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2013

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 worked out every year on the basis of Act No. 123/1998 Coll., on the right to information on the environment, as amended, and Government Resolution No. 446 of 17 August 1994, 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.

It is a comprehensive evaluation document assessing the state of the environment in the Czech Republic, including the entire context, on the basis of the data available in the given 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 2013 was discussed and approved by the Government on 12 November 2014 and then provided to the two chambers of the Parliament of the Czech Republic for information. The report is published in electronic form (http://www.mzp.cz and http://www.cenia.cz) and it is distributed at the same time on USB flash drive, together with the Statistical Yearbook of the Environment of the Czech Republic 2014.

Contents

Methodology

The Report on the Environment (hereinafter referred to as "the Report") is a basic environmental reporting document of the Czech Republic. The methodology of the Report did not change much between 1994 and 2008, and therefore it was published in a similar form, only with slight changes. As the need and demand for information and expert support for the processes of the creation and implementation of environmental strategies have grown, the methodology of the Report was modified in 2009 in order to better reflect the requirements of those who use it and to provide conclusions relevant to policy-making. The report is based on authorised data that are obtained from monitoring systems administered by organisations from both within and outside the environmental sector. The data in international comparisons are provided by Eurostat, the European Environment Agency (EEA) and the Organisation for Economic Co-Operation and Development (OECD).

THE USE OF INDICATORS TO DESCRIBE THE STATE OF THE ENVIRONMENT

The methodological basis of the Report is the indicators, i.e. the indicators described with precise methodology and linked with the Czech Republic's main environmental topics and with objectives of the State Environmental Policy of the Czech Republic 2004–2010 and the State Environmental Policy of the Czech Republic 2012–2020. Within preparation of the new State Environmental Policy of the Czech Republic 2012–2020, the set of indicators was modified so that the presented indicators are linked with the new policy and can report on fulfilment of its objectives every year. However, the data collection and creation of indicators laid down in the current State Environmental Policy of the Czech Republic 2012–2020 are not yet 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 new topical environmental problems. Assessments that use indicators are clear and user–friendly. The indicator-based assessment methodology follows methodological trends used in the EU and therefore it is in accordance with the gradual process to harmonise reporting at both national and European levels.

ENVIRONMENTAL ASSESSMENT USING A SET OF KEY INDICATORS

The formation and development of the set of key indicators stemmed from necessity to identify a small range of politically relevant indicators which, together with other information, respond to selected priority policy issues and take the main current topics into consideration. Therefore, the set is an effective tool to work out the Report and to evaluate fulfilment of the objectives and priorities set in the State Environmental Policy of the Czech Republic.

The set of key indicators includes 38 indicators selected using 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 to their environmental aspects;
- "cross-cutting" nature of the indicator – the indicator covers as many causal links as possible, i.e. it was selected 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 State Environmental Policy of the Czech Republic, to the EEA set, to environmental problems and to availability of the source data sets. For example, in recent years there has been a change in several chapters including the indicators presented. There have been greater modifications of the structure and number of indicators in the 2011 Report, when annual use of the data with longer collection and evaluation periods was reviewed in relation to reporting obligations resulting from e.g. the EU regulations. Therefore, the indicators such as the State of Animal and Plant Species of Community Importance and the State of Natural Habitats of Community Importance are not provided annually any more. Other indicators for which necessary data collection was not ensured, such as the Common bird species indicator, are not presented in the Report either and as aresult, the whole topic of Biodiversity is not included in the Report in those years which do not overlap with the above-mentioned reporting period (for more details see the chapter Availability of Data in the Report).

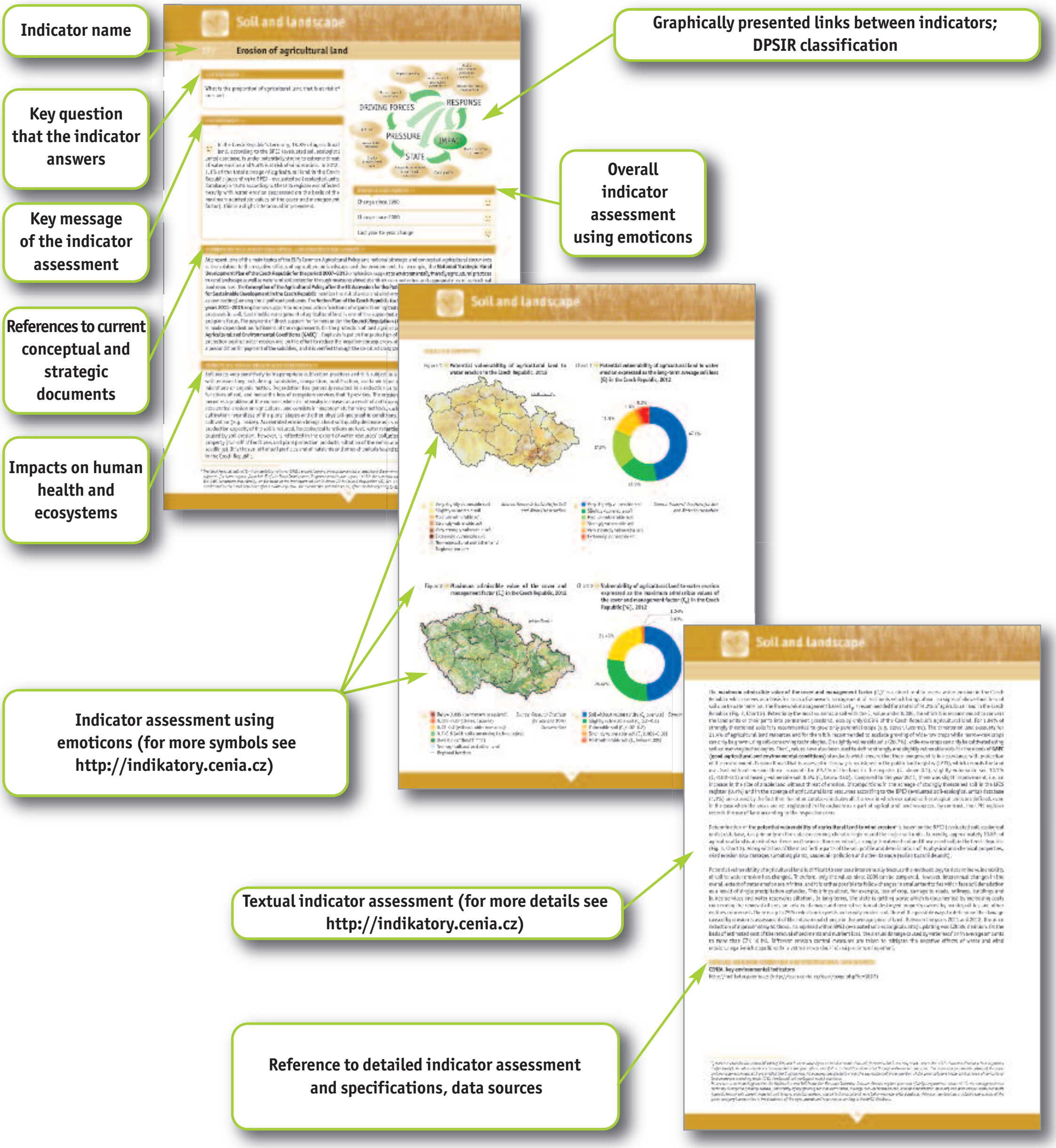
Due to the six-year evaluation period (2007–2012), as laid down in Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive), the 2013 Report contains the indicators: State of animal and plant species of Community importance and State of natural habitat types of Community importance. However, despite this monitoring, the state and development of biodiversity is not being monitored adequately; in the Czech Republic there is no regular data collection system in relation to the objectives laid down by the State Environmental Policy of the Czech Republic 2012–2020, and that is why the above-mentioned indicators do not cover the topic of Biodiversity in its entirety.

The indicators with the latest available data, i.e. also for the years in which they are not included in the Report, are presented separately on the ISSaR (Information System for Statistics and Reporting) website (http://indikatory.cenia.cz). Due to extension of the scope of or changes in the construction of some of the indicators in the Report, their names are also modified in the 2013 Report (Emission intensity of transport instead of Passenger-car and truck fleet, Transport performance and infrastructure instead of Development and structure of passenger and freight transport). Indicators contained in the set of key indicators have been developed in Czech expert institutions which deal with these issues in long terms, or they have been taken from the internationally recognised indicator sets (EEA CSI, Eurostat, OECD, etc.).

MESSAGES COMMUNICATED VIA INDICATORS

An indicator in the Report provides information across several hierarchical levels of detail. First, at the most general level, it provides comprehensible information – a key message, related (if currently possible) to a specific objective or another national or international commitment. The conceptual, strategic, and legislative documents that were valid in the given evaluated year, i.e. 2013, have also been included 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, there is also an international comparison at the end of each thematic chapter. Therefore, environmental conditions are compared with those in the other EU or EEA member states where verified data are available for the respective indicators. Each indicator is assessed according to a unified template, and presented simultaneously at http://indikatory.cenia.cz in a more detailed form than in the Report, together with methodology specifications and other metadata. The Report provides a link to the website for the respective indicator at the end of each chapter.

INDICATOR ASSESSMENT STRUCTURE

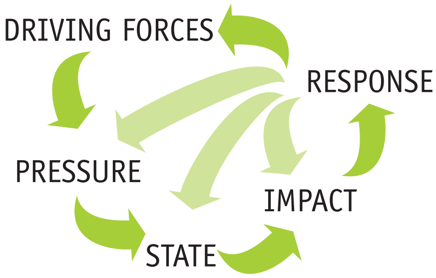


EMOTICON SYMBOL KEY

🙂	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 stagnate.
🙁	The Trend is developing negatively, not in accordance with the objectives set.

RELATED INDICATORS

Indicators in the Report are arranged in thematic areas and their position in the internationally applied DPSIR model (D – Driving Forces, P – Pressure, S – State, I – Impact, R – Response) is specified. The DPSIR model shows mutual dependence between factors affecting the state of the environment and instruments that are used to regulate them. State indicators (S) include the state (quality) of individual environmental media (such as air, water, soil, etc.); pressure (P) has a direct impact on the state (e.g. emission). Driving forces (D) are factors of pressure (i.e. the energy intensity of the economy, structure of the primary energy basis). Impact (I) means damage to the environment and human health and response (R) indicates implemented measures. However, classifications of the indicators may overlap in view of interpretations of the single dependencies. E.g. some indicators can be viewed as pressure, while from a different perspective they may indicate the state. Therefore, classification cannot be perceived as unequivocal.



LIST OF ABBREVIATIONS AND GLOSSARY OF TERMS

Since 2010, the Report has also included a list of abbreviations and a glossary of terms to better describe and clarify abbreviations and the terminology used in the Report.

Key messages of the Report

According to the 2013 assessment, the state of the environment in the Czech Republic improved slightly and the positive trend of the previous years has therefore continued. The improvement is associated with reduction of the Czech economy's negative environmental impacts in 2013, which was supported by moderate economic recession. The biggest reduction of environmental pressures has been recorded in the sectors of energy, transport and manufacturing industries. On the other hand, environmental impact of households' consumption remains considerable, especially in the area of local heating and air quality. With the main economic sectors declining, the households become one of the main factors that have a negative influence on the state of the environment.

The long-term decline in energy and material intensity of the Czech economy changes gradually into stagnation; specific environmental burden per unit of GDP in the Czech Republic continues being above average within the EU28, which, however, is related to the national economy's basis with a high proportion of industry in GDP. After a constant growth, stagnation of electricity generation and final consumption is seen in the energy sector. There are positive changes in the structure of electricity generation which is more diversified. In the last ten years, electricity generation in steam power stations is gradually declining and the importance of nuclear and renewable energy is growing. Environmental impacts of the manufacturing industry have also been declining, as a result of technological developments.

Environmentally positive development of the economy in 2013 is reflected in the production of pollutants and greenhouse gases emitted into the atmosphere, however, the industrial sector in areas where industrial plants are concentrated (Moravian-Silesian region, region of Ústí nad Labem and Central Bohemia) contributes to long-term local exceeding of the air pollution limits. In locations with high traffic burden, the quality of human life is influenced by not only transport-related emissions but also noise, despite an increase in the proportion of public transport in passenger transport and gradual modernisation of the vehicle fleet.

Above-the-limit concentrations of PM_{10} and $PM_{2.5}$ fractions and above-the-limit concentrations of benzo(a)pyrene are most hazardous for a human organism. The main producer of these health-threatening substances is local household heating, which is a source of almost 90% of all benzo(a)pyrene emission and approximately 41% of suspended particles. Air quality is not improving in the Czech Republic; it only fluctuates depending on the development of weather conditions in the given year. Roughly one-third of the Czech Republic's population continue living in areas with exceeded air pollution limit values for PM_{10} and two-thirds of the population are exposed to above-the-limit concentrations of carcinogenic benzo(a)pyrene.

As there is a gradual decline of water abstraction and consumption, the amount of discharged waste water also decreases, together with the pollutants' concentrations in watercourses. A reduced volume of waste water originating in the energy sector contributes most significantly to the decrease of waste water discharged from point sources. Areal pollution is a major source of surface water pollution; it decreased in 2013 as a result of a slight interannual decline in the use of mineral fertilisers and plant protection products in agricultural activity. A growing proportion of land under organic farming and the number of organic farms are environmentally positive trends. However, acidification and eutrophication of the environment due to agricultural activities and atmospheric deposition still continue being a problem. Air pollution load of ecosystems is going down due to decreasing environmental burden, but health condition of forest stands remains unfavourable. However, the state of the stands is influenced significantly by abiotic and biotic factors, while high stocks of hoofed game and wild boars have a fundamental impact on health of the forest and its annual increment.

As a result of landscape built-up with transport infrastructure and agricultural land take-over for territorial development of towns, there is a continual fragmentation of the natural environment. This increases pressure on plant and animal habitats and the biotopes are fading out. Artificial landscape elements also hamper water retention and infiltration, they change the mode of water runoff from the territory, increasing the risk of floods. A more frequent occurrence of floods and other dangerous hydrometeorological phenomena can be expected in relation to global climate change, which represents a new pressure on the economy and the environment.

Compared with the EU average, the Czech Republic invests above-average financial means into environmental protection in long terms, both within the public and industrial sectors. The reason for higher investment lies especially in solutions to environmental problems in recent years, solutions to current problems, which includes, inter alia, also reduction of air pollution from local sources through financial aid to replace old and unsuitable boilers, and also fulfilment of the EU legislation. Within public financing of environmental protection from the EU sources, however, problematic use of the Operational Programme – the Environment (the largest source of subsidies) continued in 2013; only 43% of the initially allocated amount had been used at the end of 2013.

THE MAIN POSITIVE FINDINGS OF THE REPORT:

- The total greenhouse gas emissions in the Czech Republic are decreasing and in 2012 they were by 33.0% lower than in 1990. Emissions from the manufacturing industries show a downward trend, and greenhouse gas emissions from transport have also been decreasing since 2007.

- In 2013, there was an interannual decrease in emissions of acidifying substances (by 6.7%), emissions of ozone precursors (by 4.8%) and secondary particulate precursors (by 7.2%). The limit values for nickel, lead and benzene were not exceeded in 2013 at any of the monitored sites. The limit values for sulphur dioxide and carbon monoxide have not been exceeded either in 2013. The limit values for annual average NO_x concentration was not exceeded at any rural station and the air pollution limit values for annual and winter average SO_2 concentrations to protect vegetation and ecosystems were nor exceeded either.

- The trend of declining water abstraction and consumption continues; the most significant reduction of water abstraction was recorded in the category of energy (interannually by 17.0%). In addition, the number of inhabitants connected to water supply networks has increased interannually.

- Compared to the year 2012, the total amount of discharged waste water was reduced interannually by 2.0%. The trend of reducing the pollution discharged from point sources continues. Increase of the number of inhabitants connected to public sewers continues. In 2013, 82.8% of the Czech Republic's population was connected to a public sewer, of which 95.0% were connected to a sewerage system ending in a wastewater treatment plant. A total of 97.4% of wastewater discharged into sewerage systems has been treated. Increase of the number of wastewater treatment plants with tertiary treatment also continues.

- For all water quality parameters that are monitored, there was a long-term decrease in their concentrations in watercourses. The was an interannual decrease of the concentration of chlorophyll 'a' by 44.1%, cadmium by 26.7%, total phosphorus by 12.1% and BOD_5 by 9.1%. Environmental quality standards, especially for cadmium and BOD_5, and in long terms also for COD_{Cr} and $N\text{-}NO_3^-$, were not being exceeded in 2013.

- The state of animal and plant species of Community importance was improving in 2000–2006 and 2007–2012. In 2007–2012, 25.3% of animal and plant species of Community importance were marked as species in a favourable state in terms of protection, as opposed to the original 18.9%.

- Based on a comparison of the 2000–2006 and 2007–2012 evaluations, the state of natural habitat types of Community importance improved in the Czech Republic, the number of favourable evaluations increased from 11.6% to 16.1%.

- The proportion of deciduous trees in the total forest area in the Czech Republic has been rising and the area of forest natural regeneration also increases.

- In 2000–2013, the total acreage of arable land decreased by 3.1% in the Czech Republic; the area of permanent grassland grew (by 3.5%) in the same period.

- In 2013, the consumption of mineral fertilisers and plant protection products decreased interannually by 3.9% and 3.5% respectively.

- The proportion of agricultural land under organic farming and the number of organic farms increase in long terms thanks to growing financial support. In 2013, 11.7% of the total area of agricultural land resources was cultivated in accordance with the organic farming principles. The organic food market is also developing.

- Energy intensity of the Czech economy has been decreasing in long terms.

- Generation of electricity in steam power stations has been gradually decreasing while the importance of nuclear energy and renewable energy sources has been rising; electricity generation from RES was by 14.6% higher than in 2012.

- Transport-related environmental burden decreases, which is influenced significantly by the vehicle fleet's modernisation. Railway transportation and industry do not cause noise burden that would be important in terms of its area in the Czech Republic.

- The Czech Republic's domestic material consumption decreases; the 2011–2012 interannual decline amounted to 11.1 %. Material intensity of the Czech economy also declines; it decreased interannually by 10.2% in 2012. The decline in material intensity results in reduced environmental burden caused by material consumption per unit of GDP generated.

- The total waste production has shown a slightly downward trend since 2009.

- The proportion of energy and material recovery of municipal waste has been growing since 2009.

- The proportion of landfilled waste and of waste deposited in another way in the total waste production was declining in 2009–2013.

THE MAIN NEGATIVE FINDINGS OF THE REPORT:

- Despite long-term decline in emissions, air quality in the Czech Republic's territory is not improving; the Moravian-Silesian region still belongs to the most polluted areas. Limit values for suspended particulates, benzo(a)pyrene and ground-level ozone have been exceeded repeatedly. In locations with high traffic load, the limit value for NO_2 was exceeded in 2013. The limit values for arsenic and cadmium were also exceeded in 2013. Compared to the year 2012, there was an increase in the number of declared smog situations due to high concentrations of PM_{10} and ground-level ozone in 2013.

- There was an interannual (2012–2013) increase in the concentration of COD_{Cr} by 3.4%. In 2013, environmental quality standards for P_{total} and AOX were exceeded in almost one third of the profiles. Generally speaking, the situation regarding eutrophication of stagnant and flowing waters is rather unsatisfactory and it is necessary to permanently reduce the burden of water with nutrients, especially phosphorus compounds.

- In 2007–2012, 37% of animal and plant species of Community importance were assessed as species in an inadequate state in terms of protection, 31.5% were classified as species in an unfavourable (bad) state.

- In 2007–2012, more than a half of habitat types of Community importance in the Czech Republic were assessed as habitats in the inadequate status in terms of protection; 26.9% were in the unfavourable status.

- The defoliation rate remains very high in the Czech Republic. The efforts to reduce the amount of cloven-hoofed game, which causes considerable damage by browsing the stands under regeneration, is unsuccessful in long terms.

- Take-ups of agricultural and forest land due to territorial development continue. In 2013, built-up and other areas expanded by 2.4 thous. ha and covered 10.6% of the Czech Republic's territory. The landscape fragmentation process due to line transport constructions continues.

- On the Czech Republic's territory, 35.9% of agricultural land is potentially threatened with water erosion and 18.4% with wind erosion. The vast majority of land that is at risk of erosion is not subject to any systematic protection that would reduce soil loss.

- Concerning selected high-risk substances, the limit values of allowable soil pollution are exceeded in long terms, predominantly in the case of PAH. The DDT group and related substances (DDD and DDE) have a high level of persistence in soil.

- The household heating methods do not change very much in the Czech Republic; 40.9% of PM_{10} emissions originated from local heating units in 2012.

- The balance of electricity exports and imports amounted to –19.4% in 2013. In relation to the environment, this is a negative phenomenon since emissions from generation of exported electricity were produced in the Czech Republic's territory.

- In 2013, there was a significant interannual increase of road freight transport performance, this type of transport continues being a considerable environmental burden. In the Czech Republic's agglomerations, 10.0% of the population are exposed to above-limit noise levels. Road transport is almost the exclusive source of excessive noise.

- Material dependency of the Czech Republic on foreign countries has been rising. In the long term, the Czech Republic is unable to achieve the state in which the economy is growing and the environmental burden caused by material consumption is decreasing. Interconnectedness of the economic development and material consumption continues being considerable and material intensity of the Czech Republic's economy is above average in the European context.

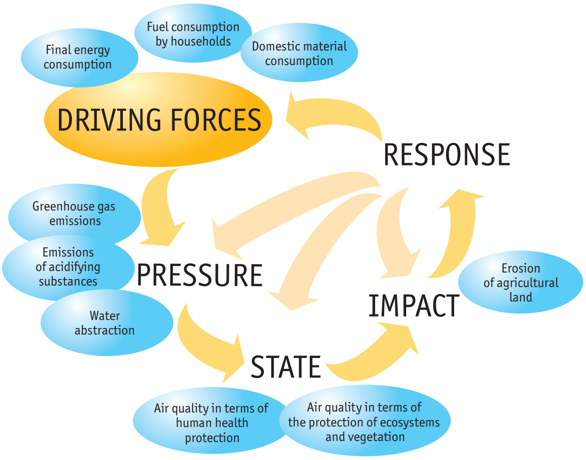
- In the framework of environmental protection financing from the EU, the subsidies of the OP - Environment were the strongest resource in 2013, however, only 43% of the initially allocated amount had been used at the end of 2013.

Air and climate

01/ Meteorological conditions

KEY QUESTION →

What were the temperature and precipitation conditions on the Czech Republic's territory in 2013?



KEY MESSAGES →

In 2013, there were normal temperatures and normal precipitation on the territory of the Czech Republic. The average annual temperature (7.9 °C) was by 0.4 °C higher than the long-term mean (1961–1990), the annual rainfall (727 mm) represents 108% of the long-term mean (1961–1990). There were months which were both below and above the average in comparison with the long-term mean; July was the warmest month (deviation +2.5°C), while March was the coldest with deviation –3.2°C. In January and February, there were an increased number of synoptic situations causing poor dispersion conditions for pollutants in the air, which in total lasted for 23 days within this period.

During the year 2013, precipitation was distributed unevenly; in terms of rainfall, the richest months were May and especially June, when abundant rainfall resulted in floods. On the other hand, low total precipitation was recorded in April, July and December.

INDICATOR SIGNIFICANCE AND CONTEXT →

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

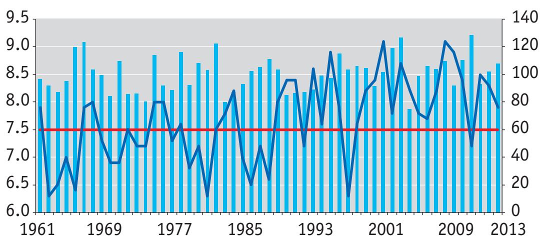
Indirect effect of the weather conditions consists in affecting the state of the environment. This concerns, in particular, the conditions for air pollutants dispersion in the air, which are, together with the emission production, the main factors in air quality fluctuation. In the summer, high temperatures and intense sunlight support formation of ground-level ozone, which is harmful to human health. Temperature and precipitation conditions also affect the surface water quality; high temperatures promote eutrophication of stagnant water and worsening the water quality for swimming.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The effect of meteorological conditions on human health is associated especially with 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 attack and with a higher mortality rate for diseases of the circulatory and respiratory system. High temperatures also encourage spreading of some infectious diseases. Chilling in freezing days may also have health effects, especially for the elderly and people without shelter. Increased concentrations of ground-level ozone have irritant effects on the respiratory system and they also damage green parts of plants, influencing agricultural production and 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

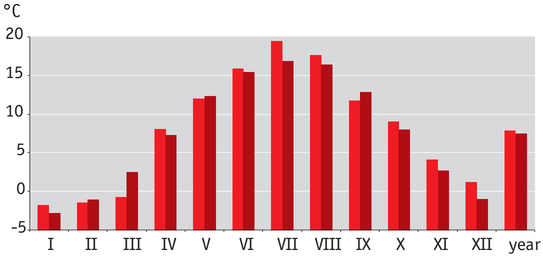
Chart 1 → **Long-term development of annual average air temperature and annual precipitation totals in the Czech Republic compared with the long-term mean (1961–1990), 1961–2013 [°C, %]**



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

Source: Czech Hydrometeorological Institute

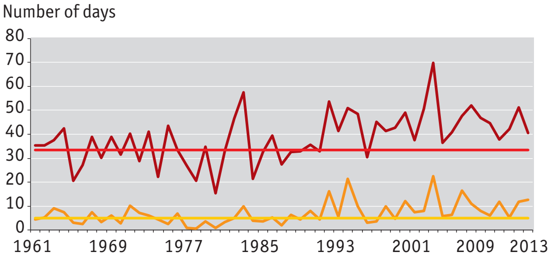
Chart 2 → **Monthly average air temperature in the Czech Republic (area temperatures) compared with the 1961–1990 temperature mean [°C], 2013**



- 🟥 Air temperature (2013)
- 🟥 Mean value of air temperature (1961–1990)

Source: Czech Hydrometeorological Institute

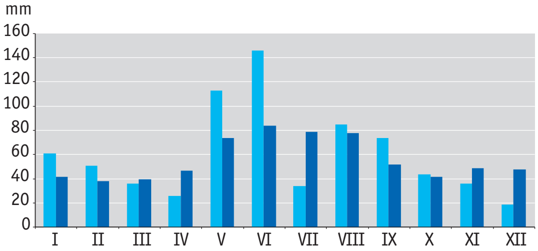
Chart 3 → **Average number of summer days and tropical days compared with the 1961–1990 mean [number of days], 1961–2013**



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 in the Czech Republic (area averages) compared with the 1961–1990 long-term mean [mm], 2013**



Source: Czech Hydrometeorological Institute

- 🟦 Precipitation total (2013)
- 🟦 Mean value of the precipitation totals (1961–1990)

There were **normal temperatures on the territory of the Czech Republic in 2013**; the average annual air temperature (7.9 °C) was by 0.4 °C higher than the long-term mean (1961–1990) (Chart 1). However, months with both above-normal and below-normal temperatures have been recorded. The biggest positive deviation from normal temperatures was recorded in July (+2.5°C), the largest negative deviation was in March (–3.2°C). Like the previous years, the year 2013 also belongs to the years with a positive annual temperature deviation from the normal, in particular due to warm weather in the summer and at the end of the year. In the past 25 years, there have been only three years (2010, 1996 and 1991) with an average air temperature below the 1961-1990 mean. In comparison with the previous year 2012, the year 2013 was colder by 0.4 °C.

According to the WMO report on the state of the climate, the **global temperature of the Earth's surface** was by 0.5 °C higher in 2013 compared to the long-term mean (1961–1990), which is 14.0 °C. From a global perspective, the year 2013 was, along with the year 2007, the sixth warmest year during the whole period of instrumental measurement which runs from approximately 1850. Likewise the previous twelve years (2001–2012), the year 2013 also ranks among 15 warmest years ever recorded. Even for Europe the year 2013 was the sixth warmest year in history. In many European countries, a very hot summer with new temperature records was recorded.

In the Czech Republic, January was **the coldest month of 2013**, with the temperature –1.8 °C; however, deviation from the normal amounted to +1.0 °C and temperatures in January corresponded to the normal (Chart 2). After a warm beginning of the year, when there was mainly rainfall, the winter weather returned in the second January decade, which lasted until the end of the third decade in January. The warmer and colder periods alternated also during February and the month as a whole was normal in terms of temperature. **Unusually cold weather** lasted from 10th March until the end of the first April decade. In the coldest parts of this period, i.e. from 14th to 17th March and from 23rd to 26th March, the minimum temperatures were below the freezing point throughout the whole territory of the Czech Republic, in the mountains they dropped below –15 °C. As a result of this temperature development, March with the average temperature being –0.7 °C and the deviation from the normal being –3.1 °C was below normal. As early as on 18th April, however, the first summer day was recorded in some places with the maximum daily temperatures higher than 25 °C. That day, the highest temperatures were recorded in Doksany (28.7 °C) and Dobřichovice (28.6 °C) and temperatures above 20 °C were measured in the whole territory of the Czech Republic with the exception of the mountain regions. The months from April to June as a whole were normal in terms of temperature. In the period from 17th to 20th June, the first hot wave in 2013 was recorded, with the temperatures exceeding 30 °C on most of the Czech Republic's territory. The highest temperature (37.2 °C) was measured on 18th June at the meteorological station Prague-Karlov.

The weather was **very hot** in July and August 2013. With an average temperature of 19.4 °C, which is by 2.5 °C above the normal, July ranked among extraordinarily above-normal months. August with temperature 17.7 °C, which is by 1.3 °C above the 1961–1990 mean, was above-normal in terms of temperatures. Hot and dry weather during July has led to an increased incidence of fires. During these months there were two hot waves in the territory of the Czech Republic. The first on was in the period from 22nd to 30th July, the other one from 1st to 8th August. The highest maximum temperature was measured on 8th August in Brod nad Dyjí and the value was 39.7 °C. This is the highest absolute maximum temperature ever recorded in Moravia.

While September temperatures were below normal (average temperature 11.8 °C), the **temperatures at the end of the year were above normal**. A colder episode with snow precipitation occurred only at the beginning of December, when it was associated with transit of a significant pressure low called Xaver. In the second decade of December, however, it was warmer and the warm and dry weather continued not only till the end of December but also till the end of the whole 2013–2014 winter period.

In 2013, there have been in the average **41 summer days and 13 tropical days** in the Czech Republic, which are above-average values in both cases; the number of tropical days was more than a double in comparison with the normal (Chart 3). There were **121 frosty days and 43 icy days** recorded in 2013. These are also slightly above-average numbers of the respective days.

Concerning the **synoptic causes of worsened air quality** in 2013, the daily average PM_{10} concentrations above 50 $ug.m^{-3}$ occurred most frequently within the synoptic types Ea (Eastern anticyclone), Ec (Eastern cyclone) and SEc (South-eastern cyclone) during which there are inversion and worsened dispersion conditions. During the winter period, these weather types occurred most at the beginning of the year, namely in January, when the Ea situation lasted for 5 days (in total these situations lasted for 11 days), and in February (Ea for 2 days, in total for 12 days). In the period from October to December 2013, these synoptic situations occurred for 7 days in total, of which one Ea situation lasted for 5 days in October.

In terms of **precipitation, the year 2013 has been normal** on the territory of the Czech Republic; the average annual rainfall (727 mm) represents 108% of the long-term mean (1961–1990). Distribution of rainfall during the year has been uneven (Chart 4). January, May, June and September can be included in the wet to very wet months while rainfalls recorded in April, July and December have been below normal.

After above-normal precipitation in January, the precipitations in February and March were within the normal limits. April was dry; the rainfall amounted only to 26 mm, which is 55% of the 1961–1990 normal. In the course of May and June, however, the significantly above-average rainfall, when more than a third of the total annual precipitation (259 mm) fell during the two months, caused the flood situation. In May, the average rainfall on the Czech Republic's territory amounted to 113 mm, which represents 153% of the normal value. This is the fifth highest total rainfall for this month since 1961. The May rainfall resulted in considerable saturation of the territory, which increased the run-off response to the rainfall from the beginning of June.

June 2013 was **very wet** on the territory of the Czech Republic; the country's area average of 146 mm represents 174% of the long-term mean (1961–1990). This is the highest June value and the sixth highest monthly rainfall in comparison with the monthly rainfall totals for all months since 1961. The highest total precipitation in June was observed in a belt stretching from Šumava Mts. and Novohradské Mts., across Central Bohemian Upland (Středočeská pahorkatina) and the Elbe valley to the Giant Mts. (Krkonoše) and Jizera Mts. (Jizerské hory) and further to the Frýdlant and Šluknov regions. Most of the precipitation fell in the mountainous areas; e.g. at Luční bouda (Giant Mts.), the monthly rainfall amounted to 372.2 mm. During June, there were 3 important precipitation episodes, most striking being the first one from 1st to 2nd June, when the 24-hour totals exceeded 100 mm in some places and extremity of the culmination flows exceeded the 100-year repetition period in the most affected areas.

After June, which was rich in precipitation, dry and hot July followed – the rainfall amounted to 34 mm, which is 43% of the long-term normal. August precipitation as a whole was within the normal limits, the September rainfall was above-normal – it amounted to 74 mm, which is 142% of the respective normal. Normal precipitation then followed in October and November. December precipitation was **extraordinarily below normal** and with a total of 19 mm (40% of the respective 1961–1990 normal) it is the driest month of the year.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1801)

02/ Greenhouse gas emissions

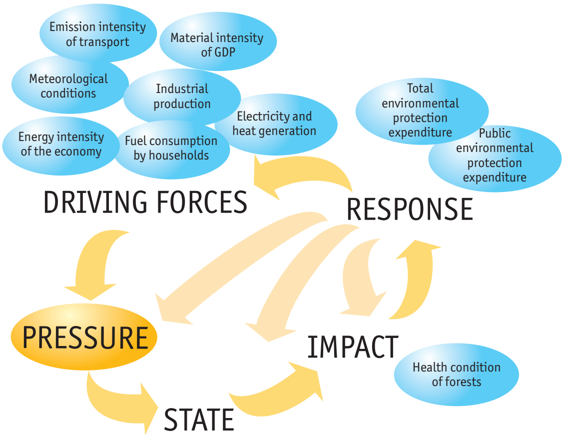
KEY QUESTION →

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

KEY MESSAGES →

🙂 The total emissions of greenhouse gases are decreasing in the Czech Republic; in 2012[1] they decreased by 2.8% and were lowest since 1990. There is a significant drop in emissions from fuel combustion in manufacturing industry and construction, and since 2007, a decline in emissions from transport has been recorded. In comparison with the year 1990, the emission intensity of the Czech Republic's economy is less than a half and it is constantly declining; however, it is still above the average level in the European context.

🙁 In the fuel and energy mix of the Czech Republic, there is dominance of fossil fuels, especially coal. That is why emissions from public electricity and heat production, which have the largest share in the total aggregate GHG emissions of the Czech Republic, do not decline but only vary according to electricity and heat generation in a given year. Greenhouse gas emissions from waste, specifically from landfilling of waste, are growing.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The Czech Republic is a signatory to the **UN Framework Convention on Climate Change** and the **Kyoto Protocol**. For the first control period (2008–2012), the Kyoto Protocol binds the Czech Republic to reduce greenhouse gas emissions by 8% compared to the base year 1990. In December 2012, a change in the Kyoto Protocol was concluded in Doha, which binds the EU to reduce aggregate emissions of greenhouse gases for the second control period (2013–2020) by 20% compared to the year 1990. At the end of 2013, the process to ratify the changes in the Kyoto Protocol was launched at the level of both the Czech Republic and the EU.

The EU's objectives in the areas of energy and climate change by 2020, and the tools to achieve them are specified in the set of legislation called "**climate-energy package**", approved in December 2008. There is a commitment resulting from the climate-energy package for the Czech Republic, i.e. to reduce emissions in the sectors falling within the EU ETS by 21% till 2020 compared to 2005, and in the sectors outside the EU ETS not to increase the emissions by more than 9% over the same period. In 2013, the European Commission published the Green Paper "**A 2030 framework for climate and energy policies**" on the basis of which negotiations on new objectives in the area of energy and climate change for the period up to 2030 were launched.

Reducing greenhouse gas emissions and the negative impacts of climate change is also one of the priorities of the currently valid **State Environmental Policy of the Czech Republic 2012–2020** and of other national strategic documents such as the **National Programme to Reduce the Impacts of Climate Change in the Czech Republic**.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The production of GHG emissions and climate change associated with it are among the biggest global environmental problems with considerable potential impacts on ecosystems and human civilization. Direct impacts of the GHG production on human health and ecosystems in the Czech Republic are minimal due to their low toxicity in atmospheric concentrations; the main impact lies in disruption of the climate system's balance. Climate change is beginning to show on the territory of the Czech Republic, for example in a form of more frequent heat waves, floods and droughts, whose impacts on human health and the national economy are significant.

