on the European subsidies. Compared to 2003, the last year before joining the EU, the **proportion of the Czech population connected to the sewerage networks** increased from 77.7% to 83.9% in 2014 (Chart 1). Primarily positive was the increase in the proportion of the population connected to the sewerage systems connected to a WWTP. Year-to-year increase in the proportion of the population connected to the sewerage system is in recent years gradual. This is caused by the fact that the sewerage systems and waste water treatment plants in the larger conurbations have been already built and it is now needed to cover the smaller communities, where the population is less concentrated and where the budgets lack funding. Waste water produced by 20.1% of the population in 2014 was not directly discharged to sewerage systems with a WWTP, but was collected in sewerage systems without treatment plants, in sumps, septic tanks and other facilities, from where it was then transported for treatment or discharged without proper treatment directly into watercourses.

The **total volume of water discharged into the public sewerage systems**, from 2013 including rain water, subject to discharge fees, stagnated (515 mil. m^3 in 2014). The volume of water discharged into the public sewerage systems without rain water, compared to 2013, decreased by 2.0% to 446.1 mil. m^3 in 2014 (out of this this volume 432 mil. m^3 was treated and 14 mil. m^3 untreated, Chart 2) which represents almost half of the volume of the year 1990 and a decrease of 22.6% compared to the year 2000.

Nevertheless, the **proportion of treated waste water** out of the water discharged into the sewerage systems was very satisfactory in 2014 and amounted to 96.9%, whereas in 1990 it was only 75.0%. In the long-term perspective the magnitude of the share has fluctuated from the year 2000 between 94 and 98%. A decrease of 0.5 percentage points in comparison with 2013 was due to a change in methodology of monitoring reporting by major operators. The lower value than the above range was recorded only in 2002 and was influenced by the limitations of waste water treatment operation affected by the floods. The WWTPs also treat a part of rain water not subject to discharge fees. Its quantity shows large annual fluctuations which correspond to the precipitation conditions of the given year. In the year 2014, when rainfall reached 97% of the long-term average, 380.0 mil. m^3 were treated (corresponding to the average value over the last 10 years) compared to 468.9 mil. m^3 of rain water in 2013.

The **total number of WWTPs** for public use in the Czech Republic has more than doubled since the year 2000 to 2,445 (i.e. on the average 1 WWTP per 4,305 inhabitants). Year-to-year the number of WWTPs grew by 2.6% (Chart 3). Due to the construction and reconstruction of WWTPs, compared to 2013, the total number of WWTPs with removal of nitrogen and/or phosphorus (tertiary treatment) increased by 63 WWTPs, the number of WWTPs with basic mechanical-biological treatment (secondary treatment) increased by 4 at the expense of 4 mechanical WWTPs. Currently, all agglomerations over 10,000 population equivalents have tertiary treatment provided, although not all meet the requirements of the Council Directive 91/271/EEC concerning urban waste water treatment regarding the quality limits of the discharged waste water. The most problematic is still the central waste water treatment plant in Prague. At the end of 2013 adequate WWTPs lacked in 11 agglomerations of 2,000 to 10,000 population equivalents. In the year 2014, the most important projects implemented were 5 new community WWTPs and the reconstruction or expansion of 11 existing municipal and industrial WWTPs for pollution sources with over 2,000 population equivalents.

The **average efficiency of WWTPs** (the quantity of pollution removed) in the Czech Republic is very high, for BOD_5 in 2014 it has reached 98.2%, for suspended solids 97.7%, for COD_{Cr} 94.9%, for P_{total} 84.2% and for N_{total} 76.9%. The values of treatment efficiency of organic pollution are similar as in the previous years, which is related to the completed reconstruction of most large WWTPs and the stabilized trend in produced pollution in different areas. The efficiency of nutrient removal increased year-to-year by 2.9 percentage points for N_{total} and for P_{total} by 0.8 percentage points.

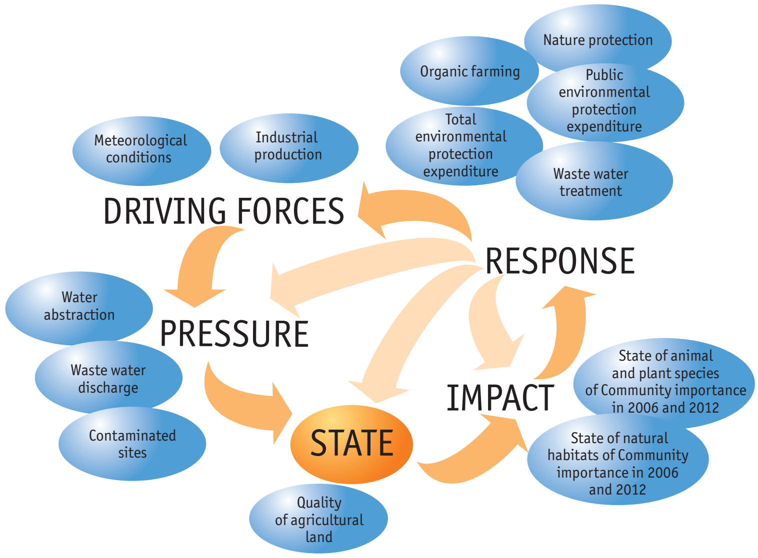
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

11/ Water quality

KEY QUESTION

Is the water quality in watercourses affecting aquatic organisms and water use improving?



KEY MESSAGES

In the long-term perspective a reduction occurred in the concentration of evaluated indicators of water quality in watercourses. The year-to-year decrease in the concentration was for cadmium 21.8%, for nitrate 17.1%, for FC 7.5% and for AOX 4.2%. Exceedances of the environmental quality standards in 2014 were successfully avoided, especially for $N\text{-}NO_3^-$ and cadmium, as well as for COD_{Cr} and BOD_5.
Based on the overall evaluation of basic indicators monitored according to the Czech standard CSN 75 7221 Classification of surface water quality, it is evident that the water quality in the rivers of Czech Republic is satisfactory.

COD_{Cr} concentration in watercourses in the period 2000–2014 more or less stagnated.

Year-to-year, a slight increase occurred in the average concentration of P_{total} by 7.4%, by 3.2% for BOD_5, by 2.6% for COD_{Cr} and for chlorophyll 'a' by 90.2%, the concentration of which in general fluctuate significantly[1] year-to-year. A third of the profiles in 2014 exceeded environmental quality standards in the indicator P_{total} and more than one fifth of the profiles in the indicator AOX.
The objective of achieving at least a good ecological status, respectively ecological potential is met by only 21.2% of the surface water bodies. A good chemical status is achieved by 56.6% of surface water bodies and 27.0% of groundwater bodies.

OVERALL ASSESSMENT

Change since 1990	positive
Change since 2000	neutral
Last year-to-year change	positive

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (the Water Framework Directive)
- achieving at least good status of water and preventing any further deterioration of their status until 2015, with some exceptions until 2027

Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy
- water protection from priority hazardous substances – achieving the standard obligations by the end of the year 2015

Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrate Directive)
- reduce and prevent water pollution by nitrates originating from agricultural sources

Directive 2006/7/EC of the European Parliament and of the Council concerning the management of bathing water quality
- defined manners of monitoring and classification of bathing water quality

State Environmental Policy of the Czech Republic 2012–2020
- achieving at least good ecological status or potential and good chemical status of surface water bodies, achieving good chemical and quantitative status of groundwater bodies

The Plan for Main River Basins
- framework objectives established for the protection and improvement of surface water and groundwater status and of water ecosystems

Management Plans of National Parts of International River Basins
- preventing deterioration of the status of surface water bodies, achieving good status of water bodies using the set objectives

Sub-basin Water Management Plans
- contain specific objectives and program measures for the improvement of water quality

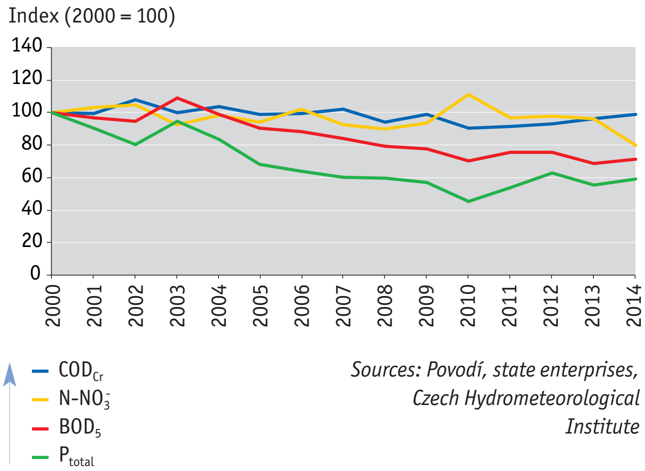
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The required water quality depends on the purpose of its use. The quality of surface water has a direct impact primarily on aquatic and water-bound organisms, but also affects other adjacent ecosystems (e.g. the floodplains). An excessive quantity of nutrients (particularly phosphorus) entering the aquatic environment contributes to the eutrophication of water, which can lead to a reduction in the number of plant and animal species (deterioration of the ecological status) and also has a negative impact on the possibility of human water use. Eutrophication causes problems when using water for drinking purposes and poses a direct health risk when using surface water for bathing. The main health risks associated with exposure and ingestion of polluted water include infection by infectious diseases and skin rashes. Hazardous substances in surface water (e.g. Hg, Ni, Cd, DDT) may subsequently accumulate in sediments and tissues of aquatic animals and thus enter the food chain of a wide range of other organisms, including humans. During flood situations the sediments are suddenly loosened up and so are the sedimented hazardous substances.

[1] The year-to-year fluctuations of chrophylle 'a' are driven by the close relationship of this indicator to the course of temperature and precipitation in the given year.

INDICATOR ASSESSMENT

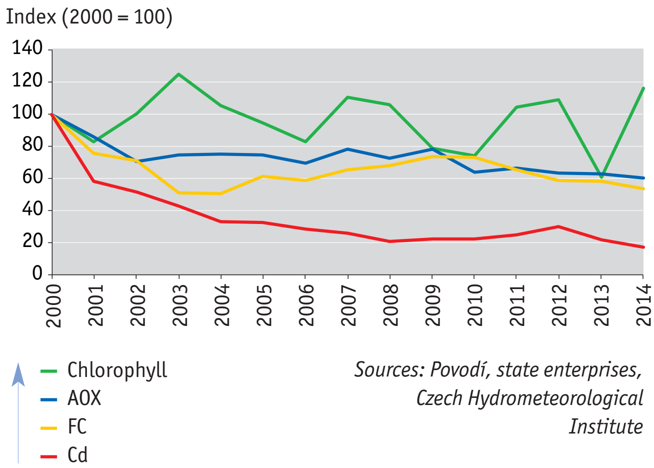
Chart 1 ➜ **Development of concentrations of pollution indicators in watercourses in the Czech Republic [index, 2000 = 100], 2000–2014**



Sources: Povodí, state enterprises, Czech Hydrometeorological Institute

The indices for the individual indicators relating to the selected base year were calculated from arithmetic averages for each year, using annual average values for 69 selected profiles within the Eurowaternet network. The number of stations for the different years and different indicators changes depending on the availability of data. The water quality assessments for BOD_5, COD_{Cr}, $N\text{-}NO_3^-$ and P_{total} were carried out for the period 2000–2014, most frequently for a set of 68 stations, in 2014 for 64 stations.

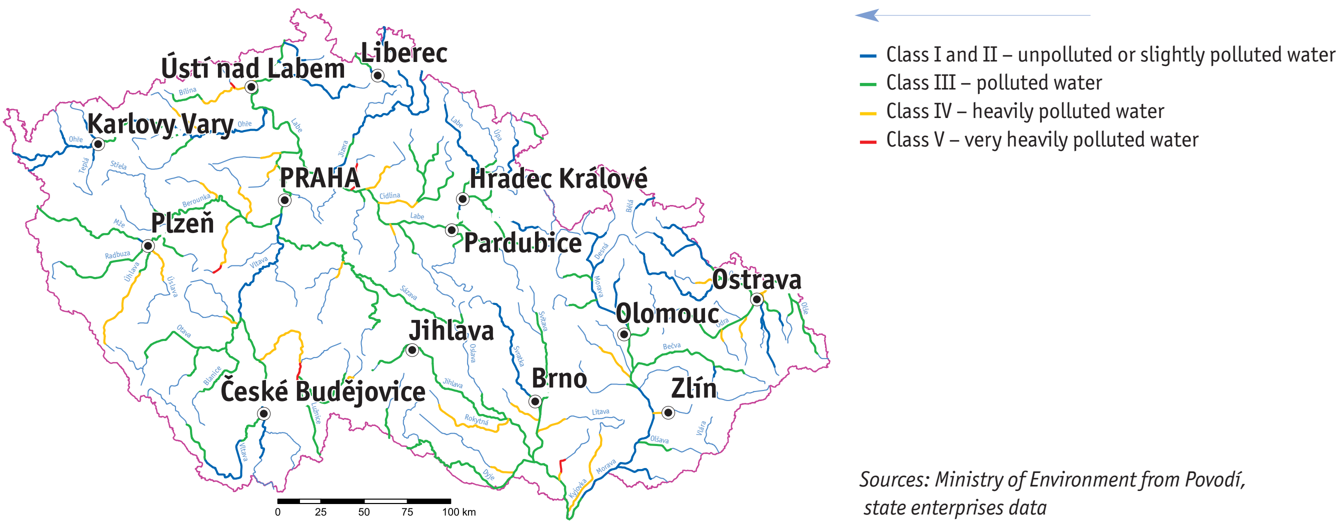
Chart 2 ➜ **Development of concentration of pollution indicators in watercourses in the Czech Republic [index: 2000 = 100], 2000–2014**



Sources: Povodí, state enterprises, Czech Hydrometeorological Institute

The indices for the individual indicators relating to the selected base year were calculated from arithmetic averages for each year, using annual average values for 69 selected profiles within the Eurowaternet network. The number of stations for the different years and different indicators changes depending on the availability of data. The water quality assessments for AOX (29–61 stations, 51 stations in 2014), Cd (42–58 stations, 46 stations in 2014), FC (44–69 stations, 44 stations in 2014) and chlorophyll 'a' (46–69 stations, 46 stations in 2014) were carried out for the period 2000–2014.

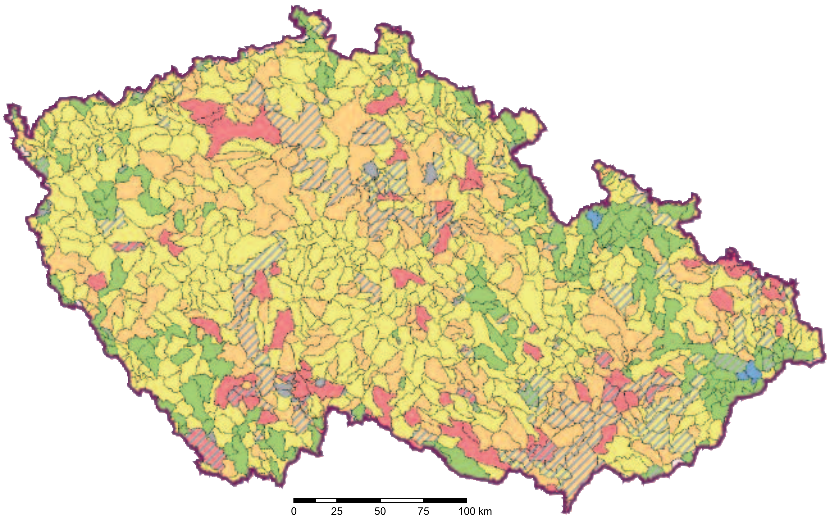
Figure 1 ➜ **Water quality in watercourses in the Czech Republic, 2013–2014**

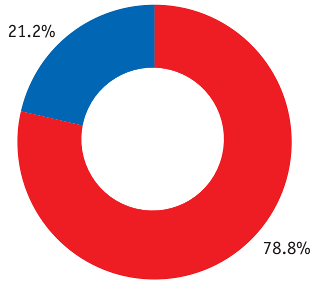


Sources: Ministry of Environment from Povodí, state enterprises data

Summary evaluation of the indicators BOD_5, COD_{Cr}, $N\text{-}NH_4^+$, P_{total} and saprobic index of zoobenthos.

Figure 2 ➜ **Ecological status and potential of surface water bodies in the Czech Republic, 2010–2012**





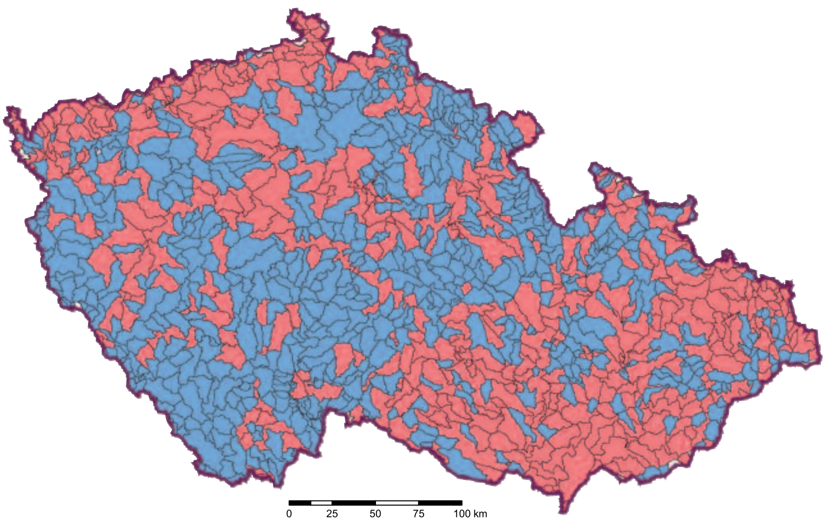
Sources: T.G. Masaryk, Water Research Institute, public research institution from Povodí, state enterprises data

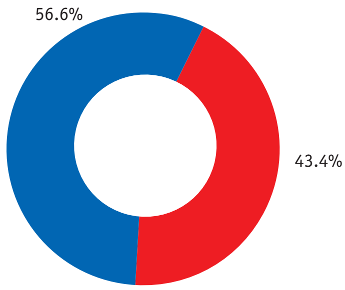
Ecological status or potential
- High status
- Good status
- Moderate status
- Poor status
- Bad status
- Good and above potential
- Moderate potential
- Poor potential
- Bad potential
- Unknown status or potential

- High or good
- Worse than good

The preliminary evaluation shown was performed in the year 2014, respectively 2015 on the basis of monitoring data in the representative profiles for the period 2010–2012 (in exceptional cases the data were supplemented by data from the years 2008, 2009 or 2013).

Figure 3 ➜ **Chemical status of surface water bodies in the Czech Republic, 2010–2012**





Sources: T.G. Masaryk, Water Research Institute, public research institution from Povodí, state enterprises data

Chemical status
- Good
- Failing to achieve good status

- Good
- Failing to achieve good status

The preliminary evaluation shown was performed in the year 2014, respectively 2015 on the basis of monitoring data in the representative profiles for the period 2010–2012 (in exceptional cases the data were supplemented by data from the years 2008, 2009 or 2013).

To improve the quality of surface water and groundwater it is important to concurrently reduce the pollution emitted from point and diffuse sources. While the development of concentration of the evaluated indicators[2] in the Czech Republic for the past 25 years was influenced particularly by the changes related to the quantity of discharged waste water, access to sewerage treatment and the socio-economic and political development (industrial restructuring, raising of living standards, accession to the EU). In recent years the quantity of pollution discharged from point sources does not now change significantly and an important role in the annual fluctuations of surface water quality is played by climatic conditions of the year. In the regional context the concentration of industrial activities is important, so as the existence of contaminated sites or the intensity of agricultural activities. At present, the diffuse nutrient pollution, pollution by substances difficult to remove from point source discharges and accidental pollution are now considered as important sources of pollution of surface water and groundwater in the Czech Republic.

In the long-term perspective, in the period 1993–2014 the Czech Republic managed to successfully reduce the river pollution by BOD_5 and P_{total} (average decrease in concentration of 59%, respectively 55%). COD_{Cr} and $N\text{-}NO_3^-$ concentration during this period has not decreased significantly (even though it has decreased by 38%, respectively by 31%) and in the period 2000–2014 it stagnated in the long-term with year-to-year fluctuations. To the reduction of the average concentration of **organic pollution** in watercourses (Chart 1), which originates mainly from municipal waste water, contributes not only to the decrease in production of this type of pollution, but also the high efficiency of removal at WWTPs. From the four above-mentioned indicators, it is the COD_{Cr} which is produced over the long-term in the highest volume, and which is subsequently released from the WWTPs into the watercourse even though its removal efficiency in WWTPs is very high (94.9% in 2014). The effectiveness of pollution removal expressed by the BOD_5 indicator is even higher (98.2%). The final concentration of COD_{Cr} in Czech Republic watercourses in 2014 thus reached 18.9 $mg.l^{-1}$, for BOD_5 it was 2.5 $mg.l^{-1}$. Within the stagnating trend, only a slight increase in concentration of BOD_5 of 3.2% and COD_{Cr} of 2.6% occurred year-to-year.

In the long term perspective the average concentration of total **phosphorus**, which in 2014 reached in rivers 0.14 $mg.l^{-1}$ (Chart 1), decreases. The lowest concentration of phosphorus in watercourses was indeed achieved in 2010, but still the values from the period 2010–2014 are below the long-term average, and year-to-year the concentration of this element only slightly increased by 7.4%. The reason for this positive long-term development is the fact that part of the phosphorus pollution originates from point sources that pass through treatment and whose volume generally decreases. The decrease in phosphorus loading was also supported by the restrictions on the use of phosphates in detergents[3] and in recent years also by the relatively lower volume of applied phosphorus fertilisers in agriculture. Yet a substantial portion of phosphorus currently comes from diffuse sources of pollution (use of mineral phosphorus fertilisers increased year-to-year by 10.5%), and this type of pollution is difficult to remove. Phosphorus pollution from agricultural sources is prevented by good agricultural practice guided by the GAEC principles. Further reduction of phosphorus concentration in surface waters is hampered by the relatively high limits for waste water discharge, and also by the fact that the obligation to remove phosphorus applies only to larger WWTPs. Other sources of phosphorus are the phosphates contained in dishwasher detergents, about 40% of Czech households are equipped by a dishwasher.

The concentration of **nitrate nitrogen** had since 2000 a fluctuating trend (Chart 1). Year-to-year, however, mainly due to the reduction in the quantity of nitrogen discharged from point sources, a significant decrease in the concentration of $N\text{-}NO_3^-$ by 17.1% occurred (a slight increase in the average annual concentration was only at 3 stations from a total of 64 evaluated). The average concentration of $N\text{-}NO_3^-$ in 2014 reached 2.6 $mg.l^{-1}$ and on none of the observed profiles the EQS limit of 5.4 $mg.l^{-1}$ was exceeded. The mineral nitrogen fertilisers are a major source of nitrogen, in addition to atmospheric deposition and municipal waste water. Although their use after 2011 declines, it is still higher than in the years 2000 and 1990. The long-term trend, with regard to the developments since the 90s, of reducing nitrate pollution is also related to, inter alia, to the reduction of emissions of nitrogen from livestock farms (decline of pig and poultry farming).

The diffuse pollution is also the source of other pollutants, mainly organic compounds from the **pesticide** group that threaten both biodiversity in rivers and standing waters, but also cause problems in the treatment of water for drinking purposes, especially in cases where the source of the water is a watercourse. Areas significantly affected by pesticide use in agriculture include the basins of the rivers Sázava, Želivka, Úhlava and Radbuza.

Among the other evaluated indicators (Chart 2), the biggest decrease since 2000 recorded in the Czech Republic watercourses was for **cadmium** (by 82.8% to 0.06 $\mu g.l^{-1}$ in 2014, a year-to-year decrease of 21.8%). Cadmium is one of the hazardous substances and its EQS (0.3 $\mu g.l^{-1}$) is practically not exceeded on the monitored profiles since 2003. In the year 2014, EQS was exceeded on only one of the evaluated profiles. The average concentration of **AOX** (21.1 $mg.l^{-1}$ in 2014) decreases slowly (year-to-year decrease compared to 2013 was 4.2%), but the proportion of EQS (25 $\mu g.l^{-1}$) non-compliant profiles is the highest - right after total phosphorus - of the assessed indicators (21.6%). The reason is that this pollution is coming e.g. from paper and chemical industries, municipal waste waters, but partly also from natural sources and is difficult to degrade. The concentration of **thermotolerant coliform bacteria** (FC) primarily reflects the level of faecal pollution and also depends on the climatic conditions of the year

[2] The development of the watercourse quality using the given indicator is evaluated on the basis of average annual concentration of eight basic indicators of pollution on selected profiles of the Eurowaternet network. Organic pollution is expressed by the indicators BOD_5 and COD_{Cr}, nutrients are represented by $N\text{-}NO_3^-$ and P_{total} for biological indicators chlorophyll 'a' was chosen, for heavy metals cadmium, for general indicators adsorbable organic halogens (AOX) and microbiological indicators are represented by thermotolerant (faecal) coliform bacteria (FC).

[3] Detergents with higher phosphate concentration than 0,5 % per weight were prohibited by Decree No. 78/2006 Coll.

(temperature, precipitation). In the period 2000–2004 the FC concentration decreased on the monitored profiles, followed by a period of growth and since 2010 the situation has improved again. In 2014, the average concentration of FC in Czech Republic watercourses was 33.9 CFU.ml^{-1} following a year-to-year decrease of 7.5%.

The **chlorophyll** concentration characterizes the level of primary production of the aquatic environment (resp. eutrophication) and it reflects mainly the influence of the climate conditions (average temperatures and precipitation pattern during the year, respectively the growing season). The higher values recorded, for example in 2003, were associated with the significantly below-average precipitation and above-average temperature conditions. Similarly, the years 2011 and 2012 were among the ones with above-average temperature. The second highest was recorded in 2014, in comparison with 2013 approximately double the average concentration of chlorophyll 'a' (17,8 μg.l^{-1}) for the reporting period (Chart 2), due to above-normal temperatures (especially in spring and autumn months, and in July, although in August the temperature was slightly below normal) and due to an overall drier half of the year (predominantly below normal precipitation in June). The average concentration of chlorophyll 'a' on the monitored profiles in the Czech Republic was therefore in the period since 2000, for the reasons given, rather volatile year-to-year. The situation regarding the eutrophication of standing and flowing waters is generally less satisfactory and it is necessary to permanently reduce the loading of water by nutrients, especially by phosphorus compounds.

In connection to the reduction of the quantity of pollution discharged from point sources, the reduction of concentration and prevention of **exceedances of environmental quality standards** is relatively successful. EQS has not been exceeded in 2014 on any of the monitored profiles in the indicator N-NO_3^-. Furthermore, the lowest proportion of profiles exceeding EQS was achieved for cadmium, namely 2.2%, then for COD_{Cr} 7.8% and for BOD_5 9.4%. On the other hand the highest exceedance was for total phosphorus 32.8% and for AOX 21.6%.

On the basis of comparison of water quality maps assembled by a summary evaluation of the basic indicators monitored according to the Czech standard CSN 75 7221 **Classification of surface water quality** continuously since the 1991–1992 period, the satisfactory water quality of watercourses in Czech Republic is obvious. Nevertheless, on short sections of watercourses Class V (Figure 1) still occur. Since the year 2000, mainly the number of sections included in class V quality was reduced. The number of sections of unpolluted and slightly polluted water has increased. Class V pollution applies in the long-term to Trkmanka which is the manifestation of intense agricultural activity and a section of Lužnice below the confluence with Nežárka. In comparison with the two-year period 2012–2013, the following streams degraded to pollution class V: upper stream of Litavka, lower stream of Vlkava and Bystřice (left tributary to Bílina which is loaded by high pollution from municipal and industrial waste water). On the other hand, the lower part of Litavka, Jičínka and Bakovský potok improved in water quality from class V to IV, respectively to class III.

The **status of surface water and groundwater bodies** in the Czech Republic, according to the evaluations[4] based on the requirements of the Water Framework Directive, is to a large extent unsatisfactory. Surface water bodies achieved at least good ecological status or ecological potential only in 21.2% (Figure 2). Good chemical status was achieved by a total of 56.6% of surface water bodies (Figure 3). In the assessment of groundwater chemical status, 27.0% of groundwater bodies were satisfactory and 69.0% of groundwater bodies had a satisfactory quantitative status. The detailed evaluations of the Czech part of the Elbe, Danube and Oder basins are provided by the Management Plans of National Parts of International River Basins. Measures were proposed to improve water status within the individual basins, where significant problems in water management were identified, particularly significant substance loading of the water, morphological changes in water flows and potential water shortages.

In the Czech Republic, the **bathing water quality** is systematically monitored and evaluated in five quality categories. In the Czech Republic, the number of bathing waters monitored in the national assessment was reduced from the maximum of 263 sites in 2011 to 251 bathing sites in 2014. The number of sites reported to the EU and assessed under the Directive 2006/7/EC (until 2011 under Directive 76/160/EEC), decreased over the years from 188 to 152 sites in 2014. In the bathing season of 2014, 50.6% of bathing waters were placed in the best category according to the quality evaluation by the Czech Republic, on the other hand a bathing ban was declared at 4.0% of the monitored sites, representing a decrease from 12 to 10 sites with water unsafe for bathing, compared to the year 2013. According to the EU evaluation, 76.3% of bathing waters were placed in the best category of water quality and only one site has reached the limit for a bathing ban.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

[4] *The evaluation is carried out every six years (2009, 2015, 2021 and 2027). This assessment of the IInd Planning period, implemented in 2014, respectively in 2015 is preliminary and is elaborated on the basis of data obtained from the monitoring programs in representative profiles in the 2010–2012 period (in exceptional cases, the data were supplemented by results from the years 2008, 2009 or 2013). The implementation and manifestation of the effect of some of the measures proposed in the Ist Planning period take place in the period 2013–2015. However, the Water Framework Directive does not include the status assessment of water bodies in 2015 and does not reflect it. It can be expected though, that some change in some indicators or in the overall status of some water bodies will occur between 2012 and 2015.*

The assessment of the status of water bodies is performed by a synthesis of individual indicators monitored, using the principle one-out, all-out (i.e. in the event that any of the monitored indicators of any assessment component exceed the limit value, the evaluation of entire body is classified as noncompliant, resp. achieves the worst value of the monitored indicator).

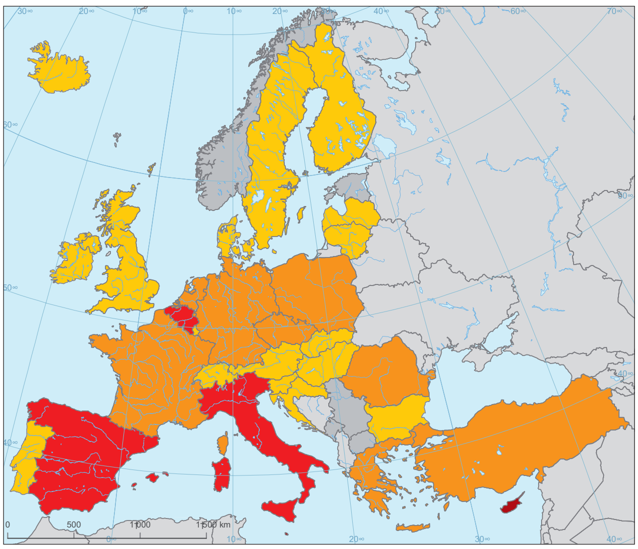
Water management and water quality in the European context

KEY MESSAGES ➜

- ➜ Most European countries do not suffer from water shortages. The most favourable situation is in northern Europe and the Slovak Republic. The Czech Republic ranks amongst the countries with relatively sufficient quantity of water sources and below-average total water abstraction. The water shortage in the most vulnerable countries in Europe in terms of water resources (southern Europe and Belgium) occurs as a result of both unfavourable natural conditions and inefficient utilization and increase in abstractions, primarily for agricultural production.
- ➜ In most European countries in the period 2004–2012 there was a decrease in the emission intensity of nutrients from the manufacturing industry. The countries with the largest decrease were Bulgaria, the Czech Republic, Norway, Lithuania, and Portugal. Compared to 2010, there was a significant reduction of disparities between countries. In the majority of countries in the years 2000–2009, the emissions of nutrients (nitrogen and phosphorus) into surface waters from households were reduced. The Czech Republic ranks amongst the countries with the most significant positive changes.
- ➜ In the field of waste water treatment the worst situation prevails in the countries of southeast Europe. The Czech Republic maintains a prominent position among the new EU member states.
- ➜ In terms of water quality, a significant decrease in the concentration of BOD_5 (by 52.7%) and orthophosphate (by 59.0%) has occurred in watercourses in the years 1993–2012, but a less significant decrease for nitrate (18.3%). In the long-term, the lowest concentration of pollutants is documented in the rivers of northern Europe. The most significant pollution by orthophosphate and BOD_5 is exhibited in the rivers of southeast Europe, for nitrate in the rivers of western Europe. In the European context, the pollution concentration expressed by these indicators (especially for phosphorus and nitrate) in the watercourses of the Czech Republic reaches above-average values. Although the water quality in watercourses has improved in the long-term, only 43% of water bodies in Europe complied with at least good ecological status in 2009.

INDICATOR ASSESSMENT

Figure 1 ➜ **Water stress expressed using the WEI index (Water Exploitation Index) [%]**

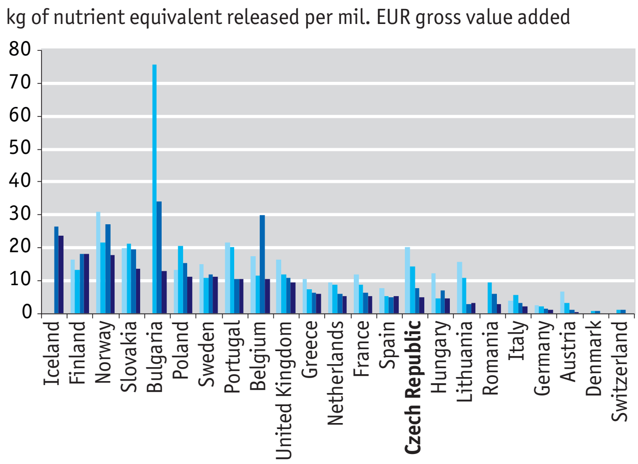


- No stress
- No stress
- Water stress
- Extreme water stress
- No data available

Source: Eurostat

Index values refer to the most recent year depending on the availability of data (2011 - Bulgaria, the Czech Republic, Croatia, Cyprus, Lithuania, Luxembourg, Malta, Poland, Romania, Slovenia, the United Kingdom, 2010 - Latvia, France, Sweden, Spain, the Netherlands, Slovakia, Denmark, Turkey, 2009 - Belgium, 2008 - Hungary, 2007 - Greece, Ireland; 2006 - Portugal, Switzerland, Finland, 2005 - Iceland; 2004 - Germany; 1999 - Austria, 1998 - Italy).

Chart 1 ➜ **Nutrients emission intensity of manufacturing industries [kg of nutrient equivalent released per mil. EUR gross value added], 2004, 2007, 2010 and 2012**

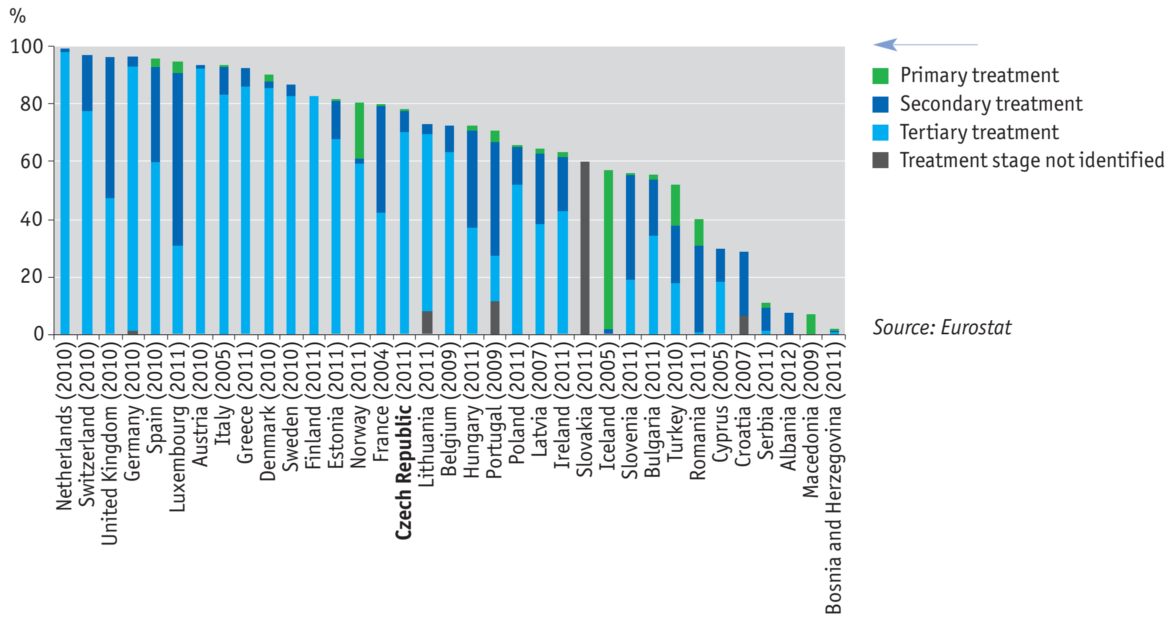


- 2004
- 2007
- 2010
- 2012

Source: EEA

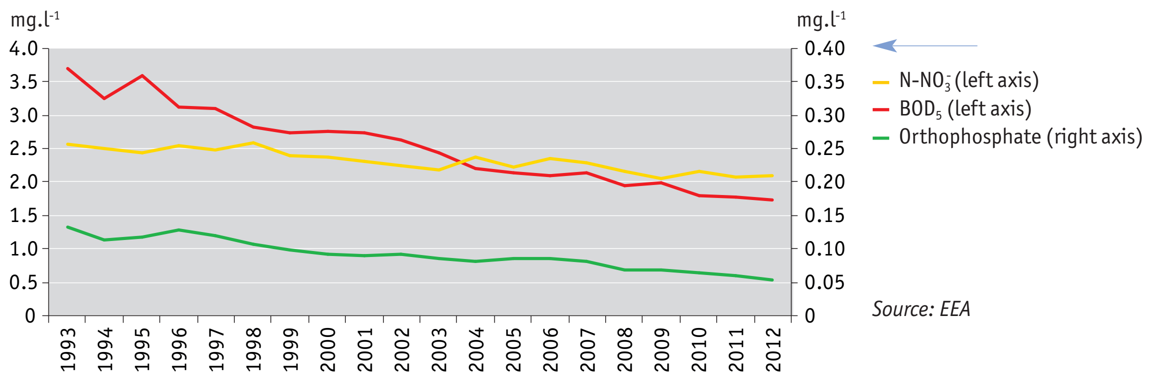
The chart shows the change in the emission intensity of equivalent nutrients from the manufacturing industry to produce 1 mil. EUR GVA (gross value added) of individual European countries for the year (ranked by value from 2012). The nutrient equivalent is the sum of total emissions of nitrogen/7.23 and total phosphorus emissions.

Chart 2 ➜ **Proportion of the population connected to WWTP according to treatment stages [%]**



The data relate to the most recent year (provided in brackets in the Chart) in the Eurostat database for the given country.

Chart 3 ➜ **Development of pollution level indicators in European watercourses [mg.l^{-1}], 1993–2012**



Concentration is expressed as average values of BOD_5 from 539 stations, $N\text{-}NO_3^-$ from 1,059 stations and orthophosphate from 874 stations. In countries where BOD_5 was not monitored, BOD_7 has been converted into BOD_5 where $BOD_7 = 1.16\ BOD_5$. Nitrate concentration is expressed as nitrate nitrogen (Austria, Belgium, Bulgaria, Germany, Estonia, France, Latvia, Liechtenstein, Lithuania, Luxembourg, Norway, Poland, Slovakia, Slovenia, Switzerland), total oxidizable nitrogen (Denmark, Finland, Ireland, Sweden) and nitrate or oxidizable nitrogen (United Kingdom). Source of data is the database WISE-SoE Rivers (Version 14).

The access to water sources is heavily dependent on the geographical location and physical geographic conditions in the different countries. The most vulnerable countries, i.e. with the highest **WEI**[1] index (Figure 1) are Cyprus, Malta, Italy, Spain, and Belgium. The water shortage in these areas occurs as a result of unfavourable natural conditions (climate, the character of the river network, geological conditions, etc.) as well as due to anthropogenic interventions in the water regime. Inefficient utilization and increase in abstraction primarily for agricultural production (e.g. Spain, Cyprus) has then in these regions ultimately a greater impact on the overall water balance than in countries with sufficient water resources. In countries with more favourable ratio of water abstractions to the volume of renewable water supplies, such as Iceland, Sweden, the Baltic States, Slovakia, Denmark, Finland, this condition is clearly influenced by the natural conditions (higher precipitation, river network density, number of lakes, water flow rate in streams). The Czech Republic ranks amongst the countries with relatively sufficient quantity of water resources in relation to the demands for their consumption. The Czech Republic belongs amongst the European countries with lower total water abstraction calculated per capita (in 2011 it was 180 m^3.inhabitant^{-1}.year^{-1}).

[1] The WEI Index (Water Exploitation Index) expresses water shortage and describes what pressure is exerted by the total water abstraction on water sources (calculated as a ratio of total water abstraction to the quantity of renewable water reserves). It thus specifies countries that have, given their resources, high abstraction and are therefore prone to water shortage (water stress). The WEI warning threshold that separates regions with sufficient water resources and regions lacking them is the value of approximately 20%. Severe water shortage may occur when the value of the WEI exceeds 40%. WEI index is used in the assessments of international organizations, e.g. UNEP, OECD, Eurostat.

The **emissions of nutrients from the manufacturing industry** (Chart 1) also contribute to the emissions of nutrients to surface waters, in addition to households and agriculture. The range of nutrient equivalent intensity required to produce 1 mil. EUR of gross value added (GVA) reflects, in addition to the development of nutrient emissions as such, the differences in the size structure of enterprises (small businesses do not have or previously had no obligation to report emissions or discharged water into the municipal WWTPs), pollution charges, taxes and factors affecting GVA. Therefore, the assessment focuses more on the developments in the individual countries rather than on comparing absolute values. The average emission intensity in 2012 reached 8.5 kg of nutrient equivalent released per mil. EUR GVA. Compared to 2010, a significant reduction of differences amongst the countries has occurred. In most European countries in the period 2004–2012 there was a decrease in the emission intensity of nutrients. The countries with the largest decrease were Bulgaria, the Czech Republic, Norway, Lithuania, and Portugal. In Finland, there was a greater decrease in GVA than in nutrients, on the contrary in Poland and Slovakia the increase in absolute emissions has been accompanied by higher GVA growth (relative decoupling). For emissions of nutrients to surface water from households calculated per capita, the majority of European countries in 2000–2009[2] achieved an emissions reduction. The biggest decrease in emissions of nitrogen occurred in Austria, Germany, Denmark, the Czech Republic, and Belgium, respectively in Lithuania and the Czech Republic for the emissions of phosphorus. In countries with higher emissions of nitrogen or phosphorus (in Romania especially nitrogen, Turkey, Bulgaria, Malta and Portugal) the low percentage of treated water and the predominance of secondary and primary treatment stage over tertiary plays the key role.

When assessing the **connection of the population to WWTPs and waste water treatment stages** (Chart 2), a generally better situation prevails in the countries of the western, southern and northern Europe. The Czech Republic holds a prominent position in the proportion of population connected to sewerage systems connected to WWTPs and also the proportion of tertiary treatment amongst the new EU member states. The situation gradually improves in Romania and Bulgaria, which have begun to aggressively build sewerage infrastructure with regard to the implementation of the EU legislation only since 2007. The proportion of population connected to WWTPs significantly increased since 2006 also in Hungary. The fact that in most countries the proportion of tertiary waste water treatment is gradually increasing is positive. The worst situation in waste water treatment prevails in states of the former Yugoslavia and other countries in southeast Europe, with the exception of Greece. Also typical for these countries is the existence of significant regional differences in these indicators between urban and rural regions.

Concerning **water quality in watercourses** (Chart 3) it can be stated that in the period from 1993 to 2012 a significant decrease in organic pollution occurred in European watercourses: expressed in BOD_5, concentration decreased by a total of 52.7%, and expressed in phosphorus (indicator orthophosphate) concentration decreased by a total of 59.0%. This positive development is mainly due to the introduction of European and national legislation, aimed primarily at municipal waste water treatment, and the introduction of phosphate-free detergents on the market. In the 1990s, the reduction of pollution discharged from the manufacturing industry reflected, inter alia, the economic changes in the context of the political and economic changes in the countries of central and eastern Europe. The decreasing trend in nitrate concentration over the period 1993–2012 was slower (by of 18.3%). The decrease was mainly due to the improvements in waste water treatment and the applications of tools to reduce agricultural inputs of nitrogen. However, diffuse pollution from agriculture remains a significant stressor in more than 40% of Europe's water bodies. In the long-term, low concentration of pollutants is recorded in the rivers of northern Europe, where the treatment of waste water is at a very good level and moreover, the rivers flow through less populated or mountainous areas. The most significant pollution by BOD_5 and orthophosphate can be found in the watercourses of southeast Europe. Orthophosphate pollution is a problem also in the Czech Republic. The highest level of nitrate pollution, similar to that in the Czech Republic, is also present in the rivers in the densely populated and intensively farmed western Europe.

Although the water quality in watercourses improves in the long-term, only 43% of water bodies complied with at least good ecological status in 2009[3], particularly in central and north-western Europe. For the year 2015 it is estimated that 53% of water bodies will comply with at least good ecological status, which represents only a slight improvement and the need for identifying the stressors on the water bodies (emissions of pollutants, morphological changes, excessive abstraction, hydrological changes affecting runoff) and the need for many related measures in the following programming period 2016–2021.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

[2] Data for update are not available.
[3] The evaluation takes place in six-year intervals; the following evaluation will be for the year 2015.

12/ Nature protection

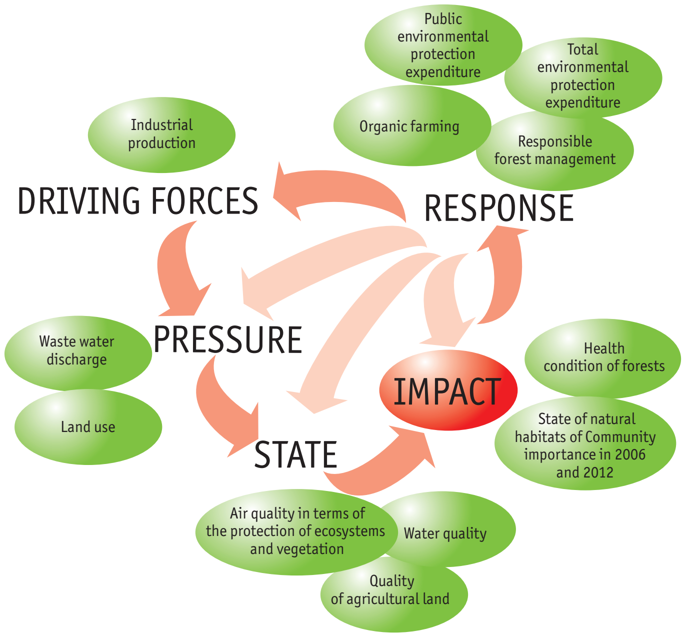
KEY QUESTION →

How and to what extent are the nature and landscape protected in the Czech Republic?

KEY MESSAGES →

The aggregate area of Special Protection Areas and Natura 2000 sites as of 2014 was equal to almost 21% of the total area of the Czech Republic, the Special Protection Areas and the Natura 2000 accounting for approximately 16% and roughly 14% of the Czech Republisc's area, respectively.

As there is no system allowing for assessments of the efficiency of nature protection measures in place, the actual effect of such nature protection measures on biological diversity cannot be fully assessed. Due to limited financial resources, only eight rescue programmes targeting the most endangered species on the list of species enjoying a special protection status.



OVERALL ASSESSMENT →

Changes of nature and landscape are slow and take a long time, and it is not possible to use automated technical equipment to acquire data which their monitoring would be based on. The indicators (except for the status of animal and plant species of Community importance, status of priority habitats of Community importance, and common bird species) thus cannot be fleshed out regularly and any assessment of the changes is possible only in the long run, on the basis of non-periodical updating of data.

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the so-called Habitat Directive)
- ensuring biodiversity through the protection of natural habitats and wild fauna and flora species in the territories of member states
- maintaining or restoring a favourable status from the viewpoint of the protection of natural habitats and wild fauna and flora species
- creating the all-European Natura 2000 system comprising Sites of Community Importance (SCIs) and Special Protection Areas (SPAs)

Directive No. 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds
- creating and declaring Special Protection Areas (SPAs) which together with Sites of Community Importance (SCIs) form the Natura 2000 system

EU Biodiversity Strategy to 2020
- halting the loss of biodiversity and degradation of ecosystem services in the European Union by 2020
- determining the share of biotopes and species in respect whereof a favourable or improving situation must be achieved

Convention on Biological Diversity
- conservation and halting the loss of biological diversity
- sustainable use of biological diversity components
- access to genetic resources and fair and equitable sharing of benefits arising from their utilization

Renewed EU Sustainable Development Strategy
- ensuring the Earth's ability to sustain life in all its diversity

Regulation (EU) No. 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction and spread of invasive alien species
- determining the essential rules with respect to the most problematic invasive species from the viewpoint of the European Union

State Environmental Policy of the Czech Republic 2012–2020
- ensuring the protection and care of the most valuable parts of nature and landscape, preventing the loss of indigenous species, and eliminating negative impacts of non-indigenous invasive species on biological diversity

National Biodiversity Strategy of the Czech Republic
- protection and conservation of ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment

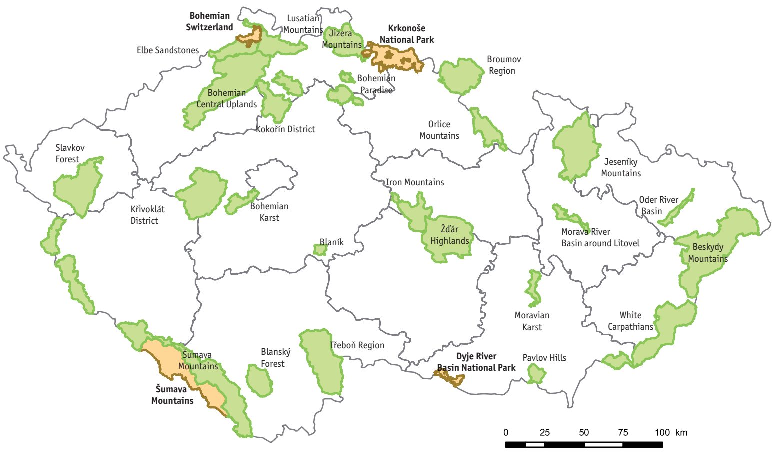
State Nature Conservation and Landscape Protection Programme of the Czech Republic
- maintaining numerous enough populations of indigenous wild fauna and flora species and minimizing risks when introducing new invasive and non-indigenous species

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➜

In addition to protecting the landscape and ensuring the protection and diversity of all plant and animal species, the term "nature conservation and landscape protection" also includes the protection and considerate usage of resources needed to ensure biological diversity of ecosystems and to provide ecosystem services extensively used by the human society for its existence. An unfavourable-inadequate and unfavourable-bad status of the nature, landscape and species results in a reduced ecological stability of the landscape, reduction of genetic resources and deterioration of productive capabilities of the agricultural and forest landscape. The result is a negative impact on the living environment and the quality of human life.

INDICATOR ASSESSMENT

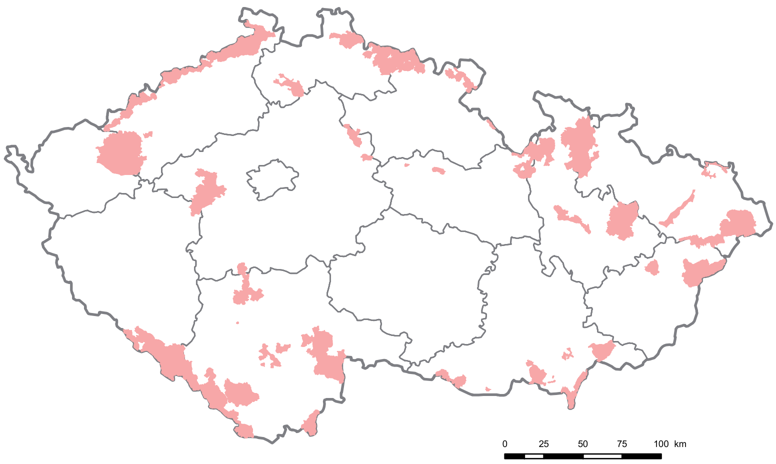
Figure 1 ➜ **Large-size specially protected areas, 2014**



National Park
Protected Landscape Area

Source: Nature Conservation Agency of the Czech Republic

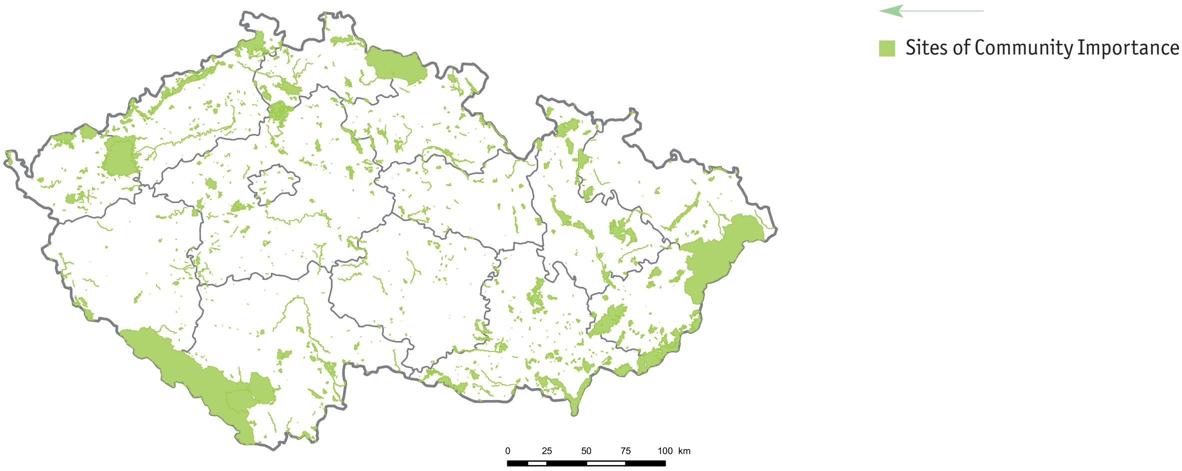
Figure 2 ➜ **Natura 2000 system areas – Special Protection Areas, 2014**



Special Protection Areas

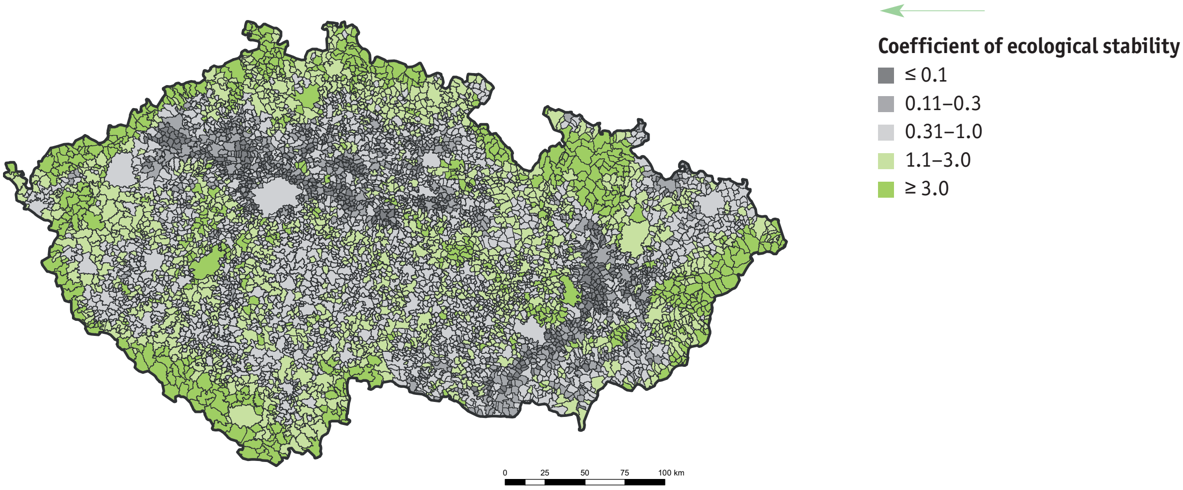
Source: Nature Conservation Agency of the Czech Republic

Figure 3 ➜ **Natura 2000 sites – Sites of Community Importance, 2014**



Source: Nature Conservation Agency of the Czech Republic

Figure 4 ➜ **Coefficient of ecological stability, 2012**



Source: Czech Statistical Office

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication. Values of the coefficient of ecological stability are divided into five basic classes: ≤ 0.1: areas where natural structures are extremely disturbed; 0.11–0.3: areas with higher-than-average use and with significantly disturbed natural structures; 0.31–1.0: intensively used areas; 1.1–3.0: relatively balanced landscape; > 3.0 natural or close-to-natural landscape.

The aggregate area of **large-size specially protected areas** (which include National Parks and Protected Landscape Areas) in 2014 was 1,220,300 hectares, i.e. 15.5% of the Czech Republic's territory (Figure 1). The National Parks conserve the most valuable areas with preserved natural phenomena and a high potential of self-regulation processes. There are altogether 4 National Parks in the Czech Republic, namely Krkonoše Mountains (declared in 1963), Podyjí/Dyje River Basin (1991), Šumava Mountains (1991), and České Švýcarsko/Bohemian Switzerland (declared in 2000). Since March 2010, a process which will ultimately result in the establishment of a fifth national park in the central part of the Protected Landscape Area of Křivoklát has been underway. There are 25 Protected Landscape Areas in the territory of the Czech Republic, the purpose of which is to preserve a specific use of a piece of landscape with a typical relief, which led to the formation of a harmonic landscape in the past. **Small-size specially protected areas** (which include National Natures Reserves/NNRs, Nature Reserves/NR, National Nature Monuments/NNM and Nature Monuments/NM) accounted for 112,200 hectares, i.e. 1.4% of the Czech Republic's territory, in 2014[1]. The most frequent changes occur in the category of small-size specially protected areas, the reason being the declaration of new areas, predominantly for the purpose of protecting sites of Community importance.

[1] However, more than a half of the small-size specially protected areas are found within a Landscape Protection Area or a National Park.

The NATURA 2000 system is a system of protected areas of Community importance, which is being built in the territory of EU member states. It comprises two types of protected areas – Special Protection Areas and Sites of Community Importance. As of 2014, the territory of the Czech Republic included 41 Special Protection Areas (Figure 2) the aggregate area of which was 703,430 hectares, i.e. 8.9% of the Czech Republic's territory. As of the same year, there were 1,075 Sites of Community Importance (Figure 3) occupying an aggregate area of 785,576 hectares, i.e. 10.0% of the Czech Republic's territory. As the SPAs and SCIs are mutually overlapping, they together account for approximately 14% of the Czech Republic's territory.

General protection of the territory is provided through so-called Territorial Systems of Ecological Stability (TSES), i.e. significant landscape elements (either existing under relevant legislation, or declared, including forests, alluvial flats, wetlands, other water elements etc.), wooden species growing outside forests, and other tools. The definition and functionality of different constituents of Territorial Systems of Ecological Stability in the Czech Republic vary over a broad range, and therefore do not tell much about the actual state of ecological stability of landscape. However, the ecological stability can be better assessed according to the **coefficient of ecological stability**[2]. Areas with extremely degraded natural structures are found in the most intensively agriculturally exploited regions of the Czech Republic and account for 3.6% of the country's territory; on the other hand, natural and near-natural landscape is found mainly in mountain ranges alongside the border, occupying 19.5% of the Czech Republic's territory and basically consistent with the special protection areas. The most frequently represented category is that of intensively exploited areas, whose share is 35.9% (Figure 4).

The system of protected areas comprises multiple overlapping elements, and therefore does not provide a full picture of the actual state of objects of protection in special protection areas and of the state of natural assets in the countryside. It also does not permit assessments of the actual influence on the state of different plant and animal species. As there are many fauna and flora species in the Czech Republic the state of which is critical, it is necessary to adopt active measures and coordinate their protection. To this end, the Ministry of the Environment has implemented, in accordance with Section 52 of Act No. 144/1992 Coll., **rescue programmes**[3]; these represent a set of measures aimed at increasing the population of the species in question above the extinction level. Due to limited funding, the rescue programmes were implemented for 4 plant species (marsh angelica/Angelica palustris; Dianthus arenarius subsp. bohemicus; whitestem pondweed/Potamogeton praelongus Wulfen; Gentianella praecox subsp. bohemica) and for 4 animal species (freshwater pearl mussel/Margaritifera margaritifera; scarce fritillary/Euphydryas maturna; Aesculapian snake/Zamenis longissimus; and European ground squirrel/Spermophilus citellus.

One of the factors endangering populations of plant and animal species and their biocenoses and the state of ecosystems is the proliferation of geographically non-indigenous species. Of the total number of 1,454 non-indigenous plant species which occur or have been recorded in the territory of the Czech Republic, 61 are regarded invasive. The most dangerous invasive plant species[4] include, for example: giant hogweed/ Heracleum mantegazzianum; knotweeds/Reynoutriae; bobby tops/Impatiens glandulifera; big-leaved lupine/Lupinus polyphyllus; or ailanthus/Ailanthus altissima. As to animals[5], 595 non-indigenous species have been documented so far, 113 of them invasive. Insofar as their impacts on biological diversity are concerned, the most dangerous ones include American mink/Mustela vison; North American raccoon/Procyon lotor; a number of fish species (e.g. Pseudorasbora parva; goldfish/Carassius auratus; brown bullhead/Ameiurus nebulosus; black bullhead/Ameiurus melas etc.); or North American crayfish species (Eastern crayfish/Orconectes limosus and signal crayfish/Pacifastacus leniusculus) that spread crayfish plague.

The overall assessment of the state of nature and landscape also needs to consider partial assessments of the condition of forests, soil, agricultural and forestry management, and ecological state of aqueous ecosystems assessed in the framework of other indicators.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

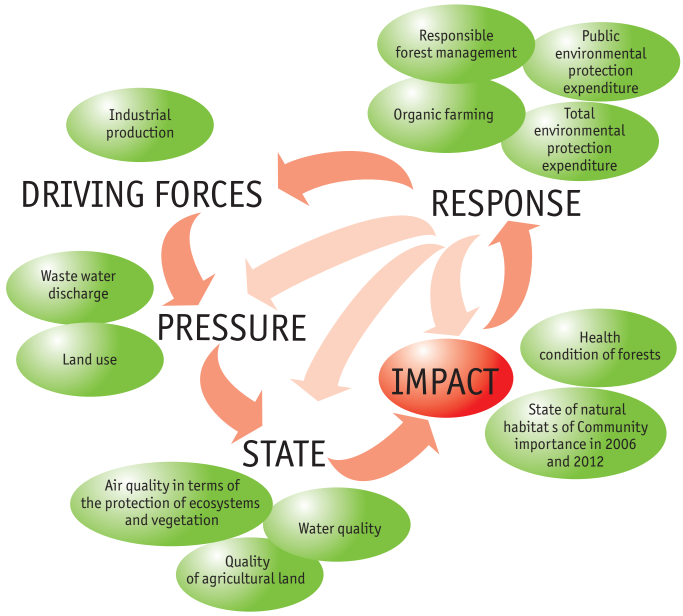
CENIA, key environmental indicators
http://indicators.cenia.cz

[2] *Míchal I. et al. (1985): Ekologický generel ČSR (Ecological Master Plan of the Czech Socialist Republic), Terplan Praha and GgÚ ČSAV (Institute of Geography of the Czechoslovak Academy of Sciences) Brno.*
[3] *See www.zachranneprogramy.cz for more details.*
[4] *Pyšek P., Chytrý M., Pergl J., Sádlo J. & Wild J. (2012): Plant invasions in the Czech Republic: current state, introduction dynamics, invasive species and invaded habitats. – Preslia 84: 575–629.*
[5] *Šefrová H., Laštůvka Z. (2005): Catalogue of alien animal species in the Czech Republic. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis 53: 151–170. doi: 10.11118/actaun200553040151.*

13/ State of animal and plant species of Community importance in 2006 and 2012

KEY QUESTION →

What are the state and the development of plant and animal species of Community importance[1] in the territory of the Czech Republic?



KEY MESSAGES →

A comparison of results of the assessments made in 2006 and 2012 shows an overall improvement of the state of plant and animal species of Community importance. Between 2007 and 2012, the state of 25.3% of the total number of plant and animal species of Community importance was assessed as favourable, as opposed to 18.9% between 2000 and 2006.

According to the 2006 and 2012 assessments, the state of protection of substantial percentages (36.7% and 37.0%, respectively) of plant and animal species of Community importance was unfavourable-inadequate; between 2007 and 2012, the state of protection of 31.5% of plant and animal species of Community importance was unfavourable-bad.

OVERALL ASSESSMENT →

According to Directive No. 92/43/EEC, the state of plant and animal species and habitats of Community importance is assessed for a six-year period. In 2007, an assessment was made for the period ending in 2006 (the beginning of the period was open); as to the 2007–2012 period, the assessment was made in 2013. The assessment is based on an evaluation of data obtained by monitoring the state of biotopes and species in the whole territory of the Czech Republic; the assessment of the state of species is based on an extensive set of activities and projects, ranging from systematic monitoring and mapping to the use of citizen science.

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the so-called Habitat Directive)
- ensuring biodiversity through the protection of natural habitats and wild fauna and flora species in European territories of member states
- maintaining or restoring a favourable status from the viewpoint of the protection of natural habitats and wild fauna and flora species
- creating the all-European Natura 2000 system comprising Sites of Community Importance (SCIs) and Special Protection Areas (SPAs)

EU Biodiversity Strategy to 2020
- halting the loss of biodiversity and degradation of ecosystem services in the European Union by 2020
- determining the share of biotopes and species in respect whereof a favourable or improving situation must be achieved

Convention on Biological Diversity
- conservation and halting the loss of biological diversity
- sustainable use of biological diversity components
- access to genetic resources and fair and equitable sharing of benefits arising from their utilization

Renewed EU Sustainable Development Strategy
- ensuring the Earth's ability to sustain life in all its diversity

State Environmental Policy of the Czech Republic 2012–2020
- ensuring the protection and care of the most valuable parts of nature and landscape, preventing the loss of indigenous species, and eliminating negative impacts of non-indigenous invasive species on biological diversity

National Biodiversity Strategy of the Czech Republic
- protection and conservation of ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment

State Nature Conservation and Landscape Protection Programme of the Czech Republic
- maintaining numerous enough populations of indigenous wild fauna and flora species and minimizing risks when introducing new invasive and non-indigenous species

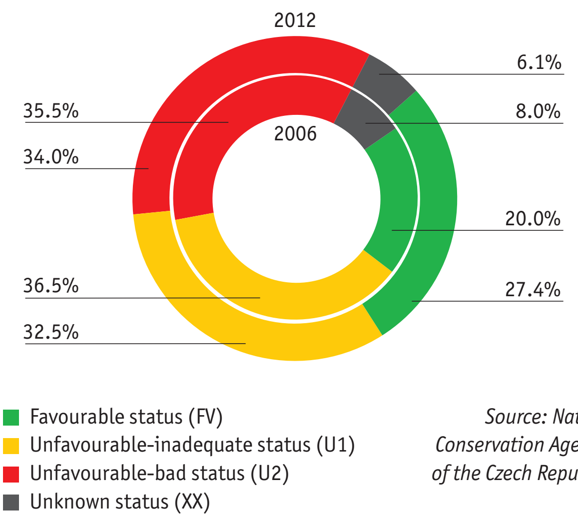
[1] *Species of Community interest ("species of European importance") include species found in European territories of member states of the European Community which are endangered, vulnerable, rare or endemic and which are defined in relevant legislation of the European Community. The indicator does not assess all species, but only those stipulated in the "Habitat Directive" (Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). From the viewpoint of the Habitat Directive, bird species are not considered species of Community importance, as they have, in accordance with the Bird Directive (Directive No. 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds), a very specific position and an independent assessment system. The state of animal and plant species of Community importance is also indicative of the overall state of all species in the territory of the Czech Republic, although the indicator deals only with species of Community importance. For an approximate assessment as the one indicated above, the set of species of Community importance is in fact a set of indication species on which the maximum possible amount of information is collected. There is no other similarly extensive group of different species that undergoes a similar assessment.*

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The state of important animal and plant species reflects the condition of biodiversity and ecosystems, including ecosystem services extensively used by the human society for its existence. An unfavourable-inadequate and unfavourable-bad status of the important animal and plant species results in a reduced ecological stability of the landscape and inappropriate modes of its use, and adverse biodiversity impacts. The unsatisfactory state influences, in particular, regulatory, supply and supporting ecosystem services and cultural and aesthetic functions of the landscape, thus affecting the quality of human life.

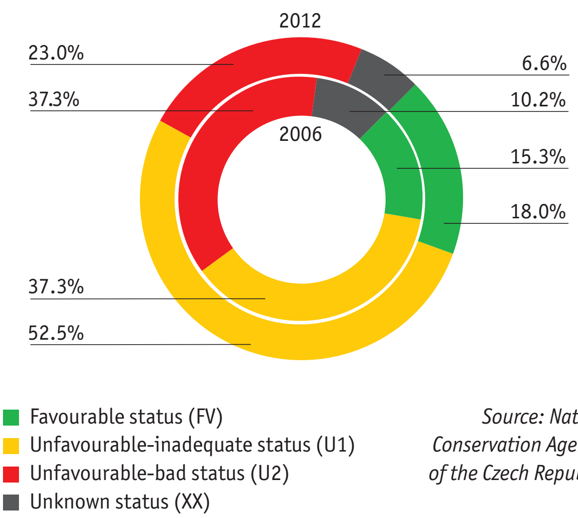
INDICATOR ASSESSMENT

Chart 1 → **State of animal species of Community importance in the Czech Republic [%], 2000–2006, 2007–2012**



Source: Nature Conservation Agency of the Czech Republic

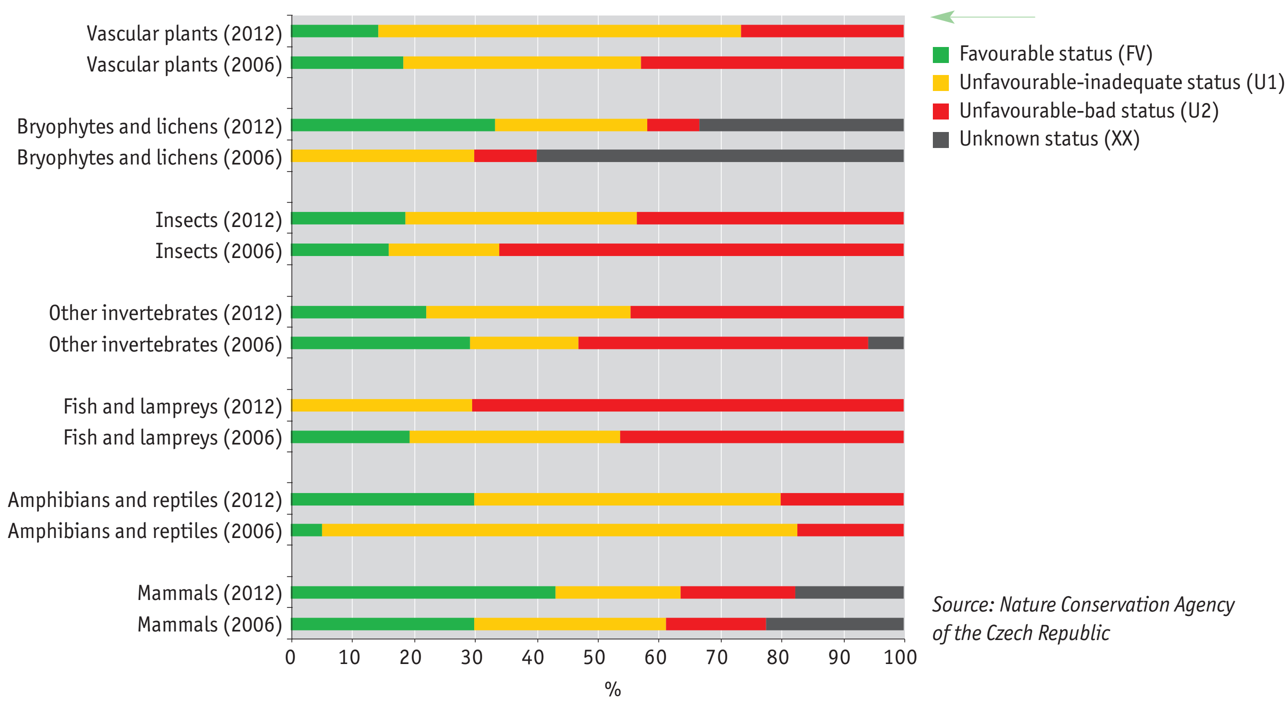
Chart 2 → **State of plant species of Community importance in the Czech Republic [%], 2000–2006, 2007–2012**



Source: Nature Conservation Agency of the Czech Republic

FV – favourable, U1 – unfavourable-inadequate, U2 – unfavourable-bad, XX – unknown

Chart 3 → **State of animal and plant species of Community importance in the Czech Republic by taxonomic groups [%], 2000–2006, 2007–2012**



Source: Nature Conservation Agency of the Czech Republic

FV – favourable, U1 – unfavourable-inadequate, U2 – unfavourable-bad, XX – unknown

The **overall status** of each species, which is determined separately for each of the two biogeographic regions which the Czech Republic is divided into, i.e. continental, occupying most of the Czech Republic's territory, and Pannonian in south-eastern Moravia, consists of four sub-parameters – area, population, habitat and anticipated development. If any of the four sub-parameters is assessed as unfavourable, the overall status of the species in question is also assessed as unfavourable.