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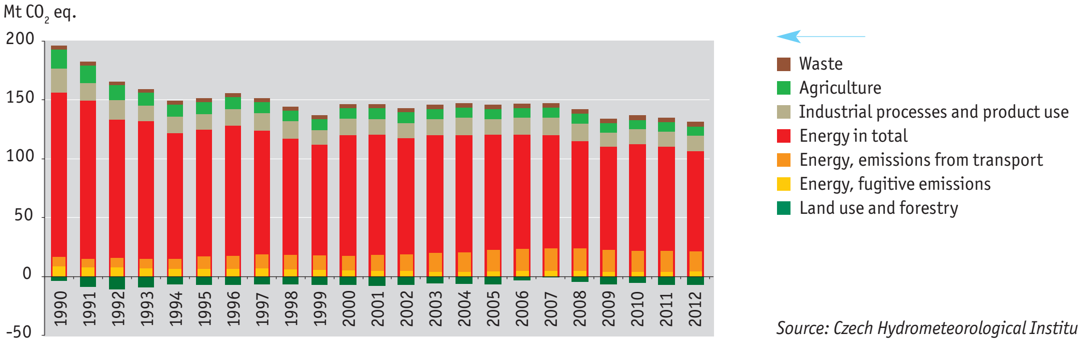
[1] *Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

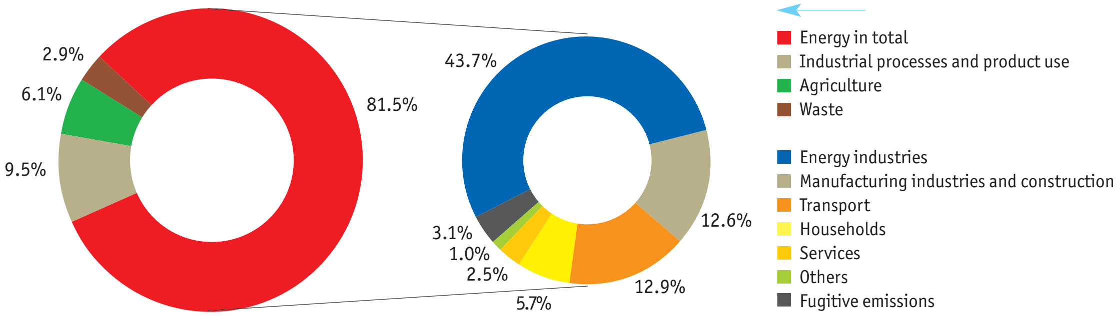
Chart 1 → **Development of aggregate greenhouse gas emissions by sectors in the Czech Republic [Mt CO_2 eq.], 1990–2012**



Source: Czech Hydrometeorological Institute

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

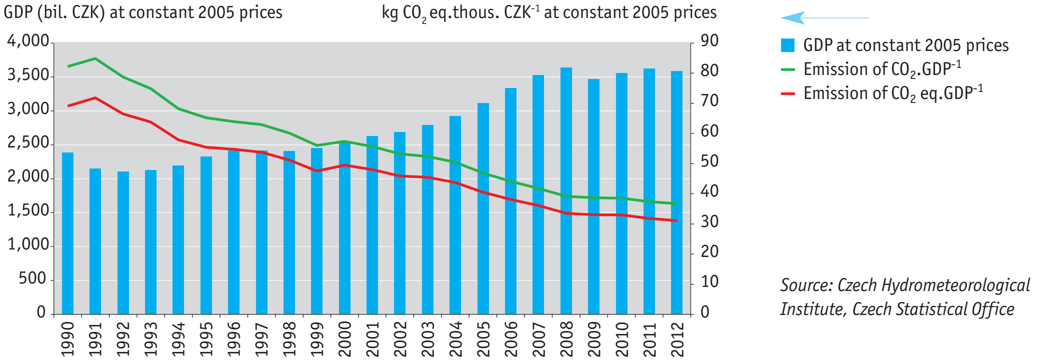
Chart 2 → **Structure of GHG emissions by major source categories, without LULUCF sector [%], 2012**



Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

Source: Czech Hydrometeorological Institute

Chart 3 → **Trends in the emission intensity of the Czech economy [kg CO_2 eq.thous. CZK^{-1} at constant 2005 prices] and GDP [bil. CZK at constant 2005 prices], 1990–2012 (excluding LULUCF)**



Source: Czech Hydrometeorological Institute, Czech Statistical Office

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

The total **aggregated greenhouse gases emissions** continue declining in the Czech Republic; in 2007–2012 they dropped by 10.7%, and in 2012 interannually by 2.8% (3.8 Mt CO_2 eq.) to 131.5 Mt CO_2 eq. (without LULUCF) and they were by 33.0% lower than in the reference year of the Kyoto Protocol, i.e. 1990 (Chart 1). If emissions and drops of the LULUCF sector are included in the calculation, the Czech Republic's emissions were lower by 35.5% in comparison with the reference year. In the **aggregated emissions' structure by the single greenhouse gases**, in 2012 the share of CO_2 was 84.5%, the share of CH_4 was 7.8% and that of N_2O amounted to 5.9%. The shares of the gases in the total emissions are relatively stable in time, only the share of F-gases is growing and in 2007–2012 it increased by about 1 percentage point to 1.7%.

In 2012, **emission of greenhouse gases from the energy sector** (CRF sector 1) comprised 81.5% of the total aggregate emissions, of which 96.2% were from the combustion of fuels. CO_2 emissions from coal combustion in stationary sources comprised 42.8% of the total emissions. Development of emissions from the **energy industry**, which occupies the largest share in the total emissions (43.7% in 2012, Chart 2), was influenced by the composition of the fuel-energy base of the Czech Republic, with a significant proportion of coal and still high, although slowly declining share of steam power plants in electricity generation (59.0% in 2012), where about 75% of the generated electricity comes from brown coal. The long-term trend in emissions from this sector was therefore stagnant in 1990–2012, being accompanied only by fluctuations related to variations in electricity and heat generation. In 2012, the emissions from the energy sector were lower by only 0.9% compared to the year 1990. In 2007–2012 they decreased by 10.6% (6.8 Mt CO_2 eq.) and the interannual decline (2011/2012) amounted to 1.7% (980 kt CO_2 eq.).

Emissions from **fuel combustion in manufacturing industries and construction** have been decreasing constantly; in 2012, they declined by a significant amount – 11.8% (2.2 Mt CO_2 eq.) and they contributed substantially to the overall decline in the aggregate emissions during that year. Since 1990, emissions from this sector decreased by 64.5%, in the period 2007–2012 by 11.1%. The positive development of emissions was influenced by gradual reduction in energy intensity of industrial processes, by restructuring in the industrial sectors and also by technological development. Decline in industrial production by 1.2% manifested itself in 2012; this was particularly significant in the sector of basic metals manufacture. **Emissions from transport** were growing significantly in the period 1990–2007 but the trend reversed and the emissions decreased by 12.1% in 2007–2012. Declining energy consumption was reflected in development of the emissions, especially in relation to individual car transport. However, the emissions from transport were by 118% higher in 2012 than in 1990. After a sharp drop in early 1990s, **emissions from heating of households and commercial buildings** vary depending on temperature conditions of the heating seasons. In 2007–2012, emissions from this sector were stagnating (decrease by 0.1%) and in 2012 they grew interannually by 3.5% (0.4 Mt CO_2 eq.) due to lower temperatures in the winter.

Emissions from industrial processes also decreased substantially in 1990s; after 2000, they have been varying according to development of the industrial production. In 2012, emissions from this sector decreased interannually by 3.2% (0.4 Mt CO_2 eq.) and by 17.4% in the period 2007–2012. F-gases comprise a significant proportion of emissions from industrial processes (18%); their production increased interannually by 8.1% in 2012 and since 2007, emissions of F-gases from industrial processes almost doubled (increase by 78%).

Emissions from agriculture have been declining gradually; in 2012 they were roughly at half the level of the year 1990. Agriculture is the biggest source of N_2O emission and the second biggest source of CH_4 emission. On the other hand, **emissions from waste** are growing (their proportion in the total emissions being 2.9%); in 2012 they were by 33.4% higher than in 1990. This trend has caused especially the growth of emissions from landfilling which amounted to 66.6% in 1990–2012. Over the past 5 years, the emissions from landfilling increased by 14.9%, even though there is a decrease of the amount of landfilled waste.[2] In the **LULUCF sector**, carbon storage in biomass prevailed over the emissions throughout the period 1990–2012 and in 2012 the emission's removals amounted to – 7.3 Mt CO_2 eq. and it increased by 3.4% in comparison with the previous year.

The **CO_2 emissions from installations involved in the emission trading system** (EU ETS) declined interannually by 6.6% in 2012 (4.9 Mt of CO_2) and they comprised 62.3% of the total CO_2 emissions recorded in the national inventory (without LULUCF). In 2013, the decline of emissions in the EU ETS continued in a slower pace, i.e. by 2.3% (1.6 Mt CO_2); in the period 2005–2013, emissions in the EU ETS decreased by 17.9%. Therefore the Czech Republic is successfully directed at fulfilment of the objectives of the climate-energy package. Development of the emissions in the EU ETS shows that major stationary combustion sources, from which 87.7% of the EU ETS emission originated in 2013, are the main driving force behind the decline in the total GHG emissions after 2005.

The **emission intensity of the Czech Republic's economy** has been declining considerably, however, it is still higher than the average of the EU28. The specific emissions per unit of GDP decreased in 1990–2012 to less than a half (by 55.4%); since 2007 by 12.2% and in 2012 interannually by 1.8% to 36.7 kg CO_2 eq.thous.CZK^{-1} at constant 2005 prices (Chart 3).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1800)

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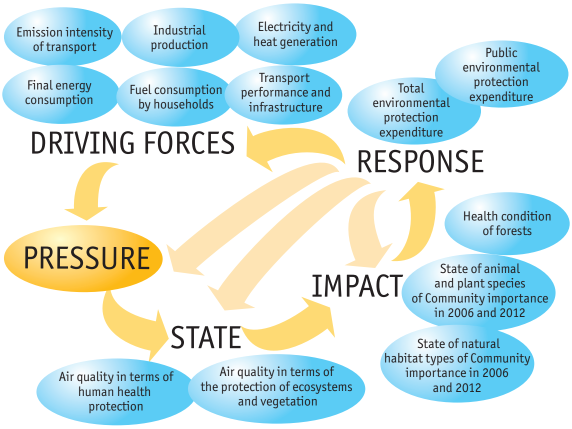
[2] *The cause consists in the methodology used to calculate the emission, i.e. First Order Decay Model (FOD), which is based on a dynamic estimation by means of data about landfilling in the previous years. The methodology presumes gradual decay of waste stored in landfills and it calculates apportionments to the annual emission of methane based on decay of the waste's single components in the given years and the composition of landfilled waste influences the amount of emission (different emission factors and proportion of degradable carbon).*

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) have been declining steadily since 1990. Since 1990, the total quantity of emissions of acidifying substances decreased by 84.8%, in 2012/2013 interannual comparison, an overall decrease of these emissions by 6.7% has been recorded.

In the 2013 total amount of acidifying substances, emissions of SO_2 comprised 36.1%, NO_x emissions 32.2% and the NH_3 emissions amounted to 31.7%.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The requirement to reduce emissions of acidifying substances is addressed by the **National Emission Reduction Programme of the Czech Republic**. The **Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)** has established for the year 2010 national emission ceilings, which are based on the relevant protocols of the **Convention on Long-Range Transboundary Air Pollution (CLRTAP)** and are determined for SO_2 (emission ceiling – 265 kt per year, i.e. 8.28 kt per year weighed by the acidifying equivalent), NO_x (286 kt per year, i.e. 6.22 kt per year weighed by the acidifying equivalent) and NH_3 (80 kt per year, i.e. 4.71 kt per year weighed by the acidifying equivalent)[1]. In 2012, the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)** was revised which sets new emission ceilings for the year 2020. The emission ceilings are set as a percentage reduction in emissions compared to the state in 2005; for SO_2 the emission reduction is set for 45%, for NO_x it is 35% and for NH_3 it is 7%. The Czech Republic's international obligations have been incorporated into the **State Environmental Policy of the Czech Republic** (2012–2020). Within the thematic area Climate Protection and Air Quality Improvement it aims at meeting the national emission ceilings and reducing the total emissions of SO_2 and NO_x by 2020. Requirements to reduce emissions of acidifying substances are also included in the document called The **Potential to Reduce Emissions of Pollutants in the Czech Republic by the Year 2020** which quantifies the reduction of pollutant emissions that the Czech Republic is able to achieve by 2020 if it takes the measures following from the valid national and European legislation, without implementation of additional measures being necessary.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Short-term exposure to acidifying substances may irritate the respiratory system which may limit its functions and reduce the organism's resistance to infectious diseases. Exposure to acidifying substances worsens the problems of persons suffering from asthma (bronchoconstriction) and allergies (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 allergy, children, the elderly, etc.).

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

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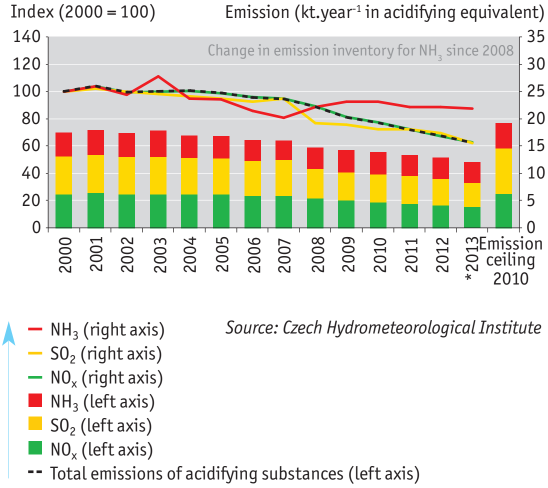
[1] *The above data concerning emissions, presented both in the charts and the texts, are expressed using the acidifying equivalent. The acidifying equivalent factors are as follows for the below substances: for NO_x = 0.02174; for SO_2 = 0.03125 and for NH_3 = 0.05882. Total emissions equal to the sum of total annual emissions of the individual substances expressed in tonnes and multiplied by their respective acidifying equivalent factors.*

INDICATOR ASSESSMENT

Chart 1 ➔ **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], 2000–2013**



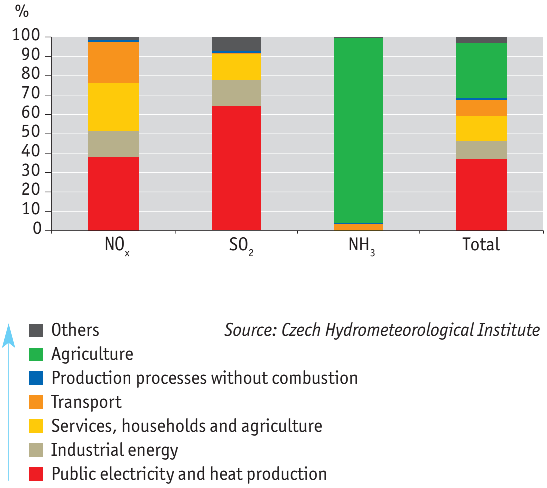
Source: Czech Hydrometeorological Institute

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

For the years 2000 to 2013, correction of the emission inventory was carried out which included updated calculation of emissions from household heating (structure of boilers and emission factors), and road transport (according to data from the Central Register of Vehicles).

** Preliminary data*

Chart 2 ➔ **Sources of emissions of acidifying substances in the Czech Republic [%], 2012**



Source: Czech Hydrometeorological Institute

Emissions of NH_3 come from livestock breeding and use of mineral nitrogen fertilisers.

Emissions in the sector of services, households and agriculture come from mobile and stationary combustion sources and also from the sector of household heating.

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

In long terms **1990–2013, emissions of acidifying substances** (SO_2, NO_x and NH_3)[2] have been decreasing, namely by a total of 84.8%, from 79.0 to 12.0 kt. year^{-1} in acidifying equivalent. The rate of the decline, however, has slowed down significantly since 2000. In 1990–2013, the biggest drop in SO_2 emissions was recorded, namely by 92.5% to 4.3 kt.year^{-1} in acidifying equivalent. The NO_x emissions decreased by 67.7% to 3.9 kt. year^{-1} in acidifying equivalent. The smallest decline was recorded for the NH_3 emissions, by 58.6% to 3.8 kt. year^{-1} in acidifying equivalent.

Between the years **2000–2013**, the emissions of acidifying substances decreased by 31.3%; the greatest decline has been recorded for NO_x emissions (by 37.3%), SO_2 emissions decreased by 37.7% and that of NH_3 by 12.7% (Chart 1). Within this period, the most significant interannual decline occurred between the years 2007 and 2008, namely by 7.8%, which was caused by recession of the national economy as a result of economic crisis.

In the **interannual 2012/2013 comparison**, it is possible to track a decline in the emissions of acidifying substances by 6.7%. The decrease was mainly caused by reduction of SO_2 emissions, namely by 10.6%. Interannually, emissions of NO_x decreased by 6.9% and the NH_3 emissions dropped by 1.8%.

Emissions of SO_2 has been declining constantly, which is mainly caused by changes in the sectoral structure of the Czech Republic's economy, desulphurisation of coal-fired power stations in 1990s, the use of fuels with a lower sulphur content and by reducing the energy intensity of the economy, which is also a result of introducing BAT technologies. The decrease in NO_x emissions was caused especially by declining consumption of solid fuels in electricity generation and household heating. The decline of the total NO_x emissions is closely related to the decrease of these emissions from the transport sector, and this change can be attributed to renewal of the car fleet, fulfilment of EURO emission standards, introduction of modern technologies in the transport sector and also to improved traffic fluency.

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[2] *In the period 2000–2013, there were corrections in the emission inventory due to adjustment of the emission factors.*

In the Czech Republic, the **main sources of emissions of acidifying substances** (Chart 2), based on the **2012 data**, include the sector of public electricity and heat production (37.0%, i.e. 4.7 kt.year^{-1} in acidifying equivalent), agriculture (28.4%, i.e. 3.6 kt.year^{-1} in acidifying equivalent), combustion processes in the sector of services, households and agriculture (13.1%, i.e. 1.7 kt.year^{-1} in acidifying equivalent), the industrial energy sector (9.6%, i.e. 1.2 kt.year^{-1} in acidifying equivalent) and the transport sector (8.0%, i.e. 1.0 kt.year^{-1} in acidifying equivalent). In comparison with the previous years, there was no significant change in the sources structure.

According to the uniform structure of reporting within NFR, there was a significant decrease in emissions from the sector of public electricity and heat production, that of industrial production and in the transport sector between the years 2007–2012. Although electricity and heat production had a rather varying character in the period concerned, a significant decrease in emissions of acidifying substances is related to a more economical use of heat energy and to efforts to reduce heat consumption both in the industrial and public sectors. The energy intensity in industry has also been decreasing. The decline in emissions of acidifying substances in the transport sector is related to introduction of modern emission removal technologies, such as three-way catalytic converters and systems of catalytic reduction (SCR), and also to the reduction of energy consumption in the transport sector. The key producers of NO_x and SO_2 emissions are combustion processes in the sector of services, households and agriculture, particularly household heating, which can only be regulated through municipal regulations and subsidies to support replacement of the existing hand-filled boilers for solid fuels with new automatic low-emission ones. The amount of emissions produced in this sector, however, greatly depends on temperature conditions in the heating season in the given years.

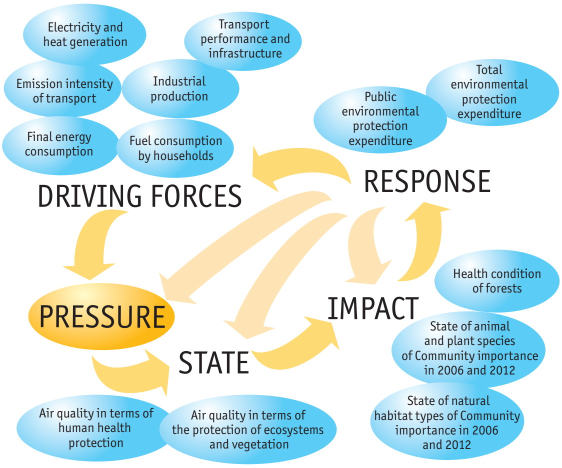
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1831)

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 67.6% in 1990–2013. Between the years 2012 and 2013, emissions of ground-level ozone precursors declined by 4.8%. In 2013, NO_x emissions accounted for 52.9% of the ground-level ozone precursor emissions, VOC emissions for 31.4%, CO emissions for 14.0% and emissions of CH_4 for 1.7%.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The requirement to reduce emissions of ozone precursors is addressed by the **National Emission Reduction Programme of the Czech Republic**. The **Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)** has established for the year 2010 national emission ceilings which are based on the relevant **protocols to the Convention on Long-Range Transboundary Air Pollution (CLRTAP)**. The emission ceilings are determined for emissions of ozone precursors as follows: NO_x: 286 $kt.year^{-1}$, i.e. 349 $kt.year^{-1}$ in TOFP[1] and VOC: 220 $kt.year^{-1}$, i.e. 220 $kt.year^{-1}$ in TOFP. In 2012, the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)** was revised which sets new emission ceilings for the year 2020. The emission ceilings are set as a percentage reduction in emissions compared to the state in 2005; for VOCs the emission reduction is set for 18%, for NO_x it is 35%. The Czech Republic's international obligations have been incorporated into the **State Environmental Policy of the Czech Republic (2012–2020)**. The thematic area Climate Protection and Air Quality Improvement aims at meeting the national emission ceilings and reducing the total emissions of NO_x and VOC by 2020. Achievability of the emission ceilings is also included in the **Potential to Reduce Emissions of Pollutants in the Czech Republic by 2020** which quantifies the reduction of ozone precursors emissions that the Czech Republic is able to achieve by 2020 if it takes the measures following from the valid national and European legislation, without implementation of additional measures being necessary.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The existence of ozone in the atmosphere is of fundamental importance for living organisms. While stratospheric ozone protects the Earth's surface and living organisms against the negative influence of ultraviolet solar radiation, tropospheric ozone, resulting from chemical reactions of so-called ground-level ozone precursors with participation of solar radiation, is considered, together with its precursors, an important pollutant. Exposure to increased concentrations of ground-level ozone can cause breathing difficulties and it increases cardiovascular and respiratory problems. Emissions of ground-level ozone precursors can cause nervous system disorders, liver and kidney damage and they prevent oxygenation of the blood. Emissions of ozone precursors and ground-level ozone in general reduce immunity of the organism. Ground-level ozone also disrupts artificial materials, surfaces of buildings and art works and therefore causes damage to property.

Ground-level ozone is a powerful oxidizing agent that harms the assimilation organs of plants. It has therefore a negative impact on all types of vegetation, including forest stands and agricultural crops. As a result of ground-level ozone's effects, vegetation is less resistant to biotic and abiotic factors such as insect pests and climatic fluctuations.

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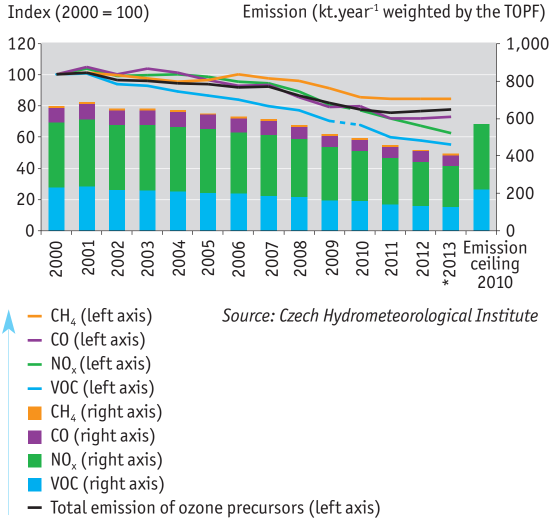
[1] *All data on emissions presented in the charts and texts are based on emission values expressed as so-called tropospheric ozone formation potential (TOFP). The tropospheric ozone formation potential factors are as follows for the substances below: VOC = 1; NO_x = 1.22; CO = 0.11 and CH_4 = 0.014.*

INDICATOR ASSESSMENT

Chart 1 → **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} weighted by the TOFP], 2000–2013**

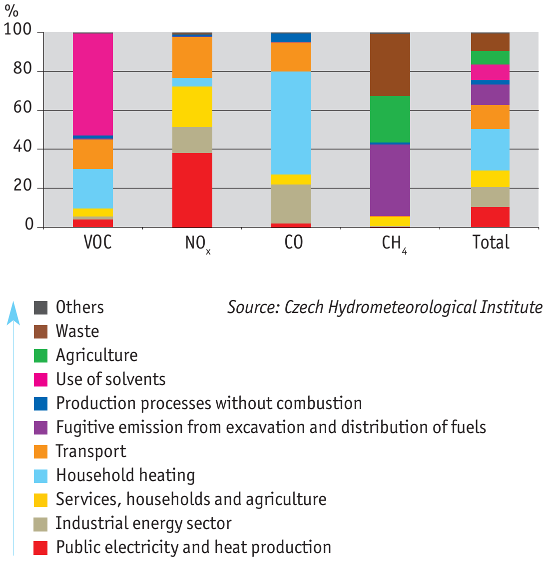


Source: Czech Hydrometeorological Institute

For the years 2000 to 2013, correction of the emission inventory was carried out which included updated calculation of emissions from household heating (structure of boilers and emission factors), and road transport (according to data from the Central Register of Vehicles).

** Preliminary data*

Chart 2 → **Sources of ozone precursors emissions in the Czech Republic [%], 2012**



Source: Czech Hydrometeorological Institute

CH_4 emissions come from manure manipulation and enteric fermentation.

Emissions in the sector of services, households and agriculture come from stationary and mobile combustion sources.

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

Emissions of ozone precursors[2] between the years **1990 and 2013**[3] fell by 67.6%, from 1,265.8 to 409.9 kt.year^{-1} in TOFP. The most important decreases occurred between 1990 and 2000; after the year 2000, the decline of ground-level ozone precursor emissions began to slow down. In the period 1990–2013, the biggest decline was recorded for VOC emissions, namely by 70.8 % to 128.8 kt.year^{-1} in TOFP, followed by a decline of NO_x emissions by 67.7% (to 216.9 kt.year^{-1} in TOFP); CO emissions decreased by 59.1% (to 57.4 kt.year^{-1} in TOPF). The least significant decline was recorded for the emissions of CH_4 (by 44.4%, to 6.9 kt.year^{-1} in TOFP).

In **2000–2013**, there was a decline in the emissions of ground-level ozone precursors by 38.5% (Chart 1). Within this period, the most significant decrease in the emissions of ground-level ozone precursors occurred between 2008 and 2013. In the reference period, VOC emissions, NO_x emissions and CO emissions decreased most, namely by 44.9% and 37.3% and 27.1% respectively; the amount of CH_4 emission declined by 15.3%.

In the **2012/2013 interannual comparison**, an overall decrease of ground-level ozone precursor emissions by 4.8% has been recorded. NO_x emissions, which declined by 6.9%, contributed most to the interannual decrease in ozone precursor emissions. A significant interannual decrease was also recorded for VOC emissions (by 4.2%).

The long-term decline in NO_x emissions is connected with a change in the sectoral structure of the Czech Republic's economy and a change in the energy mix as well as with a decrease of emissions from transport, introduction of BAT and reduction of the energy intensity of the economy. Reduction in the consumption and production of paints, adhesives and coatings contributes to the decrease

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[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. Adverse effects on human health and vegetation have been proved for the ground-level ozone. NO_x (52.9%) and VOC (31.4%) take the biggest parts in the ground-level ozone precursors emissions. CO accounts for 14.0% and CH_4 for 1.7%.*

[3] *In the period 2000–2013, there were corrections in the emission inventory due to adjustment of the emission factors.*

in VOC emissions. The CO emissions are declining due to the introduction of BAT technologies in the industrial energy sector; decline in these emissions from transport was influenced by increasing efficiency of internal combustion engines and an increase of energy transformation efficiency and also by the use of catalytic converters. Emissions of CH_4 are decreasing as a result of changes in the waste management structure.

On the basis of 2012 data, the **main sources of ozone precursors emissions**[4] in the Czech Republic are: the sectors of household heating (21.2%, i.e. 374.4 $kt.year^{-1}$ in TOPF), transport (12.3%, i.e. 216.6 $kt.year^{-1}$ in TOPF), fugitive emissions from excavation and distribution of fuels (10.6%, i.e. 186.7 $kt.year^{-1}$ in TOPF) and public electricity and heat production (10.5%, i.e. 185.2 $kt.year^{-1}$ in TOFP).

According to the uniform structure of reporting within NFR, there was a significant decrease in emissions from the sector of transport in 2007–2012 and the improvement concerned particularly CO and VOC emissions, the reduction of which is closely linked to renewal of the fleet and to introduction of modern technologies in end devices. There was also a reduction of ozone precursors emissions in the sector of industrial energy where a significant decrease of CO emissions from combustion processes in iron and steel production was recorded. On the other hand, production of emissions from the sector of manufacturing processes without combustion grew in the period concerned; production of CO emissions from iron and steel production in Třinec and Ostrava and also from the production of cement took the greatest parts in the growth. However, household heating, which depends on local meteorological conditions, remains the most important source of VOCs and CO. The amount of emissions depends on quality of the boilers and fuels that are used.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1832)

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[4] *Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.*

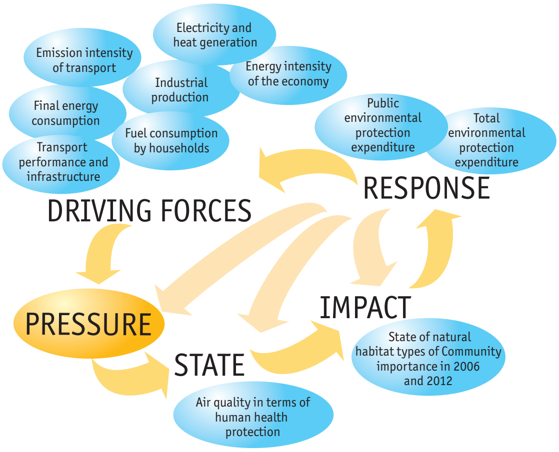
05/ Emissions of primary particulate matter and secondary particulate matter precursors

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 1990–2013, there was a reduction of the emissions of secondary particulate matter precursors by 82.8%; between the years 2000 and 2013, these emissions decreased by 34.6%. Emissions of primary particulate matter of the fraction PM_{10} dropped interannually by 4.1% in 2012.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The **National Emission Reduction Programme of the Czech Republic** deals with the requirement to reduce emissions of primary particulate matter PM_{10} (emitted directly from a source) and secondary particulate matter precursors (SO_2, NO_x, NH_3). The **Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)** has established for the year 2010 national emission ceilings which are based on the relevant **protocols to the Convention on Long-Range Transboundary Air Pollution (CLRTAP)**. The ceilings are determined as follows: SO_2 – 265 kt per year (143 kt per year weighted by the particulate matter formation potential), NO_x – 286 kt per year (252 kt per year weighted by the particulate matter formation potential) and NH_3 – 80 kt per year (51 kt per year weighted by the particulate matter formation potential)[2]. In 2012, the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)** was revised which sets new emission ceilings for the year 2020. The emission ceilings are set as a percentage reduction in emissions compared to the state in 2005; for SO_2 the emission reduction is set for 45%, for NO_x it is 35% and for NH_3 it is 7%. The Czech Republic's international obligations have been incorporated into the **State Environmental Policy of the Czech Republic (2012–2020)**. Within the thematic area Climate Protection and Air Quality Improvement, it aims at meeting the national emission ceilings and reducing the total emissions of secondary particulate matter precursors SO_2 and NO_x as well as $PM_{2.5}$ by 2020. Achievability of the emission ceilings is also included in the **Potential to Reduce Emissions of Pollutants in the Czech Republic by 2020** which quantifies the reduction of pollutants emissions that the Czech Republic is able to achieve by 2020 if it takes the measures following from the valid national and European legislation, without implementation of additional measures being necessary.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Suspended particles represent a mixture of organic and inorganic matter of different size, composition and origin. The associated health risks depend on these properties. Suspended particulates penetrate, depending on their size, 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. The vulnerable group includes children, the elderly and persons with chronic diseases of the respiratory and vascular systems. PAH or heavy metals, which have mutagenic and carcinogenic effects, can be bound to suspended particles.

Suspended particulate matter also affects ecosystems. It causes mechanical dusting which reduces the plants' active area, thereby decreasing photosynthesis, and it also enters the animals' respiratory tract. Ecosystems can be influenced by toxic effects of the substances which are bound to particulate matter. Solid particles also affect the Earth's energy balance because they scatter 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.

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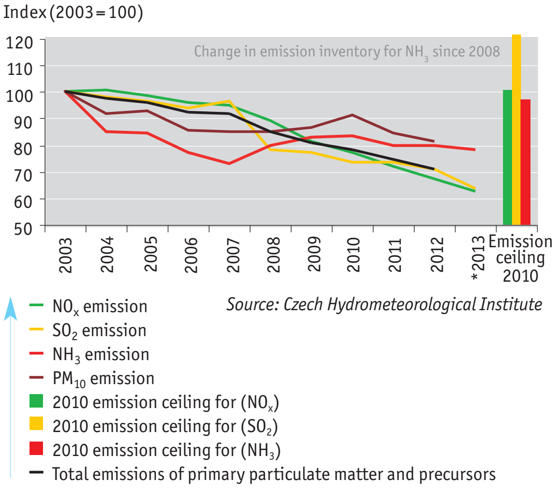
[1] *Primary particulate matter PM_{10} represents particles emitted directly from a source, namely both from natural sources (e.g. volcanic activity) and anthropogenic sources (e.g. burning fossil fuels, abrasion of tyres). Precursors of secondary particulate matter are pollutants of anthropogenic origin,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

[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], 2003–2013**



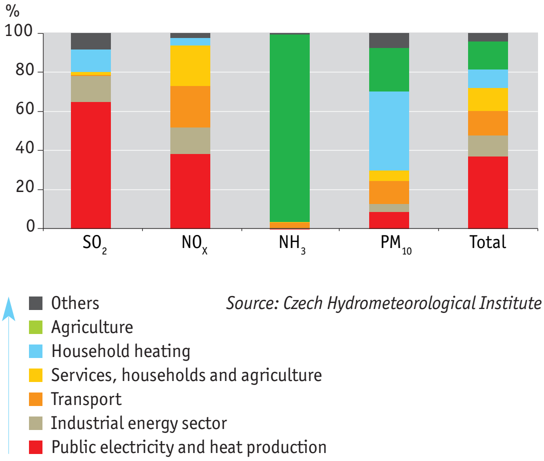
Source: Czech Hydrometeorological Institute

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

For the years 2003 to 2013, correction of the emission inventory was carried out which included updated calculation of emissions from household heating (structure of boilers and emission factors), and road transport (according to data from the Central Register of Vehicles).

** Preliminary data*

Chart 2 → **Emission sources of primary particulate matter and secondary particulate matter precursors in the Czech Republic [%], 2012**



Source: Czech Hydrometeorological Institute

Emissions of PM_{10} come from livestock breeding and field work. Emissions of NH_3 come from livestock breeding and use of mineral nitrogen fertilisers.

Emissions in the sector of services, households and agriculture come from stationary and mobile combustion sources.

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

In **1990–2013**[3] there was a reduction in emissions of secondary particulate matter precursors (NO_x, SO_2 and NH_3) by 82.8% from 1,583.7 to 272.6 $kt.year^{-1}$ in particulate matter formation potential. In this period, the biggest decline was recorded for the emissions of SO_2 (by 92.5%), NO_x emissions decreased by 67.7% and NH_3 emissions by 58.6%. The greatest decline in emissions of secondary particulate matter precursors had been recorded till the year 2000.

In **2000–2013**, the emissions of precursors of secondary particles declined by 34.6%, while the greatest decrease was recorded for NO_x emissions (by 37.3%); the SO_2 emissions dropped by 37.7% and those of NH_3 by 12.7% (Chart 1). Within this period, the most significant interannual decline occurred between the years 2008 and 2013; it was caused by recession of the national economy as a result of the economic crisis.

Within the **interannual 2012–2013 comparison**, a decline in emissions of secondary particulate matter precursors by 7.2% was found out. The SO_2 emissions, which decreased by 10.6%, and the NO_x emissions, which decreased by 6.9%, contributed most to the interannual decrease. Emissions of primary PM_{10} decreased by 4.1% interannually in 2011 and 2012.

In case of SO_2, the decline in emissions of secondary particulate matter precursors results particularly from a change in the sectoral structure of the Czech Republic's national economy, desulphurisation of coal-fired power stations in 1990s and also from the use of fuels with a lower sulphur content. The decline in SO_2 and NO_x emissions is related to reduced energy intensity of industrial production and to BAT introduction. There is a close link between reduction of NO_x emissions and modernisation of the vehicle fleet. The decline in NO_x and SO_2 emissions is also a consequence of changes in the energy mix in recent years. Likewise precursors, the reduction of PM_{10} emissions is also connected with introduction of BATs in combustion plants. Industrial production associated with construction works (e.g. cement) is reflected in the amount of emissions, too.

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[3] *In the period 2003–2013, there were corrections in the emission inventory due to adjustment of the emission factors.*

In the Czech Republic, the **main sources of emissions of primary particulate matter and secondary particulate matter precursors** (Chart 2) on the basis of the 2012 data include public electricity and heat production (37.1%, i.e. 121.3 kt.year^{-1} in particulate matter formation potential) and the sector of agriculture (14.4%, i.e. 47.1 kt.year^{-1} in particulate matter formation potential). Within this sector, emissions of PM_{10} come from livestock breeding and field work, and emissions of NH_3 precursors, in addition to livestock breeding, also come from application of mineral fertilisers. In the total amount of emissions, transport comprises 12.6%, i.e. 47.0 kt. year^{-1} in particulate matter formation potential, and while emissions of secondary particles precursors arise from combustion processes, those of PM_{10} come mainly from re-suspension, i.e. dust stirred up by road transport and tires abrasion. Household heating is an important source of PM_{10} emission (9.4%, i.e. 30.8 kt.year^{-1}). Weather conditions and quality of the burnt material have a vital impact on household heating, and thus on the production of emissions from these sources.

According to the uniform structure of reporting within NFR, there was a significant decrease in emissions from the sector of public electricity and heat production and that of industrial energy between the years 2007–2012. In spite of the fact that development of electricity and heat production was varying in the period concerned, there is a slow decline in electricity and heat production from coal-fired power plants. Thus the total amount of produced heat declines as well as energy intensity of industrial production. The construction production, which is a significant source of emissions of suspended particles, also decreased in the reference period. In these years, emissions of primary particulate matter and secondary particulate matter precursors from the transport sector dropped, too. The decline in emissions is related to improvement of combustion processes using modern technologies; emissions of primary particles are reduced also by means of solid particles filters. A significant proportion of the pollution of suspended matter, however, consists of a contribution from abrasion of tires and brakes and abrasion of the roads.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1834)

06/ Air quality in terms of human health protection

KEY QUESTION →

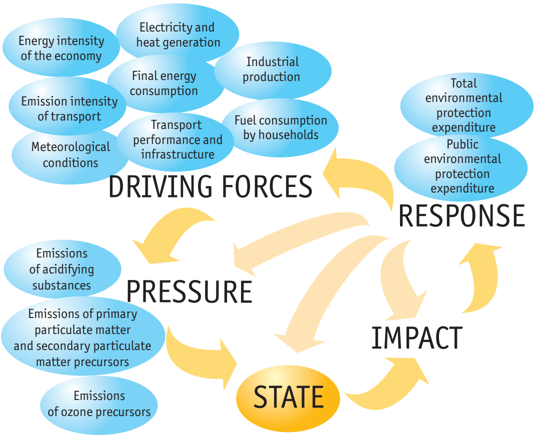
Are the limit values that have been set for air pollutants in order to protect human health being met?

KEY MESSAGES →

☺ The limit values for nickel, lead and benzene were not exceeded in 2013 at any of the monitored sites. The limit values for sulphur dioxide and carbon monoxide have not been exceeded either in 2013.

😐 According to model calculations by the State Health Institute, the estimations of premature death rate in 2006–2013 (to which exposure to PM_{10} also contributed) within the whole of the Czech Republic and estimations of individual lifelong risk of cancer due to exposure to As, Ni, BaP and benzene in urban localities in the Czech Republic for the years 2010–2013 are at a comparable level.

☹ Despite continuing decline in emissions since 2000, the air quality in the Czech Republic's territory is not improving; the Moravian-Silesian region still belongs to the most polluted areas. Limit values for suspended particulates, benzo(a)pyrene and ground-level ozone have been exceeded repeatedly. In locations with high traffic load, the limit value for NO_2 was exceeded, too. The limit values for arsenic and cadmium were also exceeded in 2013. Compared to the year 2012, there was an increase in the number of declared smog situations due to high concentrations of PM_{10} and ground-level ozone in 2013.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

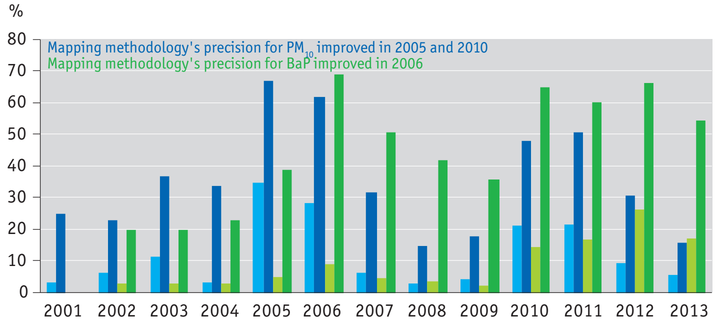
Air quality improvement in places where air pollution levels are exceeded, and, at the same time, maintaining of the present quality in places where the air pollution limits are not exceeded are among the primary objectives of the **State Environmental Policy of the Czech Republic (2012–2020)**. In its **Act No. 201/2012 Coll., on air protection**, the Czech Republic's national legislation fully adopted the 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**. The upper and lower limits for the assessment of pollution levels in terms of health protection are laid down in the **Decree No 330/2012 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.** The long-term programme to improve the Czech population's health conditions called "**Health for All in 21st Century**", approved by a Government Resolution in 2002, imposes in its goal No. 10 "to reduce the population's exposure to health risks associated with the pollution of water, air and soil" and "to systematically monitor and evaluate air quality indicators and health indicators". Implementation of the programme shall be monitored at yearly intervals. In 2010, a declaration to improve living conditions for sensitive population groups, to reduce burden concerning non-infectious environment-related diseases and to reduce exposure to bio-accumulative substances, hormone-active agents and nano-particles was approved at **5th WHO/Europe Ministerial Conference on Health and the Environment** in Parma.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

In long terms, the most important pollutants in relation to human health include suspended particulate matter ($PM_{2.5}$ and PM_{10}), including ultra-fine particulates. PAH, 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, transport and processes associated with it (re-suspension, abrasion of tires, corrosion), and coke and iron production technologies. Exposure to a mixture of aerosol particulates corresponds to the extent of air pollution and the population's life-style, and it seriousness depends on the size, shape and chemical composition of the particulates. Despite provable negative impacts of suspended particulates on human health, no threshold concentration has been determined yet. The effects of short-term increased daily concentrations of suspended particles PM_{10} include the rise of general sickness and death rates, especially in relation to heart and blood vessels diseases, diseases of the respiratory system, an increase of infant mortality and worsened problems of asthmatics. Moreover, carcinogenic effects have been proven for benzo(a)pyrene. Ground-level ozone is another substance that has negative impacts on human health and ecosystems. Primarily, it damages and irritates the respiratory system. 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 it worsens 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 [%], 2001–2013**

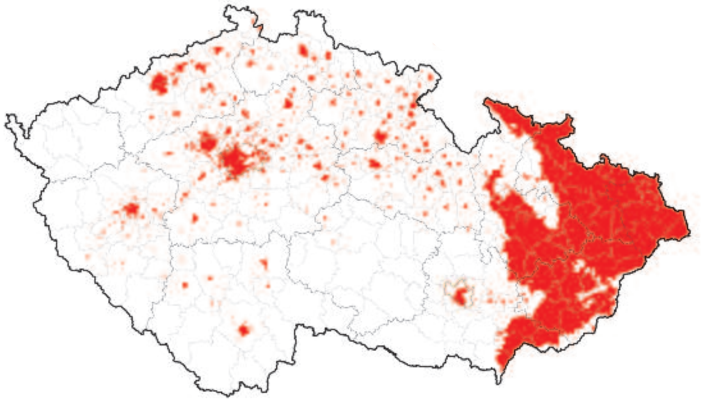


Source: Czech Hydrometeorological Institute

In 2005, the mapping methodology's precision was improved and, for the first time, a model that combined the SYMOS model, the European EMEP model and altitude data with concentrations measured at rural background stations was used to construct maps of PM_{10} concentration fields. In 2009, the methodology was redefined again by applying the CAMx model. The SYMOS model includes emissions from primary sources. Secondary particulate matter and re-suspended particulate matter that are not included in emissions from primary sources are taken into account within the EMEP and CAMx models.

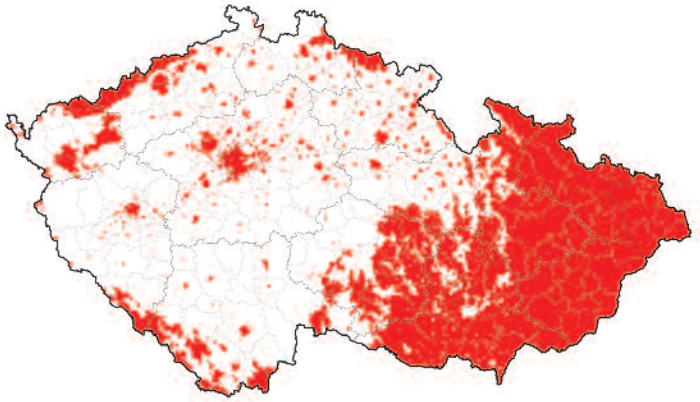
Between 2002 and 2007, the benzo(a)pyrene mapping methodology was gradually refined. In addition to an increase of the number of monitoring stations, the mapping methodology's precision was improved in 2006. In 2006, a number of towns and villages were subsequently included among those areas where the BaP target value was exceeded.

Figure 1 ➜ **Areas within the Czech Republic where health protection limit values were exceeded (excluding ground-level ozone), 2013**



Source: Czech Hydrometeorological Institute

Figure 2 ➜ **Areas within the Czech Republic where health protection limit values were exceeded, 2013**



Source: Czech Hydrometeorological Institute

Table 1 ➜ **The total annual mortality increased by "premature death" [the number of premature deaths] – the span and mean urban value for the Czech Republic, 2006–2013**

	2006	2007	2008	2009	2010	2011	2012	2013
PM_{10} (50% representation of the $PM_{2.5}$ fraction)	0–12,418 (4,352)	0–12,446 (2,452)	0–8,310 (2,128)	0–9,730 (2,332)	0–16,252 (2,991)	0–9,580 (2,796)	0–10,546 (1,792)	**0–8,980** **(1,605)**
PM_{10} (75% representation of the $PM_{2.5}$ fraction)	0–18,627 (6,528)	0–18,669 (3,678)	0–12,465 (3,192)	0–14,595 (3,498)	0–24,378 (4,487)	0–16,050 (6,934)	0–17,198 (5,480)	**0–15,206** **(5,253)**

Source: State Health Institute

The mean urban value for the Czech Republic (in parenthesis) was calculated for urban locations not exposed to extensive transport and industry. Accuracy of the estimation is in the order of 10^2.

The total mortality increase was calculated from the span of values measured in the Czech Republic and from mean values for the Czech Republic, for the annual average PM_{10} values $\leq 20\ \mu g.m^{-3}$ (or $PM_{10} \leq 13.3\ \mu g.m^{-3}$ for 75% representation of the $PM_{2.5}$ fraction) 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 conversion of the PM_{10} effects; they suppose the mean representation of $PM_{2.5}$ fraction in the PM_{10} fraction to be 50% and the estimated mean value of representation of $PM_{2.5}$ fraction in the PM_{10} fraction for the Czech Republic to be 75%.

Table 2 ➜ **Range of values of carcinogenic population risk for evaluated types of sites (As, Ni, BaP and benzene were assessed) in cities over 5,000 people (approximately 5 mil. inhabitants of the Czech Republic, number of cases per 10,000 inhabitants), 2009–2013**

Carcinogenic substances	2009		2010		2011		2012		2013		2006–2013	
Number of additional cases according to the type of burden and site	min	max	min	max	min	max	min	max	min	max	min	max
Cities (over 5,000 to 5 mil. inhab.)	4.3	60.7	3.5	48.6	3.6	48.8	3.7	70.5	**4.4**	**61.1**	3.2	78.4
Sites without traffic burden	4.5	10.3	4.4	12.8	3.7	12.1	3.7	8.6	**4.8**	**29.0**	3.2	29.0
Sites with traffic burden	4.3	30.2	3.5	29.2	4.1	9.6	4.2	10.9	**5.5**	**19.6**	3.5	39.1
Industrial sites	12.4	60.7	11.4	48.0	12.9	66.7	8.7	73.5	**8.2**	**60.5**	8.2	78.1

Source: State Health Institute

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).

In the 1990s, there was a major drop in emissions of all basic pollutants and a subsequent drop in air pollution in the Czech Republic. Despite the continued decline in emissions at the beginning of 21st century, the concentrations of pollutants in the air, especially of PM_{10}, $PM_{2.5}$, and benzo(a)pyrene, are not decreasing and development is accompanied by variations which are related mainly with the dispersion conditions.

A significantly bigger number of exceedings of the **PM_{10}** daily limit values was achieved in relation to worsened dispersion conditions, which were associated with specific synoptic situations in January–February and October–December 2013.

In 2013, a total of 20 **smog situations** were declared due to high PM_{10} concentrations, with a total duration of 56 days and 5 hours and 1 regulation lasted 1 day and 9 hours. The smog situations were most often declared in the territory of Ostrava/Karviná/Frýdek-Místek, excluding Třinec (a total of 5 declarations) and in the territory of Třinec (a total of 4 declarations). The most significant declaration took place from 21th January to 29th January 2013, when smog situation was declared in 8 territories all over the Czech

Republic at the same time. Declaration of the smog situations is closely related to occurrence of the above-mentioned specific synoptic situations. Compared to the year 2012, there was an increase in the number of smog situations (in 2012 there were 16 smog situations), however, their duration shortened (in 2012 they were declared for 80 days and 4 hours in total).

In 2013, the limit values for PM_{10} 24-hour permissible concentration was exceeded at 42 stations out of a total of 129 stations. The largest number of measuring stations where limit values were exceeded was in Moravian-Silesian region and in Prague. In contrast to the previous year 2012, when the limit value was exceeded at 50 locations out of a total of 120, there was a decrease.

In 2013, the **limit value for the 24-hour average concentration** of PM_{10} was exceeded in 5.7% of the territory and 15.9% of the Czech population was exposed to above-the-limit concentrations (Chart 1). The limit value for annual average PM_{10} concentration was exceeded on 0.7% of the Czech Republic's territory in 2013 (in 2012 it was 0.9%).

According to estimations by the State Health Institute, **exposure to suspended particulate matter** contributed to premature death rate of the population in the range between unit per cent to 10% in industrially burdened areas of Ostrava and Karviná in 2006–2013. 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 exposure to PM_{10} contributed (with estimated 50% representation of $PM_{2.5}$) has been ranging between 2,000 to more than 4,000 people per year in long terms; in 2013, this concerned 1,600 people. With estimated 75% mean representation of $PM_{2.5}$ in the PM_{10} fraction, the estimated increase of the total death rate is approximately 5,200 people in 2013. Due to a common and comprehensive effect of air pollutants on the human organism, these effects also include those of nitrogen dioxide (Table 1).

The limit value for annual **concentrations of $PM_{2.5}$** was exceeded in 9 out of 46 stations in 2013. The highest average concentrations were recorded in 7 sites in Moravian-Silesian region.

The **ground-level ozone concentrations** are influenced by meteorological conditions (sunlight intensity, temperature and occurrence of rainfall) during the period from April to September, when highest concentrations are usually measured. The concentrations of ground-level ozone have grown in comparison with the previous year 2012. In 2011–2013, air pollution limit value to protect human health was exceeded in 25.6% of the territory and 8.2% of the population were exposed to above-the-limit concentrations, which is an increase in comparison with the previous assessed period 2010–2012 (in this period, the air pollution limit value was exceeded in 16.6% of the Czech Republic's territory, with 2.8% of the population).

In 2013, a total of 16 smog situations were declared due to high ground-level ozone concentrations, with a total duration of 23 days and 1 hour. Smog situations caused by high ground-level ozone concentrations were most often declared in the region of Ústí nad Labem (3 declarations), with a total duration of 4 days and 15 hours. Occurrence of smog situations is related to high air temperatures and to clear or partly cloudy weather with low wind speed; in 2013, smog situations were declared already in April, then in June, July and August. In 2012, no smog situation was declared in connection with high ground-level ozone concentrations.

In 2013, a number of towns and villages were classified, likewise in 2012, as the territory with exceeded target limit values for **benzo(a)pyrene**. This concerns about 17.3% of the territory, where 54.5% of the population live. The limit value (1 $ng.m^{-3}$) for BaP concentration was exceeded at 21 stations from a total of 31 in 2013. The highest annual average concentration was measured in Ostrava-Radvanice (9.4 $ng.m^{-3}$), similarly to the previous years.

The total **increase of the individual lifelong risk of new cancer diseases in urban localities** of the Czech Republic due to BaP in 2013 was between 0.6 and 8 occurrences of the disease per 10,000 inhabitants for the period of 70 years. From the values calculated for different types of urban sites, a very rough conclusion can be made that in urban areas without a significant industrial load, the impact of PAH emissions from transport, combined with emissions from household furnaces, could lead to an increase in health risks in comparison with the values measured at background stations in the Czech Republic by approximately 1 case per 10,000 inhabitants. In localities affected by large industrial sources, the value of the individual risk was higher than in the other urban localities and theoretically it can represent an increase by another 4 cases per 10,000 inhabitants (Table 2).

The **map of areas with exceeded air pollution limit values, excluding ozone**, provides comprehensive information on air quality in the Czech Republic's territory in 2013. In this year, areas where air pollution limit values are being exceeded (Figure 1) for at least one substance except ozone were delimited in 17.5% of the Czech Republic's territory. In 2013, the air pollution limit value for BaP was exceeded repeatedly (see above), and the air pollution limit values for arsenic (As) and cadmium (Cd) were also exceeded at one of the 55 monitored localities. The air pollution limit values for nickel (Ni) and lead (Pb) were not exceeded on any of the monitored sites in 2013.

After the **inclusion of ground-level ozone**, 37.0% of the Czech Republic's area (Figure 2) in which the values of limit values were exceeded for at least 1 or more pollutants (SO_2, PM_{10}, CO, Pb, NO_2 and benzene) were delimited in 2013. In 2013, the limit values were exceeded for PM_{10} (see above) and NO_2 (4 traffic burdened sites from a total of 90 monitored stations). The limit values for benzene, SO_2 and CO were not exceeded at any of the monitoring stations in 2013.

Information about air pollution in the single **small settlements** is missing, due to legislatively provided positions of the monitoring 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 but their number is not big. Increased or above-the-limit concentrations of pollutants were measured in the air in small settlements (up to 10,000 inhabitants), where almost half of the Czech population live (in 2013 this concerned 47.8% of the population). This concerns especially suspended particulates, PAH and heavy metals. Therefore, air pollution in the most affected small settlements can be comparable with burden in large urban agglomerations. The reason for poor air quality in small settlements consists in morphology of the territory, the weather conditions and traffic load, namely transit traffic and traffic fluency. However, burning of solid fuels, particularly in local household furnaces, has a fundamental influence on the worsened air quality 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://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1835)

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

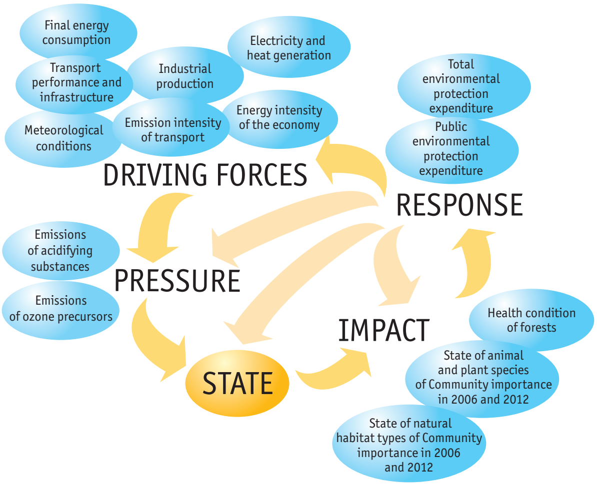
KEY QUESTION →

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

KEY MESSAGES →

🙂 In 2013, the limit value for ozone for the protection of ecosystems has been exceeded at only one station out of a total of 34 stations rated as rural or suburban. The positive trend therefore continues because in 2012 the air pollution limit for AOT40 was exceeded at 5 out of 36 monitoring stations. The limit value for the annual average concentration of NO_x was not exceeded at any rural station and the limit values for annual and even winter concentrations of SO_2 were not exceeded either.

😐 The total atmospheric deposition of sulphur, nitrogen, and hydrogen ions is not 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 AND STRATEGIC DOCUMENTS →

The **Act No. 201/2012 Coll. on air protection** and **Decree No. 330/2012 Coll.**, on the method of evaluation and assessment of the level of pollution, scope of public information about the level of pollution and during smog situation set the air pollution limits and the upper and lower limits for assessment of the pollution level to protect ecosystems and vegetation for ground-level ozone (expressed as AOT40[1] exposure index), SO_2 and NO_x.

The protocols to the **Convention on Long-range Transboundary Air Pollution (CLRTAP)**, especially the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone**, deal with reduction of emissions of ground-level ozone precursors (NO_x, VOC) and the environmental impact of ozone.

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 it negatively affects the respiratory system.

Emissions of the pollutants cause acidification and eutrophication of ecosystems, which, as a result, negatively affect the water regime and reduce biodiversity. However, the burden of ecosystems due to acid atmospheric deposition still continues and affects the water regime and biodiversity. At present, the burden of ecosystems at the regional level consists in ground-level ozone, which has impact on the biochemical, cellular and physiological levels. It damages green parts of plants and reduces the resistance of vegetation to adverse external influences. Above-limit concentrations of ozone reduce the yields of agricultural crops and affect the health of forests stands.

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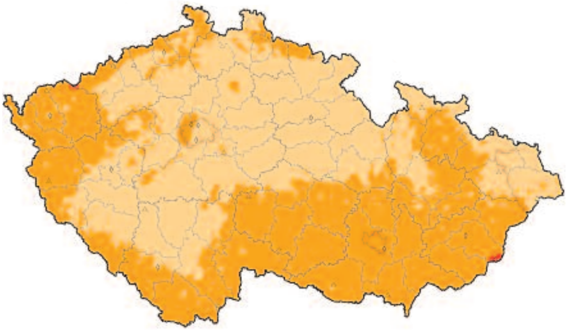
[1] *For the purposes of the Act No. 201/2012 Coll., AOT40 means the sum of the differences between the hourly concentration greater than 80 mg.m^{-3} (= 40 ppb) and the value 80 mg.m^{-3} in the given period using only the hourly values measured every day between 08:00 and 20:00 CET, calculated from 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], 2009–2013**

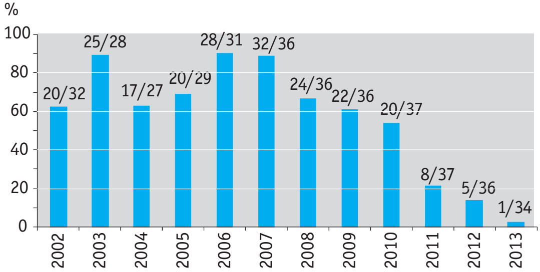


Classification of stations
◊ Suburban background
▵ Rural

AOT40
🟧 ≤ 14,000 (≤ LV)
🟧 > 14,000–18,000 ≥ LV
🟥 ≥ 18,000 (> LV)

Source: Czech Hydrometeorological Institute

Chart 1 ➜ **Percentage of stations at which the air pollution limit, expressed as AOT40 (5-year average) – for the protection of vegetation was exceeded [%], 2002–2013**

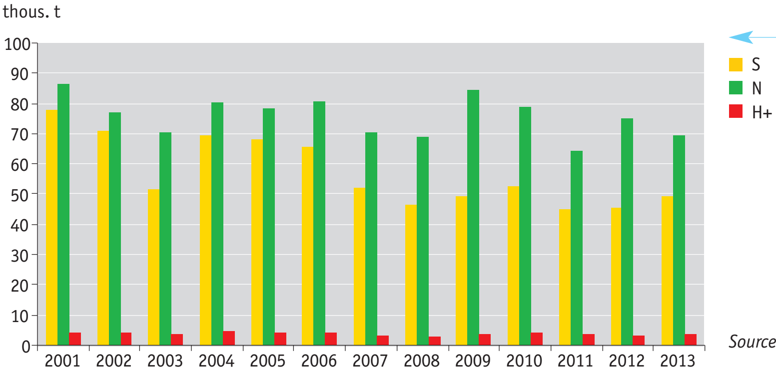


🟦 Number of stations where the target limit value was exceeded

Source: Czech Hydrometeorological Institute

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

Chart 2 ➜ **Development of the total atmospheric deposition of sulphur, nitrogen, and hydrogen ions [thous. t], 2001–2013**



Source: Czech Hydrometeorological Institute

In 2013, 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 Czech Republic's territory. Compared with the previous assessed period (2008–2012), the area where the limit value was exceeded has decreased significantly in the Czech Republic (Figure 1).

The ozone limit value for the protection of ecosystems and vegetation, according to the 2013 assessment (average for the years 2009–2013 is concerned), was exceeded at only one station (Štítná n. Vláří, 19,861.8 μg.m^{-3}.hr) out of the total number of 34 rural and suburban stations. In 2012, the ozone limit value for the protection ecosystems and vegetation was exceeded at 5 of the total number of 36 stations (Chart 1).

Interannual changes in the level of the AOT40 exposure index are affected by the sum of ozone precursor emissions, but more particularly by meteorological conditions (temperature, precipitation, solar radiation) in the period from May to July for which the indicator is calculated. As opposed to the previous year 2012 (average for the years 2008–2012 is concerned), the decline in the value of AOT40 exposure index for the year 2013 was recorded in 91.4% of the localities (80.6% in 2012) while its increase was recorded in 8.6% of the localities (19.4% in 2012). The highest values measured between 2009 and 2013 were reached in 2009 (if individual years are assessed).

The limit value for annual average concentrations of NO_x was not exceeded at any of the 13 localities classified as rural in 2013. The limit values for annual and even winter average concentrations of SO_2 were not exceeded at any rural locality (out of total of 14, or 15 localities) in 2013.

The **field of the total atmospheric deposition** (Chart 2) is the sum of wet and dry atmospheric depositions. The burden of ecosystems caused by atmospheric deposition still remains high in many areas of the Czech Republic. This is brought about by emissions from industrial sources and transport (especially NO_x emission), however, the long-range transfer from Central Europe (Germany, Poland and Slovakia) also takes its part. In 2013, the total atmospheric deposition of sulphur amounted to 49,314 t of sulphur per the total area of the Czech Republic. In 2000–2006, the total deposition of sulphur was in the range between about 65,000 and 75,000 t per year, with the exception of the year 2003, the precipitation of which was significantly below the normal values. Since 2007, the value of the total sulphur deposition varies around 50,000 t of sulphur per the area of the Czech Republic. The total deposition of sulphur has its maximum in the Ore Mountains (Krušné hory), where there are also the maximum values of the throughfall sulphur deposition.

In the last decade, the value of the total nitrogen deposition remains in the range 70,000–80,000 t per year as a result of production of NO_x emissions from transport, industrial production and energy generation. In 2013, the total deposition of nitrogen (oxidized + reduced forms) amounted to 69,693 t.year^{-1}.km^{-2}, which means that there was a slight interannual decline. The highest values of the total nitrogen deposition were measured in the Ore Mountains (Krušné hory).

The total hydrogen ion deposition in 2013 is 3,895 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 Ore Mountains, too.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1836)

Air and climate

Air and climate in the European context

KEY MESSAGES ➜

- ➜ The EU is on the way to successfully meeting the objectives of its climate-energy package; in the period 1990–2012, the EU as a whole reduced emissions of greenhouse gases by 19.2%. The Czech Republic has contributed significantly to the fulfilment of this objective because it decreased the aggregated emissions by 33% in this period. In the Czech Republic, the specific indicators of GHG emissions are above the EU28 average.

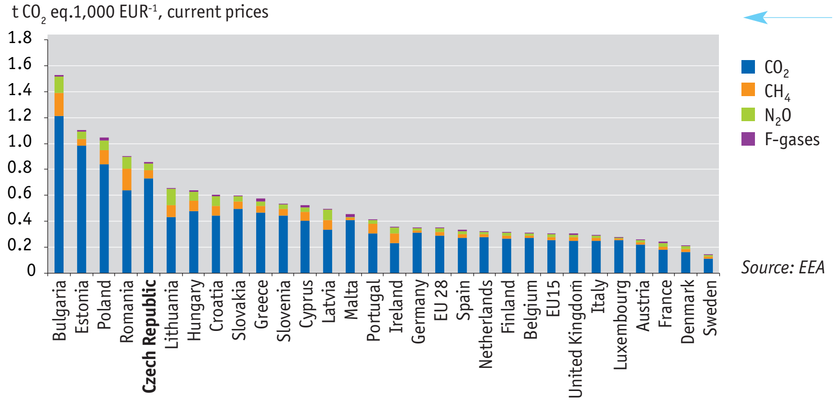
- ➜ The emissions of acidifying substances, emissions of ground-level ozone precursors and emissions of primary particles and secondary particulate matter precursors decreased significantly in the EEA member states in 1990–2011, while in the Czech Republic there was the most significant positive change.

- ➜ In the long terms, the risk of eutrophication and acidification of European ecosystems caused by emission loads is being reduced, however, the situation in the Czech Republic, despite the long-term positive development, is not satisfactory enough and the Czech Republic's ecosystems belong to the most burdened in Europe.

- ➜ Despite the long-term decline in emission of pollutants into the air, the Czech Republic still belongs to the most polluted regions of the EU27 as far as air quality in some places is concerned. In the European context, the Czech Republic's population is affected by local exceedances of the air pollution health-protection limits for PM_{10}, ground-level ozone and benzene.

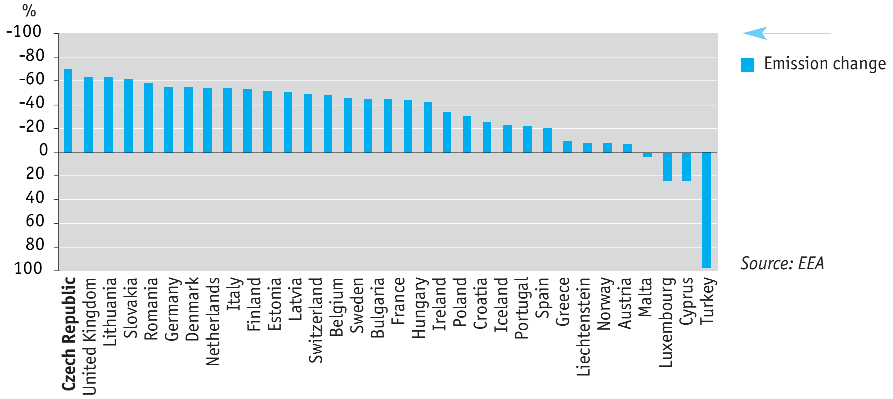
INDICATOR ASSESSMENT

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



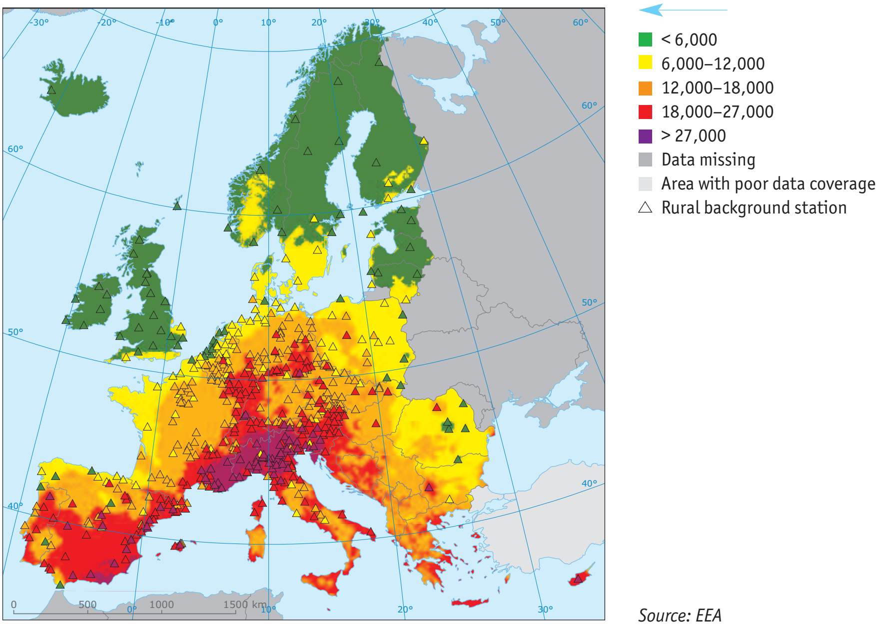
Source: EEA

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



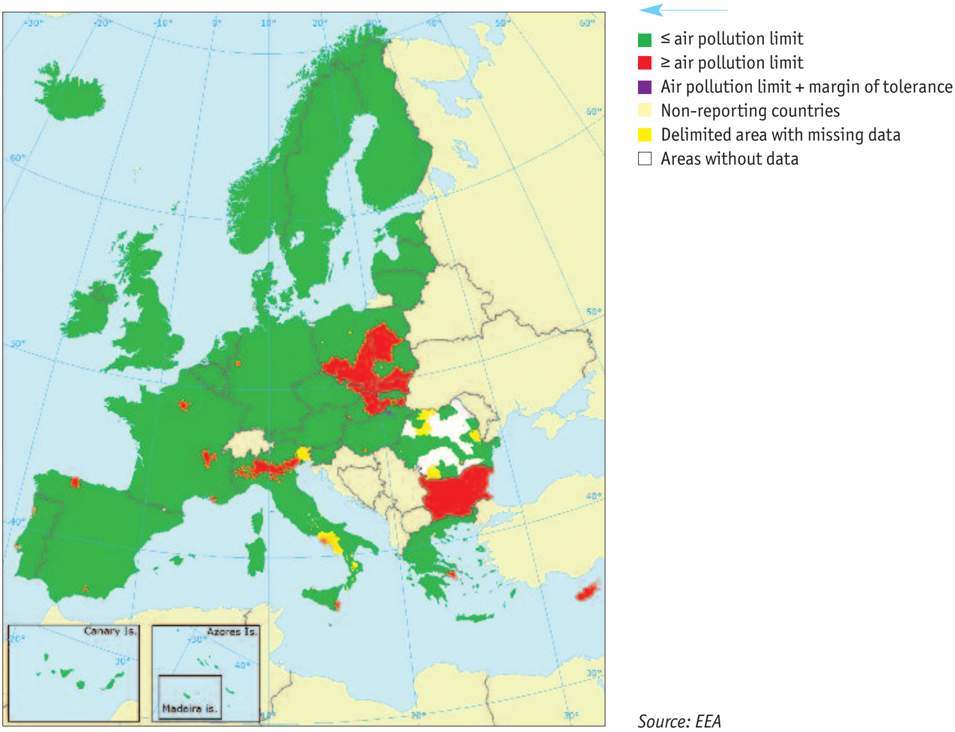
Source: EEA

Figure 1 → **Fields of the AOT40 index values in Europe [µg.m^{-3}.h], 2010**



Source: EEA

Figure 2 → **Exceeding of the air pollution limit for average annual concentration of suspended particulates to protect human health in Europe [µg.m^{-3}], 2011**



Source: EEA

The **total aggregate greenhouse gas emissions** decreased by 19.2% (1,082 Mt CO_2 eq.) in the EU28 countries in 1990–2012. The EU as a whole is therefore approaching fulfilment of the objectives of the climate-energy package, which provides for a reduction of the emissions by 20% compared to the reference year 1990. From the perspective of absolute numbers, Germany and the United Kingdom contributed most to this decline as they together reduced the emissions by about 500 Mt CO_2 eq. in this period. The biggest relative declines were registered in Latvia, Estonia and Romania, where the emissions fell to less than a half in comparison with the year 2012. The decline in the Czech Republic was also bigger (64.7 Mt CO_2 eq., 33.0%) than in the whole of the EU. Interannually, the emissions declined by 1.3% in the EU28 and by 2.8% in the Czech Republic in 2012.

Emission intensities of the economy differ significantly in the individual EU28 countries; in average it amounted to 0.35 t CO_2 eq.EUR $1,000^{-1}$ in current prices in 2012 (Chart 1). Most emissions per unit of GDP are produced in the new EU member states, especially Bulgaria, Estonia and Poland. Within the EU, the Czech Republic's emission intensity is also significantly above-average; it is 2.5 times higher than that in the EU28 and 2.8 times higher than that in the EU15. The high value of specific emissions in the Czech Republic, as well as for example in Poland and Estonia, is caused by energy generation based on fossil fuels and a by a significant position of the industry within the economy. The Czech Republic's **per capita emissions of greenhouse gases** are the third highest in the EU28 (12.5 t CO_2 eq.inhab.$^{-1}$), which is 39.4% above the European average.

Emissions of acidifying substances (NO_x, SO_2 and NH_3) in most of the EEA member states (25 of 33) decreased substantially in the period 1990–2011. In the reference period, the emissions of SO_2, which contributed most to the overall decline, decreased by 73.5%, those of NO_x by 44.0%, and emissions of NH_3 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 those of SO2 by 91.1%. The reason for this decline consists in a solution to high environmental burden resulting from intensive industrial production and mining in the 20th century. In 2011, the main sources of emissions of acidifying substances in EEA member countries were agriculture (93.6% of NH_3 emissions), road transport (40.5% of NO_x) and generation and distribution of energy (58.1% of SO_2). Transition to better quality fuels with a lower sulphur content participated in the reduction of SO_2 emissions. The emissions of NO_x and SO_2 decreased also as a result of ecologisation measures taken in industrial and energy resources (dust removal, denitrification and desulphurisation). 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 and CH_4) emissions in 1990–2011. In this period, NO_x emissions decreased by 44.3%, VOC emissions by 56.4%, CO emissions by 61.5% and CH_4 emissions by 28.6%. The Czech Republic belongs to the countries in which there was the most significant decline in ground-level ozone precursor emissions, particularly NO_x emissions by about 70% (Chart 2), VOC by about 55%, CO by 62.9% and CH_4 by 42.6%. 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 VOC emissions) and the transport sector (40.5% of NO_x emissions, 26.5% of CO emissions). Despite an increase in both passenger and freight road transport performance, introduction of new technologies to reduce NO_x formation during combustion of fuel and also introduction of technologies to remove NO_x from flue gas using catalysts, which also reduce CO emissions from transport significantly in the whole of Europe, contributed to a decline in NO_x emissions.

During the evaluated period 1990–2011, there was a decline in the **emissions of primary particles and secondary particulate matter precursors** in the EEA countries. Emissions of primary particulates decreased by 24.4% in the period considered. In the Czech Republic, emissions of primary particles decreased by 43.4%, and therefore the Czech Republic joined Cyprus, Slovakia and the United Kingdom, i.e. the countries that have contributed most to the decline during the period considered. The sector of services and households (50.5% of the total emissions), industrial energy sector (28.6%) and road transport (16.1%) altogether were the main sources of emissions of primary particles and secondary particulate precursors in the EEA member states in 2011. However, local household heating is still the major source of PM_{10} emissions in all EEA states, including the Czech Republic.

Despite a continuing trend of decreasing amounts of pollutants in the air, approximately 22–44% of **urban population** in the EU27 countries were exposed to exceeded limit values for suspended particulates; the most affected areas included Central Europe – the Czech Republic, Poland and Slovakia, and northern Italy, Bulgaria (Figure 1). The agglomeration of Karviná, Třinec and Ostrava together with the Katowice agglomeration is among the main European regions where the limit values for benzene are exceeded. This pollution is not only caused by industrial and transport burden in the areas concerned but also by long-range transmission of pollutants. The Czech Republic's population, together with countries of Southern and Central Europe, is affected negatively by exceeded air pollution limits for 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**. It is especially the western part of Europe which is affected most by critical loads of nitrogen nutrition; the most affected areas include north-eastern France, Denmark, the north of the Czech Republic and northern Italy. The reason for this load consists in the location of industrial sources and transport infrastructure, and long-range transmission of pollutants also plays an important role. Serious 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. In 2010, the limit value was not exceeded in most of the Czech Republic's territory (Figure 2). In the same year, the limit value for AOT40 was exceeded on 21% of agricultural land in 32 EEA member states (Turkey was not included).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1761,http://issar.cenia.cz/issar/page.php?id=1762)

08/ Water abstration

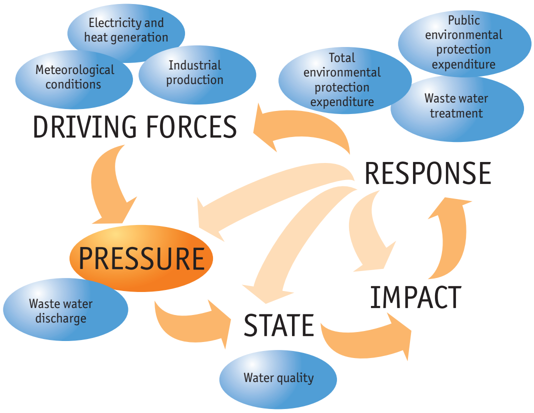
KEY QUESTION →

Is water in the Czech Republic being used in a sustainable way with respect the availability of water sources in the future?