The indicator reflects the state of biodiversity in the Czech Republic[2], where an increasing number of species of organisms fall into one of endangered categories according to criteria of the International Union for Conservation of Nature (IUCN). It shows, in particular, relative shares of the total assessment of species (defined in Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) according to a standardized scale.

The status of approximately one third of **animal species of Community importance in the Czech Republic** is assessed as unfavourable-bad, another third is assessed as unfavourable-inadequate, and their habitats are probably more or less in disarray (Chart 1). It is rather difficult to document any direct link to the habitat type. The most endangered species include species found in natural watercourses (which have been adversely affected by stream regulations and changes in watercourse dynamics), species associated with old and decaying wood (which is much less abundant in forests of the Czech Republic) and, in particular, groups of species tied to a fine mosaic of landscape elements (butterflies, amphibians and reptiles). According to the 2007–2012 monitoring programme data, the status of 27.4% animal species found in the Czech Republic is assessed as favourable, with mammals having the highest share. Species of Community importance included in the assessment also contain some new species found in the territory of the Czech Republic in the previous six-year period (e.g. golden jackal/Canis aureus, several species of bats, Balkan goldenring dragonfly/Cordulegaster heros, Orthotrichum rogeri moss, Notothylas orbicularis hornwort).

Only 18.0% of **plant species** of Community importance found in the territory of the Czech Republic are in a favourable status. The status of 52.5% of plant species is rated as unfavourable-inadequate, while plant species in an unfavourable-bad status account for 23.0%, and their habitats are probably more or less in disarray (Chart 2).

A **comparison of results of the 2006 and 2012 assessments** indicates an overall improvement. The percentages of unfavourable assessments and unknown statuses decreased between 2006 and 2012 (Chart 1, Chart 2).

However, it must be noted that the improvement of the assessments is based more on methodological factors rather than on the actual status of affairs, as the status of animal and plant species was rarely improved by active measures. The favourable status of species generally reflects a favourable situation of biotopes or species, which are even spreading in some cases.

Indicator assessment according to taxonomic groups

Sub-indicators of **animal species of Community importance** for taxonomic groups of monitored animals – mammals, amphibians and reptiles, fish and lampreys, other invertebrates and insects (Chart 3) – have been defined in a way similar to the overall indicator. The Habitat Directive does not regard birds as species of Community importance; under the Birds Directive, their position is quite specific, and birds are therefore not subject to evaluation according to European evaluation reports.

Based on results of the monitoring between 2007 and 2012, fish and lampreys have a significantly worse rating (Chart 3), with 70.4% of their species falling into the unfavourable-bad category. The most important factors endangering these species include inappropriate stream regulation measures and water pollution. More than 40% of insects and other invertebrates are in an unfavourable-bad status. Insofar as these groups are concerned, there exist many species associated with the endangered biotopes mentioned above, from structurally (in terms of age and quantity of species) rich forests, solitary trees and heterogeneously managed non-forest habitats to largely unaltered aquatic habitats. This is mainly due to a different approach to the selection of species classified as species important for the European Community. The highest proportion of favourably assessed species – 43.2% – us shown by mammals, due to the inclusion of a higher number of species which are endangered mainly in Western (i.e. considerably more urbanized and fragmented) Europe.

A comparison of the **two sets of monitoring data** indicates a positive change. Between the two assessments, the proportion of species of insects and other invertebrates falling into the unfavourable-bad category showed a significant decrease, and the proportion of species of mammals, amphibians and reptiles (falling into the favourable category) increased. The only group the state of which worsened between the assessments are fish and lampreys (Chart 3).

Similarly, sub-indicators of **plant species** for taxonomic groups of monitored plants – vascular and bryophytes and lichens, i.e. non-vascular (Chart 3) have been defined as well. In the case of the latter group, i.e. bryophytes and lichens, the fact that it has hitherto been studied

[2] The state of animal and plant species of Community importance is also indicative of the overall state of all species in the territory of the Czech Republic, although the indicator deals only with species of Community importance.

only to a limited extent (a high proportion of species in the “unknown” category) had the greatest effect, although the situation improved significantly between the two assessments, with the percentage of unknown species dropping from 60.0% to 33.3%. At the same time, the proportion of non-vascular plant species falling into the favourable category increased from 0 to 33.3%, which fact, however, may be attributable to a greater quantity of collected data. Insofar as vascular plant species that have a long history of research are concerned, a significant decrease of species falling into the unfavourable-bad category in favour of the “better” unfavourable-inadequate category was obvious between the two assessments (Chart 3).

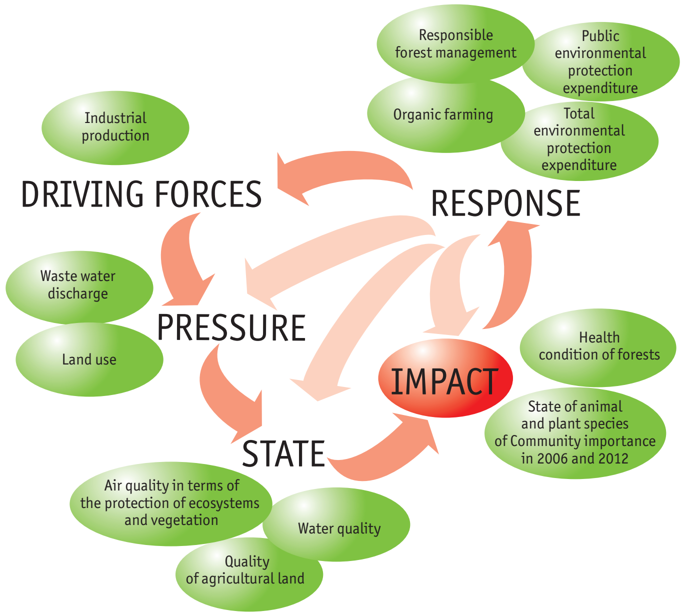
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

14/ State of natural habitats of Community importance in 2006 and 2012

KEY QUESTION →

What is the state and development of natural habitat types of Community importance[1] in the territory of the Czech Republic?



KEY MESSAGES →

☺ A comparison of results for the 2000–2006 and 2007–2012 periods indicates an improvement of the state of natural habitat types of Community importance in the Czech Republic. The percentage of habitats rated as unfavourable-bad dropped from 74.7% to 27.0%, while that of habitats assessed as favourable increased from 11.6% to 16.1%.
However, the significant improvement is attributable to a changed methodology with respect to one of the parameters entering into the assessment.

☹ Between 2007 and 2012, more than a half of natural habitat types of Community importance in the Czech Republic were rated as unfavourable-inadequate, 26.9% as unfavourable-bad.

OVERALL ASSESSMENT →

According to Directive No. 92/43/EEC, the statuses of natural habitat types of Community importance is assessed for a six-year period. In 2007, an assessment was made for the period ending in 2006 (the beginning of the period was open); as to the 2007–2012 period, the assessment was made in 2013. The assessment is based on an evaluation of data obtained by monitoring the statuses of biotopes and species in the whole territory of the Czech Republic. In the case of natural habitats, it is based on an analysis of data obtained by the mapping of biotopes of the Czech Republic, which covers the whole territory of the country (organized by the Nature Conservation Agency of the Czech Republic).

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the so-called Habitat Directive)
- ensuring biodiversity through the protection of natural habitats and wild fauna and flora species in European territories of member states
- maintaining or restoring a favourable status from the viewpoint of the protection of natural habitats and wild fauna and flora species
- creating the all-European Natura 2000 system comprising Sites of Community Importance (SCIs) and Special Protection Areas (SPAs)

EU Biodiversity Strategy to 2020
- halting the loss of biodiversity and degradation of ecosystem services in the European Union by 2020;
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Convention on Biological Diversity
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- ensuring the protection and care of the most valuable parts of nature and landscape, preventing the loss of indigenous species, and eliminating negative impacts of non-indigenous invasive species on biological diversity

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State Nature Conservation and Landscape Protection Programme of the Czech Republic
- maintaining numerous enough populations of indigenous wild fauna and flora species and minimizing risks when introducing new invasive and non-indigenous species

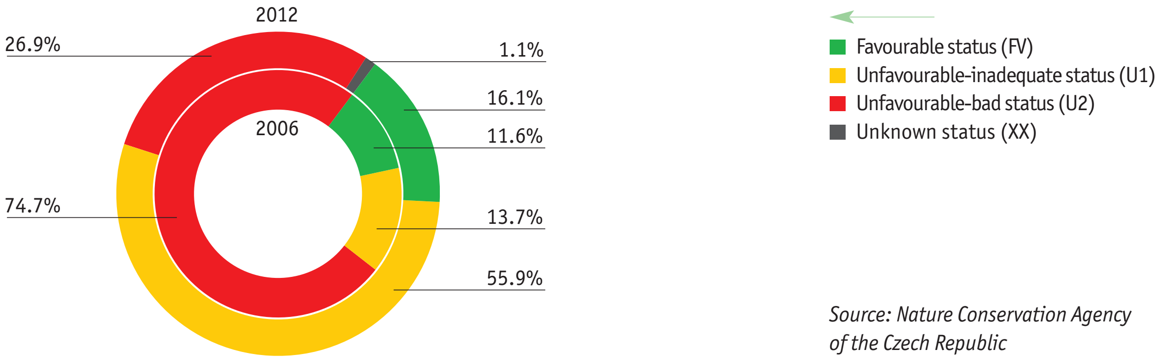
[1] *Natural habitat types of European Community interest ("European habitats") are natural habitats found in European territories of European Community member states that are in danger of disappearance in their natural range, have a small natural range following their regression or by reason of their intrinsically restricted area, or present outstanding examples of typical characteristics of one or more of the biogeographical regions defined in European Community legislation. In the Czech Republic, there are altogether 60 natural habitat types which are subject to assessment and which are mapped and interpreted using finer units, so-called biotopes, at the national level.*

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The state of different natural habitat types is an important indicator of biodiversity which, thanks to the scope of the natural habitat types being monitored, provides very representative information on the quality of the natural environment in the Czech Republic. The unfavourable status of natural habitats is due to a reduced ecological stability of the landscape, anthropogenic pressure on natural habitats and disruption of ecosystem services which are indispensable for the human society.

INDICATOR ASSESSMENT

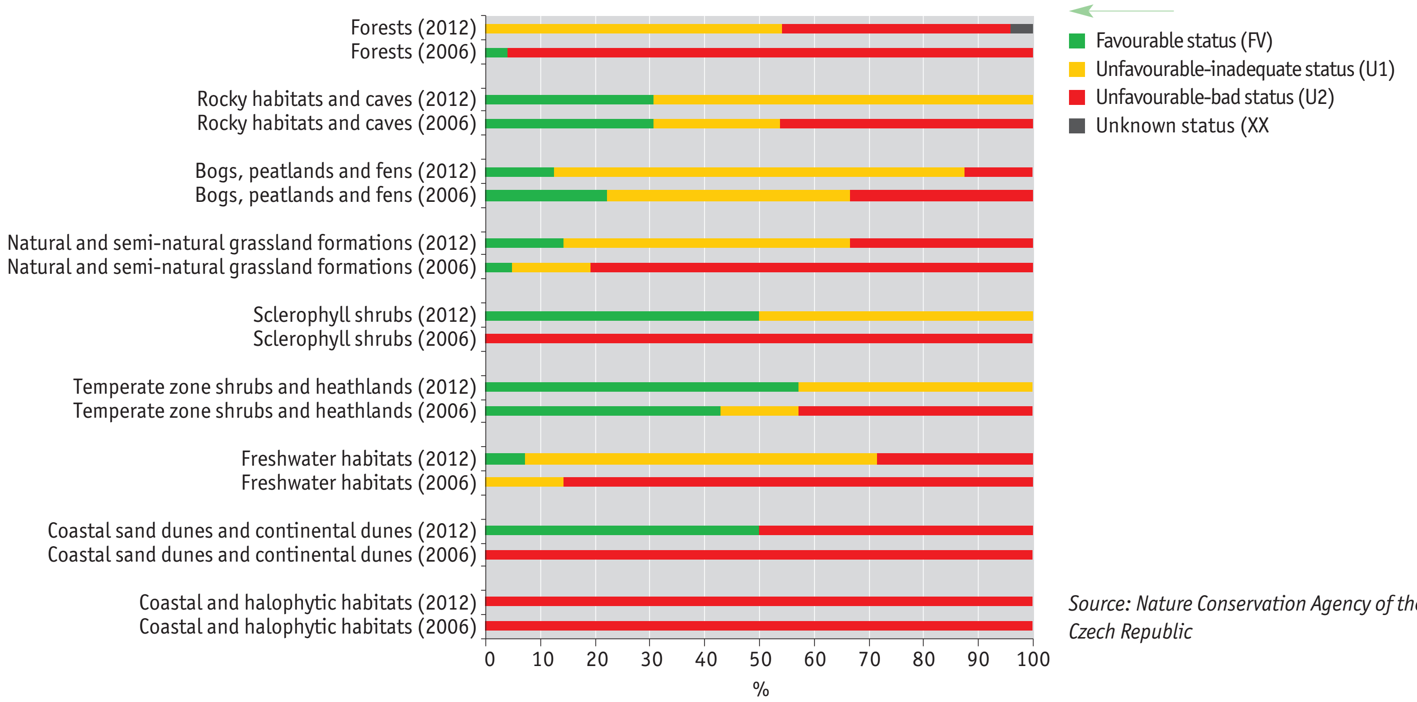
Chart 1 **State of natural habitats of European importance in the Czech Republic [%], 2000–2006, 2007–2012**



Source: Nature Conservation Agency of the Czech Republic

FV – favourable, U1 – unfavourable-inadequate, U2 – unfavourable-bad, XX – unknown

Chart 2 **State of natural habitat types of Community importance in the Czech Republic according to individual formation groups [%], 2000–2006, 2007–2012**



Source: Nature Conservation Agency of the Czech Republic

FV – favourable, U1 – unfavourable-inadequate, U2 – unfavourable-bad, XX – unknown

The state of **natural habitat types of Community importance** can also help assess the overall state of natural biotopes in the Czech Republic, although the indicator deals only with sites of Community importance[2].

Determining the **overall state** of each natural habitat type, which is defined separately for each of the two biogeographic regions which the Czech Republic is divided into, i.e. the continental region, which occupies most of its territory, and the Pannonian region in south-eastern Moravia, means considering four sub-parameters – current size, potential area, structure and function, and future outlooks. If any of the parameters is assessed as unfavourable, the overall status of the habitat is also assessed as unfavourable.

Between **2000 and 2006**, the area, size and future outlooks were mostly assessed as favourable or unfavourable-inadequate. However, the quality of structure and function is much worse, since these mainly concern the biological value of the habitat and thus also its ability to resist external pressures. The total number of habitats assessed between 2000 and 2006 was 95 – totally 11.6% of them rated as being in a favourable status, 13.7% being in a unfavourable-inadequate status, and 74.7% being in an unfavourable-bad status (Chart 1). Between **2007 and 2012**, the situation improved; the total number of habitats included in the assessment was 93. Compared to the previous period, the share of unfavourably rated sites dropped to 26.9%. On the other hand, the percentage of favourably rated habitats rose to 16.1% (Chart 1).

Between **2000 and 2006**, the Czech Republic's habitats falling into the unfavourable category included mainly those which were not very large (juniper pasturelands, coastal and halophytic habitats) and forests. On the other hand, heaths, rocky habitats, peatlands and fens generally received the most favourable assessment (Chart 2). As to the **2007–2012**, the unfavourable category again included small coastal and halophytic habitats, while the habitats that received the most favourable rating included heathlands and temperate zone shrubs. There was an improvement between the two monitored periods; the percentage of unfavourably rated habitats of coastal and continental sand dunes dropped by a half. A similar change for the better occurred with respect to forests, rocky habitats and caves, and also natural and semi-natural grassland formations (Chart 2).

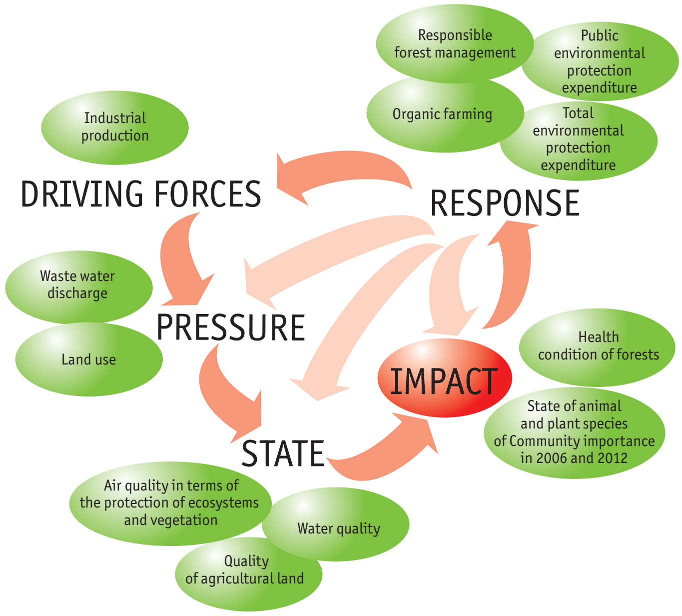
However, it must be noted that that the improvement is based more on methodological factors rather than on the actual state of affairs. Only a few habitats owe their improvement to active measures. The favourable situation generally reflects the favourable status of biotopes, but is in many cases based on a larger amount of collected data.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

[2] A similar assessment of the state of natural habitats cannot be applied at the national level, where such an indicator does not exist.

15/ Common bird species indicator



KEY QUESTION →

What progress has been made in stopping the decrease in the number of farmland bird species and woodland bird species?

KEY MESSAGES →

Between 1982 and 2014, the numbers of populations of common bird species in the Czech Republic have dropped by 7.6%. The numbers of populations of woodland bird species have dropped by 18.9%. The numbers of populations of farmland bird species have dropped by 27.5%. The trend indicates that the state of landscape and biodiversity in the Czech Republic has been worsening.

OVERALL ASSESSMENT →

Change since 1990	☹
Change since 2000	☹
The last year-to-year change	☹

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Directive No. 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds

- protection and conservation of all wild bird species in the territory of EU member states
- creating and declaring Special Protection Areas (SPAs) which together with Sites of Community Importance (SCIs) form the Natura 2000 system

Convention on Biological Diversity

- conservation and halting the loss of biological diversity
- sustainable use of biological diversity components
- access to genetic resources and fair and equitable sharing of benefits arising from their utilization

Biodiversity Action Plan

- halting the loss of biodiversity by 2010

State Environmental Policy of the Czech Republic 2012–2020

- ensuring the protection and care of the most valuable parts of nature and landscape, preventing the loss of indigenous species, and eliminating negative impacts of non-indigenous invasive species on biological diversity

National Biodiversity Strategy of the Czech Republic

- protection and conservation of ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment

State Nature Conservation and Landscape Protection Programme of the Czech Republic

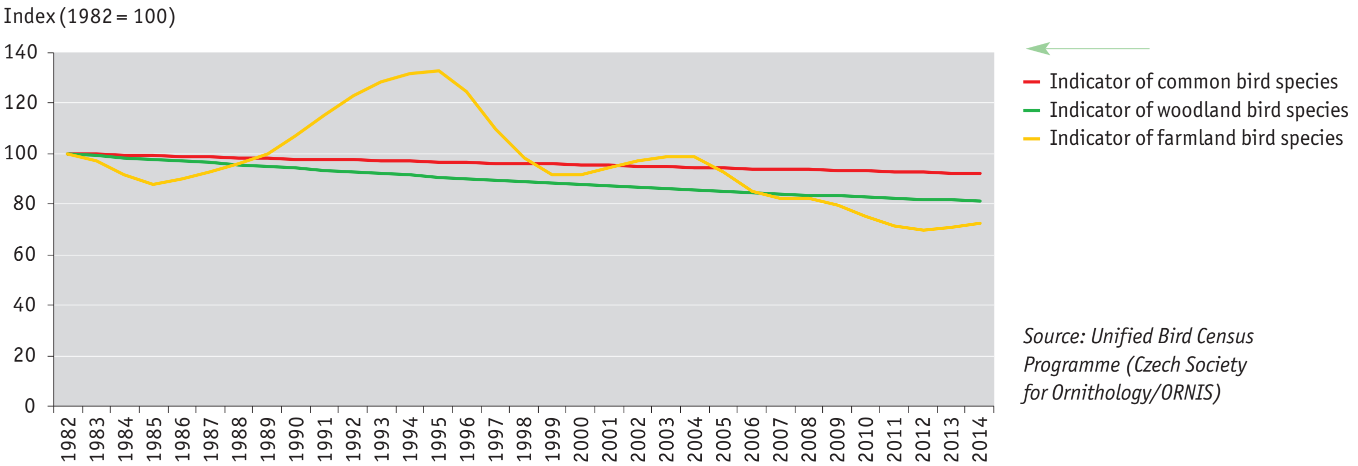
- maintaining numerous enough populations of indigenous wild fauna and flora species and minimizing risks when introducing new invasive and non-indigenous species

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The number of common farmland bird species and common woodland bird species is an indicator of biodiversity of ecosystems and their changes at the landscape level. The number of bird populations is related to the nature of agricultural and forestry management, changes in the use of landscape, and also climatic changes in the region. The low number of bird species reduces genetic resources of the populations, affects the food chain, and may ultimately result in extinction of the most endangered species.

INDICATOR ASSESSMENT

Chart 1 → **Development of the common farmland bird species indicator, the common woodland bird species indicator and the overall indicator of all common bird species in the Czech Republic [index, 1982 = 100], 1982–2014**



Source: Unified Bird Census Programme (Czech Society for Ornithology/ORNIS)

Development trends of bird populations reflect changes in the use of landscape and overall changes of ecosystems, while the effect of climatic changes is less significant[1]. Between 1982 and 2014, the numbers of populations of common bird species in the Czech Republic have dropped by 7.6%. The numbers of populations of woodland bird species have dropped by 18.9% and the numbers of populations of farmland bird species have dropped by 27.5%. The trend indicates that the state of landscape and biodiversity in the Czech Republic has been worsening. It is also reasonable to assume that the number of bird species had been dropping even before 1982, when the monitoring programme started.

Principal causes of the dramatic decline of the abundance of **farmland bird species** include continuously increasing intensification of agricultural production and concurrent abandoning of less fertile agricultural land. A temporary improvement occurred after the change of the political system in 1989, when the intensity of agricultural production temporarily dropped; farmland bird species reacted immediately by increasing their populations[2] (Chart 1). The abundance of bird species in 1994 and 1955 thus reached approximately 130% of the 1982 level. The economic consolidation of the agricultural sector brought yet another steep decline which has been continuing at varying rates until now. Another worsening came with the change of the financing of the agricultural sector after the accession of the Czech Republic to the European Union in 2004 (implementation of the EU Common Agricultural Policy and related agricultural subsidies), when the abundance of farmland bird species was dropping from approximately 99% of the 1982 level in 2004 to 72.5% in 2014. The effect of financial tools that have hitherto been used to mitigate adverse impacts of agriculture on nature (e.g. agro-environmental programmes) is obviously insufficient[3].

[1] *REIF J., ŠKORPILOVÁ J., VERMOUZEK Z. & ŠŤASTNÝ K., 2014: Změny početnosti hnízdních populací běžných druhů ptáků v České republice za období 1982–2013: analýza pomocí mnohodruhových indikátorů (Population changes of common breeding birds in the Czech Republic from 1982 to 2013: an analysis using multispecies indicators). Sylvia 50: 41–65.*

[2] *VERMOUZEK Z., 2014: Indikátor ptáků zemědělské krajiny za rok 2014. Studie pro Ministerstvo zemědělství ČR (The 2014 farmland bird species indicator. A study for the Ministry of Agriculture of the Czech Republic.). Czech Society for Ornithology, unpubl., 46pp.*

[3] *REIF J., ŠKORPILOVÁ J., VERMOUZEK Z. & ŠŤASTNÝ K., 2014: Změny početnosti hnízdních populací běžných druhů ptáků v České republice za období 1982–2013: analýza pomocí mnohodruhových indikátorů (Population changes of common breeding birds in the Czech Republic from 1982 to 2013: an analysis using multispecies indicators). Sylvia 50: 41–65.*

The abundance of **woodland bird species** has been declining fairly steadily throughout the monitored period to, reaching 81.1% in 2014. The abundance of strictly forest species (biotope specialists) has been dropping, being replaced by more widespread species with a broader ecological valence[4]. Bird communities are thus being unified and differences in the composition of avifauna of initially distinctly different ecosystems are gradually disappearing. Rare and narrowly specialized species are becoming even rarer and biodiversity at the local or regional level is reduced. Causes of the above trend have not yet been studied in the Czech Republic.

The factor that has been increasingly affecting the composition of bird species in the Czech Republic roughly since the mid-1990s is a climatic change. It is the reason why Nordic species have been disappearing from Central Europe, while the number of thermophilic species, hitherto found mainly in southern Europe, has shown a slight increase[5]. As a result of the phenomenon outlined above, the Czech Republic can expect another decline of the abundance of bird species[6], because the area with the highest diversity of bird species, which the Czech Republic is currently a part of, will be moving northeast.

An assessment of population trends of **common bird species** shows that the decline of biodiversity in the Czech Republic measured in the way described above has been continuing (down to 92.4% of the 1982 level in 2014), and unless nature protection measures are adopted across all sectors of human activities, this trend will most likely continue in the near future as well[7].

Although the protection and conservation measures that have been implemented so far, which include, in particular, agro-environmental measures in the framework of agricultural subsidies, more considerate forestry management practices, as well as general protection of nature and bird species under the Conservation of Nature and Landscape Act, probably help slow down the negative trend, they are unable to halt it, not to speak of its reversal into a positive trend. In spite of partial conservation successes, which concern mainly rare and scant species[8], the current state of affairs and near-future outlooks are unsatisfactory. System changes will be necessary in the years to come, particularly in the agricultural sector, where the relation between the intensity of agricultural exploitation and the decline of biodiversity has already been known for some time. Efficient conservation of biodiversity of forests will require, as the first step, the commissioning of detailed analyses which would describe causes of the present state, and plan appropriate protection and conservation measures accordingly.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

[4] REIF J., ŠKORPILOVÁ J., VERMOUZEK Z. & ŠŤASTNÝ K., 2014: Změny početnosti hnízdních populací běžných druhů ptáků v České republice za období 1982–2013: analýza pomocí mnohodruhových indikátorů (Population changes of common breeding birds in the Czech Republic from 1982 to 2013: an analysis using multispecies indicators). Sylvia 50: 41–65.

[5] REIF J., VOŘÍŠEK P., ŠŤASTNÝ K., KOSCHOVÁ M. & BEJČEK V., 2008b: The impact of climate change on long-term population trends of birds in a central European country. Animal Conservation doi:10.1111/j.1469-1795.2008.00200.x

[6] HUNTLEY B., GREEN R. E., COLLINGHAM Y. C. & WILLIS S. G. 2007: A Climatic Atlas of European Breeding Birds. Lynx Edicions, Barcelona.

[7] OŘÍŠEK P., KLVAŇOVÁ A., BRINKE T., CEPÁK J., FLOUSEK J., HORA J., REIF J., ŠŤASTNÝ K. & VERMOUZEK Z., 2009: Stav ptactva České republiky 2009 (State of the bird population of the Czech Republic 2009). Sylvia 45: 1–38.

*[8] VOŘÍŠEK P., REIF J., ŠŤASTNÝ K. & BEJČEK V., 2008: How effective can be the national law in protecting birds? A case study from the Czech Republic. Folia Zool. 57(3): 221–230.
VOŘÍŠEK P., KLVAŇOVÁ A., BRINKE T., CEPÁK J., FLOUSEK J., HORA J., REIF J., ŠŤASTNÝ K. & VERMOUZEK Z., 2009: Stav ptactva České republiky 2009 (State of the bird population of the Czech Republic 2009). Sylvia 45: 1–38.
INGER R., GREGORY R., DUFFY J. P., STOTT I., VOŘÍŠEK P. & GASTON K. J., 2014: Common European birds are declining rapidly while less abundant species' numbers are rising. Ecology letters 2014, doi: 10.1111/ele.12387.*

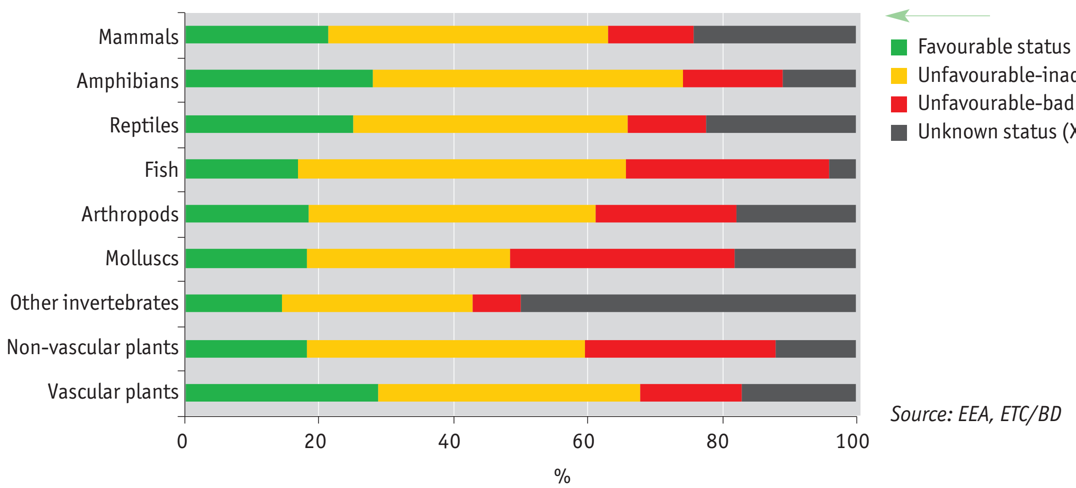
Nature in the European context

KEY MESSAGES →

- → Between 2007 and 2012, only about 23% of animal and plant species of Community importance and approximately 16% of habitats of Community importance were assessed as being in a favourable status. In the Czech Republic, the corresponding figures were approximately 25% and roughly 16%, respectively.
- → Between 1990 and 2012, the populations of common bird species, woodland bird species and farmland bird species dropped by approximately 12%, 8% and 30%, respectively.
- → Between 1990 and 2011, the populations of meadow butterflies showed a significant decline of about 50%.

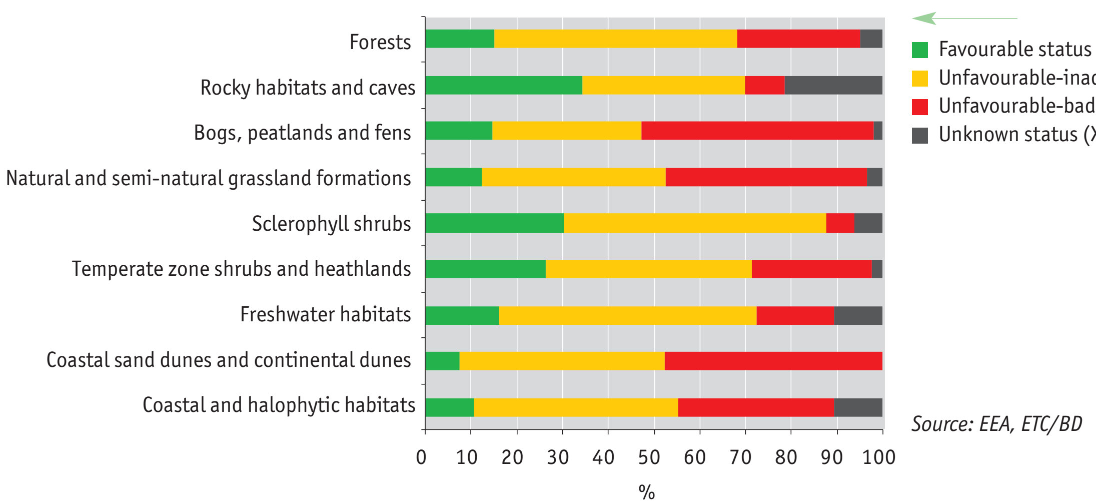
INDICATOR ASSESSMENT

Chart 1 → **State of animal and plant species of Community importance in EU25 according to taxonomic groups [%], 2007–2012**



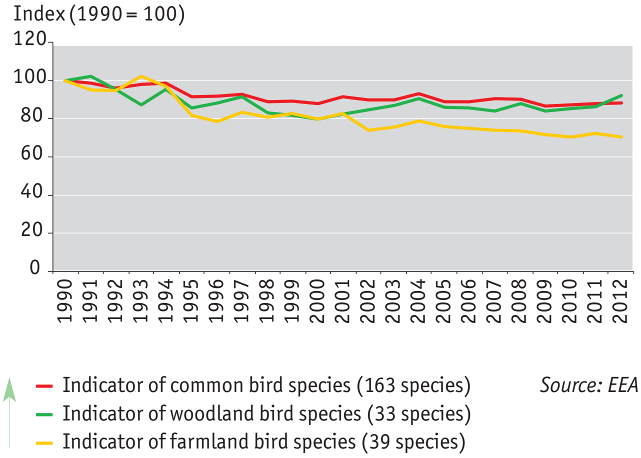
FV – favourable, U1 – unfavourable-inadequate, U2 – unfavourable-bad, XX – unknown

Chart 2 → **State of natural habitat of Community importance in EU25 according to taxonomic groups [%], 2007–2012**



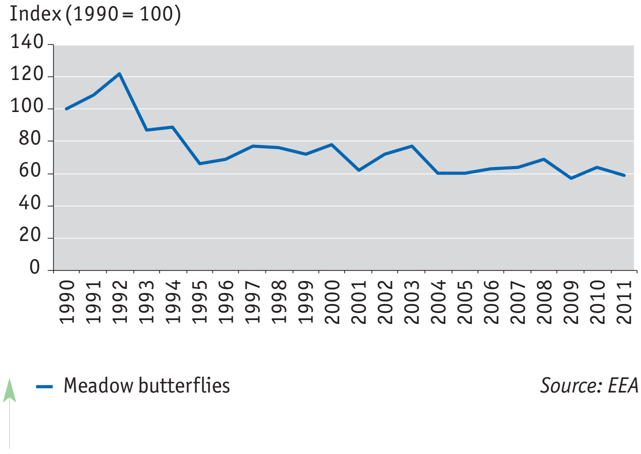
FV – favourable, U1 –unfavourable-inadequate, U2 –unfavourable-bad, XX – unknown

Chart 3 → **Development of the common farmland bird species indicator, the common woodland bird species indicator and the overall indicator of all common bird species in Europe [index, 1990 = 100], 1990–2012**



Source: EEA

Chart 4 → **Development of the indicator of meadow butterflies in Europe [index, 1990 = 100], 1990–2011**



Source: EEA

From the international perspective, the statuses of animal and plant species and of natural habitat types that are important to the European Community can be compared at several levels: at the interstate level, at the level of biogeographical areas, and potentially also at the all-European level.

Between 2007 and 2012, only 23.1% of all **animal and plant species of Community importance** found in the territory of EU25 were assessed as being in a favourable status (Chart 1); the percentages of animal and plant species of Community importance falling into the unfavourable-bad and unfavourable-inadequate categories were 18.2% and 41.7%, respectively. From the European perspective (as well as from that of the Czech Republic), the most endangered groups included fish, molluscs and arthropods (animals) and non-vascular plants.

Between 2007 and 2012, 16.4% of **natural habitat types of Community importance** found in the territory of EU25 were assessed as being in a favourable status; the percentages of natural habitat types of Community importance falling into the unfavourable-inadequate and unfavourable-bad categories were 46.8% and 30.1%, respectively. According to results of the assessment, the most endangered habitat types include coastal sand dunes and continental dunes (of which only 7.5% fall into the favourable category), and coastal and halophytic habitats (Chart 2). As to the Czech Republic, the most endangered habitat types are forests, coastal and halophytic habitats (none of which was rated as being in a favourable status), and also freshwater habitats (of which only 7.1% fall into the favourable category). On the other hand, the best-rated habitats between 2007 and 2012 are rocky habitats and caves (of which 34.3% were assessed as being in a favourable status).

In spite of the step-by-step levelling of the declining trend, the abundance of all **common bird species and common woodland species** in Europe has declined since 1990 (between 1990 and 2012 by approximately 12% and 8%, respectively). The decline of the abundance of common farmland bird species between 1990 and 2012 was even more significant – almost 30% (Chart 3). The development of bird populations in the Czech Republic is therefore consistent with the European trend (see the indicator of common bird species). However, there had been a substantial decline of all populations even before 1990. The dropping abundance of common farmland bird species, particularly in the beginning of the monitored period, is related to increasing intensification of agricultural production and concurrent abandoning of agricultural land in regions not so suitable for agricultural production.

The dramatic decline of biodiversity of grassland formations is indicated by an overall decline of populations of **meadow butterflies** (the considerable year-to-year fluctuations notwithstanding), the population of which has decreased by some 50% since 1990 (Chart 4). The main reason is a changed use of land, including agricultural intensification and unification of agricultural processes and, on the other hand, abandonment of agricultural exploitation of land, particularly in mountainous or waterlogged regions of eastern and southern Europe.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

16/ Health condition of forests

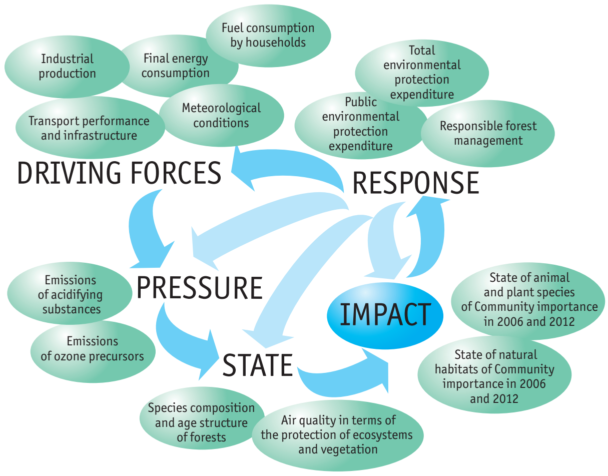
KEY QUESTION →

Is the health condition of forest stands improving in the Czech Republic?

KEY MESSAGES →

In the Czech Republic, the damage to forest stands expressed as the percentage of defoliation[1], is not progressing as fast as in the past. This is the response of forests to the improved ambient air conditions in the past two decades; the long-term effort to change the species composition of the forest stands also positively influences the health of the stands.

In the year 2014, in the Czech Republic, defoliation remains very high, the proportion of older conifers (over 60 years) that is included in defoliation classes 2 to 4 was 77.4%, for older deciduous trees it was 39.7%. In younger stands, the situation is more favourable – the proportion is 25.1% for younger conifers (below 59 years) and 16.7% for younger deciduous trees. After an improvement at the end of 1990s, there was again a trend after 2000 likely indicating the deterioration of the health condition of the forest stands, although annual fluctuations in the defoliation level are attributed to short-term effects of biotic and abiotic factors that are significant in certain years (frost and wind damage, overpopulated pests, etc.).



OVERALL ASSESSMENT →

Change since 1990	☺
Change since 2000	☹
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

EU Forest Strategy for the period 2013–2020
- promoting the balance of various forest functions to meet demand and provide vital ecosystem services
- promoting forestry and the entire value chain based on forestry as a competitive and viable contributor to bioeconomy
- emphasizing the need for the availability and comparability of the data collected at national level

State forest policy principles
- conserving forest and forest land for future generations
- increasing the competitiveness of forest management
- increasing biodiversity in forest ecosystems and their ecological integrity and stability
- reinforcing the importance of forests and forest management for the economic development of rural areas
- reinforcing the importance of education, research and innovation in forestry

National Forestry Programme
- improving the health and protection of forests by limiting clear cutting, support and introduction of more nature-friendly forest management methods, promoting natural regeneration and closer to nature tree species composition
- reducing the impacts of global climate change and extreme weather events
- preservation and enhancement of biodiversity in forests
- develop monitoring of forests

National Biodiversity Strategy of the Czech Republic
- specification of current problems of forest ecosystems restoration in areas previously (mainly in the past) exposed to elevated emission stress
- processing the concept of further mitigation impact procedure of negative processes on forest biodiversity

State Nature Conservation and Landscape Protection Programme of the Czech Republic
- increasing the species diversity of forest stands to approximate natural species composition
- increasing the structural diversity of the forest and the share of naturally regenerated and genetically suitable stand species
- strengthening of the non-productive functions of forest ecosystems

ICP Forests Programme
- evaluating and monitoring the impact of atmospheric pollution on forests

FutMon Project (Further Development and Implementation of an EU-level Forest Monitoring System)
- evaluating and monitoring the impact of atmospheric pollution on forests

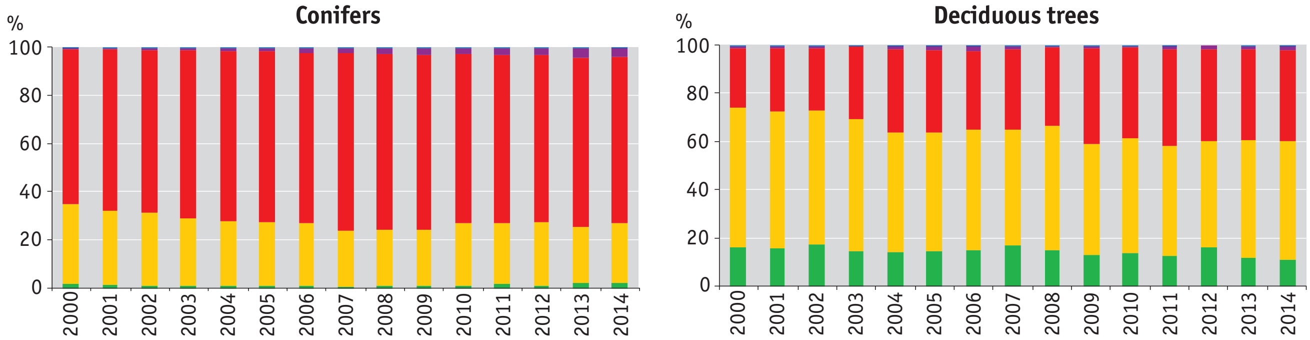
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Good forest health is crucial both to maintain sustained production of timber and other material goods and to fulfil the non-production functions (protecting soil from erosion, supporting water system, nature protection, air quality, flooding and drought control, sanitary-hygienic function, recreational and spiritual functions). The deterioration of forest health therefore has an impact not only on forest ecosystems and species living therein, but on the whole of human society.

[1] *Defoliation values are divided into five basic classes, the last three characterize significantly damaged trees: 0 – none (0–10%); 1 – slight defoliation (> 10–25%); 2 – moderate defoliation (> 25–60%); 3 – severe defoliation (> 60–< 100%); 4 – dead trees (100%).*

INDICATOR ASSESSMENT

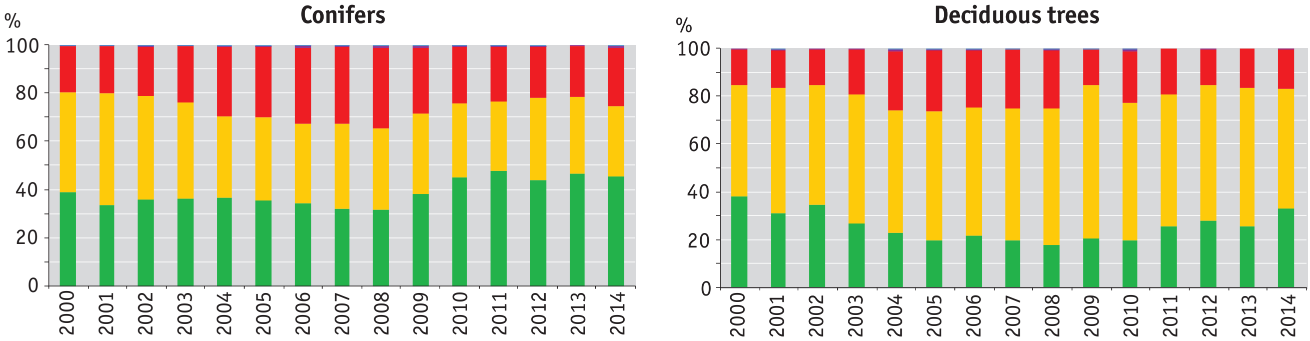
Chart 1 → **Defoliation of older conifers and deciduous trees (stands over 60 years of age) in the Czech Republic according to classes [%], 2000–2014**



- Class 0 (0–10%)
- Class 1 (> 10–25%)
- Class 2 (> 25–60%)
- Class 3 (> 60–< 100%)
- Class 4 (100%)

Source: Forestry and Game Management Research Institute, public research institution

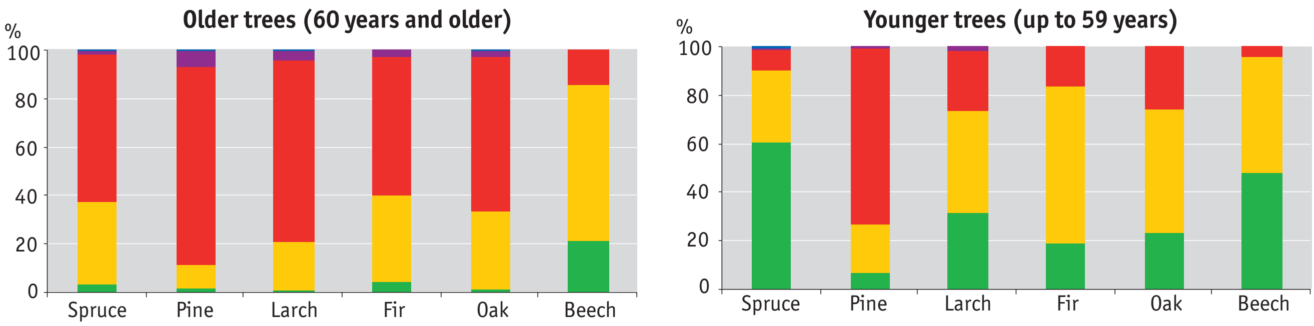
Chart 2 → **Defoliation of younger conifers and deciduous trees (stands up to 59 years of age) in the Czech Republic according to classes [%], 2000–2014**



- Class 0 (0–10%)
- Class 1 (> 10–25%)
- Class 2 (> 25–60%)
- Class 3 (> 60–< 100%)
- Class 4 (100%)

Source: Forestry and Game Management Research Institute, public research institution

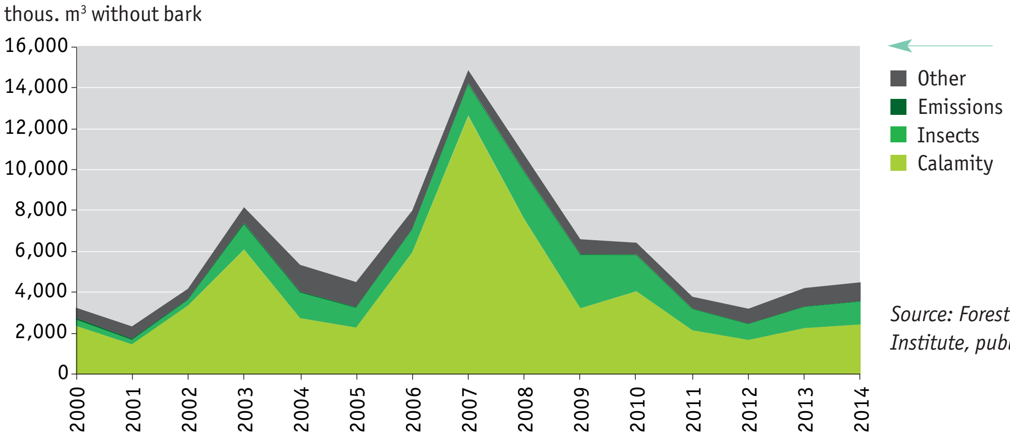
Chart 3 → **Defoliation of basic tree species in the Czech Republic, by classes [%], 2014**



- Class 0 (0–10%)
- Class 1 (> 10–25%)
- Class 2 (> 25–60%)
- Class 3 (> 60–< 100%)
- Class 4 (100%)

Source: Forestry and Game Management Research Institute, public research institution

Chart 4 ➜ **Salvage felling by causes in the Czech Republic [thous. m³ without bark], 2000–2014**



Source: Forestry and Game Management Research Institute, public research institution

The indicator assesses the state of health of trees in the stand in in two groups: older – 60 years and older and younger – less than 59 years, both for conifers and deciduous trees. The health of trees is characterized by the percentage of defoliation, defined as the relative loss of assimilation capacity in the tree crown compared to a healthy tree growing in identical vegetation and habitat conditions. The defoliation values are divided into five basic classes (0–4), of which classes 2–4 characterize significantly damaged trees.

In the **older stands (60 years and older)** a significant increase in defoliation was recorded at the end of the 80s and the 1st half of the 90s. After a period of relative stabilization at the turn of the century, which is attributed to the reaction of the forests to positive changes in the environment (especially the reduction of ambient air pollution), from the year 2000 a deterioration can be seen again (Chart 1). This trend occurs for both coniferous and deciduous trees. The long-term increase in defoliation of class 2–4 at the expense of classes 0 and 1 can be seen. For the conifers, the proportion of classes 2–4 exceeds in long-term 70% (in the year 2000 it was 64.8%, in the year 2005 it increased to 72.4%, and in 2014 up to 72.9%). For deciduous trees, the situation is more stable, but even here, the long-term trend of increasing percentage of classes 2 to 4 prevails. In the year 2000, the situation was as follows: for the sum of classes 2–4 an increase to 25.8%, in 2005 to 36.0%, and in 2010 already to 38.6%. In the year 2014 the proportion of classes 2–4 rose to 39.7% at the expense of classes 0 and 1. The deciduous trees are generally more resistant to defoliation due to the complete the annual renewal of the assimilation system.

Concerning the **evaluation of the individual species**, the situation is the least favourable for pine – in the year 2014, more than 88.9% of trees were evaluated as class 2–4, followed by larch (79.2%), and spruce (62.7%). Of the deciduous trees aged 60 years and older, a significant defoliation of oak can be seen – in the year 2014 a total of 66.9% of the trees assessed were in class 2–4 (Chart 3).

The poor health of the older forests is the result of the intense ambient air pollution stress on the forest ecosystems in recent decades. Because of the influence of widely applied desulphurization since the mid-90s of the 20th century, the environment improved and air pollution was reduced, the forest stands, however, respond to the changes with considerable delay. In addition, the ambient air pollution levels still lasts, although its intensity is significantly lower. Also the chemical composition of air pollution has changed. The older forests have been significantly affected by poor air quality since the early stages of growth. Many of these forests are also characterized by inappropriate species composition, therefore their health status remains unsatisfactory.

In the **younger stands (up to 59 years)**, the situation is at first glance more favourable (Chart 2). Generally, the lower level of defoliation in comparison with the older vegetation is due to the fact that younger forests have more vitality and ability to withstand adverse environmental conditions. A reason not to be missed is the significantly lower environmental stress than in the past. After the year 2000, worsening health condition can be seen also in these stands, characterized by an increasing proportion of trees in class 2 and 3 at the expense of classes 0 and 1 (conifers in the period 2000–2008 by 14.1 p.p., deciduous trees, over the same period by 9.8 p.p.). The change in the trend may be observed after the year 2008, when both categories of trees, thus both conifers and deciduous trees, experienced a decrease in the proportion of Class 2 and 3. To confirm that this is indeed a long-term trend in health condition improvement, however, remains to be established, whether the positive trend will continue in the coming years.

In the **assessment of individual tree species**, regarding conifers, pine is again in the least favourable situation, (in the year 2014 it had 73.1% in class 2 and higher). Significantly better values in younger versus older stands are achieved by spruce (only 9.8% in class 2 and 3). In the deciduous stands of the younger age category, the higher degree of defoliation applies mainly to oak, which in the year 2014 had in class 2 and higher a representation of 25.9% (Chart 3).

A direct consequence of the ill health of forests is their reduced ability to resist environmental stress. The damage caused by biotic and abiotic factors necessitates the implementation of salvage felling (Chart 4). In the long term, the most important factor causing the need for salvage felling are the abiotic factors, especially wind, frost, snow, and drought. The proportion of salvage felling caused by abiotic factors increased in recent years (in 2014 by approximately 8% compared to 2013). Insect damage, which is the second most common reason for carrying out salvage felling, follows the natural damage by its dynamics, since windbreaks are affected in the following season by insect attacks and fungal diseases. In the Czech Republic, of the biotic factors, the most damage is caused by the bark beetle.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

17/ Species composition and age structure of forests

KEY QUESTION

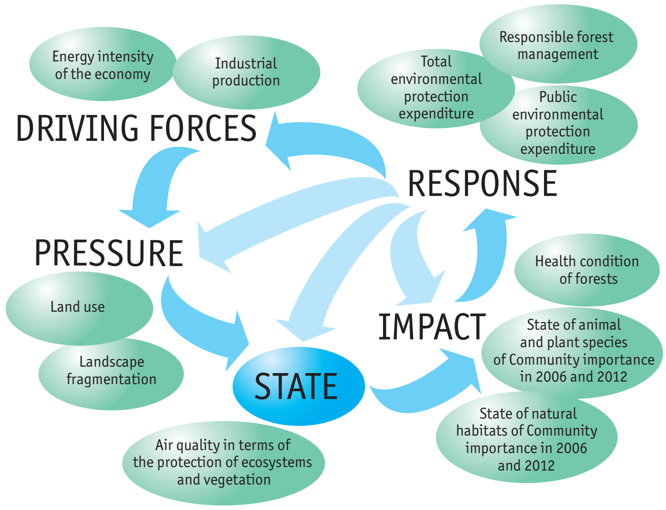
Is the unsatisfactory species composition and age structure of the forests in the Czech Republic changing?

KEY MESSAGES

The proportion of deciduous trees in the total forest area of the Czech Republic gradually increases, in the year 2014 it accounted for 26.3% of the total forest area. In the long-term, it is possible to observe the evolution towards a positive change in the species composition, towards a more natural (and more stable) composition of forest stands. However, a true approximation of forest species composition of the natural or recommended composition requires many decades of intense effort.

In the Czech Republic, the age structure of forests is not uniform. In recent years, the replacement of over age stands (over 120 years) increases. This phenomenon, which is from the economic perspective assessed negatively, may on the other hand have a positive effect in the context of the biodiversity conservation.

The proportion of fir, which is an important part of the natural forest ecosystem and which contributes significantly to maintaining the stability of the forest, has a stable, approximately 1% share of total area of forests, even though its share in artificial planting is nearly 5%.



OVERALL ASSESSMENT

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

EU Forest Strategy for the period 2013–2020
- promoting the balance of various forest functions to meet demand and provide vital ecosystem services
- promoting forestry and the entire value chain based on forestry as a competitive and viable contributor to bioeconomy
- emphasizing the need for the availability and comparability of the data collected at national level

State forest policy principles
- conserving forest and forest land for future generations
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- increasing biodiversity in forest ecosystems and their ecological integrity and stability
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- processing the concept of further mitigation impact procedure of negative processes on forest biodiversity

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- increasing the structural diversity of the forest and the share of naturally regenerated and genetically suitable stand species
- strengthening of the non-productive functions of forest ecosystems

ICP Forests Programme
- evaluating and monitoring the impact of atmospheric pollution on forests

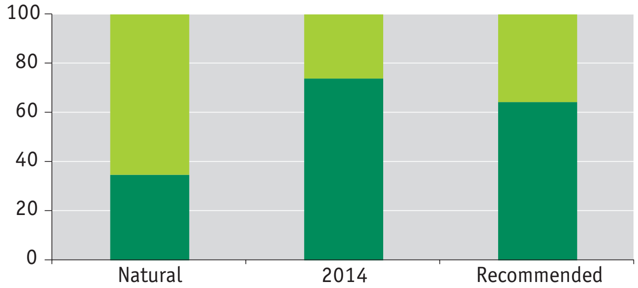
FutMon Project (Further Development and Implementation of an EU-level Forest Monitoring System)
- evaluating and monitoring the impact of atmospheric pollution on forests

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The importance of forests lies in their ability to perform their productive functions (production of timber or other forest products) and non-productive functions (protection against erosion, water regime protection, nature conservation, recreation etc.). Even-aged monocultures that are the result of uniform planting of stands (mostly spruce and pine), resist poorly in long-term biotic and abiotic factors, struggle with ill health, and therefore are no longer able to all perform all their functions in a satisfactory manner.

INDICATOR ASSESSMENT

Chart 1 → **Reconstructed natural, present and recommended composition of forests in the Czech Republic [%], 2014**

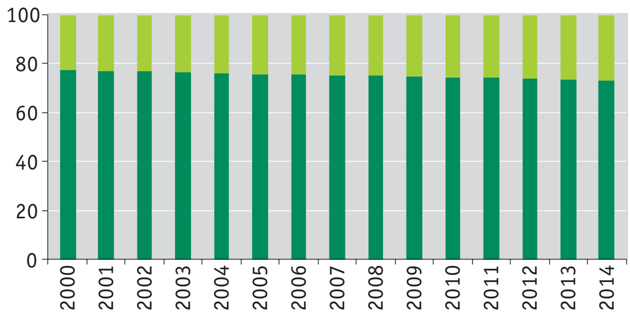


Deciduous trees
Coniferous trees

Source: Forest Management Institute

The reconstructed structure is close to the climax composition before human influence on the forest. The recommended composition of the forest is a universally optimized compromise between the natural composition and composition optimal from contemporary economic perspective.

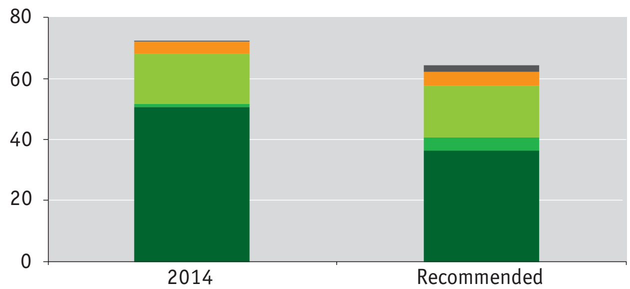
Chart 2 → **Development of the proportions of coniferous and deciduous stands in total forest area, Czech Republic [%], 2000–2014**



Deciduous trees
Coniferous trees

Source: Forest Management Institute

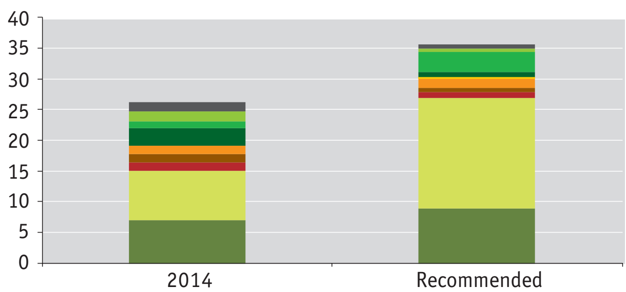
Chart 3 → **Current species composition of coniferous stands in the Czech Republic compared with the recommended composition [%], 2014**



Other
Larch
Pine
Fir
Spruce

Source: Forest Management Institute

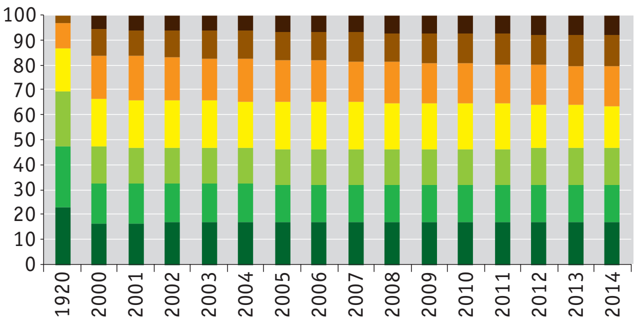
Chart 4 → **Current species composition of deciduous stands in the Czech Republic compared with the recommended composition [%], 2014**



Other
Alder
Linden
Birch
Elm
Maple
Ash
Hornbeam
Beech
Oak

Source: Forest Management Institute

Chart 5 → **Development of age structure of forest stands in the Czech Republic [%], 1920–2014**



VII (121 years)
VI (101–120 years)
V (81–100 years)
IV (61–80 years)
III (41–60 years)
II (21–40 years)
I (1–20 years)

Source: Forest Management Institute

In the Czech Republic, the **natural species composition** of forests is mainly driven by the geological structure, the transition of sub-atlantic to continental climate and the varied geomorphology. Under natural conditions in the lower elevations, oak and hornbeam forests prevail, then they transition to beech and fir and in the highest areas spruce forests dominate. Owing to the growing demand for wood as the main energy source, especially by the booming industry, spruce and pine monocultures were planted in the late 19th and early 20th century. As a result, the forests of the Czech Republic currently consist mainly of coniferous stands, often also consisting of inappropriate ecotypes. These even-aged monocultures are much more susceptible to damage from biotic and abiotic factors.

In recent decades, when restoring forests, deciduous trees (e.g. beech, oak, maple, rowan) at the expense of coniferous (spruce, pine) are increasingly used. There is thus a focused effort to achieve a favourable change in species composition, closer to the natural (and more stable) structure of forest stands (Chart 1). The growth of young forest stands remains a problem, mainly as a result of game grazing in areas with excessive stock of split hoofed game.

In the Czech Republic, the **proportion of deciduous trees** in the total forest area has been growing very slowly, being a result of the long period of rotation. In the year 2014, the proportion of deciduous trees was 26.3% of the total forest area (Chart 2). The **proportion of coniferous trees** in the total forest area of the Czech Republic decreased from 76.5% in the year 2000 to 72.5% in the year 2014. In the long-term, this focused change is more distinct, the overall proportion of deciduous trees compared to 1990 increased by 5.5 p.p.

In the Czech Republic, forests consist by more than 50% of spruce. Its proportion in the total forest area in the long-term steadily decreases, between the years 2000–2014 it decreased from 54.1% to 50.8% (Chart 3). An important part of the natural forest ecosystem is fir, which contributes significantly to maintaining the stability of the forest. **The proportion of fir in the total forest area** has been stable, at approximately 1% (in the year 2014 it accounted for 1.1%), although its proportion in re-planting rises and currently stands at 4.3%. The failure of the efforts to increase the proportion of fir is mainly attributed to the high damage caused by split hoofed game.

The deciduous trees are represented mainly by beech, whose share in the total forest area has increased up to 8.0% in the year 2014. A slower growing trend was recorded also for oak, whose share reached 7.1% of the total forest area of the Czech Republic (Chart 4).

Beech, oak and fir represent in most managed stands the trees consolidating and draining soil. Their presence in forest ecosystems provides a variety of functions, primarily involved in improving the water regime, creating microclimate favourable to the stands, reduces vulnerability to disasters caused by crop pests and increases the stability of forest stands against the wind.

The **current structure of forests in the Czech Republic** still significantly differs from the **reconstructed natural and recommended structure** (Chart 1, Chart 3, Chart 4). The **recommended structure**, which is a compromise with respect to economic interests and non-economic functions of forests, envisages a reduction in the proportion of coniferous trees (Chart 1), mainly spruce in the Czech Republic forests from the current 50.8% to 36.5% in the recommended target state. Simultaneously, it anticipates an increase in the proportion of fir from the current 1.1% to 4.4% (Chart 3) and also a significant increase in the proportion of deciduous trees, especially of beech (from the current 8.0% to the targeted 18.0%), but also of oak and linden. On the other hand, it envisages a reduction in the proportion of birch, elm and alder (Chart 4).

The **age structure of forests in the Czech Republic** is not uniform (Chart 5). The approximation of the actual age structure to the so-called normal status[1] is very slow. The area of forests under the age of 60 years is below normal, in all age classes it should be in long-term approximately 18%, which is currently not attained by any class. In the year 2014, in the 1st age class 16.9% were recorded, in the 2nd class 14.9%, and the 3rd class 14.8% of the forest land area. The reason for this unfavourable status is the increase in forest areas in the late 19th and the first half of the 20th century, mostly afforested by monocultures, which were and are replanted in recent decades. On the other hand, in recent years rises the proportion of areas of elderly to overaged stands of the 6th and 7th age class. Their proportion has since 1990 steadily increased. This may have been caused, in addition to the changes in the management of protection forests and forests in specially protected areas, also by the postponing of renewal of economically unattractive, poor quality or poorly accessible forests. This trend, which in economic terms poses the risk of losses, may on the other hand be perceived as positive in terms of biodiversity conservation. Forest stands of higher age represent favourable environment for species associated with ecosystems with high proportion of dead wood.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indicators.cenia.cz

[1] Such spatial arrangement of age classes in a normal forest is considered as normal, which best complies with the conditions of forest cultivation, protection and felling.

18/ Responsible forest management

KEY QUESTION →

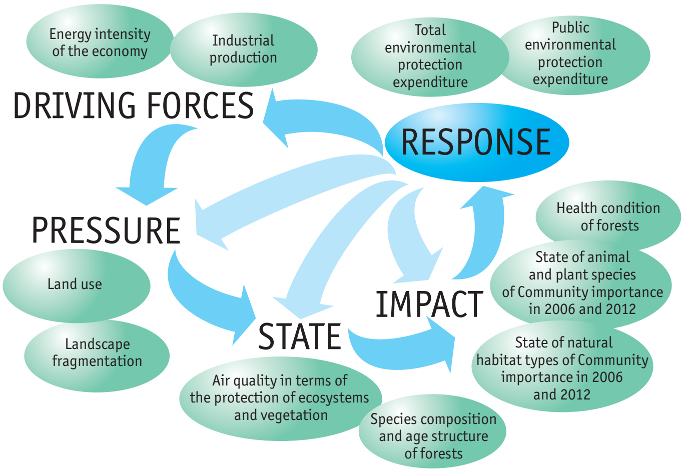
Is the forest management developing in accordance with the principles of sustainable development, nature-friendly management methods and strengthening of the non-productive forest functions?

KEY MESSAGES →

In the Czech Republic, the proportion of deciduous trees in the total forest area has been rising very slightly but constantly. This is the result of a long-term increase in the proportion of deciduous trees in forest stand regeneration. The naturally regenerated areas have also been increasing. The total forest stock has been increasing over the long term.

In the year 2014, a total of 70.0% of the commercial forest area in the Czech Republic was certified according to the principles of sustainable forest management according to the PEFC and/or FSC. The inclusion of forests into individual categories in terms of their prevailing functions does not show significant changes, there was a slight decrease in the area of protected forests.

The efforts to reduce the numbers of split hoofed game, which causes considerable damage by foraging on the stands under regeneration, are unsuccessful in the long-term. This problem is particularly significant for fir because, despite its increasing proportion in planting, an increase of its overall representation in forest stands is not achieved in the long-term.



OVERALL ASSESSMENT →

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

EU Forest Strategy for the period 2013–2020
- promoting the balance of various forest functions to meet demand and provide vital ecosystem services
- promoting forestry and the entire value chain based on forestry as a competitive and viable contributor to bioeconomy
- emphasizing the need for the availability and comparability of the data collected at national level

State forest policy principles
- conserving forest and forest land for future generations
- increasing the competitiveness of forest management
- increasing biodiversity in forest ecosystems and their ecological integrity and stability
- reinforcing the importance of forests and forest management for the economic development of rural areas
- reinforcing the importance of education, research and innovation in forestry

National Forestry Programme
- improving the health and protection of forests by limiting clear cutting, support and introduction of more nature-friendly forest management methods, promoting natural regeneration and closer to nature tree species composition
- reducing the impacts of global climate change and extreme weather events
- preservation and enhancement of biodiversity in forests
- develop monitoring of forests

National Biodiversity Strategy of the Czech Republic
- specification of current problems of forest ecosystems restoration in areas previously (mainly in the past) exposed to elevated emission stress
- processing the concept of further mitigation impact procedure of negative processes on forest biodiversity

State Nature Conservation and Landscape Protection Programme of the Czech Republic
- increasing the species diversity of forest stands to approximate natural species composition
- increasing the structural diversity of the forest and the share of naturally regenerated and genetically suitable stand species
- strengthening of the non-productive functions of forest ecosystems

ICP Forests Programme
- evaluating and monitoring the impact of atmospheric pollution on forests

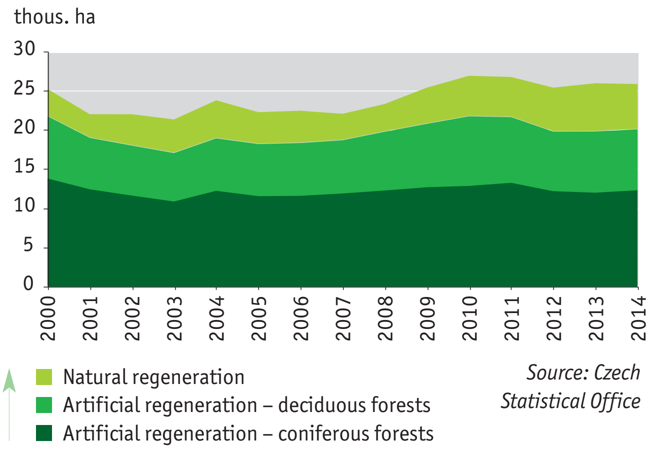
FutMon Project (Further Development and Implementation of an EU-level Forest Monitoring System)
- evaluating and monitoring the impact of atmospheric pollution on forests

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Responsible forest management leads to the improvement of production and non-production functions of forests, which are important for forest ecosystems themselves, for habitats outside of the forest and for the human society. Increasing the representation of soil stabilizing and draining tree species supports improvement of the water regime, prevents the degradation of forest soils and enhances the ecological stability, which is important e.g. in reducing the impact of extreme weather events and climate change.

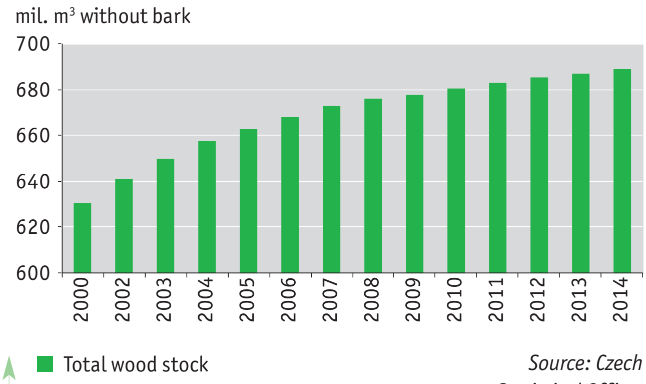
INDICATOR ASSESSMENT

Chart 1 → **Forest renewal in the Czech Republic [thous. ha], 2000–2014**



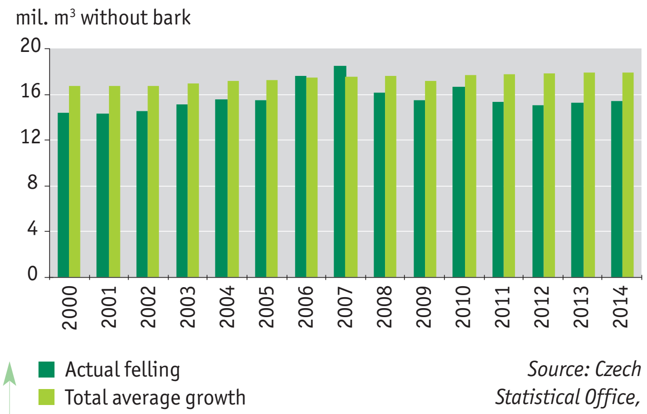
Source: Czech Statistical Office

Chart 2 → **Total wood stock development (in stands) in the Czech Republic [mil. m³ without bark], 2000–2014**



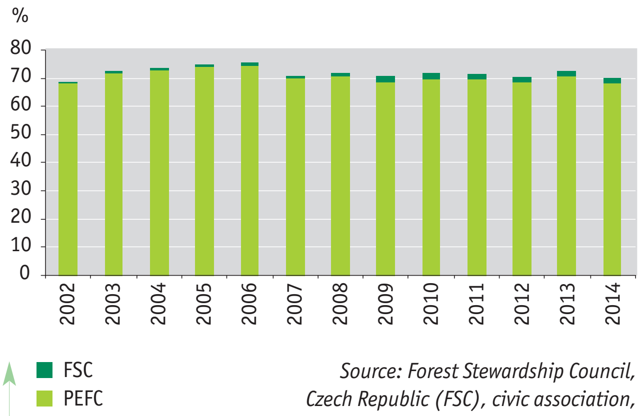
Source: Czech Statistical Office, Forest Management Institute

Chart 3 → **Comparison of realized wood felling and the total average growth increment in the Czech Republic [mil. m³ without bark], 2000–2014**



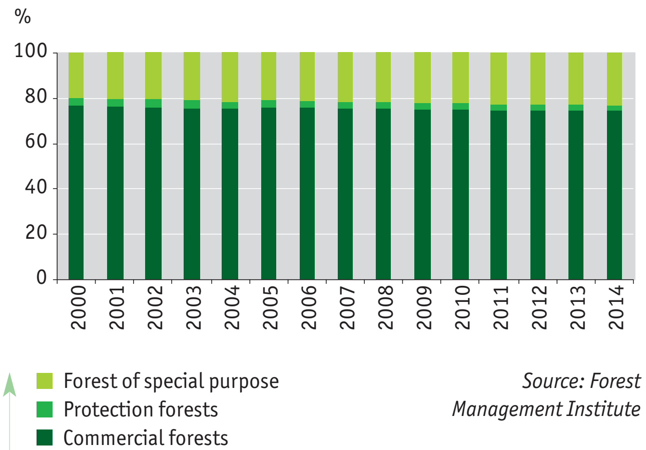
Source: Czech Statistical Office, Forest Management Institute

Chart 4 → **Development of the proportion of forest area certified pursuant to the PEFC and FSC principles in the Czech Republic's total forest area [%], 2002–2014**



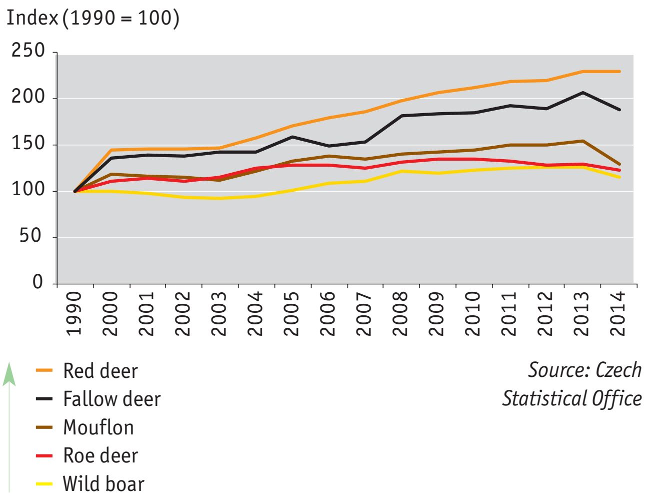
Source: Forest Stewardship Council, Czech Republic (FSC), civic association, Programme for the Endorsement of Forest Certification Schemes (PEFC), Czech Republic

Chart 5 → **Proportions of the single forest categories in the Czech Republic's total forest area [%], 2000–2014**



Source: Forest Management Institute

Chart 6 → **Spring stocks of game (selected species) in the Czech Republic [index, 1990 = 100], 1990–2014**



Source: Czech Statistical Office

In the year 2014 the positive trend in **reforestation** continued in reducing the share of conifers in favour of the deciduous trees (Chart 1). Compared to the year 2000, the share of conifers decreased by more than 2.2% (since the year 1995 by over 11%). Over the long-term, the area of naturally regenerated forests also increases. At present, the area on which natural regeneration is realized is approximately 6,000 hectares per year (in the year 2014 it was exactly 5,726 hectares), while in 1995 it was approximately 1,200 hectares. Regarding forest management and the environment this represents a highly positive trend.