KEY MESSAGES →

☺ The trend of decreasing water abstraction and consumption has been continuing. As in the previous year, the total water abstraction was decreasing in 2013, too. Abstraction from surface waters took a greater part in this decline while abstraction from groundwater participated in it to a smaller extent. In almost all of the evaluated categories, i.e. in the category of water mains for public use, energy, industry, and other users of surface water, there was a decline in the quantity of surface water abstraction compared to the year 2012; stagnation was recorded only in case of agriculture. The most significant reduction of water abstraction was recorded in the category of energy (interannually the total abstraction decreased by 17.0%).
Compared to the previous year, there was a decline in the volume of produced water, drinking water intended for implementation and of water invoiced to households and other customers. The total water consumption in households has decreased (87.2 l.inhabitant^{-1}.day^{-1}) as well as the loss of water in water mains (17.9% in 2013, compared to 19.3% in 2012). In addition, the number of inhabitants connected to water supply networks has increased interannually.

😐 The water prices continue growing.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

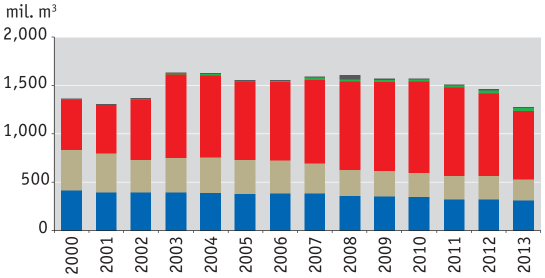
Economical use of water resources, especially for the purposes of drinking water supply, along with achievement of good water condition, belong to priority themes of the conceptual and strategic documents on both the European and the national levels. In the Czech Republic, planning in the area of water is based on, inter alia, the 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). From the perspective of the above-mentioned topics, the **River Basin Management Plans**, which are based on the Framework Directive, belong to important documents at the national level. They are elaborated for eight catchment areas and they contain programmes of measures to gradually solve the most significant water management problems. Another important strategic document is the **Plan of Major River Basin Districts of the Czech Republic**. In the area of water management services, the Plan deals with, inter alia, securing a smooth supply of the population and other consumers with sanitary and high-quality water.
Also the **Conception of the Agrarian Policy of the Czech Republic for the Period after EU Accession (2004–2013)** and the **Conception of Water Management Policy of the Ministry of Agriculture of the Czech Republic till 2015** aim at similar tasks. These Conceptions focus on creating the conditions for sustainable management of limited water wealth of the Czech Republic, which will allow harmonising the requirements for all forms of using water resources with the requirements for the protection of water and aquatic ecosystems whilst taking account of measures to reduce the harmful effects of water. The mid-term strategy of state policy concerning water supply and sewerage systems before 2015, i.e. the **Development Plan for Water Supply and Sewerage Systems of the Czech Republic**, was created within synthesis of information from the regional level. The Plan contains a concept for the solution of drinking water supply for the whole population, including specification of surface and groundwater sources of drinking water. The Development Plans for Water Supply and Sewerage Systems of the single regions in the Czech Republic are a basis for the use of the European Community's funds and national financial sources for building and renewal of water infrastructure.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Human existence and the survival of ecosystems are unambiguously dependent on the quantity and quality of water. Water abstraction must respect the requirements for the good condition and ecological limits of the water bodies, to ensure such conditions which the ecosystems need to function and support human prosperity and health, and for overexploitation not to damage these resources or adjacent aquatic ecosystems. In connection with climate change, the pressure on surface water resources, and particularly on groundwater, will be growing, especially in the context of rising demands for water in agriculture due to more frequent occurrence of drought. At the same time, however, water infiltration into soil, and thus replenishment of long-term groundwater supplies, have been decreasing. Drought, which solidifies arid soil and makes infiltration impossible during subsequent intensive rainfall, and the growing share of built-up areas, which prevent infiltration and accelerate surface runoff, have negative effects in this case. The long-term national monitoring shows that the quality of drinking water in public water mains does not pose a health risk in the Czech Republic. However, relatively numerous findings of non-compliance with the limit values of some indicators occur in samples from public and commercial wells; the reason again consists in pollutant runoff from agriculture.

INDICATOR ASSESSMENT

Chart 1 ➜ Surface water abstraction by individual sectors in the Czech Republic [mil. m^3], 2000–2013

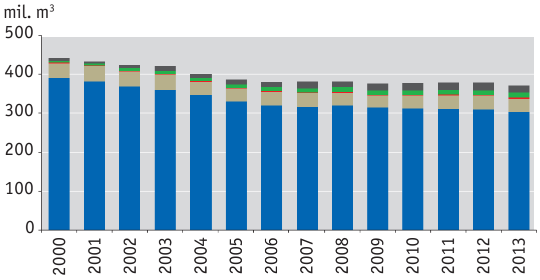


- ⬛ Others (incl. construction)
- 🟩 Agriculture, forestry and fishery
- 🟥 Energy sector
- 🟫 Industry (incl. mining)
- 🟦 Public water mains

Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

Water abstraction by users in excess of 6,000 m^3 per year or 500 m^3 per month is kept on record – 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. m^3], 2000–2013

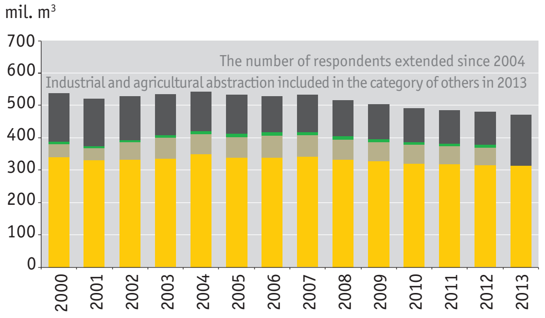


- ⬛ Others (incl. construction)
- 🟩 Agriculture, forestry and fishery
- 🟥 Energy sector
- 🟫 Industry (incl. mining)
- 🟦 Public water mains

Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

Water abstraction by users in excess of 6,000 m^3 per year or 500 m^3 per month is kept on record – pursuant to Section 10 of the Decree of the Ministry of Agriculture No. 431/2001 Coll.

Chart 3 ➜ Drinking water use by individual sectors in the Czech Republic [mil. m^3], 2000–2013

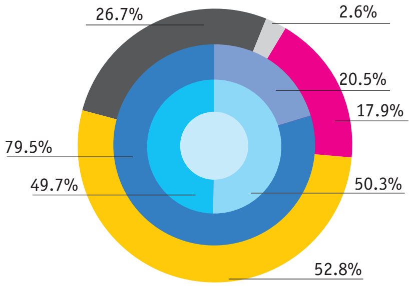


- ⬛ Others
- 🟩 Agriculture, forestry and fishery
- 🟫 Industry
- 🟨 Households

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 abstractions are included in the category of others).

Chart 4 ➜ The use of water in the Czech Republic [mil. m^3], 2013



Source: Czech Statistical Office

- ⬜ Produced water intended for implementation 593.6 mil. m^3

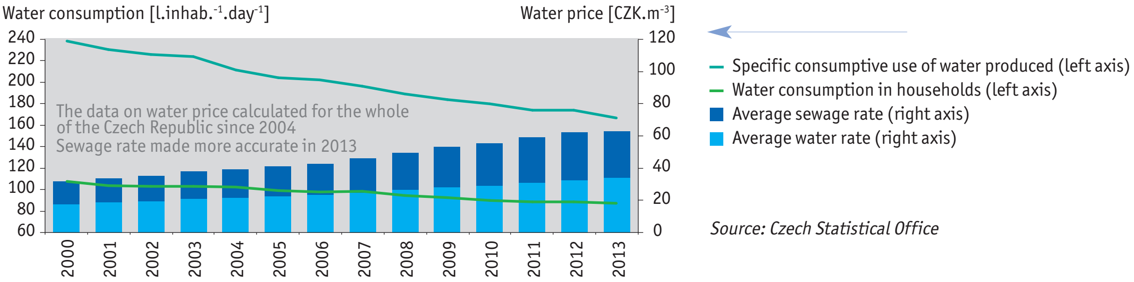
- 🟦 Groundwater 302.2 mil. m^3
- 🟦 Surface water 298.0 mil. m^3

- 🟦 Non-invoiced water 121.8 mil. m^3
- 🟦 Water invoiced 471.8 mil. m^3

- 🟨 Water invoiced for households 313.6 mil. m^3
- ⬛ Water invoiced for other users 158.2 mil. m^3
- ⬜ Other non-invoiced water 15.5 mil. m^3
- 🟪 Losses in the distribution network 106.3 m^3

The diagram shows the use of produced water that is intended for implementation. Data on the percentage shares of non-invoiced and invoiced drinking water are determined from the total volume of produced drinking water that is intended for implementation. 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.

Chart 5 ➜ **Water consumption in the Czech Republic [l.inhab.$^{-1}$.day^{-1}] and the price of water [CZK.m^{-3}], 2000–2013**



The data on water price calculated for the whole of the Czech Republic since 2004
Sewage rate made more accurate in 2013

Source: Czech Statistical Office

Until 2003 (including the year 2003), the water rates are provided for the main operators only. Since 2004, the water prices are calculated for the whole of the Czech Republic. The water prices are provided without VAT. In 2013, calculation of the sewage rate was made more precise as a result of including charged rainwater and also due to co-operation of the respondents. The resulting sewage rate per m^3 is not fully comparable with the previous years, in spite of the fact that the interannual differences do not digress from the results of the previous years.

The **total abstraction of surface water and groundwater** has been decreasing since the early 1980s. This trend manifested itself more significantly in the early 1990s; at first, it was associated mainly with changes in the structure of industrial and agricultural production as a result of restructuring the national economy, later with decreasing water demands of industrial technologies and with declining water consumption in households. After a hike in abstraction in 2002 and 2003 (a change in the range of reported data and, at the same time, the beginning of cooling water abstraction for the Temelin nuclear power station), the situation had stabilised and in the past three years, the total abstraction of surface water and groundwater has been declining again. In 2013, the total water abstraction amounted to 1,649.8 mil. m^3, which represented a decrease by 10.4% compared to the previous year. Compared to the year 2012, there was a decrease of both surface water (by 12.5%) and groundwater (by 2.2%) abstraction. Abstraction from surface sources accounted for 77.5% of the total volume of water abstracted.

The **structure of abstraction from surface water and groundwater** by user groups (CZ-NACE classification) has been more or less stable since 2003 (Chart 1, Chart 2). Of the total water abstraction, the greatest part is made in the **energy sector** (43.2%, 713.0 mil. m^3 in 2013). In vast majority, this is abstraction of water for through-flow cooling of steam turbines, and therefore 99.6% of abstraction in the energy sector (710.4 mil. m^3) are taken from surface water. Compared to the previous year, this abstraction decreased by 17.1%, which contributed substantially to the decline in the total surface water abstraction, which has declined by 12.5% interannually, after previous years of stagnation. Most of the cooling water abstracted is then returned to watercourses with a slightly altered quality (increased temperature, reduced oxygen content) and a part of the water is not returned to the watercourse due to evaporation. Reduced abstraction in Mělník power station, which uses through-flow (not circular) cooling, has taken a great part in the decrease of water abstraction for energy.

On the other hand, the biggest volume of abstraction from groundwater sources (303.5 mil. m^3, 81.8% as opposed to 24.6% in case of surface water) is used for **public water** mains as a source for drinking water production because of higher quality of groundwater that does not require much processing. In 2013, 50.3% of drinking water was produced from groundwater sources in the Czech Republic. In the Czech Republic, 37.5% of all abstraction is carried out for the purposes of water collection, treatment and distribution in public water mains. Since 2000, this abstraction decreased by 23.5%, which is related to overall reduction in the quantity of water produced and to the decline in demand for drinking water caused by introduction of more efficient technologies and savings in households and in the industry.

In 2013, the **industry sector** was the third-largest consumer of water (i.e. surface water) (15.1%, 248.5 mil. m^3). Water abstraction for the industry sector accounted for 16.8% of abstraction from surface water sources and only 9.2% of abstraction from groundwater sources. Abstraction for the industry (including mining and quarrying) shows a long-term decline (since 2000 by 45.7%). Within the 2012/2013 interannual comparison, there was a decrease of abstraction from both surface sources (by 9.2%) and groundwater sources (by 3.4%). Not only introduction of new production technologies (based on savings or environmental protection) but also economic development in the sectors with the highest abstraction (food processing, chemical and paper industries) have an impact on water abstraction for the industry in general. On the other hand, water abstraction for **agriculture** has been steadily low in the Czech Republic (2.7% of the total abstraction in 2013); in the case of crop farming, it usually has enough rainwater and the interannual fluctuations depend on the temperature development and the amount of precipitation during the growing season. In the last interannual comparison, there was an increase in water abstraction for agriculture by 1.9%. Warm and dry weather in April and July had influence on relatively high abstraction. Interannual fluctuations, however, do not necessarily have to correspond to real abstraction, which is connected with the fact that according to the law, only a part of abstracted water is subject to a charge but for the purposes of water balance, all the collected water must be reported and therefore the increase is partly a result of better reporting discipline.

Water companies belong to entities that abstract most water in the Czech Republic. In 2013, a total of 600.2 mil. m^3 of water were produced, of which 593.6 mil. m^3 were intended for implementation and 471.8 mil. m^3 was **drinking water** invoiced to households and other users (Chart 3, Chart 4). Since 2007, the amount of invoiced drinking water has been decreasing continually (a decline by 11.3% between 2007 and 2013). Households, which accounted for 66.5% of drinking water abstraction (313.6 mil. m^3) in 2013, have been decreasing their consumption since 2007 as well (Chart 3). Reduction of the quantity of water produced is also derived from the reduction of drinking water loss in distribution networks, which was 17.9% of the total volume of produced water intended for implementation in 2013 (in 2000 this was 25%). This means that 29.5 l of water were lost per each inhabitant and day in 2013 and **water consumption** per one inhabitant supplied from public water mains amounted to 166.9 $l.inhabitant^{-1}.day^{-1}$ (specific consumptive use of the water produced). The per capita water consumption reflects the trends in water abstraction (Chart 5). In households, 87.2 $l.inhabitant^{-1}.day^{-1}$ were consumed in 2013, which is 81.0% of the value of the year 2000. Declining water consumption in households is caused by a decrease in the volume of produced water; at the same time, the number of inhabitants supplied with drinking water from public water supply systems is growing; currently it is 9.85 mil. people (93.8% of the Czech Republic's population). There is also a long-term influence of rising **water and sewer rates** and of massive expansion of water-saving appliances. The increase in water and sewer rates is also influenced by oversized water infrastructure which was largely built in times when abstraction was much bigger and so with decreasing water consumption, depreciation on fixed assets of the water companies account for a growing part of the water price.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1772)

09/ Waste water discharge

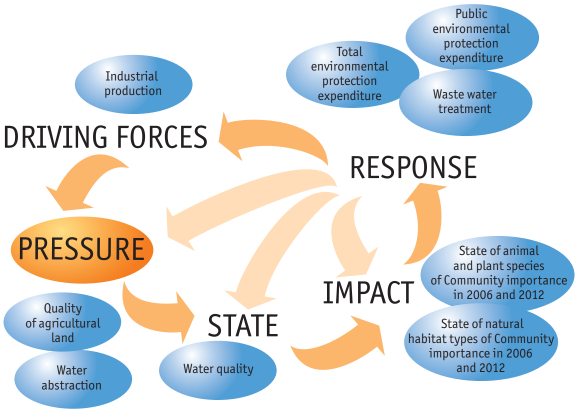
KEY QUESTION →

Have we succeeded in reducing the amount of pollution that is discharged by point sources into surface water?

KEY MESSAGES →

🙂 Compared to the year 2012, the total amount of discharged waste water was reduced by 2.0%, mainly due to decrease of the volume of waste water discharged in the energy sector by 17.8%. From a long-term perspective, the trend of reducing the pollution discharged from point sources continues. Since 2000, emission of BOD_5 decreased by 68.6%, that of COD_{Cr} by 51.0% and suspended solids by 61.8%. Since 2003, emission of $N_{inorg.}$ decreased by 21.2% and that of P_{total} by 30.6%.

😐 The total amount of discharged waste water has stagnated in the last decade. Compared with the previous year, the year 2013 was richer in precipitation, and thus there was an increase of the volume of water discharged from public sewerage systems (sewage and precipitation water), despite a slight reduction in water abstraction for water mains by 10.9%.Compared with the year 2012, there was a slight decline in discharged pollution for the indicators BOD_5 (by 1.5%) and COD_{Cr} (by 1.8%), and slight reduction has been recorded in the quantity of discharged suspended solids (by 1.9%), $N_{inorg.}$ (by 5.6%) and P_{total} (by 4.5%).



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Reducing the volume of waste water and amount of pollution discharged into surface water is the principal means for improving water quality and preserving a good condition of water bodies. At the same time it is a prerequisite for sustainable use of natural resources. The main national strategic and conceptual documents have implemented this theme into their priority axes. The **Strategic Framework for Sustainable Development in the Czech Republic** aims, inter alia, at reducing the health risks associated with negative environmental factors and with food safety or at improving the population's lifestyle and public health by reducing the impact of the inhabitants' consumption on the economic, social and environmental areas. It also puts emphasis on sustainable material management by promoting environmentally sound technologies including support to their research and development.

Other national strategic documents, mainly the **Conception of Water Management Policy of the Ministry of Agriculture of the Czech Republic till 2015** and **Development Plan for Water Supply and Sewerage Systems of the Czech Republic**, also highlight the need to reduce the entry of pollutants into water, mainly through setting the emission limits for the single pollution indicators (in accordance with the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy), minimizing the entry of nutrients and hazardous substances into the aquatic environment (in harmony with the 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 or Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources) and through support for the construction and reconstruction of WWTPs (in accordance with the requirements of Council Directive 91/271/EEC concerning urban waste water treatment).

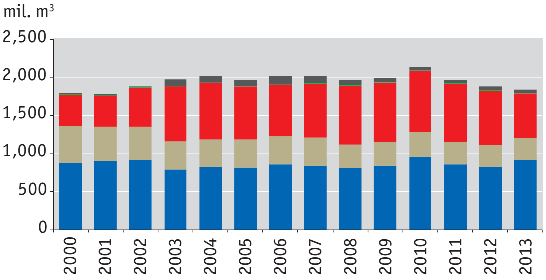
Among other things, the **Plan of Major River Basin Districts of the Czech Republic** stresses the need to introduce best available techniques (BAT) into production processes and best available technologies into waste water removal. Specific objectives and programmes of measures to improve the quality of surface water and groundwater are laid down in the **River Basins Management Plans**. Since 2010, adopted programmes of measures have been implemented. Within preparation of the second stage of planning in the area of water management for the period 2015–2021, a preliminary list of important water-management problems identified in some parts of international catchment areas within the Czech Republic's territory was compiled and published for comments as one of the basic outcomes of preparation works in 2013.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The amount of waste water, produced pollution and pollution that is discharged subsequently into surface water directly affect its quality and thus the ecosystems linked to the aquatic environment. The most important components of the pollution in waste water are organic compounds, nutrients (especially phosphorus and nitrogen) and hazardous substances. Nutrients (especially phosphorus) contained in wastewater discharged from point sources, contribute, along with diffuse sources, to excessive eutrophication of watercourses and reservoirs. Subsequently, polluted water can be a source of infectious diseases such as viral hepatitis A, dysentery, salmonella, etc. Every year, the aquatic environment is also affected by accidental pollution which is dangerous especially because of its unpredictability and highly hazardous releases. Those toxic substances are of special importance which pollute sources of drinking water (particularly groundwater sources), and which accumulate in soil and sediments from which they get into plant and animal tissues and thus into the food chain of other animals and humans where they remain even a long time after their release.

INDICATOR ASSESSMENT

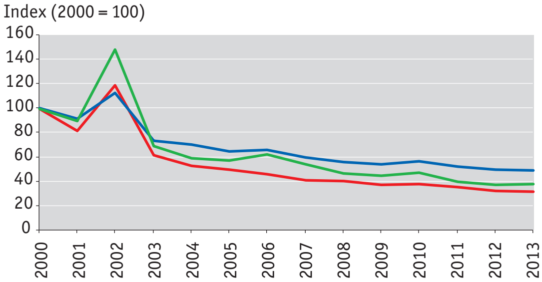
Chart 1 → The quantity of waste water discharged into surface water in the Czech Republic [mil. m³], 2000–2013



Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

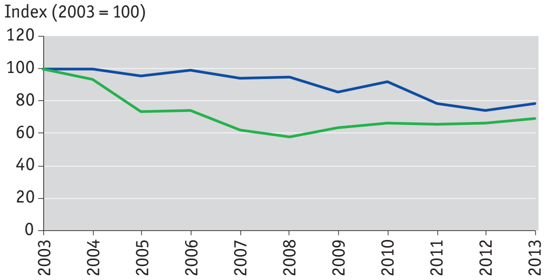
Since 2002, the discharge of waste water or mining water in excess of 6,000 m³ per year or 500 m³ per month is kept on record – pursuant to section 10 of Decree No. 431/2001 Coll.

Chart 2 → Relative representation of pollution discharged from point sources – the BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 2000 = 100], 2000–2013



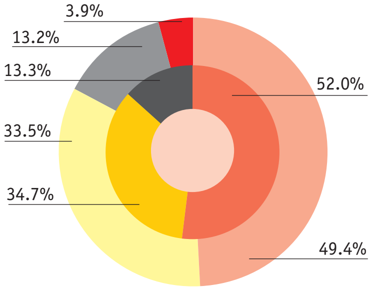
Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

Chart 3 → Relative representation of pollution discharged from point sources – $N_{inorg.}$ and P_{total} in the Czech Republic [index, 2003 = 100], 2003–2013



Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

Chart 4 → The quantity of water discharged into surface water in the Czech Republic [mil. m³], 2013



Source: Czech Statistical Office

- ■ Water discharged into watercourses 949.0 mil. m³

- ■ Rainwater and other water 493.7 mil. m³
- ■ Sewage discharged into sewerage systems 329.1 mil. m³
- ■ Industrial and other water discharged into sewerage systems 126.2 mil. m³

- ■ Treated rainwater 468.9 mil. m³
- ■ Treated sewage 317.7 mil. m³
- ■ Treated industrial and other water 125.7 mil. m³
- 🟥 Untreated waste water and rainwater 36.7 mil. m³

Likewise abstraction, the **total amount of discharged waste water** was also decreasing in 1980s and 1990s, with only sporadic occurrence of an interannual increase in volume. The trend changed in 2002 when, unlike the previous year, the amount of discharged waste water increased and this was so in the following two years, too (Chart 1). The hike at the beginning of 21st century was connected with both the change in the limit for recorded amount of discharged waste water and growing discharge of waste water from the energy sector. More than two thirds of the increase were covered by this sector; the growth was caused by start-up of cooling water abstraction for the Temelín nuclear power station and re-increase of water abstraction for the power station in Mělník. After 2004, the total amount of discharged waste water stagnated around 2 bil. m^3 per year. The only exception was the year 2010 when there was a significant increase in discharge (by 7.4% to 2,142.1 mil. m^3), mainly from public sewerage systems. The reason consisted in a higher total rainfall which increased the volume of collected rainwater. In 2013, the total volume of waste water discharged from point sources was only 1,846.4 mil. m^3 and compared to the previous year it fell by 2.0%, primarily as a result of a decline in the volume of waste water discharged from the energy sector.

The **waste water discharge structure** corresponds to the structure of the customers (a certain amount of water abstracted in the sectors of energy and agriculture is lost due to evaporation) and it has not changed significantly for the last 10 years. Discharge from public sewers (49.9%, i.e. 921.7 mil. m^3) and the energy sector (31.9%, i.e. 589.5 mil. m^3) comprise the biggest parts. In 2013, there was an increase in the volume of **municipal waste water** (sewage and rainwater) by 10.9%, despite a slight decrease of water abstraction for public water mains. The reason consisted in an increase of the proportion of rainwater and so-called ballast water in 2013, which was a rich year in terms of rainfall compared to 2012. Municipal waste waters are important point sources of pollution, especially organic pollution. On the other hand, **water discharged by the energy sector** consists almost exclusively of waste water from through-flow cooling which affects the temperature and oxygen content in water. In 2013, the volume of waste water discharged by the energy sector declined by 17.8%, which is related to a decrease in water abstraction for the energy sector that was influenced substantially by lower abstraction for Mělník power station.

Industrial waste water is another major source of pollution (15.3% and 282.4 mil. m^3); it includes not only organic pollution but also pollution with e.g. heavy metals and specific organic substances. Compared to the previous year, discharge from the industry (including mining) has declined by 1.2%. The chemical, paper, mining and food industries belong to the biggest producers of industrial waste water.

Agriculture is a specific polluter of surface water; although it discharged only 0.4% of the volume of waste water discharged from point sources (6.5 mil. m^3) in 2013, it still belongs to significant pollution sources in the Czech Republic. Most of the pollution originating from agriculture does not get to surface water from point sources but as **diffuse pollution** through rainwater run-off from agricultural land. This type of pollution is not generally recorded, but it significantly translates into the resulting quality of both surface water and groundwater. Diffuse pollution is a major source of nitrates and pesticides and it also brings about acidification. The amount of these substances which gets into water is also affected, inter alia, by dosing and application of fertilizers and plant protection substances used in agricultural production, as well as erosion conditions of agricultural land. In 2013, there was a slight increase of the volume of waste water discharged from point sources in the category of **other sources** (by 4.0%) which also includes the construction industry.

Along with the volume of discharged effluent, the quantity of discharged pollution is also very important as it indicates potential water pollution. Since 1990s there has been a substantial decline in the **quantity of organic pollution discharged from point sources** for the indicators monitored. Since 2000, the decline has been less significant, however, organic pollution expressed as **BOD_5** decreased to 6,049 t, which represents a drop by 68.6%; **COD_{Cr}** decreased to 40,100 t, i.e. a decline by 51.0%, and **suspended solids** decreased to 11,369 t, i.e. a drop by 61.8% (Chart 2). The deviation in 2002 was caused by extreme floods. Positive changes in the total amount of pollution that occurred in 1990s and whose main reason consisted in a decline in industrial production and increased volume of treated water are no longer so significant over the last ten years. Currently it is mainly the effect of extensive construction and modernisation of WWTPs intended for treatment of not only municipal but also industrial waste water which influences the development of discharged pollution. The period after 2003 has showed only occasional slight interannual increase in discharged pollution which was related, inter alia, with occurrence of precipitation extremes (e.g. in 2010 and partly also in 2013) and was therefore reflected in the volume of water discharged from public sewers (Chart 1). The last interannual (2012/2013) changes in the amount of discharged pollution were only minor – there was a slight decline in BOD_5 (by 1.5%) and COD_{Cr} (by 1.8%), despite a slight increase of pollution produced in these indicators. Concerning suspended solids, the amount of both produced and discharged pollution increased by 1.9% (Chart 2).

In comparison with 2012, the **amount of discharged nutrients** increased slightly; in case of **nitrogen** ($N_{inorg.}$) by 5.6% to 11,776 t, in case of **phosphorus** (P_{total}) by 4.5% to 1,257 t (Chart 3). These values could be (as well as a slight increase in the amount of produced $N_{inorg.}$ and P_{total} pollution) interpreted as an improved level of reporting for these indicators, which are not yet fully monitored in all sources of discharged pollution in the Czech Republic. From a long-term perspective, there is improvement; the quantity of $N_{inorg.}$ decreased by 21.2% and that of P_{total} even by 30.6% since 2003. The long-term decline is caused by reducing the amount of phosphates used in laundry detergents. Recently, however, the reduction has mainly been attributable to the fact that biological nitrogen removal and biological or chemical phosphorus removal are intentionally applied in waste water treatment technologies within new and intensified waste water treatment plants. In the Czech Republic, the vast majority of waste water discharged into watercourses goes through at least the basic treatment (Chart 4).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

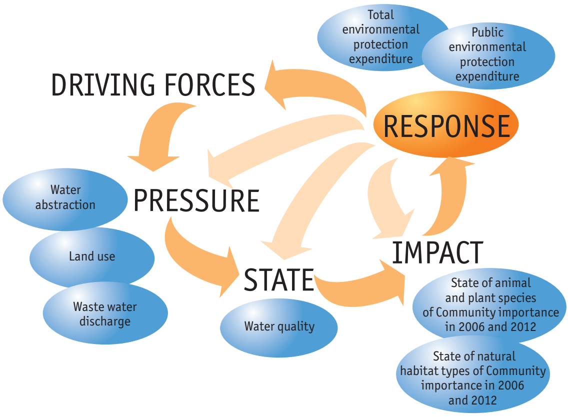
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1774)

10/ Waste water treatment

KEY QUESTION →

How much of the Czech Republic's population is connected to public sewerage systems and waste water treatment plants and what is the proportion of treated waste water?



KEY MESSAGES →

☺ The slow increase of the population connected to a sewerage system continues; in 2013, 82.8% of the Czech Republic's population was connected to a public sewer, 95.0% of them to a sewerage system ending in a WWTP.

Compared to the previous year, the volume of waste water discharged into a sewerage system (excluding rainwater subject to charge) decreased by 3.7%. A total of 97.4% of wastewater discharged into sewerage systems has been treated.

Increase of the number of WWTPs with tertiary treatment also continues. The average efficiency of a WWTP measured by means of concentrations of the basic pollution indicators varies between 74.0% and 98.1%.

😐 Since 2012, there has been a slow-down in the growth of the share of population connected to a sewerage system ending in a WWTP. So far, 21.3% of the population are not connected to a sewerage system ending in a WWTP.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Conceptual and strategic documents dedicated to policy in the area of water protection in the Czech Republic aim at protecting the environment from adverse effects of waste water discharge and they are linked to European legislation represented by the **Council Directive 91/271/EEC concerning urban waste water treatment**. The **Conception of Water Management Policy of the Ministry of Agriculture of the Czech Republic till 2015**, in accordance with the general objectives and principles of national policy in the area of water, with the long-term objectives set out in the Plan of Major River Basin Districts of the Czech Republic and the above-mentioned Directive, puts emphasis on effective disposal of waste water without negative environmental impacts. It is particularly necessary to ensure secondary treatment of municipal waste water in sensitive areas (according to the Nitrate Directive), especially through building of the missing water infrastructure (in particular WWTPs and sewerage systems), reconstruction and improvement of wastewater treatment technologies in all settlements above 2,000 PE.

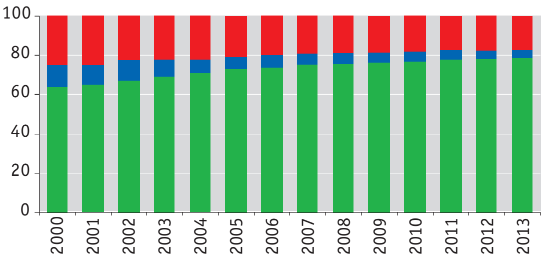
The basic conceptual document which actually deals with waste water treatment is the **Development Plan for Water Supply and Sewerage Systems of the Czech Republic**. This is a mid-term strategy of state policy concerning water supply and sewerage systems prior to 2015 that is linked to other strategic documents, while respecting the requirements of relevant EU legislation (e.g. Council Directive 91/271/EEC concerning urban waste water treatment). The primary objective in the area of waste water treatment is to increase the proportion of the population connected to public sewerage systems and the proportion of the population connected to sewers ending in a WWTP. For the **Development Plans for Water Supply and Sewerage Systems of the Czech Republic's Regions**, the number of opinions that are issued by the Ministry of Agriculture on proposed changes to the technical solutions to drinking water supply, sewerage services and waste water treatment increases every year. The Plans form a basis for using EC funds and national financial sources to build and renew water management infrastructure.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Reduction of the pollution discharged in municipal and industrial effluents is essential to achieve decoupling of the pressure on the aquatic environment and development of human society. Availability of waste water treatment and sewerage systems to the inhabitants thus represents a level of the society's development and its relation to the environment. Developed water infrastructure which ensures safe collection and treatment of sewage reduces health risk connected with developing infections and epidemics of infectious diseases. The stage of treatment of collected waste water, which affects the amount and character of discharged pollutants, has a direct impact on the quality of water bodies and related ecosystems. Inadequate sewage collection and treatment can result in deterioration of water for drinking or recreation purposes.

INDICATOR ASSESSMENT

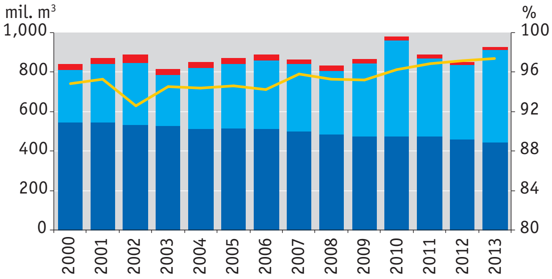
Chart 1 ➜ **Proportion of the population connected to sewerage systems and to sewerage systems ending in WWTPs in the Czech Republic [%], 2000–2013**



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. m³, %], 2000–2013**

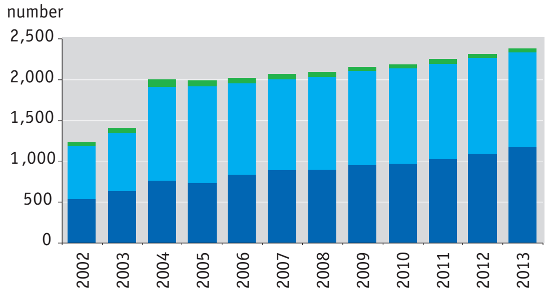


Source: Czech Statistical Office

- 🟥 Untreated waste water – sewage, industrial and other water (left axis)
- 🟦 Treated waste water – rainwater (left axis)
- 🟦 Treated waste water – sewage, industrial and other water (left axis)
- — Proportion of treated waste water without rainwater (right axis)

Till 2003 (including 2003), data for the main operators' sewerage systems are concerned. This time series of selected indicators is influenced by changes in statistical surveys and consequences of gradual transformations of the former water companies (ownership of sewers and water mains was transferred onto the respective municipalities). In 2013, there was a change in reporting of waste water discharged into sewerage systems. Rainwater subject to charge is newly included in this category, which also covers municipal sewage, industrial waste water and other water.

Chart 3 ➜ **Number of waste water treatment plants according to treatment stages in the Czech Republic, 2002–2013**



- 🟩 Primary treatment
- 🟦 Secondary treatment
- 🟦 Tertiary treatment

Source: Czech Statistical Office

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

The Czech Republic's joining the EU, subsequent fulfilment of the EU legislation and using of the EU funding have had a key influence on the development of infrastructure for the collection and treatment of waste water. Compared to the year 2003 (the last year before the country joined the EU), the **proportion of the population connected to a sewerage network** rose from 77.7% to 82.8% in the Czech Republic in 2013 (Chart 1). The increase in the proportion of the population connected to a sewerage system ending in a WWTP was particularly positive. The interannual increase of the population connected to a sewerage system is slowing down. The cause consists in the fact that most sewerage systems and WWTPs in larger conurbations have already been built and now it is necessary to cover the smaller municipalities where there is less population and where there is not enough money in the budget.

In 2013, waste water produced by 21.3% of the population was not treated directly in a WWTP but it was collected in septic tanks and similar devices from which it was subsequently transported for treatment or it was discharged directly into watercourses, without proper treatment. Compared to the year 2012, the **total volume of water discharged to public sewerage systems** (without rainwater) decreased by 3.7% and amounted to 455.3 mil. m^3 in 2013, which represents almost half the volume of the year 1989. In 2013, rainwater subject to charge was newly included in waste water discharged into public sewers and therefore the total volume was higher (517 mil. m^3). Altogether 12 mil. m^3 of these waste waters were not treated (Chart 2).

Nevertheless, the **proportion of treated wastewater** that is discharged into sewerage is very satisfactory – in 2013 it was 97.4% compared to the year 1990 (only 75.0%). In long terms, the value of this proportion has been between 94% and 98% since 2000. A value lower than this range was recorded only in 2002, and it was caused by limited operation of WWTPs that were affected by floods. A part of rainwater that is not subject to charge is also treated in WWTPs. Its quantity has shown large interannual fluctuations which correspond to precipitation levels in the respective years. In 2013, 468.9 mil. m^3 of rainwater were treated, compared to 377.3 mil. m^3 in 2012.

In the Czech Republic, the **total number of WWTPs** for public use doubled to 2.382 compared with the year 2000 (Chart 3). Due to construction and modernization of WWTPs, the total number of WWTPs with nitrogen and/or phosphorus removal (tertiary treatment) increased by 75 in all agglomerations of the Czech Republic, the number of those with basic mechanical-biological treatment (secondary treatment) decreased by 9 and the number of mechanical WWTPs decreased by 2 compared to the year 2012. The significant increase in the number of WWTPs in 2004, which is recorded in Chart 3, was caused by changes in statistical reporting. At present, all agglomerations above 10,000 PE have tertiary treatment, although not all of them fulfil the requirements of the Directive concerning the quality limits for discharged wastewater. In case of pollution sources bigger than 2,000 PE, 12 new municipal WWTPs were built and 30 existing municipal ones and 2 industrial ones were reconstructed or enlarged during the year 2013.

In the Czech Republic, the **average efficiency of WWTPs** (the amount of pollution removed) is very high – in 2013 it was for BOD_5 98.1%, for suspended solids 97.6%, for COD_{Cr} 94.4%, for P_{total} 83.4% and for N_{total} 74.0 %. The values are similar to those in previous years, which is connected with the fact that reconstruction of most large WWTPs is complete and the amount of pollution produced in individual agglomerations has stabilized.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1776)

11/ Water quality

KEY QUESTION →

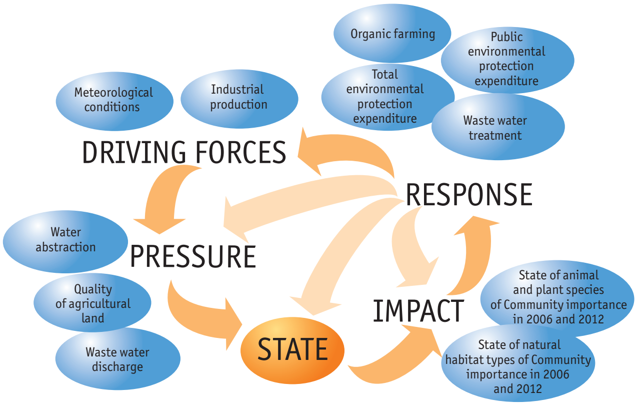
Is the quality of water affecting both aquatic organisms and the use of water in watercourses improving?

KEY MESSAGES →

☺ For all water quality parameters that are monitored, there was a long-term decrease in their concentrations in watercourses. There was an interannual decrease of chlorophyll 'a' by 44.1%[1], cadmium by 26.7%, total phosphorus by 12.1% and BOD$_5$ by 9.1%.
Environmental quality standards in 2013, especially for cadmium and BOD$_5$, and in long terms also for COD$_{Cr}$ and N-NO$_3^-$, are not being exceeded.

😐 The concentrations of nitrate and COD$_{Cr}$ in watercourses in the period 2000–2013 more or less stagnate.

☹ There was an interannual increase in the concentration of COD$_{Cr}$ by 3.4%. In 2013, environmental quality standards for P$_{total}$ and AOX were exceeded in almost one third of the profiles.
Generally speaking, the situation regarding eutrophication of stagnant and flowing waters is rather unsatisfactory and it is necessary to permanently reduce the burden of water with nutrients, especially phosphorus compounds.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The basic conceptual and strategic documents concerning the environment focus on comprehensive protection of the quality and quantity of water, preventing deterioration of the water quality and they also support measures which lead to achievement of good status of both water and the related ecosystems. The objective of achieving at least the good status of surface water and groundwater till 2027 is based on the **Directive 2000/60/EC of the European Parliament and of the Council** establishing a framework for the Community action in the field of water policy (the Water Framework Directive). The specific objectives and programmes of measures to improve water quality are set out in the **River Basin Management Plans** that are currently available for 8 basins. The main measures concerning water protection and other measures, which are not related with water protection directly but contribute to its conservation ultimately, are specified in the **Program to reduce surface water pollution with hazardous substances and particularly hazardous substances**. This program is valid for the whole territory of the Czech Republic for the period from 1st January 2010 to 22nd December 2013 and it concerns the substances or groups of substances that are hazardous for the aquatic environment (or through it) and are listed in Annex 1 to the Act No. 254/2001 Coll. (the Water Act). An important instrument for water protection from priority hazardous substances is the **Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy**. The standards have to be achieved by the end of 2015.

Diffuse pollution associated with agriculture is also a significant source of pollutants. One of the axes of the **National Strategic Rural Development Plan in the Czech Republic in 2007–2013** also deals with protection of the quality of surface water and groundwater sources through measures related to agricultural activities. The **Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources** (the Nitrates Directive) is very important with regard to diffuse pollution.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The required water quality is dependent on the purpose of its use. Surface water quality has a direct influence especially on aquatic and water-related organisms but it also affects other adjacent ecosystems, such as river floodplains. Excessive amounts of nutrients (especially phosphorus) getting into the aquatic environment contribute to eutrophication of water which can result in reduction of plant and animal species (worsened ecological conditions) and they also have negative impacts on possible use of the water by humans. Eutrophication causes problems in the use of water for drinking and it poses a direct health risk in the use of surface waters for bathing. The main health risks associated with ingestion of and exposition to contaminated water include transmission of infectious diseases and skin rashes. Certain hazardous substances contained in surface water (e.g. Hg, Ni, Cd and DDT) have the ability to accumulate in the sediments and tissues of aquatic animals in long terms and thus to get into the food chains of a great number of other organisms, including humans. During floods, the sediments are released suddenly and sedimented hazardous substances also get into water with them.

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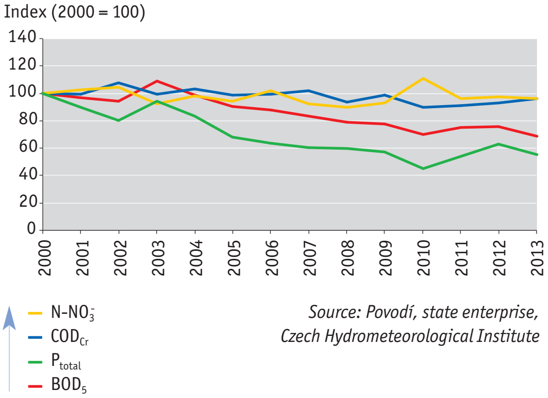
[1] *Concentrations of chlorophyll 'a' show a considerable interannual variation which is caused by this indicator's close links to the temperature development in the given year.*

INDICATOR ASSESSMENT

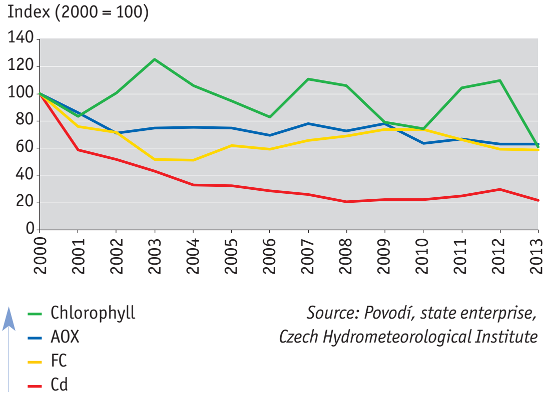
Chart 1 → **Trends in concentrations of pollution indicators of watercourses in the Czech Republic [index, 2000 = 100], 2000–2013**



Source: Povodí, state enterprise, Czech Hydrometeorological Institute

The indices for individual indicators against the selected base year were calculated on the basis of arithmetic means for each year using annual average values for 69 selected profiles within the Eurowaternet network and the number of stations for the different years and different indicators change depending on availability of data. The water quality assessments for BOD_5, COD_{Cr}, N-NO_3^- and P_{total} were carried out for the period 2000–2013, most frequently for a set of 68 stations, in 2013 for 63 stations.

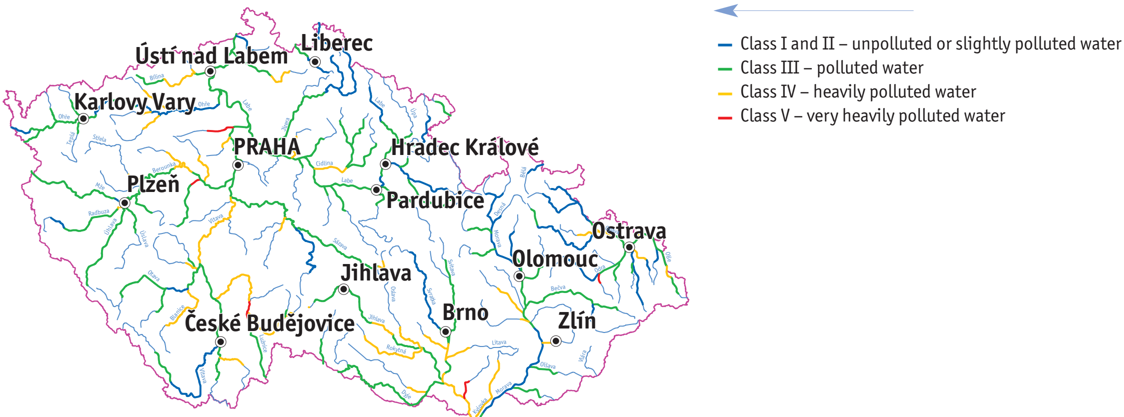
Chart 2 → **Trends in concentrations of pollution indicators in watercourses in the Czech Republic [index, 2000 = 100], 2000–2013**



Source: Povodí, state enterprise, Czech Hydrometeorological Institute

The indices for individual indicators against the selected base year were calculated on the basis of arithmetic means for each year using annual average values for 69 selected profiles within the Eurowaternet network and the number of stations for the different years and different indicators change depending on availability of data. The water quality assessment for AOX (29–61 stations; 52 stations in 2013), Cd (42–58 stations; 46 stations in 2013), FC (56–69 stations; 56 stations in 2013) and chlorophyll 'a' (46–69 stations; 46 stations in 2013) was carried out for the period 2000–2013.

Figure 1 → **Water quality in watercourses in the Czech Republic, 2012–2013**



Source: Ministry of Environment, Povodí, state enterprise

A summary of evaluations of the following indicators – BOD_5, COD_{Cr}, N-NH_4^+, P_{total} and saprobic index of zoobenthos.

In order to improve the quality of surface water and groundwater it is important to reduce pollution discharged from both point and diffuse and areal sources simultaneously. In the Czech Republic, development of concentrations of the respective indicators[2] for the past 20 years was affected mainly by changes related to the amount of discharged waste water, access to wastewater treatment and the socio-economic and political development (industrial restructuring, growing living standard, accession to the EU). In recent years, the amount of pollution discharged from point sources is not changing so markedly and therefore the climate conditions of the given year (water content of watercourses, incidence of extreme hydrological phenomena, and annual course of air temperature) play an important role in interannual fluctuations in surface water quality. On the regional basis, concentration of industrial activities, existence of old environmental contamination or intensity of agricultural activities are of great importance. At present, diffuse and areal sources of pollution with nutrients, pollution with substances that are difficult to remove and are discharged from point sources, and accidental pollution are considered to be the main sources of pollution in surface water and groundwater in the Czech Republic.

In long terms (1993–2013), pollution represented as BOD$_5$ and P$_{total}$ (decrease of the average concentration by 60% and 58% respectively) has been reduced most in watercourses of the Czech Republic. The concentrations of COD$_{Cr}$ and particularly N-NO$_3^-$ have not decreased so significantly during this period (in spite of that, there was a decline by 40% and 16% respectively) and they stagnate more or less in 2000–2013.

Reduction of average concentrations of **organic pollution** in watercourses (Chart 1), which comes mainly from municipal wastewater, is attributable not only to reducing the production of this type of pollution, but also highly efficient removal at WWTPs. In long terms, of the four above-mentioned indicators, COD$_{Cr}$ is the pollution which is produced and subsequently discharged from WWTPs into watercourses in biggest volumes even though efficiency of its removal in WWTPs is very high (94.4% in 2013). The efficiency of BOD$_5$ removal is even higher (98.1%). In 2013, the final concentration of COD$_{Cr}$ in the Czech Republic's watercourses reached 18.4 mg.l^{-1} and that of BOD$_5$ 2.4 mg.l^{-1}; interannually, the concentration of BOD$_5$ decreased by 9.1% but that of COD$_{Cr}$ increased slightly (by 3.4%).

In long perspective, the average concentration of total **phosphorus** has also declined; in 2013 it was 0.13 mg.l^{-1} in watercourses (Chart 1). Although the lowest phosphorus concentrations in watercourses was achieved already in 2010 (0.11 mg.l^{-1}), the values for the subsequent years are below long-term average and interannually the concentration declined by 12.1%. The reason for this positive trend consists in the fact that a big part of phosphorus comes from point source pollution which goes through treatment and the volume of which is generally reduced. The decline in phosphorus inputs was further supported by restrictions concerning the use of phosphates in laundry detergents beginning from 2006; in the last years, application of phosphate fertilisers in agriculture has also been declining. Nonetheless, a substantial part of phosphorus comes from diffuse pollution sources (fertiliser use on agricultural land) at present and this type of pollution is very difficult to remove. Phosphorus pollution from agricultural sources is avoided by good agricultural practice based on the GAEC principles. Pollution from areal sources is complicated by the fact that pollutants are captured in soil and their release with rainwater washout takes place slowly. Phosphorus remains being the major factor to cause eutrophication. Further reduction of phosphorus concentration in surface water is held back by relatively high limits for waste water discharge and the fact that only larger WWTPs are obliged to remove phosphorus. Increasing popularity of dishwashers, which are roughly in a third of the Czech households, is also a source of phosphorus. The regulation of phosphates in dishwasher detergents will be valid as late as in 2015.

Since 1993, the concentration of **nitrate nitrogen** in watercourses has not decreased significantly compared to the other indicators and since 2000 it has a rather fluctuating trend (Chart 1). There was no substantial interannual change; the concentration amounted to 3.1 mg.l^{-1} in 2013. Along with atmospheric deposition and sewage, nitrogen fertilisers are a significant source of nitrogen, and even though their consumption is much lower than it was before 1990, there has been an increase in their consumption since 2000. Due to a lower average nitrogen removal efficiency (74.0% in 2013) and a higher volume of inorganic nitrogen discharged from point sources, the decrease in pollution of watercourses with this element is not as clear-cut as it is e.g. for phosphorus. Since diffuse pollution generally covers most of the nitrate-nitrogen pollution, the interannual increase of its concentration in watercourses is partially bound to years with above-average run-off. During these years, there is a greater runoff from agricultural land treated with fertilisers, while during a drier growing season, application of fertilizers is limited. The long-term trend (i.e. development since 1990s) in the reduction of nitrate pollution is related, inter alia, also with the reduction of nitrogen emissions from livestock farming (pigs and poultry breeding attenuation).

Areal pollution is a source other pollutants, particularly organic substances from the group of **pesticides** that threaten not only biodiversity in watercourses and stagnant water but also cause problems in water processing for drinking purposes, especially if the source of water is a watercourse. Because of agriculture, the catchment areas of the rivers Želivka, Sázava, Úhlava and Radbuza belong to regions with a high pesticide burden. The problems of drinking water pollution can be prevented by modernising water processing plants.

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[2] *Development of a watercourse's quality is assessed within the indicator on the basis of average annual concentrations of eight selected basic indicators of pollution for selected Eurowaternet profiles. Organic pollution is expressed as BOD$_5$, COD$_{Cr}$ and nutrients are represented by N-NO$_3^-$and P$_{total}$. Chlorophyll was selected as a biological indicator and cadmium as a heavy metal indicator, adsorbable organohalogens (AOX) represent the general indicators and thermotolerant (faecal) coliform bacteria (FC) belong to the microbiological indicators.*

Since 2000, **cadmium** has recorded the greatest decrease in comparison with the other evaluated indicators (Chart 2) in the Czech Republic's watercourses (by 78% to 0.07 g.l^{-1} in 2013, interannually by 26.7%). Cadmium belongs to hazardous substances and its EQS (0.3 g.l^{-1}) almost has not been exceeded in the monitored profiles since 2003 (only 2.2% of the profiles are above EQS). In long terms, the average concentrations of **AOX** have been stagnating (26.9 mg.l^{-1} in 2013) and since 2009 they have been decreasing but the proportion of EQS non-compliant profiles (i.e. above 25 mg.l^{-1}) is the highest of all indicators (26.9%), right after total phosphorus. The reason consists in the fact that this pollution, originating in e.g. paper and chemical industries, municipal waste water but partially also in natural resources, is difficult to degrade. Concentrations of **thermotolerant coliform bacteria** (FC) primarily reflect the level of faecal pollution and they are also dependent on climatic conditions of the given year (temperature, precipitation). In 2000–2004, the concentration of FC was dropping in the monitored profiles, then there was a period of growth and since 2010 the situation improves again. In 2013, the average concentration of FC was 36.7 CFU.ml^{-1} in watercourses of the Czech Republic.

The concentration of **chlorophyll** characterizes the level of primary production in aquatic environment (or eutrophication) and the influence of climatic conditions (precipitation, temperature) is of particular importance in this context. It depends mainly on average temperatures and the course rainfall during the year (or during the growing season); the concentrations of chlorophyll 'a' therefore fluctuate interannually. For example, the higher values achieved in 2003 were connected with significantly below-average precipitation and above-average temperatures. Similarly, the years 2011 and 2012 were above average in terms of temperature. In contrast, the year 2013 was slightly above average as far as overall precipitation and temperature are concerned. In the profiles monitored in the Czech Republic, the average concentration of chlorophyll 'a' has therefore been fluctuating for the above-mentioned reasons since 2000 (Chart 2). The 2013 value amounted to 9.4 μg.l^{-1}, which is the minimum value for the period 2000–2013. Compared to the previous year, this value is lower by 44.1%. In 2013, significantly above-normal rainfall in May and June has had its influence although July was very warm and dry.

In terms of reducing the amount of pollution discharged from point sources, relatively good progress has been made both in reducing the concentrations and in preventing **exceedances of environmental quality standards**. In 2013, the lowest proportion of profiles which exceed EQS was achieved for cadmium (2.2%), BOD_5 (4.8%), COD_{Cr} (9.5%) and $N\text{-}NO_3^-$ (11.1%). On the other hand, the highest were for total phosphorus (28.6%) and AOX (26.9%).

Satisfactory quality of water in the Czech Republic's watercourses is obvious from a comparison of water quality maps, which are compiled according to summarising assessment of the basic indicators monitored continuously in accordance with **CSN 75 7221** since the period 1991–1992. However, it is still possible to record water quality class V in some short sections (Fig. 1). Since 2000, there has been primarily a reduction of the sections included in quality class V and an increase of the sections with unpolluted and slightly polluted water. In 2013, total of 6,960 km, i.e. 12.0% of the watercourses' length, were included in the quality classes IV or V[3]. This means that quality class IV or V was achieved for at least one of the indicators monitored. In long terms, quality class V has been recorded in the river of Trkmanka, where there is intensive agricultural activity, and a section of the river Lužnice (below the confluence with the Nežárka) which is burdened with municipal pollution and intensive fishing. As opposed to 2011–2012 evaluation, the lower courses of the Litavka, the Jičínka, Bakovský stream and Chodovský stream worsened to class V. On the other hand, water quality in the lower course of the Litava and two segments of the Bílina, which is highly polluted with municipal and industrial waste water, has improved from class V to class IV.

Bathing water quality has also been monitored systematically in the Czech Republic. In the Czech Republic, about 260 bathing waters are monitored systematically according to national standards and their quality is assessed in five quality categories. There are interannual changes in the number of sites (157–188 sites) reported to the EU and assessed in accordance with the Directive 2006/7/EC (according to the Directive 76/160/EEC till 2011) and bathing water profiles are also being assessed in five categories. In the 2013 bathing season, 43.4% of bathing water was classified in the best quality category (according to the national evaluation standards); by contrast, bathing was prohibited in 4.7% of the monitored sites, which is a 55.6% decrease[4] as opposed to the year 2012, when extreme values were recorded as a result of above-average temperatures in summer months which supported blue-green algae growth; faecal pollution played its role, too. According to the EU assessment standards, 76.4% of bathing water was included in the best category of water quality.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1775)

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[3] *As opposed to the previous years, this concerns not the administrative length but a digital mileage according to the Central Watercourses Register (the state in March 2014).*

[4] *Alteration to the conditions (mitigation of the limits) in the category of water hazardous for bathing (ban on bathing) before the 2013 bathing season has also influenced the reduction of the number of localities with the ban.*

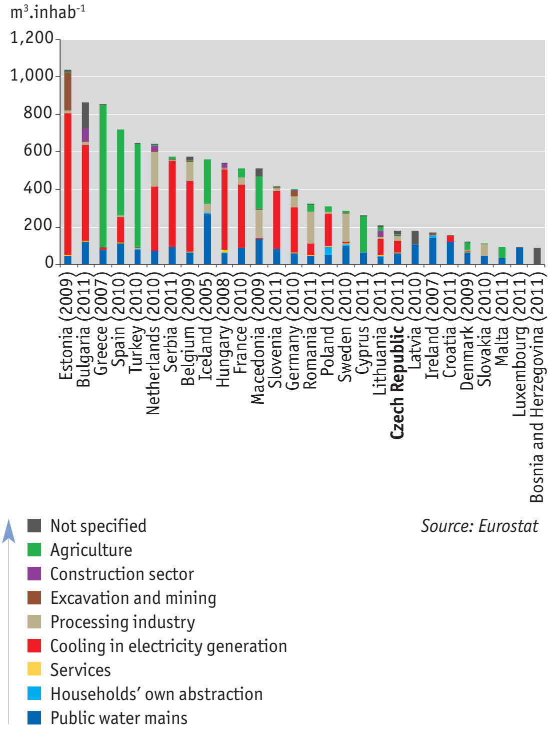
Water management and water quality in the European context

KEY MESSAGES ➔

- ➔ A greater part of Europe's territory does not suffer from lack of water. The most favourable situation is in northern Europe, Switzerland and Slovakia. With the exception of the Morava catchment area, the Czech Republic belongs to countries with a sufficient quantity of water resources and with below-average total water abstraction.
- ➔ The lack of water in Europe's most vulnerable regions concerning the amount of water resources (southern Europe, southern UK, Belgium and eastern Estonia) occurs as a result of both adverse natural conditions and uneconomical use and increased abstraction, especially for agricultural production or cooling in electricity generation.
- ➔ For the vast majority of countries, there was a decline in phosphorus emissions into surface water in comparison with the year 2000, while the Czech Republic ranks among countries with the most positive changes.
- ➔ In the area of waste water treatment, the worst situation is in most countries of south-eastern Europe.
- ➔ In terms of water quality in watercourses, there has been a significant decrease in concentration of orthophosphate (by 56.4% in total) and a less significant decrease in nitrate concentration (by 17.4% in total) since 1993. In long terms, the lowest concentrations are recorded in the rivers of northern Europe. The highest orthophosphate pollution is being recorded in watercourses of southern and south-eastern Europe, in the case of nitrate pollution in watercourses of western Europe.

INDICATOR ASSESSMENT

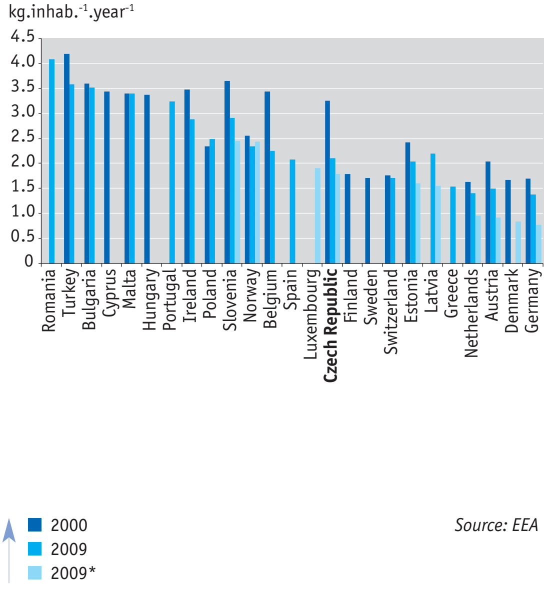
Chart 1 ➔ **Water abstraction [m^3. inhab.$^{-1}$]**



Source: Eurostat

The data are related to the most recent year for individual states (indicated in brackets in the Chart) in the Eurostat database.

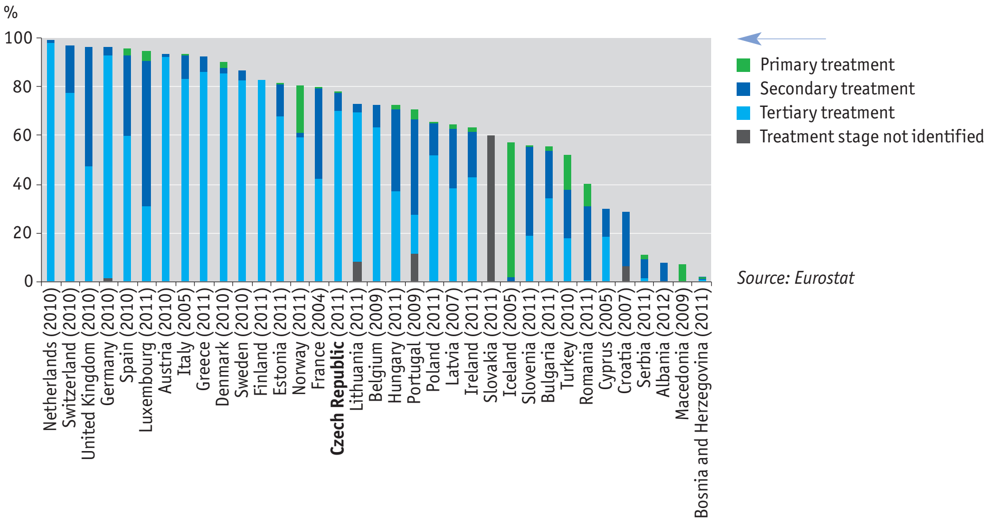
Chart 2 ➔ **Nitrogen emission intensity in the sector of households [kg.inhab.$^{-1}$.year^{-1}], 2000 and 2009**



Source: EEA

The Chart shows the changes in nitrogen emission intensity in the household sectors of various European countries, sorted by the 2009 values (if available, the 2009 value is preferred). The calculation is based on the proportion of the volume of nitrogen discharged into watercourses from sewerage system that does not end in a WWTP and from WWTPs of various treatment stages to the number of inhabitants connected to the sewerage system. The 2009 data have been included into the calculation in two variants. (1) the values calculated on the basis of a default value of population equivalent and the efficiency of water treatment (2) the values calculated from emission data reported voluntarily according to the Council Directive 91/271/EEC on municipal waste water treatment (*). Calculation methodology is available at: http://www.eea.europa.eu/data-and-maps/indicators/emission-intensity-of-domestic-sector#general_metadata.*

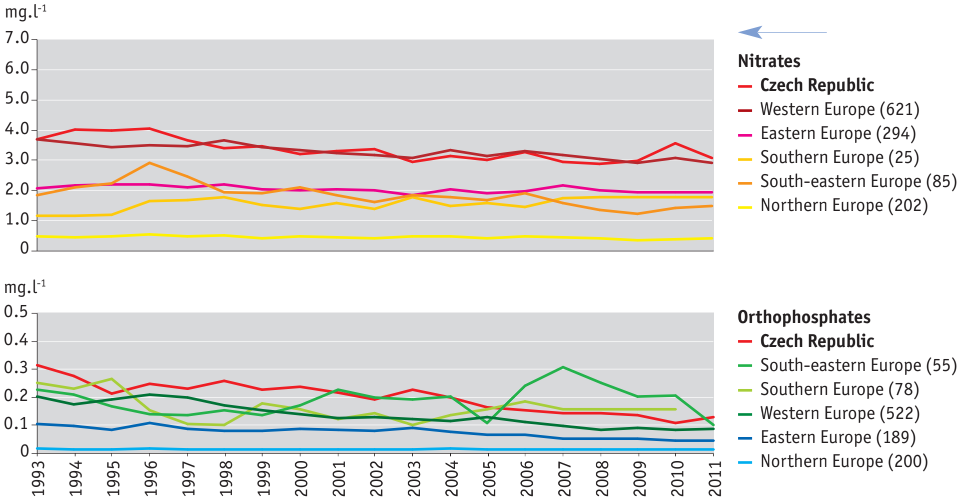
Chart 3 ➜ **Proportion of the population connected to WWTP according to treatment stages [%]**



Source: Eurostat

The data are related to the most recent year for individual states (indicated in brackets in the Chart) in the Eurostat database.

Chart 4 ➜ **Nutrient pollution in watercourses of the Czech Republic and European georegions [mg.l^{-1}], 1993–2011**



Source: EEA

Concentrations of nitrate (total oxidizable nitrogen – Finland, Sweden, Denmark, Ireland; a part of the data as total oxidizable nitrogen – United Kingdom), orthophosphate (georegions) and total phosphorus (Czech Republic) are used as indicators of nutrient pollution. The database WISE-SoERivers (Version 13) is the data source. Data for the region are calculated as the average of the annual average concentrations at the single monitoring stations and the number of stations is shown in the legend in parentheses. The single georegions consist of the following states: eastern Europe: Czech Republic, Estonia, Lithuania, Latvia, Poland (only for nitrate), Slovenia, Slovakia; northern Europe – Finland, Norway, Sweden; southern Europe – Spain; south-eastern Europe – Albania (only for nitrate), Bulgaria; western Europe – Austria, Belgium, Switzerland, Denmark, Germany, France, Liechtenstein, Luxembourg, the United Kingdom, Ireland.
Data for orthophosphates in the georegion of southern Europe are not available for 2011.

The quantity of abstracted water is related to the demand for water in various sectors, but it is also important to take availability of water resources into account. Access to water resources is highly dependent on geographical location and physical-geographical conditions in the single states or water basins. In an international comparison, the Czech Republic (except the Morava catchment area) belongs to countries with a sufficient quantity of water resources relative to water consumption. Compared to other European countries (Chart 1), the Czech Republic's **total water abstraction** per capita is below average, totalling 180 m^3 per capita per year. In terms of the amount of water resources, the most vulnerable regions are located in Spain, Portugal, Cyprus, southern and eastern France, in the south of the United Kingdom, in Belgium and eastern Estonia. The lack of water in these areas is caused by adverse natural conditions and as a result of anthropogenic interventions in the water regime. Uneconomical use of water and increasing abstraction, especially for agricultural production (e.g. in Spain, Portugal and Cyprus), have a greater impact on the overall water balance in these regions rather than in countries with enough water resources. In many countries, the total water abstraction is increased substantially by using water for cooling in electricity generation (e.g. in Estonia, Bulgaria, Serbia, Hungary etc.). On the other hand, in states with a more favourable ratio of water needs to the volume of renewable water supplies (i.e. with the lowest WEI index)[1] such as Scandinavia, Iceland, a great part of the Baltic states, Slovakia and Switzerland, this state is influenced by the given natural conditions.

International comparison of per capita **nitrogen emissions** to surface water from households (Chart 2) along with phosphorus emissions indicate nutrient emissions into the aquatic environment which can lead to eutrophication. For the vast majority of countries, there was a decline in phosphorus and nitrogen emissions into surface water in comparison with the year 2000. The greatest decrease of nitrogen emission was recorded in Austria, Germany, Denmark, Czech Republic and Belgium, and, concerning phosphorus emission, in Lithuania and the Czech Republic. In states with higher nitrogen or phosphorus emissions (Romania, especially in terms of nitrogen, Turkey, Bulgaria, Malta and Portugal), a low proportion of treated water and predominance of primary and secondary treatment stages over the tertiary stage play the main role.

Concerning **connection of the population to WWTPs and respective wastewater treatment stages** (Chart 3) the situation is generally better in the countries of western, southern and northern Europe. The Czech Republic holds the leading positions among the new EU member states in the share of the population connected to sewerage system with a WWTP and in the proportion of tertiary treatment. The situation gradually improves in Romania and Bulgaria, which have been intensively building the sewerage infrastructure with regard to implementation of the EU legislation since 2007. The percentage of the population connected to WWTPs increased significantly after 2006 in Hungary, too. What is positive is the fact that the proportion of tertiary stage of wastewater treatment increases gradually in most countries. The worst situation in water treatment is in the states of former Yugoslavia and other states of south-eastern Europe, with the exception of Greece. Existence of great regional differences in these indicators between the cities and rural regions is also typical for these countries.

In terms of **water quality in watercourses** (Chart 4), it can be concluded that in 1993–2011, there has been a significant decrease in concentration of phosphorus (i.e. orthophosphates) in rivers (by 56.4% in total) of all regions monitored in Europe. This positive development is mainly brought about by implementation of European and national legislation aimed at reducing pollution discharged in municipal waters, and by introduction of phosphate-free detergents to the market. In the case of nitrates, there was a relatively small decline in average (a total of 17.4%) mainly due to the improvement of wastewater treatment and application of tools to restrict agricultural inputs of nitrogen. In long terms, the lowest orthophosphate and nitrate concentrations are recorded in the rivers of northern Europe, where wastewater treatment is at a very good level and the rivers flow through less populated areas or mountain areas. Recently, the highest orthophosphate concentrations are identified in southern Europe (data for Spain), where there is a significant share of areal pollution from agriculture, and in south-eastern Europe (data for Bulgaria) where high phosphorus emissions from households and the processing industry have their influence. Within the European context, the situation regarding eutrophication of flowing and stagnant waters in the Czech Republic continues being unsatisfactory and it is necessary to go on reducing the burden on water with nutrients, especially compounds of phosphorus. The decline in nitrate pollution was not as significant as that of orthophosphates. In the south, and in the past two years also in south-eastern of Europe there was even an increase of this type of pollution. The highest level of nitrate contamination has been recorded in the rivers of western Europe. The pollution reaches the levels similar to those recorded in watercourses in the Czech Republic. The reason consists in the concept of intensive agricultural production and high population density in the given areas. Agriculture is therefore the largest contributor to nitrate pollution in the whole of Europe and the Czech Republic.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1763)

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[1] *The WEI index (Water Exploitation Index) expresses lack of water and describes the pressure that the total abstraction of water exerts on water resources (calculated as proportion of the total water abstraction to the volume of renewable water supplies). It therefore identifies the countries which have, given their own resources, high abstraction and are therefore prone to water shortage (water stress). The WEI warning threshold, which separates regions with enough water and water shortage, is a value around 20%. There can be serious water shortage if the value of WEI exceeds 40%. The WEI index is used in assessments by international organisations such as UNEP, OECD or Eurostat. The WEI map of Europe is available in the indicator's detailed evaluation.*

Biodiversity[1]

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

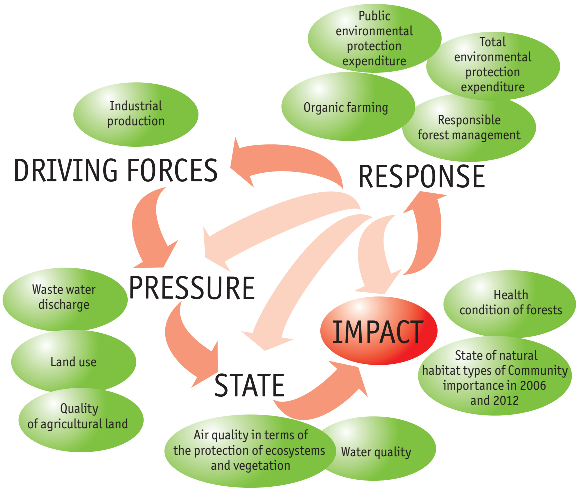
KEY QUESTION ➔

What is the state and development of animal and plant species of Community importance[2] in the territory of the Czech Republic?

KEY MESSAGES ➔

☺ Within comparison of 2006 and 2012 evaluations, it is possible to conclude a generally improving state of animal and plant species of Community importance. In 2007–2012, 25.3% of animal and plant species of Community importance were marked as species in a favourable state in terms of protection; on the other hand, only 18.9% of all species were in this state in 2000–2006.

☹ According to the results of 2006 assessment (a total of 36.7% of the species) as well as those from 2012 (37.0%), a significant proportion of animal and plant species of Community importance was marked in terms of protection as species in an inadequate state; 31.5% of important animal and plant species were classified as species in an unfavourable (bad) state in 2007–2012.



OVERALL ASSESSMENT ➔

The state of animal and plant species and habitats of Community importance is evaluated in six-year intervals that are laid down in Directive 92/43/EEC. Assessment of the state was made in 2007 for the period up to 2006 (the beginning of the period was open), and then again in 2013 for the period 2007–2012. The evaluation focuses on monitoring data concerning the state of biotopes and species in the whole territory of the Czech Republic and evaluation of the state of species is based on a large set of activities and projects from systematic mapping to use of citizen science.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

The **Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora** (Habitats Directive) is crucial for the protection and monitoring of important plant and animal species; according to the Directive, sites of Community importance are established and together with SPAs, they form the European network Natura 2000.

The main policy framework is formed by the Communication from the European Commission on the EU Biodiversity Strategy to 2020 of May 2011, which was also a subject of the European Parliament resolution of 20th June 2012. Evaluation of the state of species and natural communities in terms of protection is an essential element in evaluation focused on implementation of the strategy's objectives, especially objective 1, which sets the proportion of biotopes and species for which it is necessary to achieve a favourable or improving state.

The **Convention on Biological Diversity** of 1992 (CBD) sets a general framework for biodiversity protection; its main objectives are the conservation of biological diversity including halting its loss, sustainable use of its components and fair sharing of the benefits arising from utilization of genetic resources. At the EU level, these objectives are specified in more detail in other strategic documents such as the **Renewed EU Sustainable Development Strategy**, which aims at ensuring the Earth's ability to sustain life in all its diversity.

Within the thematic area Nature and Landscape Protection, the **State Environmental Policy of the Czech Republic 2012–2020** sets the objectives to ensure the protection and care of the most valuable parts of nature and landscape, preventing the loss of native species and reducing the negative impacts of non-native invasive species on biodiversity.

Protection of ecosystems and natural habitats, including maintenance and recovery of viable populations of species in their natural environment, is also emphasized in the **National Biodiversity Strategy of the Czech Republic**. The **State Nature and Landscape Protection Programme of the Czech Republic** aims at maintaining a sufficiently numerous population of indigenous wild plant and animal species and minimising the risks related to introduction of new invasive and non-native species.

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[1] *The chapter does not cover the thematic area of biodiversity in its entirety. In relation to financial resources available to the Ministry of Environment, the possibility of including additional indicators to assess the state of biodiversity and landscape based on the objectives of the State Environmental Policy of the Czech Republic (2012–2020) or the standard indicator sets used within the EU to assess biodiversity (SEBI indicators) is limited.*

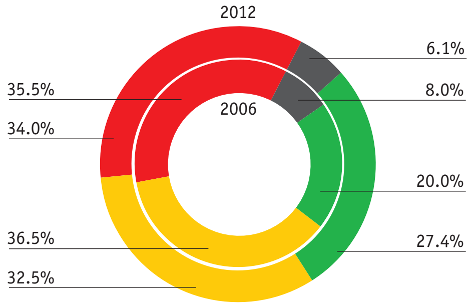
[2] *Species in the interest of the European Community (i.e. species of European importance), are the species on European territory of the EC member states which are endangered, vulnerable, rare or endemic and which are laid down in the EC legislation. The indicator does not evaluate all species but only those specified in the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora). From the perspective of the Habitats Directive, bird species are not important species because they have, according to the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds), a completely specific position and a separate assessment system. According to the state of animal and plant species of European importance, it is possible to roughly evaluate the general state of species in the Czech Republic, even though the indicator deals only with species of European importance. For such an approximate evaluation, the group of species of European importance represents in fact a set of indicator species, on which maximum amount of information is collected. No similarly large and distinct group of species is evaluated.*

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

A favourable state of major animal and plant species is important not only to ensure biodiversity of the ecosystems, but also to ensure all ecosystem services that humans use amply within their existence. Unfavourable (inadequate and bad) state of major species has resulted in reduced ecological stability of landscape and limited genetic resources, which translates into the production abilities of agricultural and forestry landscape. The unfavourable state of major animal and plant species is reflected especially in the regulating, provisioning and supporting ecosystem services and it also affects cultural and aesthetic features of landscape, thus influencing the quality of human life.