The **total standing wood stock** has been increasing constantly (Chart 2). Increase in total growing stock is a long-term trend and it has not changed even after the year 2000. In addition to the normal growth increment, the increasing share of older stands and the modest growth in stand tree density also contribute to this development.

Part of the growing stock is indeed unavailable for **felling** (felling is restricted in the special purpose forests and in the protection forests, in reservations, and in the first zones of national parks it is almost impossible). Even so the total volume of production is in the long term lower than the **total average growth increment** (Chart 3). The total mean growth increment, which expresses the production capacity of forest habitats is a crucial indicator in assessing the principle of balance and sustainability of felling. After the year 2000 the total production exceeded the total average growth increment only twice, in 2007 and 2008, mainly as a result of processing of wood damaged by the Kyrill hurricane and the subsequent bark beetle calamity (salvage felling accounted for 80.5% of the total felling).

In recent years, the **total logged volume** has been greater than 15 mil. m^3 without bark (in 2012 it was 15.1 mil. m^3, in 2013 it was 15.3 mil. m^3, and in 2014 it was 15.5 mil. m^3). Salvage (calamity) felling represents in the last several years the volume corresponding to 20–30% of the planned volume of production (in 2014 it was 29.3%, in 2013 it was 27.7%, in 2012 it was 21.5%, which was the lowest value since 2000). The total average growth increment in the monitored period (since 2000) steadily increased from 17 to 18 mil. m^3 without bark.

The area of forests certified in accordance with the principles of the PEFC (Programme for the Endorsement of Forest Certification Schemes) and **FSC** (Forest Stewardship Council)[1], i.e. sustainably managed forests, peaked in 2006 (75.4% of the total forest area in the Czech Republic), in the year 2007 there was a decline, and since then it has been stable around 70% of the total forest area of the Czech Republic. In 2014, a total of 70.0% of forest area was commercial (Chart 4). Forest certification in the Czech Republic developed particularly after 2000, when in addition to sustainable forest management, there was an effort to inform consumers about the environmental qualities of the wood. The reason for the decline of awarded certificates in recent years is that forest owners do not see the added value of these certificates. Of the total number of issued certificates, the majority are PEFC certifications, in the year 2014 it was 68.2%. The area of forests certified according to the more challenging, but more environmentally friendly FSC system, remains low (Chart 4). In the year 2014, in comparison with the previous period, it remains virtually unchanged, and it represents 1.9% of the total forest area in the Czech Republic.

The classification of forests into **categories according to their principal function** does not exhibit significant changes (Chart 5). In the long-term the proportion of commercial forests has been slightly decreasing (in the year 2014 it was 74.5% of the total forest area, compared to 76.7% in the year 2000) in favour of special purpose forests (in 2014 it was 22.9% of the forests, while in the year 2,000 it was 19.8%). The slight decrease in the area of protection forests in the relative immutability of natural conditions suggests, that the current possibilities of classifying forests into the protective category are not fully utilized.

Reducing and maintaining the numbers of split hoofed game and wild boars in hunting grounds is a priority, particularly with regard to the damage caused by wild boars on crops and land (and lately even in private gardens), and above all by split hoofed game grazing in newly established forest growths. Game hunters declare long-term interest of downsizing both split hoofed game and wild boars. In the year 2014, by a focused effort, almost all species of game monitored were significantly reduced, with the exception of fallow deer whose numbers were kept at approximately the previous year's level (Chart 6). In order to reduce the damage caused by wild animals on agricultural and forest property, the plans for breeding and hunting must be carefully prepared in accordance with the relevant provisions of the Act No. 449/2001 Coll., on game management, so that the number of split hoofed game and wild boars range between minimum and standardized populations.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

[1] *Forest certification under the PEFC and FSC systems is one of the forest management processes which aim at sustainable forest management in the Czech Republic and strive to improve all forest functions in favour of the human environment. Through the certificate, the forest owner declares a commitment to manage the forest pursuant to the given criteria. In terms of international recognition, both systems are considered equal.*

Forests in the European context

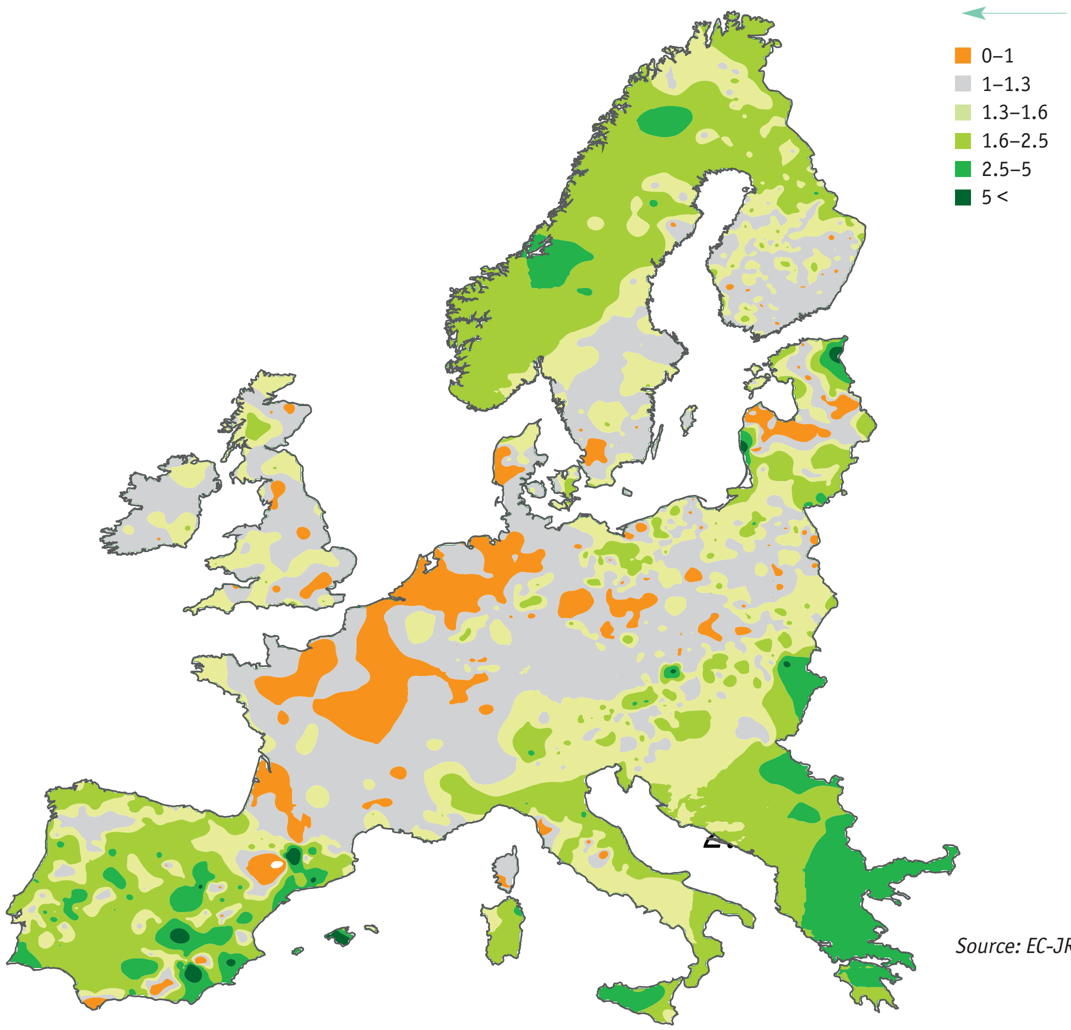
KEY MESSAGES →

→ The general situation in European forestry may be considered as satisfactory, there is no systematic imbalance in the sense of favouring production over biodiversity, or vice versa. The total area of forest stands, as well as the total standing stock, are growing.

→ However, the forests are facing increasing pressure caused by human activity, increasing the risk of forest soil acidification and eutrophication of the landscape. The health status of forests in Europe is also not satisfactory, between 2002–2012, in Europe, the average defoliation increased to 17.2%. The Czech Republic is in this respect among the areas with higher levels of defoliation. In Central Europe, including the Czech Republic, the age and species composition of the stands, and the related dominant way of reforestation remain a problem.

INDICATOR ASSESSMENT

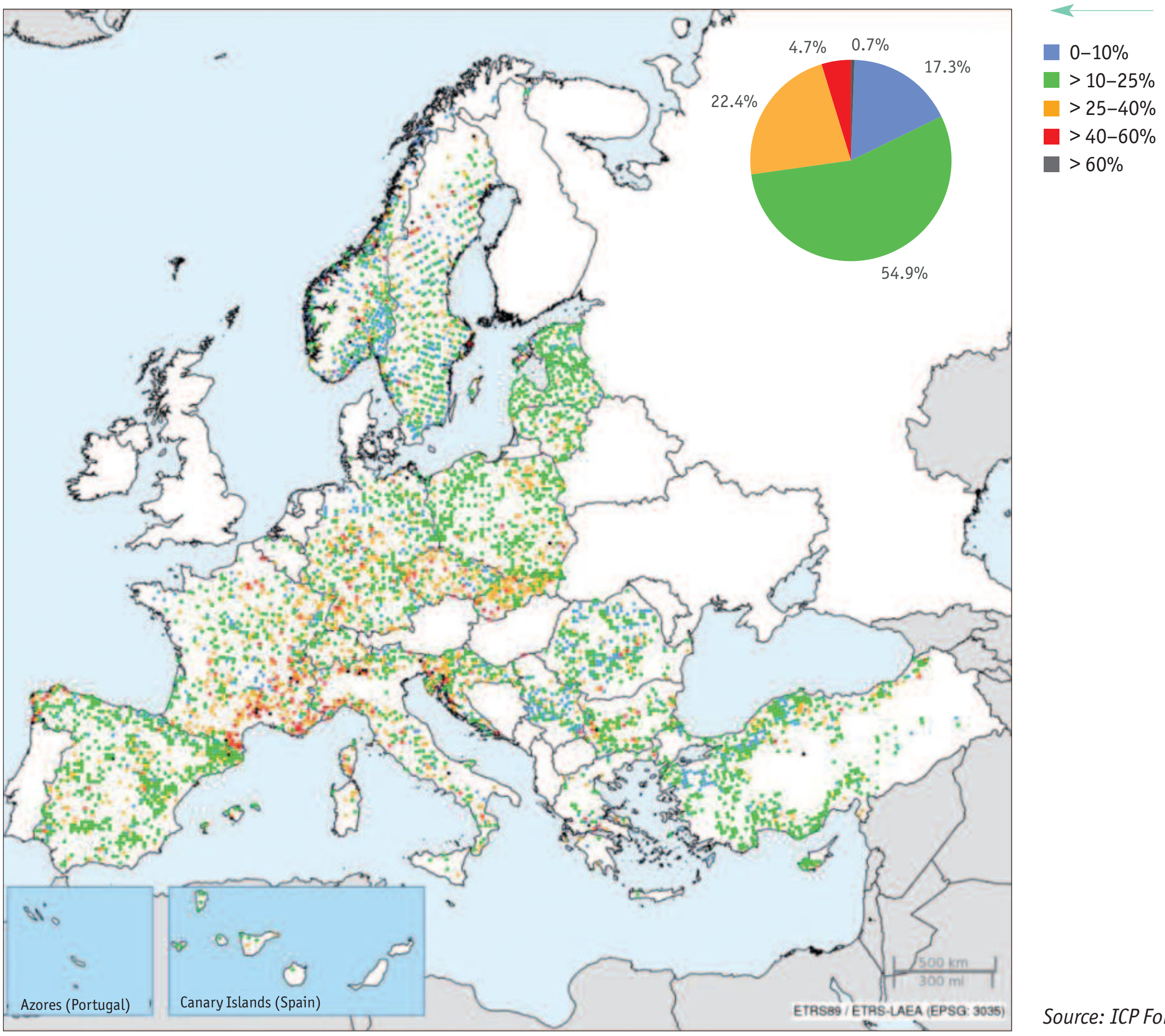
Figure 1 → **European forest areas according to the value of C/N index, 2008**



Source: EC-JRC

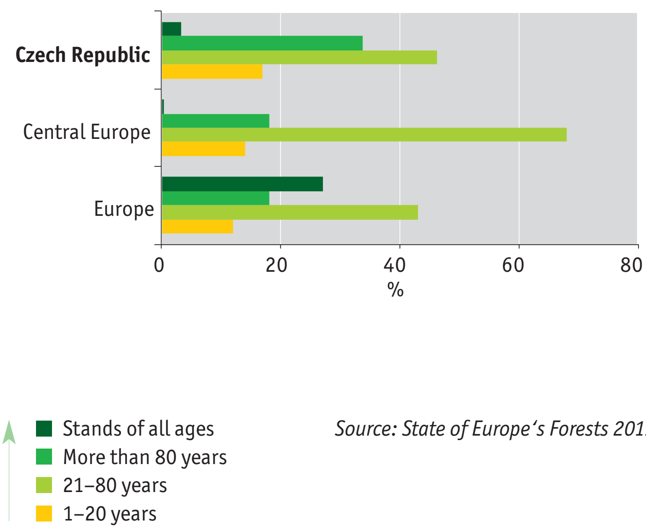
Prepared on the basis of data from the second forest soil research within the project BioSoil in 2004–2008.

Figure 2 ➜ **Defoliation on the main monitoring sites of all tree species [%], 2014**



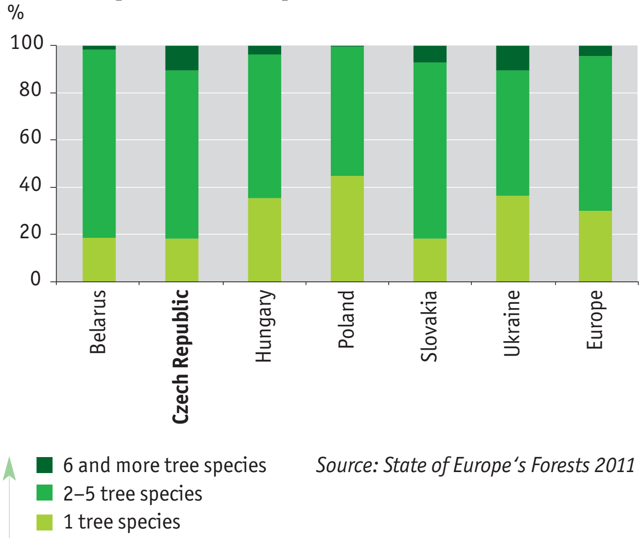
Source: ICP Forests

Chart 1 ➜ **Age structure of forest stands [% of forest area], 2010**



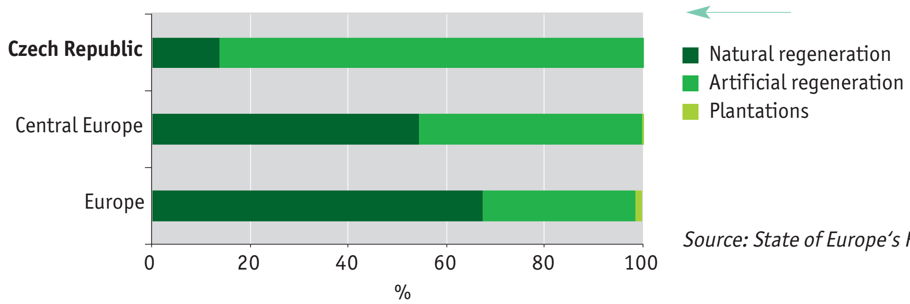
Source: State of Europe's Forests 2011

Chart 2 ➜ **Species structure of forest stands in selected countries [% of forest area], 2005**



Source: State of Europe's Forests 2011

Chart 3 ➜ **Proportion of the single forest regeneration types [% of afforested area], 2010**



Source: State of Europe's Forests 2011

Forests in Europe are facing increasing pressures caused by human activities that pose a risk for both the vitality of forest soils, as well as the health status of the forests.

The vitality of forest soils and stands can be evaluated by using the ratio of the concentration of carbon and nitrogen (C/N ratio) in forest land, which is a good indicator for assessing the **level of decomposition of organic matter, nitrogen accessibility in the soil and nutrient cycle**. Areas with the most affected soils are located mostly in Western and Central Europe. The Czech Republic has the majority of forest soil with C/N index slightly above 1, which is the lowest value in comparison with other Central European countries (Figure 1). The basic cause of the impaired vitality of soils is the high level of atmospheric deposition of nitrogen and other pollutants that exceed the long-term biochemical consumption and storage capacity of forest soils. Different situations in different parts of Europe are also influenced by different soil types in different parts of the continent, which have significantly different storage capacity[1].

On the European territory, 54.9% of the forests are in the category of low defoliation damage (10–20%) and 0.7% of the forests in the highest category of damage (over 60%). The forests with the most significant damage are mainly located in the Central and Southern Europe, notably in southern and south-eastern France, northern Italy, the Czech Republic, the Slovak Republic, and in Central Germany (Figure 2). There are many reasons, defoliation is the result of a complex set of factors and is influenced by short-term factors (pest outbreaks or influence disease, frost, wind and other weather conditions), along with long-term factors (inappropriate age and species composition of vegetation, soil acidification, long-term exposure to atmospheric pollution and others).

The high degree of defoliation generally indicates a decrease in the resistance of forests to various environmental influences. This is a worrying finding, especially in relation to the predicted more frequent extreme weather events in the near future and the fact that in the long-term the efforts to significantly reduce nitrogen deposition have been unsuccessful.

In the Czech Republic, in comparison with the European **average age structure**, the percentage of stands older than 80 years is significantly higher (33.8% in the Czech Republic, 18.0% in Europe), and also the area of all-aged stands is smaller (Chart 1). The current situation is a result of historical development. Intensive forest management and in particular the trend of planting monocultural stands in the 20th century and the late 19th century have led to an entirely unsatisfactory age and species composition of forest stands in comparison with the natural composition. Changing the unfavourable conditions, which forest management faces in the Czech Republic, given the length of the life cycle of forest trees, will be a long-term process. On the other hand, it is clear that in comparison with the average of the Central European region[2], concerning biodiversity, conservation and non-production functions, the proportion of trees older than 80 years and all-aged stands, the situation in the Czech Republic is significantly better than in the other countries (Chart 1).

In the Czech Republic, the situation concerning the **species composition of forest stands**, in comparison with the European average, is more favourable (Chart 2), concerning the quantity of monocultural stands (18.5% in the Czech Republic, 30.3% in European average). When comparing the area of stands with more than 6 tree species, the situation in the Czech Republic is also favourable. The area of these

[1] In healthy forests the C/N ratio in the surface layer is significantly higher than in the mineral soil (depth to 10 cm). In areas with high loads of nitrogen the situation may be reversed – C/N ratio in the surface layer is lower than in the mineral soil. Therefore, the proportion of these two values (C/N index) may serve as an indicator of the imbalance caused by excessive supply of nitrogen. If the index is below 1, nutrient cycling is disrupted and the health and vitality of forest stands may be compromised.

[2] The evaluation of Central Europe included data from the following countries: Belarus, the Czech Republic, Hungary, Poland, Slovakia, Ukraine. Region Europe comprises all European countries except the Russian Federation.

stands is much higher than the European average (10.3% in the Czech Republic and 4.2% average in Europe). However, the European average also includes specific forest ecosystems that naturally consist of only one or two species (e.g. Nordic pine forests, subalpine spruce forests), while in the Czech Republic monocultures, due to the natural conditions, should not virtually exist.

In the Czech Republic, the situation regarding the area of **monocultures** and mixed forests, is better in comparison with the countries of Central Europe. The overall trend in the European forests in comparison with the year 1990 is positive, moving towards a mixed species composition. Similar to the age structure, a significant change in species composition may be realized only in the long-term.

An essential tool for the conservation of forest landscapes and the changes in the age and species composition of forests is the r**estoration of forest ecosystems**. In terms of maintaining the genetic diversity, natural species composition and dynamics of the forest ecosystems, natural regeneration is the most suitable process. This, however, is not appropriate in many cases, especially if it involves a process of conversion of monocultures, changes in species composition of introduced species to naturally occurring, or restoration of forests after salvage felling.

In Europe, natural regeneration prevails over the artificial one (Chart 3). In this respect, the Czech Republic is far from attaining the level of European or Central European average (13.6% in the Czech Republic, Central European average is 54.2%). In the Czech Republic, due to the unsuitable species composition and age structure of forests, their natural regeneration is limited. The overall trend, however, in the Czech Republic shows a rising share of natural regeneration in the medium-term.

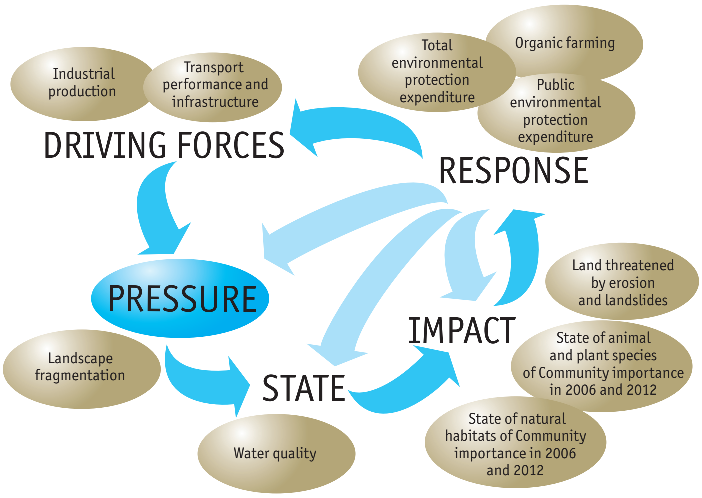
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

19/ Land use

KEY QUESTION

What is the state and development of land use in the Czech Republic?



KEY MESSAGES

The area of permanent grassland, especially at the expense of arable land, is increasing. The forest area, which plays an important role in water retention in the landscape as well as in the preservation of biodiversity, is slightly increasing.

The total acreage of agricultural land resources of the Czech Republic is decreasing. In the period 2000–2014 there was a decrease of 64.3 thous. ha, which is almost 1% of the territory of the Czech Republic. An important factor in the take up of agricultural land is the expansion of built-up and other areas, which formed 10.7% of the territory of the Czech Republic in 2014.

OVERALL ASSESSMENT

Change since 1990	☹
Change since 2000	☹
Last year-to-year change	☹

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

European Landscape Convention
- support of landscape protection, management and planning and organization of European cooperation in this area

Territorial agenda of the European Union 2020
- promotion of polycentric and balanced territorial development
- management and interconnection of ecological, cultural, landscape-related values of regions

The United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, particularly in Africa
- restoration, protection and sustainable care for land and water resources and the preservation of biological diversity

Spatial Development Policy of the Czech Republic
- economical use of built-up areas, provision of the protection of undeveloped areas (especially agricultural and forest land) and preservation of public greenery

State Nature and Landscape Protection Programme of the Czech Republic
- securing the protection of soil as an irreplaceable and non-renewable natural resource
- reversing the negative trend of decreasing area of agricultural land
- preservation or restoration of grasslands

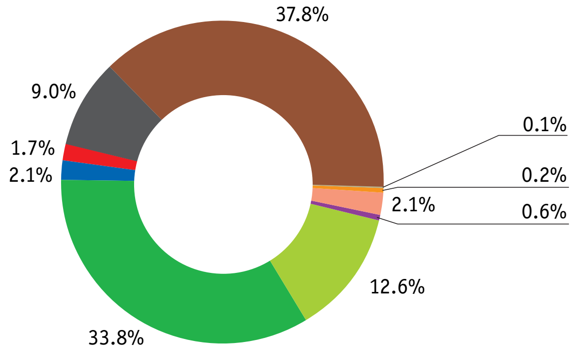
State Environmental Policy of the Czech Republic 2012–2020
- restriction on permanent take-up of agricultural land and bedrocks

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Land use and its changes caused by human activities affect the landscape character and its functions and therefore also have an effect on individual ecosystems and on biological diversity. Environmentally more valuable categories of land use, which include forests and permanent grassland, have a water management and erosion control function and are important for the protection of biodiversity. By contrast, arable land represents a potential environmental burden from agricultural activities, in particular for water quality. The development of construction and of other man-made surfaces reduces the retention ability of the landscape, and thus increases the flood threat of the territory; especially in the summer the artificial surfaces affect the temperature and humidity conditions with possible impacts on the public health.

INDICATOR ASSESSMENT

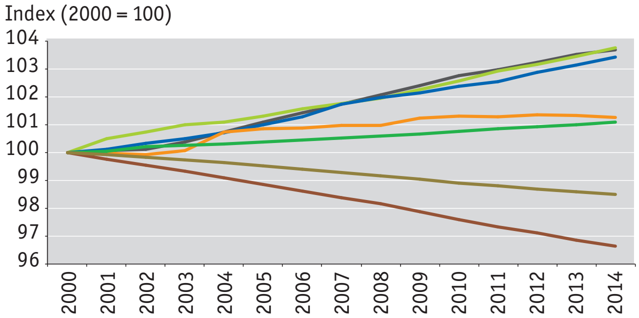
Chart 1 → **Land use in the Czech Republic [%], 2014**



- Arable land
- Hop gardens
- Vineyards
- Gardens
- Fruit orchards
- Permanent grassland
- Forest land
- Water areas
- Built-up areas and courtyards
- Other areas

Source: Czech Office for Surveying, Mapping and Cadastre

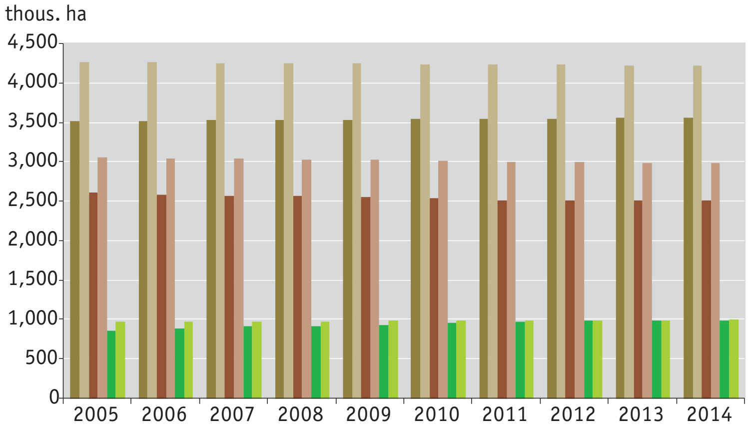
Chart 2 → **Land use development in the Czech Republic [index, 2000 = 100], 2000–2014**



- Built-up and other areas
- Permanent grassland
- Water areas
- Forest land
- Hop gardens, vineyards, fruit orchards and gardens
- Agricultural land in total
- Arable land

Source: Czech Office for Surveying, Mapping and Cadastre

Chart 3 → **Development of agricultural land area and its main categories recorded in the Cadastre of Real Estate and LPIS [thous. ha], 2005–2014**



- Agricultural land, LPIS
- Agricultural Land, Cadastre of Real Estate
- Arable land, LPIS
- Arable land, Cadastre of Real Estate
- Permanent grassland, LPIS
- Permanent grassland, Cadastre of Real Estate

Source: Ministry of Agriculture, Czech Office for Surveying, Mapping and Cadastre

LPIS – Land Parcel Identification System

The structure of land use in the Czech Republic is characterized by a high proportion of arable (37.8%) and forest land (33.8%) in the total land resources (Chart 1). The proportion of agricultural land resources in the total land resources of the Czech Republic in 2014 amounted to 53.5%. Arable land occupied more than two thirds (70.7%) of the total area of agricultural land.

Land use development after 2000 is characterized by a gradual decrease in the acreage of arable land and an increase in areas of permanent grassland, forests and built-up and other areas (Chart 2). These trends are partially a result of decline in economic activity in remote and less attractive areas where the acreage of arable land is decreasing, while the areas of permanent grassland and forest land are growing. Further increase of permanent grassland in these areas is supported by the Government's subsidy policy, which promotes the re-use of land for agricultural purposes in remote areas. On the other hand, a significant anthropogenic pressure on land use, which leads to the build-up of areas and to the increase of the area of arable land at the expense of other environmentally more valuable land use categories, is typical for the main agricultural areas and urban centres. As a result of these trends, the total area of agricultural land has been slightly decreasing; in the period 2000–2014 it decreased by 64.3 thous. ha (1.5%) in total, in 2014 by 4.2 thous. ha (0.1%) compared with the previous year.

Between 2013 and 2014, the area of **arable land** decreased by 6.8 thous. ha, i.e. by 0.2%, in the period 2000 to 2014 by 103.4 thous. ha (3.1%). The largest losses of arable land (total of 7.9 thous. ha) in 2014 were caused by the transformation of arable land into permanent grassland (about 4 thous. ha in total, of which a loss of about 1 thous. ha was recorded in the Pilsen Region), and into built-up and other areas, which even meant a take up of agricultural land. In total, this concerned 2.3 thous. ha mainly in the regions of Central Bohemia and South Moravia (approx. 800 ha in total). A significant area of arable land was reforested in 2014 (630 ha) or transformed into water areas (360 ha). Increases of arable land in 2014 amounted to a total of 1.1 thous. ha; new arable land was created mainly on permanent grassland areas (488 ha), other areas (256 ha) and fruit orchards (148 ha).

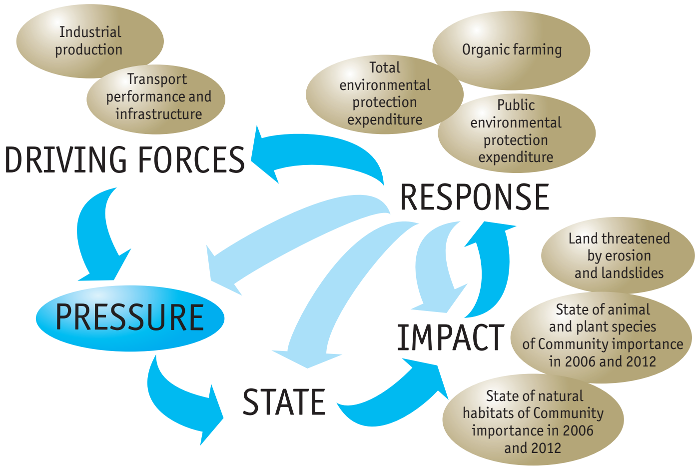
The acreage of **permanent grassland**, which is, with a share of 12.6% in the total land resources of the Czech Republic, the third most common land use category in the Czech Republic, increased in 2014 by 2.8 thous. ha, i.e. by 0.3%, compared with the previous year. In the period from 2000–2014 the increase amounted to 36.2 thous. ha (3.5%). Permanent grassland areas continue to grow at a steady pace since 2000. The area of forest land is also gradually increasing. In 2014, the year-to-year increase amounted to 2.7 thous. ha (0.1%), which represents the largest year-to-year increase since 2002. The area of water surfaces, which expanded to 5.5 thous. ha in the period 2000–2014 and represented 2.1% of the Czech Republic (3.2%), is also increasing.

The area of **built-up and other areas** increased between 2013 and 2014 by 1.2 thous. ha (0.1%). Since 2000, it increased by 29.9 thous. ha (3.6%) to 839.9 thous. ha, which is 10.7% of the territory of the Czech Republic. The year-to-year increase of built-up and other areas in 2014 was the smallest since 2002. In 2014, the built-up areas expanded by 102 ha (0.1%), other areas by 1,113 ha (0.2%). In 2014, increases in the land use cathegories of roads (roads, motorways and other communications) by 1,460 ha and in the category public greenery (by 954 ha) were recorded in the overall assessment of other areas. Increases in these land use categories were largely made at the expense of the category arable land, whose area decreased as a result of its transformation into other areas by about 2 thous. ha. The highest decreases in the category of other areas occurred in the subcategories other areas and barren land (in total about 1 thous. ha) and mining areas (286 ha). Based on these data, it can be concluded that the land take due to the construction of transport infrastructure and other facilities is continuing; however, the increase of the total acreage of other areas has slowed down due to the transformation of unused land and mining areas into other land use categories.

According to the data of the **public land registry LPIS** (Land Parcel Identification System) 45.1% of the territory of the Czech Republic was used for agricultural purposes in 2014, which is by approximately 661.3 thous. ha less (15.7%) than the area of agricultural land resources registered in the Cadastre of Real Estate (Chart 3). Arable land comprised 70.4% of agricultural land registered in the LPIS and permanent grassland 28.0%. One of the reasons for the different acreage of agricultural land registered in the LPIS and the Cadastre of Real Estate, among other things, is the fact that in the Cadastre of Real Estate, unlike in the LPIS, arable land is registered even if it was temporarily excluded from agricultural land resources. In the period 2005–2014, the total area of land registered in the LPIS (unlike the Cadastre of Real Estate) was slowly increasing (by 39.8 thous. ha, i.e. by 1.1%), mainly as a result of the growth of registered areas of permanent grassland by 133.4 thous. ha (15.5%), at a decrease in the recorded acreage of arable land by 105.4 thous. ha, i.e. by 3.0%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indicators.cenia.cz

20/ Landscape fragmentation



KEY QUESTION

Is the process of landscape fragmentation being slowed down?

KEY MESSAGES

Although the pace of decline of unfragmented areas is decreasing, the process of landscape fragmentation still continues. For the period 2000–2010[1] the surface area of unfragmented landscape decreased by 5.2% and in 2010 it represented 63.4% of the total area of the Czech Republic.

More than 6,000 transverse barriers are recorded on the watercourses of the Czech Republic. In 2014, there were a total of 843 weirs, which may adversely affect aquatic ecosystems (e.g. migration of aquatic animals).

OVERALL ASSESSMENT

Change since 1990	☹
Change since 2000	☹
Last year-to-year change	☹

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
- ensuring the continuity of natural habitats and wildlife migration

Regulation No. 1315/2013 of the European Parliament and of the Council of the EU of 11 December 2013 on Union guidelines for the development of the trans-European transport network
- requirement to take into consideration the physical restrictions and topographical features of the regions as well as environmental
- impacts, including the fragmentation of the landscape, during the planning and development of the transport network; if this is not possible, mitigation of these impacts or their compensation and effective protection of biological diversity is required

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
- gradual removal of transverse barriers restricting the aquatic organisms' migration and of the reduction of the burden on aquatic environments in all EU member states

Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel
- enabling the passability of rivers and improvement of the state of river habitats, leading to the reduction in mortality of eels resulting from human activity

Spatial Development Policy of the Czech Republic
- ensuring the protection of undeveloped areas (in particular agricultural and forest land) and preservation of public greenery, including minimisation of its fragmentation
- preservation of the permeability of landscape and minimisation of the extent of its fragmentation while choosing the locations of transport and technical infrastructure

State Environmental Policy of the Czech Republic 2012–2020
- reduction and mitigation of impacts of landscape fragmentation and increase of ecological stability of landscape

The Concept of Making the Czech River Network Passable
- systematic solution to the renewal of watercourses, taking into account the needs of aquatic and water-related ecosystems in order to ensure the watercourses' passability
- definition of significant watercourses in terms of migration or sections of watercourses on two levels: above-regional priority habitat biocorridors with international relevance and National priority sections of watercourses in terms of territorial and species protection

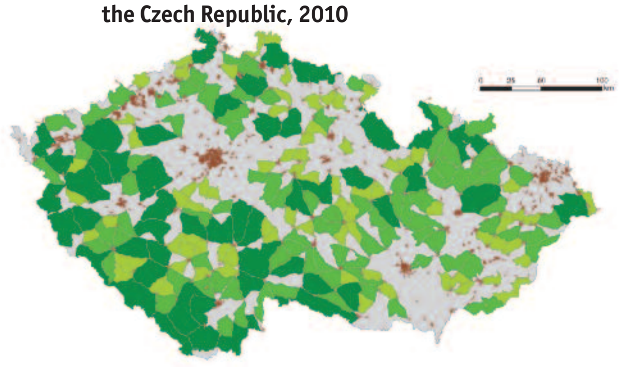
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Landscape fragmentation belongs to important problems which have negative impacts on the landscape character and plant and animal populations. The impacts of fragmentation are not immediate, however, they are long-term and irreversible. The breaking of landscape arises from natural processes (gales, fires, floods), but is also caused by human activities, namely by agriculture, urbanization and most seriously by construction and the use of transport infrastructure. Fragmentation barriers in nature reduce the landscape's potential for recreation and its passability enabling free movement of humans. There is also an increase of noise pollution in the environment concerned. Landscape fragmentation significantly affects natural aquatic and terrestrial ecosystems and the plants and animals living in them. Not only are natural habitat of individual species of organisms being taken over and their size is decreasing, but also populations are fragmenting, migration distances are increasing, migration barriers are being formed, and thus a limitation of food sources and breeding opportunities is occurring. All this leads to a loss of genetic diversity and reduced viability of populations and ecosystems.

[1] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

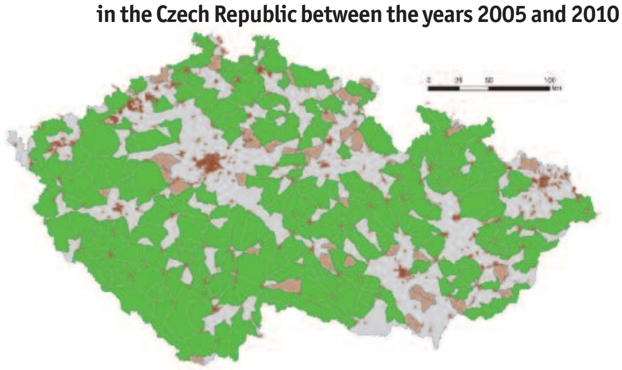
Figure 1 ➔ **Landscape fragmentation due to transport in the Czech Republic, 2010**



UAT area *Source: Evernia*

- Over 300 km²
- 150–299 km²
- 100–149 km²
- Urbanised areas (over 2 km²)
- Fragmented areas

Figure 2 ➔ **Dynamics of landscape fragmentation due to transport in the Czech Republic between the years 2005 and 2010**

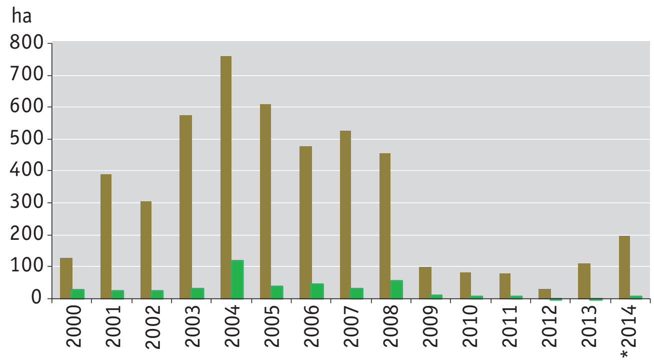


Source: Evernia

- UAT 2010
- UAT which disappeared since 2005
- Urbanised areas (over 2 km²)
- Fragmented areasy

Assessed using UAT (Unfragmented Areas by Traffic) polygons. UAT is a method of determining the so-called unfragmented areas by traffic, i.e. areas which are delimited by roads with traffic intensity higher than 1,000 vehicles per 24 hours or multi-track railways, and whose area is larger than 100 km².

Chart 1 ➔ **Development of land take of agricultural land and of plots intended for fulfilment of forest functions due to road infrastructure in the Czech Republic [ha], 2000–2014**



- Land take of agricultural land by road infrastructure
- Land take of forest land by road infrastructure

Source: Transport Research Centre

The methodology of reporting the take-overs of agricultural land and of plots intended for fulfilment of forest functions is annually affected by temporary take-ups of such land which are associated with the construction of transport infrastructure.
** Preliminary data*

During the period 2000–2010, the area of **unfragmented landscape** decreased from 54,000 km² (68.6% of the total area of the Czech Republic) to 50 thous. km² in 2010 and therefore covered 63.4% of the total area of the Czech Republic (Figure 1 and Figure 2). The rate of decline, compared with the previous five-year period (2000–2005, difference was 5.4%), decreased in the last assessed 5 years to 2.4%, even though the fragmentation of the landscape in the Czech Republic still continues and the forecasts predict that the proportion of unfragmented landscape in the year 2040 will achieve only 53%.

The highest level of **landscape fragmentation** in the Czech Republic has been recorded in Central Bohemia, South Moravia and the Moravian-Silesian Region (Figure 1), which at the same time belong among the regions with the highest decrease of unfragmented areas for the period 2005–2010 (Figure 2). The high increase of fragmentation is caused by the territorially incompact expansion of built-up areas as a result of the continuing urbanisation taking place mainly in urban agglomerations and also the development of transport infrastructure, especially the construction of urban ring roads, express roads and motorways. On the contrary, the Pilsen Region and the South Bohemian Region belong among the regions with the highest number of unfragmented areas, where the more diverse topography and large-scale protected areas result in a lower population density and thus less need for transport services.

In the years 2000–2014, approximately 4,830 ha of **agricultural land** and approximately 439 ha of **forest land** (Chart 1) were **taken for the construction of transport infrastructure** in the Czech Republic. The most significant decrease in agricultural land in the period 2000–2014 occurred in the Central Bohemian and South Bohemia Region, in particular, due to the continuing preparation and construction of motorway D3, in the Central Bohemian Region, the land take is also closely related with the construction of the Prague ring road connecting the motorways D1 and D5. Then in 2013–2014, an increase in land take occurred only in the Hradec Králové Region due to the works on the construction of the motorway D11. The most significant decrease in forest land was recorded between the years 2000 and 2014 in the Central Bohemian Region and the Moravian-Silesian Region. Between the years 2013–2014 forest land was taken-up by transport infrastructure in the Central Bohemian Region and Moravian-Silesian Region.

Transport infrastructure represents a serious and often insurmountable obstacle to many important species of animals. The solution consists in a suitable construction of migration objects, such as underpasses, bridges and overpasses. Given the lack of a unified database, however, it is not possible to evaluate the importance and effectiveness of these measures.

Watercourses and their flood plains represent a specific migration route, which different communities and animal and plant populations are bound to. Building of structures and **damming watercourses by transverse obstacles on watercourses** result in a fragmentation of the given route, which adversely affects the biodiversity of river ecosystems. The most intensive regulations of watercourses occurred in the 19th and 20th century in connection with industrialization of the landscape and increased demands for the use of water resources. At present, flood prevention measures also have an impact on river network fragmentation. In the territory of the Czech Republic, more than 6,000 transverse barriers are recorded on different orders of watercourses, including weir barriers higher than 1 m and water reservoirs larger than 50 ha. At important watercourses managed by the state enterprise Povodí (21.3% of all watercourses in the Czech Republic), a total of 843 dams were recorded in 2014, of which 196 are managed by state enterprise Povodí Labe, 343 by state enterprise Povodí Vltavy, 43 by state enterprise Povodí Ohře, 179 by state enterprise Povodí Moravy, 82 by state enterprise Povodí Odry.

Damming a watercourse has its purpose from the water-management point of view, but it may also have negative impacts resulting in the degradation of habitats, reduction or loss of free migration of animals and changes in the communities of aquatic species of organisms. In the Czech Republic, an occurrence of 12 species of fish which migrate between the sea and river environments was recorded on the basis of a reconstruction of historical sites, of which, however, only two of them are currently recorded in the Czech Republic, namely European eel (Anguilla anguilla) and Atlantic salmon (Salmo salar).

In order to maintain and strengthen the populations relying on migration and to fulfil the Concep of Making the Czech River Network Passable, an increase in the number of upcoming proposed constructions of fish passes has been endorsed since 2010. In 2014, a total of 401 of these projects were prepared and 16 of them were implemented.

In 2014, 3 fish passes were constructed on the Elbe (Roudnice nad Labem, Štětí, Dolní Beřkovice) and 1 on the Tichá Orlice (Mladkov) within the authority of Elbe river basin administration. In 2014, a total of 9 fish passes were registered in the Morava River basin. In 2014, there were 16 permeable migration barriers in the Vltava river basin on watercourses defined as above-regional priority corridors and 16 migration barriers on watercourses defined as national priority sections of watercourses listed in the Concept of Making the Czech River Network Passable. In the Ohře river basin, 2 migration barriers were made passable and a fish pass on Kamenice in Hřensko was built, allowing salmons to migrate from the Elbe River into the traditional spawning grounds. Fish passes were being set up in the Odra river basin as part of the recovery, reconstruction and major repairs at lower river profile and weir objects.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

[2] Upcoming fish passes are projects that are consulted with the Nature Conservation Agency of the Czech Republic. Nature Conservation Agency of the Czech Republic, however, offers no information as to whether these projects are ready for implementation and whether they are being implemented. This information is provided only in such fish pass projects, which are submitted within the Operational Programme Environement.

21/ Land threatened by erosion and landslides

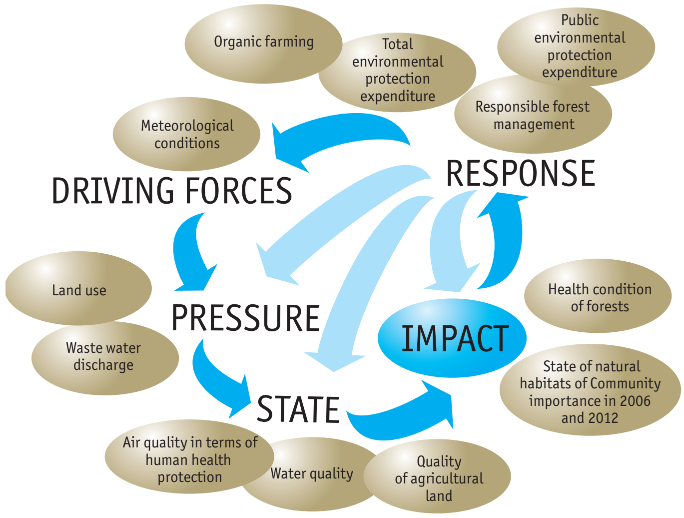
KEY QUESTION

How big is the proportion of agricultural land that is threatened by erosion and landslides?

KEY MESSAGES

In the Czech Republic, 63.6% of agricultural land is potentially threatened[1] by water erosion and 18.1% to wind erosion. Out of this, 23.9% of agricultural land is extremely threatened by water erosion and 3.2% of most vulnerable agricultural soils to wind erosion. A framework farming method preventing soil erosion is recommended for a total of 67.1% of agricultural land in the Czech Republic. Converting of the respective land units or their parts to grassland was recommended for 0.8% of agricultural land. Growing of perennial forage crops only is recommended on 2.3% of agricultural land.

Regarding slope instabilities, the most serious source of risk are considered to be active landslides, covering in the Czech Republic in the year 2014 an area of 3.5 thous. ha out of the total area of 64.4 thous. ha.



OVERALL ASSESSMENT

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

State Environmental Policy of the Czech Republic 2012–2020

- reducing the risk of agricultural land, forest land and rock erosion
- limiting and controlling contamination and other degradation of soil and rocks caused by human activities
- restoration of the landscape water regime by implementing erosion control measures in the landscape
- preventing the consequences of natural risks
- preventing and mitigating the effects of crisis situations on the environment

Regulation (EU) No. 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009

- payment of support includes, among other things, the additional support per ha for observing agricultural practices which have a beneficial effect on the climate and the environment
- comply with the standards for agricultural and environmental status established by the Member State and pursuing objectives to prevent soil erosion, maintain soil structure and keep organic matter in soil and to ensure minimum level of care is one of the requirements conditioning the direct payments under the conditionality provisions

Action Plan of the Czech Republic for the Development of Organic Farming in the years 2011–2015

- ensuring non-productive functions of organic agriculture, which contribute to the restoration of stability and natural processes in the soil

United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa

- combating desertification and mitigating the effects of drought in affected or threatened areas (in Central Europe in areas prone to soil erosion)

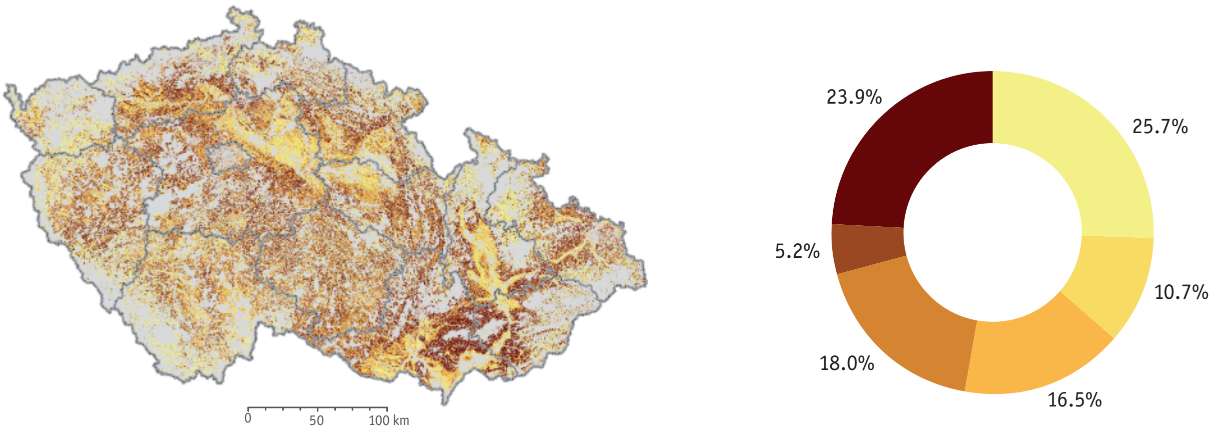
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Soil erosion and landslides are amongst the most significant degradation impacts negatively impacting the soil. Degradation generally results in a restriction or complete loss of production and non-production functions of soil. The very process of erosion as well as of landslides are normal natural phenomena, but an increase in their intensity as a result of anthropogenic activities is a serious problem. Accelerated erosion causes a reduction in the quality of soil by erosion of its most fertile parts, thus reducing soil fertility, loss of ecological functions of soil and reduction of water retention and recharge functions. The damage caused by erosion, however, also influences the level of water pollution, causes silting of water reservoirs and thus also indirectly affects human health. Erosion can also cause damage to property (topsoil washing, fertilisers and plant protection products runoff, clogging of drainage systems and sewerage networks, the loss of seeds and seedlings, damage to roads, buildings and utilities). Landslides also cause serious direct or indirect damage, e.g. by surface bulging or subsidence, accumulation of soil and rocks, bulging of slope face, soil accumulation or uprooting of trees, as well as damage to property and human health (e.g. by soil or rock slides or damage to roads or railways, movement retaining walls or cracking buildings, cable ducts, pipelines, etc.).

[1] Potential vulnerability of agricultural land to water erosion expressed as a long-term average soil loss G higher than 2.1 $t.ha^{-1}.year^{-1}$.

INDICATOR ASSESSMENT

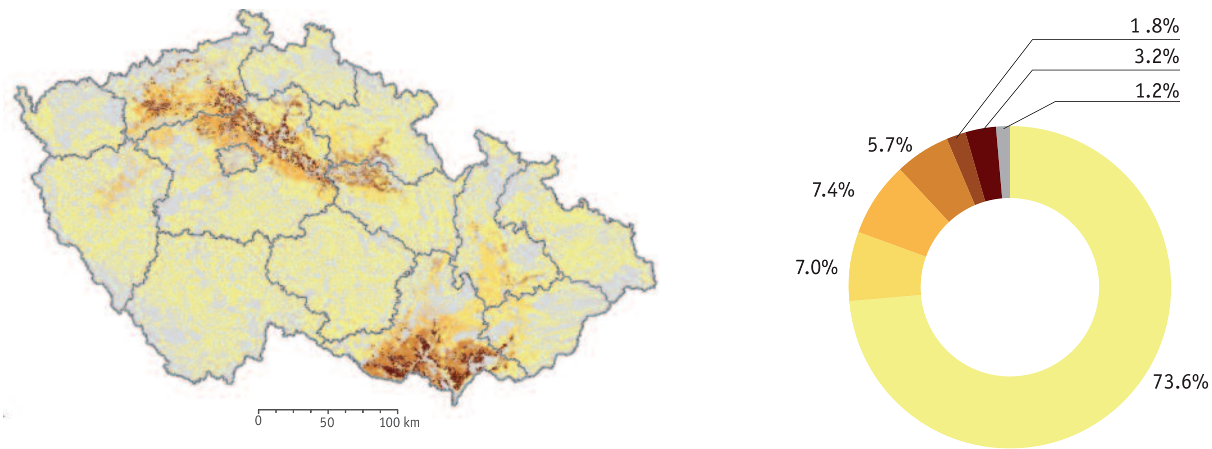
Figure 1 ➜ **Potential vulnerability of agricultural land to water erosion in the Czech Republic (expressed as a long-term average soil loss G) [t.ha^{-1}.year^{-1}], 2014**



- Very slightly vulnerable soil (G up to 1.0)
- Slightly vulnerable soil (G 1.1–2.0)
- Medium vulnerable soil (G 2.1–4.0)
- Strongly vulnerable soil (G 4.1–8.0)
- Very strongly vulnerable soil (G 8.1–10.0)
- Extremely vulnerable soil (G over 10.1)
- Non-agricultural soil or not evaluated

Source: Research Institute for Soil and Water Conservation, public research institution

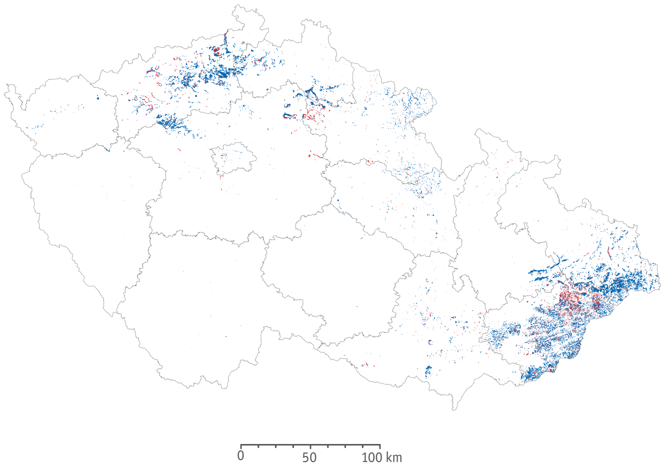
Figure 2 ➜ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic [% of agricultural land], 2014**



- Soil without vulnerability
- Fractionally vulnerable soil
- Slightly vulnerable soil
- Vulnerable soil
- Strongly vulnerable soil
- Most vulnerable soil
- Non-agricultural soil or not assessed

Source: Research Institute for Soil and Water Conservation, public research institution

Figure 3 ➜ **Landslides and other dangerous slope instabilities on the territory of the Czech Republic, 2014**



Source: Czech Geological Survey

Erosion is one of the degradation influences negatively impacting the soil. Under normal conditions, erosion is a natural and gradual process. The intensity of anthropogenically conditioned accelerated water erosion of agricultural land, mainly due to inappropriate farming methods (e.g. large scale unification of land plots, growing monocultures, removal of landscape elements, lack of grass-covered belts or terraces, land management irrespective of the slope of the land or growing crops potentially vulnerable to erosion, e.g. maize) may be 10 to 1,000 times higher than the normal (geological) erosion and leads to an erosion of soil particles to the extent that the soil-forming process fails to compensate adequately by formation of new soil. The **actual erosion** that would express the real current state of erosion threat, including the anthropogenic influences, is not consistently monitored on the whole territory of the Czech Republic. Therefore, for the assessment of agricultural land vulnerable to water and wind erosion and determination of the wind and erosion threat, the so-called potential erosion vulnerability of agricultural land is used, where the calculations are based on natural conditions and inherent characteristics of the soil and relief.

Water erosion is amongst the most important manifestations of soil degradation. **Potentially threatened by long-term average soil loss (G)**[2] of more than 2.1 $t.ha^{-1}.year^{-1}$ (i.e. above the lower limit of the medium vulnerable soil) was 63.6% of the assessed area of agricultural land in the Czech Republic (according to the BPEJ soil quality database, 2014 assessment – Figure 1). If the indicator G with a value higher than 10.1 $t.ha^{-1}.year^{-1}$ is used, then 23.9% of agricultural land is exposed to extreme water erosion. On heavily eroded soils, the average reduction of the yields attains up to 75% and land prices are reduced by up to 50%. In addition to the economic damage, the loss of soil represents environmental damage, as the soil-forming process rate, compared to the loss of soil by water erosion, is very slow. Currently, the maximum loss of soil in the Czech Republic has been calculated at approximately 21 mil. t of topsoil per year. The biggest problem in the long run is the loss of soil in areas of the highest quality soil (the area around Elbe and the Moravian valleys, Figure 1), where the largest proportion of land with most vulnerable soil can be found. It is a fertile region with the longest history of agriculture and the most intensive farming.

The map of the **maximum admissible value of the cover and management factor (C_p)**[3] is used as an instrument for the protection of agricultural land against water erosion. If the determined value of the factor in a given location is exceeded, erosion should be adequately eliminated by a suitable (framework) farming method or, more precisely by erosion control. Framework farming method based on C_p as calculated in the year 2014 is recommended for a total of 67.1% of the evaluated area of agricultural land in the Czech Republic according to the BPEJ soil quality database. The conversion of the respective land units or their parts to grassland was recommended for 0.8% of agricultural land, for 2.3% of agricultural land the growing of perennial forage crops (e.g. clover, lucerne) was recommended, on 31.9% it is recommended to exclude the cultivation of crops potentially enhancing erosion (e.g. crops planted in wide rows), and for the remaining 32.1% of agricultural land less threatened by erosion it is recommended to use soil conservation technologies. The C_p values were used for

[2] *The calculation of the average long-term loss of soil G is based on the Universal Soil Loss Equation (USLE): $G = R \times K \times L \times S \times C \times P$ [$t.ha^{-1}.year^{-1}$]. Inputs into the equation include the following factors: rainfall and runoff erosivity factor adjusted for regional climate according to public land register database (R), soil erodibility factor (K), slope length factor (L), slope steepness factor (S), cover-management factor adjusted for regional climate (C) and the support practices factor (P).*

[3] *The calculation of C_p is based on the Universal Soil Loss Equation (USLE), expressed in the form: $C_p = G_p/(R \times K \times L \times S \times P)$. Inputs into the equation include the following factors: maximum permissible average annual loss of soil preserving soil functions and fertility relative to the depth of the soil (G_p), rainfall and runoff erosivity factor adjusted for regional climate according to public land register database (R), soil erodibility factor (K), slope length factor (L), slope steepness factor (S) and cover-management factor adjusted for regional climate (P). C_p are divided into 5 groups.*

the definition of strongly and slightly erosion vulnerable **arable land** for the needs of standards of **Good Agricultural and Environmental Conditions (GAEC)** that provide land management tools in accordance with environmental protection. Thus the assessed erosion vulnerability is registered in the Public register of land LPIS. The types of arable land not vulnerable to erosion in the register represent 90.0% (C_p greater than 0.1), slightly vulnerable to erosion 9.6% (C_p 0.02–0.1) and heavily vulnerable to erosion 0.4% (C_p less than 0.02).

In the Czech Republic in the year 2014, **wind erosion**[4] potentially threatened (soil slightly vulnerable to most vulnerable) 18.1% of the evaluated area of agricultural land (in by BPEJ soil quality database, Figure 2). The most threatened agricultural land by wind erosion was represented 3.2%. If the current trends in land management will continue it may be assumed that in the future the danger of wind erosion will increase. The causes of increasing wind erosion are particularly the oversized farm land plots with one type of crop and the lack of linear elements in the landscape (alleys, hedge rows etc.). In addition to the loss of the most fertile part of the soil profile and the deterioration of the physical and chemical properties of soil, wind erosion damages sprouting plants, pollutes the air and causes further damage by wind driving the topsoil.

It is difficult to **compare** year-to-year the **potential vulnerability of agricultural land** because the methodologies to determine vulnerability of soil to water erosion get more accurate. However, especially in the case of potential vulnerability to the long-term average soil loss (G) and the maximum admissible value of the cover-management factor (C_p) the methodology was refined in 2014. This included developing of a new regionalised rainfall and runoff erosivity factor (R) on arable land and the use of different values of permissible average annual soil loss for medium deep soils (G_p). Nevertheless, the changes may be observed better in smaller areas which are struggling with soil loss as a result of various precipitation episodes.

The widespread geodynamical phenomena that cause in the Czech Republic serious direct or indirect damage include **slope instabilities**, the most important of which are landslides, which may be natural phenomena or be caused by human activity. In the conditions of temperate climate of central Europe, the behaviour of slopes is affected primarily by climate contingent factors and the type of rock. Landslides most commonly affect large areas of the Czech Republic in the Outer Western Carpathians, Bohemian Central Uplands and the area around the River Ohře (Figure 3). The mapping of landslide areas in the Czech Republic is carried out systematically since 1997, when extreme rainfall initiated the formation of large numbers of landslides. Gradually the records of slope instabilities were verified, replaced or supplemented by data arising in the context of detailed geological mapping, assessment activities within the Czech Geological Survey and the evaluation of damage caused by floods in 1997, 2002, 2006, 2009, 2010, 2013 and 2014. The most serious source of risk considered are the active landslides. In 2014, the Registry of slope instabilities of the Czech Republic contained 17,490 items of slope instabilities with a total area of 64.4 thous. ha, out of which 3.5 thous. ha consisted of active landslides.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
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[4] *The methodology for establishing the potential vulnerability of agricultural land to wind erosion was used. From the data on soil environmental quality units, the data on climatic regions (the sum of daily temperatures above 10°C, average rainfall certainty for the growing period, probability of dry vegetation periods, average annual temperature, annual precipitation), and information on the main soil units (genetic soil type, soil-forming substrate, grain size, skeletal characteristics, rate of hydromorfism). The final evaluation is expressed by the product of the climate region factor and the main soil unit factor.*

22/ Contaminated sites

KEY QUESTION →

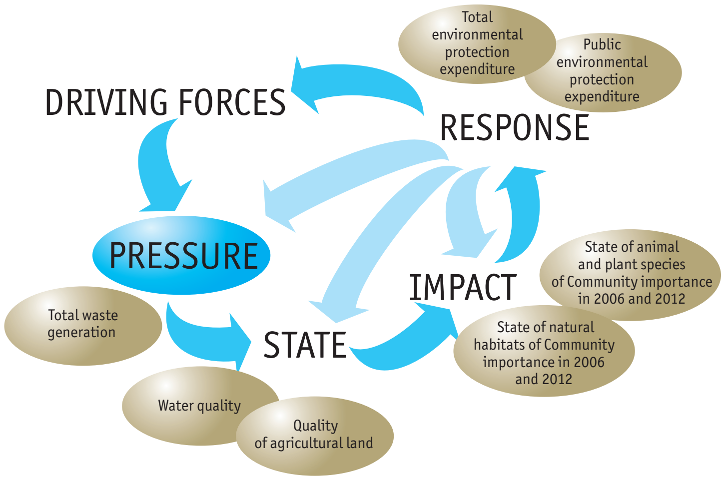
How many historical contaminated sites (old environmental burdens) are registered in the Czech Republic and how is their remediation progressing?

KEY MESSAGES →

🙂 At present, the need for remedial action is evaluated on the basis of an elaborated risk analysis, according to the respective methodical guidance of the Ministry of Environment. Remedial actions recorded in Evidence System of Contaminated Sites over the period 2010–2014 include finalized remediation of 220 contaminated sites, remediation in 45 projects was completed in an unsatisfactory condition. From Operational Programme Environment, which is in this field a major source of support, financing was approved for 12 projects in the year 2014 for the implementation of the investigation work and risk analysis, with total costs of 23.1 mil. CZK.

😐 The Evidence System of Contaminated Sites database of contaminated sites or, more precisely of old environmental burdens has not been maintained by systematic inventory of data, but is updated by incrementally adding sites, because the subject of old contaminated site remediation is not regulated by any law and there is no unified approach in this area. For this reason, the Evidence System of Contaminated Sites database does not provide an overview of the total number of contaminated or potentially contaminated sites in the Czech Republic. The Evidence System of Contaminated Sites database currently contains 4,829 sites, of which 2,379 are sites with up-to-date records.
In the land use planning analytical materials used for regional planning 9,279 sites are registered.

☹ Despite the undoubted benefits and the large scope of work already carried out in the Czech Republic, there is still a large number of contaminated sites where the extent of risks to the environment and human health is not known.



OVERALL ASSESSMENT →

Change since 1990	N/A
Change since 2000	🙂
Last year-to-year change	🙂

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

State Environmental Policy of the Czech Republic 2012–2020
- limiting and regulating contamination and other soil and rock degradation by human activity
- remediation of contaminated areas, including old environmental burdens and sites with ordnance exposure

Operational Programme Environment 2014–2020
- finalize the inventory of old environmental burdens (the target value for the year 2023 is 10 thous. of registered contaminated sites)
- on the basis of risk analysis results implement remediation of the most seriously contaminated sites (the target values for the year 2023 are 1.5 mil. m^3 of excavated or pumped contaminated material and 500 thous. m^2 of remediated sites in the Czech Republic)

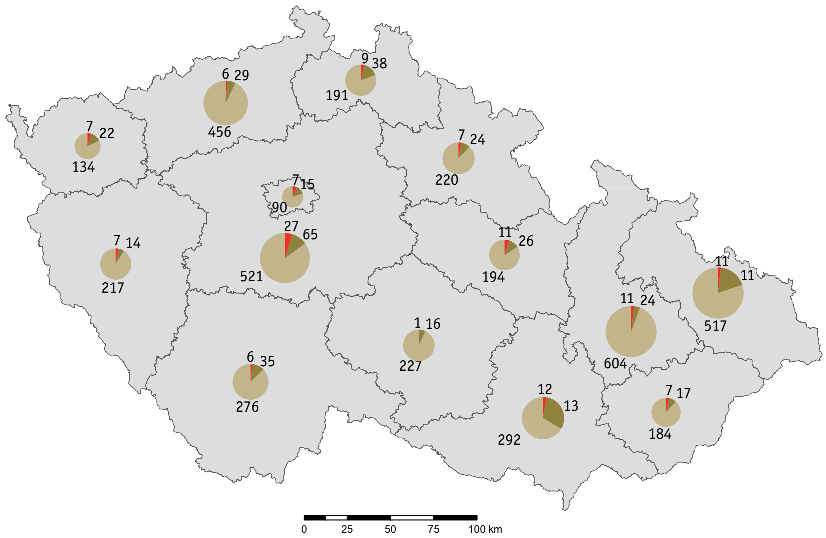
National implementation Plan for the Stockholm Convention on Persistent Organic Pollutants
- removal of contaminated sites

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Contaminated sites pose environmental risks of pollution to groundwater sources intended for public drinking water supply, soil and rock environment, building structures or air. Groundwater contamination represents a threat especially if the groundwater is used for drinking purposes. As a result of contamination of the rock environment or building structures human health might be threatened by hazardous toxic or carcinogenic substances. Remediation of the contaminated sites thus contributes to reducing health risks by removing the most hazardous contaminants from groundwater and rock environment and also has benefits for the revitalization of the landscape as a whole, for the restoration of the state of the environment and regeneration of natural relationships in the ecosystems.

INDICATOR ASSESSMENT

Figure 1 ➜ **Number of contaminated sites registered in Evidence System of Contaminated Sites[1] in the Czech Republic, 2014**

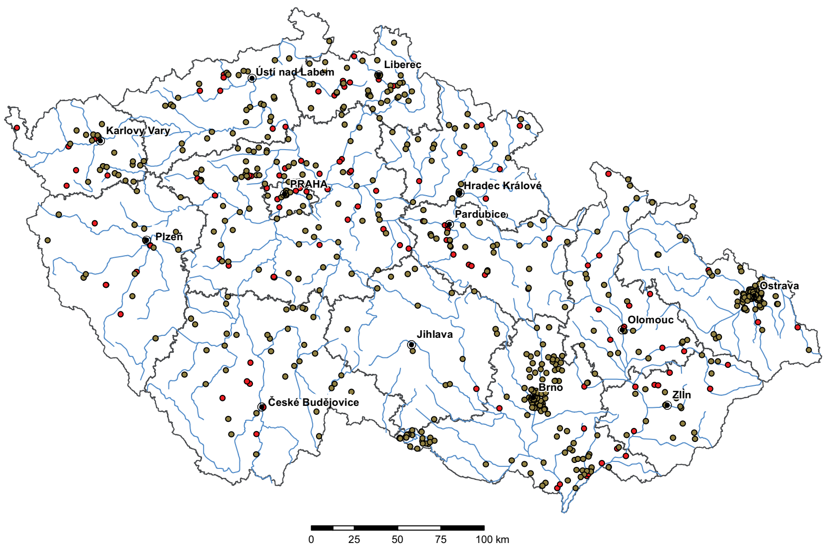


- Total
- Sites with remediation priority (A3)
- Sites with priority for investigations (P4)
- Other registered sites

Source: Ministry of Environment

Sites with remediation priority (A3) and priority for investigations (P4) have been determined according to the valid Methodological Guideline of the Ministry of Environment No. 1/2011.

Figure 2 ➜ **Locations of contaminated sites with priority for investigations and for remediation registered in Evidence System of Contaminates Sites in the Czech Republic, 2014**



Selected information from Evidence System of Contaminated Sites database

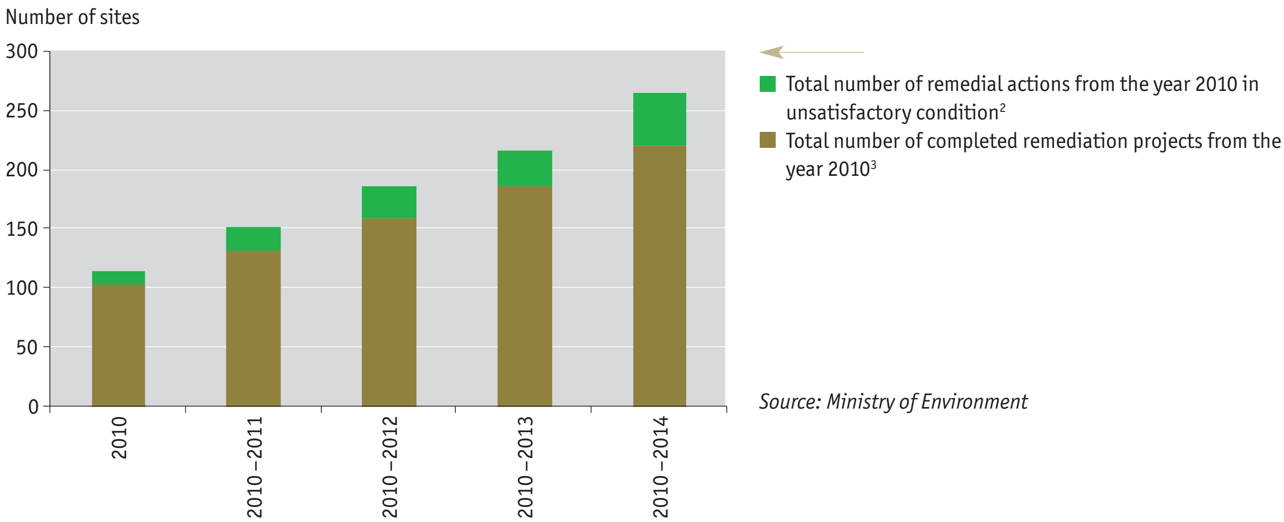
- Sites with remediation priority (A3)
- Sites with priority for investigations (P4)

Source: Ministry of Environment

Sites with remediation priority (A3) and priority for investigations (P4) have been determined according to the valid Methodological Guideline of the Ministry of Environment No. 1/2011.

[1] Evidence System of Contaminated Sites is a public database which contains: old environmental burdens, i.e. contaminated sites addressed especially by projects of the Ministry of Finance, Ministry of Environment, Operational Programme Environment, project status of the removal of the contaminated sites resulting from Soviet army residence on our territory and priority locations addressed by the Czech Environmental Inspection. It also includes test data from the District Authorities existing at the time of the database inception in 2004 and landfill sites closed before the adoption of Act No. 238/1991 Coll., on waste. The Evidence System of Contaminated Sites database does not include information on remedial actions implemented by the Regions, State Environmental Fund of the Czech Republic, other ministries and private investors.