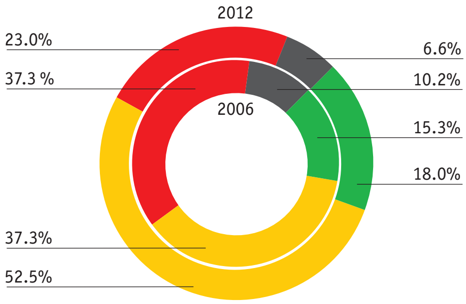
INDICATOR ASSESSMENT

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



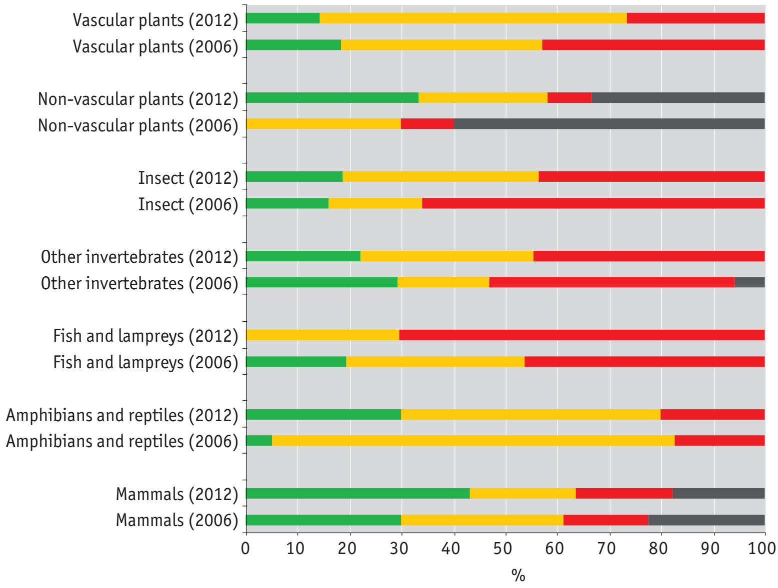
Source: Nature Conservation Agency of the Czech Republic

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

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

The **overall status** of each species, which is determined separately for both biogeographical areas of the Czech Republic, i.e. the continental zone, covering most of the territory, and Pannonian zone in south-eastern Moravia, consists of four separate parameters: the range, population, habitats and supposed development. If one of these parameters is assessed as unfavourable, the overall status of the species is also assessed as unfavourable.

The indicator reflects the state of species diversity in the Czech Republic[3] while a growing number of species can be assessed within some of the IUCN endangerment categories. Primarily, it shows the relative proportions of the overall species evaluation (provided for by the Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora), according to a standard scale.

In the **Czech Republic**, the status of approximately one-third of **animal species of Community importance** is assessed as unfavourable-bad and one-third as unfavourable-inadequate and their habitats are probably more or less disrupted (Chart 1). It is quite difficult to document any direct link to the type of habitat. The most endangered species include species found in natural watercourses (which have been affected by regulations and changes in watercourse dynamics), species that are tied to old and decaying wood (which is much less abundant in Czech woods), and groups of species that are tied to a fine landscape mosaic (butterflies, amphibians and reptiles). According to the 2007–2012 monitoring, 27.4% of animal species of Community importance were in a favourable state in terms of protection in the Czech Republic while mammals comprised the biggest proportion of the species with favourable status. The evaluated species of Community importance also include several species that were newly identified in the last six-year period in the Czech Republic's territory, e.g. golden jackal, several bat species, Balkan goldenring, moss species Orthotrichum rogeri, round notothylas.

Only 18.0% of **plant species of Community importance in the Czech Republic** are in a favourable state in terms of protection. 52.5% of plant species of Community importance are assessed as being in an unfavourable-inadequate status and 23.0% are in an unfavourable-bad status and their habitats are probably more or less disrupted (Chart 2).

Within comparison of 2006 and 2012 evaluations, a **generally improving state** can be pronounced. The number of inadequate and bad statuses declined between the two years (Chart 1 and Chart 2).

However, it has to be noted that improvement of the evaluation results was based on methodology rather than facts as the improvement of the plant and animal species' statuses was rarely a result of active interventions. A favourable status of species is usually a reflection of a favourable situation of the habitats or species, which are currently spreading even further in some cases at present.

INDICATOR ASSESSMENT ACCORDING TO TAXONOMIC GROUPS

Analogically to the overall indicator, sub-indicators of **animal species** of Community importance have been defined for the taxonomic groups of monitored animals – mammals, amphibians and reptiles, fish and lampreys, and other invertebrates and insects (Chart 3). Under the Habitats Directive, birds are not species of Community importance as they have a quite special position based on the Birds Directive; that is why birds are not subject to evaluation according to the European evaluation reports.

According to the results of 2007–2012 monitoring, fish and lampreys (Chart 3) show a substantially worse evaluation among these groups as 70.4% of these evaluated species are in an unfavourable status. Inappropriate watercourses regulation and water pollution are the most significant endangerment factors for these species. In this evaluation, insects and other invertebrates show an unfavourable status which is higher than 40%. Within these groups, there is a wide range of species that are tied to the above-mentioned types of endangered biotopes, ranging from structurally (in terms of age and species) rich forests and solitary trees to heterogeneously managed non-forest habitats and largely unaltered aquatic habitats. This is mainly due to the different approach to selecting species included in the species of Community importance. The highest proportion of the favourable status has been achieved in case of mammals, namely 43.2%, due to the inclusion of a greater number of species that are mainly endangered in Western (i.e. considerably more urbanized and fragmented) Europe.

Based on a comparison of both monitorings, it is evident that there has been a positive change. Between the two evaluations, the proportion of unfavourable status for insects and other invertebrates has declined significantly and the favourable proportion increased in case of mammals and amphibians and reptiles. On the other hand, the status worsened only for fish and lampreys between the two evaluations (Chart 3).

Partial sub-indicators for the systematic groups of monitored **plants** – vascular and non-vascular – have also been defined (Chart 3). In the case of non-vascular plants (species of Community importance include lichens and bryophytes), the fact that the group has only been studied to a limited extent has the greatest effect (a high proportion of the "unknown" category), in spite of the fact that this category declined substantially between the two evaluations (from 60.0% to 33.3%). The proportion of the favourable status of non-vascular plants has grown from 0 to 33.3% in the period concerned. Nonetheless, this may be caused by a greater amount of data collected. In case of vascular plants, which have a long tradition of research, there was a significant decline between the two evaluations concerning the proportion of species in an unfavourable state towards a better-evaluated category of inadequate status (Chart 3).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1838)

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[3] *Based on the state of plant and animal species of Community importance, the overall state of plant and animal species in the Czech Republic can be assessed even though the indicator only deals with species of Community importance.*

13/ State of natural habitat types of Community importance in 2006 and 2012

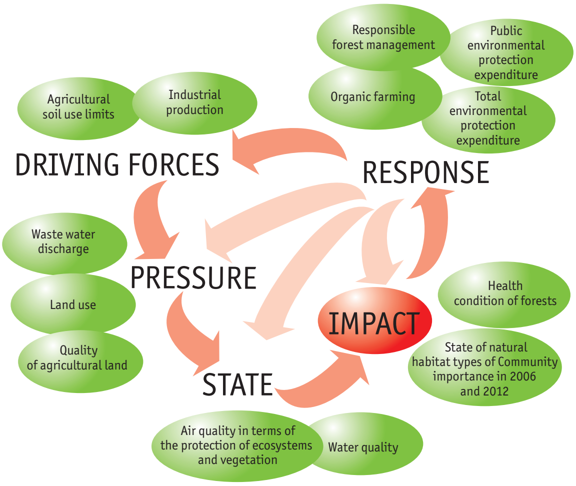
KEY QUESTION ➔

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

KEY MESSAGES ➔

🙂 On the basis of a comparison of the 2000–2006 and 2007–2012 evaluations, a conclusion can be made that the status of natural habitat types of Community importance improved in the Czech Republic. Unfavourable statuses decreased from 74.7% to 27% and the number of favourable evaluations grew from 11.6% to 16.1%. However, the significant improvement in the state is caused by a methodology change in one of the evaluation parameters.

🙁 In 2007–2012, more than half of habitat types of Community importance in the Czech Republic were assessed as habitats in the inadequate status in terms of protection; 26.9% were in the unfavourable status.



OVERALL ASSESSMENT ➔

The statuses of natural habitat types of Community importance are evaluated in a six-year period laid down in Directive 92/43/EEC. Assessment of the states was carried out in 2007 for the period till 2006 (the beginning of the period was open), and again in 2013 for the period 2007–2012. The assessment is based on evaluation of data concerning the statuses of biotopes and species monitored in the whole territory of the Czech Republic. Concerning natural habitats, the assessment is based on an analysis of the data collected within biotopes mapping which covers the whole of the Czech Republic (organised by the Nature Conservation Agency of the Czech Republic).

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

The **Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora** (i.e. the Habitat Directive) is of crucial importance for the protection and evaluation of natural habitat types of Community importance. Sites of Community Importance (SCI) and special protection areas (SPA) for birds that together form Natura 2000 network were identified pursuant to the Directive.

The main policy framework is formed by the Communication from the European Commission on the EU Biodiversity Strategy to 2020 of May 2011, which was also a subject of the European Parliament resolution of 20th June 2012. Evaluation of the statuses of species and natural communities in terms of protection is an essential element in evaluation focused on implementation of the Strategy's objectives, especially objective 1, which sets the proportion of biotopes and species for which it is necessary to achieve a favourable or improving state.

The general framework for biodiversity protection is provided by the **Convention on Biological Diversity**. Its main objectives are the conservation of biological diversity (incl. halting its loss), the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising from the utilization of genetic resources. At the EU level, these objectives are specified in more detail in other strategic documents such as the **Renewed EU Sustainable Development Strategy**, which aims at ensuring the Earth's ability to sustain life in all its diversity.

At the national level, other important strategic documents include the **National Biodiversity Strategy of the Czech Republic** that aims – among other things – at protecting ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment. The **State Nature Conservation and Landscape Protection Programme of the Czech Republic** aims at maintaining and improving ecological stability of landscape, ensuring the sustainable use of landscape and ensuring adequate care for the optimised system of specially protected areas and a well-defined territorial system of ecological stability which preserve both biological diversity and functioning of natural processes.

Within the thematic area Nature and Landscape Protection, the **State Environmental Policy of the Czech Republic 2012–2020** sets the objectives to increase ecological stability of landscape, to ensure the protection and care of the most valuable parts of nature and landscape and to restrict the decline of natural habitats.

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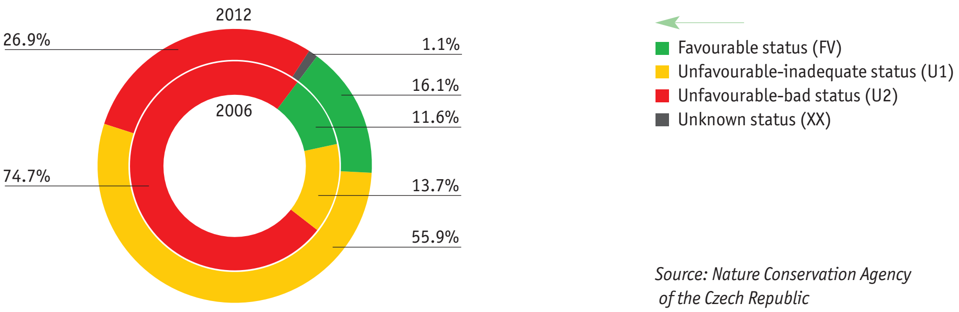
[1] *Natural habitat types of Community interest ("European habitats") are natural habitats in the European territory of the European Community member states which are in danger of disappearance in their natural range, have a small natural range following their regression or by reason of their natural qualities or which represent outstanding examples of typical characteristics related to one or more biogeographical regions that are defined by European Community legislation. In case of the Czech Republic, this concerns a total of 60 evaluated habitat types that are mapped and interpreted at the national level by means of fines units, i.e. biotopes.*

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The statuses of different natural habitat types affect the size and density of the population of the single species that are bound to them and thus they influence the general ecosystems biodiversity. The unfavourable statuses of natural habitats decrease ecological stability of landscape, resulting in disruption of ecosystem services that are essential for human society. Humans take advantage of not only supplying, supporting and regulating services; their health is stimulated positively by cultural functions as well (aesthetic value and recreational potential of landscape, etc.).

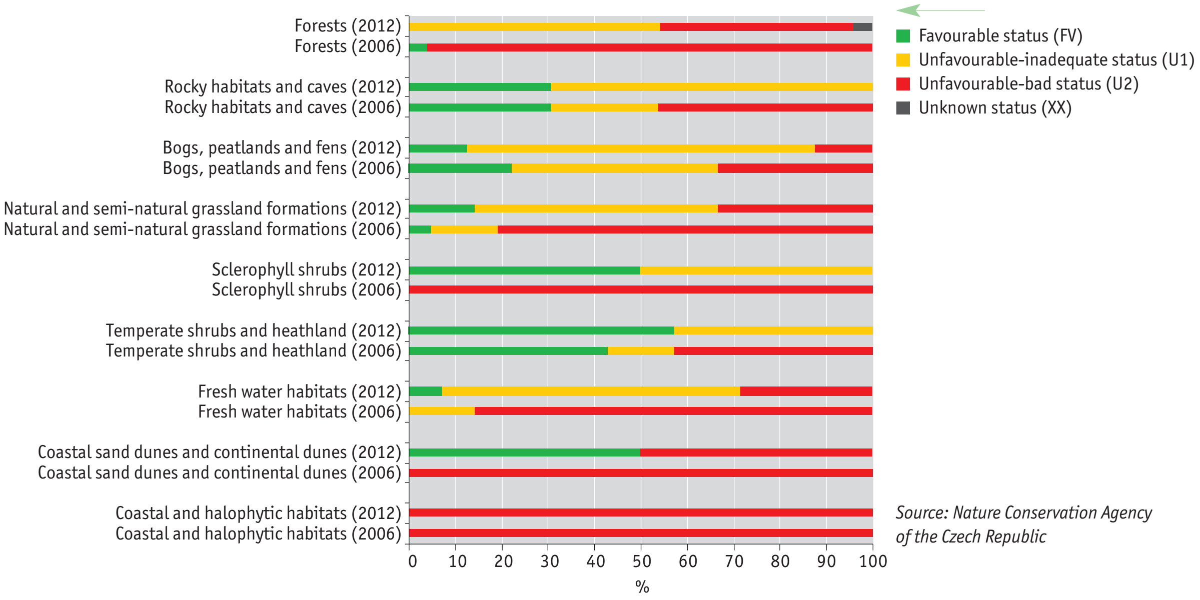
INDICATOR ASSESSMENT

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



Source: Nature Conservation Agency of the Czech Republic

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



Source: Nature Conservation Agency of the Czech Republic

Based on the state of **natural habitat types of Community importance**, the general state of natural biotopes in the Czech Republic can be assessed, even though the indicator only deals with habitat types of Community importance[2].

The **overall status** of each natural habitat type, which is determined separately for both biogeographical areas of the Czech Republic, i.e. the continental zone, covering most of the territory, and Pannonian zone in south-eastern Moravia, consists of four separate parameters: the present area, potential range, structure and function and supposed development. If one of these parameters is assessed as unfavourable, the overall status of the habitat is also assessed as unfavourable.

In **2000–2006**, the range, area and supposed development were mostly assessed as favourable and less favourable. 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 pressure. In 2000–2006, a total of 95 natural habitat types were assessed – 11.6% of them had a favourable status, 13.7% of them had a less favourable status and 74.7% of natural habitat types were in an unfavourable status. In **2007–2012**, there has been a positive change; in total 93 natural habitat types were evaluated, and unlike the previous period, the unfavourable statuses decreased to 26.9%. In the category of favourable status, there was an increase to 16.1% as opposed to the previous period (Chart 1).

In the Czech Republic, assessment was unfavourable for habitats that are not very large (juniper pastures, coastal and halophytic habitats) and for forests in **2000–2006**. On the other hand, the assessment was relatively most favourable for heaths, rocky habitats, peatlands and fens in this period (Chart 2). In **2007–2012**, small-area coastal and halophytic habitats again were given unfavourable evaluation. By contrast, temperate shrubs and heathland were assessed as being in the most favourable state. There was improvement between both evaluations because e.g. the proportion of unfavourable status decreased by a half for coastal sand dunes and continental dunes. A similarly positive change took place in case of forests, rocky habitats and caves and also natural and semi-natural grassland formations (Chart 2).

However, it has to be noted that improvement of the evaluation results was based on methodology rather than facts. The improvement of the habitats' statuses was only rarely a result of active interventions. A favourable status is usually a reflection of a favourable situation in the biotopes; however, in a number of cases, more favourable evaluation is based on a greater amount of collected data.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1839)

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[2] *An identical assessment of the state of natural habitats cannot be applied at the national level because of non-existence of such an indicator.*

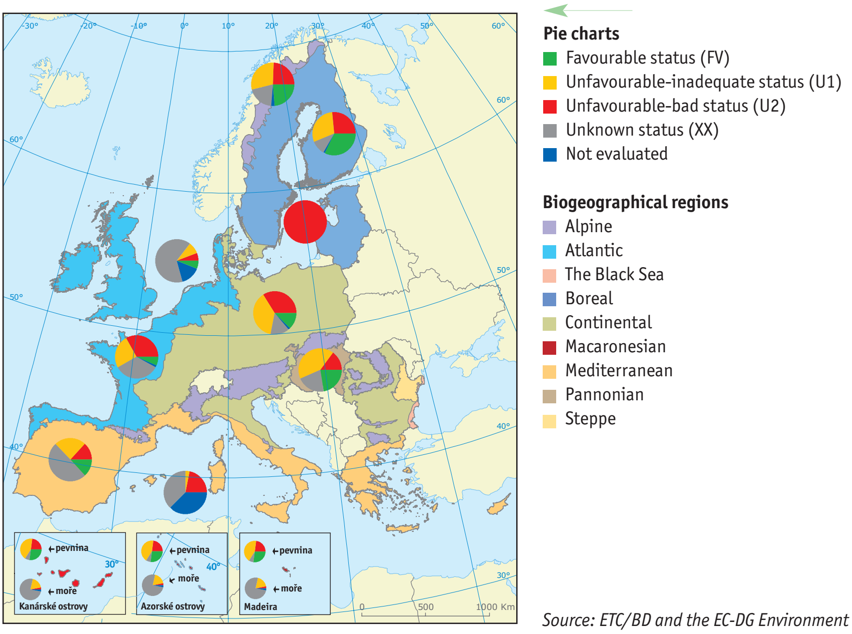
Biodiversity in the European context

KEY MESSAGES →

- → Approximately a half of important plant and animal species were included in the unfavourable status in the EU25 in 2000–2006. From a pan-European perspective, the situation in the Czech Republic is at the average level in the case of important animal and plant species and also in the case of important natural habitat types. The evaluation is unfavourable for habitats that are not very large and for forests.

INDICATOR ASSESSMENT

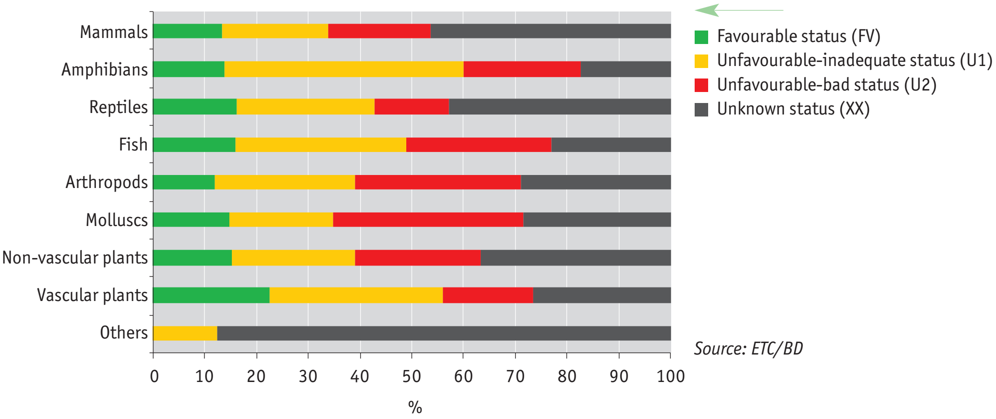
Figure 1 → **Comparison of the overall state of species of Community importance according to bio-geographical areas, 2000–2006**



Source: ETC/BD and the EC-DG Environment

Data for the period 2007–2012 are not, due to the methodology of their reporting, available at the time of publication.

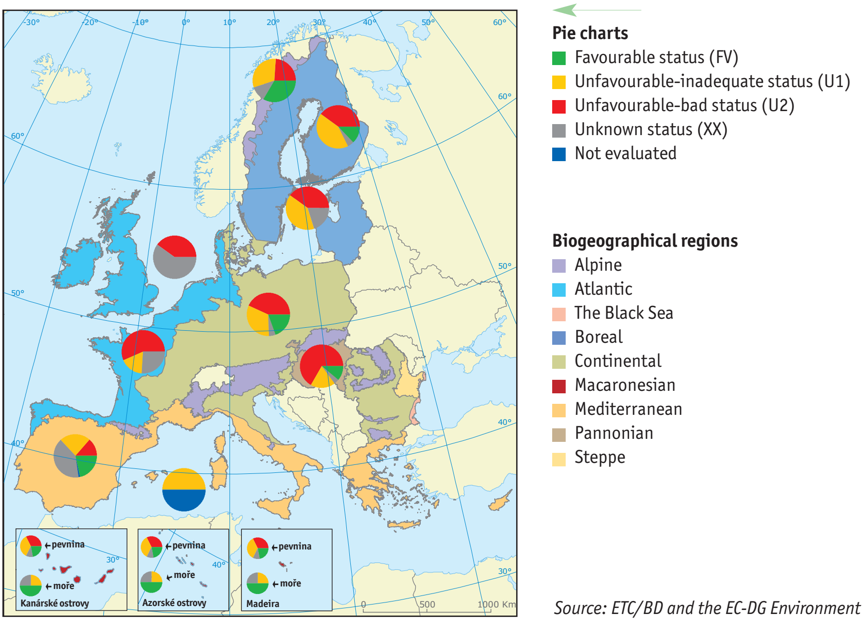
Chart 1 → **State of animal and plant species of Community importance according to taxonomic groups [%], 2000–2006**



Source: ETC/BD

Data for the period 2007–2012 are not, due to the methodology of their reporting, available at the time of publication.

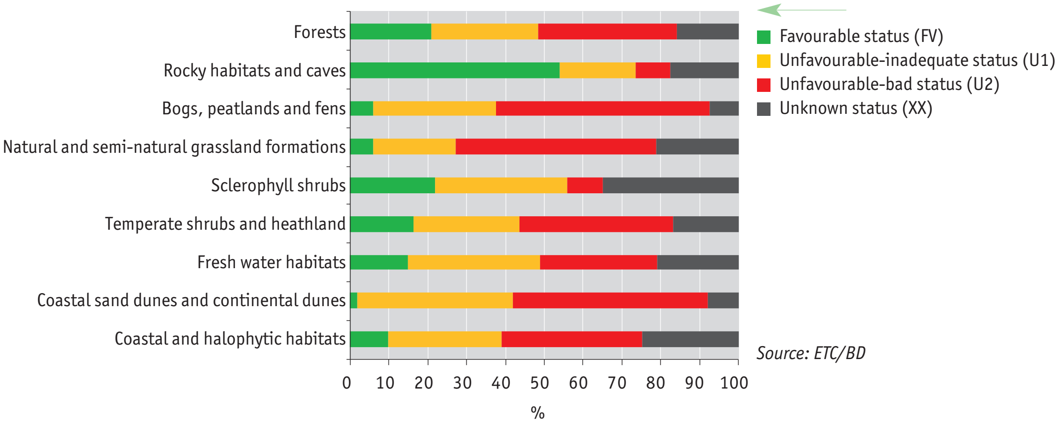
Figure 2 ➜ **Comparison of the state of natural habitat types of Community importance according to bio-geographical areas, 2000–2006**



Source: ETC/BD and the EC-DG Environment

Data for the period 2007–2012 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 ➜ **State of natural habitat types of Community importance in the EU25 according to individual formation groups [%], 2000–2006**



Source: ETC/BD

Data for the period 2007–2012 are not, due to the methodology of their reporting, available at the time of publication.

From the international perspective, the statuses of animal and plant species, as well as those of natural habitats that are important to the European Community, can be compared on several levels; at the interstate level, at the level of bio-geographical areas, and possibly at the European-wide level.

In 2000–2006, approximately a half of important animal and plant species in the EU25 were assessed as being in an unfavourable status and it is possible to see substantial differences between the single biogeographical areas (Figure 1). The unfavourable status of the important species occurs most in the Baltic and continental biogeographical regions. From the European perspective, amphibians and non-vascular plants were threatened most in this period, likewise in the Czech Republic in the given period (Chart 1). The status of species of Community importance in the Czech Republic reflects the European-wide trend and shows average results at this level.

Within the whole of Europe, the statuses of natural habitat types of European importance are very variable; a relatively high proportion of favourable status was recorded for habitats in the Alpine region, by contrast, there is unfavourable status in important habitats of the Atlantic area. The status of natural habitat types of Community importance in the Czech Republic reflects the European-wide trend and shows average results at this level (Chart 2). Coastal sand dunes and continental dunes belong to the most endangered habitat types in the European context (approximately 90% of the habitats were in an inadequate and unfavourable statuses in 2000–2006); on the other hand, rocky habitats and caves showed the favourable status (Chart 2).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1764)

Forests

14/ Health condition of forests

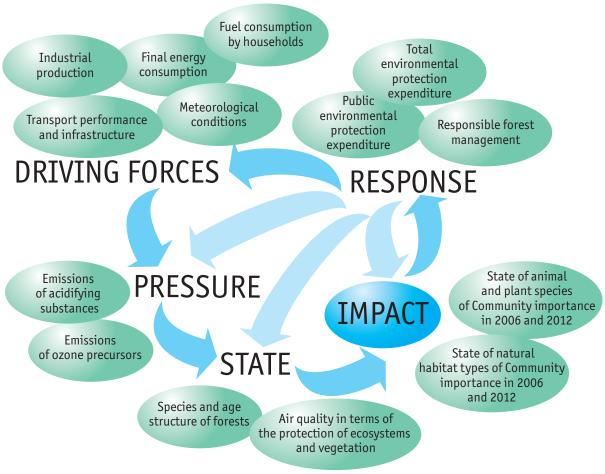
KEY QUESTION ➔

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

KEY MESSAGES ➔

🙂 Damage to forest stands in the Czech Republic expressed as the percentage of defoliation[1] is not progressing as fast as it was in the past. This is a result of several factors. This can definitely be considered as a response of forest stands to air pollution improvement in the last two decades; the long-term efforts to change the species composition of forest stands also has positive impacts on the stands' health condition.

☹ The defoliation rate remains very high in the Czech Republic The proportion of older conifers (over 60 years) that belong to defoliation classes 2 to 4 was 77.4% in 2013; for older deciduous trees this was 48.8%. In younger stands, the situation is more favourable – the proportion is 21.5% for younger conifers (below 59 years) and 16.6% for younger deciduous trees. After improvement of the state at the end of 1990s, there was again a trend after 2000 showing more deterioration of the forest stands' health condition, although annual fluctuations in the defoliation level are attributed to short-term effects of biotic and abiotic factors that are significant in the given 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 AND STRATEGIC DOCUMENTS ➔

The **EU Forest Action Plan** for 2007–2011 aims mainly at supporting and strengthening sustainable management in forests and their multifunctional role.

One of the partial objectives of the environmental pillar of the **National Forestry Programme for the period until 2013** aims "to improve the health condition and protection of forests" by limiting clearings, supporting and implementing nature-friendly management methods and supporting a natural and nature-friendly renewal of the composition of tree species. Other partial objectives include "to reduce the impacts of global climate change and extreme meteorological phenomena", "maintain and improve biodiversity in forests" and "develop forest monitoring".

The Forest Ecosystems part of the **National Biodiversity Strategy of the Czech Republic** aims at specifying the current issues of forest ecosystem renewal in areas that were exposed to increased pollution in the past while using the results of research into and monitoring of the impacts of pollution on forest and forest soil to date. In addition, it is also necessary to prepare a strategy for further abating the impacts of adverse processes on forest biodiversity.

Another important document is the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** that defines 12 measures aimed at increasing species diversity of forest stands towards a natural species composition, enhancing the structural diversity of forests, naturally renewing species that are genetically suitable and at improving the non-production functions of forest ecosystems.

The **ICP Forests programme**, which is part of the CLRTAP convention, is important from the international perspective. The programme focuses on assessing and monitoring the impacts of air pollution on forests. Another document of international importance is **FutMon** (Further Development and Implementation of an EU-level Forest Monitoring System) project that is being implemented under the **LIFE+ programme** and aims at developing a long-term forest monitoring system.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

Healthy forests are important not only due to sustainable production of wood and other material goods but also due to fulfilment of non-productive functions (soil protection against erosion, support to water cycle, nature conservation, air quality control, floods and drought control, health-related and sanitary functions, recreational and spiritual functions). That is why declining health condition of forests influences not only ecosystems and the species living in them but also the whole human society.

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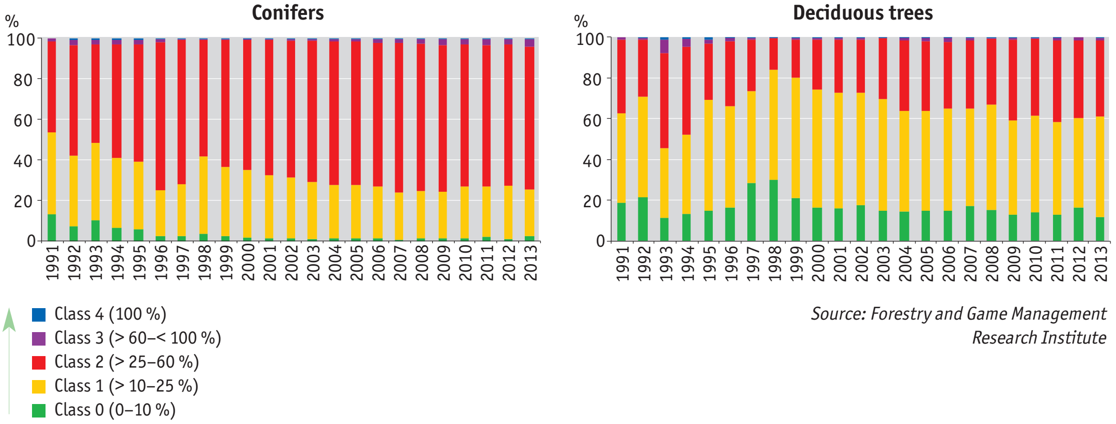
[1] *Defoliation levels are divided into five basic classes, of which the last three characterize significantly damaged trees: 0 – no defoliation (0–10%); 1 – slight defoliation (>10–25%); 2 – moderate defoliation (>25–60%); 3 – severe defoliation (>60–100%); 4 – dead trees (100%).*

INDICATOR ASSESSMENT

Chart 1 → **Defoliation of older conifers and deciduous trees (stands over 60 years of age) in the Czech Republic according to classes [%], 1991–2013**

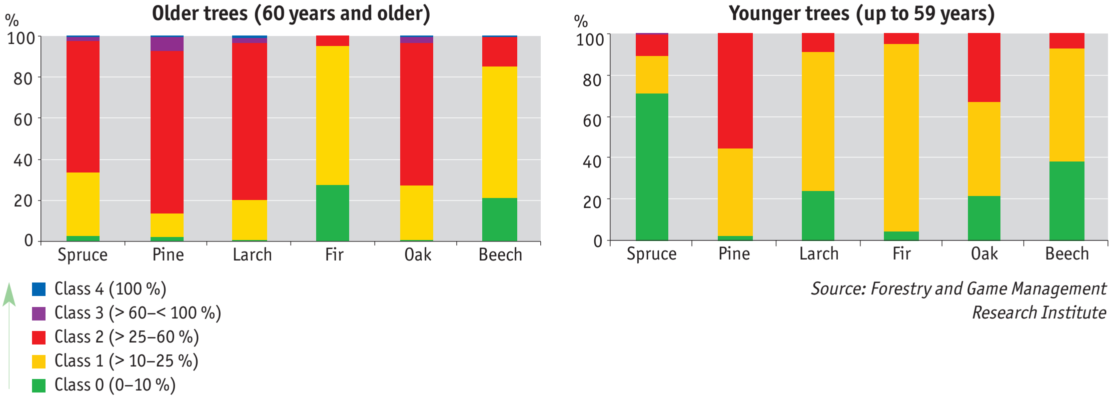


Source: Forestry and Game Management Research Institute

Chart 2 → **Defoliation of younger conifers and deciduous trees (stands up to 59 years of age) in the Czech Republic according to classes [%], 1998–2013**

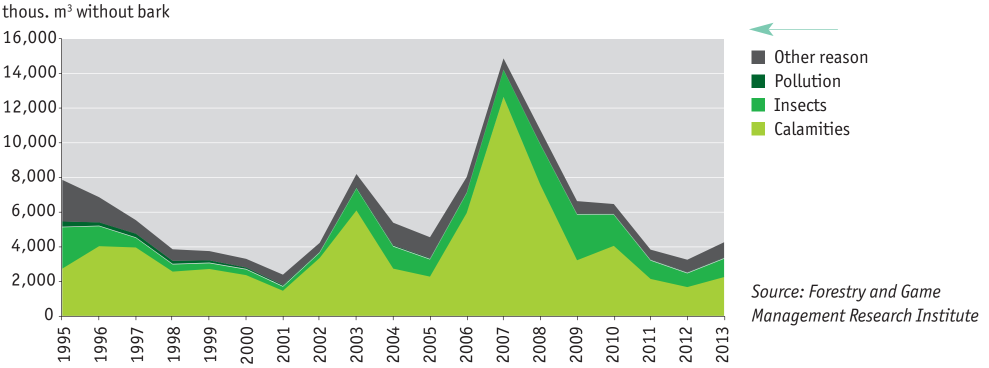
Source: Forestry and Game Management Research Institute

Chart 3 → **Defoliation of basic tree species in the Czech Republic by classes [%], 2013**



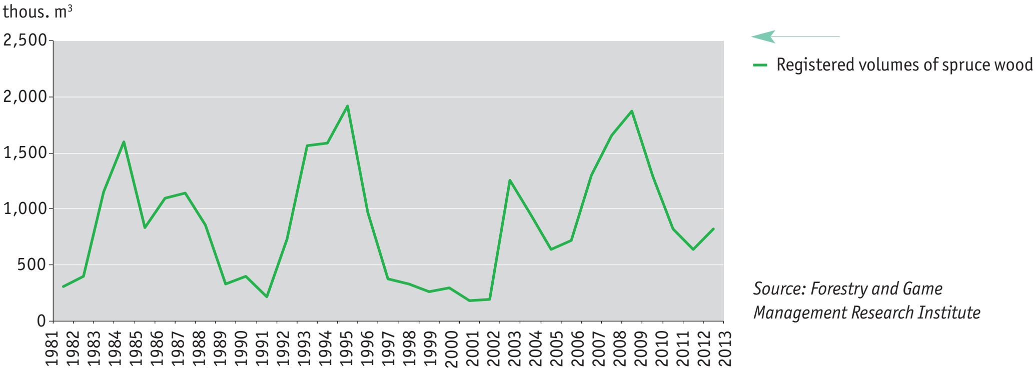
Source: Forestry and Game Management Research Institute

Chart 4 → **Salvage felling by causes in the Czech Republic [thous. m³ without bark], 1995–2013**



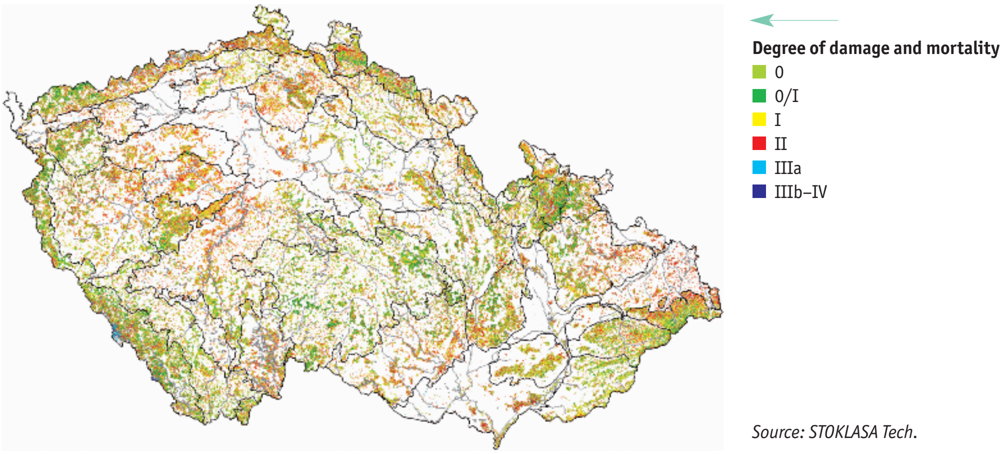
Source: Forestry and Game Management Research Institute

Chart 5 → **Registered volumes of spruce wood affected by bark beetle in the Czech Republic [thous. m³], 1981–2013**



Source: Forestry and Game Management Research Institute

Figure 1 → **Dynamics of forest stands' health conditions in the Czech Republic, 2001–2012**



Source: STOKLASA Tech.

The indicator assesses the health conditions of trees in the respective stands divided into groups of older (60 years and older) and younger trees (below 59 years), both for conifers and broadleaves. The health condition of trees is characterised by the defoliation percentage which is defined as a relative loss of the assimilatory system in a tree crown compared to a healthy tree that is growing under the same conditions in terms of stand and habitat. Defoliation levels are divided into five basic classes (0 to 4), of which the last three (2 to 4) characterise significantly damaged trees.

In **older stands (60 years and older)**, there was a significant increase in defoliation in late 1980s and in the first half of 1990s (Chart 1). After a period of relative stabilisation at the turn of the century, which is attributed to the response of forest stands to positive environmental changes (mainly the reduced pollution load), deterioration of the state is observed in the last decade again. This trend is more significant for coniferous trees which show an increasing long-term representation in defoliation classes 2 and 3 at the expense of classes 0 and 1. As far as deciduous trees are concerned, the situation is a little bit more stable; however, there is a long-term prevailing trend of growing percentage in class 3. In 2000, this concerned 24.7%, in 2005 it was 34.0%, in 2010 as much as 37.8%, and in 2013 it was 37.4% at the expense of classes 0 and 1. In general, broadleaves are more resistant to defoliation due to their complete renewal of the assimilatory system every year.

Within evaluation of individual tree species, the situation is least favourable for pine (in 2013, more than 86.5% of the trees in the monitored areas were in classes 2 to 4), followed by larch (79.9%) and spruce (66.6%). Concerning deciduous trees older than 60 years, significant defoliation has been recorded for oak (a total of 73.0% of evaluated trees were in classes 2 to 4 in 2013).

The bad health condition of older forest stands is the result of strong air pollution load of forest ecosystems in the past decades. Although the environment improved and air pollution decreased as a result of general desulphurisation taking place since the mid 1990s, forest stands respond to these changes with a considerable delay. In addition, the air pollution load still continues though its intensity is provably lower. The chemical composition of air pollution has changed, too. Older stands have been substantially influenced by low air quality since their early stages of growth. Moreover, many of these stands are characterized by unsuitable species composition and that is why their health conditions remain unsatisfactory.