Chart 1 → **Number of contaminated sites with completed remediation registered in Evidence System of Contaminated Sites in the Czech Republic, cumulative for the period 2010–2014**



Source: Ministry of Environment

[2] *Remediation was terminated for other reasons (e.g. lack of financial resources, unanticipated extent of contamination, newly identified circumstances, etc.).*
[3] *Remediation may be registered as completed also when post-remediation monitoring continues.*

Contaminated sites (old environmental burdens) represent serious contamination of the rock environment, groundwater or surface water, soil or building structures and threated human health and the environment. The continuing extensive occurrence of contaminated sites in the Czech Republic is one of the remnants of more than fifty-year (1938–1989) governance of undemocratic regimes, when environmental protection and the use of harmful substances in industrial and other production were not at high level.

Remedial interventions started before 1989 or immediately after 1989 were mostly carried out randomly without deeper economic priority analysis of the interventions, as a result of the economic interests of investors on the sites or in response to an acute threat to water resources, environment or public health. The systematic removal of these contaminated sites started on a larger extent after the year 1990. For some of them, especially within the framework of the privatization, the state accepted the liability.

In parallel with commencing the remediation interventions an incremental database of the existing contaminated sites **Evidence System of Contaminated Sites** was started, which is publicly accessible. The Evidence System of Contaminated Sites database has not been maintained by systematic inventory of data, but is updated by incrementally adding sites, because the subject of old contaminated site remediation is not regulated by any law and there is no unified approach in this subject. For this reason, the Evidence System of Contaminated Sites database does not provide an overview of the total number of contaminated or potentially contaminated sites in the Czech Republic. Therefore, in the years 2009–2012 the first phase of the National Inventory of Contaminated Sites was implemented. Within its framework, the methodology and software tools for inventorying maximum number of contaminated or potentially contaminated sites were developed. The pilot survey on 10% of the territory of the Czech Republic has identified by using new methodologies nearly 1,000 sites. As it turned out, about 1/3 of these sites had already been registered in Evidence System of Contaminated Sites.

Total **number of contaminated sites** in the Czech Republic is not known but is estimated approximately at 10,000 contaminated sites. In the land use planning analytical materials[4], used for regional planning, 9,279 sites are registered. The Evidence System of Contaminated Sites database in the year 2014 contained 4,829 sites, of which 2,379 (49% of sites) are sites with up-to-date records and the remaining 2,450 sites in the Evidence System of Contaminated Sites database have not yet been updated. Most of the sites of old environmental burdens with the highest priority for investigation and remediation are located in South Moravia, Moravian-Silesian and Central Bohemian Regions. These are mostly former industrial facilities, landfills, fuel stations, etc. (Figure 2).

[4] *The obligation to create such documents is imposed by Act No. 183/2006 Coll., on spatial planning and building code (the Building Act). According to Annex No. 1 of the Decree No. 500/2006 Coll., on planning analytical materials, planning documentation and methods of recording of planning activities, as amended by Decree No. 458/2012 Coll., this is phenomenon No. 64 – old environmental burden areas and contaminated sites. The first data for local analytical planning documents were submitted to the authorities of spatial planning in 2007. In accordance with the Building Act, also the ongoing database updates of Evidence System of Contaminated Sites (http://sekm.cz/) are promptly and immediately made available to the spatial planning authorities.*

At present, the need for remedial action is evaluated on the basis of an elaborated risk analysis, according to the methodical guidance of the Ministry of Environment No. 1/2011 which proves the potential of an adverse effect on the health of people or sensitive ecosystems near the contaminated site. The remediation of contaminated sites in the Czech Republic in predominantly financed from three main sources. The first source are the so called "Environmental Agreements"[5] which fund contaminated sites incurred before privatization of the former state enterprises, where the state assumed the liabilities associated with their existence. The second major source of funding are the financial sources of the individual ministries, state enterprises, etc. The third source of funding are the European funds through the Operational programmes, especially Operational Programme Environment, where it is possible to request co-funding for contaminated sites projects. In these projects, the polluter or his legal successor are not known, or the originator of pollution became extinct without a successor. The Operational Programme Environment projects may be co-financed from EU funds by up to 85% and the other part of funding up to 5% may be covered from the state budget or by co-financing from the budget of the State Environmental Fund. Within the 10th call for support area 4.2, respectively the 58th call of Operational Programme Environment 2007–2014 (February–May 2014), financing for 12 projects for the realization of investigation work and risk analysis was approved, with total costs of 23.1 mil. CZK. The requested amount for financial support from the Cohesion Fund was 17. 5 mil. CZK.

The number of contaminated sites with **completed remediation** in the Czech Republic may be, at least in part, evaluated on the basis of the data stored in the Evidence System of Contaminated Sites database (Figure 1), which does not include information on remediation projects of the Regions, State Environmental Fund, other ministries and even private entity projects, and therefore is not complete. In the period 2010–2014 remediation of 220 contaminated sites was completed, remediation of another 45 remedial action projects was completed in an unsatisfactory condition (e.g. because of lack of financial resources, unanticipated extent of contamination, newly identified circumstances, etc.). The largest number of remediation projects was completed in 2010. In 2014 remediation was completed on 35 sites and 14 other remedial actions have been completed in an unsatisfactory condition. Despite the undoubted benefits and the large extent of already implemented remedial actions, still a large number (on the order of thous.) of contaminated sites remain in the Czech Republic, where the extent of the risks to the environment and human health is not known, or the risks are so serious that it is essential to pay increased attention to them.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
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[5] In cases of national enterprises where the "Environmental Agreement" was not conclude as part of the privatization project, the buyer received a discount on the purchase price to cover the elimination of contamination. In these case of contaminated sites, the buyer became the successor of the originator of contamination.

Soil and landscape in the European context

KEY MESSAGES →

→ In the context of the EU28 countries, the Czech Republic has a high proportion of arable land in the total area (31.8%), and thus also a high potential for environmental pressures, particularly those concerning water quality, arising from agricultural activities.

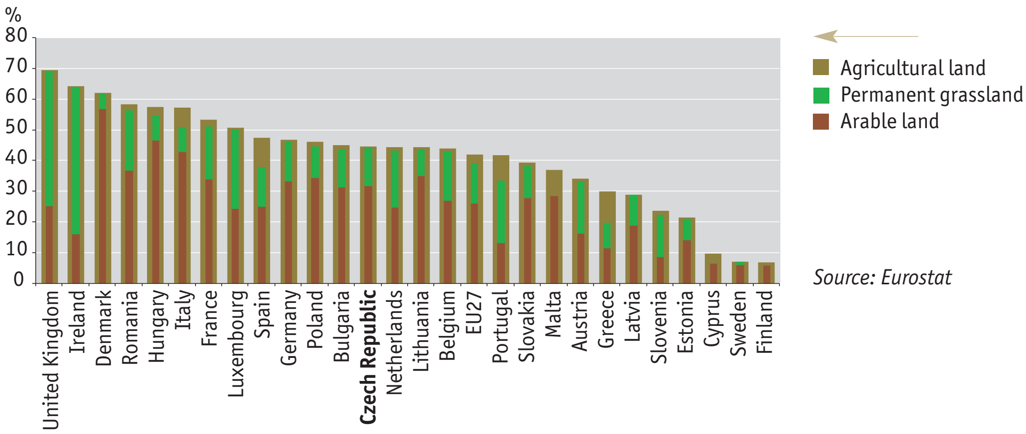
→ The Czech Republic belongs among the most fragmented European countries.

→ According to the latest available model data, approximately 130 mil. ha of the area of EU is threatened by water erosion. Of these, the most vulnerable are the areas exposed to the soil loss exceeding 10 $t.ha^{-1}.year^{-1}$. Wind erosion, which is estimated to threaten approximately 42 mil. ha of land, also represents a serious problem. Although in the European context, the Czech Republic does not rank among the states most threatened by erosion, it also has areas that are heavily threatended by erosion.

→ Old contaminated sites represent a major problem for the quality of soils and waters in many European countries. In 2011, 2.5 mil. of potentially contaminated sites were estimated to exist in selected European countries, of which 47% of the sites were identified to date. Of these ca. 1.2 mil. sites, 29% were identified as in need of remediation and 17% have already been remediated. The average national expenditure for the management of contaminated sites in 2011 amounted to 10.7 EUR per capita.

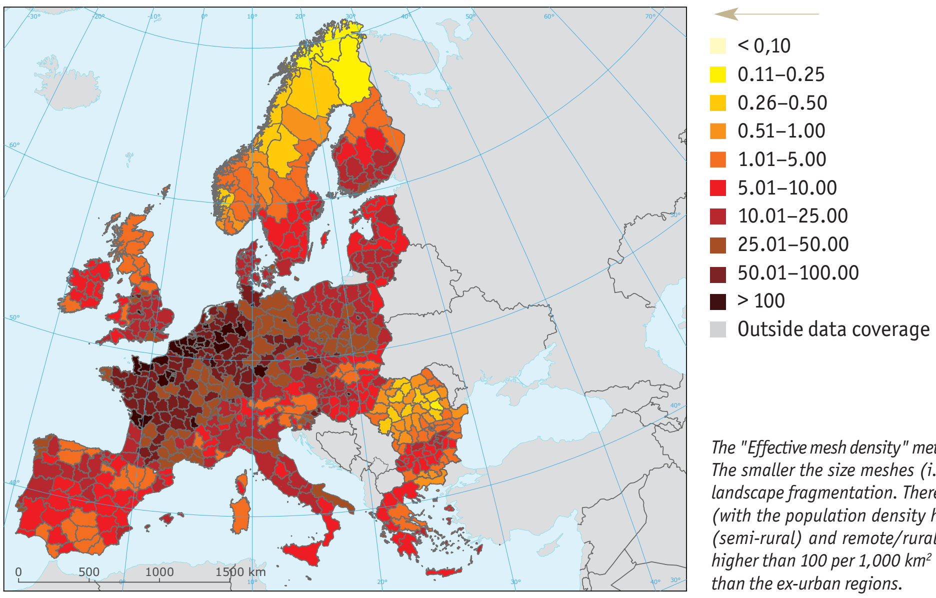
INDICATOR ASSESSMENT

Chart 1 → **Proportion of agricultural land, arable land and permanent grassland in the total territory [%], 2013**



Source: Eurostat

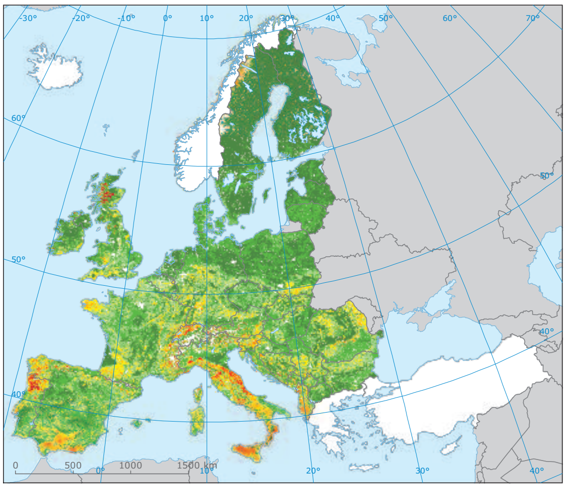
Figure 1 → **Landscape fragmentation by NUTS regions, 2009**



Source: EEA

The "Effective mesh density" method is based on the number of meshes per 1,000 km². The smaller the size meshes (i.e. greater number per 1,000 km²), the higher the landscape fragmentation. There are three categories of regions: heavily urbanized (with the population density higher than 100 inhabitants per 1 km²), ex-urban (semi-rural) and remote/rural. In urbanized regions, the number of meshes is higher than 100 per 1,000 km² and they are in average 40 times more fragmented than the ex-urban regions.

Figure 2 ➜ **Soil erosion by water determined according to the RUSLE model [t.ha^{-1}.year^{-1}], 2006**



- < 0,5
- 0,5–2
- 2–5
- 5–10
- 10–20
- 20–50
- > 50
- No data available
- Outside data coverage

Source: JRC, EEA

Soil erosion by water is determined by a calculation according to the RUSLE model (Revised Universal Soil Loss Equation). The current model includes the slope length (L) and steepness (S) factor, the cover-management factor (C), the stoniness correction factor (St), the support practices factor (P), the rainfall-runoff erosivity factor (R) and the soil erodibility factor (K), which reflects the average precipitation characteristics. On the contrary, it does not include the impact of local precipitation extremes. The presented map therefore provides only an approximate view of soil erosion by water in Europe and specific sites cannot be evaluated in detail on its basis. Currently, data are being validated based on national data and expert assessments.

In 2013, **agricultural land** occupied a total of 41.9% of the EU territory, the share of agricultural land in the total territory of individual countries varies considerably, which is caused by a wide range of natural and socio-economic conditions within the European region. United Kingdom and Ireland have the highest shares of agricultural land (Chart 1), however, most of it is occupied by permanent grassland. On the contrary, Finland and Sweden have a very small share of agricultural land on the total area, since around 75% of the territory of the country is covered by forests. The share of agricultural land in the total land resources of the Czech Republic is slightly above average compared with the EU (44.6% in 2012). Most of the agricultural land in the Czech Republic is occupied by arable land (71.5%) which is intensively cultivated which causes a higher environmental burden than farming on permanent grassland. The share of man-made surfaces (built-up areas, roads, etc.) in the total surface area of the EU is the highest in the Benelux countries (about 12–14%). Water areas occupy the largest share of the total area in the Netherlands (10.6%) and in Finland and Sweden (9.7% and 8.5%).

Landscape Fragmentation in Europe is affected especially by transport infrastructure and by the degree of urbanization; however, the specifics of agricultural land use, which are subject to the geographical conditions of the individual states, also significantly contribute to it. Given the above factors, Luxembourg, Belgium and the Netherlands belong among the most fragmented countries, followed by the Czech Republic with a slightly lower share. On the other hand, Norway, Sweden and Romania are countries with the lowest fragmentation in Europe (Figure 1).

Approximately 130 mil. ha of land in the EU is threatened by **water erosion** according to the latest available model data (Figure 2). The most vulnerable soils are exposed to loss exceeding 10 t.ha^{-1}.year^{-1} (especially in the southern and southeastern Europe, Switzerland and Scotland). Moreover, an increase in the exposure of soil to water erosion due to increased variability of rainfall and due to changes in land use is expected in the future. **Wind erosion** (especially in many areas of Denmark, eastern England, north-west France, northern Germany and eastern Netherlands) also represents a serious problem which is estimated to threaten approximately 42 mil. ha of land, of which 1 mil. ha of land is seriously threatened. In the case of wind erosion, an increase in erosion vulnerability due to more frequent occurrences of droughts are also expected. Although in the European context, the Czech Republic does not rank among the states most threatened by erosion, it has also areas that are heavily threatended by erosion. In the final assessment, it is necessary to take into account the uncertainties stemming from the inaccuracies in the input data of the model and the fact that there were no specific measurements of soil erosion, but erosion vulnerability given by the individual factors.

In 2011, 2,5 mil. of potentially **contaminated sites**[1] were estimated to exist in selected European countries. These sites, where inappropriate manipulation with hazardous substances occurred in the past, pose the risk of soil contamination or groundwater or surface waters contamination.

[1] *Definition of the term in individual states stems from national legislation. In the Czech terminology, these concern old ecological burdens.*

Of these, 47% (1.17 mil. sites) were identified to date[2], of which 29% (342 thous.) were identified as in need of remediation and 17% (58 thous.) have already been remediated. Mining, metal-working industry and petrol stations (from the sector of services) represent the most frequent source of contamination in European countries. The most common contaminants are mineral oils and heavy metals. The average national expenditure of selected European countries for the management of contaminated sites in 2011 amounted to 10.7 EUR per capita, which represents 0.04% of the national GDP. Approximately 81% of the national expenditure was spent on remediation works and 15% on site investigations. The stated values, however, reflect the situation of only 27 of the total polled 39 member states of the EEA. The underlying data are not complete for all states and in some cases set definitions and interpretations for the identification of sites, etc. differ. Most European countries have adopted national, or where appropriate, regional legislation governing the exploration and redevelopment activities in contaminated sites, but so far no European framework document has not been created.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

[2] *Identification of the site or preliminary study has been carried out.*

23/ Quality of agricultural land

KEY QUESTION →

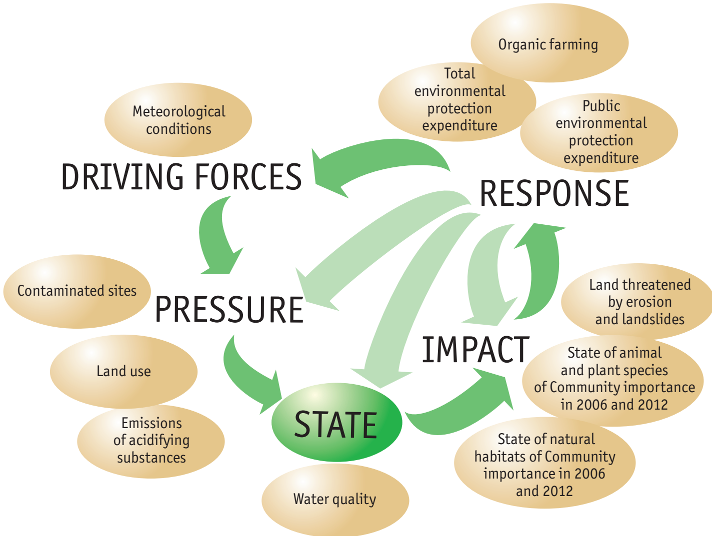
Is the quantity of chemicals used in agriculture decreasing and what is their effect on the quality of soil?

KEY MESSAGES →

In the year 2014, the consumption of plant protection products decreased by 9.1%. A positive growth trend was also confirmed for the consumption of lime substances, which grew by 11.9%, due to the need to reduce the high acidity of agricultural land.

The mineral fertiliser consumption since 2011 has almost stagnated, consumption rose slightly year-to-year by 3.9%. Soil quality and its production capabilities are adversely affected, especially in cases of one-sided application of mineral fertilisers while not including organic fertilisers. The introduction of hazardous substances, or elements through agrochemicals, is insignificant.

For selected hazardous substances, in the long-term, limits values in soil are exceeded, mainly in for the high risk and potentially carcinogenic polycyclic aromatic hydrocarbons chrysene and fluoranthene. A high degree of persistence in soil is exhibited by a group of persistent chlorinated pesticides - especially DDT and DDE resulting therefrom, where limit exceedance was detected in 42.2% of the samples tested for DDT.



OVERALL ASSESSMENT →

Change since 1990	☺
Change since 2000	neutral
Last year-to-year change	☹

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive)
- requirements for management in vulnerable zones (subsidies check in the Cross Compliance system)

3rd Action program of the Nitrates Directive for the period 2012–2016
- set of mandatory measures the farmers must meet in vulnerable areas (measures laid down in Government Decree No. 262/2012 Coll., on the designation of vulnerable zones and action program, and its amendment No. 117/2014 Coll.)

Directive 2009/128/EC of the European Parliament and of the Council establishing a framework for Community action to achieve the sustainable use of pesticides
- conditions for the use of plant protection products

National action plan to decrease the use of pesticides in the Czech Republic
- limiting risks resulting from the use of plant protection products
- optimizing the use of plant protection products without limiting the scope of agricultural production and the quality of plant products

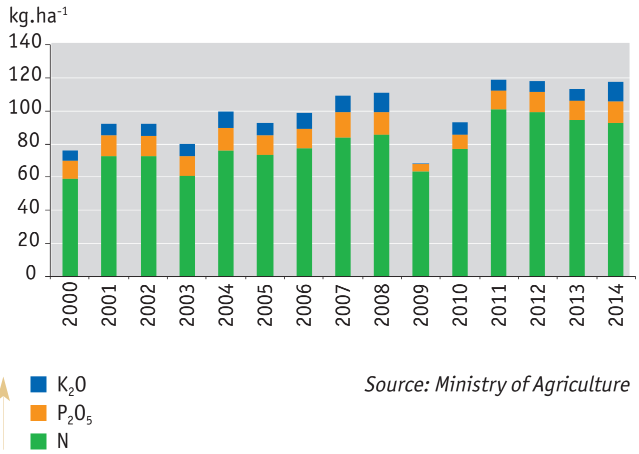
Regulation (EU) No. 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009
- the payment of support includes, among other things, an additional payment per ha for observing agricultural practices which have a beneficial effect on the climate and the environment
- compliance with standards for agricultural and environmental condition established by the Member State and pursuing an aim to prevent soil erosion, maintain soil structure and soil organic matter and to ensure a minimum level of maintenance is one of the requirements conditioning the direct payments under the conditionality provisions

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The use of mineral fertilisers and agrochemicals, and other anthropogenic effects contributes to soil degradation, causing a decline in biodiversity of soil microorganisms, affects the quality of surface water and groundwater, disrupts the balance of ecosystems and interferes with the food chain. The soil also receives risk elements and substances that are not directly related to agricultural activities, but e.g. with industrial production. Many substances in the soil bind to soil particles, and thereby accumulate there over very long time. These substances, often hazardous to the health, may then get into the food via the food chain. Leaching of pollutants (especially nitrates) results in the contamination of drinking water sources.

INDICATOR ASSESSMENT

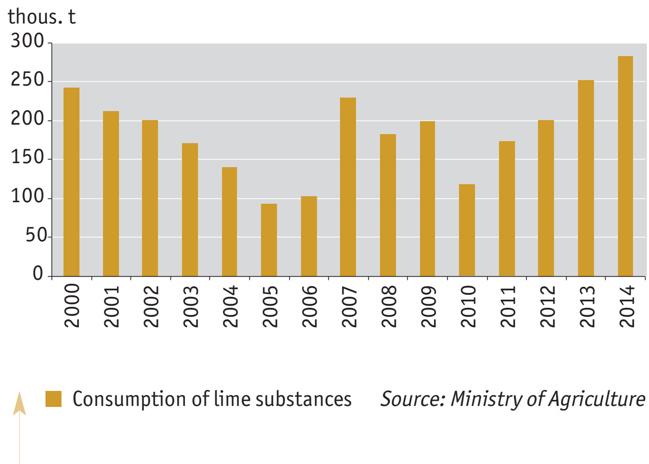
Chart 1 → **Development of the consumption of mineral fertilisers in the Czech Republic [kg of net nutrients.ha⁻¹], 2000–2014**



Source: Ministry of Agriculture

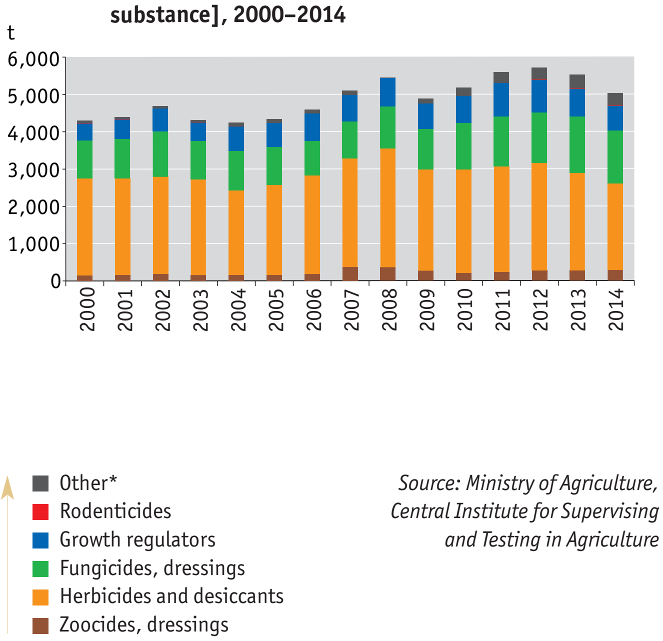
In the year 2014, on the basis of information from the Czech Statistical Office, the area of the so-called "utilized agricultural land" of 3,515 thous. ha was used in the calculation.

Chart 2 → **Development of the consumption of lime substances in the Czech Republic [thous. t], 2000–2014**



Source: Ministry of Agriculture

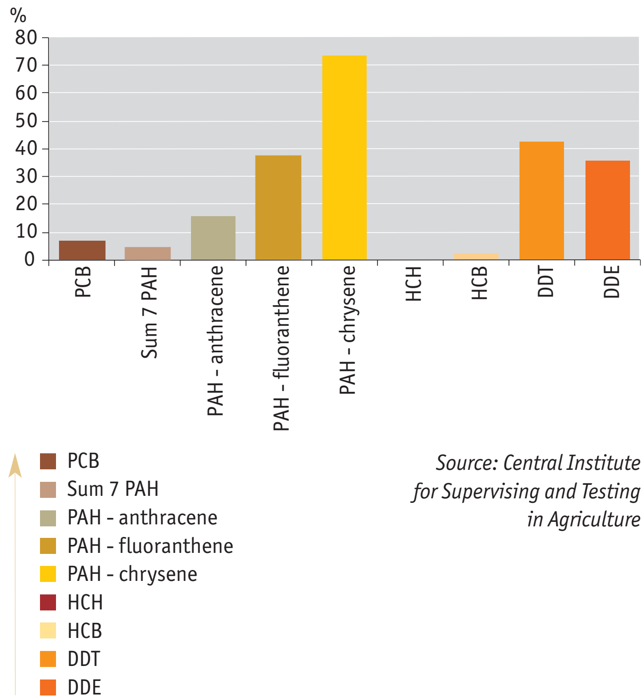
Chart 3 → **Development of consumption of plant protection products in the Czech Republic [t of effective substance], 2000–2014**



Source: Ministry of Agriculture, Central Institute for Supervising and Testing in Agriculture

***Other – auxiliary chemicals, repellents, mineral oils, etc.*

Chart 4 → **Proportion of samples exceeding limit values of risk substances in soil in the Czech Republic [%], 2014**



Source: Central Institute for Supervising and Testing in Agriculture

Results of Basal soil monitoring. Evaluated on the basis of samples from selected 40 monitoring plots and 5 areas in protected areas (The Krkonoše Mountains National Park, Kokořín, Pálava, Bílé Karpaty Mountains, Orlické hory). The limit values for the specified risk substances are established by the Decree No. 13/1994 Coll.

The **application of mineral fertilisers** in 2014 slightly increased year-to-year by 3.9% to 117.6 $kg.ha^{-1}$ of pure nutrients, reaching similar values as in the years 2011 and 2012 (Chart 1). The period since 2000 has seen a growing trend of consumption of mineral fertilisers, albeit with fluctuations in the individual years. Since the year 2011, the development is essentially stagnant. The decreases are mostly caused by adverse weather conditions, especially by long-term drought in several regions of the Czech Republic, the increases by the expected above-average harvest of agricultural crops. Atypical year in the entire period was 2009, with a marked decline, which was caused by high prices especially of phosphate and potassium fertilisers and low market prices of agricultural products. Regarding the composition of mineral fertilisers, nitrogen fertilisers clearly dominate in the long-term and represent more than 75% of total consumption.

The consumption of **organic fertilisers** after the previous decline caused by the decline of livestock production, stagnated in the period after 2004. The total net deposit of nutrients from **manure and organic fertilisers** in 2014 was 68.7 $kg.ha^{-1}$ (27.3 $kg.ha^{-1}$ of N, 15.1 $kg.ha^{-1}$ of P_2O_5 and 26.3 $kg.ha^{-1}$ of K_2O). In the year 2014, however, for the first time, this statistic included input of nutrients from digestate, which is produced by agricultural biogas stations, whose numbers have been increasing in the recent years, and therefore the year-to-year change may not be assessed. In the year 2014, this source contributed to the soil an average of 12.0 $kg.ha^{-1}$ of N, 3.6 $kg.ha^{-1}$ of P_2O_5 and 8.0 $kg.ha^{-1}$ of K_2O. Part of the organic manure is no longer used as fertiliser, but it is delivered to the agricultural biogas stations as feedstock. Nutrients from input manure (solid and liquid manure) make up an estimated half of the nutrients in the resulting digestate. The second half of the nutrients comes from the incoming biomass (mainly maize) and this quantity of nutrients actually increases the supply of nutrients to the soil by organic fertilisation. Generally speaking, the consumption of fertilisers depends mainly on the temperature and precipitation conditions, the intensity of farming and cultivated crops. The limiting factor in fertiliser consumption is then the financial standing of farming entities.

Given the relatively large proportion of acidic agricultural soil (see below), it is expedient to apply **lime substances** to these soils. A positive growth trend in this direction in recent years may be observed and was confirmed in 2014, the annual growth in the consumption of lime substances was 11.9% year-to-year, to 283 thous. t (Figure 2).

The **consumption of plant protection products**, as another input of anthropogenic substances into the soil, is influenced by the actual incidence of diseases and pests in the given crop year, which varies according to the weather conditions during the year. The consumption of plant protection products in 2014 fell by 9.1% to 5,021.7 thous. kg of active ingredient (Chart 3). The largest proportion of the total consumption were herbicides and desiccants (46.2%), followed by fungicides and dressings (28.2%) and growth regulators (13.2%).

In the Czech Republic, the **quality of agricultural land** and its production capabilities are negatively affected especially by cases of improper, one-sided application of mineral fertilisers without the contribution of organic fertilisers. Long-term and one-sided fertilisation, especially when applying nitrogen fertilisation only, may thus greatly reduce soil fertility and induce other negative manifestations such as acidification, reduction of sorption capacity, and decrease of soil biomass. The negative impact of agrochemicals is usually associated with erosion or, more precisely outwash from fields into watercourses and reservoirs. Input of hazardous substances, particularly heavy metals contained in mineral fertilisers (potentially sludge and sediments) or in plant protection products is in the Czech Republic insignificant, because the use of these potentially hazardous substances in the agricultural sector in the Czech Republic is governed by regulatory limits. Soil fertility and the resulting yield may also be influenced by the structure of crops and their rotation. The negative effects are manifested primarily by long-term absence of clovers, i.e. perennial forage crops that increase and stabilize yields of subsequent crops. Land degradation may occur also at local contamination by chemical spills or leakages of contaminated water, by discharge of waste directly into the soil, leaching from contaminated sites, landfills, etc.

In the Czech Republic, within the Agrochemical testing of agricultural soil[1] , a monitoring of selected parameters of soil fertility parameters is conducted, and the effect of fertilisation intensity on soil properties is evaluated. This information is used to guide the use of fertilisers in fertiliser planning. According to the **content of essential available nutrients**, i.e. phosphorus, potassium, magnesium and calcium[2], on the basis on the results of the last monitoring cycle in 2007–2012, fertilisation intensity is recommended: for soils with low nutrient content (8.4% to 24.5% of agricultural land in the Czech Republic) intensive fertilisation, for soils with satisfactory to good nutrient content (51.0% to 69.0% of agricultural land in the Czech Republic) mild fertilisation, and for soils with high to very high nutrient content (21.9% to 24.6% of agricultural land in Czech Republic) no fertilisation. To maintain the achieved production and soil nutrient supply, the annual average dose per ha of land should be from 100 kg to 120 kg N, 30 kg P_2O_5, and 50 kg to 150 kg K_2O.

[1] The sampling takes place at regular six-year cycles (the last complete cycle in 2007–2012). During this period, almost the entire area of agricultural land in the Czech Republic was monitored.

[2] Within Agrochemical testing of agricultural soil nitrogen content is not monitored due to the relatively high variability and dependence on climatic conditions.

Assessing the total consumption of mineral and organic fertilisers in 2014, it can be stated that while the recommendations are complied with for nitrogen and phosphate fertilisers, for potassium fertilisers the current annual application, despite the year-to-year increase, is significantly lower. In the Czech Republic, the average value of **soil reaction of agricultural land** over the period 2008–2013 was 6.0 pH (i.e. slightly acidic). Approximately 33.6% of agricultural land has an acidic soil reaction (i.e. PH 5.5). Given that the other 40.8% of agricultural land has a slightly acidic soil reaction, nearly 75% of agricultural land would require the application of lime substances.

According to the results of **hazardous element content in soil monitoring** (after extraction with aqua regia), over long-term (between 1998–2014), the most problematic is the concentration of arsenic with 4.0% of over limit samples for all soils (i.e. for light, medium and heavy soils), as well cadmium (3.0%), chromium (1.7%) and nickel (1.4%). Still, the agricultural land in the Czech Republic, in terms of heavy metal content, in most cases, is not dangerous for the food chain. According to the monitoring of **hazardous substances in plants**, risk can be identified as low, because in only five samples of agricultural crops for food use (from a total of 85 plant samples), excessive concentration of cadmium was detected.

As part of the **hazardous elements and substances content in soil monitoring** (Basal soil monitoring)[3], inorganic pollutants are monitored, i.e. heavy metals in sediments on agricultural land (e.g. As, Cd, Ni, Pb, Zn and other), as well as persistent organic pollutants (especially the 16 indicator polycyclic aromatic hydrocarbons (16 EPA PAHs), polychlorinated biphenyls (7 congeners of PCBs) and organochlorine pesticides (HCH, HCB, DDT group of substances)). The presence of hazardous elements and substances in soil is not necessarily related to agricultural activity, and if so, it is mainly due to the application of plant protection products, sludge from WWTPs or sediments from water reservoirs and watercourses. The **monitoring of persistent organic pollutants** (Chart 4), shows in particular the long-term excessive content of polycyclic aromatic hydrocarbons (PAHs), chrysene, anthracene and fluoranthene, which are with the exception of anthracene (significant reduction in the number of unsatisfactory samples in 2014), toxicologically high risk chemicals and potentially carcinogenic. Their source is in particular the incomplete combustion of carbon (fossil) fuels. Overall, generally, the median value for the sum of 16 EPA PAHs in the topsoil of arable land in 2014 is one of the lowest values in the monitoring period 2004–2014. The other problematic organic pollutants are from the persistent chlorinated pesticides (OCP) group, dichlorodiphenyltrichloroethane (DDT) and organochlorides resulting therefrom (DDD and DDE in particular). In the Czech Republic, the use of preparations based on DDT is prohibited since 1974, but these substances are characterized by high persistence in soil and thus cause its long-term contamination, with proven carcinogenic impact on humans. Even though after an increase in DDT contents in arable land in 2013, a decrease compared to the value of the previous year occurred in 2014, with DDT limit exceedance in 42.2% of samples (19 out of 45 samples). The limit value for the content of PCB (sum of 7 congeners) in the soil was exceeded in 2014 in three out of 45 soil samples, in the areas of arable land in close proximity to industrial zones.

The danger of hazardous elements and substances lies also in their easy transport to other environments and bioaccumulation (accumulation in living organisms). This is confirmed by the results of monitoring of reservoir and river sediments and sampling and analysis of plants grown on agricultural land. Regarding **reservoir and river sediments**[4], in the period 1995–2014, the largest percentage of samples (total 27%) exceeding the limit values, was recorded again for PAH (50.0% of samples of sediments from village ponds and rivers). High percentage of village pond sediments samples tested for DDT did not comply with the limit values (23.1% of samples). Concerning hazardous substances, the most frequent contaminant is cadmium (total of 17.1% of the samples, village pond sediments 21.0% of samples) and zinc (8.1% of samples).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

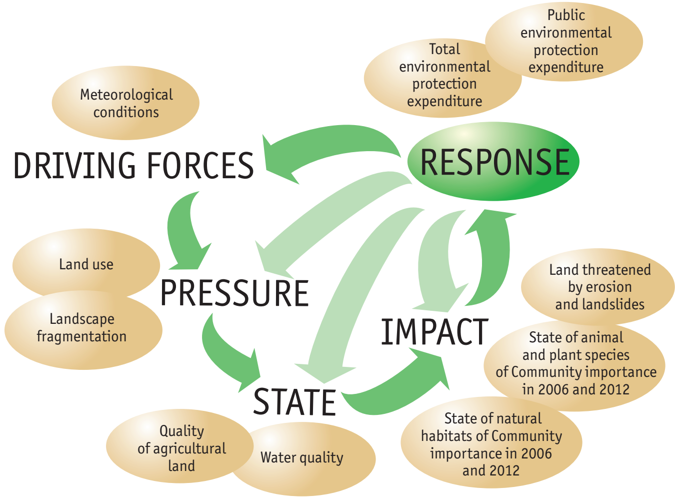
[3] Basal soil monitoring is performed either annually by sampling of plants in order to determine the levels of hazardous elements and substances in crops and by sampling of soil (40 selected plots and five plots in protected areas) focused on the monitoring of selected persistent organic pollutants (POPs) and/or in six-year cycles on all monitoring plots. The last evaluated six-year cycle took place in 2007; analyses of samples collected in 2013 were completed in 2014 and data are currently undergoing processing.

[4] Sediments from rivers and ponds are formed by deposition of eroded solid particles. The average values of the parameters are monitored by the Central Institute for Supervising and Testing in Agriculture in watercourses and in field, village, and forest ponds.

24/ Organic farming

KEY QUESTION →

Is the proportion of agricultural land under organic farming increasing?



KEY MESSAGES →

In the long run, the proportion of agricultural land under organic farming increases. In the Czech Republic, over the last 10 years, the area of agricultural land farmed organically increased almost two times - from 255 thous. ha to 494 thous. ha. In the year 2014, around 11.7% of the total agricultural land was under organic farming. The number of organic farms in the same period increased almost 5 times, from 810 to 3,888 farms. Regarding the land structure under organic farming, in the long-term dominates the most supported permanent grassland (83.6%), which comprises 41.5% of the total area of permanent grassland. Also 18.0% of the total area under permanent crops and 2.3% of arable land are farmed organically.
The organic food market is developing, the number of organic food producers is increasing, as well as the total consumption of organic food.

The increasing trend over the last three years of agricultural land area under organic farming and of the number of organic farms has stopped and stagnates. In the year 2014, there was a slight decrease in arable land area and permanent crops in organic farming.
The organic food market is still underdeveloped despite the growing tendency, the average annual consumption of organic food per capita remains below 200 CZK.

OVERALL ASSESSMENT →

Change since 1990	🙂
Change since 2000	🙂
Last year-to-year change	🙂

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

The Common Agricultural Policy 2014–2020
- measures to protect the environment of the European Union – e.g. crop diversification, maintenance of permanent grassland and the creation of ecologically focused regions

European Action Plan for Organic Food and Farming
- promoting organic farming through rural development, organic food market and strengthening of research

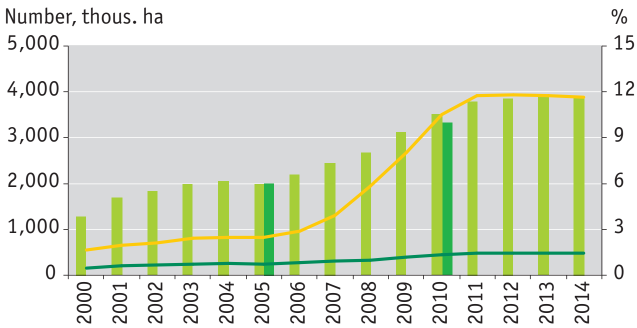
Action Plan of the Czech Republic for the Development of Organic Farming in the years 2011–2015
- achieving 15% proportion of organic farming out of the total area of agricultural land in the Czech Republic by the year 2015
- achieving at least 20% proportion of arable land organically farmed out of the total land area by the year 2015
- achieving 3% proportion of organic food in total food consumption by the year 2015
- increasing the proportion of Czech organic food in the domestic market for organic food to 60% by the year 2015
- increasing the consumption of organic food annually by at least 20% by 2015

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The organic farming is characterized particularly by not burdening the soil by mineral fertilisers or other chemical plant protection products. It has a positive effect on the quality of soil as well as on the quality of produced food, on the health of livestock and indirectly also on the human health. Organic farming contributes significantly to the protection of surface water and groundwater, has a beneficial effect on soil microorganisms, increases biodiversity and ecological stability of the landscape, including the anti-erosion effect. It contributes positively to the sustainable development of rural areas and influences the character of the landscape preserving it by not applying the conventional farming approaches, such as creating large land units with monoculture crops.

INDICATOR ASSESSMENT

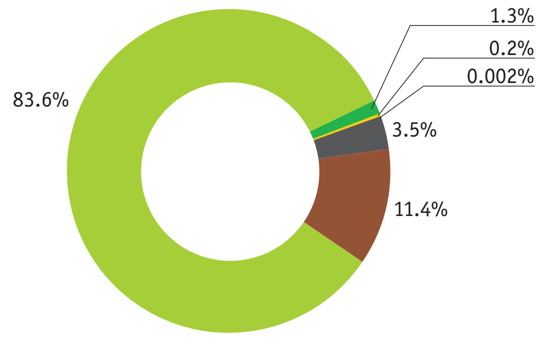
Chart 1 ➔ **Development of organic farming in the Czech Republic [number, thous. ha, %], 2000–2014**



Source: Ministry of Agriculture

- Number of organic farms (left axis)
- Area of agricultural land under organic farming (left axis)
- Proportion of land under organic farming in agricultural land resources (right axis)
- Proportion of land under organic farming in agricultural land resources – 2005 and 2010 targets (right axis)

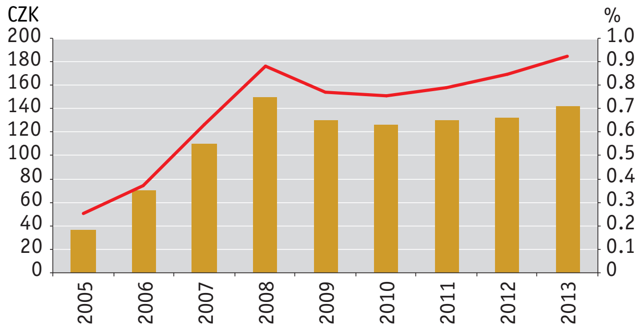
Chart 2 ➔ **Structure of land resources in organic farming in the Czech Republic [%], 2014**



Source: Ministry of Agriculture

- Arable land
- Permanent grassland
- Orchards
- Vineyards
- Hop gardens
- Other areas

Chart 3 ➔ **Consumption of organic food in the Czech Republic [CZK, % of the total food and beverages consumption], 2005–2013**

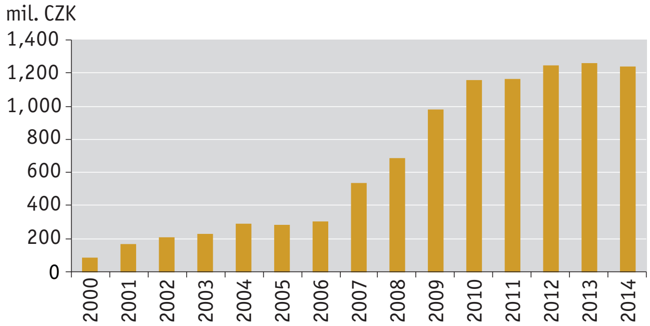


Source: Institute of Agricultural Economics and Information, Ministry of Agriculture

- Consumption per capita per year (left axis)
- Proportion in the total food and beverages consumption (right axis)

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Chart 4 ➔ **Financial resources disbursed within the framework of the agri-environment measure "Organic farming" in the Czech Republic [mil. CZK], 2000–2014**



Source: Ministry of Agriculture

- Disbursed financial resources

The importance of organic farming in the Czech Republic has been growing steadily since the late 1990s, mainly thanks to the European and national support and growing public interest in organic food. Since the year 2000, the Czech Republic increased the **area of agricultural land under organic farming** by almost three times – from 166 thous. ha to 494 thous. ha and during the past 10 years, i.e. almost two times. Thus in the year 2014, approximately 11.7% of the total agricultural land was under organic farming (Chart 1). Since the year 2000, the **number of organic farms**, working in accordance with the established principles of organic farming, increased by nearly 7 times from 563 to 3,888 organic farms in 2014. During the past 10 years, the number of organic farms increased almost 5 times (Figure 1). However, the former remarkable growth rates of both area of agricultural land under organic farming and the number of organic farms over the last three years, were replaced by stagnation with only minimum year-to-year fluctuations. The slowdown of the growth trend is mainly due to the access termination, in effect since 2011, for new applicants to the grant programme "Organic Farming" within the agri-environment measures due to the approaching end of the programming period and the exhaustion of the grant programme absorption capacity, and by the expiration of the five-year commitments from the date of entry of the individual applicants into the grant programme.

Regarding the **land structure under organic farming** (Chart 2), permanent grassland dominates in the long-term, in the year 2014 it accounted for 83.6% (413 thous. ha). The permanent grassland proportion of the total area of organically farmed land, after an initial decline after 2003 (with a share of 90.7%), has not changed significantly for several years, despite the fact that the area of permanent grassland in the same period increased by about 180 thous. ha. The year-to-year increase the proportion of permanent grassland in 2014 amounted to 0.3 percentage points at the expense of a slight decrease in the proportion of organically farmed arable land, orchards, hop gardens and vineyards. The second largest proportion of organically farmed land area is represented by arable land accounting for 11.4% (56 thous. ha), while in the year 2003 this proportion was 7.7%. The rest of organically farmed land area then consists of permanent crops (vineyards, orchards, hop gardens) and other areas. The proportion of permanent crops, despite their marginal representation, in the period 2003–2014 increased significantly from 0.4% to 1.5% (i.e. to 7.7 thous. ha). The main reason is the increase in payments for organic production of fruit and wine, as well as raised awareness about the proper organic quality production.

One of the main reasons for the high proportion of permanent grassland in organic agriculture is the setting of the agri-environmental programmes, which has greatly motivated the farming entities to perform environmental functions primarily on grassland at the expense of arable land. In the support of organic farming on permanent grassland, the fact, that even though permanent grassland is not directly used in the production of organic plant products, but indirectly in the organic livestock production, and has an irreplaceable landscape function, plays an important role. This function consists particularly of influencing the quantity and quality of groundwater and surface water, of anti-erosion and anti-flood effects, and of significant biodiversity protection. The extension, rehabilitation and maintenance of grassland communities in the landscape are one of the opportunities to protect land and soil resources. Organic farming mostly develops in regions with large-scale animal production systems based on permanent grasslands and its importance is generally lower in the regions with dominating intensive farming systems.

If the main mode of organic land use is related to the total area of the respective agricultural land (according to the records of the public land register LPIS), in the year 2014 permanent grassland under organic farming represented 41.5% of the total grassland, permanent crops 18.0% of the total area of permanent crops (i.e. orchards, vineyards, and hop gardens) and organically farmed arable land represented only 2.3% of the total area of arable land in the Czech Republic.

Since the year 2001, the number of **organic food** producers has grown significantly. While in the year 2001 organic food was made by 75 producers, in the year 2014 it was already 506 producers. Maximum was reached in the year 2011, when 646 organic food producers served the market. Following a significant decrease in the number of manufacturing sites, primarily related to the commercial activity changes of the Billa company, which over the years 2012–2013 gradually ended baking organic pastry from frozen semi-finished products in their supermarkets. Czech consumers buy organic food mostly in retail chains, as well as in health food and organic food stores. Direct sales are on the rise, especially through farmers' markets, box-scheme distribution systems, or new farm shops in the big cities. Nevertheless, it should be noted that despite the growing trend (Chart 3), that the Czech organic food market is still underdeveloped – the average annual consumption of organic food in 2013 reached 185 CZK per capita and the proportion of organic food in the total consumption of food and beverages varies between 0.6–0.7%. The main reason is the higher price of organic food, which makes this market highly sensitive to fluctuations in the economic cycle or, more precisely to the economic standing of the households (Chart 3). The main categories of organic food with the largest sales volume in the long-term are "Other processed foods "(especially ready-to-use meals e.g. baby food), followed by "Milk and milk products" and "Fruits and vegetables".

The significant development of organic farming is mainly due to the **European and national subsidies**. The traditional support for organic farmers (subsidies per ha included in the transitional period or in organic farming) is from the year 2007 disbursed within the Rural Development Programme 2007–2013, which is still winding down because of the five-year duration of commitments. Already in the year 2014, grants from the Rural Development Programme 2014–2020 were paid out. In these programmes organic farming is part of the so-called agri-environment measures under Axis II. Since the year 2007, organic farming is also supported by a significant point advantage in evaluating investment projects within the investment measures of the Rural Development Programme, which is part of Axis I and III. In the year 2014, less funds were paid out within the agri-environment programme "Organic Farming" (1.24 bil. CZK) than in 2013, and the total amount of funds paid for organic farming (Chart 4) did not continue to increase. The Ministry of Agriculture also financially supports every year the training of organic farmers and organic food producers, the educational activities are implemented predominantly by non-governmental organisations.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

Agriculture in the European context

KEY MESSAGES ➔

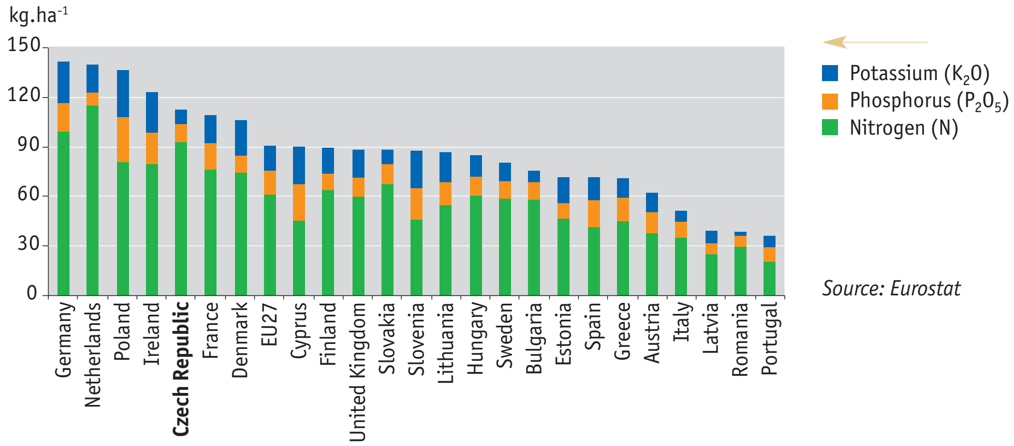
➔ Agriculture represents a significant burden on the quality of surface water and groundwater, due to the excessive application of mineral fertilisers and plant protection products on agricultural land. The consumption of mineral fertilisers in the Czech Republic is above the European average. The consumption of mineral fertilisers in the Czech Republic has not been influenced by the development of organic farming in any major way, unlike some other countries, where there is also a high proportion of agricultural land under organic farming. The consumption or, more precisely, sales of plant protection products in the Czech Republic are average in the European context. Most products sold fall into the category of herbicides.

➔ Organic farming in the EU27 and the Czech Republic, in the long-term, is experiencing a relatively rapid development. The area of agricultural land under organic farming in the years 2003–2012 in the EU27 increased by 69%, in the Czech Republic by 84%. The Czech Republic ranks among countries with the highest proportion of organically farmed land (13.1%), more than 18% proportion is achieved by Austria.

➔ The organic food market in the Czech Republic, compared to other countries in central and eastern Europe is one of the most developed markets with further growth potential. Yet in comparison with developed countries of Europe, the annual consumption of organic food (7 EUR per capita in 2012) is still at a low level. This is due, among other things, to the high cost of organic food in the Czech market. Approximately one third of the total turnover in organic foods in the EU27 is realized in Germany.

INDICATOR ASSESSMENT

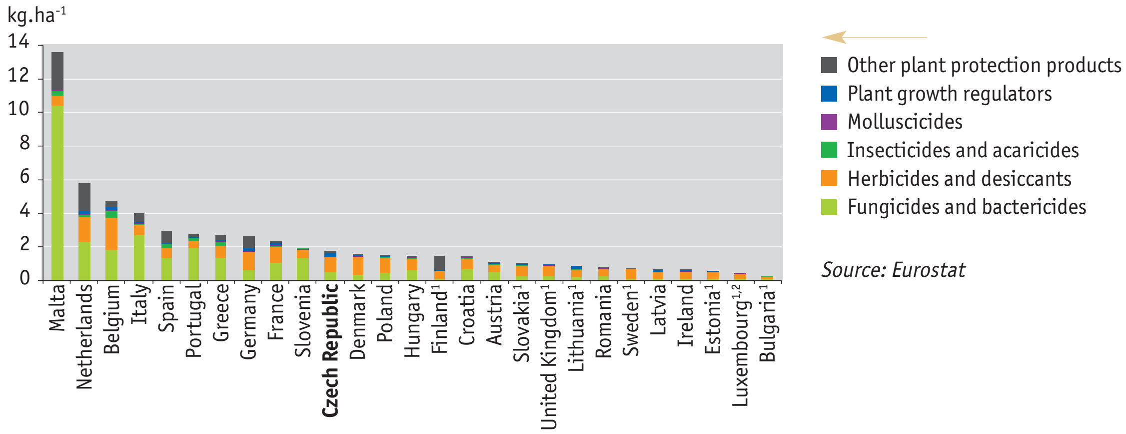
Chart 1 ➔ **Consumption of mineral fertilisers (N, P_2O_5, K_2O) [kg.ha^{-1} of utilized agricultural area], 2013**



Source: Eurostat

Preliminary data.

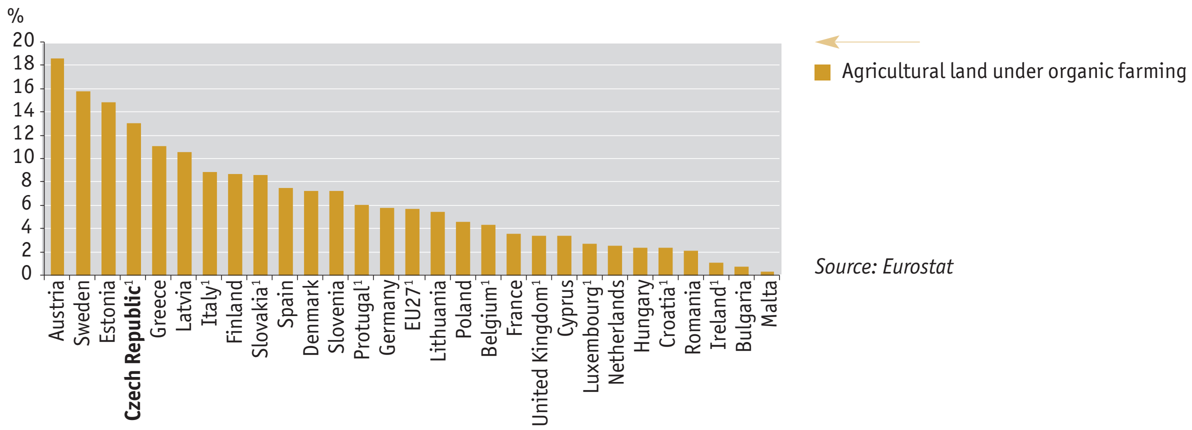
Chart 2 ➔ **Quantity of plant protection products sold [kg.ha^{-1} of utilized agricultural area], 2013**



Source: Eurostat

[1] *Incomplete (individual) data.*
[2] *Data for Luxembourg relate to the year 2012.*

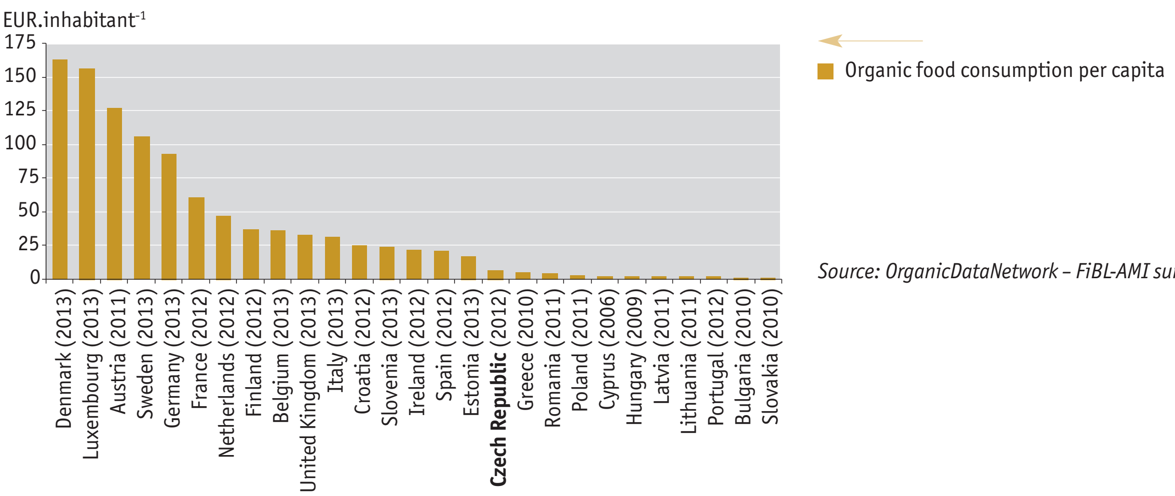
Chart 3 ➜ **Proportion of land under organic farming out of the total area of utilized agricultural land [%], 2012**



Source: Eurostat

[1] *Estimated data*

Chart 4 ➜ **Annual organic food consumption per capita [EUR. inhabitant^{-1}]**



Source: OrganicDataNetwork – FiBL-AMI survey 2015

Data relate to the latest year (in parentheses in the Chart) in the Eurostat database for the given state.

The potential environmental burden caused by agriculture, especially in water pollution is above average in the Czech Republic, compared to other EU27 countries. The reason is the high proportion of arable land in the total agricultural land resources and above average **consumption of mineral fertilisers** compared to the EU27 average (Chart 1). Regarding the development in recent years, it can be stated that the trend in fertiliser consumption in the Czech Republic is similar to the development of the EU27 average. In the Czech Republic as well as in the EU, in the structure of fertilisers´ consumption the application of nitrogen fertilisers clearly prevails. The potassium fertilisers, with the lowest application in the Czech Republic, in the EU27 average slightly prevail over the phosphate fertilisers. The consumption of fertilisers and plant protection products in each country depends mainly on the temperature and precipitation conditions, the intensity of farming, type of crops, and last but not least on the financial possibilities of the farming entities. The development of organic farming in each country also plays its role. However, while in the other states which have, like the Czech Republic, this agricultural sector highly developed, below-average consumption of fertilisers can be observed, in the Czech Republic, likely because of the slower decline of fertiliser use in conventional farming, this correlation does not apply.

Comprehensive international data on **plant protection products** are not available for the consumed chemicals, but for the quantity sold. In this respect, the Czech Republic in the European context achieves average values (Chart2), the majority of the sold products are herbicides. States with a higher volume of products sold per agricultural land area have a higher proportion of fungicides. The highest product sale per ha is reported by Malta, which has the smallest area of cultivated farmland in entire Europe. In the individual states, sales of plant protection products are mainly influenced by the actual incidence of diseases and pests in the given crop year, which varies according to the weather conditions during the year, and is especially driven by air temperature and precipitation.

Organic farming in the EU27 and the Czech Republic, in the long-term, is experiencing a relatively rapid development. In the year 2012, agricultural land under organic farming occupied a total of 10.0 mil. ha, compared to the year 2003 (5.9 mil. ha) representing an increase of 69%, with an average annual increase of about 450 thous. ha. The number of organic farms then, in same period, increased by about 67%. In spite of this, land under organic farming occupies only 5.7% of the total utilized agricultural area in the EU27. In the Czech Republic, however, this figure is two times as high, i.e. 13.1% (Chart 3), placing it among the leading countries in the EU27 (the highest proportion, more than 18% is achieved by Austria). The area of 469 thous. ha in 2012, ranks the Czech Republic as second only to Poland (662 thous. ha) in the group of countries that joined the EU in 2004 and later. The largest area of organically farmed land is in Spain (1.8 mil. ha), Italy (1.2 mil. ha) and France (1.0 mil. ha) representing nearly 40% of agricultural land under organic farming in the EU27. The dynamics of organic farming development of in the Czech Republic is above average, despite a slowdown in 2012. In the Czech Republic, the area of agricultural land under organic farming increased from 2003 to 2012 by about 84% and the number of organic farms increased almost 5 times. This was caused by the market development and the growing demand for organic products after the year 1990, implementation of EU legislation and financial support, which started even before joining the EU.

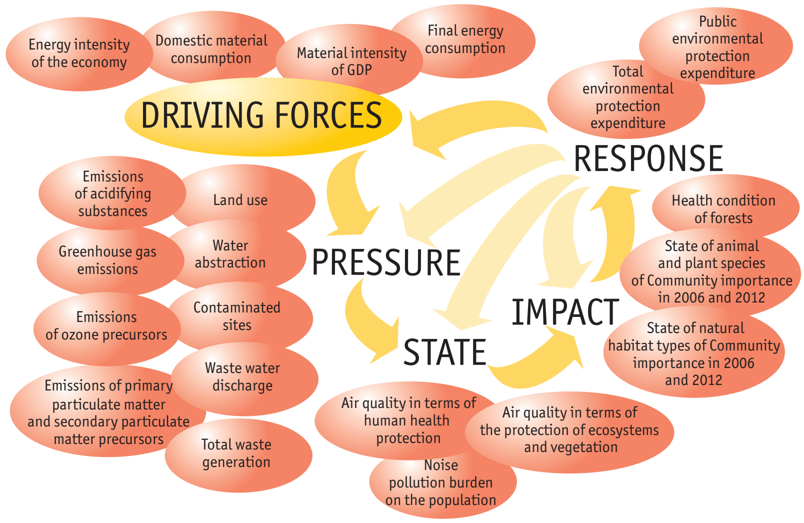
The **organic food market** of the EU27 is represented by the total annual turnover (according to the latest available data from 2009–2013) of approximately 22.2 bil. EUR. The largest organic food market is Germany with about a third of the total turnover in the EU27 for organic food (7.6 bil. EUR in the year 2013), i.e. 100 times greater than turnover in the Czech Republic (70 mil. EUR in 2012). More illustrative is the comparison of the per capita annual consumption of organic food. It was highest in Switzerland (210 EUR.inhabitant^{-1} in the year 2013) and in EU27 in Denmark (163 EUR.inhabitant^{-1} in 2013). The lowest consumer spending on organic food is in central, eastern and southern Europe (Figure 4). The average annual per capita consumption in the Czech Republic in 2012 was only about 7 EUR (less than 200 CZK). The main reason is the higher price of organic food in the Czech Republic, which makes this market highly sensitive to the economic situation of households, and the lack of promotion. In the countries of central and eastern Europe, however, the Czech organic food market is considered to be one of the most developed, with a potential for further growth.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

25/ Industrial production



KEY QUESTION →

What is the environmental impact of industrial production development and of its structural changes?

KEY MESSAGES →

Year-to-year the industrial production in 2014 increased by 5%.

Year-to-year (2012–2013) emissions decreased in the category industrial power for most of the monitored substances, while in the category production processes without fuel combustion the emissions values for most of the substances increased. In the longer-term comparison, however, an overall downward trend of emissions from the industry may be observed.

The energy intensity of the industry in 2013 increased by 11.0%.

OVERALL TREND ASSESSMENT →

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

European Commission Strategy
- definition of specific measures to ensure and improve EU access to raw materials (February 2011)
- fair and sustainable supply of raw materials from the global markets
- foster sustainable supply of raw materials within the EU
- increasing resource efficiency and promoting recycling

European REACH legislation
- exclusion of substances with the worst impact on human health and the environment from circulation and replacing them with less harmful substances

State Environmental Policy of the Czech Republic 2012–2020
- reducing the environmental impact of the industry, in particular emissions of pollutants and greenhouse gases
- reducing energy and material intensity of industry

Raw Material Policy of the Czech Republic
- enhancing resource security of the state
- ensuring the protection of reserved mineral deposits
- using domestic sources of raw materials to the maximum extent possible
- supporting material saving technologies
- economical use of available reserves of brown coal and evaluation of the real potential of domestic resources of brown coal
- ensuring the continuation of domestic uranium production as a super-strategic resources
- continuing the modernization of mining and processing technology
- improving the social perception of the mining industry

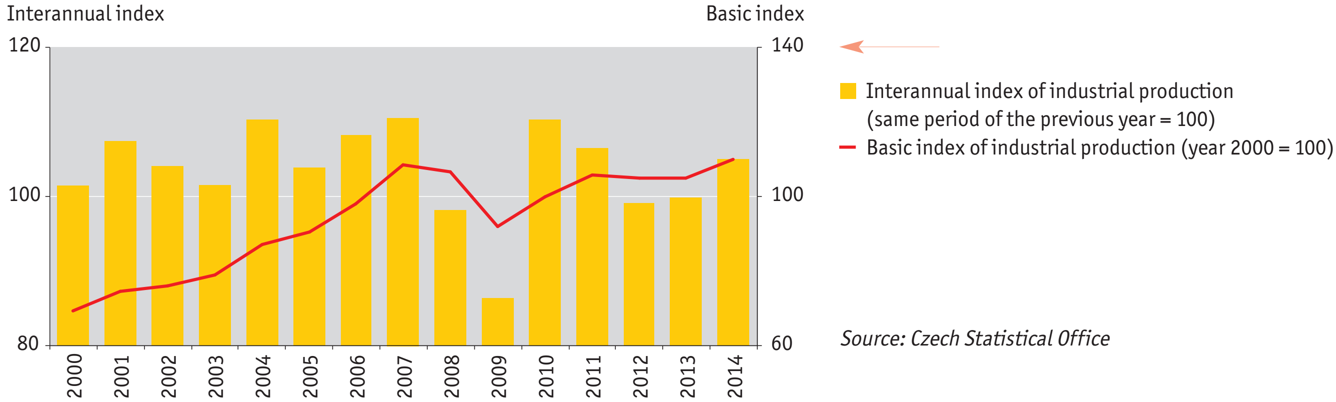
Secondary Raw Material Policy of the Czech Republic
- increasing self-sufficiency in raw material resources of the Czech Republic by substituting primary sources by secondary raw materials
- promoting innovation securing the extraction of raw materials in a quality suitable for further use in industry
- promoting the use of secondary raw materials as an instrument to reduce energy and material demands of the industrial production while eliminating of negative impacts on the environment and human health

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The industrial sector is a consumer of significant quantities of natural resources, including both raw materials used in production and energy resources. The extraction of raw materials disrupts the landscape and affects the quality, quantity and level of groundwater in mining areas. In the vicinity of the mined deposits dust and noise emissions may increase, not only due to the mining itself, but also as an impact of transportation large quantities of material. These factors then affect the surrounding ecosystems and populations. They lead to the death or force migration of animals and plants that do not adapt to these changes. Some mining projects, however, may actually benefit biodiversity because they give rise to valuable ecological niches. In industrial areas, an increased environmental pollution often occurs, especially regarding air pollution, both for commonly monitored substances and for specific substances associated with specific industrial production. The proven results of air quality deterioration are: increased morbidity, allergies, asthma, respiratory and heart problems, cancer, reduced immunity etc. Noise pollution affects the nervous system of humans and animals. The industry also produces, imports and processes chemicals, mixtures and products whose content does not always possess known properties with respect to toxicity for the environment and for humans.

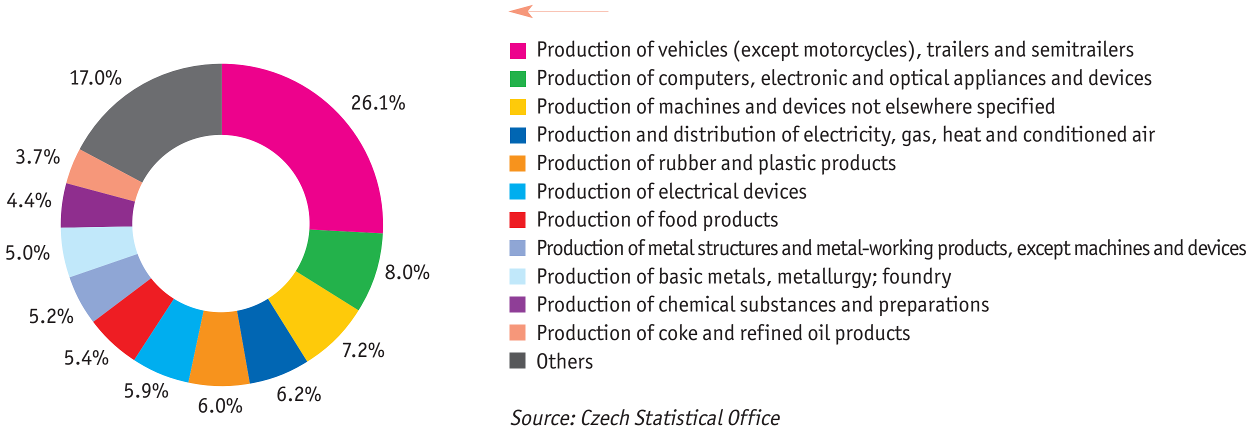
INDICATOR ASSESSMENT

Chart 1 → **Index of industrial production in the Czech Republic, 2000–2014**



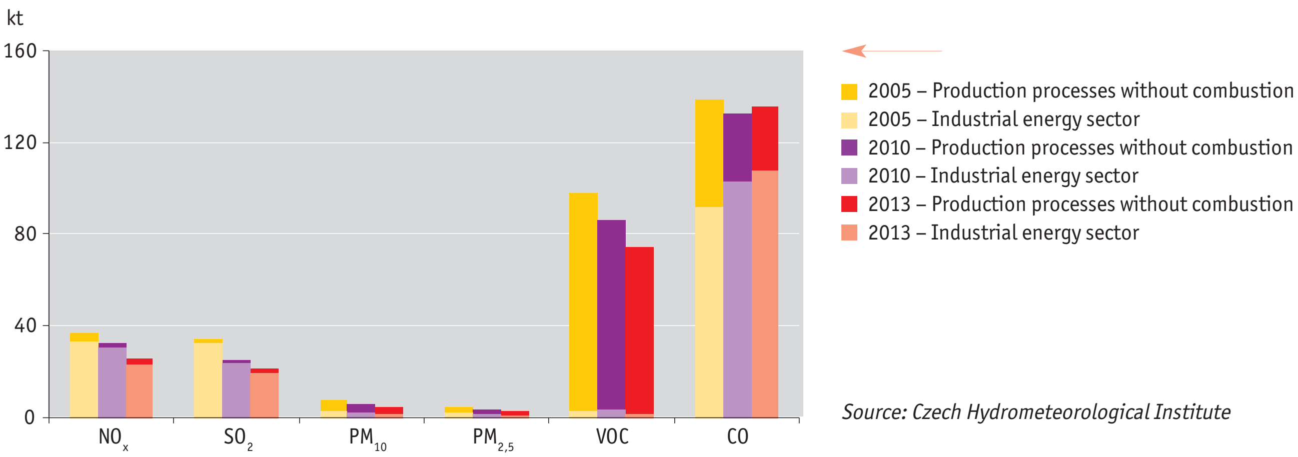
Source: Czech Statistical Office

Chart 2 → **Structure of industrial production in the Czech Republic [%], 2014**



Source: Czech Statistical Office

Chart 3 → **Pollutant emissions from industry in the Czech Republic [kt], 2005, 2010, 2013**



Source: Czech Hydrometeorological Institute

VP – Production processes without combustion, PE – Industrial energy sector
For the years 2000–2013 the emission inventory has been redefined, newly the category of manufacturing processes without combustion includes the use of solvents. Data for the years indicated are already recalculated and included in the chart.

The Czech Republic industry produces a wide range of **pollutant emissions and waste products** while consuming a significant amount of non-renewable natural resources and energy sources. On the other hand, it should be noted that it **generates approximately 30% of the country's GDP**, making it one of the critical elements of the Czech economy. This sector has environmental impact especially in regions where the large industrial enterprises are concentrated (Moravian-Silesian Region, Ústí nad Labem Region, Central Bohemian Region). In the period 2000–2014, the effect of industrial production on the environment decreased.

The industrial production in the Czech Republic in 2014 increased by 5.0% (Chart 1). To the growth of industrial production mostly contributed to the automotive industry, which benefited mainly from the favourable situation on the European car markets. The automotive industry is the most important branch of industry of the Czech Republic, 26.1% of revenue from the manufacturing industry comes from this industry (Chart 2). Also other branches of the manufacturing industry were successful, especially metal fabrication and manufacture of electrical equipment. The rubber and plastics industry, which has long-term stable results, also participated in the economic growth. The construction sector experienced a recovery in the year 2014, which was reflected by the decline of negative values.

The emissions from the industrial sector[1] (Chart 3) can be divided into two groups – emissions from industrial energy (production processes involving fuel combustion) and emissions from industrial processes (production processes without fuel combustion). Among the emissions from industrial energy are in particular the NO_x and SO_2 emissions from fuel combustion, including CO, emissions from iron and steel production. The second group, industrial production processes without combustion of fuel, it is highly specific regarding the type of production. These sources emit a wide range of emissions that affect the environment in different ways. This group includes the category of solvents, which are a significant source of VOC emissions.

In the year 2013, the industrial energy category exhibited a year-to-year decrease in emissions of all monitored substances, with the exception of CO. On the other hand, the category of production processes without fuel combustion exhibited an increase of emissions of monitored substances, except SO_2. Overall, the emissions significantly decreased for SO_2 (by 19%) and NO_x (by 9.4%). A year-to-year increase in emissions occurred in CO (by 5.6%) and $PM_{2.5}$ (by 3.9%). The values of PM_{10} emissions have risen by 0.5% and VOC emissions in the year 2013 remained at the same level as in the previous year. In the longer-term comparison of emissions from the industrial sector (Chart 3), a decreasing trend of emission values is apparent, both from the industrial energy and the production processes. This trend was supported in part by a decline in industrial production in the context of the economic crisis, nevertheless after the economic recovery since 2010, emissions of almost all substances from the industry retained values with a decreasing trend. The exception is CO, whose vast majority comes from iron and steel in industrial sources in Ostrava and Třinec and the increase or decrease of emissions here corresponds with the volume of production.

The energy intensity of the industry in the years 2000–2009 decreased significantly, which has led to a decline in specific environmental load per unit of industrial production. While in 2000 the energy intensity[2] of the industrial sector was 643.2 $MJ.thous.CZK^{-1}$, in the year 2009 it amounted to only 338.7 $MJ.thous.CZK^{-1}$. This trend was favourable for the environment, because higher energy consumption in production means a higher burden for the environment. Since 2010, the energy intensity varies. In the year 2013[3] there was an annual increase of GVA (gross value added) in the industry (by 2.8%), but at the same time the final energy consumption increased in this sector (by 7.9%). Due to the higher growth in energy consumption over the GVA of this sector and the industry overall, the energy intensity increased from 326.5 to 362.6 $MJ.thous.CZK^{-1}$, which corresponds to an increase of 11.0%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

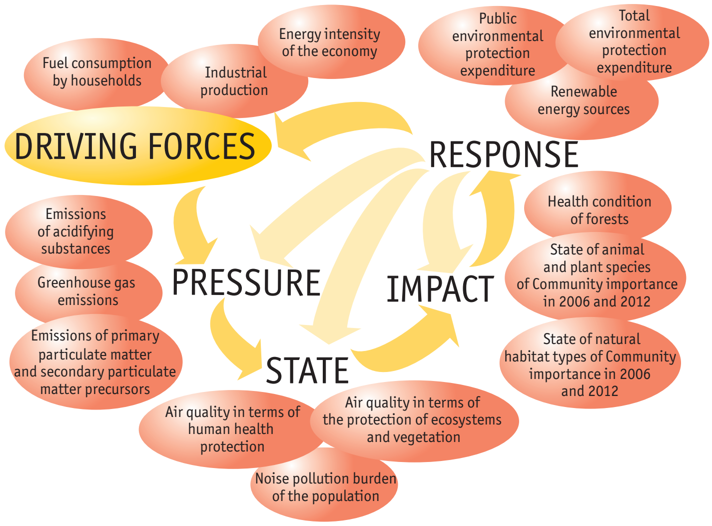
http://indicators.cenia.cz

[1] Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication.

[2] Energy intensity is calculated as the ratio of the final energy consumption in industry and GVA of this sector at constant prices of 2010.

[3] Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication.

26/ Final energy consumption



KEY QUESTION →

Are the final energy consumption[1] and the resulting environmental load from energy production decreasing in the Czech Republic?

KEY MESSAGES →

The final energy consumption in recent years varies, it is affected by the changes in the industry due to the economic recession and its aftermath.

Most of the energy is consumed in industry, households and transportation.

In 2014, year-to-year, the final energy consumption in the Czech Republic decreased by 6.2%.

OVERALL TREND ASSESSMENT →

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Climate-Energy Package
- reducing greenhouse gas emissions
- increasing the share of renewable energy sources in the final energy consumption

Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources
- achievement of the goals for the Czech Republic, i.e. a 13% share of renewable energy sources (RES) in gross final energy consumption in 2020

Directive 2010/30/EU on information concerning the energy consumption
- determine ways to inform end-users about the energy consumption during use
- provide additional information relating to products associated with energy consumption so that end-users are able to select more efficient products

Directive 2010/31/EU on the energy performance of buildings
- decreasing the energy demand of buildings

Directive 2012/27/EU on energy efficiency
- fulfilling the main objective of 20% energy efficiency by the year 2020 and further energy efficiency improvements beyond this date
- fulfilling of the national indicative target established for the Czech Republic at 47.84 PJ (13.29 TWh) of new savings in final energy consumption by the year 2020

Action Plan for Energy Efficiency KOM/2006/545
- framework of policies and measures designed to strengthen the utilization of possibilities related to the estimated savings potential of 20 % of the EU's annual primary energy consumption by 2020.

State Energy Concept of the Czech Republic
- increasing energy efficiency and achievement of energy savings in the economy and households.

Second Plan for Energy Efficiency (national document issued in accordance with the request of Directive 2006/32/EC of the European Parliament and of the Council)
- reduction of the final energy consumption

National Action Plan for Energy from Renewable of the Czech Republic
- 14% share of energy from renewable sources in gross final consumption of energy in 2020
- 10.8% share of energy from renewable sources in gross final consumption in transportation in 2020

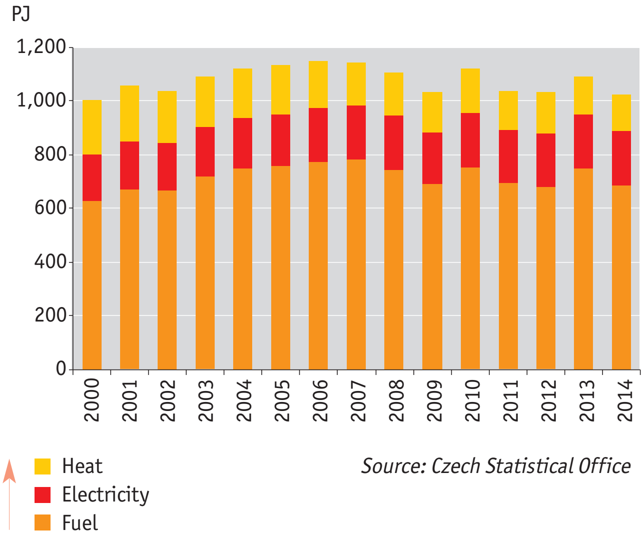
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The actual energy consumption does not have direct impacts on human health and ecosystems, but its production is very significant for the quality of the environment because of the energy mix in the Czech Republic. Given the high proportion of fossil fuels, it is a significant source of emissions of pollutants and greenhouse gases. Due to the production of greenhouse gases into the atmosphere, energy consumption contributes to climate change associated with more frequent occurrence of hydrometeorological extremes – heatwaves, flooding or extreme temperatures, and thus to the overall disruption of the landscape. The production of electricity and heat is also accompanied by air pollution that affects the health of population and pollution stress on ecosystems.

[1] The final energy consumption is consumption determined before entering the appliances in which it is used to produce the final useful effect, but not to produce another formof energy (with the exception of secondary energy sources).

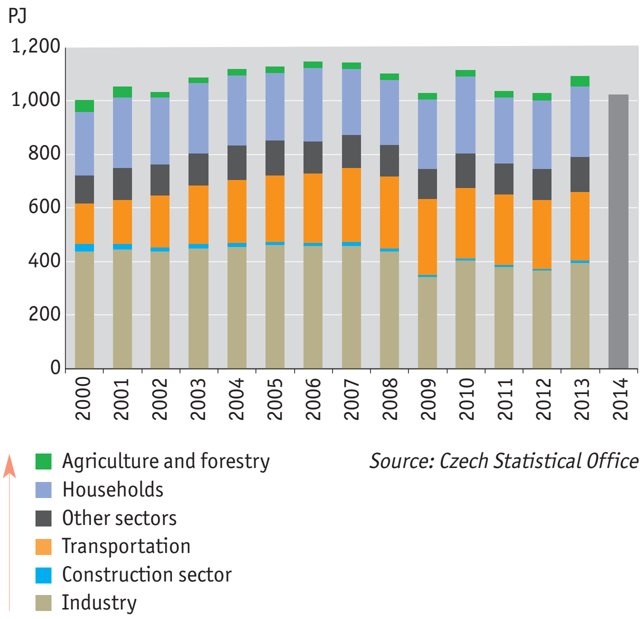
INDICATOR ASSESSMENT

Chart 1 → **Development of final energy consumption by source in the Czech Republic [PJ], 2000–2014**



Source: Czech Statistical Office

Chart 2 → **Development of final energy consumption by sector in the Czech Republic [PJ], 2000–2014**



Source: Czech Statistical Office

The energy consumption is influenced by many factors. In the **agricultural sector** the main driver of the decrease in consumption is the effort to increase energy efficiency as well as productivity improvements. Changes in energy intensity in the **service sector** are the result of balancing conflicting driving forces: on the one hand increases the efficiency of energy use, on the other the growing demand for the convenience of people hampers energy consumption reduction in the service sector. Higher energy consumption then occurs especially in connection with the installation of air conditioning and the trend of increased use of information and communication technologies. The factors leading to reducing the energy intensity of service the sector may include building insulation and the installation of efficient equipment for heating, air conditioning and lighting. Also in **transportation**, several conflicting factors play against each other. The proportion of individual automobile transportation in transportation energy consumption is consistently high, but energy consumption per unit of transportation performance declines. A similar situation is in road transportation where the transport performance increases. In the **household** sector, power consumption increases on the one hand because of the increasing living area of households, increased comfort level, greater number of electrical appliances, but on the other hand are the improvements in the efficiency of heating, heat insulation of existing buildings and new construction already built in low energy standard.

The **final energy consumption** (Chart 1) fluctuates in the monitored period since the year 2000. In the years 2002 to 2006 it had an increasing trend, but since the year 2007 the situation reversed and the consumption started to decline or fluctuate. Due to the fact that energy consumption is by the largest part affected by the industry, it is clear that also here the economic crisis in 2008–2009 was reflected. In the year 2010 a temporary increase in total energy consumption was recorded, together with the growth of the industrial production and the national economy as a whole, with subsequent fluctuations corresponding to the fluctuations in the economy. In the year 2014, the Czech Republic exhibits an annual reduction in final energy consumption by 6.2%.

The highest final energy consumption (Chart 2) is exhibited by the **industrial sector** (36.3% in 2013[2]). The high consumption in this sector is determined by the energy intensity of industrial production and the high share of industry in GDP. The industrial sector accounts for approximately 30% of the country's GDP. Energy consumption in this area fluctuated year-to-year, however, since 2006, due to the restructuring of industries and through the efforts to implement more energy efficient technologies it decreased every year. Significant year-to-year decline in consumption occurred in 2009 as a result of the economic crisis that severely affected the sector. In 2010, however, the energy consumption reflected the economic growth and year-to-year (2009–2010) the consumption increased by 18.0%. Between the years

[2] *Data for the single sectors for the year 2014 are not due to the methodology of their reporting, available at the time of publication*

2011 and 2012 a slight downward trend continues, but the last observed year-to-year consumption (2012–2013) in this sector increased by 7.9%. The most energy-intensive industries within the manufacturing industry are: manufacturing of metals including metallurgic processing, manufacture of non-metallic mineral products, chemical and petrochemical industries.

Another important sector in energy consumption are the Czech **households**, which in 2013 consumed 24.4% of energy. The development of energy consumption in households is significantly affected by the character of the heating seasons. Year-to-year (2012–2013) an increase in household consumption by 3.7% was recorded, which is largely due to the colder heating season in the year 2013 compared to the more moderate one in 2012. The **transportation sector** contributed 23.6% to the total consumption in the year 2013. Only in this industry the long-term energy consumption increased, but since 2010 the trend is rather volatile. In the year-to-year comparison 2012–2013 the energy consumption in transportation retained the same values.

The **potential for energy savings** is in the industry, services and households: the efficiency of steam power plants and heating plants, application of best available techniques, using energy efficient appliances, construction of energy efficient buildings, using high-quality insulation materials, elaboration of energy audits, labelling for electrical

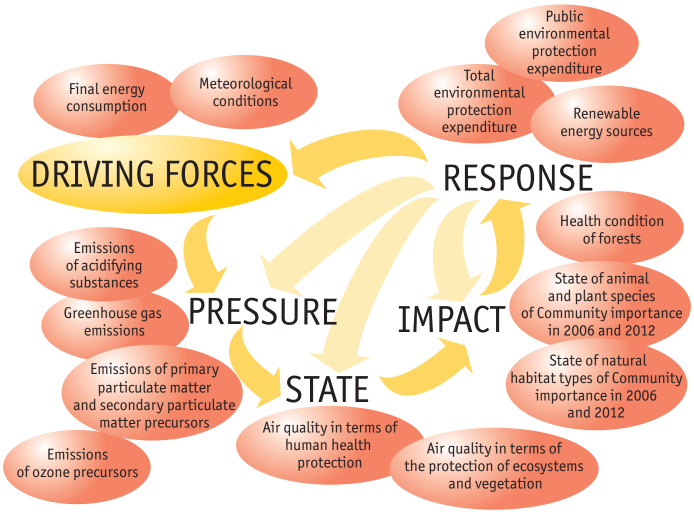
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

27/ Fuel consumption by households

KEY QUESTION

What progress has been made in reducing the negative impacts of local heating units on air quality and public health?



KEY MESSAGES

Since the year 2011, the ways of heating homes in the Czech Republic have not changed much. District heat supply (36.0%) and heating by natural gas (34.5%) still prevail.

In 2013[1] a total of 37.9% of PM_{10} emissions originated from the local heating units. The character of household heating has considerable influence on the environment and, in particular, on the health of inhabitants.

OVERALL TREND ASSESSMENT

Change since 1990	🙂
Change since 2000	🙂
Last year-to-year change	😐

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

State Energy Concept of the Czech Republic
- increasing energy efficiency and energy savings in the economy and households

State Environmental Policy of the Czech Republic 2012–2020
- improve air quality in areas where pollution limits are exceeded
- maintaining air quality in areas where pollution limits are not exceeded

Act no. 261/2007 Coll., on the stabilization of public budgets
- impose a consumer tax on fuels producing more pollutants into the air (coal approximately 10%, electricity for heating 1%)

Act no. 201/2012 Coll., air protection act
- minimum emission requirements for combustion sources using solid fuels with a rated thermal input up to and including 300 kW, serving as a heat source for hot water central heating systems

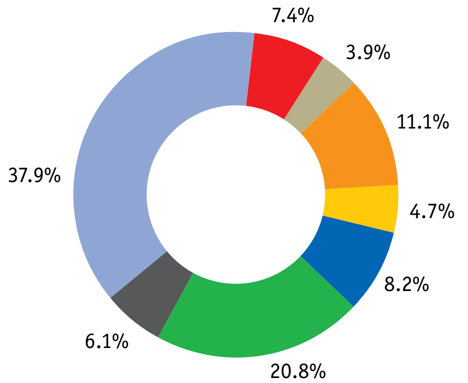
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The way of heating homes and the given type of fuel affects the air quality in the immediate environment where people reside. The emissions from local sources, compared with emissions from large combustion facilities, are very dangerous because they are discharged directly into the environment, where the population resides. From the chimneys of low buildings, mostly family houses, the pollutants are not dispersed enough in the air and people breathe these substances directly. Due to the incomplete combustion of solid fuels polyaromatic hydrocarbons are produced, which have carcinogenic effects and contribute also to a number of other health problems of the population: increase in morbidity especially in the form of higher incidence of cardiovascular disease, respiratory problems or respiratory diseases.

[1] *Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

Chart 1 → **PM_{10} emissions from different economic sectors in the Czech Republic [%], 2013**

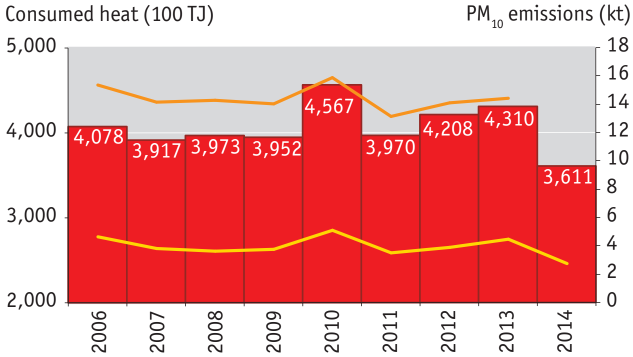


- Public energy sector
- Production processes with combustion
- Transportation
- Other emissions from fuels
- Production processes without combustion
- Agriculture
- Other sectors
- Household heatingtí

Source: Czech Hydrometeorological Institute

Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication.

Chart 2 → **Comparison of heating season with consumed heat and PM_{10} emissions from household heating in the Czech Republic [number of day-degrees, 100 TJ, kt], 2006–2014 (2013)**

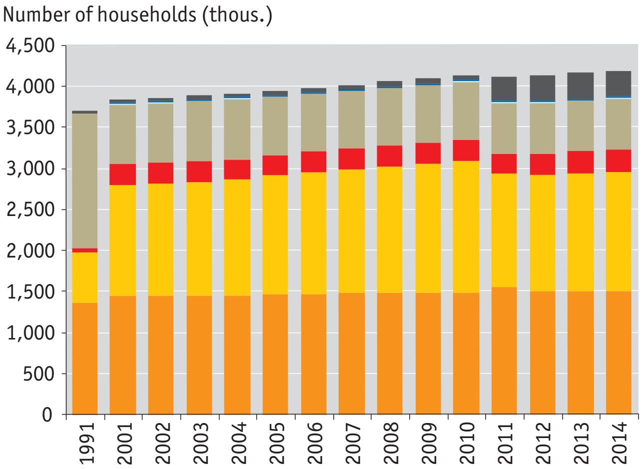


- Number of day-degrees (left axis)
- Consumed heat (left axis)
- PM_{10} emissions (right axis)

Source: Czech Hydrometeorological Institute

The PM_{10} emission data for the year 2014 are not due to the methodology of their reporting, available at the time of publication.

Chart 3 → **Prevailing heating methods used in permanently inhabited households in the Czech Republic [thous. of households], 1991, 2001–2014**

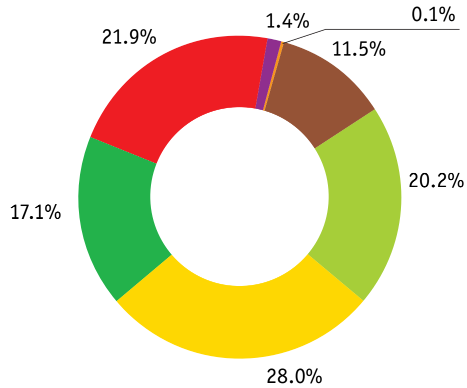


- Others
- Propane-butane
- Liquid fuels
- Solid fuels
- Electricity
- Natural gas
- District heating

Source: Czech Hydrometeorological Institute

Data from the population and housing censuses in 1991, 2001 and 2011 have been included in the calculation.

Chart 4 → **Fuel and energy consumption by households (the proportion of energy contained in individual sources) in the Czech Republic [%], 2014**



- Coal, coke and coal briquettes
- Biomass
- Natural gas
- District heating
- Electricity
- Heat of the environment (heat pumps, solar collectors)
- Liquid fossil fuels

Source: Ministry of Industry and Trade

Home heating is affected by many factors. The **intensity of heating** in dwellings is largely dependent on the outside temperature in the area. Another also important factor is the habits of the population, e.g. thermal comfort level and ventilation intensity are highly individual and significantly impact the heat consumption for heating. Due to the rising energy prices and the fact that the vast majority of energy is consumed in homes for heating and hot water, the households replace their appliances by more efficient ones with higher efficiency, the houses and apartments are being insulated.

The **way of heating used** and the type of fuel have a significant influence on the environment, because especially in small local heating units, they significantly influence the emissions and consequently the air quality. The type of fuel used for the heating of households is driven by its availability, price, and convenience of use.

In the year 2013[1] the local heating units generated 14.4 kt of PM_{10} emissions, representing 37.9% of the total emissions of these pollutants (Chart 1). The emissions of pollutants from home heating and concurrently the quantity of heat used in heating systems are fundamentally impacted by the meteorological conditions (Chart 2). In the year 2013 the total PM_{10} emissions the Czech Republic amounted to 38.0 kt. Compared to 2012, the quantity of PM_{10} emissions from household heating increased by 2.1%. This increase is mainly influenced by the characteristics of the heating season[2], which was colder in 2013 than in the previous year (Chart 2).

Data on the prevailing **way of heating households** are derived from the Population, houses and apartment census which is conducted once every 10 years. In the meantime, the data are estimated and supplemented by the number of newly completed apartments and from the documentation of distributors of fuels and energy. Since the year 2001, the way of heating homes in the Czech Republic has not changed much, heating by solid fuels decreases only slightly. This category includes mainly coal and wood, however their exact proportion is not clearly specified, wood and coal are often burned together and their proportion depends upon their current availability and price. The chart illustrates the predominant way of heating, however, the households often use more types of fuel for heating. Usual are the combinations of gas/wood and coal/wood, in the rural areas for example gas or electricity/coal/wood. In the past decade, the sector of local home heating shows an increase in the share of burning firewood, while the consumption of other fossil fuels is declining. This trend has resulted in an increase in emissions of PM_{10}, $PM_{2.5}$ and B(a)P. This increase was reflected in the emission balance significantly with a delay in the year 2011, when the emission model incorporated the results of the census in 2011.

In the year 2014 the population of the Czech Republic used for home heating most frequently the **central (district) heat supply** (36.0% of households) and natural gas (34.5% of households). Solid fuels heated 15.1% of households (see Chart 3). In these households, combustion sources are installed, where according to expert estimates, approximately one third consists of old combustion installations with slow burn design with the worst parameters regarding formation of emissions.

In the year 2014, the total quantity of energy supplied to households was approximately 246.2 PJ, which is 10.4% less than in 2013. This development is related to the length of the heating season and temperatures in the winter season. The heating season of 2014 was very mild, and therefore less demanding in terms of heating (Chart 2).

The mild heating season was also reflected in the **year-to-year change in fuel consumption in households** where there was a decrease in the consumption of almost all types of fuels (natural gas by 18.3%, coal, coke and coal briquettes by 16.5%, district heating by 15.4%, biomass by 2.0%). The exception are the heat pumps and solar panels. In recent years these systems have seen development and heat production growing every year. Solar panels are often used for hot water heating or for preheating of water. The year-to-year increase for this category was 8.7%. The electricity consumption in households increased slightly by 1.3%. This category, however, includes all electricity consumed in households, including use for purposes other than heating (Chart 4).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

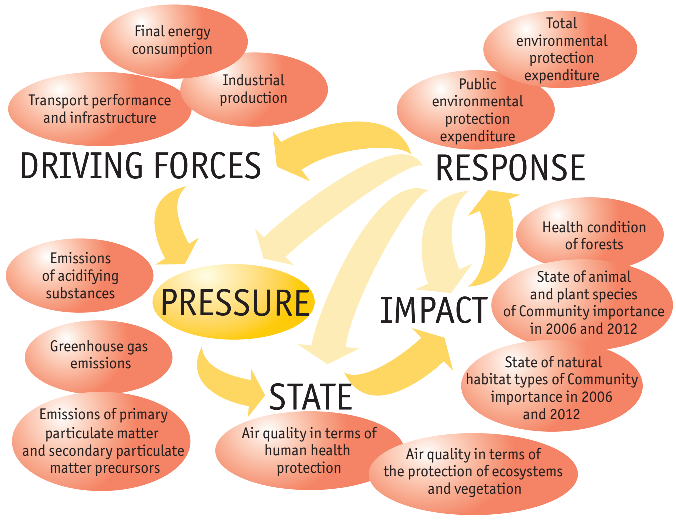
[1] Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication

[2] The heating season is characterized by the unit day-degree, which is the product of the number of heating days and the average difference between indoor and outdoor temperature. The day-degree thus illustrates how cold or warm it was for a certain period of time and the quantity of energy needed to heat the buildings.

28/ Energy intensity of the economy

KEY QUESTION →

Are the efforts to reduce energy intensity of the Czech Republic economy successful?



KEY MESSAGES →

The energy intensity of the Czech economy has been decreasing in the long-term. In the year 2014, its value has decreased by 4.1% due to a slight increase in GDP and the reduction in consumption of primary energy sources (PES).

In the structure of PES (Primary Energy Sources) the consumption of solid and liquid fuels decreases. On the contrary, the consumption of gaseous fuels, production of energy in nuclear power plants and also the quantity of energy obtained from renewable sources slightly increases.

OVERALL TREND ASSESSMENT →

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Climate-Energy Package (2008)
- reducing greenhouse gas emissions by at least 20% by 2020, compared to 1990
- increasing energy efficiency, the target is to reduce energy consumption by 20% by 2020

State Energy Concept of the Czech Republic
- increasing energy efficiency and energy savings in the economy and households

State Environmental Policy of the Czech Republic 2012–2020
- protection and sensible use of resources
- support for energy savings
- ensuring commitment to energy efficiency by 2020 (for the EU as a whole it is 20%)

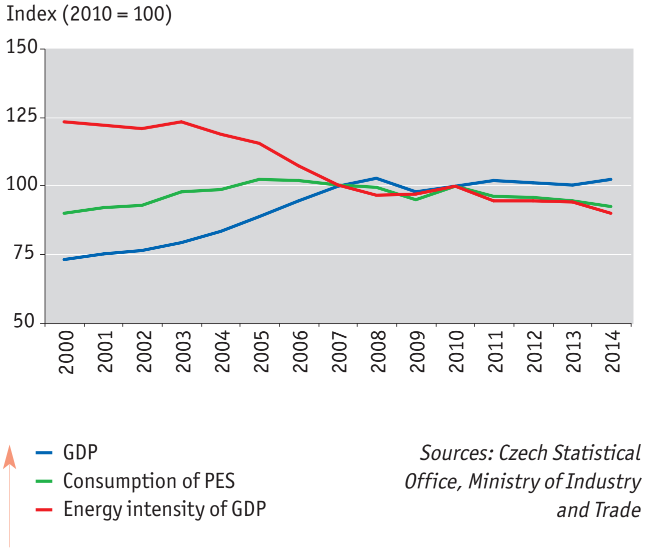
Second Plan for Energy Efficiency
- achieving of the national indicative target of 9% energy savings over the period 2008–2016 at 20,309 GWh

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The impacts of high energy demands on human health and ecosystems are considerable. Production of large amounts of energy causes higher emissions of pollutants and greenhouse gases. Due to the greenhouse gas emissions the energy sector contributes to climate change, the emissions of pollutants contribute to air pollution load on ecosystems, e.g. defoliating of forests and overall disruption of the landscape. Air pollution also affects the higher incidence of respiratory problems, allergies, asthma and decreased immunity and increased mortality in general.

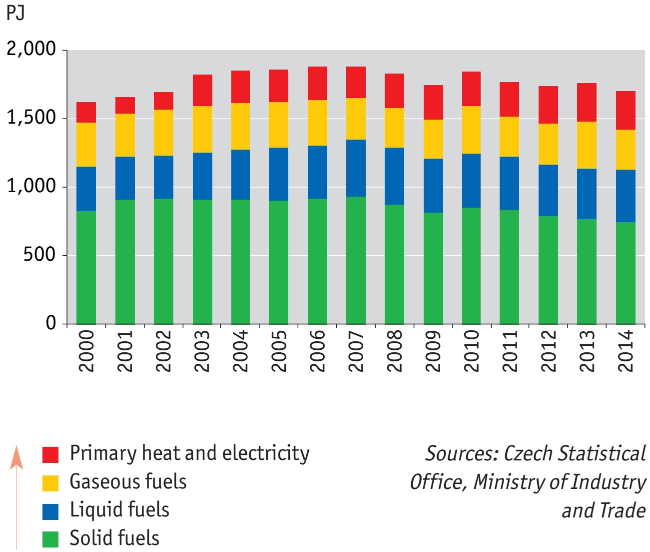
INDICATOR ASSESSMENT

Chart 1 → **Energy intensity of Czech Republic GDP [index, 2010 = 100], 2000–2014**



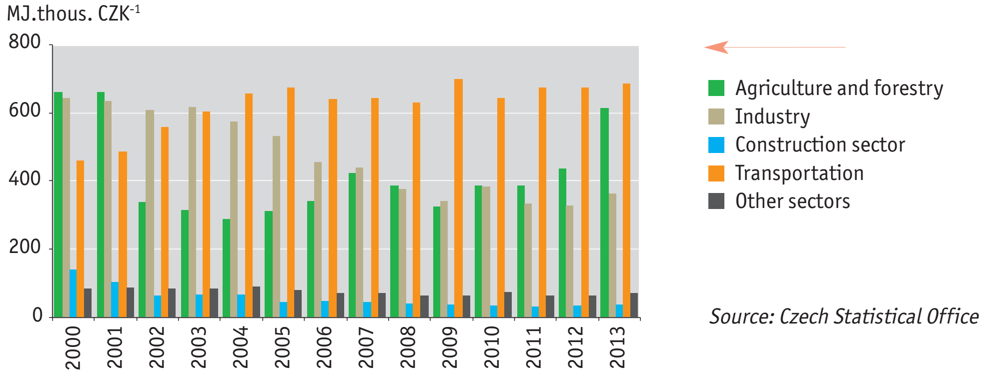
Sources: Czech Statistical Office, Ministry of Industry and Trade

Chart 2 → **Development of primary energy sources consumption in the Czech Republic [PJ], 2000–2014**



Sources: Czech Statistical Office, Ministry of Industry and Trade

Chart 3 → **Development of energy intensity by sectors, expressed as the proportion of the sector final energy consumption and its gross added value in the Czech Republic [MJ.thous. CZK^{-1}], 2000–2013**



Source: Czech Statistical Office

Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication

The **energy intensity of the economy** is the amount of energy needed to ensure the given volume of production, transportation or services. Therefore, it measures the energy consumption of the economy and its overall energy efficiency. It corresponds to the demand that the given industry sector has on energy consumption. The aim of reducing the energy consumption is to ensure the highest production output and quality of services at the lowest possible demand for energy resources.

The energy intensity of the Czech Republic economy is decreasing in the long-term (Chart 1). Generally, this is due to the economic growth (GDP), but also due to the reduction in energy consumption, thus the increasing proportion of production with less energy demand, owing to the use of best available techniques, building insulation, or savings in the households. This relative indicator is obtained as a ratio of energy consumption and the GDP value; therefore, it decreases if the change in energy consumption is lower than the GDP change in the reference period (ideally, if the GDP grows and energy consumption decreases, so-called absolute decoupling). In addition to energy intensity we also encounter the term **energy efficiency.** This is defined as a measure of efficiency of energy processes defined by the ratio between total energy outputs and inputs of the same process, expressed in percentage. In practice, energy efficiency increases by getting the same output with less energy.

In the years 2008–2009 the financial and economic crisis affected also the **energy intensity of the economy**. GDP fell and so did the consumption of primary energy sources, but in such proportions that the energy intensity of the economy after the long decline again temporarily increased. Since the year 2010, however, the energy intensity of the economy continues the ongoing slight decline or stagnation. In the year 2014, the consumption of PES slightly decreased (by 2.2%), but at the same time there was an increase in gross domestic product (by 2.0%). The energy intensity of the economy thus amounted to 426.7 GJ.thous. CZK^{-1} (constant prices of base year 2010) and year-to-year it has thus decreased by 4.1%. On the longer-term scale since the year 2000 (when the value reached 583.5 GJ.thous. CZK^{-1}), there was an overall decrease in energy intensity by 26.9%.

The **PES consumption in the Czech Republic** (Chart 2) steadily grew since the year 2000 (year-to-year by 0.7 to 5.6%). In 2007, PES consumption reached the highest value for the entire monitored period since the year 2000, namely 1,879.5 PJ. Then the trend reversed and the PES consumption began to decline with slight fluctuations. In the year 2014 there was an annual decrease in the consumption of primary energy sources by 3.6% and its value reached, according to the preliminary estimates, 1,699.8 PJ.

Since the year 2007, in the **structure of PES** (Chart 2) a decrease in consumption of solid and liquid fuels can be recorded. By contrast, the consumption of gaseous fuels and energy production in nuclear power plants slightly increases (category primary heat and electricity. The quantity of energy derived from renewable sources also increases. The proportion of fossil fuels in consumption still predominates, in the year 2014 it represented 43.9% of total primary energy sources. Liquid fuels had a share of 22.7%, gaseous fuels 17.4%, and primary heat and electricity (representing the electricity produced by nuclear and hydro power plants, excluding pumped storage power plants, wind and photovoltaic power plants plus the balance of imports and exports of electricity) had 16.1%.

The **increased proportion of primary heat and electricity** in the total consumption is a result of the increase of production in nuclear power plants, significant financial support for renewables and efficiency of the European trading scheme EU ETS, which leads to better utilization of emission-free sources (i.e. those that do not produce greenhouse gases).

The transportation, agriculture and industry sectors represent the most significant proportion in the **economy energy intensity by sectors** (Chart 3). While the energy intensity of industry in the period from 2000 continuously decreases, for **transportation** a rather growing trend was recorded which, however, in the last 3 years, rather fluctuates. The energy intensity of traffic, compared to other sectors, is high because it includes also private automobile transportation, which does not create any added value to the national economy. In the year 2013, an annual increase in transportation energy intensity by 1.9%, was recorded, for industry growth of 11.0% and for agriculture 40.8% (which was partly caused by the increase of the agricultural sector production).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

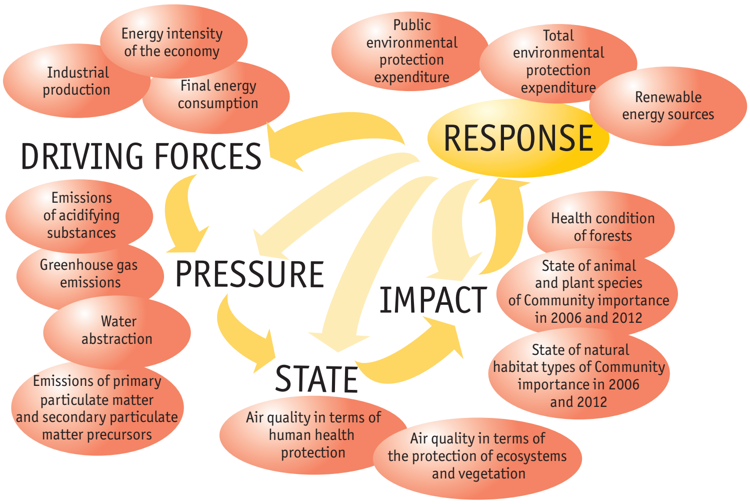
CENIA, key environmental indicators

http://indicators.cenia.cz

29/ Electricity and heat generation

KEY QUESTION →

What is the structure and quantity of generated energy and what impacts does the electricity and heat generation have on the environment in the Czech Republic?



KEY MESSAGES →

The production of electricity in steam power plants burning particularly brown coal gradually decreases, on the other hand the importance of nuclear energy and renewable energy increase.

The total electricity production has fluctuated since 2000, but in the long-term it has a slightly increasing trend. Year-to-year, in 2013–2014 the production of electricity decreased by 1.1%.

The export nature of the electricity market persists. The summary balance of foreign trade in the year 2014 amounted to 18.9% export from the total quantity of electricity produced in the Czech Republic. In relation to the environment, the prevailing export is a negative phenomenon, because the emissions from the production of exported electricity are generated on the territory of the Czech Republic.

The energy dependence of the Czech Republic in 2014 amounted to 30.2%, the highest value in the period since the year 2000.

OVERALL TREND ASSESSMENT →

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Climate-Energy Package (2008)
- reducing greenhouse gas emissions by at least 20% by the year 2020 compared to the year 1990
- increasing energy efficiency by 20% by the year 2020 compared to the year 1990
- increasing the proportion of renewable sources in the final energy consumption

Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (is a part of the package)
- 13% proportion of RES in final energy consumption by the year 2020

State Environmental Policy of the Czech Republic 2012–2020
- reducing greenhouse gas emissions
- securing 13% proportion of energy from renewable sources in gross final energy consumption by the year 2020
- ensuring commitment to increase energy efficiency by the year 2020

State Energy Concept of the Czech Republic
- maximizing energy utilization
- maximizing efficiency in acquiring and converting energy sources
- supporting the production of electricity and heat from renewable energy sources
- optimizing the use of indigenous energy resources
- optimizing the use of nuclear energy
- minimizing of environmentally harmful emissions and greenhouse gas emissions
- optimizing of backup energy sources

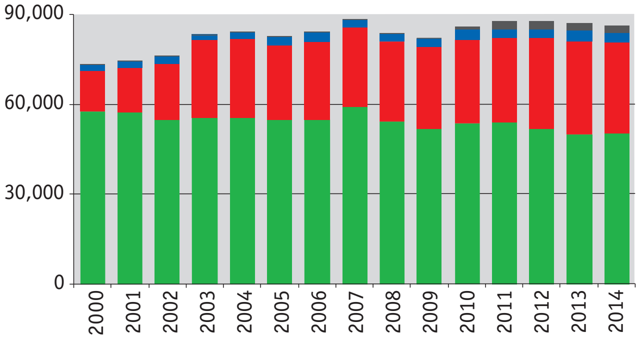
Concept of raw material and energy security of the Czech Republic (under preparation)
- should be in accordance with the new State Energy Concept and State Raw Materials Policy of the Czech Republic

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The composition and the proportion of individual energy sources is closely related to the production of pollutant emissions and greenhouse gases that are discharged into the atmosphere. The energy sector contributes to climate change by the production of greenhouse gas emissions, the emissions of pollutants contribute to air pollution load on ecosystems and among other things, to the defoliation of forests. Air pollution causes a higher incidence of respiratory problems, allergies, asthma and increased morbidity and mortality in general. The predominance of the use of local fossil fuels guarantees a certain degree of energy security and independence. However, strip mining of brown coal causes disruption of the landscape and the related reduction in the attractiveness of the territory. Many facilities for the production of energy also occupy large areas of land, affecting the microclimate in the given area or interfering with the aesthetic and recreational function of the landscape.

INDICATOR ASSESSMENT

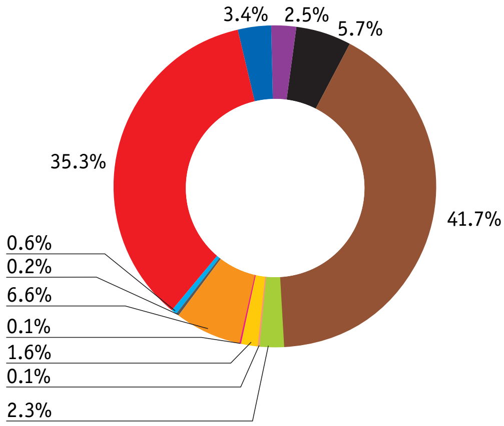
Chart 1 → **Electricity generation by power plant type in the Czech Republic [GWh], 2000–2014**



- Others
- Water
- Nuclear
- Steam

Source: Energy Regulatory Office

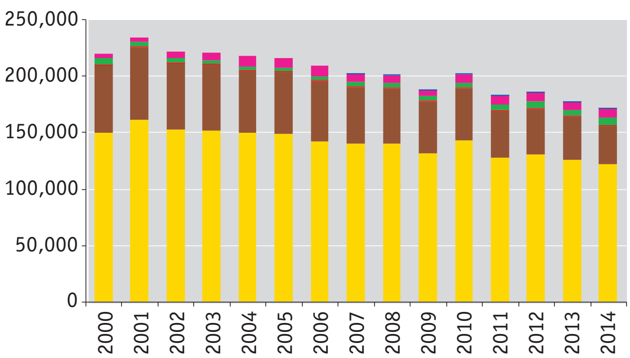
Chart 2 → **Electricity generation by fuel type in the Czech Republic [%], 2014**



- Black coal
- Brown coal
- Biomass
- Oil
- Natural gas
- Landfill gas
- Other gases
- Unspecified fuel
- Wind power stations
- Nuclear power stations
- Hydroelectric power stations
- Solar power plants

Source: Energy Regulatory Office

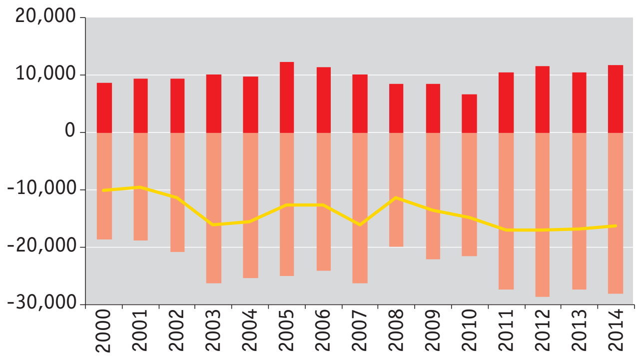
Chart 3 → **Net heat production by source in the Czech Republic [TJ], 2000–2014**



- Heat pumps
- Chemical and waste heat
- Steam-gas cycle and cogeneration
- Nuclear power stations
- Heating stations
- Power stations and heating plants

Source: Czech Statistical Office

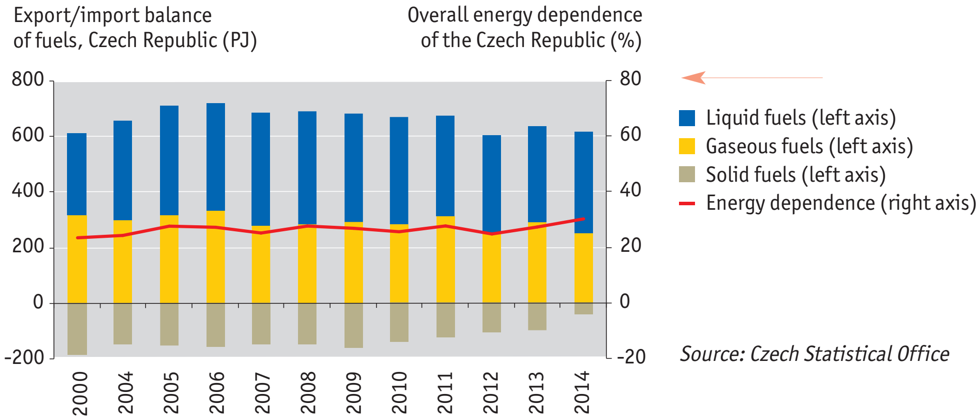
Chart 4 → **Electricity imports and exports in/from the Czech Republic [GWh], 2000–2014**



- Import
- Export
- Balance

Source: Czech Statistical Office

Chart 5 ➔ **Export/import balance of single fuels, overall energy dependence of the Czech Republic [PJ, %], 2000, 2004–2014**



Source: Czech Statistical Office

The electricity and heat production depends on the demand, and thus on consumption. The demand for electricity is particularly influenced by the industrial sector (32% share of the annual electricity consumption in the year 2014) and households (25% of the annual consumption in the year 2014). Another important factor is the foreign trade, because part of the electricity produced in the Czech Republic is exported abroad. Sources from which electricity and heat are produced and the extent of their use (energy mix), however, are influenced by many factors. Among the most important ones are the sources of energy raw materials and their availability and the energy policy, which sets the conditions for their use.

The **total electricity production** has fluctuated since 2000, the year-to-year changes are in the order of units of percent, nevertheless, in the long-term it has a slightly rising trend (Chart 1). Compared to the year 2000, 17.2% more electricity was produced in the year 2014. The reason is the increase in domestic consumption and the higher value of balance of electricity exports to other countries. Year-to-year, from 2013 to 2014 there was a decrease in production of electricity by 1.1%. In the year 2014 total 86,113 GWh of electricity was produced (in the year 2013 it was 87,065 GWh).

The **energy mix of the Czech Republic** (Chart 2) is constantly changing over time. Historically, the production of electricity in the Czech Republic was based especially on the combustion of brown and black coal, whose reserves were always sufficient. In 1985 the Dukovany nuclear power plant was put into operation, in the year 2002 the nuclear power plant Temelín. Some steam power plants burning particularly brown coal were shut down, some were modernized. In this situation, enters the development of renewable energy sources, which by each year attain a larger share in the overall energy mix.

In the year 2014, the **steam power plants** burning particularly brown coal produced 50,228 GWh of electricity, which represents 58.3% of the total electricity production. The second place was occupied by the nuclear power plants with a share of 35.2% (30,325 GWh). In the year 2014 hydroelectric power plants (including pumped storage) produced 2,961 GWh of electricity, which represents a decrease of 21.3%. This decrease was due to the extremely low level in watercourses. For the other sources the year-to-year changes were negligible.

The **proportion of electricity produced from renewable energy sources** in the monitored period annually increased until the year 2013. In the year 2014 this trend stopped and there was a slight decline in electricity production from these sources by 0.8%. In the year 2014 total 9,170 GWh of electricity was produced from RES, which corresponds, as in the previous year evaluated, to a 10.6% share of the total electricity produced in the Czech Republic.

Heat generation (Chart 3) is in the Czech Republic is provided mainly by power plants and heating plants (70.9%) and by heating stations[1] (19.6%). Other sources producing heat have a share only on the order of several units of percent. The heat from these facilities (Chart 3) is intended for sale and for use in own business in public and facility energy systems, however, it is not intended to produce electricity. Due to the fact that this heat is also intended for industrial use, a noticeable decline in the year 2008 is visible in the total quantity of heat energy produced, caused by the economic crisis and declining industrial production.

[1] *Power station with heat supply – a source intended primarily for electricity generation but it is also a source of heat in the partial heat production operational mode. Heating plant – a source in which both heat and electricity produced in a common circuit. Heating station – a separately standing heat source for a residential area or an industrial plant, supplying heat to the heating network or possibly to heat transfer substations.*

The **total quantity of heat produced** is decreasing, which is a proof of the savings and efficient use of thermal energy and efforts to reduce heat consumption in the industrial and public sectors. Net heat production in 2014 totalled 171,731 TJ, a slight year-to-year decrease of 3.3%.

The public and industrial energy sector is a major producer of **emissions of pollutants and greenhouse gases** into the atmosphere. In the year 2013[2], the energy sector contributed 79.0% to total emissions of SO_2, to 47.8%, of NO_x emissions, 52.3% of CO_2 emissions, and 11.3% of PM_{10} emissions. Compared to last year, there was a decrease of the main monitored emissions: for NO_x by 12.2%, for SO_2 by 10.1%, for CO_2 by 5.2%, and for PM_{10} by 3.8% of.

As in the previous years, the export nature of the electricity market persists. In the year 2014, total of 28.1 TWh of electricity (Chart 4) was exported abroad, i.e. 32.7% of the total quantity produced. On the other hand, 11.8 TWh of electricity were imported. The balance of exports and imports amounts to –16.3 TWh, which is 18.9% of the total quantity of electricity produced in the Czech Republic (86,113 GWh). In relation to the environment, the predominant export of electricity is rather negative, because the emissions from energy consumed abroad actually originate in the Czech Republic.

The **energy dependence** shows the extent to which an economy relies on imports to meet its energy needs. The Czech Republic is currently almost self-sufficient only in electricity production from coal, because the raw materials are mined on its territory. Electricity and coal are also exported (Chart 4 and Chart 5). Regarding coal, this relates solely to black coal, which is due to its quality used in metallurgy. Concurrently the Czech Republic imports black coal. The Czech Republic is dependent on **supplies of oil and natural gas**. Although the Czech Republic is the only EU country producing uranium, it imports nuclear fuel for nuclear power plants, because the Czech Republic does not own the technology to produce nuclear fuel. More than two-thirds of oil and gas and all nuclear fuel are purchased by the Czech Republic from Russia. The total energy dependence of the Czech Republic in 2014 amounted to 30.2%, the highest value in the period from the year 2000 (Chart 5).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

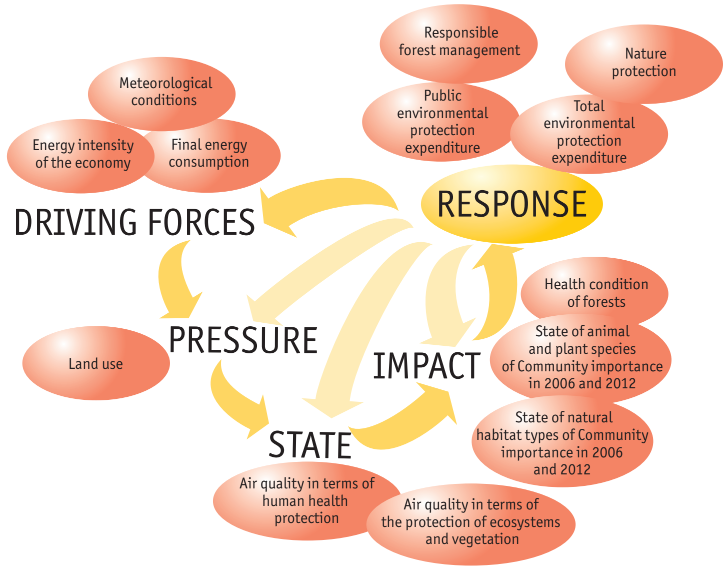
http://indicators.cenia.cz

[2] Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication

30/ Renewable energy sources

KEY QUESTION →

What is the structure and proportion of renewable energy sources in the total energy sources?



KEY MESSAGES →

Electricity generation from the supported sources, i.e. biomass and biogas has increased by 19.2%, respectively by 11.9%.

The shift towards greater diversity of energy sources is beneficial in terms of greater energy independence and security.

Heat production from renewable energy sources is mostly influenced by the use of wood for heating households.

The slight year-to-year decrease in electricity production from renewable energy sources in the Czech Republic was caused by the decrease of hydropower production due to low water levels in water courses.

OVERALL TREND ASSESSMENT →

Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Climate-Energy Package (2008)
- reducing greenhouse gas emissions by at least 20% by the year 2020 compared to the year 1990
- increasing energy efficiency by 20% by the year 2020 compared to the year 1990
- increasing the share of renewables in final energy consumption

Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (is a part of the package)
- 13% share of RES in final energy consumption by the year 2020

State Environmental Policy of the Czech Republic 2012–2020
- reducing greenhouse gas emissions
- securing a 13% share of energy from renewable sources in gross final energy consumption by the year 2020
- securing a 10% share of renewable energy in transportation by the year 2020

State Energy Concept of the Czech Republic
- supporting the production of electricity and heat from renewable energy sources
- developing of cost-effective renewable energy sources with the gradual removal of financial support for new sources
- effective support of the state in RES access to distribution network
- streamlining the permitting processes
- promotion of technological development and pilot projects and concurrently the public acceptability of RES development in order to achieve the proportion of RES in electricity production over 15%

National Action Plan for Energy from Renewable Sources of the Czech Republic
- achieve a 14% share of energy from renewable sources in gross final consumption of energy in the year 2020

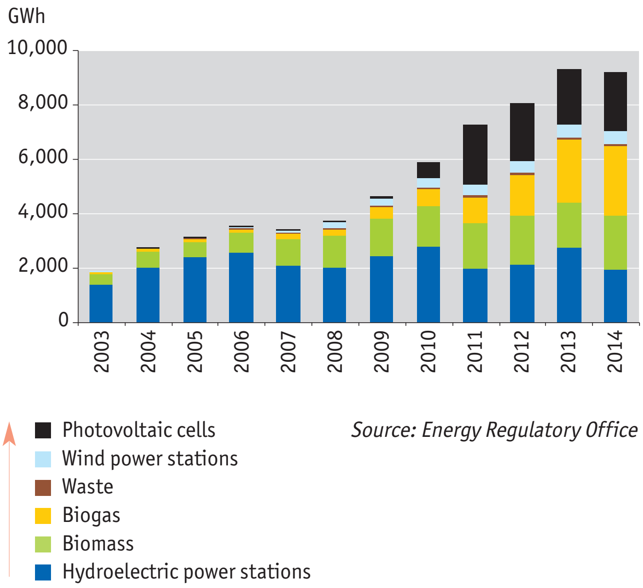
Action Plan for Biomass in the Czech Republic for the period 2012–2020
- determining of the potential of various types of biomass in the Czech Republic for efficient energy use while respecting food self-sufficiency of the Czech Republic

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The renewable energy sources are generally perceived as a clean and environmentally friendly, because they do not pollute the surroundings as much as the fossil fuel sources during their operation. They are also beneficial in terms of climate change mitigation, mainly they do not contribute to greenhouse gas emissions. Additionally, they are also significant in terms of energy self-sufficiency of the Czech Republic, they do not directly stress the environment and their effects on human health are, compared with other energy sources, minimal. The often discussed issue of renewable resources is the occupation of arable land by photovoltaic plants or the disruption of the aesthetic values of the landscape by wind turbines.

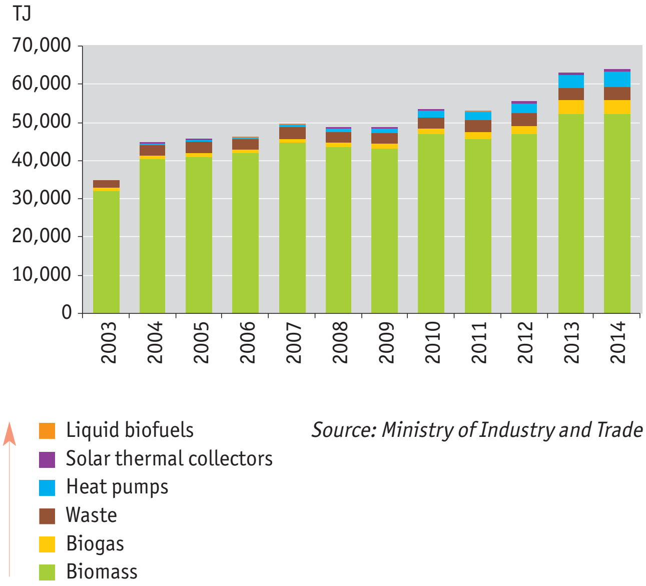
INDICATOR ASSESSMENT

Chart 1 ➔ **Electricity generation from RES in the Czech Republic [GWh], 2003–2014**



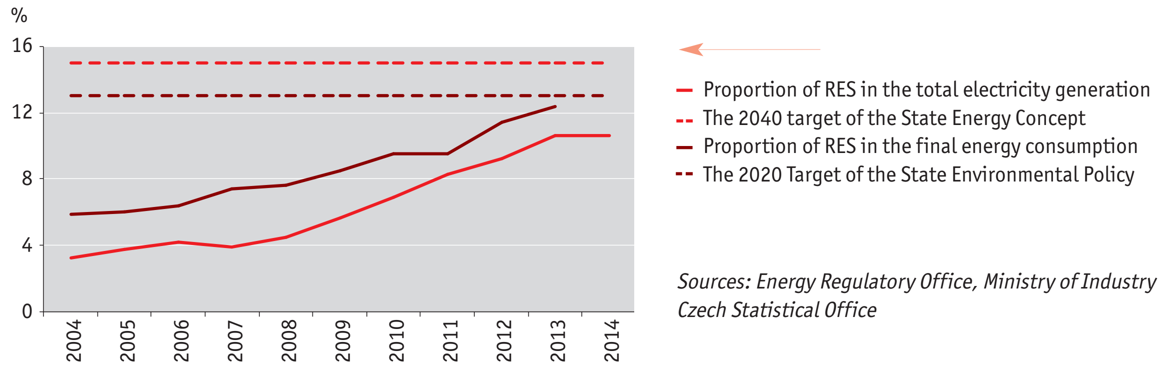
Source: Energy Regulatory Office

Chart 2 ➔ **Production of heat from RES in the Czech Republic [TJ], 2003–2014**



Source: Ministry of Industry and Trade

Chart 3 ➔ **Targets for RES and the status of their implementation in the Czech Republic [%], 2004–2014 (2013)**



Sources: Energy Regulatory Office, Ministry of Industry and Trade, Czech Statistical Office

Data for the year 2014 are not due to the methodology of their reporting, available at the time of publication.

The **renewable sources** are an important part of the energy mix because they contribute to the reduction of pollutant emissions and of greenhouse gases. Furthermore, given that the energy produced from them comes from own territory, they increase the country's energy security and independence on the international trade in energy commodities. Their disadvantage is the considerable dependence on climatic, meteorological and geographical conditions, therefore they cannot be placed at any location. Also, their energy production may not be regulated according to the actual demand.

The **production of electricity from renewable sources** has experienced in the last decade a significant development (Chart 1) as a result of international and national strategies and targets, that have generated significant support for renewable sources. In the year 2014, total of 9,170 GWh was produced from renewable sources, which represents after 6 years of significant growth for the first time a slight year-to-year decline (by 0.8%). This was caused by the decrease in the production in hydro power plants by 30.2%. The production of electricity in this category was at its lowest level since 2004 and was caused by the extremely low level of water courses. An additional slight decline in production was recorded in wind power (by 0.8%), although the installed capacity increased (by 3.0%). This decrease in production is also the result of meteorological conditions. For other renewable sources the year-to-year changes were positive. The largest year-to-year jump in production occurred for the supported sources: for electricity production from **biomass** with a recorded increase of 19.2% and from **biogas** where the production increased by 11.9%.

In the year 2014, the largest **proportion of electricity produced from renewable energy sources** was from biogas (28.0%), followed by photovoltaics (23.2%), and biomass (21.9%). The following important source are the hydroelectric power plants (20.8%). On a much smaller scale electricity is produced by wind power (5.2%), its potential the Czech Republic is limited by natural conditions. The smallest share is taken up by the biodegradable fraction of municipal solid waste (waste category) at 0.9%.

The **structure of electricity production from renewable energy sources** in the Czech Republic is relatively diverse and the proportion of the single energy sources is balanced. This state came about only in 2011, when RES received support. In the previous period, the only major renewable source of energy were the hydropower stations, while other sources had a minimum share.

The **heat production from renewable energy sources** increases in the long-term, in 2014 a year-to-year increase of 2.8% was recorded (Chart 2). The largest proportion is provided by the biomass (81.5%), which is the decisive factor for fuel consumption in households, especially of wood for heating. Year-to-year the production of heat from biomass was stagnant at –0.2%. The other sources of heat generation have a much smaller share (6.4% heat pumps, 6.0% biogas, 5.1% waste, solar thermal collectors 1.0%). More significant year-to-year increase was recorded for the generation of heat by heat pumps, by 18.6%.

The Czech Republic proceeds today, having updated the State energy concept and the State environmental policy towards **two indicative targets** regarding electricity production from renewable energy sources (Chart 3). The State environmental policy implemented the target from the European Directive, i.e. the share of RES in gross final energy consumption of 13% by the year 2020. In the year 2013, the value for the Czech Republic, according to the uniform methodology for the EU, was 12.4%. However according to the data calculations by the Czech Statistical Office this target was achieved already in 2012. The second target, resulting from the updated State energy concept, is to achieve the proportion of RES in electricity production over 15%. In the year 2014, this proportion was the same as in the previous year, 10.6%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

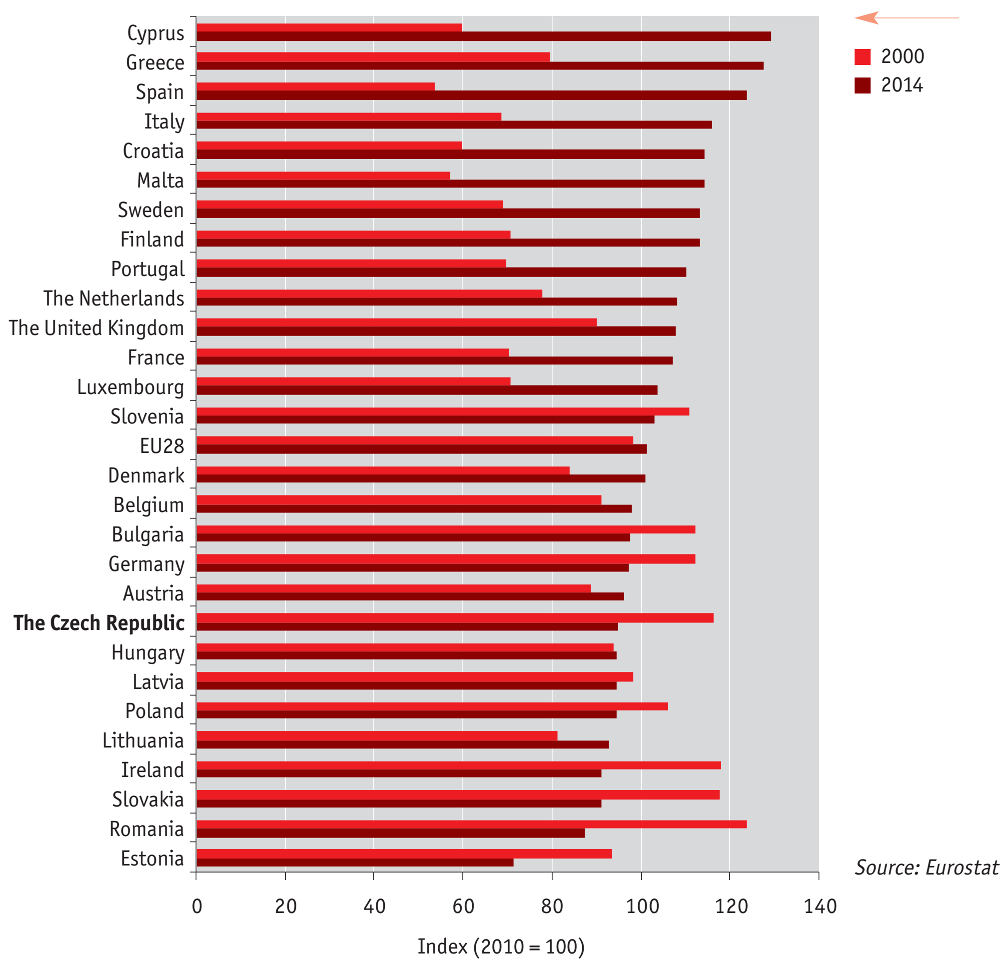
CENIA, key environmental indicators
http://indicators.cenia.cz

Industry and energy in the European context

KEY MESSAGES →

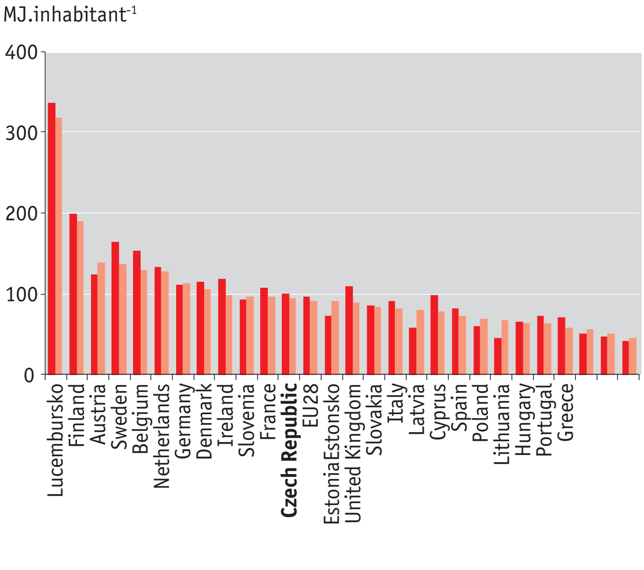
- The industrial production in the individual EU28 countries develops in different ways, depending on the historical conditionalities, sources of raw materials, policy and international trade.
- The energy consumption in the European countries in the period 2000–2013 is relatively constant, but national trends vary considerably.
- The energy intensity of the EU28 economies and of the Czech Republic is decreasing due to the improvements in energy efficiency by the end users and also in the production of electricity. Structural changes in the economy also occur.
- The proportion of renewables in the final energy consumption in the EU28 in the year 2013 increased to 15%. The target for 2020 is 20%. The national target for the Czech Republic is set at 13%, in 2013 it reached 12.4%.
- The European countries are dependent on fossil fuel imports from outside of the EU. Energy dependence of EU28 is 53.2%, the dependence of the Czech Republic is 27.9%. The Czech Republic has reserves of brown and black coal, but liquid and gaseous fuels have to be imported.

Chart 1 → **Industrial production index [index, 2010 = 100], 2000, 2014**



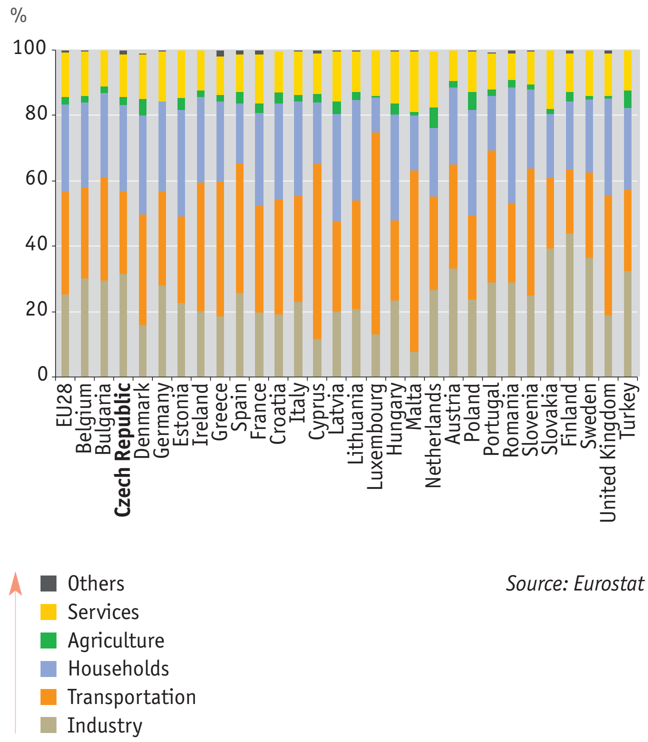
The industrial production index includes mining and quarrying, manufacturing industry, generation and distribution of electricity, gas, heat and conditioned air.

Chart 2 → **Final energy consumption per capita, [MJ.inhabitant^{-1}], 2000, 2013**



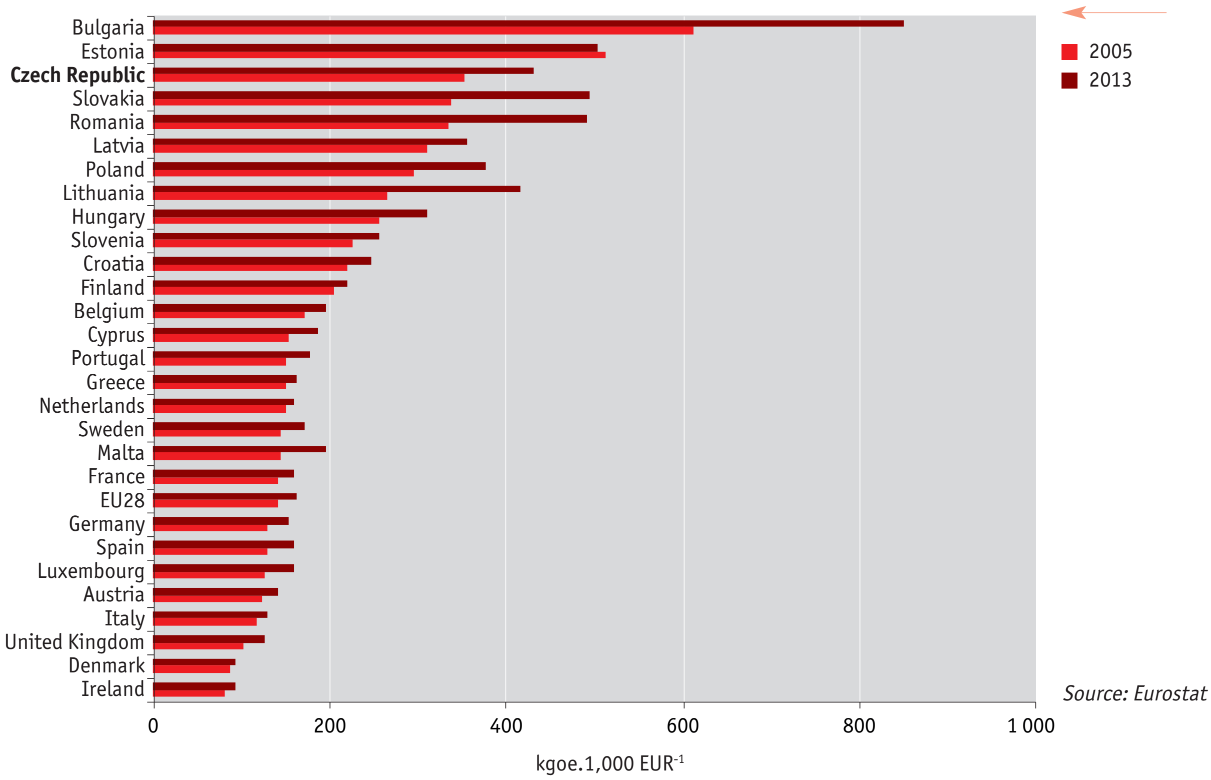
Source: Eurostat

Chart 3 → **Final energy consumption by sectors [%], 2013**



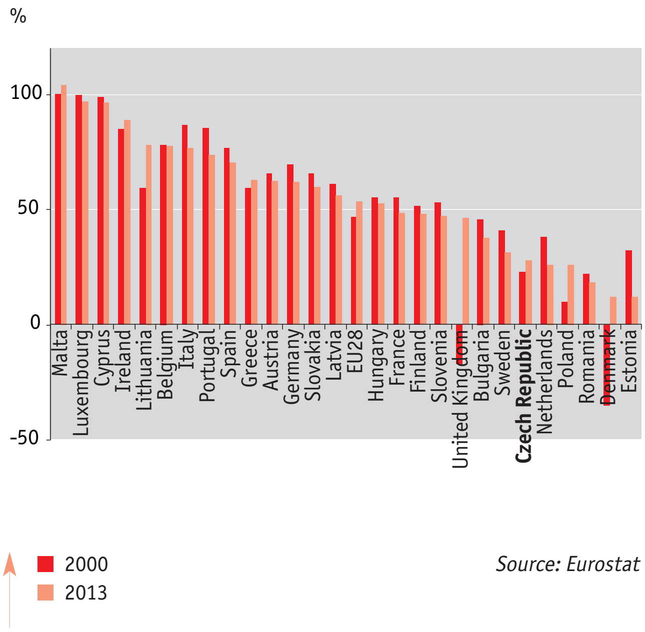
Source: Eurostat

Chart 4 → **Energy intensity of the economy [kgoe.1,000 EUR^{-1}], 2005, 2013**



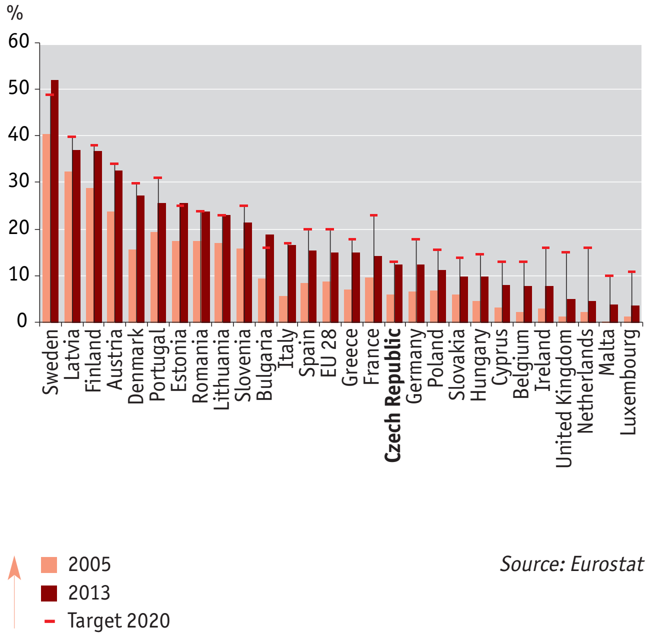
Source: Eurostat

Chart 5 ➜ **Energy dependence [%], 2000, 2013**



Source: Eurostat

Chart 6 ➜ **Proportion of renewable energy sources in final energy consumption [%], 2005, 2013**



Source: Eurostat

The **industrial production** in the European countries develops in different ways (Chart 1). While for example in Slovakia or Estonia its index has increased since 2000 by tens, other countries have experienced on the contrary a significant decrease (Greece, Italy, Spain). These changes are related to the orientation of the individual national economies, the stability of the national economy, interconnectivity of the national economies with other countries, openness to foreign trade, domestic markets and other economic, political and demographic factors. The value of the index of industrial production in the entire EU28 increased over the period from 2000 to 2014 from 98.5 to 101.5. For comparison, in the Czech Republic this change was much more pronounced, the index in the same period increased from 69.5 to 110.2.

The focus on industrial production in the individual countries is largely due to the presence of mineral and energy resources deposits. During the second half of the 20th century, the European countries have pursued two different directions. While the western part applied market economy based on the principle of balance between supply and demand, the eastern part was subordinated to central planning, where the emphasis was on industrial production and industrialization. In the Czech economy the industry plays a significant role. The Czech Republic is historically focused on industrial production and this legacy still continues.

The EU28 energy consumption in the period from 2000 to 2013 is relatively constant, however, the national trends in this period greatly vary. The per capita final energy consumption (Chart 2) is largely related to climatic conditions, because a significant portion of the energy is consumed for heating homes. Therefore, the higher **per capita consumption** is in the Nordic countries, and on the contrary lower in the countries in southern Europe with warmer climates. In most countries, when comparing the years 2000 and 2013, a decline in energy consumption per capita occurred, which is in line with the general efforts to reduce energy intensity of the economy. On the contrary, a growing consumption of energy has been reported in countries such as Austria, Estonia, Latvia and Lithuania. It reflects the structural changes in the economy and higher energy efficiency. In the Czech Republic, the per capita consumption is 95.0 MJ, i.e. 4.0% higher than the average for EU28 (91.3 MJ.inhabitant^{-1}).

In the year 2013, the final EU28 energy consumption reached the value of 1,103.8 million tons of oil equivalent (toe)[1]. The largest proportion was consumed in transportation (31.6%), households (26.8%) and industry (25.1%). Next follows the service sector (13.8%) and agriculture (2.2%). The proportion of energy consumption in the single sectors in the different EU28 countries varies (Chart 3), depending on the type of economy, the level of living standards, climatic conditions etc.

[1] toe – tonne of oil equivalent. It corresponds to the energy extracted from one tonne of oil, 41.868 GJ or 11.63 MWh.

The **energy intensity of the EU28 economies** (Chart 4) decreases, in the 2005–2013 period it decreased from 164.0 to 141.6 kgoe.1,000 EUR^{-1}. It is due to the improvements in energy efficiency both of end users and in the production of electricity. Additionally, the share of renewables in the energy mix increases and the structural changes occur in the economy. These include e.g. increasing the share of services in GDP and the shift within the industrial sector from energy-intensive towards less energy-intensive and toward those with higher added value. All EU28 Member States reported between 2005 and 2013 a decline of energy intensity, with the exception of Estonia (up 2.2%). The largest decrease was recorded in the Central European countries (Lithuania, Slovakia and Romania), caused by changes in their economic structure. The energy intensity of the Czech Republic decreases (in the 2005–2013 period from 431.2 to 353.8 kgoe.1,000 EUR^{-1}), however, compared to the EU28 average, it is high. The reason is the significant role of industry in GDP.

The **energy dependence** among the EU28 member states varies considerably (Chart 5). It is caused by the differences in the availability of domestic fossil sources and the potential of renewable energy sources. The total energy dependence of the Czech Republic in 2013 amounted to 27.9%, which makes the country the sixth least dependent country in EU28 (the average energy dependence of EU28 is 53.2%). The lower energy dependence of the Czech Republic is influenced by own resources of solid fuels (brown and black coal) which are also exported abroad. However, the Czech Republic has to import gaseous and liquid fuels. In the year 2013, there was no longer any energy independent state amongst the EU28 (more exported than imported). In the year 2000 there were two countries: the United Kingdom and Denmark. Europe is heavily dependent on **fossil fuel imports** from outside of the EU. High dependence on oil (approximately 90% of consumption is imported) is caused by the high consumption of petrol and diesel in transportation and minimal own sources of raw materials. Imports of natural gas make up about two thirds of the European consumption. This fuel is used mostly by households and the industry. For solid fuels, which are used mainly for the production of electricity and heat, the imports account for more than a third of the consumption of EU28 countries.