In **younger stands (below 59 years)**, the situation is more favourable at first sight (Chart 2). A generally lower defoliation level in comparison with the older stands is due to the fact that the younger stands have higher vitality and ability to resist to unfavourable environmental conditions. Another reason which must not be omitted consists in a significantly lower environmental burden than in the past. Defoliation in stands under 59 years of age has been evaluated only since 1998, that is why the situation in the first half of 1990s cannot be assessed. After 2000, deterioration of health condition has been observed in these stands, too. It mainly concerns an increase in classes 2 and 3 at the expense of classes 0 and 1 (conifers for the period 2000–2008 by 14.1%, broadleaves by 9.8% in the same period). A change in the trend can be seen after 2008 when in both categories, i.e. for both conifers and broadleaves, there is a decline in classes 2 and 3. However, it is necessary to wait if the positive development continues in the next years before a statement confirming a long-term health condition improvement trend can be pronounced.

Within evaluation of individual coniferous species, the situation is least favourable for pine again (55.6% in class 2 or higher in 2013). In case of spruce, the values are much better for younger stands as opposed to older ones (only 10.8% in classes 2 and 3). Concerning deciduous stands, it is especially oak (33.3% of trees in class 2 or higher in 2013) which takes part in a higher level of defoliation in the younger category, too.

Along with ground-level health condition monitoring which uses defoliation assessment, remote sensing methods by means of satellite imagery have also been used in long terms in the Czech Republic. The data collected from remote sensing contain information allowing to assess the state of vegetation, especially the quantity of assimilation system in tree crowns and its general physiological condition. The evaluated data describe the stands' general health condition. Nonetheless, the specific causes, e.g. air pollution, biotic pests, unsuitable silvicultural measures or climate changes etc., cannot be identified from these data.

For the purposes of defining zones of forest endangerment, maps of dynamics of the forests' health conditions have been created (Figure 1). The dynamics represents an estimation of the maximum values of damage that can be expected in the given site if the overall effects on forest stands recur in the next period in an extent similar to the one in the previous period.

A direct consequence of the forests' bad health condition consists in their reduced ability to resist environmental impacts. Damage caused by biotic and abiotic effects raises the need for salvage felling (Chart 4). In long terms, abiotic factors, especially wind, frost, snow and drought, are the most important factors which bring about the need for salvage felling. In comparison with the previous year, the share of salvage felling caused by abiotic effects increased by approximately 34% in 2013. Dynamics of insect damage, which is the second most common reason for salvage felling, follows the salvage damage because the stands affected by breakage are a target of insect and fungi infestation in the following season. In the Czech Republic, bark beetle damage is most important of all biotic factors (Chart 5).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1850)

15/ Species and age structure of forests

KEY QUESTION →

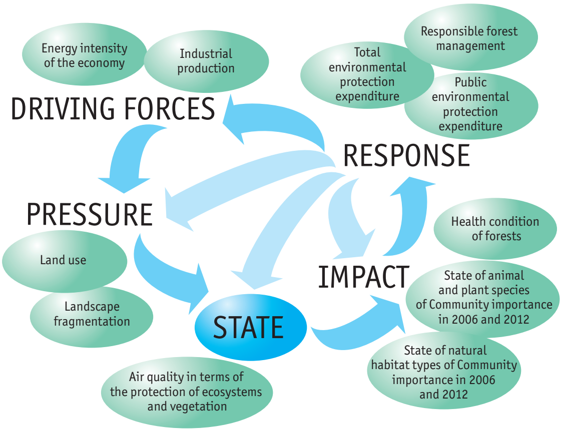
Is the unsatisfactory species and age structure of the Czech Republic's forests changing?

KEY MESSAGES →

🙂 The share of deciduous trees in the total forest area has been growing slowly in the Czech Republic. In long terms, it is possible to observe development towards a favourable change in the species structure towards a more natural (and stable) composition of forest stands, however, true approaching to the natural forest species structure or recommended structure requires many decades of intensive efforts.

☹ The proportion of fir, which is an important part of the natural forest ecosystem and which contributes significantly to maintaining forest stability, has been stable in the total forest area since 1995 (about 1%) even though its share in artificial planting is almost 5%.

😐 The age structure of the Czech Republic's forests is not proportional. In recent years, the area of overmature stands (over 120 years) is growing. On the other hand, this phenomenon, which is considered negative in terms of economy, can have a positive effect in the context of biodiversity conservation.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **EU Forest Action Plan for 2007–2011** aims mainly at supporting and strengthening sustainable management in forests and their multifunctional role.

One of the priorities of the **Strategic Framework for Sustainable Development in the Czech Republic**, "Responsible management in the agricultural and forestry sectors", aims at maintaining and improving biodiversity in forests by means of supporting nature-friendly ways of management and strengthening the non-productive functions of forest ecosystems.

The aims of the **State Environmental Policy of the Czech Republic (2012–2020)** in the area of forestry are to support the increase of the proportion of soil-improving and strengthening tree species within forest regeneration and reforestation, to conserve and use forest gene pools, to support the forest ecosystems renewal in areas affected by air pollution and to apply nature-friendly technologies in forest management.

In its ecological pillar, the **National Forestry Programme for the Period till 2013** aims at "maintaining and improving forest biodiversity", namely by assessing and, in justified cases, by revising the target species structure as an intersection among the economic, ecological and social pillars of the forest. Concerning forests where the nature conservancy significance prevails, it also specifies an intention to manage the forests in order to get closer to natural species structure, to preserve in the landscape the mosaics of stands that have a high biological value, and to support increase of the proportion of rotting wood, logging residues and trees that have gone through natural ageing in the forest.

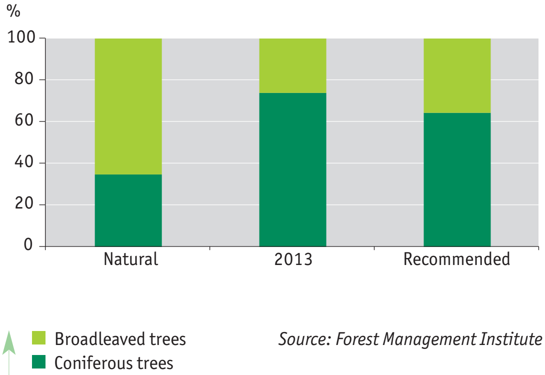
Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic**, which define the objective to increase the forest stands' species diversity towards the natural species structure and to strengthen the non-wood-production functions of forest ecosystems.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The importance of forest stands consists in their ability to fulfil production functions (production of wood and other forest products) and non-production functions (protection against erosion, water regime protection, nature conservancy, recreation, etc.). Even-aged monocultures, a result of planting homogeneous, mainly spruce and pine stands, resist badly to abiotic and biotic influences in long terms; they also suffer from bad health condition and thus they cannot entirely fulfil all their functions.

INDICATOR ASSESSMENT

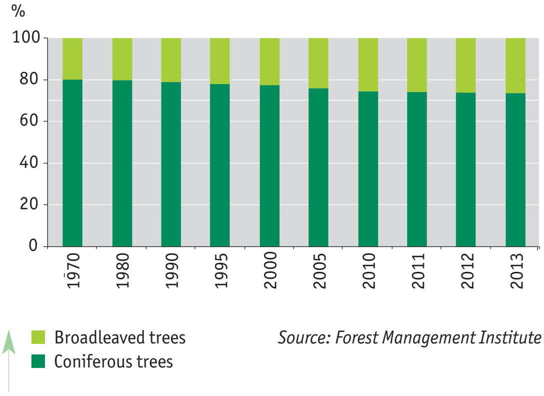
Chart 1 → **Reconstructed natural, present and recommended composition of forests in the Czech Republic [%], 2013**



Source: Forest Management Institute

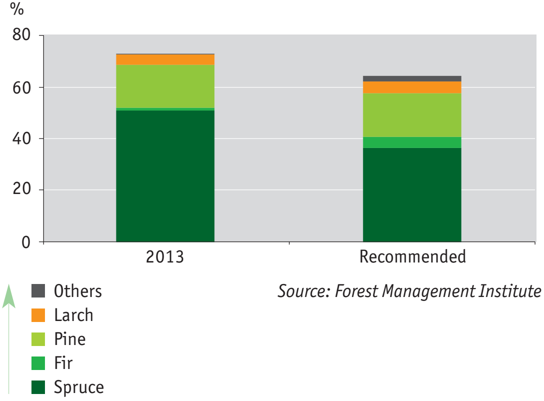
The reconstructed natural composition is close to the climax composition in the time before humans began influencing the forest. The recommended forest composition is a comprehensively optimized compromise between the natural composition and the composition that is most advantageous from the current economic perspective.

Chart 2 → **Development of the proportions of coniferous and deciduous stands in the total forest area in the Czech Republic [%], 1970–2013**



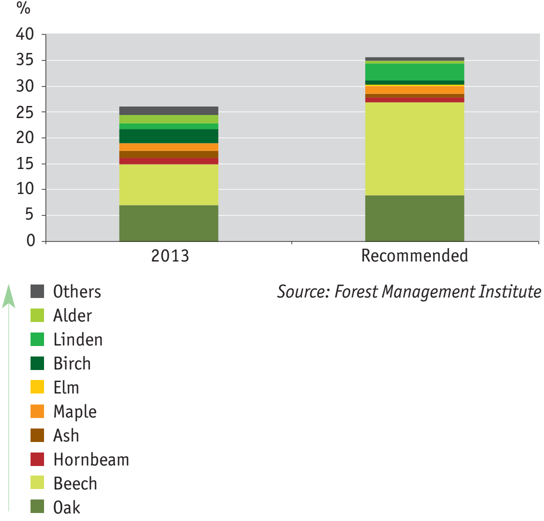
Source: Forest Management Institute

Chart 3 → **Present species structure of coniferous stands in the Czech Republic in comparison with recommended structure [%], 2013**



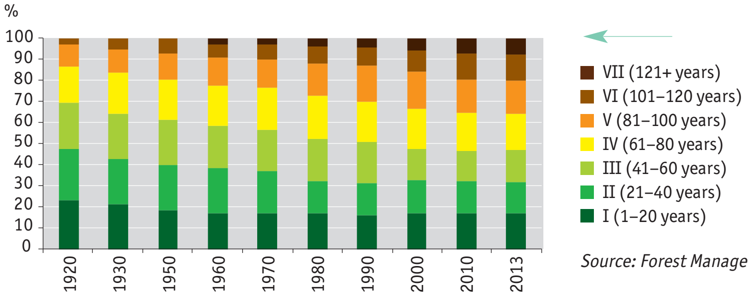
Source: Forest Management Institute

Chart 4 → **Current species composition of deciduous stands in the Czech Republic compared with the recommended composition [%], 2013**



Source: Forest Management Institute

Chart 5 → **Development of age structure of forest stands in the Czech Republic [%], 1920–2013**



Source: Forest Management Institute

The **natural species composition of the Czech Republic's forests** depends mainly on the geological structure, transition between the sub-Atlantic and continental climates as well as on diverse geomorphology. In natural conditions, oak and hornbeam forests prevail in lower altitudes; they change into beech and fir forests and in the top heights, spruce stands dominate. As a result of growing demand for wood as the main energy source, namely by developing industry in particular, fast-growing spruce and pine monocultures were planted in large areas in the second half of 19th and early 20th centuries. As a consequence, the Czech Republic's forests are made up of mostly coniferous stands, often of unsuitable ecotypes. These even-aged monocultures are much more susceptible to damage caused by biotic and abiotic factors.

In the last decades, deciduous tree species (such as beech, oak, maple and rowan trees) have been increasingly used in forest renewal at the expense of coniferous trees (spruce and pine). This results in a targeted and favourable change in species composition towards a more natural (and stable) structure of forest stands (Chart 1). Further development of young forest stands remains problematic, largely due to browsing in locations with excessive hoofed game stock.

The **share of deciduous trees in the total forest area in the Czech Republic** has been growing very slowly, which is, however, a consequence of long rotation period. In 2013, the share accounted for 26.2% of the total forest area (Chart 2). The **proportion of coniferous stands in the Czech Republic's total forest area** fell by 3.6 p.p. in 2000–2013.

The Czech Republic's forests are composed of spruce in more than 50%. However, its proportion in the total area of forest stands has been decreasing in long terms; it declined by 2.9 p.p. in 2000–2013 (Chart 3). Fir, a species important for maintaining forest stability, is an important part of a natural forest ecosystem. The **proportion of fir in the total forest area** has been stable (about 1%) since 1995 although its share in afforestation was growing in the same period and now it amounts to approximately 5%. The failure to increase the proportion of fir in the total forest area is attributed, inter alia, to damage caused by hoofed game.

Deciduous trees are represented mainly by beech whose share in the total forest area rose to 7.8% in 2013. There has been a slower increasing trend in case of oak the proportion of which grew to 7.1% of the total forest area in the Czech Republic (Chart 4).

Beech, oak and fir are represented in most of the target economic sets as soil-improving and strengthening tree species. Their participation in forest ecosystems ensures a number of functions; primarily, they contribute to water regime improvement, create more favourable micro-climate in stands, reduce the stands' susceptibility to pest infestation and increase the forest stands' stability against wind.

The **current composition of the Czech Republic's forests** still differs significantly from both the **reconstructed natural and recommended structure** (Chart 1, Chart 3 and Chart 4). The **recommended structure**, which is a compromise regarding economic interests as well as non-economic functions of forests, assumes reduction in the proportion of coniferous trees (Chart 1), especially spruce in stands in the Czech Republic, by another approximately 15%. At the same time, it assumes an increase in the share of fir from current 1.1% to 4.4% (Chart 3). It also presumes a significant increase in the proportion of deciduous trees, particularly beech (from present 7.8% to 18%), but also oak and linden. By contrast, it assumes reduction in the proportion of birch, elm and alder (Chart 4).

The **age structure of forests** is not proportional in the Czech Republic (Chart 5). Approaching of the actual age structure to what is considered normal[1] is very slow. The area of stands younger than 60 years is below normal; in long terms it should be around 18% in all age classes, which is currently not true in any class. In 2013, 16.8% of the forest land area were recorded in age class 1, 14.9% in age class 2 and 14.8% in age class 3. The reason for the above-described adverse state consists in an increase of forest area at the end of 19th century and in the first half of 20th century; this area was afforested predominantly with monocultures which have been a subject of regeneration in recent decades. On the other hand, the proportion of old and overaged stands in age classes 6 and 7 has been growing in recent years. Their share has been increasing constantly since 1990. This may be caused by a change in forest management methodology applied in protective forests and in specially protected territories, and by postponing the renewal of economically unattractive, less accessible or low-quality stands. This trend, which poses a risk of economic loss on one hand, can be perceived positively in terms of biodiversity preservation on the other. Forest stands of higher age represent a favourable environment for species linked to ecosystems with high percentage of dead wood.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1961)

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

16/ Responsible forest management

KEY QUESTION ➜

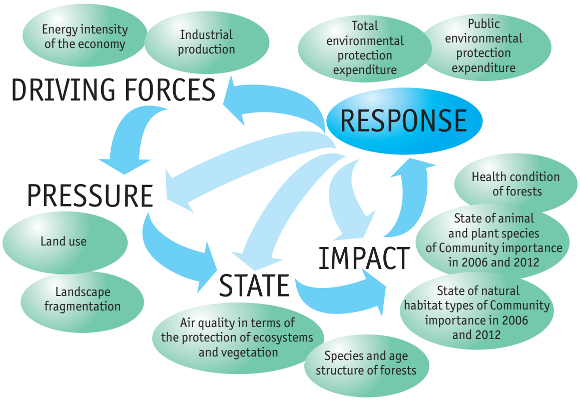
Is forest management developing in accordance with the principles of sustainable development, nature-friendly management methods and strengthening the non-productive functions of forest?

KEY MESSAGES ➜

🙂 The proportion of deciduous trees in the total forest area in the Czech Republic has been rising very slightly but constantly. This is the result of a long-term increase in the proportion of deciduous trees in forest stands regeneration. The area of natural regeneration has also been growing. The total forest stock has been increasing over the long term.

😐 The area of forests certified in accordance with the principles of sustainable forest management according to PEFC peaked in 2006; then there was decline and the current trend can be considered stagnant, although there was a slight increase in the area of certified forests in the last year. The percentage of forest area certified by means of the more environmentally demanding FSC system remains very low (1.9% of the total forest area). The classification of forests into individual categories in terms of their prevailing functions does not show marked changes. A slight decrease in the area of protective forests with natural conditions being relatively constant show that the current possibilities consisting in including forests into the category of protection forests are not fully utilized.

🙁 The efforts to reduce the amount of cloven-hoofed game, which causes considerable damage by browsing the stands under regeneration, are unsuccessful in long terms. This problem is particularly significant for fir because, despite its increasing share within planting, an increase of its overall representation in forest stands is not achieved over a long period.



OVERALL ASSESSMENT ➜

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➜

The **EU Forest Action Plan** for 2007–2011 aims mainly at supporting and strengthening sustainable management in forests and their multifunctional role.

One of the priorities of the **Strategic Framework for Sustainable Development in the Czech Republic**, "Responsible management in the agricultural and forestry sectors", aims at maintaining and improving biodiversity in forests by means of supporting nature-friendly management methods and strengthening the non-productive functions of forest ecosystems.

The aims of the **State Environmental Policy of the Czech Republic** in the area of forestry are to support increase of the proportion of soil-improving and strengthening tree species within forest regeneration and reforestation, to support the forest ecosystems renewal in areas affected by air pollution, to strengthen certification processes within the PEFC system and to apply nature-friendly technologies in forest management.

One of the partial objectives of the environmental pillar of the **National Forestry Programme for the period until 2013** aims at "improving the health condition and protection of forests" particularly by reducing clearcutting, by promoting and implementing nature-friendly management methods and by supporting natural regeneration and species composition. Other partial objectives include "to maintain and improve biodiversity in forests" and "to achieve a balance between the forest and the game".

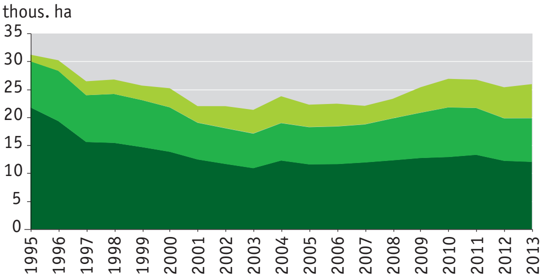
Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic** that aim at increasing biodiversity in forest stands towards a natural species composition, increasing structural diversity, natural renewal of the species diversity in genetically suitable stands and at enhancing the non-production functions of forest ecosystems.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➜

Sound forest management improves the productive and non-productive functions of forests that are important both to forest ecosystems as such and to communities outside forests and all of human society. Increasing the proportion of soil-improving and stabilising tree species improves the water regime, prevents the degradation of forest soils and enhances ecological stability that is important for reducing the impacts of extreme weather events and the climate change.

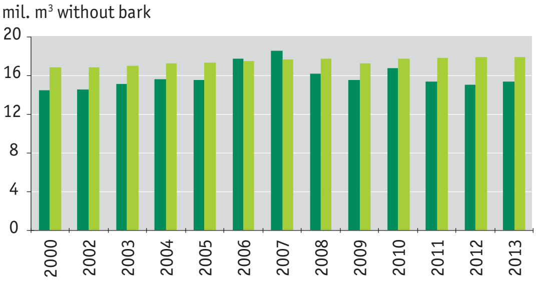
INDICATOR ASSESSMENT

Chart 1 → Forest renewal in the Czech Republic [thous. ha], 1995–2013



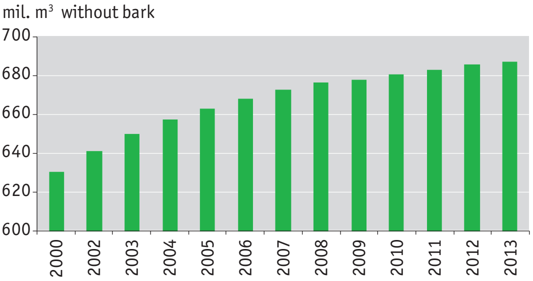
Source: Czech Statistical Office

Chart 2 → Comparison of wood felling and the total average growth in the Czech Republic [mil. m^3 without bark], 2000–2013



Source: Forest Management Institute, Czech Statistical Office

Chart 3 → Total wood stock (in stands) in the Czech Republic [mil. m^3 without bark], 2000–2013

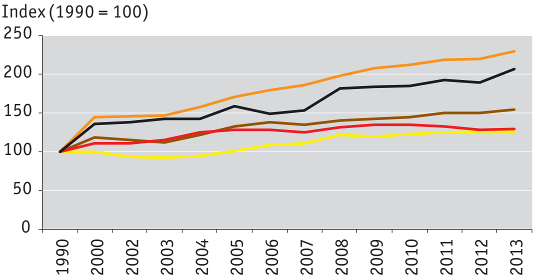


Source: Forest Management Institute, Czech Statistical Office

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 [%], 2002–2013

Source: FSC Czech Republic, PEFC Czech Republic

Chart 5 → Spring stocks of game (selected species) in the Czech Republic [index, 1990 = 100], 1990–2013



Source: Czech Statistical Office

Chart 6 → Proportions of the single forest categories in the Czech Republic's total forest area [%], 2000–2013

Source: Forest Management Institute

In 2013, a positive trend in reducing the proportion of coniferous trees in favour of deciduous trees continued within **forest regeneration** (Chart 1). Compared with 1995, the proportion of coniferous trees decreased by more than 12%. The area of naturally regenerated forest stands also increases in the long term. At present, the area on which natural regeneration takes place amounts to more than 6,000 ha (in 2013 it was exactly 6,112 ha), while in 1995 it was about 1,200 ha. In terms of forestry and the environment it is a highly positive trend.

The **total standing wood stock** has been increasing constantly (Chart 3). The growth of the total standing wood stock is long-term and this trend has not changed after 2000 either. In addition to growth of the normal increment, increasing shares of older stands and a slight growth of stand density also participate in the above-described development.

A part of standing wood stock is unavailable for **felling** (felling is limited in forests of special purpose and it is almost excluded in protection forests, in reserves and first zones of national parks) but the total volume of production is still lower than the total average increment in long terms (Chart 2). The total average increment, which express production capacities of forest habitats, is a crucial indicator in assessment of the principle of balance and sustainability of felling possibilities. After 2000, the total felling volume exceeded the total average increment only twice, in 2007 and 2008, namely due to the processing of wood mass damaged by hurricane Kyrill and the subsequent destruction caused by the bark beetle (salvage felling accounted for 80.5% of total felling).

In the last years, the **total felling volume** has been about 15 mil. m^3 without bark (this was 15.4 mil. m^3 in 2011, 15.1 mil. m^3 in 2012 and 15.3 mil. m^3 of wood in 2013). Recently, salvage felling represents an amount corresponding to 20%–30% of the planned felling volume (it was 27.7% in 2013 and 21.5% in 2012); the 2012 value was the lowest value since 2000. The total average increment has been growing constantly from 17 mil. m^3 to 18 mil. m^3 without bark during the period monitored (since 2000).

The **area of forests certified in accordance with the PEFC** (Programme for the Endorsement of Forest Certification Schemes), and **FSC** (Forest Stewardship Council) principles[1] i.e. forests managed in a sustainable way, reached its peak in 2006 (75.4% of the Czech Republic's total forest area). In 2007, there was a decrease and since that year, it has been stable at about 70% of the Czech Republic's total forest area. In 2013, this figure was 72.6% (Chart 4). Forest certification developed in the Czech Republic primarily after the year 2000; at that time, there were efforts focused on sustainable forest management as well as on informing consumers about the environmental qualities of wood. The reason for the decrease in issued certificates in recent years seems to be the necessity to comply with the demanding certification standards but also with financial requirements. Of the total number of issued certificates, most are PEFC certificates (97.2% in 2013). Compared with previous years, there was a slight increase in the area of forests certified in this way. The percentage of forest area certified by means of the more environmentally demanding FSC system remains low (Chart 4). In 2013, it did not basically changed in comparison with the previous period; it amounts to 1.9% of the Czech Republic's total forest area.

Reducing and maintaining the amount of cloven-hoofed game in hunting grounds is a priority, in particular with regard to damage that wild boar causes on crops and land (and lately even in private gardens) and to other cloven-hoofed game's browsing in the newly established forest cultures. A separate problem consists in regulation of the numbers of sika deer (Cervus nippon nippon) in the Czech Republic's forests (spring stocks of sika deer: 9,031 in 2011, 10,437 in 2013); this species interferes the gene pool of red deer and causes damage on forest land. Although the bags have been growing constantly, including the annual records in the numbers of caught game, the game populations in the Czech Republic's forests continue to rise (Chart 5). In long terms, hunting grounds users have been showing their interest in reducing the stocks of both wild boar and other cloven-hoofed game and the Ministry of Agriculture issued a recommendation for the state hunting administration in this respect. In order to reduce damage caused by game on agricultural and forest properties, it is necessary to carefully work out breeding and hunting plans in accordance with the relevant provisions of the Act No 449/2001 Coll., on game management, so that the number of cloven-hoofed game ranges between the minimum and standard figures.

The classification of forests into individual categories in terms of their prevailing functions does not show marked changes (Chart 6). In long-terms, there is a slight decrease in the proportion of commercial forests in favour of forests of special purpose. A slight decrease in the area of protective forests with natural conditions being relatively constant show that the current possibilities consisting in including forests into the category of protective forests are not fully utilized.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1851)

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[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

Forests in the European context

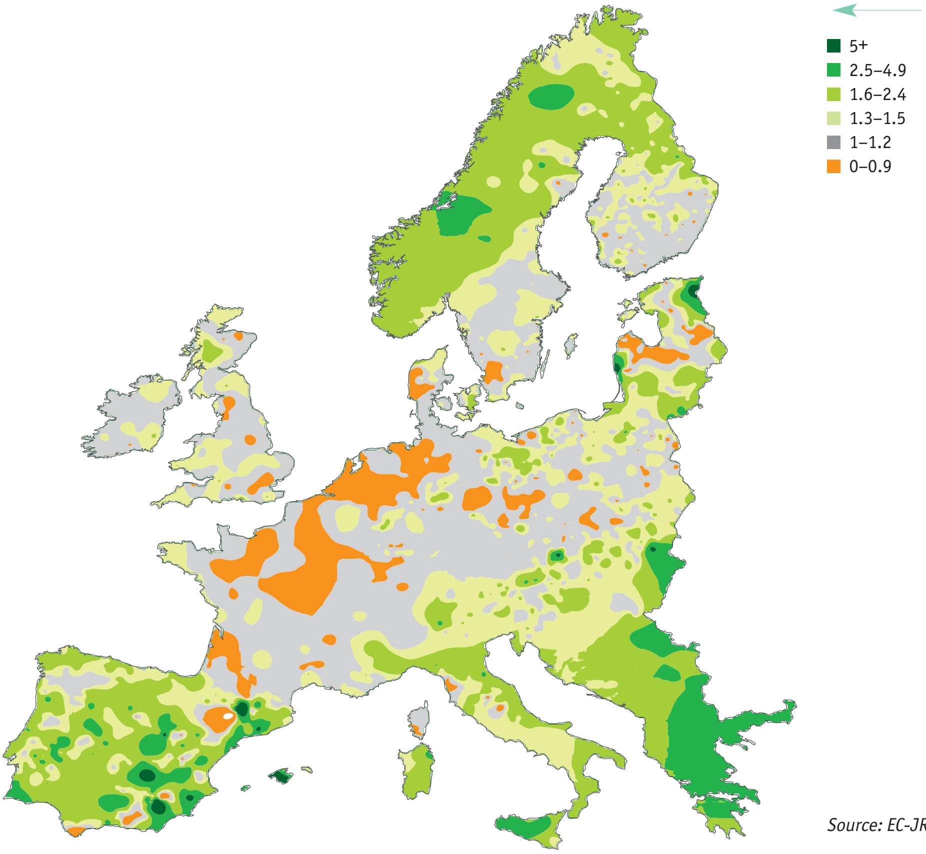
KEY MESSAGES ➜

- ➜ The general situation in European forestry can be considered satisfactory, there is no systematic imbalance or favouring production over biodiversity, or vice versa. The total area of forest stands, as well as the total standing stock, are growing. The sectoral policies and tools are stable. In this area, the biggest challenge for the next period is the development of economic instruments which support sustainable forest management. In the area of forestry policy, a systematic approach and integration with the other sectoral policies are required.

- ➜ The biggest problem of the European forests appears to be the risk of forest soil acidification, eutrophication and landscape fragmentation. Although the risk of acidification in the Czech Republic is not among the highest in Europe, forest soil is at actual risk and the high burden with nitrogen emissions may worsen the situation even more. The health condition of forest stands is not satisfactory in Europe, either. More than a fifth of the trees in European forests are classified as severely damaged or dead. In this respect, the Czech Republic belongs to the areas with higher defoliation levels, and growing defoliation in the last decade is also alarming. In a part of Europe, the age and species structure of stands and related prevailing way of regeneration remain a problem. Even though this problem greatly concerns the Czech Republic, there is a long-term improvement of the state, which is a result of taking silvicultural measures in recent decades.

INDICATOR ASSESSMENT

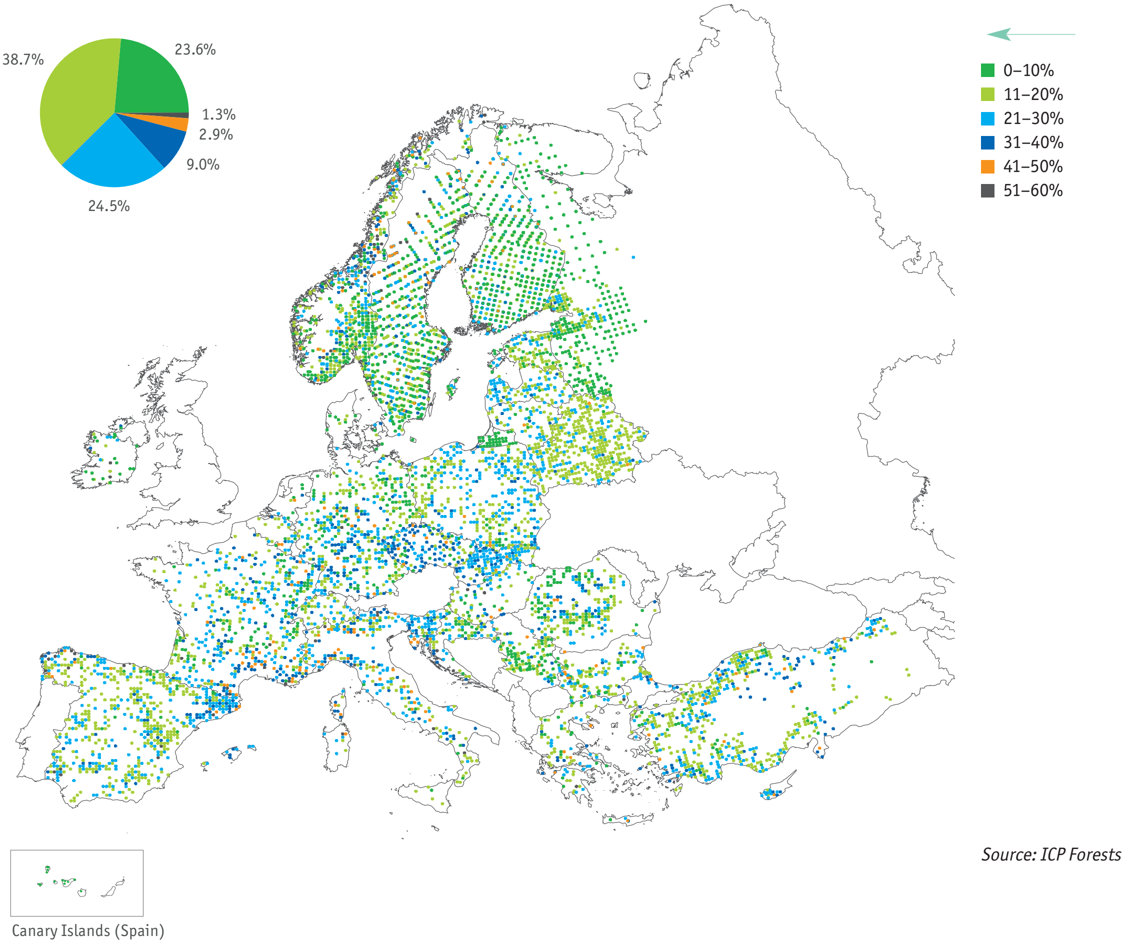
Figure 1 ➜ **European forest areas according to the value of C/N index, 2008**



Source: EC-JRC

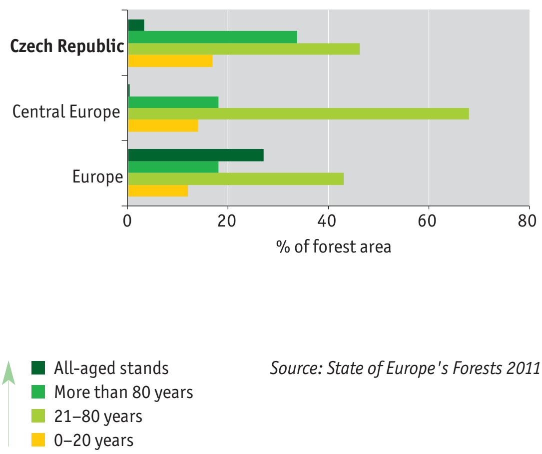
Worked out on the basis of data from the second forest soils research within the project BioSoil in 2004–2008.

Figure 2 ➜ **Defoliation on the main monitoring sites of all tree species [%], 2009**



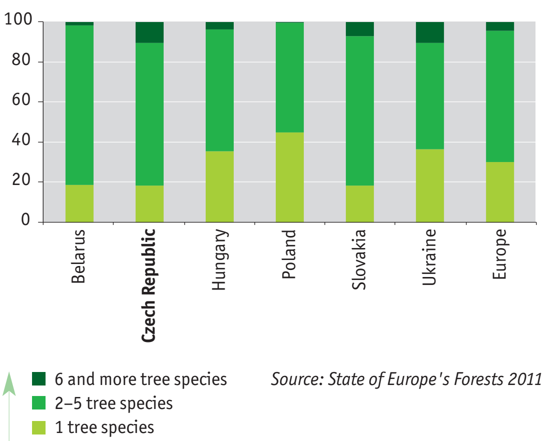
Source: ICP Forests

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



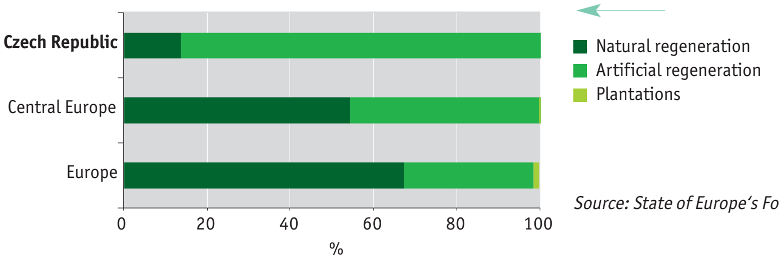
Source: State of Europe's Forests 2011

Chart 2 ➜ **Species structure of forest stands [% 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

Vitality of forest soil and stands can be evaluated using the carbon to nitrogen concentration ratio (C/N ratio) in forest soil, which is a suitable indicator to assess the **level of organic matter decomposition, nitrogen accessibility in soil and nutrients cycle**. In healthy forests, the C/N ratio in the surface layer is much greater than in mineral soil (at a maximum depth of 10 cm). In areas with high nitrogen load, however, the situation may be reversed – the C/N ratio in the surface layer is lower than in mineral soil. Therefore, the quotient of these two values (C/N index) can serve as an indicator of imbalance caused by an excessive supply of nitrogen. If this index is lower than 1, the nutrients cycle is disrupted and health and vitality of the forest stand may be threatened.

Areas with the most affected soils are mainly in Western and Central Europe, the situation in the southern and northern parts of the continent is more favourable (Figure 1). The basic cause consists in the high level of atmospheric deposition of nitrogen and other pollutants, which exceeds biochemical consumption and storage capacity of forest soils in long terms. Different situations in different parts of Europe are also affected by various types of soils in different parts of the continent, which have significantly different storage capacity. In the Czech Republic, the C/N index of most forest soils is slightly above 1. The median of the values of all the examined soil samples is 1.14, while 95% of the samples were in the interval between 0.9 and 1.78. Nonetheless, it is the lowest value in comparison with other Central European countries; e.g. the median of forest land in Poland amounts to 1.26, in Hungary 1.42 and in Slovakia 1.49.

High nitrogen deposition and the low value of C/N index stimulate the growth of plants. However, if forest land is unable to sufficiently supply the stands with other nutrients, especially calcium and magnesium cations, there will be probably health disruptions. Moreover, if C/N ratio in the surface layer of the soil is low and nitrogen deposition is high (more than 20 kg N.ha^{-1}.year^{-1}), nitrate leaching into surface water and groundwater occurs, which leads to eutrophication.

Defoliation is an indicator of the **forest stands' health condition**. It is influenced by a variety of factors, from climate conditions through weather fluctuations, deposition to damage caused by insects and fungal diseases. More than a fifth of all assessed trees showed defoliation higher than 25% and were therefore classified as damaged or dead (Figure 2). On the Czech Republic's territory, defoliation in the interval 20–40% was recorded on most sites, which includes the country among areas with poorer health conditions of stands. Moreover, evaluation of the trends showed that in 1998–2009 defoliation increased in most of the Czech Republic's sites while the prevailing European trend remained unchanged in this period (60.7% unchanged, improved state in 14.9%, deteriorated state in 24.4% of all European monitoring sites). In general, Central Europe, together with the Mediterranean, are considered as areas with higher defoliation levels. There are a number of causes – defoliation is a consequence of many factors and it is affected by short-term events (pests or diseases outbreaks, damage due to frost, wind and other weather influences), together with long-term factors (unsuitable age and species composition of stands, soil acidification, long exposure to atmospheric pollution and others).

A high defoliation level generally indicates reduced resistance of forest stands to various environmental impacts. This is an alarming finding, especially in connection with more frequent extreme weather events predicted for the near future and with the fact that nitrogen deposition has not been decreased significantly in long terms.

Monitoring of **age structure** of forests helps significantly to understand the historical development of forests as well as the likely future developments. In terms of traditional forests management, the indicator of the potential wood production is concerned. In terms of biodiversity conservation and evaluation of non-productive functions (the recreational function in particular), a greater proportion of stands over 80 years of age and all-aged stands is more favourable.