The proportion of **renewable energy sources** in the EU28 countries has increased in the 2005–2013 period from 8.7 to 15.0% (Chart 6). The European countries have set targets for renewable energy sources, that in 2020 their share in the final energy consumption will be 20%. The different EU28 countries, however, have in view of their differing potential for renewable energies different national targets for their proportion of RES in consumption (National Action Plans). For example, Denmark, Finland and Estonia extensively use wind turbines to produce electricity, installed at sea and on land, Germany plans to develop photovoltaics and intends to supplement its energy mix by the installation of wind turbines at sea. Austria bets on water energy and by using pump and storage plants it can well regulate renewable energy production with greater fluctuations (photovoltaic and wind). This capacity will be used by the surrounding states, as is currently done already by Germany. Slovakia plans a uniform development of electricity production from solar radiation, wind and biomass. The national targets of Sweden, Estonia, Lithuania and Bulgaria were already achieved in the year 2013. The Directive on the promotion of renewable energy sources obliges the Czech Republic to reach a 13% share of RES in gross final energy consumption. In 2013, the share of energy from renewable sources according to Eurostat data was 12.4%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

31/ Transport performance and infrastructure

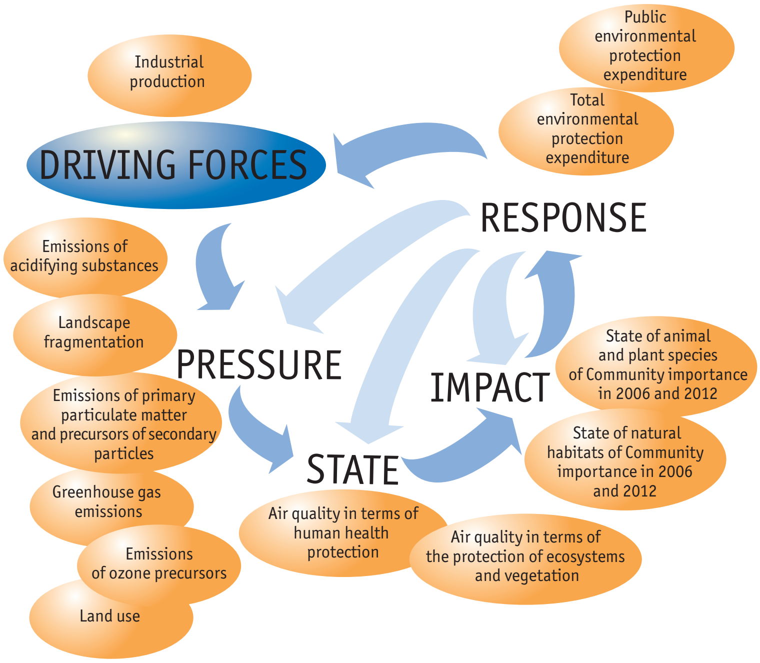
KEY QUESTION →

What is the development of transport and the related environmental burden?

KEY MESSAGES →

In 2007–2014, the proportion of public transport in total passenger transport performance increased by 3.9 p.p. to 34.0%. Individualisation of passenger transport is no longer continuing. Railway passenger transport performance is growing as is the use of railways within integrated transport systems. Cycling infrastructure is developing.

Road freight transport comprises more than three quarters of the total freight transport performance and causes a significant environmental burden and noise pollution.



OVERALL ASSESSMENT →

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

White Paper – Roadmap to a Single European Transport Area
- reducing (and gradually eliminating) dependence of the EU transport system on oil
- shifting 50% of medium- and long-distance freight transport from road to railway and water transport
- completing the European high-speed railway network by 2050, tripling the length of the high-speed railway network and maintaining a dense railway network in all Member States

Transport Policy of the Czech Republic for the Period 2014–2020, with prospects till 2050
- supporting energy efficient public transport
- supporting non-motorised transport in the connectivity system

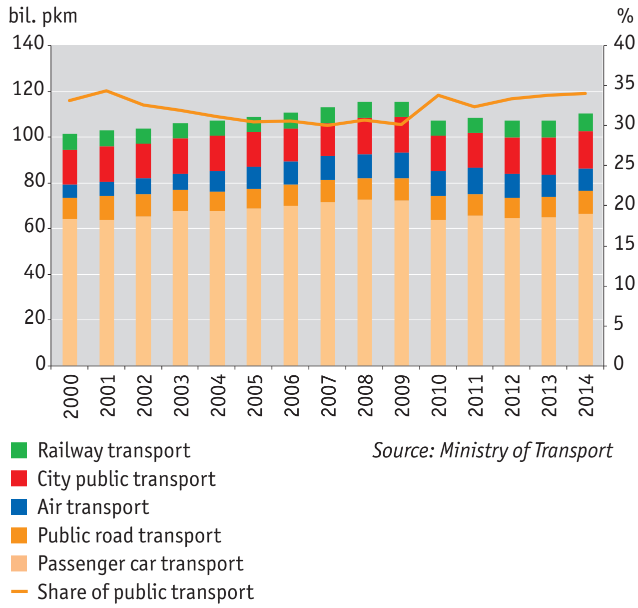
Strategic Framework for Sustainable Development of the Czech Republic
- modernising and developing freight and passenger railway transport

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The effects of transport on ecosystems and human health stem mainly from actual road traffic (emission and noise pollution); however, the effects of development and operation of transport infrastructure on the landscape and on biodiversity are also significant. The composition of passenger and freight transport performance has an influence on transport efficiency, the spatial requirements of transport, and the energy and emission intensity of transport. Linear transport infrastructure causes fragmentation of the landscape, and its development is tied to land-takes of agricultural and forest land. The development of cycling infrastructure, however, represents a potential environmentally friendly solution to mobility, especially within cities.

INDICATOR ASSESSMENT

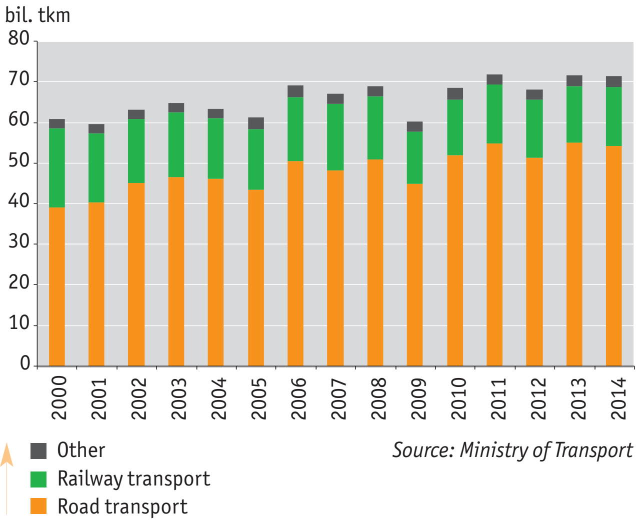
Chart 1 → **Development of passenger transport performance and the proportion of public transport in total passenger transport performance in the Czech Republic (excluding air transport) [bil. pkm, %], 2000–2014**



Source: Ministry of Transport

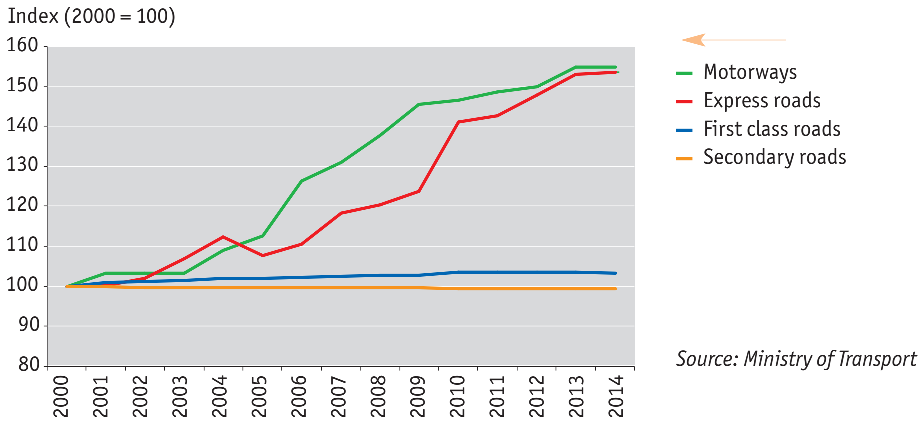
In 2010, there was a methodological change in calculation of the passenger car transport performance based on the national transport census. It is therefore impossible to interpret the development of transport performance between the years 2009 and 2010 as an actual drop in passenger car transport or in passenger transport as a whole.
Public road transport and air transport in 2014 – preliminary data.

Chart 2 → **Development of freight transport performance in the Czech Republic [bil. tkm], 2000–2014**



Source: Ministry of Transport

Chart 3 → **Development of the road and motorway networks in the Czech Republic [index, 2000 = 100], 2000–2014**



Source: Ministry of Transport

The **environmental burden caused by transport** has gradually stabilised after growing dynamically in the 1990s and early 21st century. Since the end of the first decade of the 21st century, the slight drop was made possible by the modernisation of the fleet and both development and composition of transport performance, especially in the case of passenger transport. The reversal of the growing adverse impact of transport on the environment was supported by the development of the Czech economy, which was marked by stagnation and fluctuation after 2009.

Total passenger transport performance grew steadily during the period of economic growth in 2000–2008. Further development was marked by stagnation and slight fluctuation (Chart 1). In 2014, total transport performance grew year-to-year by 2.7% and was 8.6% higher than in 2000. The onset of the 21st century was characterised by a continued individualisation of passenger transport; passenger car transport grew by 11.3% between 2000 and 2008; conversely, rail passenger transport fell slightly. Since 2009, the trend toward individualisation of transport has been reversed, especially as a result of a rise in railway transport performance and city public transport, whereas passenger car transport has stagnated. In 2014, the proportion of public transport (excluding air transport) reached 34.0% and was clearly above average in comparison with EU as a whole. This fact is positive from the point of view of reducing the impact of transport on the health of the population and on the environment as public transport (especially railway transport) is more efficient and causes less environmental burden in comparison with passenger car transport.

Railway passenger transport performance has been growing since 2009. In 2014, performance grew interannualy by 2.6% to 7.8 bil. pkm, and compared to 2000 it was 6.8% higher. In 2014, railways transported 176.1 mil. people, which is 1.5 mil. people more than in 2013. Since 2000, railway performance within integrated transport systems has been growing: in 2013[1] it amounted to 13.4% of total railway transport performance while in 2000 it was only 2.9%. After 2010, international railway transport performance has also grown, in 2013 its proportion in total transport performance was 10.5%. The competitive environment on international railway corridors has contributed to the growth of railways.

Public road transport performance, i.e., line and irregular buses, fluctuated in 2000–2014 with no clear trend; it grew 10% year-to-year in 2014 to 10.0 bil. pkm[2] and overall by 7.0% since 2000. The number of transported passengers grew 3.4% year-to-year to 349.4 mil. and was about double that of railway transport. This percentage does not correspond to the comparison of railway transport performance and bus transport performance. This is due to the fact that the average transport distance of buses (28.6 km in 2014) is much shorter compared to that of trains (44.3 km). The performance of city public transport in 2004–2014 increased by 8.3%; city public transport in 2014 amounted to 47.7% of total ground-level types of public transport. Developments in the performance of the Prague metro, which grew in 2010–2014 by 10.6% and by 75% since 2000, was responsible for the growth of city public transport performance in the monitored period.

At the onset of the 21st century, **air transport performance in the Czech Republic**[3] grew quickly (by 83.8% in 2000–2008). In subsequent years it fell slightly, to 9.7 bil. pkm in 2014, which is 9.4% less than in 2008. A total of 12.1 mil. passengers passed through airports in the Czech Republic in 2014, which represents a state of stagnation compared to the previous year. The proportion of national transport in overall performance of airports in the Czech Republic is negligible and continues to fall, amounting to only 0.7% in 2014.

Total **freight transport performance** grew by 17.5% in 2000–2014 as a result of a significant rise in road freight transport performance of 37.7% (Chart 2). Railway freight transport performance fell by 25.3% and the proportion of road freight transport in total freight transport performance reached 75.7% in 2014. This development in freight transport, caused by the fact that business entities prefer road freight transport, is not favourable for the environment, as road freight transport produces more emissions compared to all other kinds of freight transport and causes a significant noise burden on inhabitants. In 2014, road freight transport fell year-to-year by 1.5% and railway freight transport grew by 4.3%.

After 2000, a **network of motorways, express roads and first class roads** was developing in the Czech Republic, which was associated with land take of agricultural and forest land, the largest ones taking place in 2003–2008. In 2000–2014, the motorways network expanded by more than a half of the original size to 776 km, the express roads network to 459 km (Chart 3). During the period concerned, the length of first class roads increased by 202 km; conversely, the length of lower class roads decreased slightly by 300 km.

Cycling infrastructure is developing quickly: in 2013[4], the Czech Republic had 34,173 km of marked cycling routs and 1,903 km of cycling paths. For now at least, cycling transport comprises only a small share of the transport volumes; however, this share differs substantially from region to region depending on the size of principal city, level of cycling infrastructure, its integration into the transport system and shape of the terrain. Based on the results of the 2011 census, 1.4% of commuters use bicycles as a means of transport to get to work. This share is biggest in the districts of Uherské Hradiště (4.6%), Prostějov (4.1%) and Nymburk (4.0%), and the smallest in major cities (Prague 0.2%, Brno – city 0.3%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

[1] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*
[2] *According to preliminary data.*
[3] *Airline carriers registered in the Czech Republic.*
[4] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*

32/ Emission intensity of transport

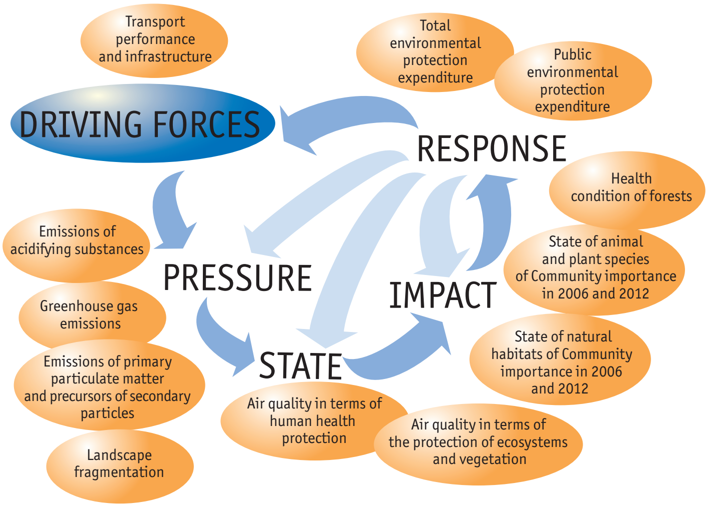
KEY QUESTION

Is the emission intensity of transport, together with its impact on the environment and public health, declining?

KEY MESSAGES

Emission intensity of transport in the Czech Republic and the overall production of pollution from transport are declining. This positive trend is the most significant in the case of NO_x, VOC and CO. The use of renewable energy sources in transport is rising. In 2014, the proportion of renewable energy sources consumed by transport in final energy consumption attained 6.9% in the Czech Republic.

In 2014, energy consumption in transport grew year-to-year and, as a result, greenhouse gas emissions increased as well. The Czech Republic has a very old fleet of passenger cars. In 2014, the average age of the fleet was 14.5 years and the trend is a growing one. The use of alternative fuels and propulsions in transport continues to be marginal. Only the use of CNG is growing. The 10% target of energy from renewable sources in transport stipulated by Directive 2009/28/EC of the European Parliament and of the Council has not yet been met. According to the Czech Republic's updated National Action Plan for Energy from Renewable Sources, it is expected that this target will be reached by 2020, however.



OVERALL ASSESSMENT

Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

White Paper – Roadmap to a Single European Transport Area
- reducing greenhouse gas emissions from transport by 60% compared to 1990 levels by 2050
- reducing of greenhouse gas emissions from transport by 20% compared to 2008 levels by 2050
- improving the energy efficiency of vehicles for all kinds of transport

Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources
- achieving a 10% share of energy from renewable sources in all kinds of transport by 2020

Transport Policy of the Czech Republic for the Period 2014–2020, with prospects till 2050
- reducing NO_x, VOC and $PM_{2.5}$ emissions from the road transport sector by renewing the car fleet in the Czech Republic and increasing the share of alternative fuels
- reducing dependence of transport on energy obtained from fossil fuels
- promoting fulfilment of emission limits in cities by building bypasses and establishing low emissions zones
- increasing the proportion of renewable sources in total energy consumption in transport to 10% by 2020
- reducing consumption of automobile petrols and engine diesels and replacing them with alternative fuels

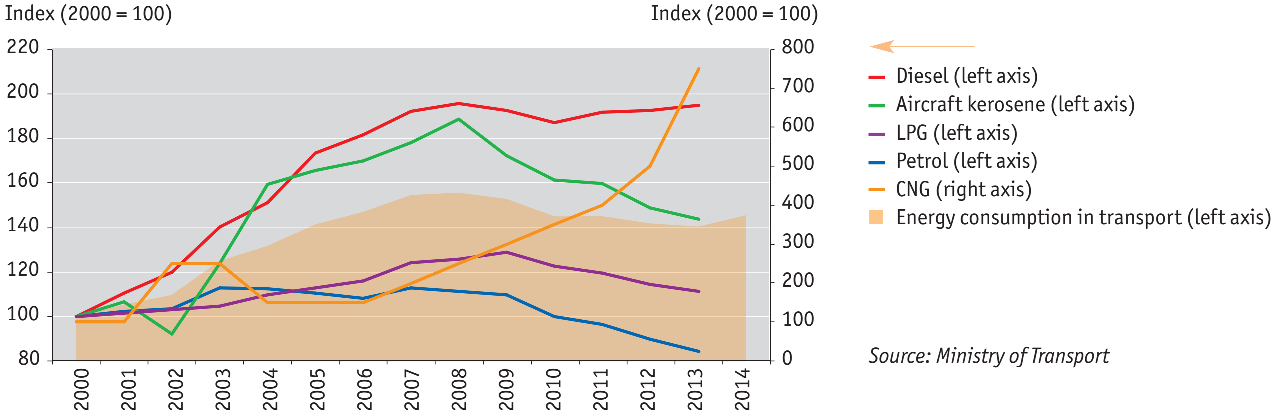
Strategic Framework for Sustainable Development of the Czech Republic
- reducing emissions of pollutants and greenhouse gases from transport
- increasing the energy efficiency of transport

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Production of emissions from transport has a significant link to public health protection, as transport emissions are emitted into the ground-level of atmosphere and their most serious impact is manifested especially in densely populated areas. Transport contributes to emission intensity in urban areas also because bypasses have not been built for transit traffic in numerous cases. In cities and agglomerations without significant industry, transport is the main factor affecting air quality and thereby the public health. The negative effects include reduced immunity, deterioration of the health of asthmatics and allergy sufferers and the more frequent occurrence of respiratory and cardiovascular diseases. Trough air pollution, transport also burdens ecosystems, namely by producing precursors of ground-level ozone which damages vegetation and reduces agricultural yields.

INDICATOR ASSESSMENT

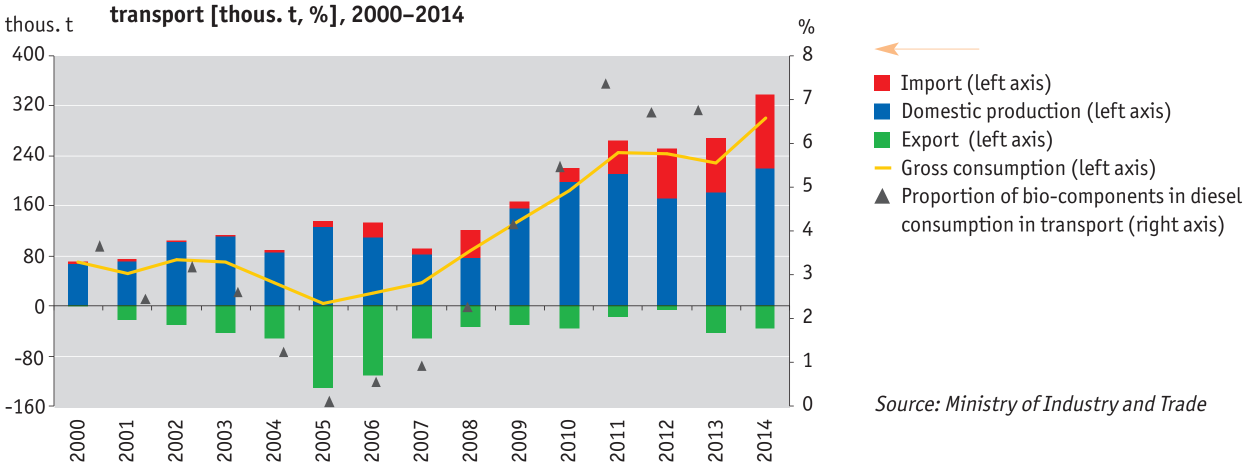
Chart 1 → **Energy and fuel consumption in transport [index, 2000 = 100], 2000–2014**



Source: Ministry of Transport

Fuel consumption data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

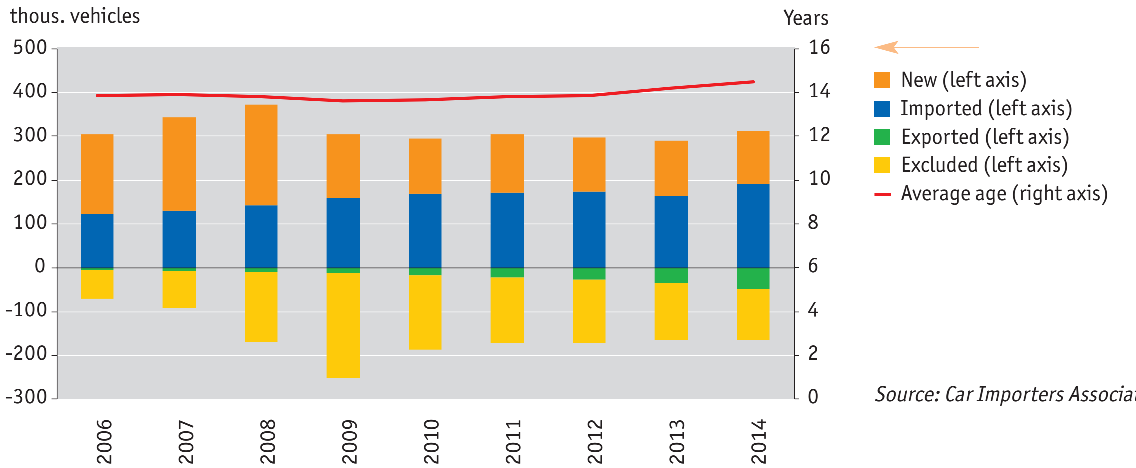
Chart 2 → **FAME production and consumption in the Czech Republic and proportion of bio-components in diesel consumption in transport [thous. t, %], 2000–2014**



Source: Ministry of Industry and Trade

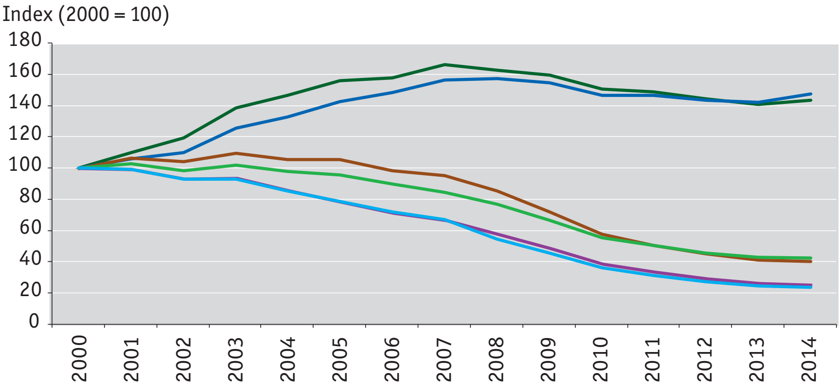
FAME = Fatty Acid Methyl Esters. In the Czech Republic, rapeseed oil methyl esters (RME) constitute almost 100% of FAME consumption.
Fuel consumption data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Chart 3 → **Number of registrations of new passenger cars, imported second-hand cars, exported and excluded vehicles, and the average age of the passenger cars fleet [thous. vehicles, years], 2006–2014**



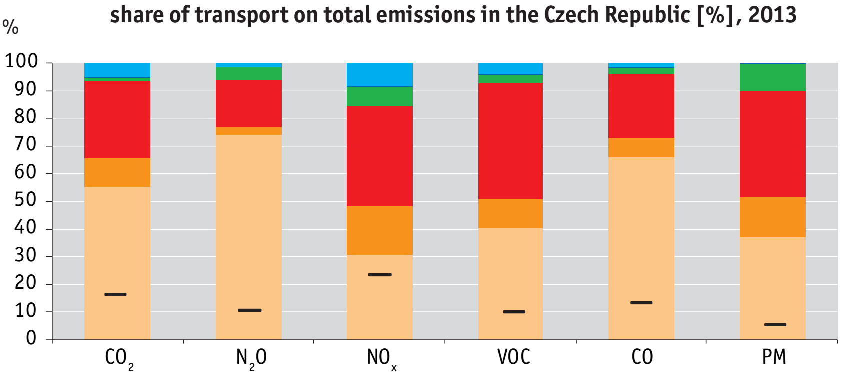
Source: Car Importers Association

Chart 4 → **Emissions of air pollutants and greenhouse gases from transport in the Czech Republic [index, 2000 = 100], 2000–2014**



Source: Transport Research Centre

Chart 5 → **Proportion of the various types of transport in transport-related emissions in the Czech Republic [%], 2014, and the share of transport on total emissions in the Czech Republic [%], 2013**



Source: Transport Research Centre, Czech Hydrometeorological Institute

Data on the total emission balance for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Energy consumption in transport increased by 45.7% in the period 2000–2014 and reached 251.7 PJ in 2014. Energy consumption rose sharply in 2000–2008 (by 55.8%), when the growing trend of passenger and freight transport performance was supported by economic growth (Chart 1). In 2008–2013, energy consumption in transport fell. The decline in 2008–2013 amounted to 9.8% (26.3 PJ), with passenger car traffic (a drop of 12.5 PJ) and road freight traffic (a drop of 6.8 PJ) contributing most to this. This decline was, however, only temporary. In 2014, energy consumption in transport grew year-to-year by 8.8 PJ (3.6%). In 2014, passenger car transport contributed most to overall energy consumption at 56.2%, followed by road freight transport at 27.3%. Public kinds of passenger transport (including air transport) thus contributed less than 20% to total energy consumption in transport.

At the beginning of the 21st century the fuel consumption in transport was rising which reflected the development of passenger and freight transport performance. After 2008, petrol and aircraft kerosene consumption began to fall. The rise in the proportion of diesel propulsion in the passenger car fleet from 11.1% in 2000 to 33.7% in 2014 started to be seen in the development of diesel consumption. The consumption of LPG is not growing, and use of this alternative fuel in transport continues to be marginal in the Czech Republic. CNG consumption is seeing significant growth, however, especially as a result of the use of CNG in public road transport. In 2000–2013, CNG consumption increased 7.5 times, tripling since 2008.

The consumption of renewable energy resources in transport is growing. For now, however, it is still under 10%, which is the target for 2020 under the current transport policy. A fundamental share of sustainable energy sources in transport is provided by the mandatory inclusion of bio-components in diesel and petrol. Consumption of FAME[1], a bio-component of diesel, attained a total of 300.4 kt in 2014, whereas in 2005 it was only 3.2 kt (Chart 2). In this period the increase was thus more than a hundredfold. In connection with increased consumption, domestic FAME production also grew. In 2005–2014, it grew by 72.8% to 219.3 kt (year-to-year growth of 20.7%). Not even this production was able to cover consumption in 2014, however. The proportion of the bio-component in transport-related diesel consumption reached 6.8% in 2013[2] and

[1] FAME = Fatty Acid Methyl Esters. In the Czech Republic, rapeseed oil methyl esters comprise almost 100% of FAME consumption.
[2] Fuel consumption data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

since 2011 has not increased. Bioethanol fuel consumption grew from almost zero in 2007 to 119.0 kt in 2014. In 2013, the proportion of bioethanol fuel in petrol consumption amounted to 6.3%. Total consumption of sustainable energy sources in transport reached 18.2 PJ in 2015, which constitutes 6.9% of final energy consumption in the Czech Republic.

Modernisation of the dynamic structure of the vehicle fleet, i.e., vehicles operating on roads, contributes to reducing the impact of transport on air quality. However, the fleet of registered vehicles in the Czech Republic remains very old. At the end of 2014, the number of registered passenger cars was 4,833.4 thous. (year-to-year growth of 2.2%). The average age of the entire fleet was 14.5 years. Renewal of the vehicle fleet through registration of new passenger cars is improving (Chart 3). The number of new registered passenger cars grew by 16.7% in 2014 to 192.3 thous. (Chart 3). The fleet renewal coefficient thus reached 4.0%. On the other hand, the insufficient and continued slow pace of excluding of vehicles from the register designed for physical liquidation is a problem; as a result, the number of registered vehicles continues to increase and their average age is not falling. In 2014, a total of 117.7 thous. passenger cars were permanently excluded (cancelled), which is 10.4% fewer vehicles than the previous year and 30.4% less than in 2010.

The transport related emissions of air pollutants and greenhouse gases are falling, as is **emission intensity**, i.e., the amount of emissions produced per unit of transport performance. This favourable development was influenced not only by the aforementioned factors, but also by the implementation of EU legislation regulating emissions of air pollutants and greenhouse gases produced from new vehicles. In 2000–2014, the biggest drop was registered in the case of pollutants that are removable by end technologies, such as three-way catalytic converters, particulate filters, exhaust gas recirculation (EGR) systems and selective catalytic reduction (SCR). NO_x emissions decreased in this period by 57.3%, VOC emissions by 76.2% and CO emissions by 74.9%. Emissions of suspended particles declined by 59.6% (Chart 4), especially as a result of a significant reduction of suspended particles produced by road freight transport, the proportion of which in total suspended particle emissions from transport in 2014 was 38.4%. The figure for passenger car transport was 37.0%. According to a study conducted by the National Institute of Public Health, road transport emits $PM_{2.5}$ and PM_1 fractions in particular, which are the most hazardous to human health. According to the National Institute of Public Health, the proportion of the ultra fine PM_1 fraction in total suspended particles emitted by transport is higher than 60% and can be as high as 90%. The methodology and results aimed at monitoring emission and concentration of PM_1 were, however, obtained from case studies and projects only; they, therefore, cannot be interpolated as applying to the whole of the Czech Republic.

The drop in emission intensity of transport was even more marked in the period concerned than the drop in the emissions themselves, as passenger and freight transport performance increased in this period. In the case of NO_x, the emission intensity of passenger car transport fell in the period 2000–2014 by 64.2% to 195.1 t.bil. pkm^{-1}, road freight transport by 75.8% and public road transport by 43.8%. This means that in 2014, passenger cars produced on average a third less NO_x emissions per transport performance unit compared to 2000.

In 2000–2014, **greenhouse gas emissions** from transport followed the trends in energy consumption, with the increase at the start of this period. In 2014, CO_2 emissions were 47.3% and N_2O emissions 43.3% above the level of 2000. In 2008–2013, although greenhouse gas emissions fell by 9.6% and 13.3% respectively, this fall was, however, followed by a year-to-year increase in 2014 as a result of increased energy consumption in transport, which amounted to 3.6% in the case of CO_2 and 1.8% in the case of N_2O.

The main source of CO_2, N_2O and CO emissions is passenger car transport, with its proportion in total transport emissions amounting to 55.5%, 74.2% a 65.9%, respectively, in 2014 (Chart 5). The biggest source of NO_x, VOC and suspended particle emissions is road freight transport. The shares of other modes of transport on the total transport emissions are already markedly smaller. In 2014, air transport was the source of 8.3% of NO_x emissions, and railway transport was the source of 9.8% of suspended particle emissions. The proportion of transport in total national emissions also fell in line with declining transport emissions, and in 2013[3], transport was not the sector contributing the most to total emissions with regard to any of the monitored substances, with its proportion in NO_x emissions being the highest at 23.6%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

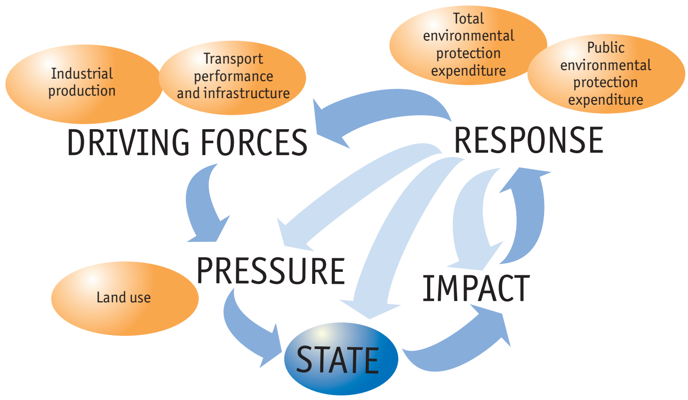
CENIA, key environmental indicators
http://indicators.cenia.cz

[3] Emission inventories for the year 2014 in NFR format are not, due to the methodology of their reporting, available at the time of publication.

33/ Noise pollution burden on the population

KEY QUESTION →

What is the state and development of the noise pollution in the Czech Republic?



KEY MESSAGES →

The noise exposure of the population is not uniformly distributed within the territory of the Czech Republic. It is concentrated mainly in large settlements and around major roads. In the agglomerations of Liberec, Olomouc and Ústí n. Labem/Teplice, the proportion of the population exposed to noise exceeding the stipulated limit values is below the average for all agglomerations in the Czech Republic.

In the Czech Republic, 2.8% of the population is exposed to noise levels exceeding the stipulated limit value the whole day and 3.3% at night. The biggest noise burden, predominantly from road transport, is in the agglomerations of Pilsen, Prague and Brno, where 10% of the population is exposed to noise levels above the stipulated limits. In regional centres and smaller communities, transit transport on main roads causes a substantial noise burden.

OVERALL ASSESSMENT →

The data currently available from Strategic Noise Mapping do not allow assessment of the noise pollution trends, as they were not collected over a longer period of time and according to the same methodology over multiple periods.

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise (Environmental Noise Directive – END)
- determining exposure to environmental noise, through noise mapping and by using assessment methods common to the Member States
- ensuring that information on environmental noise and its effects on the public is made available
- adopting action plans by the Member States, based upon noise-mapping results, with a view to preventing and reducing environmental noise
- processing of Strategic Noise Mapping by 30 June 2012 and then once every five years

Act No. 258/2000 Coll., on protection of public health and on amendment to some related acts
- procuring strategic noise maps for all agglomerations with a population exceeding 100 thous. and for main roads and railways by 30 June 2012
- procuring action plans for reducing noise pollution in areas specified by noise mapping

Transport Policy of the Czech Republic for the Period 2014–2020, with prospects till 2050
- implementing measures for protection against noise and vibrations especially in densely populated areas where hygienic noise limits are exceeded

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

At present, noise is a significant indicator of environmental quality and factors affecting the public health. Excessive noise is a source of stress, which brings about number of diseases of affluence. Noise nuisance, i.e., the subjective effects of acoustic discomfort, and also sleep disturbance and influence on everyday activities (work, recreation) are considered the most frequently occurring noise impacts on humans. The most serious health effects of noise are effects on the hearing organs and cardiovascular system. Noise levels causing these effects are not reached in the municipal environment, however. Noise effects animals in the same way as it does humans, possibly leading to disturbance of populations and loss of biodiversity.

INDICATOR ASSESSMENT

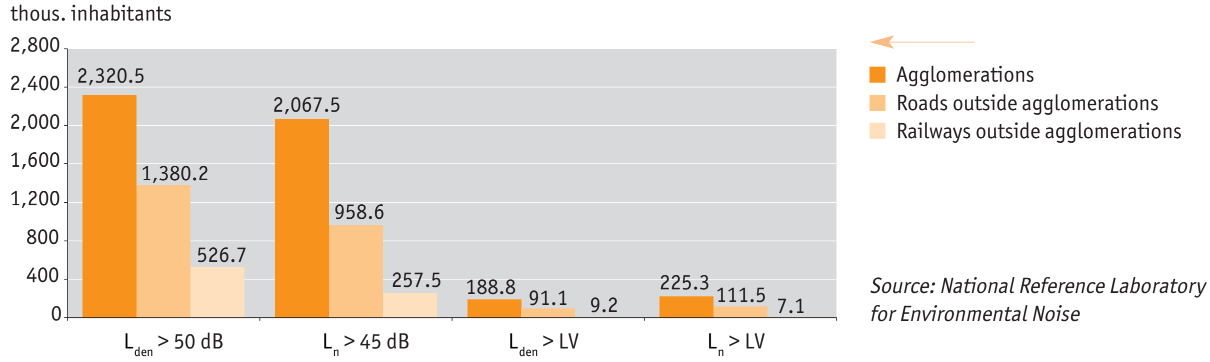
Table 1 ➔ **Limit values (LV) for noise indicators in the Czech Republic [dB], according to Decree No. 523/2006 Coll., on noise mapping**

Source of the noise	L_{den} [dB]	L_n [dB]
Road transport	70	60
Railway transport	70	65
Air transport	60	50
Integrated devices	50	40

Source: Decree No. 523/2006 Coll., on noise mapping

L_{den} – limit value for day, evening and night, characterising 24-hour disturbance by noise
L_n – limit value for night hours (11:00 p.m. – 7:00 a.m.) characterising sleep disturbance

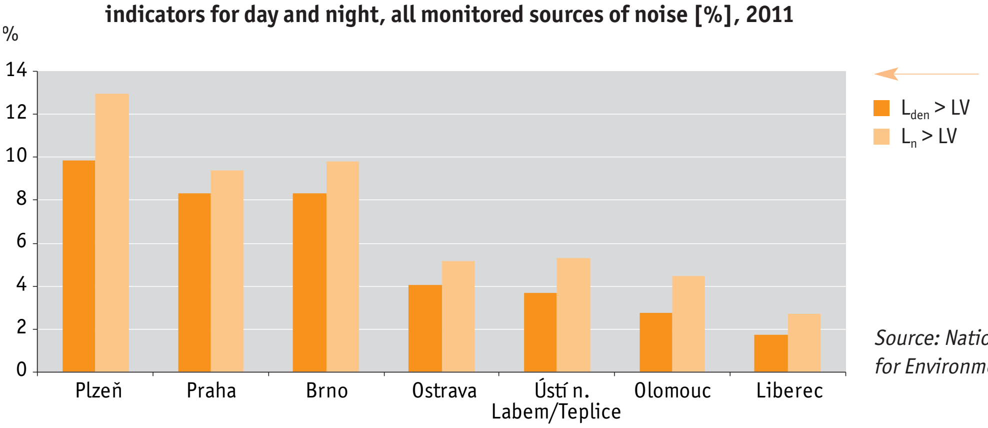
Chart 1 ➔ **Total number of the Czech Republic's inhabitants living in the given noise pollution categories for 24-hour (L_{den}) and night (L_n) noise pollution [thous. inhabitants], 2011**



Source: National Reference Laboratory for Environmental Noise

LV – the limit value of noise indicators is stipulated separately for the various sources of noise – see Table 1.
The data used for the agglomerations of Prague and Brno is from the first round of Strategic Noise Mapping.
Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

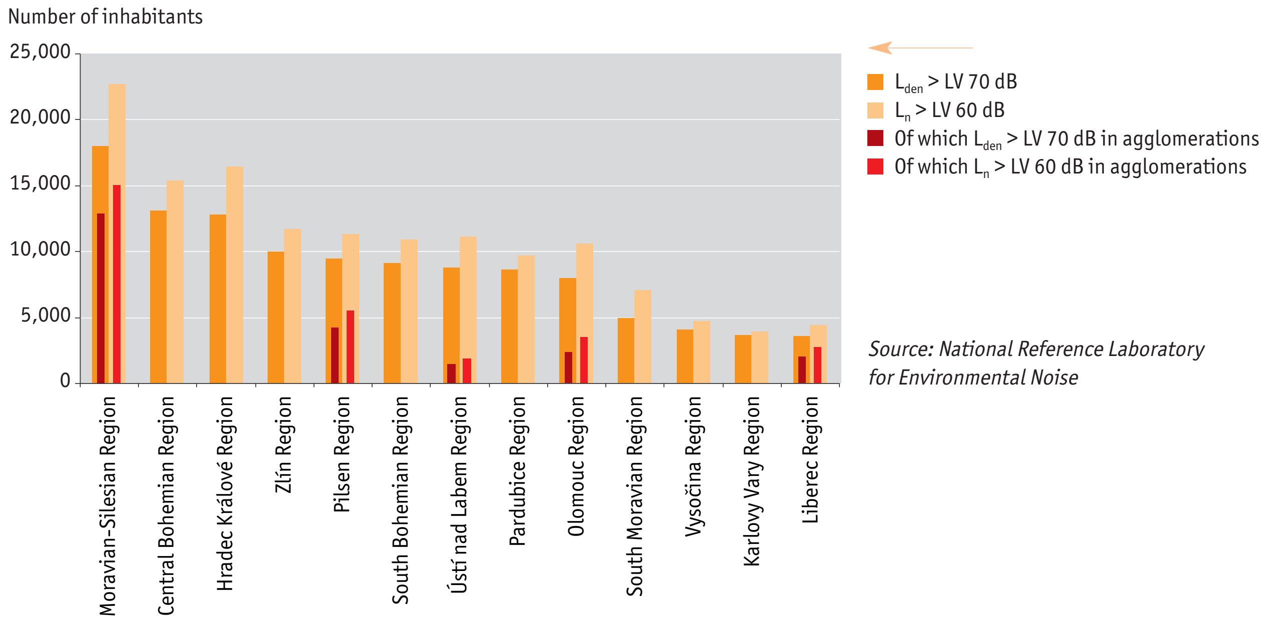
Chart 2 ➔ **Proportion of the population in the Czech Republic's agglomerations living in the areas with exceeded limit values of noise indicators for day and night, all monitored sources of noise [%], 2011**



Source: National Reference Laboratory for Environmental Noise

LV – the limit value of noise indicators is stipulated separately for the various sources of noise – see Table 1.
The data used for the agglomerations of Prague and Brno are from the first round of Strategic Noise Mapping.
Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Chart 3 → **Number of inhabitants in the Czech Republic's regions exposed to above-limit noise pollution from main roads*, in agglomerations ** and outside agglomerations [number of inhabitants], 2011**



Source: National Reference Laboratory for Environmental Noise

**Roads with traffic intensity exceeding 3 mil. vehicles per year.*
***Under Decree No. 561/2006 Coll. this means agglomerations with a population exceeding 100 thous., specifically the agglomerations of Ostrava, Pilsen, Ústí n. L./Teplice, Olomouc and Liberec. The data for the second round of Strategic Noise Mapping are not available for the agglomerations of Prague and Brno.*
Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Based on currently available **Strategic Noise Mapping**[1] results, a total of 289.2 thous. inhabitants, i.e., 2.8% of the Czech Republic's population, live in areas with a 24-hour noise burden exceeding the stipulated limit value. At night, 343.9 thous. inhabitants, i.e., 3.3% of the Czech Republic's population, are disturbed by excessive noise (Chart 1). The majority of people affected by excessive noise live in urban agglomerations[2]. Specifically, 188.8 thous. inhabitants, i.e., 65.3% of the total population, are exposed to excessive noise the whole day and 225.3 thous. inhabitants, i.e., 65.5% of the whole affected population, at night. Outside of urban agglomerations, traffic on the main roads is the main cause of excessive noise, affecting 91.1 thous. inhabitants 24 hours a day and on 111.5 thous. inhabitants at night. The traffic on main railway lines used by more than 30 thous. trains per year causes a noise burden on 9.2 thous. inhabitants 24 hours a day and 7.1 thous. at night. More than a third of the Czech Republic's population (approx. 4.2 mil. inhabitants) are exposed to noise exceeding 50 dB (which is the lowest level for noise mapping) for the whole day and in case of night noise burden above 45 dB it is approximately 30% of the population. The above values refer to the indicators L_{den} and L_n[3] and do not include the results for airports, as these were not available at the time of publication.

Noise pollution in the Czech Republic's agglomerations is the worst in the agglomeration of Pilsen, where 9.8% of the inhabitants are exposed to noise exceeding the 24-hour limit values and 13% at night. Such an unfavourable situation can be found in the agglomerations of Prague and Brno, where about 8–10% of the inhabitants are exposed to excessive noise (Chart 2). A better acoustic environment can be found in the agglomerations of Liberec, Olomouc and Ústí n. Labem/Teplice, where the proportion of the population living in areas where noise indicator limit values are exceeded is below the average for all the Czech Republic's agglomerations. The best situation is in the agglomeration of Liberec, where the figures are in the case of 24-hour noise disturbance 6.9% and night disturbance 8.1%. In agglomerations, the majority of inhabitants are affected by 24-hour noise pollution above 50 dB, most of them in the agglomerations of Ústí n. Labem/Teplice (96.7%) and Pilsen (95.8%). From this point of view, the best situation is in the agglomeration of Ostrava (51.8% of the population); however, this is influenced by the agglomeration's delimitation which does not include the city's territory exclusively.

[1] The objective of Strategic Noise Mapping is to obtain a general overview of the noise impact on the population in EU Member States and determining critical locations where the limit values of noise indicators are exceeded. Action plans for noise reduction measures in critical locations identified by Strategic Noise Mapping will be developed.
[2] Agglomerations will be defined by Decree No. 561/2006 Coll., stipulating a list of agglomerations for the purpose of assessing and reducing noise. The data used for the agglomerations of Prague and Brno are from the first round of Strategic Noise Mapping.
[3] The indicator L_{den} describes all-day noise disturbance; L_n is the noise indicator of sleep disturbance. The limit values of these noise indicators under Decree No. 523/2006 Coll. are set out in Table 1.

In the Czech Republic's agglomerations, there are a total of **30 hospitals** exposed to 24-hour road traffic noise pollution and 38 hospitals are affected at night. Most hospitals exposed to excessive noise are in Prague (13) and Pilsen (6). The number of school facilities exposed to excessive noise from road traffic is 114, the most being in Prague (36), Pilsen (31) and Ostrava (20). What is more, there are 14 schools exposed to excessive noise from industry in Pilsen.

Road traffic is the unequivocally the dominant source of excessive noise in agglomerations, providing more than 90% of the excessive noise that inhabitants in agglomerations are exposed to. A significant excessive 24-hour railway-related noise burden has been recorded in Prague (12.3 thous. inhabitants or 11.6% of the population affected by excessive noise), Brno (2.2 thous. inhabitants or 6.9%) and Ústí n. Labem/Teplice (360 inhabitants or 5.4%). At night, the railway noise pollution in agglomerations is substantially higher. Excessive noise from integrated devices, including stationary sources of noise (industry, construction etc.) burdens the inhabitants of the agglomeration of Pilsen the most: 2.5 thous. inhabitants, which is 13.9% of the population affected by excessive noise, are affected by excessive noise the whole day and 8.6 thous. inhabitants, or 36.9% of the population affected by excessive noise, are affected at night. It should be noted in respect of this data that lower limit values apply to integrated devices than to roads and railway transport (Table 1) and that the relative proportions of the various sources of noise in the excessive noise burden cannot be added together, as inhabitants may be exposed to a number of noise sources at the same time.

According to Directive 2002/49/EC, **noise pollution related to traffic on main roads** is monitored only on the main roads with traffic intensity higher than 3 mil. vehicles per year. The number of people affected by excessive noise is determined according to the number of inhabitants who live in the vicinity of these roads. A comparison of the situation in the various **regions of the Czech Republic**[4] shows that the greatest number of inhabitants exposed to noise levels from the main roads exceeding the limit values are located in the Moravian-Silesian Region (Chart 3), where 18.0 thous. inhabitants (1.5% of the population of the region) are exposed to high noise levels the whole day, with 71.7% of these inhabitants living in the agglomeration of Ostrava. In comparison, in the Ústí nad Labem Region and Olomouc Region, noise from main roads particularly affects areas outside urban agglomerations. If agglomerations are excluded from the calculations, the Central Bohemian and Hradec Králové Regions suffer the biggest noise burden from main roads, 2.3% of the population of Hradec Králové Region is affected the whole day and 3.0% at night. The best situation is in the Liberec region, where less than 1% of the population, including the agglomeration of Liberec, is exposed to excessive noise from main roads owing to better routing of main transit roads away from inhabited areas.

A higher proportion of inhabitants affected by excessive noise from main roads was discovered on municipal level. About 4% of the population of Hradec Králové (3.7 thous. inhabitants), 3.8% of the population of Pardubice (3.3 thous. inhabitants), and 2.8% of the population of České Budějovice (2.6 thous. inhabitants) live in areas where limit values for 24-hour noise from main roads are exceeded. In the case of smaller municipalities, a substantially greater number of inhabitants are exposed to excessive noise. In extreme cases, the number can exceed 50%. According to results available to date, the worst situation is in municipalities located in the Hradec Králové Region (Bílsko u Hořic, Blešno and Ohařice) due to the fact that major long-distance routes pass through them.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

[4] Apart from the Region of the Capital City of Prague, which is assessed as an agglomeration.

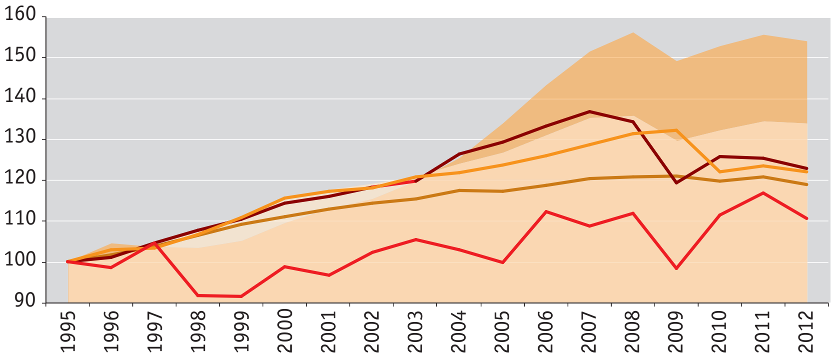
Transportation in the European context

KEY MESSAGES →

- → Total passenger and freight transport performance in the EU28 and the Czech Republic no longer continues to increase after growth in the early 21st century and fluctuates according to economic developments.
- → Passenger car transport comprises more than 80% of total passenger transport performance in the EU28. The level of individualisation of transport in the Czech Republic is markedly below the average for the EU28, especially due to the greater use of public city transport.
- → The proportion of road freight transport in the structure of freight transport performance is above-average in the Czech Republic compared to the EU28 as a whole and continues to grow.
- → The proportion of transport-related greenhouse gas emissions in total aggregated greenhouse gas emissions in the Czech Republic is one of the lowest in the EU28 countries for the reason of high emissions from stationary sources.

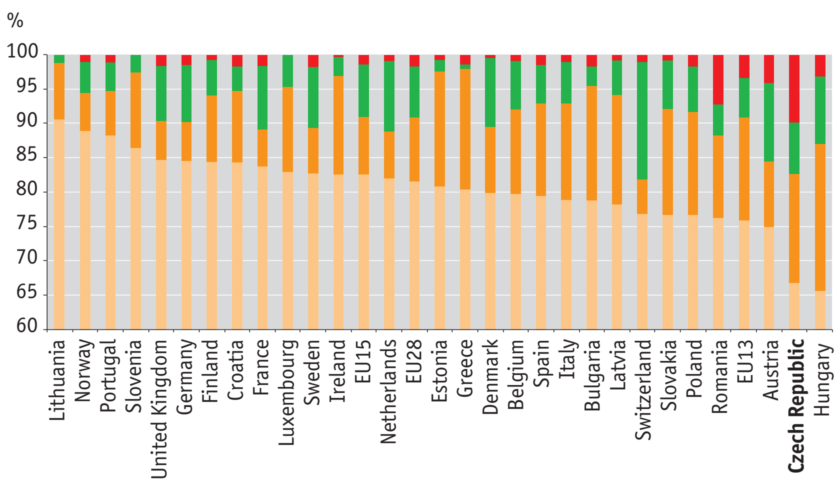
INDICATOR ASSESSMENT

Chart 1 → **Development of total performance in passenger and freight transport and GDP in the Czech Republic and EU28 [index, 1995 = 100], 1995–2012**



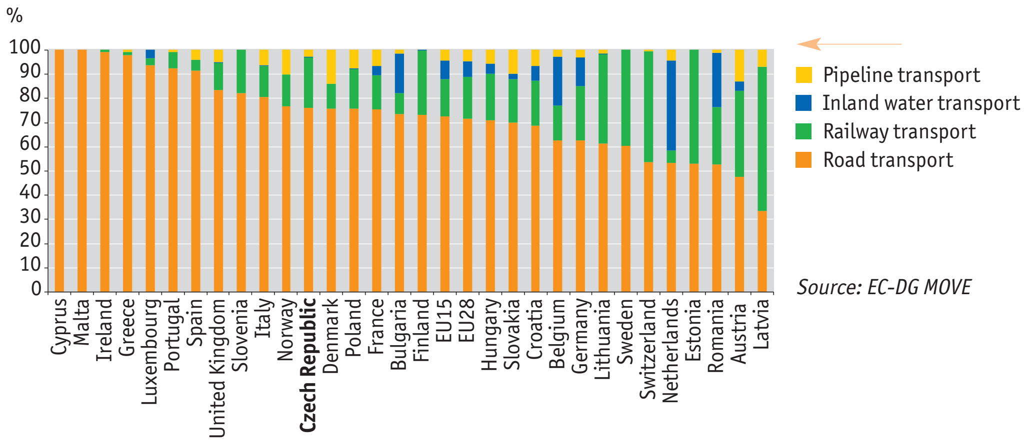
Source: EC-DG MOVE

Chart 2 → **Structure of passenger transport performance (excluding air transport) [%], 2012**



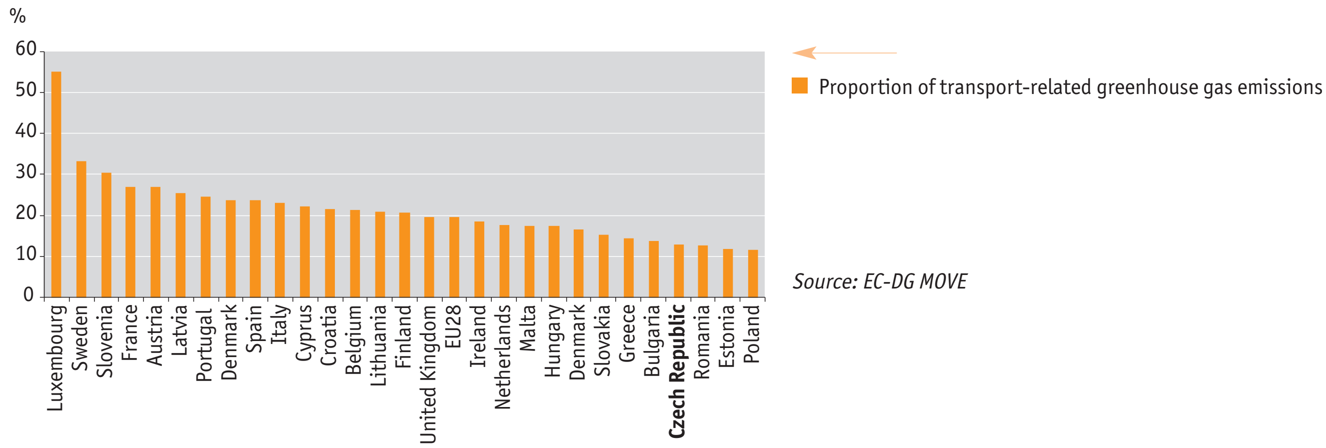
Source: EC-DG MOVE

Chart 3 → **Structure of freight transport performance (excluding sea transport) [%], 2012**



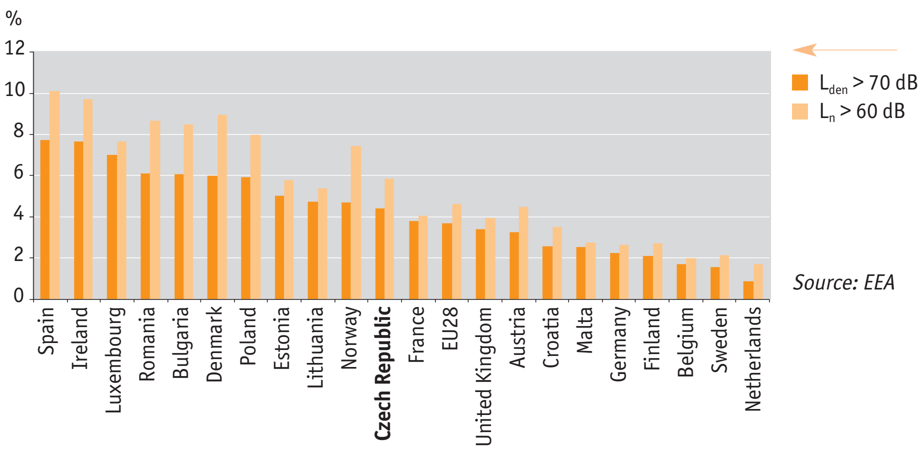
Source: EC-DG MOVE

Chart 4 → **Proportion of transport-related greenhouse gas emissions in total aggregated greenhouse gas emissions [%], 2012**



Source: EC-DG MOVE

Chart 5 → **Noise impact from road transport exceeding the stipulated noise pollution levels for 24-hour noise disturbance (L_{den}) and night noise disturbance (L_n) in agglomerations with a population over 100 thous. [% of exposed agglomeration inhabitants], 2012**



Source: EEA

Data for the Czech Republic in agglomerations Prague and Brno are available from the first round of Strategic Noise Mapping only. The EU28 countries not indicated in the chart have not still provided the data.

Total transport performance of passenger and freight transport in the EU28 and in the Czech Republic grew in 1995–2008. After 2008, this trend came to stagnation and freight transport performance in particular followed economic development distinctly (Chart 1). In **passenger transport performance**, passenger car transport comprises the highest proportion: 81.6% in the EU28 and 66.8% in the Czech Republic (excluding air transport, Chart 2). The lower level of transport individualisation in the Czech Republic than in the EU28, favourable in terms of environmental burden, can be explained by the higher, and in recent years also increasing, use of public transport in the Czech Republic. The proportion of city railway transport (metro, tram) in total passenger transport performance in 2012 reached 9.8% in the Czech Republic, the highest in the EU28. Similarly, the proportion of city and line buses in total transport performance of 15.8% ranks the Czech Republic at the top of the whole of the EU28.

The EU, as a whole, is a region with the **greatest number of registered passenger cars**, and the greatest level of motorisation in the world. The total number of registered cars in the EU 28 reached 242 mil. in 2012, with average motorisation reaching 488 cars per 1 000 inhabitants. The level of motorisation in each country is dependent on economic performance and standard of living. In the Czech Republic, it is slightly below the EU28 average (448 vehicles.1,000 inhab.$^{-1}$ in 2012), but higher than the average for the new EU Member States.

In most of the EU28 countries, the composition of **transport performance** for inland types of **freight transport** is characterised by the high proportion of road freight transport, which reached 71.6% on average for the whole of the EU28 in 2012 (Chart 3). In the Czech Republic, the proportion of road freight transport is even higher (76%) and continues to grow. This is related to the decline in large-scale transport, which takes place mainly by railway. A greater presence of alternatives to road freight transport contributes to reducing the environmental impact of transport in countries with a developed railway freight transport system (Latvia, Estonia and Austria) and even water transport system (the Netherlands and Romania).

The proportion of transport-related greenhouse gas emissions in total aggregated greenhouse gas emissions amounts to about one-fifth in the whole of the EU28 (Chart 4). The proportion of transport in total emissions is very high in states with a developed road transport system and whose energy industry uses carbon-free sources and whose processing industry contributes less to GDP creation (Luxembourg, Sweden and France). The Czech Republic, especially with regard to the significant amounts of greenhouse gases produced by stationary sources, belongs to those countries where transport contributes the least to total emissions (12.9% in 2012). Countries with an economy and energy industry similar in nature to that of the Czech Republic also register similarly lower proportions of transport-related greenhouse gas emissions (Poland), as do countries with lower transport performance and thus lower emissions from passenger car transport (Romania and Bulgaria).

According to the second round of Strategic Noise Mapping, the Czech Republic is above average among the EU28 countries in terms of **excessive transport-related noise pollution** in agglomerations with a population over 100 thous. (Chart 5). In the Czech Republic, 4.4% of the population is exposed to 24-hour road traffic-related noise exceeding 70 dB, while in the EU28 it is 3.7%. For night noise levels exceeding 60 dB, the numbers are 5.9% and 4.6%, respectively. In the Czech Republic, 62.9% of the population in agglomerations with a population over 100 thous. is exposed to 24-hour noise levels above 55 dB, while in the EU28 it is 37.8%. Based on data available to date, Spain and Ireland suffer the greatest noise pollution. The majority of the countries of Western and Northern Europe (especially the Netherlands, Sweden and Belgium) suffer less noise pollution in urban agglomerations, which is due to the fact that transit traffic is diverted away from city centres and traffic is restricted in residential areas (bans, speed limits, etc.).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

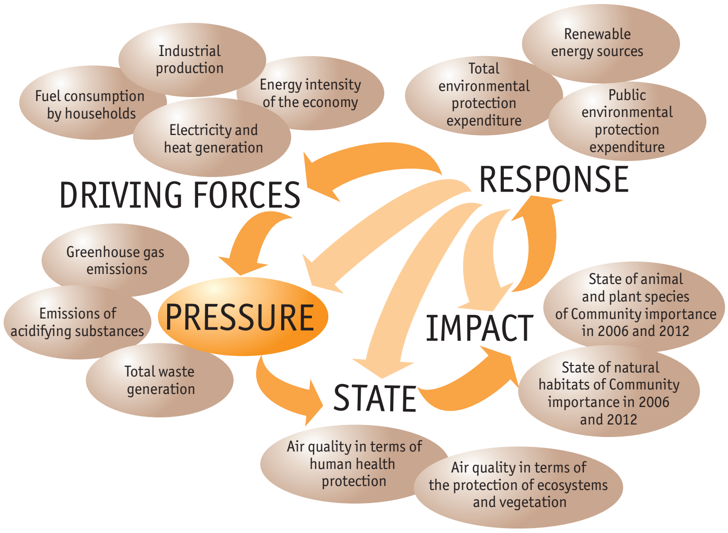
CENIA, key environmental indicators

http://indicators.cenia.cz

34/ Domestic material consumption

KEY QUESTION →

Is the environmental burden associated with the extraction and consumption of materials decreasing in the Czech Republic?



KEY MESSAGES →

The domestic material consumption is decreasing in the Czech Republic; it decreased by 13.9%[1] in the period 2000–2013. The consumption of fossil fuels, especially of coal and oil is decreasing. The environmental pressures associated with the extraction and consumption of raw materials are therefore being reduced.

The share of biomass in the domestic material consumption in the Czech Republic is very low, amounting to 13.1% in 2013. The material dependency of the Czech Republic on other countries is increasing. In addition to oil and natural gas, the Czech Republic is almost completely dependent on imports of metallic minerals.

OVERALL ASSESSMENT →

Change since 1990	🙂
Change since 2000	🙂
Last year-to-year change	🙂

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy
- efficient use of natural resources
- creation of a circulatory economy based on the use of secondary raw materials as resources

EU Sustainable Development Strategy
- transition to low-carbon economy and economy with low material inputs based on resource-efficient technologies

7th Environmental Action Programme until 2020
- transition to a green, competitive and low-carbon resource-efficient economy

Strategic Framework for Sustainable Development in the Czech Republic
- support of sustainable material economy of the Czech Republic
- reduction of the impact of material flows on the environment

National Reform Programme
- effective use of secondary raw materials, conversion of waste to resources and the support of recycling

Secondary Raw Materials Policy of the Czech Republic
- increase of the self-sufficiency of the Czech Republic on raw material resources by resorting to the use of secondary resources
- inclusion of secondary raw materials in the statistical surveys in the area of material flow accounts

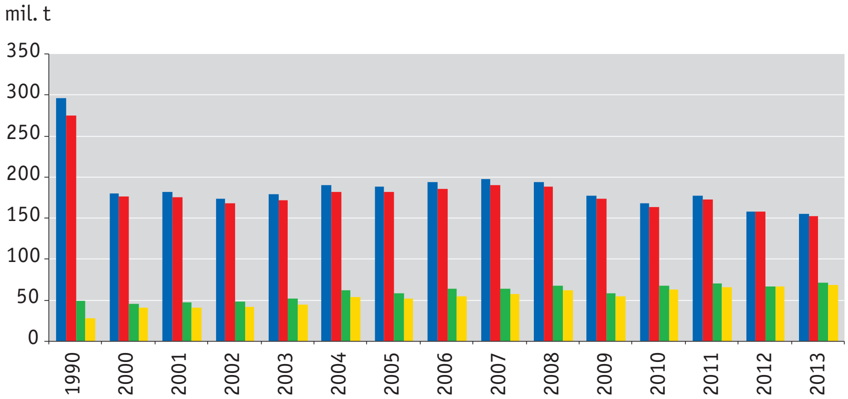
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The domestic material consumption influences the extent of environmental burdens that are associated with resource use and waste flows of the national economy, in particular in the form of emissions to air and water and waste production. The extraction of raw materials and the cultivation of biomass in large agrosystems causes pressures on the landscape, affect the status of ecosystems, can lead to the loss of biodiversity and to the reduction of the quality of surface water and groundwater. Emissions to air and water have an effect on human health and ecosystems and burning of fossil fuels is also a significant source of greenhouse gas emissions.

[1] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

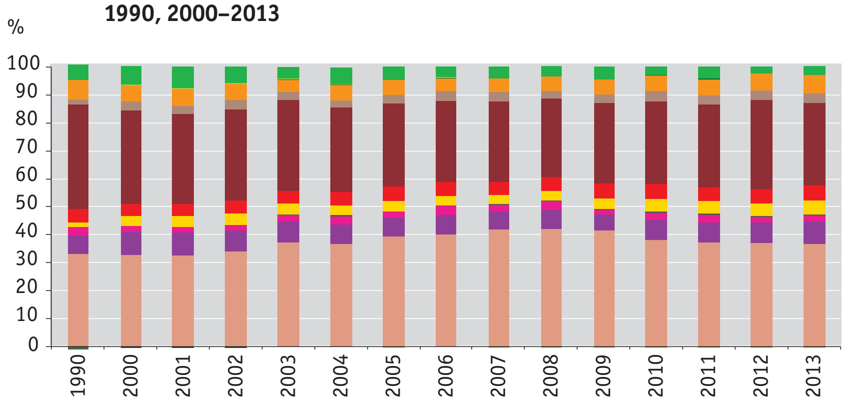
Chart 1 → **Development of domestic material consumption and its components in the Czech Republic [mil. t], 1990, 2000–2013**



Sources: Czech Statistical Office, Environment Center, Charles University in Prague

Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 → **Development of the structure of domestic material consumption in the Czech Republic according to material groups [%], 1990, 2000–2013**



Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Sources: Czech Statistical Office, Environment Center, Charles University in Prague

The Domestic Material Consumption (DMC)[2] is decreasing in the Czech Republic, in the period 2000–2013 it decreased by 13.9%, while the year-to-year decrease in 2013 was estimated at 1.5% to 155.0 mil. t. The decrease in DMC over the period 2009–2013 was mainly caused by the state of the economy of Czech Republic, which was impacted by the global economic and financial crisis. The environmental burden associated with the natural resources extraction and materials consumption in 2013 was approximately at half the value compared to the beginning of the 1990s (Chart 1).

The development of the overall DMC in the period 2000–2013 was most influenced by the development of consumption mineral materials for construction purposes and fossil fuels (Chart 2). **The consumption of mineral materials for construction** initially increased in the period 2000–2013, it increased by about 22 mil. t (37.5%) between the years 2000 and 2008, in other years it experienced a decline, and in 2013 it was slightly below the level of the year 2000 (by 3.6%); the year-to-year decrease in 2013 was estimated at 2.0%. The decrease in the consumption of mineral materials for construction in recent years has been associated with the decline of construction activities,

[2] DMC is calculated as domestic used extraction minus exports plus imports. It measures the amount of materials (raw materials, semi-finished products and products) consumed by the economy for production and consumption. The value of domestic used extraction indicates the level of burdens and impacts on the environment which are associated with the extraction of raw materials and the cultivation of biomass.

the construction production index in 2013 reached 83.1% of the average of the year 2010. As a result of the decline in demand for construction materials in the period 2008–2013, the domestic extraction of materials for construction dropped by 29.1%, i.e. by about 24 mil. t. The environmental pressure caused by the extraction of construction materials was therefore reduced.

The fossil fuels represented 40.2% of the DMC in the Czech Republic in 2013. **The coal consumption** has been declining steadily, in the period 2000–2013 it decreased by 23.9% (14.4 mil. t) and in 2013 it was less than half the amount recorded in the year 1990. This trend is the result of gradual changes in the fuel energy mix of the Czech Republic, the reduction of the consumption of coal for home heating and the development in the manufacturing industry. Particularly in the end of the evaluated period the domestic coal extraction dropped together with the decreasing consumption. The brown coal extraction decreased in the period 2008–2013 by 14.5% (6.9 mil. t) to 40.6 mil. t; the mining of black coal decreased in this period by 29.4% (3.6 mil. t) to 8.6 mil. t, of which only in 2013 the mining decreased in the year-to-year comparison by significant 20.2% (2.2 mil. t), which resulted in the decline in the export of black coal by 9.7%.

Oil consumption increased at the beginning of the 21st century as a result of the growth of transport performance of both passenger and freight transport (28.4%, i.e. about 2.2 mil. t in the period 2000–2008), since the year 2008 the trend reversed and oil consumption has been decreasing. In 2013 the year-to-year oil consumption decreased by 0.7% (52,000 t) and was 4.9% higher than in 2000. The figures of the consumption of oil at the end of the reporting period reflects the growing energy efficiency of transport amidst the stagnation of traffic performance, which are influenced by economic developments.

The consumption of natural gas varied considerably between the individual years, in the period 2000–2013 as a whole it had a slightly rising trend. In 2013, according to the DMC indicator the natural gas consumption increased by 16.7% (1.2 mil. t) compared to 2000, in the last assessed year, 2013, it increased in the year-to-year comparison by 17.3% (1.2 mil. t) to 8.0 mil. t. According to Energy Regulatory Office's (ERO) data, the consumption of natural gas this year increased only slightly by 1.5% to 8.3 bil. cubic metres. The disproportion between the development of real consumption of natural gas and DMC of natural gas is caused by the fact that DMC includes above the ERO results also the imports of natural gas products and gas in storage (in 2013, a year-to-year increase by about 950 mil. cubic metres) as it captures the material remaining in the economy, rather than directly its consumption by the end consumer.

The consumption of **industrial minerals** in the period 2000–2013 decreased by 16.8% to 12.1 mil. t; the development reflected the gradual reduction of material intensity of industrial production and the decline in industrial production which occurred at the end of this period. The consumption of **metallic minerals** increased in 2013 by 14.4% to 4.0 mil. t, it was lower by 11.6% (0.5 mil. t) than in 2000. The level of domestic used extraction of metallic minerals in the Czech Republic is very low (only uranium ore is mined on the territory of the Czech Republic) and the size of the direct material input, i.e. the sum of domestic production and imports (20.1 mil. t in 2012, a year-to-year increase by 3.1%) is many times higher than the DMC. This is a result of higher exports of products and semi-finished metal products (16.1 mil. t in 2013), whose major contribution is represented by the exports of the automotive industry. For the Czech Republic, this state represents an additional environmental burden from the processing of metallic minerals beyond the scope domestic consumption.

The consumption of renewables in 2013 increased by 8.7% to 20.4 mil. t, in the long term, however, the consumption of biomass in the Czech Republic decreases. In 2013 it was 29.5% lower than in 2000 which is about half the value of 1990. **The share of renewables** in the overall DMC in the Czech Republic is very low and is not increasing, in 2013 it reached the amount of 13.1%, in 2000 it was 15.6%. From an environmental perspective, the small share of renewables in the overall DMC is disadvantageous, since the consumption of renewable energy sources is associated with smaller environmental pressure than the consumption of non-renewable resources.

Material dependency on foreign countries, i.e. the share of imports on DMC continues to rise; in 2013 it reached 45.5%, which is 3.2 percentage points more than in the previous year and 20.7 percentage points more than in 2000. In terms of material groups, the Czech Republic is considerably or completely dependent on imports of oil, gas and metal minerals. On the other hand, in the case of biomass the domestic production exceeds the consumption and the biomass surplus is exported.

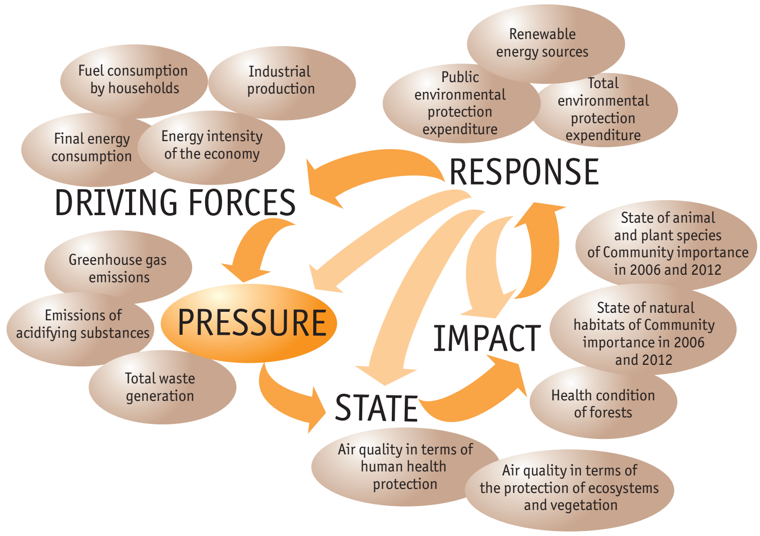
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

35/ Material intensity of GDP

KEY QUESTION

Is the material intensity of GDP generation decreasing in the Czech Republic?



KEY MESSAGES

The material intensity of the Czech economy is decreasing, it decreased by 37.3% in the period 2000–2013. In 2013[1] it decreased by 0.9% in comparison with the previous year. The decrease in material intensity enables the reduction of the environmental burden caused by material consumption per unit of GDP generated.

A long term state in which the economy is growing and the environmental burden caused by material consumption is decreasing, i.e. so called absolute decoupling, is not being attained. The interdependence of economic development and material consumption therefore still remains significant.

OVERALL ASSESSMENT

Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Europe 2020 competitiveness strategy – initiative for a more resource-efficient Europe
- efficient use of natural resources
- reduction of material intensity of economy (DMC/GDP)

7th Environmental Action Programme until 2020
- transition to a green, competitive and low-carbon resource-efficient economy

Waste Prevention Programme of the Czech Republic
- creation of conditions for lower consumption of primary resources and gradual reduction of waste production

Strategic Framework for Sustainable Development in the Czech Republic
- increase of energy and raw material efficiency of economy

National Reform Programme
- streamlining of the lifecycle of natural resources and reduction of material and energy intensity of the Czech economy

Secondary Raw Materials Policy of the Czech Republic
- promotion of the use of secondary raw materials as a tool for reducing energy and material intensity of industrial production

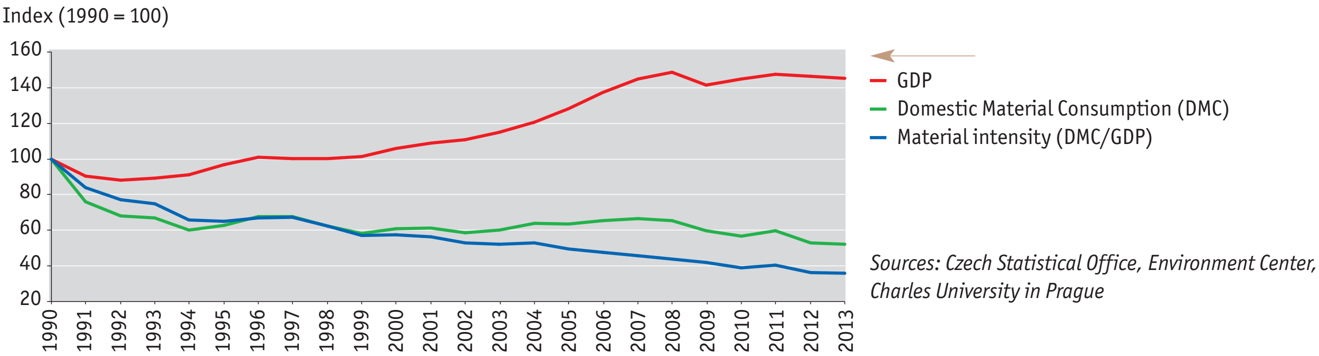
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The material intensity of GDP measures the efficiency in transforming primary materials into economic output and thus the extent to which the economy affects the state of ecosystems and human health. The environmental burdens (see the indicator Domestic Material Consumption) are associated with material consumption. The consequence of these burdens consists in a deteriorated state of the elements of the environment which may have an impact on human health and ecosystems. Material intensity is also closely linked to the intensity indicators of greenhouse gas emissions per capita and per unit of GDP, thus on the potential of reducing overall emissions.

[1] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*

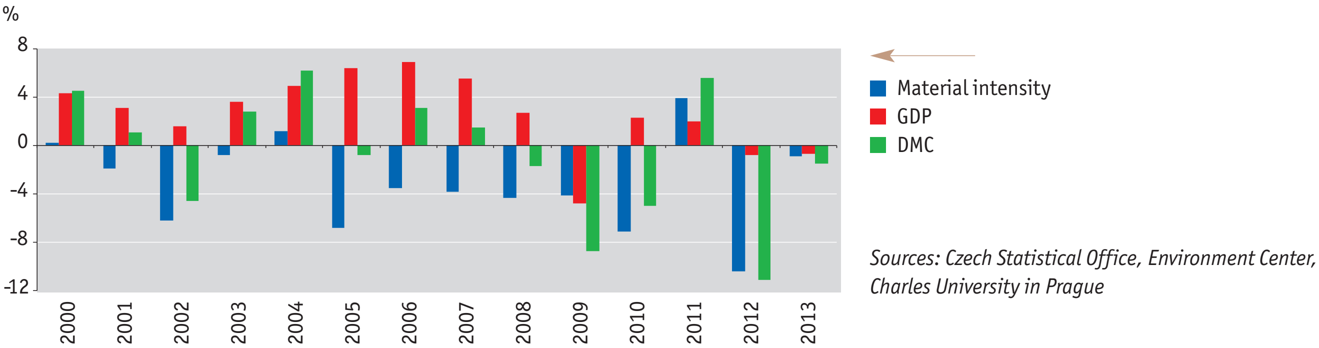
INDICATOR ASSESSMENT

Chart 1 ➜ **Material intensity, domestic material consumption and GDP in the Czech Republic [index number, 1990 = 100] 1990–2013**



GDP figures in constant prices in 2010. Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 ➜ **Year-to-year development of material intensity, DMC and GDP [%], 2000–2013**



GDP in constant prices in 2010. Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

The material intensity of the economy of the Czech Republic, i.e. the physical quantity of materials that the economy requires in order to create a unit of GDP, is steadily decreasing. It was reduced by 37.3% in the period 2000–2013 while the year-to-year decrease in 2013 was estimated at about 0.9% to 39.0 kg.1,000 CZK^{-1} (Chart 1) and was approximately one third of the value in comparison with the beginning of the 90s of last century. The decreasing material intensity represents a positive trend, which indicates the increasing efficiency of transformation of material inputs into economic performance and also the decrease of environmental burden per unit of GDP.

The period 1990–2000 saw the **reduction of material intensity**, in particular, as a result of the decline in domestic material consumption caused by structural changes in the national economy. Over these years the GDP changed insignificantly – it even decreased at the beginning of 1990s. In the period 2000–2007 the economic growth positively affected the development of material intensity, which was, however, accompanied by a slight rise in material consumption. This was the result of a situation in which significant economic growth was based on materially-intensive sectors, such as construction, manufacture of metalworking products, manufacture of machinery and equipment and manufacture of motor vehicles. Even after 2008 the decline of material intensity continued during insignificant development of Czech economy with a clear drop in 2009 (Chart 2). The major factors of the decline in material intensity in this period was the gradual increase in the share of nuclear energy and energy from renewable sources in the energy mix and the decline in coal consumption associated therewith, the reduction of energy consumption of transport and a drop in industrial production.

The development of material consumption in the period 1990–2013 as a whole represents the so-called **decoupling,** i.e. the separation of the development of economy and environmental burden. However, absolute decoupling, i.e. an ideal state from an environmental point of view, in which the economy is growing and the environmental burden represented by material consumption is decreasing, is not being attained in the long term. Relative decoupling, which consists in the similar trends in the development of material consumption and economy, while the consumption of materials is increasing in relative terms to a lesser degree than the economy or decreasing to a larger degree than the economy, was achieved as a result of the growth of the economy (at a growing DMC) in 1995, 2001, 2003 and 2006–2007. Relative decoupling at a decline of both the DMC and the economy was recorded in the years 1990–1992, 1997–1998, 2009 and in the years 2012–2013. In the reference period, absolute decoupling was reported only in the years 1993–1994, 1999, 2002, 2005, 2008 and in the year 2010 for the last time.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

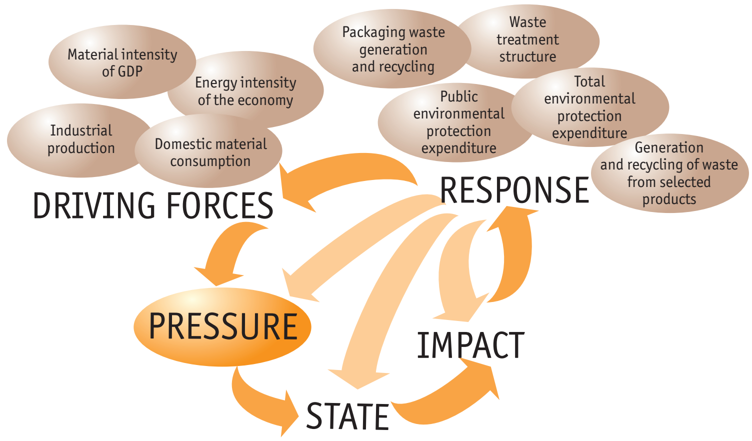
CENIA, key environmental indicators

http://indicators.cenia.cz

36/ Total waste generation

KEY QUESTION →

Is total waste generation declining?



KEY MESSAGES →

The total waste generation during the monitored period, i.e. since 2009, shows a stagnating trend.

OVERALL ASSESSMENT →

Change since 1990	N/A
Change since 2009[1]	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Directive 2008/98/EC of the European Parliament and of the Council on waste
- minimizing adverse impacts of the generation and treatment of waste
- prioritization of practical implementation of the waste hierarchy

The State Environmental Policy of the Czech Republic 2012–2020
- reducing adverse environmental impacts of waste
- preventing the generation of waste, in particular through environmental awareness of people
- supporting uses of waste as a substitute of natural resources
- supporting the development and generation of easily repairable, recyclable and materially usable products
- reducing generation through the use of the latest available technologies, reuse of waste and support of waste-free technologies
- preventing the generation of hazardous waste through reducing the content of hazardous substances in products

Government Regulation No. 197/2003 Coll., on the Waste Management Plan (WMP)
- preventing the generation of waste
- reducing specific waste generation, including that of hazardous waste, independently on the level of economic growth
- reducing the quantity and dangerous properties of waste
- maximizing the recovery of waste as a substitute of primary natural resources

Czech Republic's Waste Prevention Programme
- minimizing adverse impacts of the generation of waste on human health and environment
- reducing the quantity and dangerous properties of generated waste
- maximizing the recovery of waste as a substitute of primary resources
- prevention in the form of reuse of product and improved generation efficiency

Secondary Raw Materials Policy of the Czech Republic
- supporting innovations allowing secondary raw materials to be obtained from waste in a quality suitable for further industrial use
- supporting innovations in and transfers of science and research into the industry of processing and use of secondary raw materials
- obtained from waste, in the framework of programmes of the Ministry of Industry and Trade (Operational Programme Enterprise and Innovations for Competitiveness)
- supporting the introduction of voluntary agreements between state authorities and the business community for the purpose of voluntarily establishing product take-back systems, and thus eliminating the generation of waste

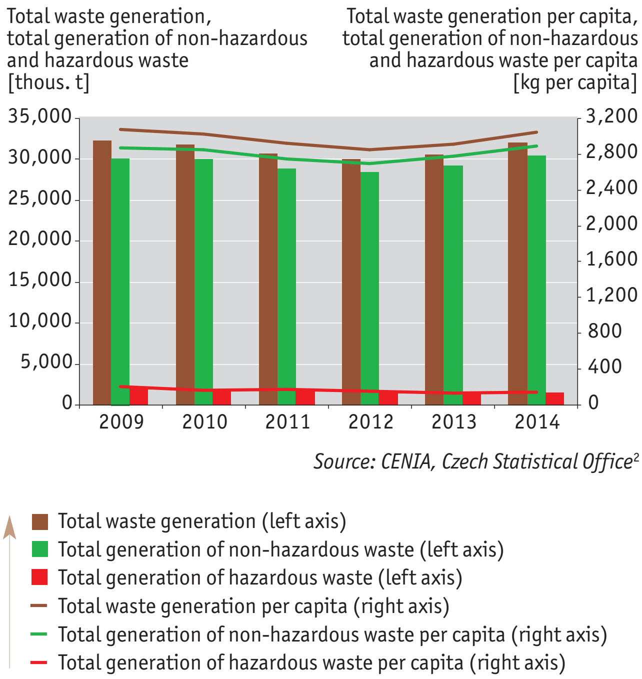
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Waste is an inseparable product of human activities, which is why emphasis is placed on its prevention and the use of the best available technologies. Due to its quantity and composition, the generation of waste may pose risks both to human health and ecosystems. The objective is to minimize adverse impacts of the generation of waste on the environment and to reduce the exploitation of resources. In particular, waste should substitute natural materials, raw materials and primary energy resources. The generation and subsequent treatment of waste may involve activities in the course of which non-indigenous substances escape into the atmosphere, pollute water and soil, or cause pollution of food and occupation of land. Through the food chain, substances contained in waste can find their way into the human body, which especially the waste with dangerous properties causes irreversible changes to.

[1] *OVERALL ASSESSMENT – postponed because of changes of the calculation methodology.*

INDICATOR ASSESSMENT

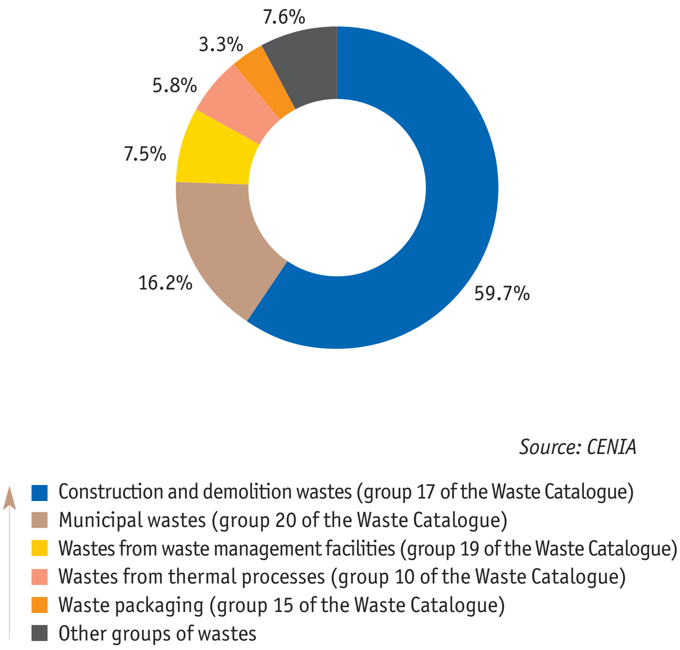
Chart 1 ➜ **Total waste generation, total generation of non-hazardous and hazardous waste in the Czech Republic [thous. t], total waste generation per capita in the Czech Republic [kg per capita], total generation of non-hazardous and hazardous waste per capita in the Czech Republic [kg per capita], 2009–2014**



Source: CENIA, Czech Statistical Office[2]

The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Chart 2 ➜ **Structure of total waste generation in the Czech Republic [%], 2014**



Source: CENIA

The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Between 2009 and 2014, the **total waste generation** (the sum of total generations of non-hazardous and hazardous waste) was stagnating, or rather showed a slight decrease by 0.7% to 32,028.4 thous. t, in spite of a 4.6% increase in the last available year-to-year comparison between 2013 and 2014. Another important indicator is the **total waste generation per capita**, which was 3,043.1 kg per capita in 2014. Between 2009 and 2014, the value of the indicator dropped by 32.4 kg per capita. On the other hand, it rose by 129.9 kg per capita between 2013 and 2014 (Chart 1). The value of the indicator is influenced by several factors; however, the most important of them reflects construction work on government-funded building projects (Chart 2), as 59.7% of the total amount of waste is generated by the building industry (group 17 of the Waste Catalogue). The generation of this group of wastes rose by 1,220.0 thous. t to 19,124.6 thous. t in 2014.

Since 2009, the **total generation of non-hazardous waste** (Chart 1) showed a slight decrease of 1.2%, to 30,462.5 thous. t; between 2013 and 2014, it increased by 4.4%.

Hazardous waste represents only a relatively small portion of the total waste generation, just 4.9%. However, because of the danger it poses, the percentage of hazardous waste in the total waste generation is an essential indicator in the monitoring of the development of waste management (WM) in the Czech Republic. Between 2009 and 2014, the value of the indicator dropped from 6.7% to 4.9%, in spite of a slight increase from 4.7% to 4.9% between 2013 and 2014. A positive trend can also be observed in an absolute reduction of the total generation of hazardous waste. Between 2009 and 2014, the total generation of hazardous waste dropped by 27.6%, although it increased again by 8.5% between 2013 and 2014. The **total generation of hazardous waste per capita** in 2014 was 148.8 kg per capita, and it decreased by 57.2 kg per

[2] Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

capita between 2009 and 2014, but last available year-to-year comparison between 2013 and 2014 shows an increase of 11.5 kg per capita (Chart 1). There are no clearly defined development trends in the generation of hazardous waste, which depends mainly on the condition of economy and industry. The increased amount of hazardous waste generated was attributable to projects of reclamation of historically contaminated sites which were going on during the monitored period. The generation of hazardous waste can be prevented by reducing the content of hazardous substances in products.

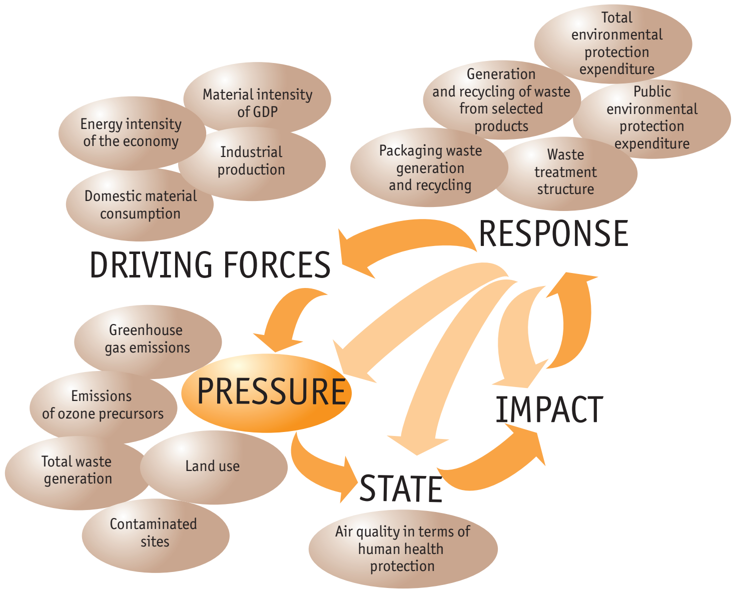
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

37/ Municipal waste generation and treatment

KEY QUESTION →

Is the generation of municipal waste decreasing and is the structure of municipal waste treatment changing?



KEY MESSAGES →

The total municipal waste generation during the monitored period, i.e. since 2009, shows a stagnating trend.

Although landfilling continues to prevail as the principal method of municipal waste treatment, its use has been declining since 2009 in favour of material and energy recovery.

OVERALL ASSESSMENT →

Change since 1990	N/A
Change since 2009[1]	(neutral)
Last year-to-year change	(neutral)

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Council Directive 1999/31/EC on the landfill of waste
- preventing and minimizing adverse environmental impacts of municipal waste landfilling
- reducing the proportion of landfilled biodegradable municipal waste (BMW) to 35% (of weight) of the total amount of BMW (produced in 1995) by 2020

The State Environmental Policy of the Czech Republic 2012–2020
- adhering to and complying with the hierarchy of municipal waste treatment
- increasing the proportions of municipal waste used for material and energy recovery
- reducing the proportion of landfilling in the disposal of municipal waste
- increasing the proportion of selected household and similar waste prepared for reuse and recycling to 50% of weight by 2020

Government Regulation No. 197/2003 Coll., on the Waste Management Plan (WMP)
- increasing the proportion of municipal waste used for material recovery
- reducing the weight proportion of landfilled municipal waste
- reducing the maximum amount of landfilled BMW

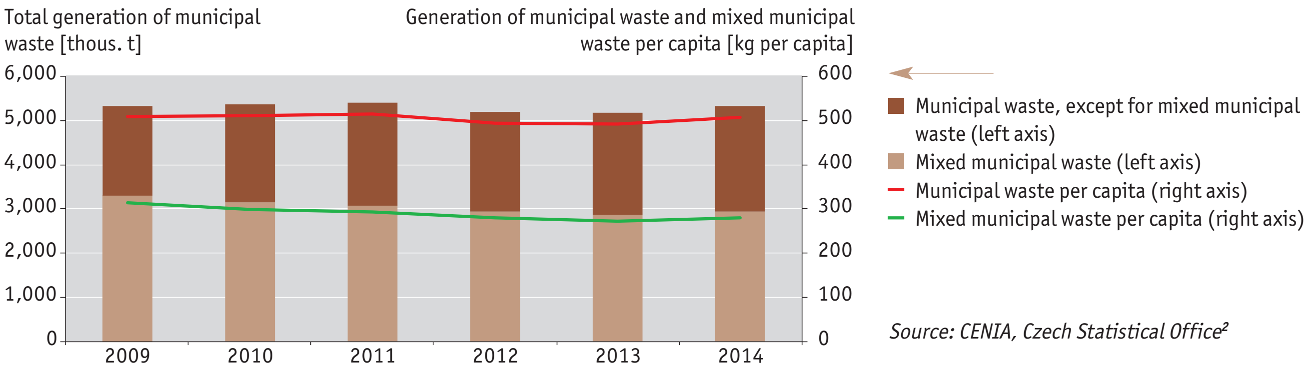
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The definition of municipal waste laid down in the Waste Act indicates that the generation of municipal waste is closely related to the place of residence of every individual and that the waste can affect the state of health and aesthetic perception of the human society. While mixed municipal waste is not classified as hazardous, it may contain, if unsorted, various hazardous components, including batteries and accumulators, paints, solvents, drugs etc. If not properly treated of, the substances contained in municipal waste may find their way into the environment, namely into the atmosphere, water and soil. Here they may be deposited in biomass for extended periods of time and propagate further through the food chain. Other effects of the generation and treatment of municipal waste include adverse impacts on the landscape character and function related to the operation of waste treatment facilities. Landfilled BMW is a source of greenhouse gases and, if the landfill is not properly secured, also of eluates in seepage water and soils. Through animals, its harmful components may find their way into the food chain and adversely affect human health. However, if municipal waste is properly separated and processed, its effects on the environment and human health are positive (use of BMW as compost or anaerobic digestate as a biofertilizer).

[1] *OVERALL ASSESSMENT – postponed because of changes of the calculation methodology.*

INDICATOR ASSESSMENT

Chart 1 → **Total generation of municipal waste in the Czech Republic [thous. t], generation of municipal and mixed municipal waste per capita in the Czech Republic [kg per capita], 2009–2014**



Source: CENIA, Czech Statistical Office[2]

The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Table 1 → **Selected municipal waste treatment methods in the Czech Republic as percentages of the total generation of municipal waste [%], 2009–2014**

Treatment method [%]	2009	2010	2011	2012	2013	2014
Proportion of municipal waste used for energy recovery	6.0	8.9	10.8	11.8	11.9	11.8
Proportion of municipal waste used for material recovery	22.7	24.3	30.8	30.4	30.2	34.7
Proportion of municipal waste disposed of by landfilling	64.0	59.5	55.4	53.6	52.2	48.3
Proportion of municipal waste disposed of by incineration	0.04	0.04	0.04	0.04	0.05	0.07

The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Source: CENIA

The **municipal waste** includes, for example, mixed municipal waste, its separated components (paper, plastic, glass, and beverage cartons), large-volume waste, but also hazardous waste.

Since 2009 till 2014, the **total generation of municipal waste** was stagnating or, more precisely, oscillating around a value slightly above 5 mil. t (Chart 1).

As municipal waste is closely related to the place of residence of every individual, the development of its **per capita generation** represents an important indicator. Between 2009 and 2014, the average generation of municipal waste per capita was equal to 503.7 kg per capita. More specifically, the indicator's value in 2014 was 505.8 kg per capita. Since 2009, there was thus been a slight decline of 1.6 kg per capita, in spite of an increase of 14.2 kg per capita between 2013 and 2014 (Chart 1).

The category of **mixed municipal waste** includes waste falling under catalogue number 20 03 01. It is unseparated waste produced by households, but also by non-manufacturing activities of businesses. The fact that the generation of mixed municipal waste has been declining since 2009 can be regarded as particularly positive. Between 2009 and 2014, the generation of mixed municipal waste dropped by 10.6%, although there was a year-to-year increase of 2.7% in 2014, to 2,936.9 thous. t. Mixed municipal waste accounts for 55.1% of the total generation of municipal waste. Just like in the case of the total generation of municipal waste, the **per capita generation** of mixed municipal waste is

[2] *Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).*

an important indicator for comparisons. Between 2009 and 2014, the total generation of mixed municipal waste per capita dropped by 34.1 kg per capita; however, there was a year-to-year increase of 6.9 kg per capita between 2013 and 2014, to 279.0 kg per capita (Chart 1).

The **waste treatment methods** are identified using codes defined in Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste treatment details, as amended. According to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set", the waste treatment methods can be divided as follows:

- use of municipal waste for material (recovery, recycling and others),
- use of municipal waste for energy (using waste in a manner similar to fuels and in other ways to generate energy),
- disposal of municipal waste in landfills (by landfilling),
- disposal of municipal waste in incinerators (incineration on land).

Municipal waste is a specific group of waste, which fact is also reflected in its **treatment methods**. Unlike in other groups, the prevailing method of disposal is **landfilling**. Since 2009, however, there was a slight decline in the quantity of landfilled municipal waste every year (Table 1). Between 2013 and 2014, the quantity of landfilled municipal waste dropped by 128.8 thous. t to 2,570.0 thous. t. Between 2009 and 2014, the percentage of municipal waste disposed of by landfilling decreased from 64.0% to 48.3%.

Another important municipal waste treatment method is its use for **material recovery**, the proportion of which increased from 22.7% in 2009 to 34.7% in 2014. Between 2013 and 2014, the quantity of municipal waste used for material recovery rose by 288.1 thous. t to 1,849.9 thous. t.

Step by step, the use of municipal waste for **energy recovery** is also becoming more important. Since 2009, the percentage of municipal waste used for this purpose increased from 6.0% to 11.8%. Between 2013 and 2014, the quantity of municipal waste used for energy recovery rose by 12.7 thous. t to 627.2 thous. t.

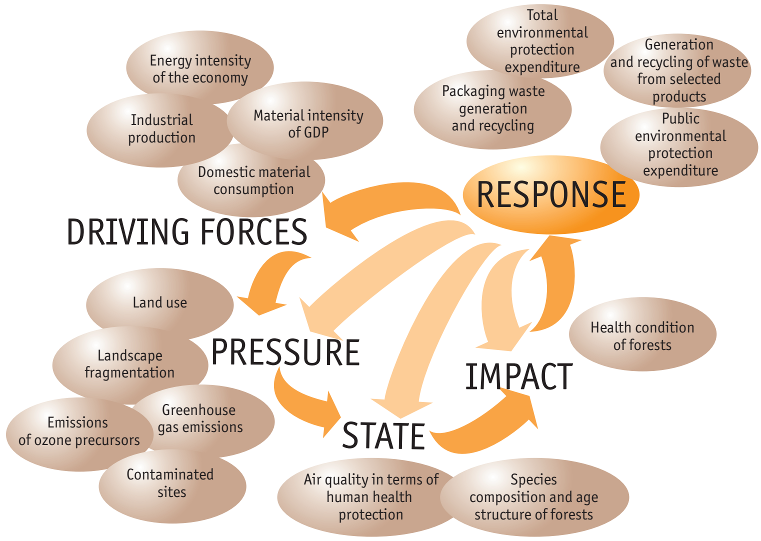
As to **incineration**, the situation is dramatically different; the method is used to treat of an almost negligible amount of municipal waste (its percentage is almost zero).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indicators.cenia.cz

38/ Waste treatment structure

KEY QUESTION →

How has the waste treatment structure been changing?



KEY MESSAGES →

Between 2009 and 2014, the proportion of waste used for material recovery rose from 72.5% to 79.5%. During the same period, the percentage of waste disposed of by landfilling dropped.

In the long run, the use of waste for energy recovery has been more or less stagnating.

OVERALL ASSESSMENT →

Change since 1990	N/A
Change since 2009[1]	positive (smiley)
Last year-to-year change	positive (smiley)

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

Directive 2008/98/EC of the European Parliament and of the Council on waste
- waste treatment in compliance with environmental and human health protection
- supporting implementation of the hierarchy of waste treatment

The State Environmental Policy of the Czech Republic 2012–2020
- adhering to and complying with the hierarchy of waste treatment: prevention of the generation of waste, preparations for reuse, waste recycling, other waste recovery (e.g. energy) and disposal methods
- maximizing the recovery of waste
- reducing the proportion of landfilled waste in the total quantity of waste that is disposed of
- preventing unlawful treatment of hazardous waste
- minimizing risks of cross-border transport of waste and its environmental impacts

Government Regulation No. 197/2003 Coll., on the Waste Management Plan (WMP)
- minimizing adverse impacts of waste treatment on human health and environment
- maximizing the recovery of waste as a substitute of primary natural resources, with recycling being the preferred method
- building up a uniform and adequate network of waste treatment facilities and stopping the support of establishing additional landfilling sites by the state

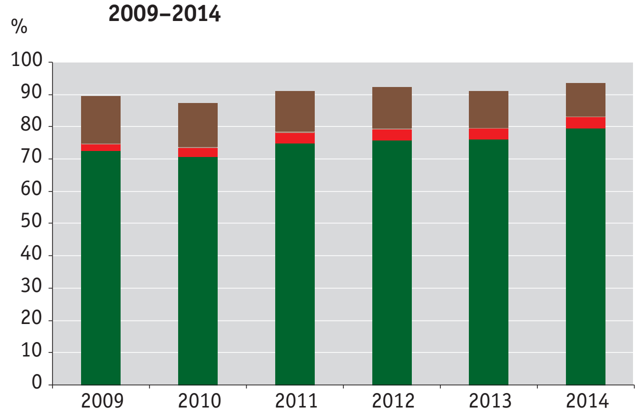
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Waste must be treated of in a manner that does not pose a threat to human health and components of the environment, is not a nuisance because of the noise or odour it generates, and does not adversely affect the landscape or sites of special interest. In a broader sense, the term waste treatment includes gathering, collection, purchase, handling, transport, storage, treatment, recovery and disposal of waste. All of these operations can cause a release of pollutants into the environment. Compliance with safe waste treatment rules and adherence to the hierarchy of waste treatment, with priority assigned to preventing the generation of waste, are therefore essential. Other effects of waste treatment may include adverse impacts on the landscape character and functions caused by the construction and operation of waste treatment facilities. Landfilling poses another environmental threat, as it uses up land and is a source of emissions of greenhouse gases; if the landfill is not properly secured, there is also a possibility of eluates seeping into surface water and groundwater and also into soils. The odour and noise produced by waste treatment facilities are not inconsiderable as well.

[1] *OVERALL ASSESSMENT – postponed because of changes of the calculation methodology.*

INDICATOR ASSESSMENT

Chart 1 ➔ **Proportions of selected waste treatment methods in the total waste generation in the Czech Republic [%], 2009–2014**

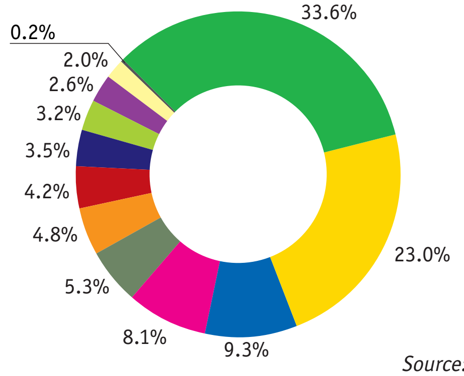


Source: CENIA

- Proportion of waste disposed of by landfilling
- Proportion of waste disposed of by incineration
- Proportion of waste used for energy recovery
- Proportion of waste used for material recovery

The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Chart 2 ➔ **Structure of waste used for material recovery in the Czech Republic [%], 2014**



Source: CENIA

- Use of waste for landscaping etc.
- Recycling/reclamation of other inorganic materials
- Exchange of waste for submission to any of the operations numbered R1 to R11
- Recycling/reclamation of metals and metal compounds
- Land treatment resulting in benefit to agriculture or ecological improvement
- Deposition of waste as technological material to secure landfill
- Use of waste obtained from any of the operations numbered R1 to R10
- Recycling/reclamation of organic substances
- Use of waste for reclamation of landfills
- Sale of waste as a raw material ("secondary raw material")
- Composting
- Other ways of waste using for material recovery (R2, R6, R7, R8, R9, N2, N8, N15)

The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

The **waste treatment methods** are identified using codes defined in Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste treatment details, as amended. According to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set", the waste treatment methods can be divided into uses of waste for material recovery (regeneration, recycling and others), uses of waste for energy recovery, disposal of waste by landfilling (deposition on landfills and others), and waste incineration.

Since 2009, a positive trend of a step-by-step increase of the proportion of **recovered wastes** at the expense of that of disposed wastes can be observed. The reasons include, in particular, changes of waste treatment technologies, the need to substitute primary materials (which waste can be a good source of), and financial support of waste use facilities provided under the Operational Programme Environment.

Similarly, there has also been a positive trend in the **use of waste for material recovery**; between 2009 and 2014, the proportion of waste used for this purpose rose from 72.5% to 79.5%. Between 2013 and 2014, the quantity of waste used for material recovery increased by 2,155.8 thous. t to 25,466.9 thous. t (Chart 1). Insofar as the structure of the use of waste for material recovery is concerned, no significant changes have been observed in recent years. The use of waste (particularly construction and demolition wastes) for landscaping and recycling of other inorganic materials and metals still rank among the most frequently employed methods (Chart 2).

Only a small proportion of the total waste generation is used for **energy recovery.** In the long run, the use of waste for energy recovery has been more or less stagnating. Between 2009 and 2014, the percentage of waste used for energy recovery rose from 2.2% to 3.5%, and there was also a slight increase of the amount of waste used for this purpose between 2013 and 2014, by 68.3 thous. t to 1,110.4 thous. t (Chart 1).

The **proportion of waste that is disposed of** in the total generation of waste has been steadily declining. The reasons include a higher level of recycling, uses of waste instead of primary materials, and, last but not least, also the introduction and implementation of modern waste treatment technologies.

The most frequent method of waste disposal is depositing waste onto or into land, i.e. **landfilling**. This fact represents a persistent major problem for the Czech Republic. However, the situation changed for the better between 2009 and 2014, with the proportion of landfilled waste in the total generation of waste dropped from 14.6% to 10.3%. The 2013–2014 year-to-year comparison indicates a decline of the amount of landfilled waste by 169.4 thous. t to 3,293.5 thous. t (Chart 1).

Another method of waste disposal is **incineration**. In the long run, it has been stagnating. Only some 0.3% of the total waste generated is incinerated every year, which is a negligible proportion compared to landfilling (Chart 1).

Proper waste treatment and compliance with rules of operation applying to waste treatment facilities are regularly checked by the Czech Environmental Inspectorate. In 2014, inspectors of its waste management, packages and chemical substances department conducted 3,422 inspections, 1,442 of them planned and 1,980 unplanned, including 599 inspections based on a proposal or submission delivered to the organization. The aggregate amount of fines levied on the basis of the inspections was CZK 68,373 thous., i.e. CZK 24,568.1 thous. less than in 2013.

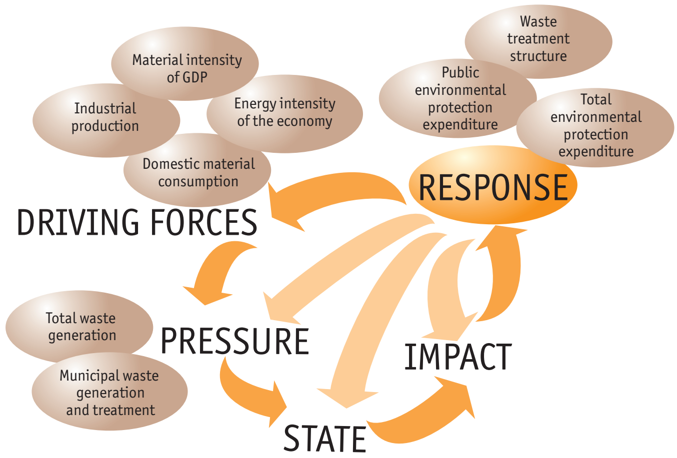
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

39/ Packaging waste generation and recycling

KEY QUESTION →

Is the amount of generated packaging waste decreasing and is the proportion of packaging waste recovery increasing?



KEY MESSAGES →

Between 2009 and 2014, the generation of packaging waste increased by 14.0%, but the percentage of recycled packaging waste was increasing as well. The most frequent uses of packaging waste include recycling and energy recovery. Annual legislative objectives of recycling and overall recovery of packaging waste were fulfilled.

OVERALL ASSESSMENT →

Change since 1990	N/A
Change since 2009[1]	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

European Parliament and Council Directive 94/62/EC on packaging and packaging waste

- minimizing environmental effects of packagings and packaging waste
- preventing the generation of packaging waste through a reduction of the total volume of packagings
- supporting repeated use of packagings
- developing innovative, environment-friendly and sustainable recycling processes
- reducing the toxicity of packaging waste through preventing the use of heavy metals in packagings

The State Environmental Policy of the Czech Republic 2012–2020

- minimizing the quantity of packagings used
- increasing the level of material recovery to 70% and the level of overall recovery of packaging waste to 80% by 2020

Government Regulation No. 197/2003 Coll., on the Waste Management Plan (WMP)

- preventing the generation of packaging waste
- providing prerequisites in support of reusable packagings and repeated use of packagings as an essential condition of reducing the generation of packaging waste
- priority: prevention, repeated use, recycling

Act No. 477/2001 Coll., on packaging

- preventing the generation of packaging waste through reducing the weight, volume and harmful effects of and contents of chemical
- substances contained in packagings
- producing packagings that are reusable, recyclable or organically recyclable, or can be used for energy recovery
- increasing the level of material recovery to 55% and the level of overall recovery of packaging waste to 60% by December 31, 2014 (the objectives are set every year)

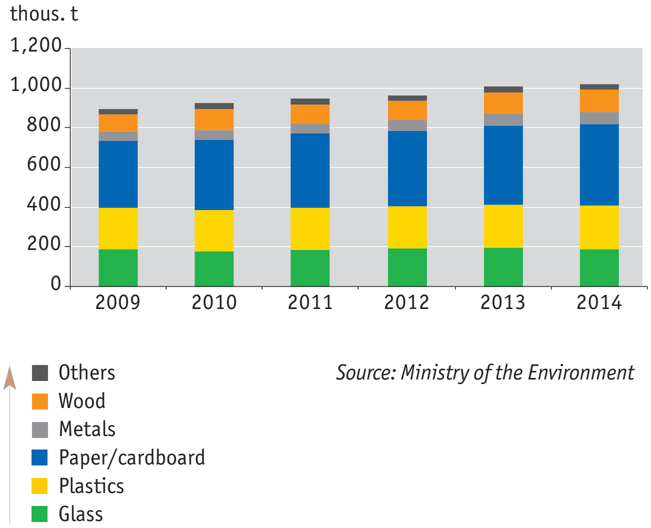
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

One of the phenomena characterizing the consumer society is the generation of packaging waste. On the one hand, it results in an increased pressure on the environment; however, material recycling of packaging waste significantly reduces the pressure, as it saves, inter alia, natural resources and reduces energy demands of the production process. Both the generation of packagings and packaging waste treatment facilities are environmental burdens, particularly with respect to harmful pollutants they release into the atmosphere or water, which subsequently have an adverse impact on human health. The presence of heavy metals is also a factor of environmental pollution (including organisms), which is why their use in packagings is regulated by the Packaging Act. When looking for a suitable packaging, i.e. one which is environmentally friendly, it is necessary to consider the entire packaging system (raw material acquisition, generation of packaging, transport, consumption, usability, recyclability and suitable methods of disposal). Packaging waste affects the character of the landscape, and may change the development of different plant and animal species or influence their biotopes.

[1] *OVERALL ASSESSMENT – postponed because of changes of the calculation methodology.*

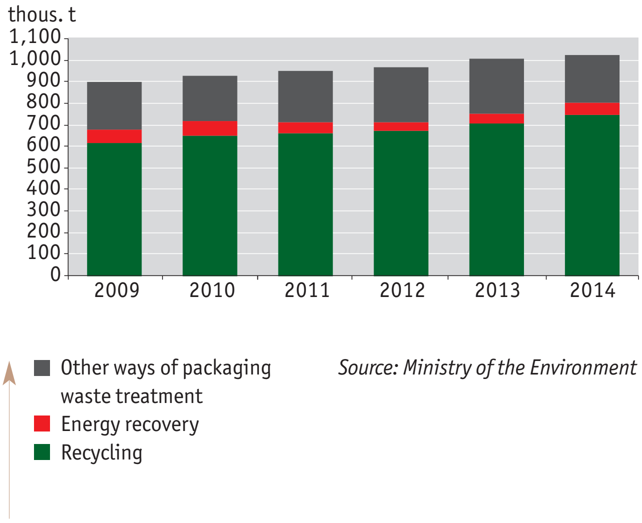
INDICATOR ASSESSMENT

Chart 1 → **Packaging waste and packaging waste material structure in the Czech Republic [thous. t], 2009–2014**



Source: Ministry of the Environment

Chart 2 → **Recovery of packaging waste in the Czech Republic [thous. t], 2009–2014**



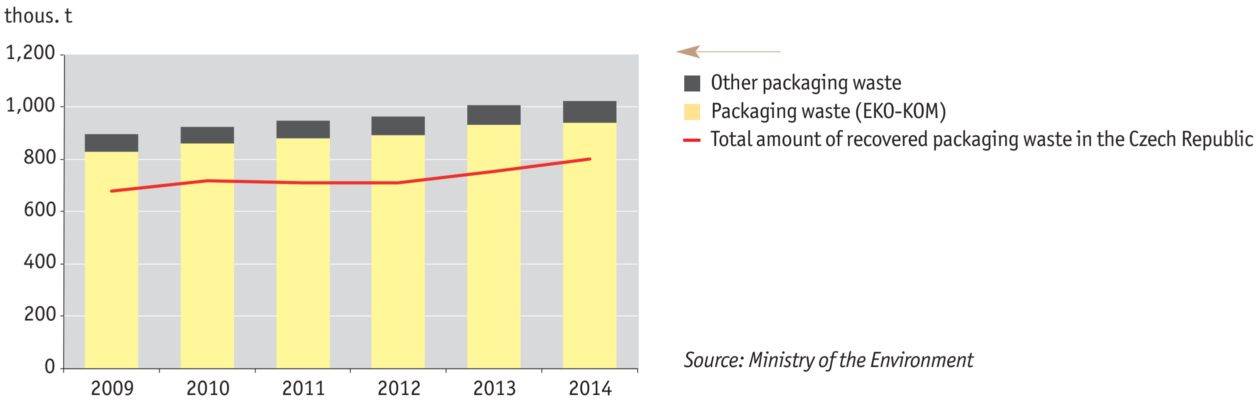
Source: Ministry of the Environment

Table 1 → **Number of entities that are obligated to utilize packaging waste or to provide take-back and that participate in the EKO-KOM system, and the number of municipalities that participate in the EKO-KOM system, 2009–2014**

Year	Number of clients participating in the EKO-KOM system	Number of municipalities participating in the EKO-KOM system
2009	20,573	5,861
2010	20,591	5,904
2011	20,482	5,993
2012	20,241	6,025
2013	20,233	6,057
2014	20,277	6,073

Source: EKO-KOM, a.s.

Chart 3 → **Generation and recovery of packaging waste (within the EKO-KOM system and elsewhere) in the Czech Republic [thous. t], 2009–2014**



Source: Ministry of the Environment

A growing **generation of packaging waste** is one of the most characteristic phenomena of the consumer society. This phenomenon has been present in the Czech Republic for quite some time. Between 2009 and 2014, the generation of packaging waste rose by 14.0%. In 2014, the generation of packaging waste in the Czech Republic amounted to 1,019.8 thous. t, a 1.4% increase compared to 2013. The year-to-year growth rate of the generation of packaging waste has been increasing since 2009 (Chart 1).

As to the **material structure of packaging waste**, the most frequently occurring component are paper or cardboard packagings (40.3% in 2014), a long way ahead of plastics (21.5%) and glass (18.6%). The structure has been relatively stable over the years, with year-to-year fluctuations of percentages of the different types of packaging waste not exceeding 4% (Chart 1).

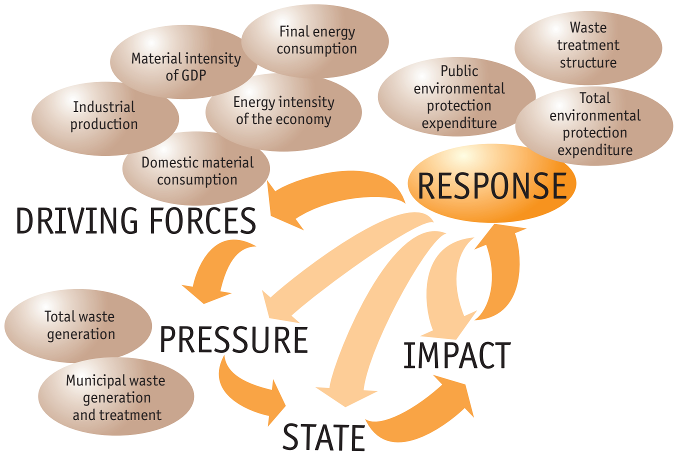
The **total amount of recovered packaging waste** in the Czech Republic in 2014 was 801.2 thous. t, i.e. 78.6% of the total generation of packaging waste. The legislative objective (60%) for 2014 was thus met. Since 2009, the amount increased by 123.0 thous. t, i.e. 18.1%, and the year-to-year increase between 2013 and 2014 was 49.6 thous. t, i.e. 6.6% (Chart 3).

In the light of the steadily growing generation of packaging waste, the increasing **proportion of recycled packaging waste** can be viewed as a very positive phenomenon (Chart 2). Recycling is the most frequent use of packaging waste. Between 2009 and 2014, the amount of recycled packaging waste rose by 128.7 thous. t and between 2013 and 2014 by 40.9 thous. t, to 744.3 thous. t. While the proportion of recycled packaging waste in the total generation of packaging showed only a slight increase between 2009 and 2014 (to 73.0%), it still meets the legislative objective for that year (55%), and by a large margin at that. The second most frequent recovery is energy; however, the proportion of packaging waste used for this purpose dropped from 7.0% in 2009 to 5.6% in 2014. However, the last year-to-year comparison between 2013 and 2014 showed an increase of 8.7 thous. t, to 56.9 thous. t.

Issues related to packaging waste are dealt with in Act No. 477/2001 Coll., on packaging, according to which all entities introducing packagings or packaged products in the market are obliged to take back and use packaging waste. The relevant entities can meet the above obligation either on their own, or collectively, through EKO-KOM, a.s., the authorized packaging company. There were no significant changes in the number of clients meeting their obligation through the **authorized packaging company** between 2009 and 2014 (Table 1); nevertheless, when looking at each year, it is possible to see some dynamism in the number of clients joining or leaving the collective system. The EKO-KOM system had the highest number of clients in 2010; since then, the number was gradually dropping until 2014, when the trend was reversed. The fluctuations of the number of client are caused by winding up or mergers of companies. In 2014, the number of clients using the system of the authorized packaging company EKO-KOM, a.s., thus reached 20,277. The number of municipalities making use of the system was gradually growing; by 2014, their number was 6,073 (out of the total number of 6,253 municipalities in the Czech Republic), with 10,483 thous. inhabitants (i.e. roughly 99% of the Czech population). The number of new entrants in 2014 was 16. In 2014, the proportion of packaging waste registered in the EKO-KOM system accounted 92.0% of the total generation of packaging waste (Chart 3).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indicators.cenia.cz

40/ Generation and recycling of waste from selected products



KEY QUESTION

Is the amount of generated waste from selected products decreasing and is the proportion of its recovery increasing?

KEY MESSAGES

Between 2009 and 2014, the generation of waste from selected products increased, and the same applies to the period between 2013 and 2014. Since 2009, the take-back of most of the selected products also rose, as it also did between 2013 and 2014. During the monitored period, it was the take-back of portable batteries and accumulators that showed the greatest progress. The most frequent uses of waste from selected products include material and energy recovery. The percentage of waste from selected products used for material recovery is increasing.

OVERALL ASSESSMENT

Change since 1990	N/A
Change since 2009[1]	:-)
Last year-to-year change	:-)

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Directive 2012/19/EU of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE)
- preventing adverse effects of generation and treatment of WEEE on the environment and human health
- minimizing the disposal of WEEE as unsorted municipal waste and achieving a high level of separate collection of WEEE

Directive 2006/66/EC of the European Parliament and of the Council on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC
- supporting high levels of collection and recycling of waste batteries and accumulators
- minimizing the disposal of waste batteries and accumulators as mixed municipal waste
- prohibition of the placing of certain batteries and accumulators containing mercury and cadmium on the market
- achieving the following recycling efficiency of recycling processes: lead-acid batteries and accumulators 65%, nickel-cadmium batteries and accumulators 75%, other waste batteries and accumulators 50%

Directive 2000/53/EC of the European Parliament and of the Council on end-of life vehicles
- preventing generation of waste from vehicles
- increasing rates of reuse and recycling of waste from vehicles and reducing their quantity that is disposed of

The State Environmental Policy of the Czech Republic 2012–2020
- increasing levels of collection, recovery and reuse of waste electrical and electronic equipment
- achieving the following minimum levels of collection of batteries and accumulators (percentages of the total quantity of products placed on the market per year): 25% by September 26, 2012; 45% by September 26, 2016

Government Regulation No. 197/2003 Coll., on the Waste Management Plan (WMP)
- implementing procedures enabling to increase the efficiency of take-back and recovery in the collection, gathering and sorting of waste batteries and accumulators
- achieving, not later than by January 1, 2015, a reuse and recovery rate of at least 95% of the average weight of all car wrecks taken over during the calendar year, and a reuse and material recovery rate of at least 85% of the average weight of all car wrecks taken over during the calendar year

Secondary Raw Materials Policy of the Czech Republic
- preparing an Action Plan in support of the Czech Republic's self-sufficiency in raw materials through substituting primary resources by secondary raw materials in cases where such substitutions are technically feasible and economically profitable
- supporting innovations in and transfers of science and research into the industry of processing and use of secondary raw materials obtained from waste, in the framework of programmes of the Ministry of Industry and Trade (Operational Programme Enterprise and Innovations for Competitiveness)
- inclusion of technologies of processing and use of secondary raw materials obtained from waste among industries supported by investment incentives

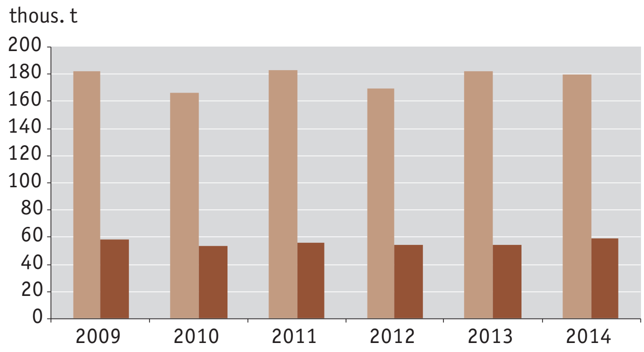
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Waste from selected products (electrical and electronic equipment, batteries and accumulators, car wrecks, tyres) contain substances which, if treated improperly, may find their way into the environment, namely into the atmosphere, water and soil, and pose a risk for the environment and human health. In order to maintain and improve quality of the environment and to save energy, the content of such substances in products must be reduced, and waste resulting from the products must be treated properly, usually by special procedures specific for different products. The amount of this waste and its adverse impacts on the environment and human health can be reduced by, for example, developing clean and reusable products and special technologies used to manufacture them.

[1] *OVERALL ASSESSMENT – postponed because of changes of the calculation methodology.*

INDICATOR ASSESSMENT

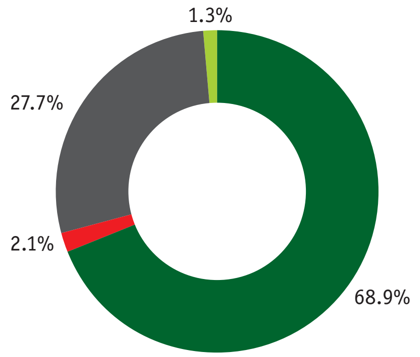
Chart 1 → **Quantity of electrical and electronic equipment placed on the market and the take-back rate of electrical and electronic equipment and separate collection of waste electrical and electronic equipment achieved in the Czech Republic [thous. t], 2009–2014**



Source: Ministry of the Environment

- Electrical and electronic equipment placed on the market
- Take-back + separate collection

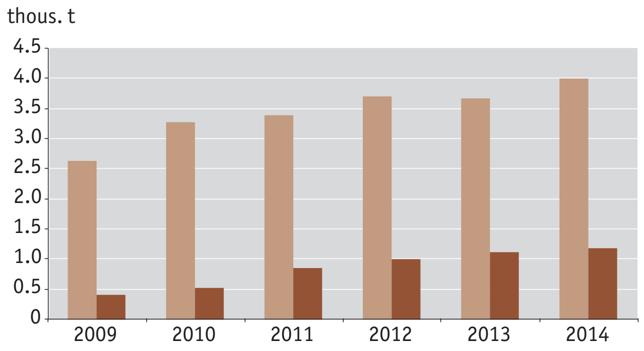
Chart 2 → **Electrical and electronic equipment and waste electrical and electronic equipment treatment methods in the Czech Republic [%], 2014**



Source: Ministry of the Environment

- Reuse
- Material recovery
- Energy recovery
- Other ways of waste treatment

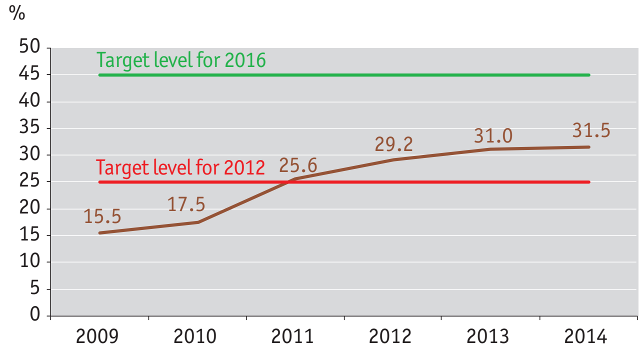
Chart 3 → **Quantity of portable batteries and accumulators placed on the market and quantity of portable batteries and accumulators taken back in the Czech Republic [thous. t], 2009–2014**



Source: Ministry of the Environment

- Quantity of portable batteries and accumulators placed on the market
- Quantity of portable batteries and accumulators taken back

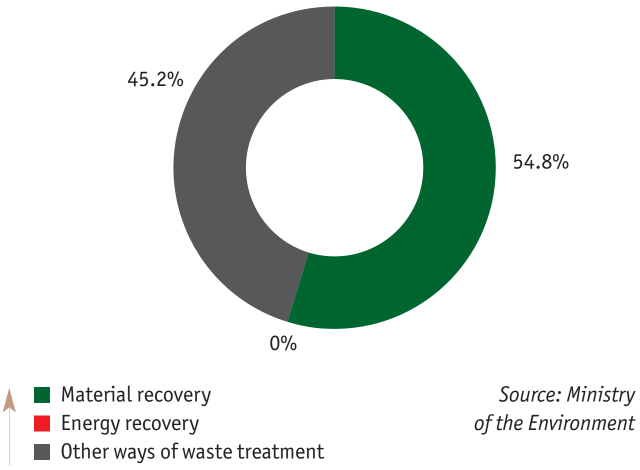
Chart 4 → **Development of the take-back level of portable batteries and accumulators in the Czech Republic [%], 2009–2014**



Source: Ministry of the Environment

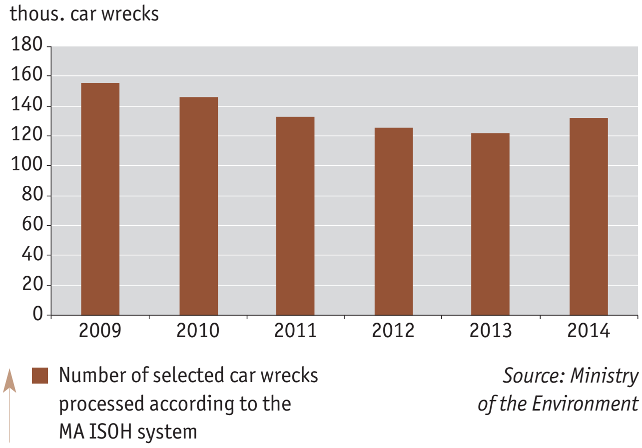
- Take-back level

Chart 5 → **Treatment of portable batteries and accumulators taken back in the Czech Republic [%], 2014**



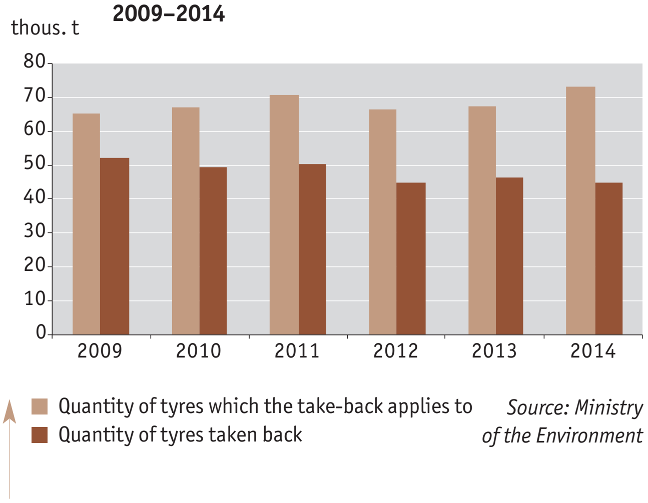
Source: Ministry of the Environment

Chart 6 → **Number of selected car wrecks processed in the Czech Republic according to the MA ISOH system [thous. car wrecks], 2009–2014**



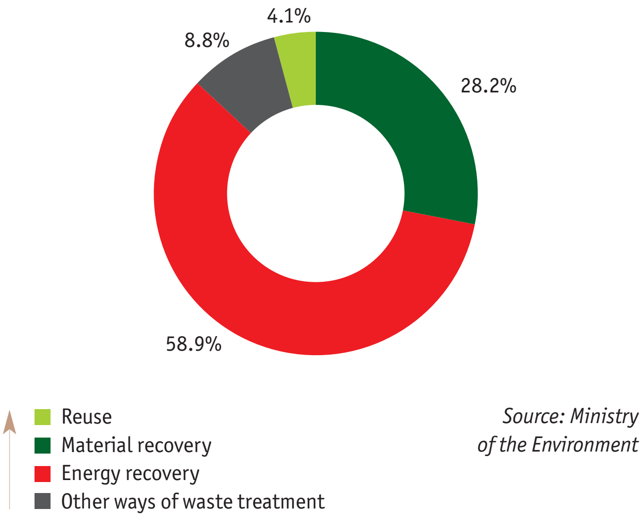
Source: Ministry of the Environment

Chart 7 → **Quantity of tyres placed on the market and quantity of tyres taken back in the Czech Republic [thous. t], 2009–2014**



Source: Ministry of the Environment

Chart 8 → **Treatment of tyres in the Czech Republic [%], 2014**



Source: Ministry of the Environment

Between 2009 and 2014, the **quantity of electrical and electronic equipment[2] placed on the market** showed a slight decline of 1.4%, and the same decline, i.e. 1.4%, was also registered between 2013 and 2014, bringing the total to 179.3 thous. t (Chart 1).

The take-back applies to selected used household electrical and electronic equipment and appliances, which are handed back at take-back points, to firms processing electrical and electronic waste, or at end sellers of such equipment and appliances. As to non-household electrical waste which comes from electrical and electronic equipment intended exclusively for professional applications, its separate collection is arranged by the manufacturer. Since 2009, the take-back and separate collection has been more or less stagnating (Chart 1). In most cases, manufacturers fulfil these obligations through collective systems.

In 2014, the most frequent use of **electrical and electronic equipment and waste electrical and electronic equipment** was material recovery, which accounted for a 68.9% share. The use of the waste for energy recovery and reuse accounted only for 2.1% and 1.3%, respectively (Chart 2). Between 2013 and 2014, the proportion of electrical and electronic waste used for material recovery rose from 67.5% to 68.9%, which translates into 40.8 thous. t. During the same period, the use of the waste for energy recovery and reuse rose from 1.5% to 2.1% and from 1.1% to 1.3%, respectively.

[2] *http://www.mzp.cz/cz/odpadni_elektronicka_zarizeni_nakladani_cr*

When assessing data on **batteries and accumulators**[3], it is necessary to distinguish between their different groups, which include automotive, industrial and portable batteries and accumulators. The greatest attention is paid to portable batteries and accumulators, as they pose the highest risk that they would be, due to their small dimensions, disposed of as a component of mixed municipal waste.

Between 2009 and 2014, the generation of portable batteries and accumulators was found to grow by 51.6%. Between 2013 and 2014, the generation of portable batteries and accumulators increased by 8.9% to a total amount of 4.0 thous. t (Chart 3).

The growing generation was also reflected in an increased volume of portable batteries and accumulators taken back; between 2009 and 2014, there was a significant increase of 191.9% to 1.2 thous. t. The year-to-year increase between 2013 and 2014 was equal to 7.3% (Chart 3).

Between 2009 and 2014, the **take-back level** of portable batteries and accumulators increased from 15.5% to 31.5%. On a year-to-year (2013–2014) basis, the take-back level increased from 31.0% to 31.5%. The reasons why the take-back level was growing included better awareness of take-back obligations and an expanded network of collection points. The number of manufacturers which properly meet their obligations, in particular through collective systems, is also increasing. One of the essential requirements applying to portable batteries and accumulators is achieving a minimum take-back level. The objective for 2012 (25%) was achieved, as the actual take-back level was 29.2% (Chart 4). Insofar as the 2016 target figure (45%) is concerned, however, the existing growth rate is not sufficient.

As to **methods employed to treat of** portable batteries and accumulators taken back in 2014, the dominant position belonged to material recovery, with a 54.8% share; they are not used for energy recovery (Chart 5). Between 2010 and 2014, the percentage of portable batteries and accumulators used for material recovery grew from 46.7% to 54.8%, i.e. to 0.7 thous. t, a slight decline experienced in 2014 notwithstanding.

According to the Directive, recycling processes must achieve a prescribed recycling efficiency. In 2014, the recycling efficiencies of lead-acid batteries, nickel-cadmium batteries and accumulators and other waste batteries and accumulators were 65.8%, 94.7% and 58.6%, respectively. The target figures were thus achieved in all the groups.

Annual reports of manufacturers are, to some extent, irrelevant and year-to-year comparisons and general assessments are not possible due to many reasons. This is why the assessment of data is based on the **Car Wrecks**[4] Module of the Waste Management Information System (in Czech acronymized as MA ISOH) into which car wrecks processing entities and companies enter data directly. An assessment of the numbers of processed car wrecks according to the MA ISOH system shows that there was a decline of 15.1% between 2009 and 2014, although an increase of 8.4% to 132.0 thous. car wrecks was registered between 2013 and 2014 (Chart 6).

The quantities of **tyres**[5] placed on the market and taken back were, to some extent, underrated in the reporting system. For this reason, there were considerable differences between the generation of waste tyres and the quantity of tyres taken back. In 2014, the number of entities subject to the reporting duty, and hence the amount of collected data, increased as a result of a legal obligation of entry into the register of entities subject to the reporting duty.

Between 2009 and 2014, the quantity of tyres which the take-back applies to rose by 12.3%. As to the 2013–2014 period, the quantity increased by 8.7% to 73.1 thous. t (Chart 7).

As to the quantity of tyres taken back, a decline of 14.0% was registered between 2009 and 2014; there was also a decline of 3.3% to 44.6 thous. t between 2013 and 2014 (Chart 7).

Unlike the other groups of products mentioned above, waste tyres are predominantly used for energy recovery (58.2%), with material recovery accounting for a 28.2% share. The reuse is minimal (1.8 thous. t), which indicates that retreading of tyres takes place outside the waste treatment system (Chart 8). Between 2009 and 2014, the share of waste tyres used for energy recovery dropped from 71.8% to 58.9%. On a year-to-year basis, the amount of waste tyres used for energy recovery dropped by 2.5 thous. t to 25.9 thous. t in 2014. On the other hand, the use of waste tyres for material recovery increased from 14.5% to 28.2% between 2009 and 2014; on a year-to-year basis, the amount of waste tyres used for material recovery rose by 3.1 thous. t to 12.4 thous. t in 2014. As to reused tyres, their proportion rose from 3.4% to 4.1% between 2009 and 2014 and, on a year-to-year basis, the amount of reused tyres showed a slight increase of 1.8 thous. t in 2014.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indicators.cenia.cz

[3] *http://www.mzp.cz/cz/ukazatele_odpadoveho_hospodarstvi_baterie_akumulatory*
[4] *http://www.mzp.cz/cz/modul_vraky_isoh*
[5] *http://www.mzp.cz/cz/vybrane_ukazatele_odpadoveho_hospodarstvi*

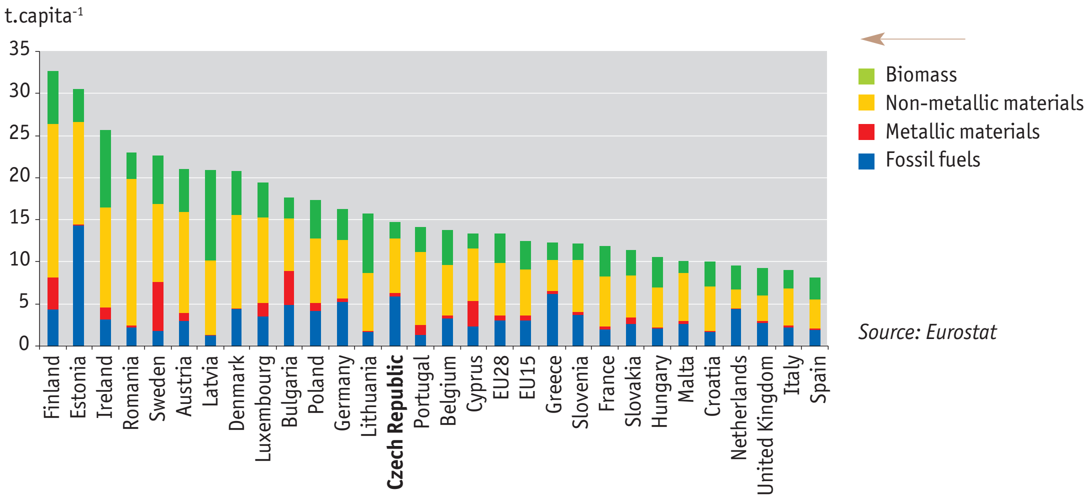
Material flows in the European context

KEY MESSAGES ➜

➜ Both the domestic material consumption (DMC) per capita and material intensity of Czech Republic were above the average of EU15 and EU28 countries in 2013[1]. Nevertheless, as a result of the marked decline in intensity indicators of material flows in the Czech Republic, the position of the Czech Republic in EU has been gradually improving. In the DMC structure, the Czech Republic has a high proportion of fossil fuels. On the other hand, the share of renewable sources on the DMC, whose consumption is causing lower environmental burden than the consumption of non-renewable resources, are among the lowest in the EU in the Czech Republic.

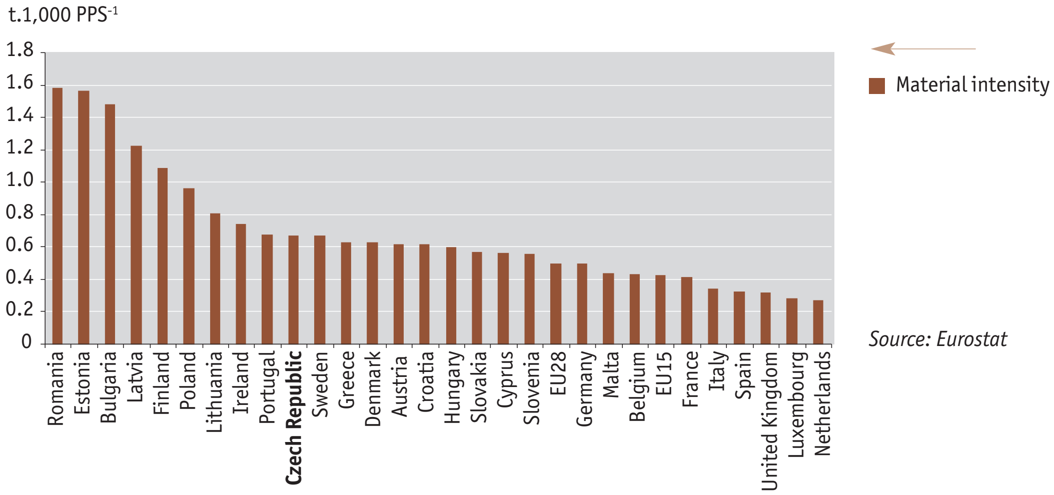
INDICATOR ASSESSMENT

Chart 1 ➜ **Domestic material consumption per capita, according to material groups [t.capita^{-1}], 2013**



Source: Eurostat

Chart 2 ➜ **Material intensity of the economy [t.1,000 PPS^{-1}], 2013**



Source: Eurostat

With regard to the specifics and performance of its economy, the composition of the energy mix with a high share of coal and the environmental conditions with fossil fuel deposits, the Czech Republic belongs to the countries with **above-average intensity indicators of material consumption**. The higher material intensity of the economy of the Czech Republic indicates higher environmental burden associated with obtaining and processing raw and other materials. In comparison with countries of similar type of economy; however, the level of material intensity of the Czech economy may be assessed as favourable.

[1] *Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.*

In the period 2000–2013 most of the countries of the EU28 experienced a decrease in **domestic material consumption per capita**, the highest of which occurred in Spain (by 52%) and Ireland (by 46%), mainly as a result of the decline in construction activity. On the contrary, the largest increase in domestic material consumption per capita was recorded in Romania (by 199%), Estonia (114%) and Lithuania (88%) mainly as a result of large-scale infrastructure investments. DMC per capita in the Czech Republic decreased in the period 2000–2013 by 17.4% to 14.7 $t.capita^{-1}$, which is 10.8% more than the average of the EU28 countries, and 18.6% more than the average of EU15 countries (Chart 1). The Czech Republic has a high **share of fossil fuels** (40.2% in 2013) in the composition of DMC per capita in comparison with EU28 countries. The share of biomass in DMC in the Czech Republic in 2013 was the third lowest after Cyprus and Estonia, mainly due to the high consumption of non-renewable material resources.

Compared with the EU28 **the material intensity of the Czech economy** is significantly above average; in 2013 it was 0.65 $t.1{,}000\ PPS^{-1}$ and was 31.4% higher than in the EU28 and 52.6% higher than in the EU15 (Chart 2). The Western European countries with high GDP per capita have the lowest material intensity, while high material intensity is typical for countries with lower economic performance and high DMC per capita, such as Romania, Estonia and Bulgaria.

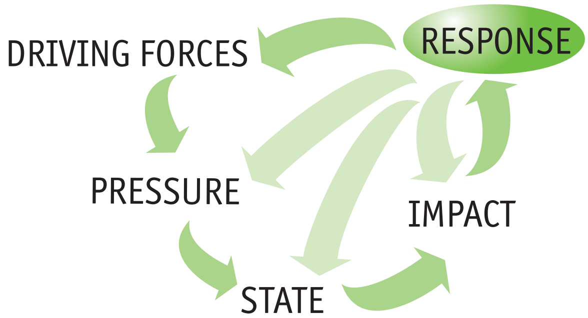
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

41/ Total environmental protection expenditure

KEY QUESTION →

How much financing in the form of investment expenditure or non-investment costs is spent on maintaining and improving the environment?



The financing of environmental protection through investment and non-investment costs is a response (R) to the development and the state (S) of the environment thus far, namely of its individual components, aiming to maintain and improve the state. In addition, financial resources are spent on reducing the negative pressures (P) on the environment, which mainly arise from the activities of economic sectors, and by extension, on reducing the subsequent impacts on ecosystems and human health (I).

KEY MESSAGES →

Total expenditure on environmental protection in 2014 grew by 9.5% year-to-year to CZK 91.5 mil., thus confirming its long-term growing trend. An increase in expenditure on environmental protection of 15.8% to CZK 31.4 bil. and an increase in non-investment costs of 6.4% to CZK 60.1 bil. contributed to the growth. Thanks to total expenditure growth, its proportion in GDP (current prices) increased slightly year-to-year from 2.0% in 2013 to 2.1% in 2014.

In terms of programme focus, most funds were expended on waste management, just like in previous years (total CZK 43.2 bil.). This was followed by waste water treatment at CZK 22.4 bil. and air and climate protection at CZK 12.9 bil.

OVERALL ASSESSMENT OF INVESTMENT EXPENDITURE →

Change since 1990	🙂
Change since 2000	🙂
Last year-to-year change	🙂

OVERALL ASSESSMENT OF NON-INVESTMENT COSTS →

Change since 1990	N/A
Change since 2000	🙂
Last year-to-year change	🙂

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

State Environmental Policy of the Czech Republic 2012–2020

- increasing investment in using clean technologies, renewable energy resources and more economical use of resources of a renewable nature
- strengthening promotion of science, research and innovation from foreign sources for the effective implementation of environmentally friendly technologies and eco-innovation in industry
- including negative externalities into the polluters' costs, such as application of the "polluter pays" principle
- supporting research and analysis aimed at cost-effective policies leading to minimising the costs of achieving environmental protection targets

National Research, Development and Innovation Policy of the Czech Republic in 2009–2015 and the National Priorities of Oriented Research, Experimental Development and Innovations ("RDI Priorities")

- increasing the proportion of investment in supporting science, research and innovations in environmental protection as one of the conditions for ensuring sustainable development of the Czech Republic and its competitiveness (under the RDI Priorities, the aim is to secure up to 18% of the total research, development and innovation budget for each thematic area "environment for a good life" and "sustainability of energy and material resources")

Strategic Framework for Sustainable Development in the Czech Republic

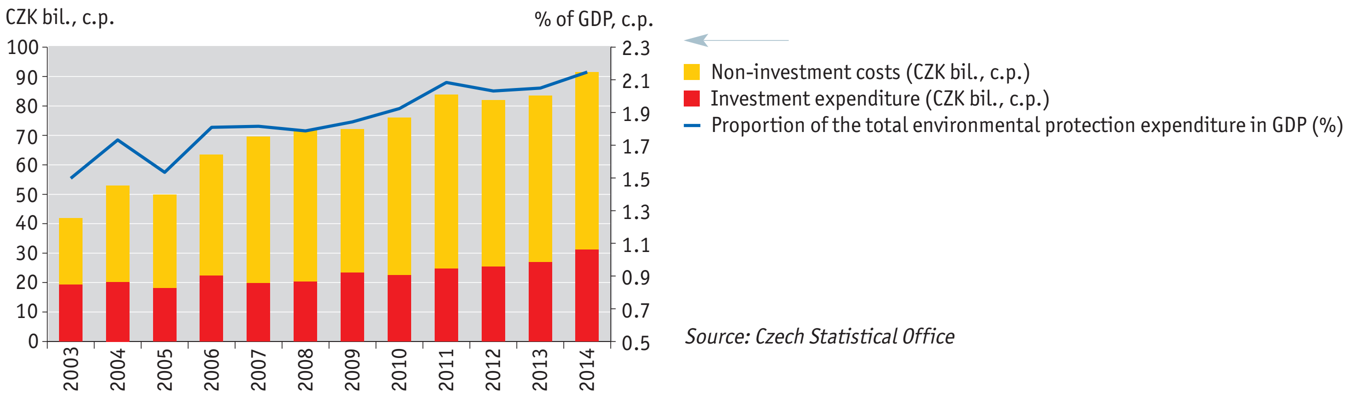
- supporting the dynamics of the national economy and strengthening competitiveness
- supporting an increase in the proportion of environmentally friendly technologies (e.g., low-waste and BAT technologies)
- supporting research, development and innovations in the area of environmentally friendly and knowledge-based technologies with a high added value and lower demands on material consumption

Europe 2020 Strategy

- supporting research, development and innovations in combination with more effective use of resources; investment into clean low-carbon technologies to secure competitiveness and job creation (green jobs)

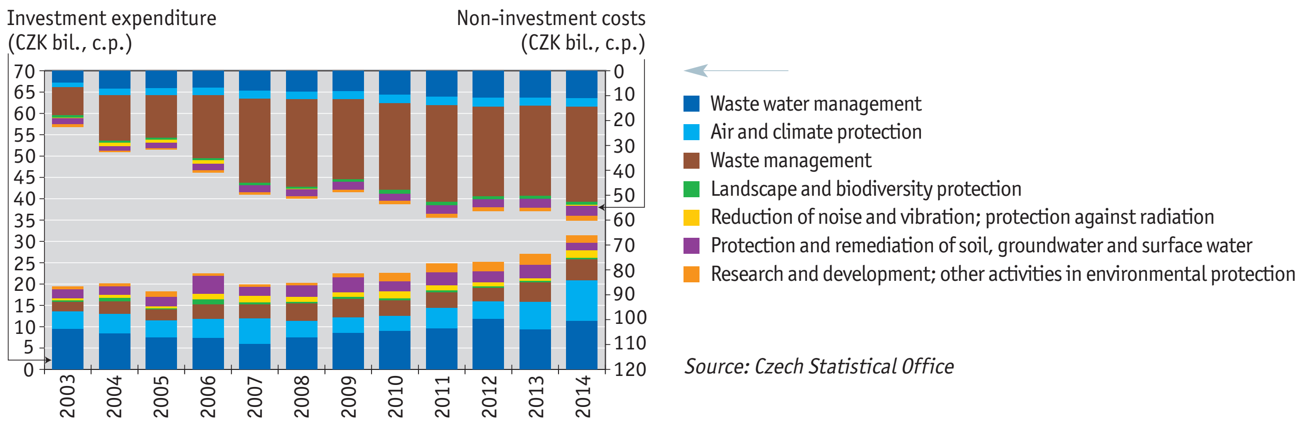
INDICATOR ASSESSMENT

Chart 1 → **Total environmental protection expenditure in the Czech Republic [CZK bil., % of GDP, current prices], 2003–2014**



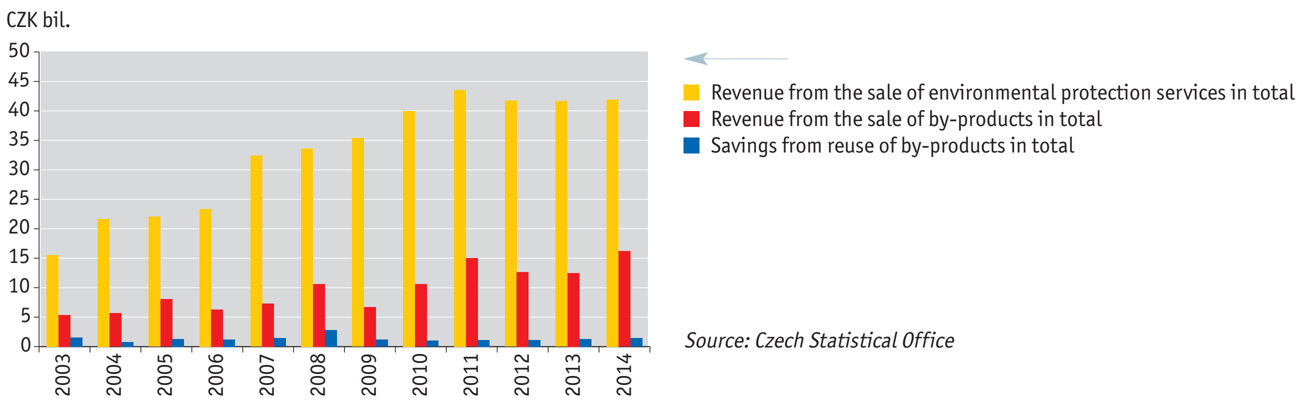
Source: Czech Statistical Office

Chart 2 → **Investments and non-investment costs for environmental protection in the Czech Republic according to the programme focus [CZK bil., current prices], 2003–2014**



Source: Czech Statistical Office

Chart 3 → **Economic benefit of environmental protection activities in the Czech Republic [CZK bil.], 2003–2014**



Source: Czech Statistical Office

Total environmental protection expenditure
The total statistically monitored expenditure on environmental protection represents the sum of investments in environmental protection and non-investment costs of environmental protection that are expended by the monitored entities of the Czech Economy (i.e. both private companies and the public sector). Investment expenditure includes all expenditure for tangible fixed assets, i.e. expenditure that relates to environmental protection activities, the main objective of which is to reduce the negative effects resulting from the business activity. Non-investment costs are current expenditure, especially payroll costs, payments for material consumption, energy, repairs, maintenance etc. The statistical collection of source data is carried out by the Czech Statistical Office. The data on investment expenditure for environmental protection have been collected since 1986; the data on non-investment costs have been monitored statistically since 2003.

In 2014, the **total expenditure** on environmental protection amounted to CZK 91.5 bil., an increase of 9.5% compared to 2014. Both investment expenditure and non-investment costs thus contributed to total growth. **Investment expenditure** increased year-to-year by CZK 4.3 bil. (i.e. by 15.8%) to CZK 31.4 bil., thereby confirming both the steady ascending trend in the amount of investments funds dedicated to environmental protection. In 2014, **non-investment costs** grew year-to-year by CZK 3.6 bil. (i.e. by 6.4%) to CZK 60.1 bil., thereby confirming its roughly two-third share on total environmental protection expenditure. Total expenditure growth was also reflected in the year-to-year increase of its proportion in the GDP (current prices) from 2.0% in 2013 to 2.1% in 2014 (Chart 1).

Investment in environmental protection
Over the long-term, most environmental protection investments are focused on waste water treatment, air and climate protection and waste management. This trend continued in 2014 as well, with these three areas dominating in the financial resources invested in projects and activities to reduce negative impacts.

As part of the last **year-to-year development of investments**, a growing trend for investment expenditure, which grew to CZK 31.4 bil. (+15.8%) in 2014, was confirmed. As in previous years, most investments are directed at integrated installations, where an integrated approach to environmental protection is applied based on the principle of introducing and using BATs and other innovations. The aim of this approach is the gradual overall modernisation of production and operating facilities of environmental polluters, which will lead to a reduction of the negative impacts caused by their operations.

In terms of **programme focus**, in 2014, just like in previous years, most funds were invested in waste water treatment (CZK 11.4 bil.), air and climate protection (CZK 9.5 bil.) and waste management (CZK 5.0 bil.). Compared to 2013, in absolute terms, the greatest increase was seen in investments in air and climate protection (by CZK 3.1 bil., i.e. by 47.9%), in waste water treatment (by 2.0 bil., i.e. by 21.2%) and noise and vibration reduction, including radiation reduction (by CZK 1.0 bil., i.e. by 153.0%). Conversely, a year-to-year decrease could be seen in the protection and remediation of soil and ground and surface water (by CZK 1.3 bil., i.e. by 41.9%), Chart 2.

In terms of **economic sectors** of the investing entity (CZ-NACE), public administration, defence, compulsory social security (39.7% of total investments in 2014) and the manufacturing industry (21.7% of total investments) contributed the most to total long-term investments. The energy industry, i.e. the production and distribution of electricity, natural gas, heat and conditioned air, also contributes substantially to total investments (18.4%), as does water supply, including activities related to waste water, waste and remediation (12.0%).

Concerning the division into **corporate and government (public) sectors**, private and public non-financial enterprises invested CZK 18.1 bil. and the government sector (on both the central and regional levels) CZK 13.2 bil. Just like in 2013, the corporate sector invested a greater share in environmental protection. Here the "polluter pays" principle applies: the main responsibility for protecting the environment has to be transferred onto private entities.

Economic benefits from environmental protection activities, which consist in revenue from the sale of environmental protection services, revenue from the sale of by-products and savings related to the re-use of by-products are closely related to environmental protection investments (Chart 3). Even in 2014, waste management dominated in all three groups of benefits, which meant that it continued its long-term primacy as the most profitable area in environmental protection. While this area contributed 72.1% to revenues from the sale of services and 87.6% to savings on the use of by-products, its proportion in the sale of by-products was as high as 96.0%.

Non-investments costs of environmental protection
The Czech Statistical Office has been monitoring non-investments costs of environmental protection since 2003. Despite short-term fluctuations, costs have seen a long-term growing tendency, and in 2014, non-investment costs increased year-to-year by CZK 3.6 bil. (i.e. by 6.4%) to CZK 60.1 bil. Non-investment costs thus comprise a substantial part of total environmental protection expenditure (about 2/3 in 2014), with the greatest amount of non-investment costs being expended on material and energy consumption and on wages.

In terms of **programme focus**, in 2014, just like in previous years, most of the funds were spent on waste management (CZK 38.3 bil., which, along with investment costs, comprises the biggest part of total environmental protection expenditure) and waste water treatment (CZK 11.0 bil.) – see Chart 2. Other priority areas include long-term protection and remediation of soil, ground water and surface water (CZK 3.9 bil. in 2014) and air and climate protection (CZK 3.4 bil.). As regards the year-to-year change in the amount of non-investment costs within the main areas of environmental protection, growth was registered in all cases, most often with the percentage growth rate being in the single digits.

In terms of **economic activities sectors** of the investing entity (CZ-NACE), in 2014, just like in the previous year, the biggest proportion of non-investment costs for environmental protection was spent in the water supply sector and in activities related to waste water, waste and remediation (52.5% of total non-investment costs), in the manufacturing industry (19.8% of total non-investment costs) and in the sector of public administration, defence and compulsory social security (15.8%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

42/ Public environmental protection expenditure

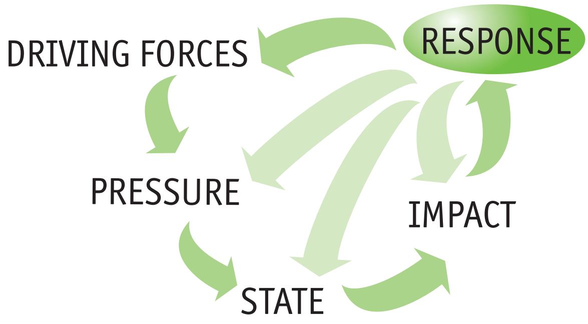
KEY QUESTION →

What is the structure and amount of financial resources expended from national and international and public resources to protect the environment?

KEY MESSAGES →

In 2014, expenditure both from central sources (i.e. from the state budget and state funds) and from local budgets increased year-to-year. Environmental protection expenditure from central sources grew markedly by CZK 12.5 bil., i.e. by 48.4%, to CZK 38.4 bil. (0.90% of the GDP in current prices). The reason for this is especially the sharp rise in air protection expenditure in connection with the promotion of insulation and energy savings programmes and the promotion of changes to heating and particulate matter elimination technologies, along with contributions to the New Green Savings Programme. Even expenditures from territorial budgets grew, specifically by CZK 1.5 bil., i.e. by 4.6%, to CZK 33.9 bil. (0.80% of the GDP in current prices). In terms of programme focus, air protection, water protection and biodiversity and landscape protection were the areas most supported from central sources in 2014. Most funding from territorial budgets was spent on water protection, waste management and biodiversity and landscape protection.

In 2014, the efficiency of utilisation of EU resources through the Operational Programme Environment, the strongest operation programme in terms of subsidies, improved markedly. Based on the executed acceleration measures, not only did the issuance of new Decisions to Provide a Subsidy increase substantially, but so did the payment dynamics. For 2014, Decisions to Provide a Subsidy pertaining to EUR 1.5 bil. were issued, resulting in distribution of 92% of the total programme allocation.



The financing of environmental protection through the state budget, the state fund and local budgets is a response (R) to the development and the state (S) of the environment thus far, namely of its individual components, aiming to maintain and improve the state. In addition, financial resources are spent on reducing the negative pressures (P) on the environment, which mainly arise from the activities of economic sectors, and by extension, on reducing the subsequent impacts on ecosystems and human health (I).

OVERALL ASSESSMENT →

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS →

State Environmental Policy of the Czech Republic 2012–2020

- reinforcing financing of research and development in the area of climate change scenarios and identifying and monitoring their impact
- increasing investments in protecting and retaining ecosystem services, protecting biodiversity and promoting development and across-the-board expansion of sustainable agriculture, fishing and forestry
- reinforcing financing of the creation of tools and technologies for monitoring and mitigating natural hazards and increasing funding for ensuring permeability of migration barriers, especially transport structures
- ensuring maximum use of financial resources, especially from EU funds

Strategic Framework for Sustainable Development in the Czech Republic

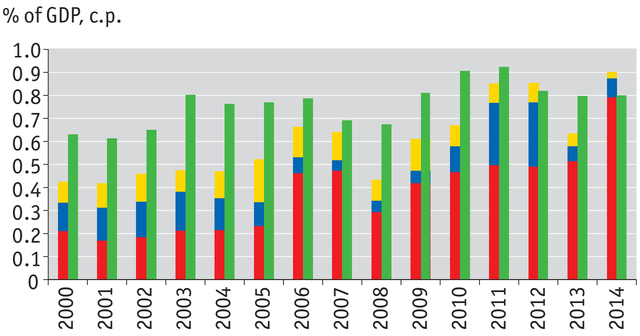
- ensuring investment in the priority areas of risk prevention and protection of health, lives, environment and property
- ensuring financing of measures in climate change prevention and adaptation in developing countries, including technological cooperation
- rationalising subsidy heading systems for providing EU and state budget resources to cover the needs of regions and municipalities, especially as regards the financing of investments
- ensuring long-term sustainability of public financing

Operational Programme Environment 2014–2020

- allocating financial assistance of EUR 2.637 bil. to the Operational Programme Environment 2014–2020 (contribution from the Cohesion Fund and European Regional Development Fund) into the following priority axes (PA):
- PA 1 – Improving water quality and reducing flood risks: 29.2% of total programme allocation
- PA 2 – Improving air quality in human settlements: 17.2% of total allocation
- PA 3 – Waste management and material flows, environmental burden and risks: 17.4% of total allocation
- PA 4 – Protection and care for nature and landscape: 13.3% of total allocation
- PA 5 – Energy savings: 20.1% of total allocation
- PA 6 – Technical assistance: 2.8% of total programme allocation

INDICATOR ASSESSMENT

Chart 1 ➜ **Proportion of public environmental protection expenditure in GDP in the Czech Republic by source type [% GDP, current prices], 2000–2014**

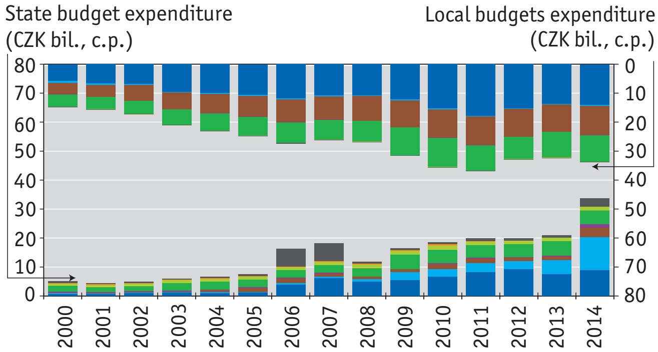


Source: Ministry of Finance of the Czech Republic, Czech Statistical Office

- Proportion of the local budgets' expenditure on environmental protection in the GDP
- Proportion of the National Property Fund's expenditure on environmental protection in the GDP
- Proportion of the state environmental protection funds' expenditure in the GDP
- Proportion of the state budget expenditure on environmental protection in the GDP

The National Property Fund of the Czech Republic was dissolved as of 1 January 2006. Both its competencies and resources spent on removal of old contaminated sites that originated prior to privatisation are now in the remit of the Ministry of Finance of the Czech Republic. A part of public environmental expenditure of local budgets may be a duplication of expenditure from central sources.

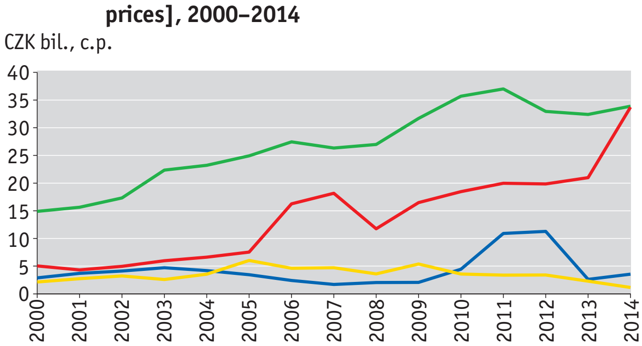
Chart 2 ➜ **Public environmental expenditure from the state and local budgets in the Czech Republic by programme focus [CZK bil., current prices], 2000–2014**



- Water protection
- Air protection
- Waste management
- Soil and groundwater protection
- Biodiversity and landscape protection
- Reduction of physical factors' impacts
- Administration in environmental protection
- Environmental research
- Other activities in ecology

Source: Ministry of Finance of the Czech Republic

Chart 3 ➜ **Public environmental protection expenditure in the Czech Republic by source type [CZK bil., current prices], 2000–2014**

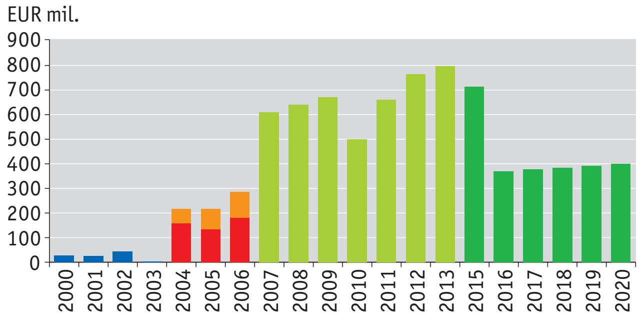


- Environmental protection expenditure from local budgets
- Environmental protection expenditure from the state budget
- The state environmental protection funds' expenditure
- National Property Fund's expenditure on environmental protection

Source: Ministry of Finance of the Czech Republic

The National Property Fund of the Czech Republic was dissolved as of 1 January 2006. Both its competencies and resources spent on removal of old contaminated sites that originated prior to privatisation are now in the remit of the Ministry of Finance of the Czech Republic. A part of public environmental expenditure of local budgets may be a duplication of expenditure from central sources.

Chart 4 ➜ **Allocation of financial resources from the EU funds for environmental projects in the Czech Republic [EUR mil.], 2000–2020**



Source: Ministry of Environment

- Operational Programme Environment (2014–2020)
- Operational Programme Environment (2007–2013)
- Operational Programme – Infrastructure (2004–2006)
- Cohesion Fund (2004–2006)
- ISPA (2000–2003)

The year 2014 is not indicated in the chart because in the Operational Programme Environment no allocation was determined in the 2007–2013 programming period for 2014 and for the 2014–2020 programming period the allocation 2014 was moved to 2015.

Public environmental protection expenditure comprises environmental protection expenditure from central sources and local budgets. However, given the data collection methodology use by the Ministry of Finance of the Czech Republic, total public environmental protection expenditure cannot be seen as a simple sum of central sources and local budgets due to the fact that a part of public environmental expenditure by the local budgets is taken from central sources and therefore these expenditures are duplicate. Public environmental protection expenditure includes both capital and current expenditure.

Just like in other areas, the amount of expenditure is analysed in relation to the Czech Republic's economic possibilities and performance, i.e. to the gross domestic product, also in environmental protection in order to monitor adequacy of the environmental expenditure. After a prior decline, both expenditure from central sources and expenditure from local budgets grew in 2014 (Chart 1). The proportion of expenditure from central sources between 2013–2014 grew by 0.27 percentage points to 0.90% of the GDP; expenditure from local budgets grew 0.01 percentage points to 0.80% of the GDP. In addition to the improving Czech economy, more effective utilisation of resources from national programmes and EU funds, to which co-financing resources from public budgets are bound, contributed to the growth.

Public expenditure from central sources

The state budget is the most significant central source of funding, especially subsidies or returnable financial aid. Other central sources of environmental protection expenditure are the State Environmental Fund of the Czech Republic and the dissolved National Property Fund, whose remaining competencies and resources are now in the remit of the Ministry of Finance of the Czech Republic. The Ministry of Finance uses these resources especially for the remediation of old environmental damage caused prior to privatisation and – to a lesser extent – the Ministry of Environment uses them to remediate damage caused by the presence of Soviet troops in the Czech Republic.

When evaluating long-term trends in public expenditure from central sources, we can observe a substantial growth in expended financial resources from the total amount of CZK 10.1 bil. in 2000 to the final CZK 38.4 bil. in 2014. To a great extent, the growth of expenditure was covered by financial resources from the EU structural funds, which are used especially to balance the state of the environment in the Czech Republic with that in the other developed EU countries and to meet the requirements of the EU standards and which are considered to be the resources of the state budget from which the environmental protection projects are co-financed or pre-financed.

As in previous years, the **state budget** was the biggest central source of public expenditure on environmental protection in 2014. Compared to 2013, state budget expenditure grew markedly by 60.7% to CZK 33.7 bil., especially for the reason of the sharp increase in air protection expenditure (see below).

The area to receive the most support from the state budget in 2014 was **air protection**, which took over the top spot from water protection, which had long held primacy. In 2014, CZK 11.5 bil., i.e. CZK 6.7 bil. more (+114.4%) than in 2013 was expended on air protection (Chart 2). This development depends particularly on the support of insulation and energy savings programmes and on the support of changes in heating and particulate matter filtration technologies. As part of **water protection**, i.e. other area supported by the state budget, CZK 8.9 bil. was spent, which is CZK 1.3 bil. more (+16.7%) than in the previous year. Growth was due in particular to increased expenditure on collection and treatment of waste water. In terms of total support, **biodiversity and landscape protection** followed with expenditure of CZK 4.8 bil. (CZK –0.2 bil., i.e. –4.4% compared to 2013). Here, most resources were expended on supporting protected nature areas, care for appearance of towns and villages and for public greenery, and on soil remediation after extraction and excavation activities. Total remediation costs on the part of mining companies have amounted to more than CZK 18 bil. since 1993. Subsidies, obtained from mining fees and taxes on specific extracted minerals, are also used to remedy environment damage caused by extraction and excavation activities (CZK 146.0 mil. was available in 2014 from the state budget for these purposes). Expenditure on **waste management** grew significantly from the previous year (by 153.7% to CZK 3.2 bil.), especially as part of support for the collection and transport of municipal waste.

The **State Environmental Fund of the Czech Republic** is the largest extra-budgetary central source of environmental protection financing (alongside state funds such as the State Agricultural Intervention Fund of the Ministry of Agriculture and the State Fund for Transport Infrastructure of the Ministry of Transport). Its revenues are generated mainly from payments for pollution of or damage to environmental media or from repayments of loans, and since 2009 also from the sale of emission allowance units related to the **Green Savings Programme**. In 2014, there was an increase in environmental protection expenditure from the State Environmental Fund of the Czech Republic 0.9 bil. (i.e. by 35.8%) to CZK 3.5 bil. The importance of the State Environment Fund of the Czech Republic is currently associated mainly with the provision of subsidies within the **New Green Savings Programme**, which falls under insulation and energy savings programmes or programmes to change heating technology and under measures to reduce greenhouse gas production. In 2014, 6 606 applications from home owners for subsidies totalling CZK 1.5 bil. were registered under this programme. The programme is funded by revenue from the sale of emission allowances under the EU ETS. The programme's total allocation will depend on the amount of this income (estimated amount: up to CZK 27 bil.). This programme is administered by the State Environmental Fund, however, these are financial resources of the state budget.

The State Environmental Fund of the Czech Republic also uses its own resources to co-finance expenditure from the European funds. Under the Operation Programme Environment 2007–2013, it co-financed projects both in the form of subsidies or a combination of subsidies and special loans, providing CZK 6.4 bil. by the end of 2014. Of this amount, almost CZK 2 bil. pertained to 2014 alone. The State Environmental Fund also administers the collection of fees related to environmental protection. The purpose of the collection of fees is direct return of the fees back to environmental protection, as opposed to environmental taxes for which such return is not a necessary precondition. In 2014, the main income from the collection of fees or payments under the State Environment Fund came from groundwater use (CZK 359.4 mil.), air pollution (CZK 320.1 mil.), discharge of waste water into surface water

(CZK 209.8 mil.) and the exclusion of land from the agricultural land resources (CZK 149.7 mil.). The fees therefore represent a source for providing support within the Fund's competence; the support is used mainly in a form of loans, subsidies and payment for a part of interest from loans and goes primarily to the priority areas of environmental protection in the Czech Republic, i.e. water protection, air protection, and biodiversity and landscape protection.

CZK 1.2 bil., i.e. by CZK 1.1 bil. less than in 2013, from the **financial resources of the dissolved National Property Fund**, which are administered by the Ministry of Finance of the Czech Republic and intended for removal of old pre-privatisation environmental contamination, were spent in 2014 (Chart 3).

Public expenditure from local budgets

Financial resources originating from **territorial budgets of municipalities and regions** constitute another pillar of public environmental expenditures. As in the case of expenditure from the central sources, there was also a substantial expenditure increase in 2000–2013 from CZK 14.9 bil. to CZK 33.9 bil. (i.e. +127.5%). This happened despite the 2012–2013 decline caused by lower activity in using financial resources from national programmes and the EU funds to which co-financing resources from public budgets are bound. In 2014, expenditure from territorial budgets grew 4.6% year-to-year to CZK 33.9 bil. Territorial budgets, alongside the state budget, represent the most important public sources of financing environmental protection in the Czech Republic (Chart 3). This source allows the municipalities and regions to expend resources on events that are implemented continually based on the competencies of the municipalities or regions. A part of these expenditures, however, also comprises resources (e.g., subsidies) from central sources.

As regards **protection of the single environmental media and its financing from the territorial budgets** of municipalities and regions, water protection, in particular waste water collection and treatment, is one of the main priorities, with CZK 14.1 bil., i.e. by 2.7% more than in 2013, being expended thereon (Chart 2). Waste management, especially municipal waste collection, was the second greatest item in financing (in total CZK 9.5 bil., i.e. +6.2% compared to 2013), followed by biodiversity and landscape protection focusing in particular on the care for appearance of towns and villages and for public greenery (a total of CZK 9.3 bil., i.e. +5.3% compared to 2013). In connection with the issue of air pollution, especially from local heating sources using solid fuels, air protection is growing in importance, with CZK 0.2 bil. being spent in this area (by 35.9% more than in 2013). A fundamental initiative in this area was implementation of the Joint Programme to Promote Replacement of Boilers (the so-called boiler subsidy).

Financing by the EU and foreign sources

In addition to national funding programmes in environmental protection, managed primarily by the State Environmental Fund of the Czech Republic, public expenditures on environmental protection are strengthened since 2004 thanks to direct support from the EU and the possibility to co-finance projects from other foreign sources as well. The main sources to finance environmental protection were the Operational Programme Infrastructure (OPI) and the Cohesion Fund (CF). At present it is especially the Norwegian and the EEA Financial Mechanisms, the Swiss-Czech Cooperation Programme and the Operational Programme Environment, which is the largest source in terms of subsidies and linked thematically to the OPI.

The intermediate body of the Operational Programme Environment, OPI and CF is the State Environment Fund of the Czech Republic, which, as a specialised state financial institution, arranges, based on delegation of agreements with the Ministry of the Environment, administration and financing of projects from EU sources. These most significant expenditures on environmental protection are recorded in state budget expenditure.

As part of the Operational Programme Environment, a total of EUR 4.9 bil. (Chart 4) was originally allocated to financing environment protection for 2007–2013; however, the N+2/N+3[1] rule was not met in 2013, which resulted in a reduction of the financial allocation to EUR 4.6 bil. Within the Operational Programme Environment, more than 26.8 thous. project proposals have been submitted from the beginning of the programming period till the end of 2014 with a request for financing from the EU funds in the amount of EUR 9.8 bil. In 2014, the number of projects proposals increased by almost 4 thous. with a request for financing from EU funds in the amount of almost EUR 0.6 bil. Of the proposals submitted, 17 994 projects totalling EUR 4.7 bil. of financing from the CF/ERDF were recommend for financing until the end of the year. Significant progress also occurred in the case of projects that were issued Decisions to Provide a Subsidy (totalling EUR 1.5 bil. for 2014), which led to 92% of the total programme allocation being distributed. Recipients then actually utilised 71% of the total financial allocation earmarked for the 2007–2013 period. 2014 saw a fundamental positive turnaround in the speed of utilisation of European financial resources. The anticipated effect from the intensively executed acceleration measures was achieved. Not only did the issuance of new Decisions to Provide a Subsidy increase substantially, but so did the payment dynamics. Extra efforts undertaken at the end of 2014 managed to entirely revert the risk of a reduction in the 2014 allocations. Positive utilisation results in 2014 substantially improved conditions for achieving a good result in 2015, or after the programme ends. In 2015, the approaching final deadline for eligible expenditures, which was set for the end of 2015, will have an impact on the successful utilisation of the programme. If the utilisation dynamics from 2014 are retained in 2014, the operational programme can aim for zero decommitment.[2] The goal for 2015 is not only to ensure that the remaining allocation is utilised, but also to finalise the steps to approve the subsequent Operational Programme Environment for 2014–2020 and fully utilise the first financial resources from the subsequent programme.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indicators.cenia.cz

[1] The N+2 / N+3 rule is considered to be an administrative instrument to ensure that financial resources are utilised from the structural funds smoothly. According to this rule, the allocation of support for the Nth year has to be utilised within the next two or three calendar years.

[2] Decommitment, or the automatic cancellation of a commitment, means that if the financial resources allocated to the implementation of the Operational Programme Environment are not utilised by the respective deadline, they expire and are returned to the EU budget.

Environmental protection expenditure in the European context

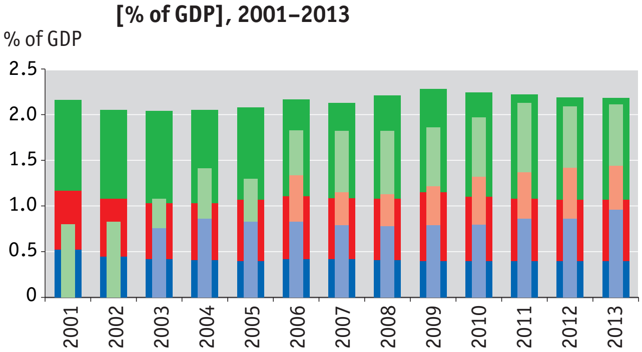
KEY MESSAGES

- Investments in environmental protection in the Czech Republic are, compared to the EU28 average, above-average over the long-term. This applies to both the public and industrial sectors. Together with the sector of specialised companies providing environmental services (specialised producers), these investments amounted to a total of 0.67% of GDP in 2014, compared with 0.41% of GDP in the EU28. The reason for increased investment in the Czech Republic is first the need to fulfil the conditions of the EU and the requirements of the respective European legal regulations and the need to resolve the high environmental burden which resulted from age-long unresolved problems related to intensive industrial production and mining in the last century.

- Due to a smaller amount of current expenses spent on environmental protection in the Czech Republic, however, total expenditure (i.e. the investments and current expenses together) on environmental protection remained slightly below the EU average (2.11% of the GDP in the Czech Republic, 2.22% of the GDP in the EU28). This difference, however, is decreasing steadily due to the substantial contradictory development of environmental protection investments in the Czech Republic: while the proportion of investments in GDP within the EU28 fell by 0.07 p.p., it grew by 0.17 p.p. in the Czech Republic.

INDICATOR ASSESSMENT

Chart 1 → **Total environmental protection expenditure by the main sectors in the Czech Republic and in the EU28 [% of GDP], 2001–2013**

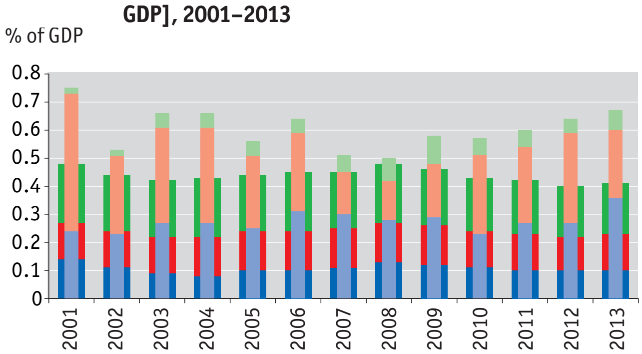


- EU28 Total expenditure – specialised producers (*)
- EU28 Total expenditure – public sector (*)
- EU28 Total expenditure – industry sector (*)
- Czech Republic Total expenditure – specialized producers
- Czech Republic Total expenditure – public sector
- Czech Republic Total expenditure – industry sector

Source: Eurostat

(*) Estimate. Data for all sectors monitored in the Czech Republic are available since 2006.

Chart 2 → **Investment in environmental protection by the main sectors in the Czech Republic and in the EU28 [% of GDP], 2001–2013**

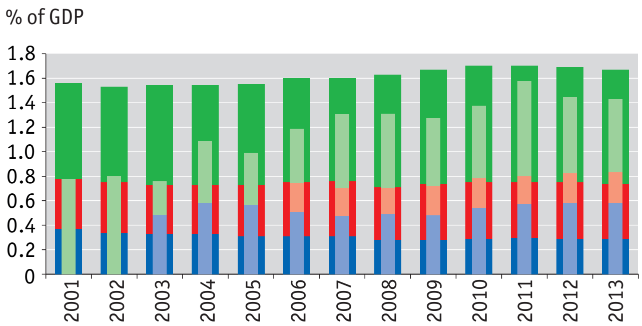


- EU28 Investment – specialised producers (*)
- EU28 Investment – public sector (*)
- EU28 Investment – industry sector (*)
- Czech Republic Investment – specialised producers
- Czech Republic Investment – public sector
- Czech Republic Investment – industry sector

Source: Eurostat

(*) Estimate.

Chart 3 → **Non-investment costs (current expenditure) on environmental protection by the main sectors in the Czech Republic and in the EU28 [% of GDP], 2001–2013**

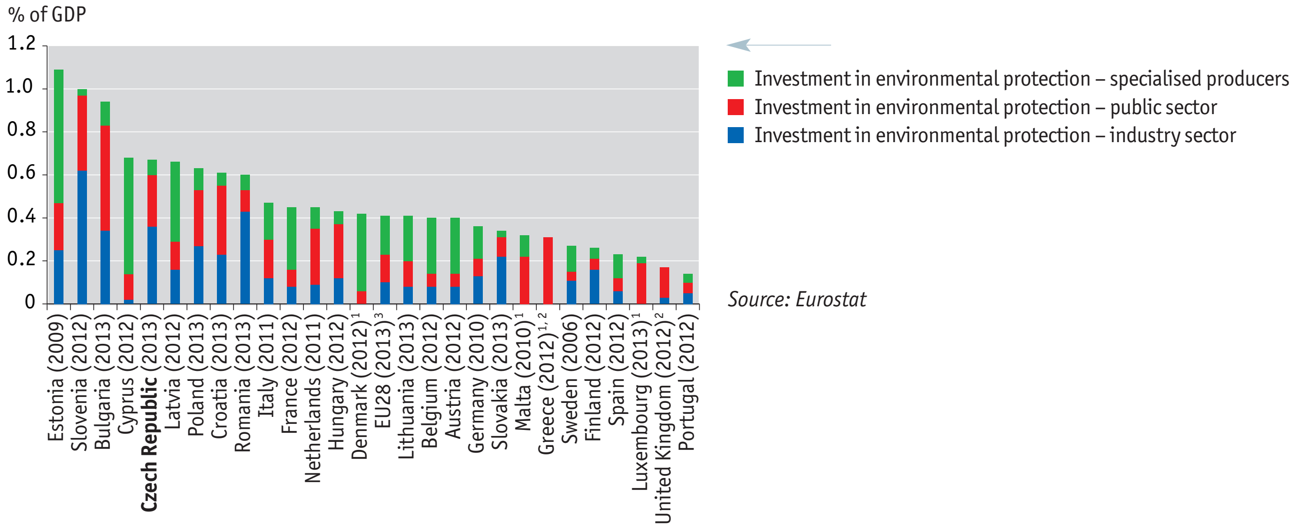


- EU28 Current expenses – specialised producers (*)
- EU28 Current expenses – public sector (*)
- EU28 Current expenses – industry sector (*)
- Czech Republic Current expenses – specialised producers
- Czech Republic Current expenses – public sector
- Czech Republic Current expenses – industry sector

Source: Eurostat

(*) Estimate. Data for all sectors monitored in the Czech Republic are available since 2006.

Chart 4 ➜ **Investment in environmental protection by the main sectors [% of GDP], the last year available**



Source: Eurostat

(1) Data for the industry sector are not available, (2) data for specialised producers are not available, (3) an estimate.

Within an international comparison of the **total expenditure on environmental protection** which was carried out by Eurostat, these expenses can be looked at from the perspective of three main sectors: the public sector, the industry sector (i.e. mining and quarrying; manufacturing, electricity, gas and water distribution) and the sector of specialized companies providing environmental services (i.e. public and private companies focused on environmental protection services, such as waste collection).

Just like in the Czech Republic, it is possible to divide the total environmental protection expenditure into two main groups: investment expenditure and non-investment costs (current expenses) related to the activities which are directly aimed at prevention, reduction and elimination of pollution or any other damage to the environment. Monitoring the proportion of environmental protection expenditure in GDP is important as this is an indicator of the important of environmental protection in relation to the overall economic activities of the country concerned.

Concerning the total expenditure on environmental protection, the Czech Republic has slightly below-average values in comparison with the EU average (2.11% of the GDP in the Czech Republic, 2.18% of the GDP in the EU28), Chart 1. This fact is caused mainly by a lower amount of non-investment costs, which is, however, partially balanced by above-average investments (see below for more detail). This difference, however, is decreasing steadily due to the substantial contradictory development of environmental protection investments in the Czech Republic: while the proportion of investments in GDP within the EU28 fell by 0.07 p.p., it grew by 0.17 p.p. in the Czech Republic. The reason for this diverging trend with respect to investment, and thereby also total environmental protection expenditure, is the different impact of the financial and economic crisis on the economies of the various EU member states.

Just like in the Czech Republic and even within the EU28, the greatest proportion of expenditure on environmental protection is spent on waste management, waste water collection and treatment and air protection.

From the perspective of the first subgroup under total expenditure, i.e. **investment activities in environmental protection**, it can be concluded that the Czech Republic has a very good position compared with the EU28 average, within both the public and industry sectors (Charts 2 and 4). This is based on the fact that the Czech Republic, just like the other new EU member states, invests more intensively in environmental protection in order to comply with stricter EU conditions and requirements of the relevant EU legislation. Possible use of the EU funds or other foreign subsidy programs also enhances the investment level (see the "Total environmental protection expenditure" indicator).

Conversely, the Czech Republic shows worse investment activity in the sector of specialised companies providing environmental services (specialised producers), which includes especially companies working in waste management (e.g. waste collection companies) and waste water treatment. A lower proportion of these investments compared to the European average is also caused by the fact that some of the services provided by specialised producers can be provided by the public sector itself (e.g., investment in waste collection or waste water treatment plants organised by municipalities), including the relevant investment expenditure. The differences may result from specialisation and concentration of individual industrial activities within the single countries – for example, waste water treatment or waste management can be done by industrial plants themselves because of recycling or re-use of their own waste in the following production processes. Fundamental investments into these facilities then increase the investment activities of the industrial companies at the expense of specialised producers which also deal with recycling.

The second subgroup under total environmental protection expenditure is **current expenses on environmental protection**, which include, in addition to the costs of maintenance and the facility's operation, especially payroll costs, payments for rent, energy and other material. While in the case of investment expenditure in the Czech Republic, the industry and public sectors took the decisive part in its amount compared with the EU average, concerning current expenses, specialised producers cover the greatest part, just like in the EU28 (Chart 3). The reason lies especially in financially intensive processes in waste management and waste water treatment which these companies administer either within their property or on the basis of a contract (mandate from the public sector).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz

List of abbreviations

AOT40	accumulated ozone exposure over a threshold of 40 parts per billion
AOX	adsorbable organically-bound halogens
BaP	benzo(a)pyrene
BAT	Best Available Techniques
BMW	biodegradable municipal waste
BOD_5	biochemical oxygen demand over five days
BPEJ	evaluated soil-ecological unit
c.p.	current prices
CENIA	Czech Environmental Information Agency
CF	Cohesion Fund
CLRTAP	Convention on Long-range Transboundary Air Pollution
CNG	compressed natural gas
COD_{Cr}	chemical oxygen demand by potassium dichromate method
CRF	Common Reporting Format
CSN	Czech state standard
CZ-NACE	Classification of Economic Activities
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DG AGRI	Directorate-General for Agriculture and Rural Development
DG ENV	Directorate-General for Environment
DG JRC	Directorate-General Joint Research Centre
DG MOVE	Directorate-General for Mobility and Transport
DMC	Domestic Material Consumption
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EC	European Communities
EEA	European Environment Agency
EEC	European Economic Community
EGR	Exhaust Gas Recirculation
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
END	Environmental Noise Directive
EQS	Environmental quality standards
ERDF	European Regional Development Fund
ETC/BD	European Topic Centre on Biological Diversity
EU ETS	European Union Emission Trading System
EU	European Union
EU27	Member States of the European Union by 31 Dec 2012
EU28	Member States of the EU27 + Croatia (integrated 1 Jul 2013)
Eurostat	Statistical Office of the European Union
FC	thermotolerant (faecal) coliform bacteria
FSC	Forest Stewardship Council
GAEC	Good Agricultural and Environmental Conditions
GDP	Gross domestic product
GVA	Gross value added
HCB	Hexachlorobenzene
HCH	Hexachlorecyclohexane
HRDP	Horizontal Rural Development Plan
ICP Forests	International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
ISPA	Instrument for Structural Policies for Pre-accession
ISSaR	Information System for Statistics and Reporting
IUCN	International Union for Conservation of Nature
LPG	Liquefied Petroleum Gas
LPIS	Land Parcel Identification System
LULUCF	Land Use, Land Use Change and Forestry

LV	Limit Value
MA ISOH	Car Wrecks Module of the Waste Management Information System
N/A	not available
NECD	National Emission Ceilings Directive of the EU
NFR	Nomenclature for Reporting
NM	natural monument
NNM	national nature monument
NNR	national nature reserve
NR	nature reserve
NUTS	nomenclature of units for territorial statistics
OCP	organochlorine pesticides
OECD	Organization for Economic Co-operation and Development
OPI	Operational Programme Infrastructure
p.p.	percentage point
PA	priority axis
PAHs	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PEFC	Programme for the Endorsement of Forest Certification Schemes
PES	primary energy sources
PHCs	Population and housing censuses
pkm	passenger-kilometre
PM	particulate matter
POPs	persistent organic pollutants
PPS	Power Purchase Standard
REACH	Registration, Evaluation and Authorization of Chemicals
RES	Renewable energy sources
SAICM	Strategic Approach to International Chemicals Management
SCI	Site of Community Importance
SCR	selective catalytic reduction
SPA	Special Protection Area
tkm	tonne-kilometre
TOFP	tropospheric ozone formation potential
TSES	Territorial system of Ecological Stability
UAT	Unfragmented Areas by Traffic
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	undissolved substances
USLE	Universal Soil Loss Equation
VAT	value added tax
VOC	volatile organic compounds
w.b.	without bark
WEEE	waste electrical and electronic equipment
WEI	Water Exploitation Index
WHO	World Health Organization
WISE	Water Information System for Europe
WMO	World Meteorological Organization
WMP	Waste Management Plan
WWTP	waste water treatment plant

Glossary of Terms

Acaracides. Plant protection products intended to control mites.

Acidification. It is a process in which elements of the environment are acidified. It consists in increasing the acidity and primarily affects air and secondarily water and soil. Acidification is caused by the emissions of acidifying substances (i.e. sulphur oxides, nitrogen oxides and ammonia) into the air.

Agricultural land resources. Agricultural land resources consist of land that is cultivated in agriculture, i.e. arable land, hop-gardens, vineyards, gardens, fruit orchards, meadows, pastures (i.e. "agricultural land") and land that was and should continue to be cultivated by agriculture, but is not cultivated at present (i.e. "temporarily uncultivated land"). Agricultural land resources also include ponds to breed fish and water poultry and non-agricultural land required for the provision of agricultural production, such as field paths, plots with irrigation devices, irrigation reservoirs, drainage furrows, dams to protect against flood or water logging, anti-erosion terraces etc.

AOT40. The target value for ground-level ozone levels from the perspective of ecosystem and vegetation protection. It refers to the accumulated ozone exposure over the threshold of 40 parts ppb. The AOT40 cumulative exposure to ozone is calculated as the sum of the differences between the hourly ozone concentration and the threshold level of 40 ppb (= 80 $\mu g.m^{-3}$) for each hour in which the threshold value was exceeded. According to the requirements of Government Regulation No. 597/2006 Coll., the AOT40 is calculated over a three month period from May to July from ozone concentration measurements taken every day between 8:00 and 20:00 CET.

AOX. These are adsorbable organically-bound halogens. The summary indicator AOX is expressed in chlorides as the equivalent weight of chlorine, bromine, and iodine contained in organic compounds (e.g., trichloromethane, chlorbenzene, chlorophenols etc.) which, under certain conditions, adsorb onto activated carbon. The main source of these substances is the chemical industry. While poorly degradable and water-soluble, these compounds are soluble in fats and oils, and thus easily accumulate in adipose tissues.

Areal temperatures and precipitation totals. Values of individual weather elements related to a particular territory, representing the mean value of the element in this area.

Bactericides. Antimicrobially active substances intended to exterminate bacteria.

BAT. Best Available Techniques. In accordance with Act No. 76/2002 Coll., on integrated prevention, the best available techniques are the most efficient and advanced stages of development of the applied technologies and activities as well as their means of operation, which show practical suitability of certain techniques designed to prevent, and if it not possible, to reduce emissions and their environmental impacts. What is mean by techniques is both the technology used and the way in which the installation is designed, built, operated, maintained and put out of operation. What is meant by available techniques are techniques developed on a scale that allows their implementation in the relevant industrial sector under economically and technically acceptable conditions, taking into account the costs and benefits, whether they are reasonably accessible to the operator, regardless of whether they are used or produced in the Czech Republic. What is meant by best techniques is the most efficient technique of achieving a high level of protection of the environment. In determining the best available techniques, standpoints referred to in Annex 3 to this Act must be taken into account.

Biomass. As a general concept, biomass includes all organic material that participates in the energy and element cycles within the biosphere. It includes mainly substances of plant and animal origin. For the purposes of the energy sector, biomass is considered plant material that can be utilised for energy (e.g. wood, straw, etc.) and biological waste. The energy accumulated in the biomass originates from the sun, similar fossil fuels.

BMW. Biodegradable municipal waste is a biodegradable component of municipal waste, such as food and garden waste, and paper and cardboard, which undergoes anaerobic or aerobic decomposition.

BOD_5. Biochemical oxygen demand measured over a five day period. BOD_5 represents the amount of oxygen consumed by microorganisms during the biochemical oxidation of organic substances over five days under aerobic conditions at a temperature of 20 °C. It is thus an indirect indicator of the amount of biodegradable organic pollution in water.

BPEJ. The evaluated soil-ecological unit (BPEJ) is a five-digit numeric code associated with agricultural land plots. It expresses the main soil and climatic conditions, which affect the production capacity of agricultural land and its economic value.

Climatic conditions (climate). This is the long-term weather trend that is determined by the energy balance, atmospheric circulation, the character of the active surface and human activities. Climate is an important component of natural conditions of any specific location. It affects the landscape and its use for anthropogenic activities. It is geographically contingent and it reflects the latitude, altitude and degree of ocean influence.

CO_2 eq. This carbon dioxide emission equivalent measures aggregating greenhouse gas emissions. It expresses any greenhouse gas unit recalculated to CO_2 radiation efficiency that is counted as 1, other gases have higher coefficients.

COD_{Cr}. Chemical oxygen demand determined by the dichromate method. COD_{Cr} is the amount of oxygen consumed in the oxidation of organic substances (including substances biochemically non-degradable) in water through an oxidizing agent – potassium dichromate under standard conditions (two hours of boiling in a 50% acid with a catalyst). It is therefore an indirect indicator of the amount of all organic pollution in water.

Community heating. Community heating is a system of generating heat in a centralized location which is then distributed through heat networks to multiple objects. The term district heating is an equivalent term to community heating.

Contaminated sites. Severe contamination of the rock environment, groundwater or surface water, soil or building structures which occurred due to improper handling of hazardous substances in the past and which threatens human health and the environment. The discovered contamination can be considered an old environmental burden only if the originator of the contamination does not exist or is not known, and this rule must be respected even in the case of the legal successor to the originator of the contamination. Contaminated sites may be of different nature – they may be landfills, industrial and agricultural areas, small retail outlets, unsecured warehouses of hazardous substances, former military bases, areas affected by mining of mineral resources or abandoned and closed mining waste repositories posing serious risks.

Cross Compliance. A conditionality check-up system, which, on one hand allows the use of European financial support, and on the other hand, specifies the requirements and standards concerned with this use of financial support which have to be complied with. All these requirements and standards are based on valid European and national regulations and their fulfilment was monitored within national check-ups prior to the introduction of the Cross Compliance System.

DDT. Dichlorodiphenyltrichloroethane is a chlorinated pesticide. The production and use of DDT is now banned in most countries all over the world, in particular due to their bioaccumulation, toxicity, carcinogenic effects and contribution to reduced fertility.

Decade. In climatology, this term refers to a set of ten subsequent days in one month. The first decade always begins on the first day of the month and each month is therefore divided into three decades. In general terms, the decade is a set of ten consecutive years.

Decoupling. The separation of the economic growth curve from the environmental pressure curve. Decoupling reduces the specific environmental pressure per unit of economic output. It can be either absolute (performance of the economy grows while the pressure decreases) or relative (economic output grows, while the pressure also grows, yet at a slower rate).

Degree-day. It is a unit of characterizing the heating season. It is calculated as the product of the number of heating days and the difference between the average indoor and outdoor temperature. Therefore, it shows how cold or warm a given period of time was and how much energy is needed to heat the buildings.

Desiccants. These are products used for the removal of excess moisture.

Digestate. The residue from the anaerobic fermentation process occurring in biogas production. Digestate fertilisation is similar to the organic fertilisation. Nevertheless, it is always advisable to take into account the actual nitrogen content. Compared to organic fertilisers, digestates usually have higher total nitrogen content in the original mass.

Domestic Material Consumption. This term covers all materials that are consumed in the economy. It is calculated as the sum of Domestic Used Extraction and imports, i.e. direct material input, from which exports are subtracted. Domestic Material Consumption is expressed in mass units and includes raw materials, semi-finished products and products.

Ecological Valence Ecological valence is the ability of the organism to exist in the presence of a certain range of conditions, i.e. conditions to which the organism can adapt.

Ecosystem Services. Ecosystem services are the benefits that people obtain from ecosystems. They are divided into provisioning services (food, wood, medicines, energy), regulating services (regulation of floods, drought and diseases, land degradation), supporting services (soil formation and nutrient cycling) and cultural services (recreational, spiritual and other nonmaterial benefits).

EGR. This abbreviation stands for Exhaust Gas Recirculation. It is a technology used for the reduction of exhaust emissions from Diesel vehicles. Its principle consists in the recirculation of part of the exhaust gas from the exhaust pipe back to the cylinder, which reduces the oxygen content in the combusted air and thus the production of nitrogen oxides. The disadvantage of this system lies in the reduction of the engine's output, increased fuel consumption and also higher production of solid particulates (due to imperfect combustion), which have to be subsequently removed by particulate filters.

Emissions. The discharge or release of one or more pollutants into the environment. These substances may originate from natural sources or human activities.

Equivalent noise level. Equivalent noise level A is the average energy of the instantaneous levels of acoustic pressure A and is expressed in dB. Equivalent noise level is hence a constant noise level with approximately the same effect on the human organism as time-varying noise.

Erosion. A complex process involving the disruption of the soil surface, its transmission and sedimentation of the loosened soil particles. Under normal conditions, it is a process which is natural, gradual, fully in accordance with the soil-forming process. Human activity, however, creates the triggering conditions for the so-called anthropogenically conditioned accelerated erosion of agricultural land.

Eutrophication. The process of enrichment of water by nutrients, especially by nitrogen and phosphorus. Eutrophication is a natural process, in which the main nutrient sources are nutrients washed from soil and the decomposition of dead organisms. Excessive eutrophication is caused by human activities. Nutrient sources include fertiliser use, sewerage discharge etc. Excessive eutrophication leads to the overgrowth of algae in water and subsequently to the lack of oxygen in water. Soil eutrophication distorts its original communities.

EU ETS. The European Union Emission Trading System in GHG emission allowances. One of the key instruments of the EU greenhouse gas emission reduction policy. The system should help reduce emissions in a cost-effective way and to enable the member states as well as the whole EU to comply with the obligations to reduce greenhouse gas emissions specified by the Kyoto Protocol. The system covers large industrial and energy businesses, its legislative basis is laid down in the Directive 2003/87/EC of the European Parliament and of the Council.

Fungicides. Plant protection products intended to control fungi.

Greenhouse gases. Gases that are naturally present in the atmosphere or produced by humans which have the ability to absorb long wave radiation emitted by the Earth's surface, thus influencing the climate's energy balance. The action of greenhouse gases results, in part, in an increased daily average temperature near the Earth's surface. The most important greenhouse gas is water vapour, which accounts for 60–70% of the total greenhouse effect in mid-latitudes (excluding the effect of clouds). The most important greenhouse gas that is affected by humans is carbon dioxide.

Hazardous waste. Waste reporting one or more of the hazardous properties listed in Annex No. 2 to Act No. 185/2001 Coll., such as explosiveness, flammability, irritability, toxicity, and others.

Herbicides. Products intended for the disposal of unwanted plants, such as weeds or invasive plants.

Immission. Pollutant contained in the air which gets into contact with its recipient (a person, plant, animal, material), and affects him/her/it. It is formed by a physico-chemical conversion of emission.

Infiltrated water. Water entering the sewerage system due to insufficient waterproofing, etc.

Insecticides. Plant protection products intended to control insects.

Investment on environmental protection (= investment expenditure). Investment expenditure on environmental protection includes all expenditures for the acquisition of tangible fixed assets, spent by the reporting entity in order to acquire fixed assets (by purchase or their own activities), together with the total value of tangible fixed assets acquired free of charge, or not transferred under applicable legislation, or reassigned from private use to business use.

Lime fertilisers. Calcium for the production of lime fertilizers is obtained from carbonate rocks and magnesium carbonate rocks that naturally formed from calcium that had been released from minerals. Another source of lime fertilisers are waste materials from industry – carbonation sludge, cement dust, phenol lime etc., and natural lime fertilisers of local importance. Lime material is used as fertiliser either directly (possibly after mechanical processing) or in the form of fertilisers produced through a chemical process (burnt lime, slaked lime, etc.).

LULUCF. The category covering emissions and removals of greenhouse gases resulting from land use, land use changes and forestry. This category is usually negative for countries with high forest cover and low levels of logging, and positive for countries with low forest cover or where rapid changes in landscape towards cultural landscape are taking place.

Material dependency on foreign countries. It expresses the share of imports on Domestic Material Consumption. It is usually assessed for certain groups of materials (e.g. crude oil), which indicates whether the state of the economy of the given state is dependent on imports of this material and to what extent.

Material Intensity of GDP. The amount of materials that a given economy needs to produce a unit of economic output. High material intensity indicates high potential pressure of the economy on the environment and vice versa. The pressure arises not only from the extraction of materials, but also from waste flows, e.g. emissions and waste.

Meteorological conditions. The physical state of the atmosphere in a certain place and at a given time. The developments of meteorological conditions may affect some economic activities (e.g. energy) and the state of the environment (air quality). The term should not be confused with climatic conditions (climate).

Mineral fertilisers (inorganic, industrial, chemical fertilisers). Fertilisers containing nutrients in the form of inorganic compounds obtained through extraction and/or physical and/or chemical industrial processes.

Mixed municipal waste. It is the waste that remains after the separation of usable components and hazardous components from municipal waste and is sometimes also called 'residual' waste.

Mollusscicides. Plant protection products intended for controlling molluscs, mainly slugs and snails.

Motorisation. This term indicates the number of motor vehicles per 1,000 inhabitants. Together with other indicators (the age of the fleet, the composition of the fleet based on drive types etc.), motorization measures the extent to which the vehicle fleet influences the environment. The indicator is most frequently used for passenger cars; in that case, it is also referred to as automobilisation.

Municipal Waste. All waste produced in a municipality by the activities of natural persons and listed as municipal waste in the implementing legal regulation, with the exception of waste produced by legal persons or natural persons authorised to carry out business activities.

Non-hazardous waste. Waste that is not listed in the list of hazardous waste in Decree No. 381/2001 Coll. and does not show any hazardous characteristics listed in Annex No. 2 to the Act on Waste.

Non-investment costs on environmental protection. Common or operating expenses, which include payroll costs, payments for material and energy consumption, repairs and maintenance etc. and payments for the services whose main purpose is the prevention, reduction, modification or removal of pollution and pollutants etc. or other degradation of the environment, which are generated by the production process of a given business.

Organic food. Food produced from organic farming produce under the conditions stipulated by legislation. It meets specific requirements for quality and health safety (e.g. without using artificial fertilisers, harmful chemical sprays or genetically modified organisms). It does not contain chemical additives, preservatives, stabilisers, artificial dyes etc.

Organic (manure) fertilisers. Fertilisers in the form of livestock excrements, including plant residues, compost, straw, tops and green manure. Their main component are organic substances of plant and animal origin (carbohydrates, cellulose, amino acids, proteins, etc.). Along with these substances, organic fertilisers also contains nutrients (N, P, K, Ca, Mg and other).

Organochlorine pesticides. A group of substances known as organochlorine pesticides includes DDT, HCH (hexachlorocyclohexane) and HCB (hexachlorobenzene) derivatives and others. These are persistent lipophilic substances which were once used as pesticides.

PCBs. Polychlorinated biphenyls is the collective term for 209 chemically related compounds (congeners) which differ in the number and position of chlorine atoms bound to the biphenyl molecule. They had a wide range of commercial use in the past. Their production was banned due to their persistence and bioaccumulation ability. The most harmful effects of these substances include carcinogenic effects, damage to the immune system and liver and reduced fertility.

PES. Primary energy sources. PES are the sum of domestic or imported energy sources, expressed in energy units. Primary energy sources are one of the basic indicators of energy balance.

Population equivalent. Population equivalent is a number expressing the size of a municipality as a pollution source through converting pollution from facilities and other pollution sources to the amount of population that would be needed to produce the same amount of pollution. One population equivalent corresponds to the production of 150 l waste water and 60 g BOD_5 (organic pollution) per day.

POPs. Persistent organic pollutants are substances that remain in the environment for a long period of time. They accumulate in the fatty tissues of animals and enter human organisms through the food chains. Even in very small doses, they can cause reproductive disorders, affect hormonal and immune functions and increase the risk of cancer.

RES. Renewable energy sources. These sources are called "renewable" because they constantly replenish themselves thanks to solar radiation and other processes. From the perspective of human existence, direct sunlight and some of its indirect forms are "inexhaustible" energy sources. RES include wind energy, solar energy, geothermal energy, water energy, soil energy, air energy, biomass energy, landfill gas energy and sludge gas and biogas energy.

Rodenticides. Chemical substances intended to control rodents.

SCR. Selective catalytic reduction is a technology of reducing NO_x emissions of diesel engines to the level of higher emission standards EURO 4–6. The technology is used especially by large goods vehicles and buses and its principle consists in the injection of the reduction agent (solution of urea, i.e. AdBlue) into the exhaust, which leads to the reduction of nitrogen oxides into nitrogen and water.

Sorption capacity (ability) of soil. The ability of the soil to bind (to sorb) ions or entire molecules of different compounds from soil solution into the solid particulates of the soil. Depending on the type and intensity of sorption, the sorbed substances (nutrients) are protected against wash-out, creating a reservoir of nutrients easily accessible for plant and allowing a gradual nutrient intake during the vegetation period and at the same time substantially reducing the undesirable increase of salt concentration in the soil solution.

Suspended particles. Solid or liquid particles that remain in the atmosphere for a long time due to their negligible stalling speed. Particles in the air pose a significant risk factor for human health.

Traffic Performance. This indicator evaluates the road network load. It is calculated as transport intensity expressed as the number of vehicles that pass through a certain road over a certain time period, multiplied by the road length. If we add up traffic performance of all roads, we reveal the traffic performance of the entire road network. Traffic performance is measured in vehicle-kilometres (vkm) and is not dependent on the vehicles' load.

Transport performance. The number of passengers or the weight of cargo transported over a distance of 1 kilometre. It is measured in "passenger-kilometres" (pkm) and "tonne-kilometres" (tkm).

Transport volume. The number of passengers or the weight of the cargo transported by a given mode of transportation during the monitored period (usually a day or a year).

TSES. A territorial system of ecological stability is a mutually interconnected set of natural and altered, yet near-natural ecosystems which maintain a natural balance. A distinction is made between local, regional and supra-regional systems of ecological stability. The basic building parts of TSES are bio-centres, bio-corridors and interactive elements.

UAT. Unfragmented Areas by Traffic. It is a method of determining "areas that are unfragmented by traffic", i.e. areas which are delimited by roads with traffic intensity higher than 1,000 vehicles per 24 hours or multi-track railways with an area larger than 100 km^2.

Vehicle fleet. All vehicles belonging to the monitored category. A distinction is made between a static and dynamic vehicle fleet. The static vehicle fleet comprises all vehicles registered on the given date in the Central Vehicle Register. The dynamic fleet includes only vehicles in actual operation on roads.

Waste. Any movable object that a person disposes of, or that a person intends to or is obliged to dispose of belonging to one of the groups of waste listed in Annex No. 1 to Act No. 185/2001 Coll.

Weather. The terms referring to the state of the atmosphere above a certain point on the earth's surface at a certain time. Weather is described using a set of meteorological parameters (temperature, pressure, precipitation, wind speed and direction, and more), including the vertical profiles of these parameters, and meteorological phenomena (generally unquantifiable – ice, fog, storm, hail, etc.).

Zoocides. Plant protection products intended against animals that can cause damage to plants.

Methodology

The Report on the Environment (hereinafter as "Report") is the basic environmental reporting document in the Czech Republic. The methodology of the report did not change significantly in the period 1994–2008 and therefore the document was published in a similar form, only with minor changes. Due to the needs and demands for information and technical support for the formulation and implementation of environmental strategies by the Ministry of Environment, a modification in the methodology of the Report was made in 2009 in order to better reflect the requirements of these agents and to provide the relevant conclusions for policy decisions. The Report is normally based on authorised data obtained from monitoring systems administered by organizations both within and outside the environmental sector. The data of Eurostat and the European Environment Agency (EEA) are used in the international comparisons.

THE USE OF INDICATORS TO DESCRIBE THE STATE OF THE ENVIRONMENT

The methodological basis of the Report is represented by the indicators, i.e. the indicators with precise methodology and linked with the Czech Republic's main environmental topics and objectives of the State Environmental Policy of the Czech Republic 2012–2020. The data collection and the creation of the indicators laid down in the current State Environmental Policy of the Czech Republic 2012–2020 have not yet been fully secured and the Report therefore contains a selection of available indicators. Environmental Indicators are among the most commonly used environmental assessment instruments. Based on data, they demonstrate the state, specifics and development of the environment and can indicate newly arising environmental problems. Assessments on the basis of indicators are clear and user-friendly. The indicator-based assessment methodology follows the methodological trends used in the EU and is thus in accordance with the reporting at both national and European levels.

ENVIRONMENTAL ASSESSMENT USING A SET OF KEY INDICATORS

The formation and development of a set of key indicators stemmed from the need to identify a small range of politically relevant indicators, which together with other information respond to the selected priority policy issues and address major current issues. The set is therefore an effective tool for drawing up the Report and for evaluating the fulfilment of the objectives and priorities of State Environmental Policy of the Czech Republic 2012–2020.

A set of key indicators is composed of 42 indicators, selected according to the following criteria:

- ➜ relevance to the current environmental problems;
- ➜ relevance to the current environmental policy, strategies and international obligations under implementation;
- ➜ availability of high-quality and reliable data over a long period of time;
- ➜ relation to sectoral concepts and environmental aspects;
- ➜ "cross-cutting" nature of the indicator – the effort to capture as many causal links as possible, i.e. indicator selected in order to represent both the causes and consequences of other phenomena in the DPSIR chain;
- ➜ link to indicators defined at the international level and detailed at the EU level.

The proposed set of indicators is not static, but is constantly being adapted to the needs of the current State Environmental Policy of the Czech Republic, to environmental problems and the availability of the source data sets. In recent years, for example, there has been a change in the number of chapters including the presented indicators. Greater modifications in the structure and number of indicators were made in the 2014 Report.

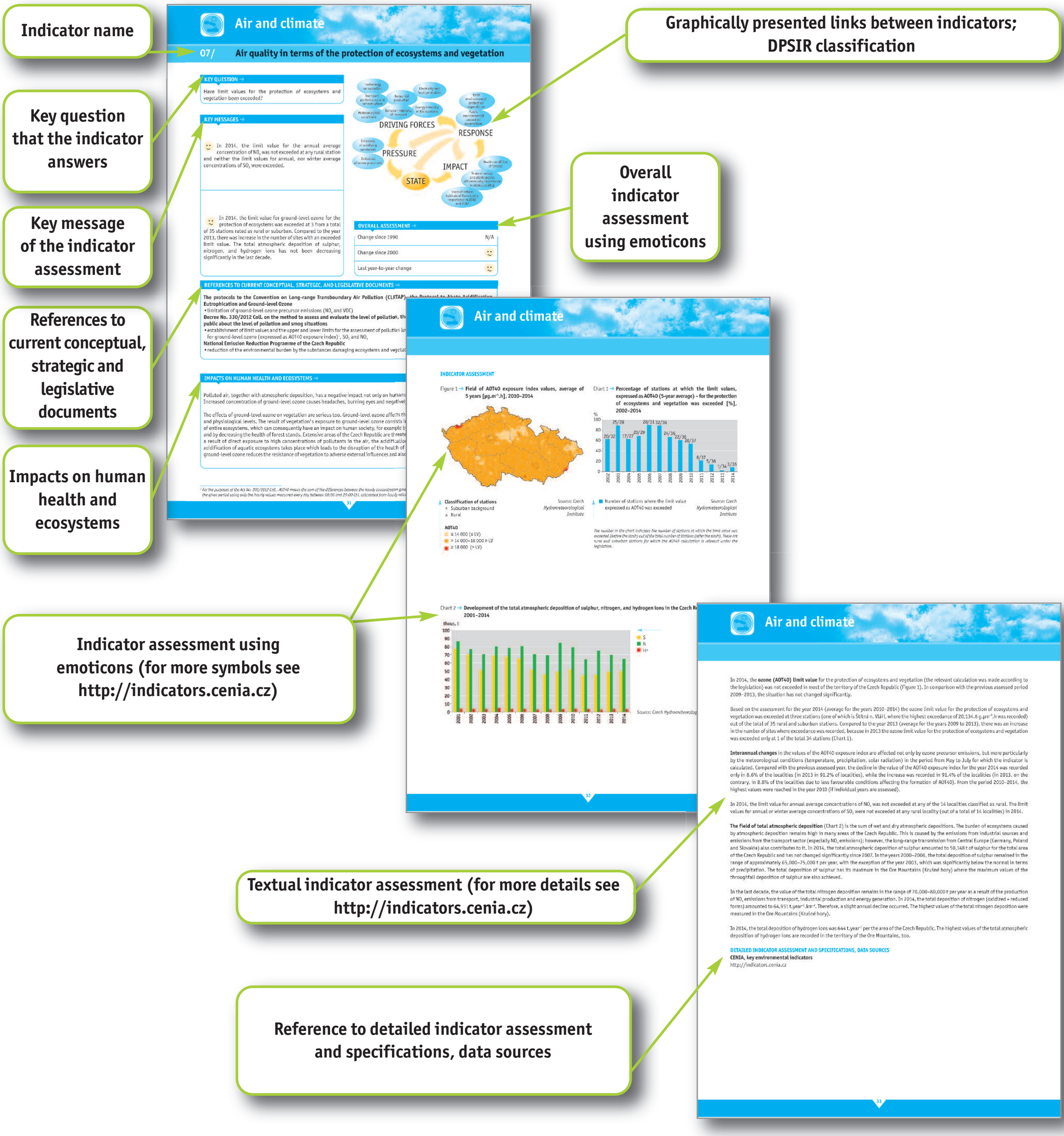
The 2014 Report therefore includes a thematic chapter Nature (formerly Biodiversity) with new indicators – Nature conservation and Common bird species indicator, as well as previously presented indicators State of animal and plant species of Community Importance and State of natural habitats of Community Importance (assessed under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora – Habitats Directive). The 2014 Report also features modification of the previously presented chapter Soil and Landscape, which is currently divided into two thematic units, Soil and Landscape and Agriculture, while the indicators presented here were expanded by the indicator Old ecological burdens. In order to broaden its scope, the name of the former indicator Erosion of agricultural land was changed to Soil erosion and landslide risk. The thematic chapter Waste and material flows was expanded by the indicator Generation and recycling of waste from selected products.

The indicators of the Report are separately presented on the ISSaR (Information System for Statistics and Reporting) website (http://indicators.cenia.cz). Indicators contained in the set of key indicators have been developed in cooperation with Czech expert institutions, which deal with these issues in the long term, or have been adopted from the internationally recognised indicator sets (EEA CSI, Eurostat, OECD, etc.).

MESSAGES COMMUNICATED VIA INDICATORS

An indicator in the report provides the information in several hierarchical levels of detail. First, at the most general level, it provides comprehensive information – a key message, related (if currently possible) to a specific objective or another national or international commitment. The conceptual, strategic, and legislative documents which were in force in the given assessed year, i.e. in the year 2014, are also presented in the Report. General information also includes an overall assessment of the trend and impacts of the assessed phenomena on human health and ecosystems. Within a more detailed indicator assessment, the assessment of international comparison is also included at the end of each thematic chapter. Where the verified data are available for the respective indicators, the state and development of the environment is compared with other member states of the EU or member states of the EEA. Each indicator is assessed according to a unified template and simultaneously presented at http://indicators.cenia.cz in a more detailed form than in the Report together with methodology specifications and other metadata. A link to the relevant website is provided in the Report at end of each chapter.

INDICATOR ASSESSMENT STRUCTURE



MEANINGS OF EMOTICONS

:)	The trend is developing positively, in accordance with the objectives set.
:~	The trend is developing neither positively nor negatively and can be referred to as stagnating.
:(	The trend is developing negatively, not in accordance with the objectives set.

THE INCLUSION OF INDICATORS ACCORDING TO THE DPSIR MODEL

The indicators in the Report are arranged in thematic areas and their positions in the internationally applied model DPSIR (D – Driving Forces, P – Pressure, S – State, I – Impact, R – Response) is specified. DPSIR model shows the dependencies between factors affecting the state of the environment and instruments that are used to regulate them. The state indicators (S) include the state (quality) of individual environmental media (air, water, soil, etc.), pressure (P) directly affects the state (e.g. emission etc.). Driving force (D) are pressure factors (i.e. the energy intensity of the economy, the structure of the primary energy basis). Impacts (I) refer to the damage to the environment and human health and response (R) to the implemented measures.
However, the classification of indicators can overlap as a result of interpretations of individual dependencies.