In comparison with the European average, the share of stands over 80 years of age is much lower in the Czech Republic and the area of all-aged stands is also smaller (Chart 1). The current situation is the result of historical development. Intensive forest management and especially the trend of even-aged monocultures at the end of 19th and in 20th centuries have led to a completely unsuitable age and species structure of the forest stands in comparison with natural composition. Nonetheless, the change of the unfavourable state at which forest management in the Czech Republic is directed is a long-term process due to the length of forest tree species life cycles. On the other hand, it is obvious that in comparison with the Central European average[1] the situation in the Czech Republic is much better than that in other countries (Chart 1).

Along with age structure, the forest stands' **species composition** is also an indicator of their stability. Although specific forest ecosystems consisting of only one or two tree species do occur naturally in Europe (e.g. Nordic pine forests or subalpine spruce forests), multiple-species mixed forests are usually richer in terms of biodiversity and therefore desirable.

From the perspective of species composition, the situation in the Czech Republic is more favourable in comparison with the European average (Chart 2), regarding the quantity of the monoculture stands (18.5% in the Czech Republic, 30.3% in the European average). The situation in the Czech Republic is also favourable when compared to the size of stands consisting of more than 6 tree species. The area of these stands is much larger than the European average (10.3% in the Czech Republic and the average 4.2% in Europe). However, it is necessary to realise that the above-mentioned naturally occurring monocultures were included in the European average, while on the territory of the Czech Republic, there should not be any monocultures with regard to the natural conditions.

In comparison with Central European countries, the situation in the Czech Republic is more favourable than elsewhere in the region concerning the area of both the monocultures and mixed forests. In comparison with the year 1990, the general trend in development of European forests, which is directed at mixed species composition, is positive. Likewise the age structure, a more noticeable change in species composition can also manifest itself in the long term only.

The essential tool to preserve forest landscapes as well as to change the age and species compositions of forests is regeneration. Natural **regeneration** is most suitable in order to preserve genetic diversity and maintain the natural species composition and dynamics of forest ecosystems. However, natural regeneration is not appropriate in many cases, especially if it concerns a process to transform monocultures, to change the species composition from introduced species to naturally occurring ones, or a process to renew forests after salvage felling.

Generally speaking, natural regeneration prevails in Europe (Chart 3). In this respect, the Czech Republic is well below the European and Central European averages. Due to unsatisfactory species composition and age structure of the forests, natural regeneration can only be used to a limited extent in the conditions of the Czech Republic. However, the general trend in the Czech Republic shows a rising proportion of natural regeneration in the medium term.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1765)

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[1] *Within evaluation of the Central Europen region, data from the following countries were included: Belarus, Czech Republic, Hungary, Poland, Slovakia, Ukraine. The region "Europe" includes all European countries, with the exception of the Russian Federation.*

17/ Land use

KEY QUESTION →

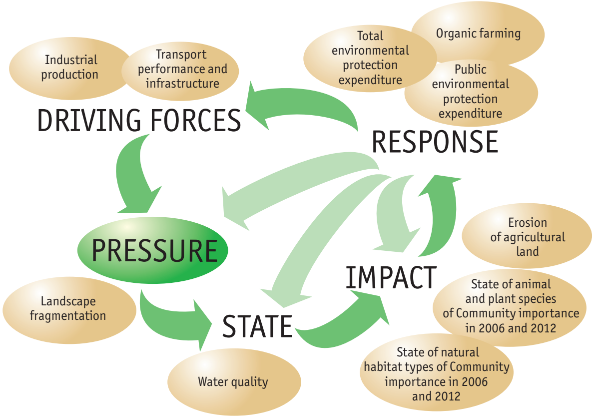
What pressure on the environment does the state and development of land use represent?

KEY MESSAGES →

☺ Development of the structure of the Czech Republic's agricultural land resources is positive from the environmental point of view; there is a decrease in acreage of arable land under intensive cultivation (for the period 2000–2013 by 3.1%) and an increase in the permanent grassland area (for the period 2000–2013 by 3.5%), which has a stabilising function in the landscape. The total area of agricultural land recorded in LPIS (public land register) is increasing, especially due to the growth of registered permanent grassland.

One-third of the Czech Republic's territory consists of forests, which have an important function concerning water retention in landscape as well as biodiversity preservation.

☹ Agricultural land take-ups continue due to expansion of built-up and other areas; in total 2.9 thous. ha of arable land have been taken up in this way in 2013. In 2000–2013, the size of built-up and other areas extended by 3.5% (28.7 thous. ha) and these types of land, which also include areas reclaimed after non-agricultural activities, occupied 10.6% of the Czech Republic's territory.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **State Nature Conservation and Landscape Protection Programme of the Czech Republic** aims at maintaining and enhancing the ecological stability of landscape as well as its natural and aesthetic values and at ensuring sustainable use of landscape, in particular by limiting development of open landscape. The **Spatial Development Policy of the Czech Republic** lays down the strategy and basic conditions for the fulfilment of the tasks of land planning, especially with regard to sustainable development of the territory. In relation to the environment, the general priorities include, inter alia, to protect and develop natural, civilizational and cultural values of the territory, to create conditions for the protection of the territory and population against natural risks (e.g. floods, landslides) and thus to reduce the scale of potential damage, to improve transport accessibility of the territory while respecting the landscape's specific features, to support development of public greenery and to enhance the use of abandoned sites and areas (i.e. brownfields). Within the thematic area Nature and Landscape Protection, the State Environmental Policy of the Czech Republic 2012–2020 sets the objectives and measures in territorial protection. The priorities of the **State Environmental Policy of the Czech Republic 2012–2020** in this area are the protection and strengthening of ecological functions of landscape, preservation of the natural and landscape values and improvement of the quality of the environment in settlements. The issue of landscape and land use is also addressed by the Strategic Framework for **Sustainable Development in the Czech Republic**, namely by priority axes "Spatial Development" and "Landscape, Ecosystems and Biodiversity".

The Czech Republic's international obligations concerning sustainable land use stem from the **European Landscape Convention**. Its importance lies in the fact that it promotes sustainable landscape conservation, management and planning and facilitates European cooperation in this area. **Territorial Agenda of the European Union 2020** can be included into the EU documents concerning sustainable use of landscape; its priorities focus, inter alia, on support to management and interconnection of ecological, cultural and landscape-related values of regions.

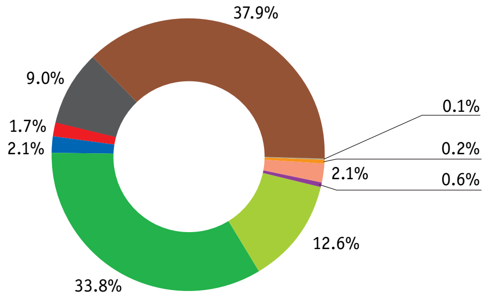
In May 2013, the European Commission issued the Communication **Green Infrastructure (GI) – Enhancing Europe's Natural Capital** in connection with art. 3.2 of the EU Biodiversity Strategy to 2020 and the material called "A resource-efficient Europe – Flagship initiative of the Europe 2020 Strategy". The subject of the Communication was to create a supportive framework for the use of green infrastructure as a tool which aims at ensuring a system of territorial and functional preconditions for a wider application of natural processes through land planning. The green infrastructure is a strategically planned network of natural and semi-natural areas with different environmental features which should be designed and managed in order to provide a wide range of ecosystem services. It includes green areas (or blue areas if aquatic ecosystems are concerned) and other physical elements in the continental (including coasts) and marine areas. On mainland, the green infrastructure can be located in rural areas as well as in the urban environment.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

Land use and its changes caused by human activities affect the landscape character and its functions and thus they influence the ecosystems and biological diversity. Development of built-up areas and other man-made surfaces reduces the landscape's retention capacity, thus increasing the floods threats and affecting the local temperature, humidity (especially in the summer season) and public health. The loss of agricultural land in favour of anthropogenic surfaces is adverse for the national economy; degradation of stabilising elements in landscape (e.g. permanent grasslands in agricultural areas) causes a decline of important habitats and increases the risk of soil erosion.

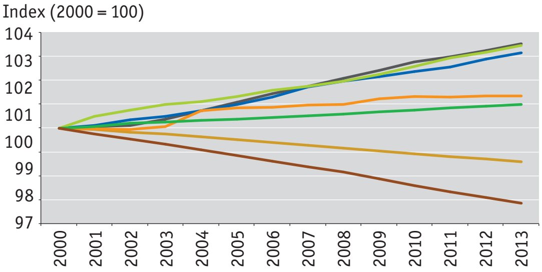
INDICATOR ASSESSMENT

Chart 1 ➔ **Land use in the Czech Republic [%], 2013**



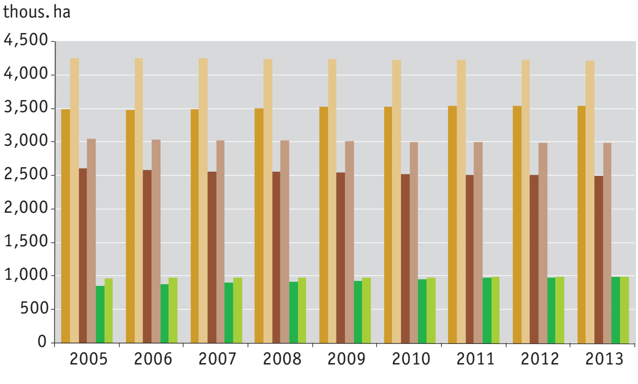
Source: Czech Office for Surveying, Mapping and Cadastre

Chart 2 ➔ **Land use development in the Czech Republic [index, 2000 = 100], 2000–2013**



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], 2005–2013**



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

LPIS - Land Parcel Identification System

Land use in the Czech Republic is very diverse and depends on the altitude, climate, the territory's altitude profiles and also on anthropogenic loads, especially in industrial and urban areas. The most represented categories of land use are arable land, which occupied 37.9% of the Czech Republic's territory according to the data of the Czech Office for Surveying, Mapping and Cadastre (Chart 1), and forests (33.8%). The proportion of agricultural land in the Czech Republic's land resources was 53.6% and built-up and other areas occupied 10.6% of the country's territory in 2013.

Land use development in the Czech Republic after 2000 is characterized by a gradual decrease in the acreage of arable land, increase in the areas of permanent grassland and also by negative growth of the size of built-up and other areas (Chart 2). These changes resulted from a decline of economic activities in less attractive and more remote regions where the area 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 also supported by the Government's subsidy policy, which promotes the re-use of remote areas in agriculture. On the other hand, a significant anthropogenic pressure on land use, which leads to build-up of the territories and to an increase of arable land area 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, and also due to a slight growth in the size of forest land and water surfaces, the total area of agricultural land resources is declining slowly; in 2000–2013 this concerned about 60 thous. ha (1.6%).

Between the years 2012 and 2013, the area of **arable land** decreased by 7.4 thous. ha, i.e. by 0.3%; since 2000, it has declined by 96.6 thous. ha (3.1%). Conversion of arable land into permanent grassland (3.9 thous. ha, mainly in South Bohemia and the Pilsen region) and transformation of arable land into built-up and other areas (2.9 thous. ha in total, mainly in Central Bohemia and the Zlín region) participated most significantly in the reduction of arable land in 2013. In 2013, the area of **permanent grassland** increased by 2.9 thous. ha, i.e. by 0.3%; since 2000 it has been by 3.5%.

The size of built-up and other areas grew interannually (2012/2013) by 2.4 thous. ha (0.3%); since 2000 this increase amounted to 28.7 thous. ha (3.5%). In 2013, built-up areas enlarged by 290 ha (0.2%), other areas, which include roads and other transport infrastructure, industrial sites, excavation sites, public greenery and other plots not belonging to the other categories, increased by 2,065 ha (0.3%). Increased areas of local roads participated most notably in the growth of the size of other areas in 2013. The total area of excavation sites gradually decreases, however, the area of sandy gravel excavation sites is growing, which has a negative impact on landscape and valuable ecosystems in river valleys.

The highest **proportions of arable land in the total land resources** are in Central Bohemian region and South Moravian region (about 50%), the smallest proportions are, by contrast, in the regions of Karlovy Vary and Liberec (16.3% and 20.5% respectively). The highest representation of permanent grassland and forest land is in the region of Liberec where these land use categories together cover approximately two-thirds of the territory. The largest share of water surfaces is in South Bohemian region (4.4%); built-up and other areas dominate in the city of Prague where they occupy approximately 47% of the total area.

According to the **public land registry LPIS** (Land Parcel Identification System), 45.0% of the Czech Republic's area is used in agriculture, which is by approximately 672.0 thous. ha (15.9%) less than the area of agricultural land resources registered in the Cadastre of Real Estate (Chart 3). The main difference between the LPIS and the Cadastre of Real Estate is in the category of arable land; in 2013, this concerned about 482.3 thous. ha of arable land, which probably lies fallow or is used in another way. In the categories of orchards and hop gardens, only about half of the total acreage of these types of land is registered in the LPIS, in the category of vineyards this is about two thirds. One of the causes of the differences in the total size of agricultural land is probably the fact that in the Cadastre of Real Estate, unlike the LPIS, agricultural land is registered even if it was temporarily excluded from agricultural land resources. In 2005–2013, the total area of land registered in the LPIS (unlike the Cadastre of Real Estate) was growing (by 54.6 thous. ha, i.e. 1.6%), especially due to the increase of permanent grassland by 128.6 thous. ha (14.9%). In 2013, almost all the permanent grassland recorded in the Cadastre of Real Estate (99.7%) was recorded in LPIS, too.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

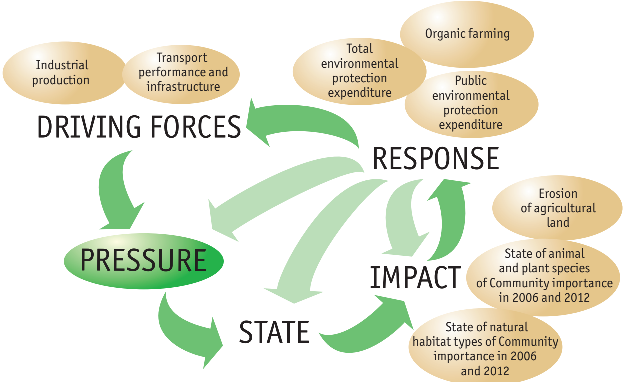
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1852)

18/ Landscape fragmentation

KEY QUESTION

Is there a slowdown in the landscape fragmentation process?



KEY MESSAGES

☹ Although the pace of decline of unfragmented areas is decreasing, the landscape fragmentation process still continues. For the period 2000–2010, the size of unfragmented landscape decreased by 5.2% and in 2010 it accounted for 63.4% of the Czech Republic's total area.

More than 6,000 transverse barriers are recorded in the Czech Republic's watercourses; in 2013, there were a total of 842 weirs which may have an adverse impact on 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 AND STRATEGIC DOCUMENTS

Solutions to the negative impacts of territorial development on landscape are one of the important topics of national and international conceptual and strategic documents. The **European Convention on Landscape** aims at ensuring the protection and development of unique European landscape types which should be in accordance with the principles of sustainable use with regard to its natural and cultural heritage. The **Spatial Development Policy of the Czech Republic** is the instrument of land-use planning which focuses on sustainable development of the territory concerned. Its priorities include, inter alia, to use built-up areas economically (support to reconstruction and remediation), to ensure the protection of undeveloped territories (especially agricultural and forest land) and to preserve public greenery including minimisation of its fragmentation. Within design of transport and technical infrastructure, care must be taken to maintain the permeability of landscape and minimise the extent of its fragmentation. Limitation and mitigation of the impacts of landscape fragmentation and an increase of ecological stability of landscape are also among the objectives of the thematic area "Nature and Landscape Conservancy" in the **State Environmental Policy of the Czech Republic 2012–2020**. The **Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora** also requires to ensure continuity of natural habitats and wildlife migration; the protection of natural habitats concerns not only terrestrial ecosystems but also the aquatic environment, particularly watercourses. The Communication of the European Commission called **Green Infrastructure (GI) – Enhancing Europe's Natural Capital** creates a supportive framework for the use of green infrastructure as a tool which aims at ensuring a system of territorial and functional preconditions for a wider application of natural processes through land planning. The green infrastructure is a strategically planned network of natural and semi-natural areas with different environmental features which should be designed and managed in order to provide a wide range of ecosystem services. One of the basic preconditions for ensuring of and support to all of the network's functions is its continuity. The **Regulation No. 1315/2013 of the European Parliament and of the Council** of 11 December 2013 on Union guidelines for the development of the trans-European transport network requires that during planning and development of the network, physical limitations and topographic features of regions as well as environmental impacts are taken into consideration, including landscape fragmentation, land occupation, air and water pollution and noise pollution and if this is not possible, that these impacts are mitigated or compensated and biodiversity is protected efficiently.

Ensuring passability of the river network belongs to other major problems at the national and international levels. The issue of passability of transverse barriers in watercourses is dealt with by the **Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy**. It aims at the gradual removal of transverse barriers hampering the aquatic organisms' migration and of the burden on aquatic environments in all EU member states. Another important document focusing on fragmentation of the aquatic environment is the **Council Regulation No. 1100/2007 establishing the measures to regenerate the stocks of European eel (Anguilla anguilla)**. The Regulation aims at enabling passability of rivers and improving the state of river habitats, thereby ensuring the reduction of mortality of eels due to human activity. Protecting the morphology of watercourses' natural beds and improving their passability for fish and other aquatic animals are the main objectives of the **Plan of Major River Basin Districts of the Czech Republic**. The **Concept of Making the Czech River Network Passable** is an important strategic tool; it aims at a systemic solution to renewal of the watercourses, taking into account the needs of aquatic and water-related ecosystems in order to ensure the watercourses' passability. The Concept also enhances the priority of passability onto an international level and defines the watercourses or their parts that are important from the migration point of view on two levels: Above-regional priority habitat corridors with international relevance and National priority sections of watercourses in terms of the territorial and species protection.

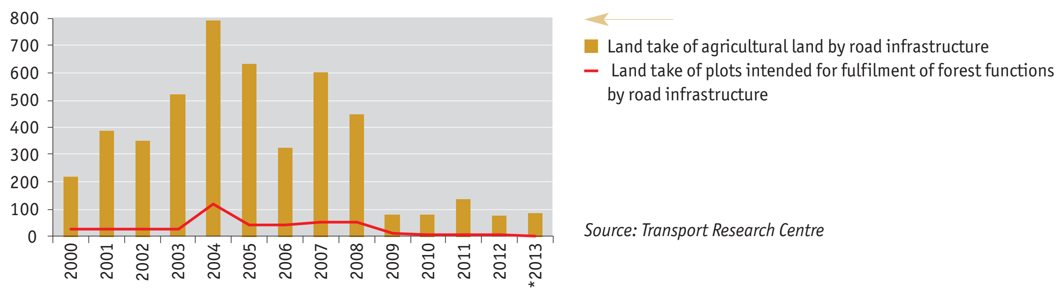
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

Landscape fragmentation belongs to important problems which have negative impacts on landscape character and plant and animal populations. The negative effects are often not immediate but long-term and irreversible. Breaking of landscape arises from natural processes (gales, fires, floods), but it is particularly deepened by human activities, namely agriculture, urbanization, most frequently by construction and the use of transport infrastructure. Fragmentation barriers 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 the natural habitats of individual species of organisms are directly taken over and made smaller, but also populations living in landscape are fragmented, the organisms' migration is made impossible, food sources are limited and reproduction opportunities are reduced. All this results in a loss of genetic diversity and reduced viability of populations and ecosystems.

INDICATOR ASSESSMENT

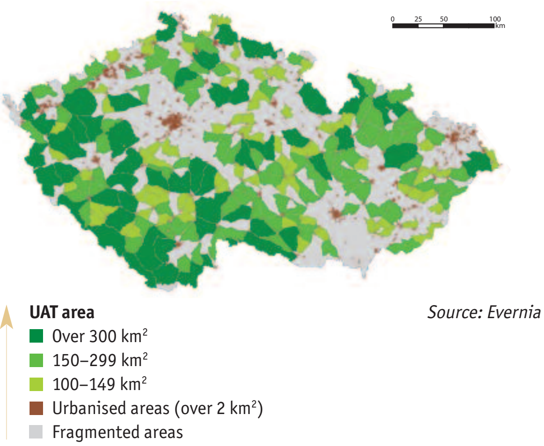
Chart 1 ➔ **Trends in land take of agricultural land and of plots intended for fulfilment of forest functions due to road infrastructure in the Czech Republic [ha], 2000–2013**



Source: Transport Research Centre

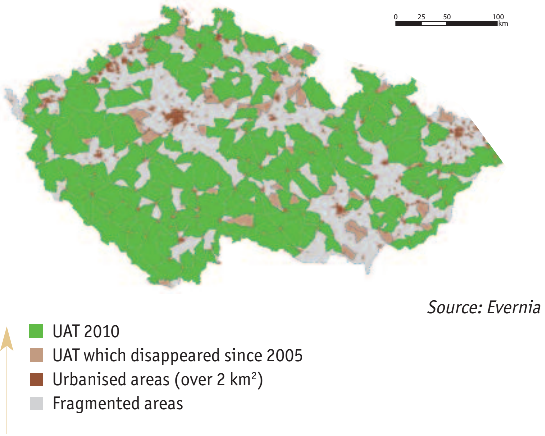
The methodology of reporting the take-overs of agricultural land and of plots intended for fulfilment of forest functions is annually affected by temporary take-overs of such land which are associated with the transport infrastructure building time.
** Preliminary data*

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



Source: Evernia

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



Source: Evernia

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

During the period 2000–2010, the **area of unfragmented landscape** decreased from 54,000 km² (68.6% of the Czech Republic's total area) to 50,000 km² in 2010 when it coved 63.4% of the country's total area (Figure 1 and Figure 2). The rate of decline compared with the previous period (2000–2005, the difference was 5.4%) has slowed down in the last 5 years (the difference is 2.4%), however, landscape fragmentation due to traffic continues in the Czech Republic and forecasts predict that the proportion of unfragmented landscape will be only 53% in 2040.

The highest level of **landscape fragmentation** within the Czech Republic has been recorded in Central Bohemia, South Moravia and the Moravian-Silesian region (Figure 1), which also belong to the regions with the highest decline in unfragmented areas in 2005–2010 (Figure 2). The high increase of fragmentation is caused by the territorially incompact growth of built-up areas as a result of continuing urbanisation taking place mainly in urban agglomerations, and also by related building of transport infrastructure, primarily city ring roads, motorways and express roads. On the other hand, the Pilsen region and South Bohemian region belong to regions with the highest number of unfragmented areas where there is lower population density due to a more diverse relief and larger protected areas and therefore there is smaller need for transport services.

In 2000–2013, a total of 4,743 ha of **agricultural land** and 461 ha of **forest land** were the totals of land taken **for the construction of transport infrastructure** in the Czech Republic. The most significant loss of agricultural land in 2000–2013 took place in Central Bohemian and South Bohemian regions, mainly due to continuing preparation and building of motorway D3; in Central Bohemia, take-overs of land are also closely related with building of Prague City Ring Road which connects the motorways D1 and D5. The most significant loss of forest land was recorded in Central Bohemian and South Bohemian regions, too. For many species, transport infrastructure is an important and often insurmountable obstacle. The solution consists in suitable construction of migration objects, such as underpasses, bridges and tunnels. Due to a non-existent 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 to which different communities and animal and plant populations are bound. Building of structures and **damming of watercourses with transverse obstacles** result in fragmentation of the given route, which has an adverse effect on biodiversity of the river ecosystems. The watercourses' regulation was most intensive in 19th and 20th centuries, in connection with industrialisation of the landscape and increased demands for the use of water resources. At present, flood prevention measures also have their influence on river network fragmentation. In the territory of the Czech Republic, more than 6 thous. transverse barriers are recorded, 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 842 weirs were recorded in 2013, of which 196 are managed by state enterprise Povodí Labe, 343 by state enterprise Povodí Vltavy, 42 by state enterprise Povodí Ohře, 179 by state enterprise Povodí Moravy and 82 by state enterprise Povodí Odry.

Damming of a watercourse has its water-management purpose but it may have negative impacts resulting in degradation of habitats, restriction or loss of free animal migration and changes in the communities of aquatic species of organisms. In the Czech Republic, occurrence of 12 fish species which migrate between the sea and the river environments was documented on the basis of a reconstruction of historical sites but only two of them are currently recorded in the Czech Republic's territory, namely common eel (Anguilla anguilla) and Atlantic salmon (Salmo salar). The **Concept of Making the Czech River Network Passable** was compiled as a response to extensive fragmentation of the Czech Republic's river system and to the need to make the transversal barriers passable. The Concept lists several above-regional priority habitat corridors, namely the Labe international River Basin (where 11 priority sections have been determined), the Odra international River Basin with 3 priority sections and the Danube international River Basin with 2 priority sections. The first phase of making the river network passable, which will last until 2015, includes those sections of the watercourses passability of which is incorporated into programmes of measures within the first River Basin Plans. Within the Labe International River Basin, this concerns 45 transverse barriers, within the Odra International River Basin there are 9 transverse barriers and within the Danube International River Basin 10 transverse barriers. In order to strengthen and maintain the stocks with migration needs, there is an increase of proposed fish passes constructions since 2010. In 2013, 74 of such projects were prepared as opposed to the year 2010 when only 45 of them were submitted.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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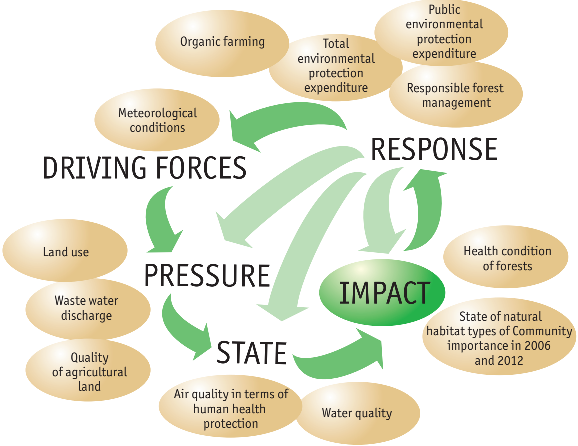
19/ Erosion of agricultural land

KEY QUESTION ➔

How big is the proportion of agricultural land that is at risk of erosion?

KEY MESSAGES ➔

😐 On the territory of the Czech Republic[1], 35.9% of agricultural land is at potential risk of water erosion and 18.4% at risk of wind erosion. Of this amount, 7.4% of agricultural land resources are strongly to extremely strongly vulnerable in relation to water erosion (according to long-term average outwash of land); in case of wind erosion this figure is 5.1%. The framework management to prevent further erosion is recommended for a total of 51.2% of agricultural land in the Czech Republic. Concerning development from 2010, a stagnant trend is observed; in most of the areas at risk of soil erosion no systematic protection is carried out which would reduce the loss of soil and prevent further degradation of the soil profile.



OVERALL ASSESSMENT ➔

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

The EU's Common Agricultural Policy and national strategic and conceptual agricultural documents consider the solution to the negative effects of agriculture on landscape and the environment to be one of the main topics. For example, the **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013** emphasises support to environmentally friendly agricultural practices in rural landscape as well as water and soil protection through measures aimed at anti-erosion protection and appropriate use of agricultural land resources. The **Conception of the Agricultural Policy after the EU Accession for the Period 2004–2013** and the **Strategic Framework for Sustainable Development in the Czech Republic** mention the risk of water and wind erosion and other ways of soil degradation (such as compacting) among the significant problems. The **Action Plan of the Czech Republic for the Development of Organic Farming in the years 2011–2015** emphasises, inter alia, support to non-production functions of organic farming that contribute to renewal and stability of natural processes in soil. Sustainable management of agricultural land is one of the supported areas on which European and national grant programmes focus. The payment of direct support for farmers, especially under the **Council Regulation (EC) 73/2009** establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, is made dependent on fulfilment of the requirements for the protection of land against accelerated erosion in order to achieve Good Agricultural and Environmental Conditions (GAEC)[2]. Emphasis is put on the protection of soil against erosion on sloping land, the soil protection against water erosion and on the effort to reduce the negative consequences of erosion. Fulfilment of the GAEC standards is a precondition for payment of the subsidies, and it is verified through the so-called cross compliance system.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

Erosion belongs to degradation influences with negative effects on soil. Other forms of soil degradation include e.g. landslides, compaction, acidification, contamination and the loss of humidity, soil microflora biodiversity or organic matter. Degradation has generally resulted in a reduction or total loss of productive and non-productive functions of soil. The erosion process itself is a natural phenomenon, however, an increase of its intensity as a result of anthropogenic activities is a serious problem. Accelerated erosion brings about soil quality decrease as its most fertile parts are removed and thus the production capacity of the soil is reduced, its ecological functions are lost, water retention and infiltration are inhibited. Damage caused by soil erosion, however, is reflected in the extent of water resources' pollution and water reservoirs' siltation, which has indirect impacts on human health, too. Erosion can also cause damage to property (run-off of topsoil, fertilizers and plant protection products, siltation of the amelioration and sewerage networks, loss of seeds and seedlings).

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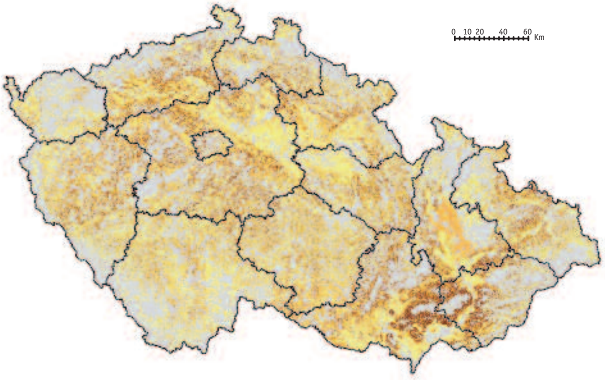
[1] *In the category of slightly vulnerable to extremely vulnerable land.*

[2] *The Good Agricultural and Environmental Conditions (GAEC) ensure farming in accordance with protection of the environment. Its fulfilment is mandatory for all applicants for direct payment, for some support from Axis II of the Rural Development Programme and some support within the common organisation of the wine market. The EU member states define the GAEC conditions individually, on the basis of the framework set out in Annex III to Council Regulation (EC) No. 73/2009. Since 1st January, 2009, a total of 5 standards were established in the Czech Republic; after 1st January, 2010, the number was extended to 10, after 1st January 2012 to 11 (with a prospect for extension to 12 after 1st January 2014), with GAEC 1 and GAEC 2 dealing with soil erosion.*

INDICATOR ASSESSMENT

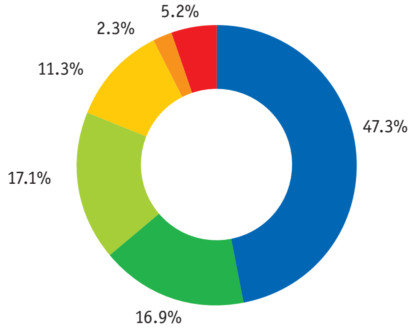
Figure 1 ➔ **Potential vulnerability of agricultural land to water erosion expressed as the long-term average soil outwash G in the Czech Republic [$t.ha^{-1}.year^{-1}$], 2013**



- 🟨 Very slightly vulnerable soil (G below 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 above 10.1)
- ⬜ Non-agricultural and other land
- — Regional borders

Source: Melioration and Soil Protection Research Institute

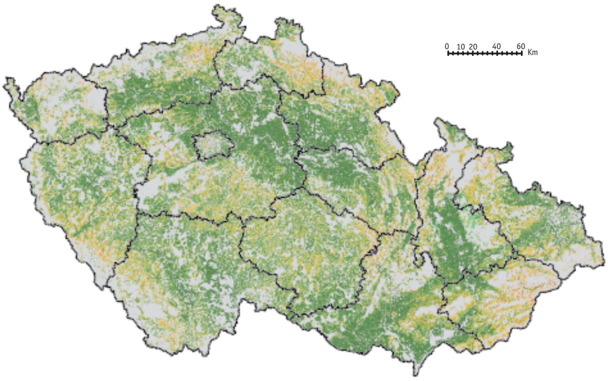
Chart 1 ➔ **Potential vulnerability of agricultural land to water erosion expressed as long-term average soil loss in the Czech Republic [% of agricultural land resources], 2013**



- 🟦 Soil without vulnerability
- 🟩 Predisposed soil
- 🟩 Slightly vulnerable soil
- 🟨 Vulnerable soil
- 🟧 Strongly vulnerable soil
- 🟥 Most vulnerable soil

Source: Melioration and Soil Protection Research Institute

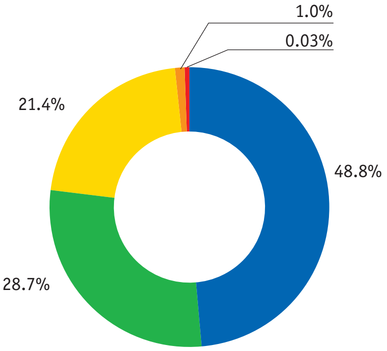
Figure 2 ➔ **Maximum admissible value of the cover and management factor (C_p) in the Czech Republic, 2013**



- 🟥 Below 0.005 (permanent grassland)
- 🟧 0.005–0.02 (clover, lucerne)
- 🟨 0.02–0.2 (without wide-row crops)
- 🟩 0.2–0.6 (with soil-conserving technologies)
- 🟩 Over 0.6 (without limits)
- ⬜ Non-agricultural and other land
- — Regional borders

Source: Melioration and Soil Protection Research Institute

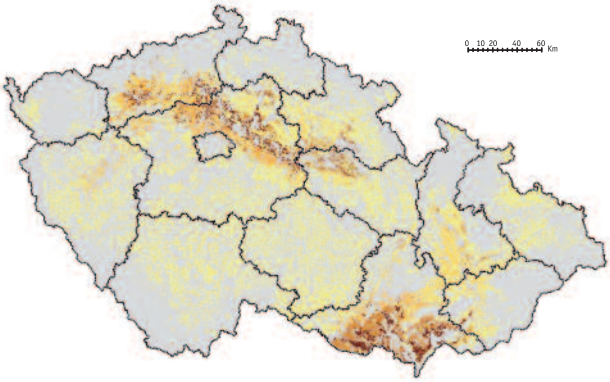
Chart 2 ➔ **Vulnerability of agricultural land to water erosion expressed as maximum admissible values of the cover and management factor (C_p) in the Czech Republic [% of agricultural land resources], 2013**



- 🟦 Soil without vulnerability (C_p over 0.6)
- 🟩 Slightly vulnerable soil (C_p 0.2–0.6)
- 🟨 Vulnerable soil (C_p 0.02–0.2)
- 🟧 Strongly vulnerable soil (C_p 0.005–0.02)
- 🟥 Most vulnerable soil (C_p below 0.005)

Source: Melioration and Soil Protection Research Institute

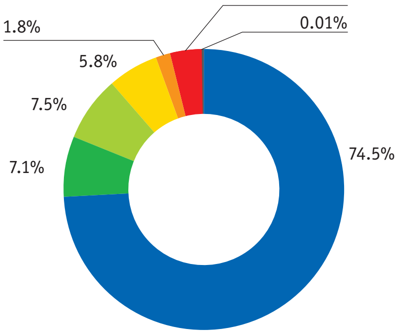
Figure 3 ➔ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2013**



- 🟨 Soil without vulnerability
- 🟨 Fractionally vulnerable soil
- 🟧 Slightly vulnerable soil
- 🟧 Vulnerable soil
- 🟫 Strongly vulnerable soil
- 🟫 Most vulnerable soil
- ⬜ Non-agricultural and other land
- — Regional borders

Source: Melioration and Soil Protection Research Institute

Chart 3 ➔ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic [% of agricultural land resources], 2013**



- 🟦 Soil without vulnerability
- 🟩 Fractionally vulnerable soil
- 🟩 Slightly vulnerable soil
- 🟨 Vulnerable soil
- 🟧 Strongly vulnerable soil
- 🟥 Most vulnerable soil
- ⬛ Not assessed soil

Source: Melioration and Soil Protection Research Institute

Erosion is a complex process which involves breaking the soil surface, transport and reverse sedimentation of loose soil particles. Under normal conditions, this is a natural and gradual process, in full accordance with the soil-forming process. However, human activities create starting conditions for accelerated erosion of agricultural land that is brought about anthropogenically. Its intensity, especially in the case of water erosion, can be 10–1,000 times higher than the normal (geological) erosion. This accelerated erosion, caused especially by the farming methods, leads to such loss of soil particles that the soil-forming process fails to respond adequately by corresponding soil formation from the bedrock.

The most frequent cause of accelerated erosion on agricultural land consists in inappropriate farming methods, such as massive uniting of plots, monocultures, removal of landscape elements, absence of grass-covered belts of terraces, cultivation regardless of the plots' slopes or cultivation of crops that are dangerous in terms of erosion (e.g. maize).

The current erosion, which would express the present actual state of erosion threat including the anthropogenic effects, is not monitored consistently for the whole of the Czech Republic's territory. An assessment of the **potential erosion vulnerability of agricultural land** is therefore used to identify agricultural soils susceptible to water and wind erosion and to find out the erosion threat; within this method, the calculations are based on the natural conditions and natural characteristics of the soil and relief.

Water erosion is among the most essential manifestations of soil degradation. The extent of water erosion vulnerability of agricultural land can be quantified in two main ways – the potential quantification is possible by means of **long-term average annual soil loss** (G)[3] and direct quantification by means of the **maximum admissible value of the cover and management factor** (C_P)[4].

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[3] *The universal soil loss equation (USLE) is used to calculate the estimated average long-term soil loss (G, t.ha^{-1}.year^{-1}): $G = R \text{ x } K \text{ x } L \text{ x } S \text{ x } C_p \text{ x } P$. The following factors are included in the equation as inputs: rainfall and runoff erosivity factor (R), soil erodibility factor (K), topographic factors (L and S), cover and management factor (C_p) and support practice factor (P). All acreages are absolute or relative expressions of the proportion of the given category in the total acreage of agricultural land resources according to the BPEJ (evaluated soil ecological units) database.*

[4] *C_p does not examine the potential level of risk, but it serves directly as an erosion protection tool. The maximum permissible values of the cover and management factor (C_p) are divided into 5 categories. All acreages are absolute or relative expressions of the proportion of the given category in the total acreage of agricultural land resources according to the BPEJ (evaluated soil-ecological units) database.*

According to the **long-term average annual soil loss**, more than a half (52.7%) of agricultural land is potentially threatened with or predisposed to water erosion in the Czech Republic. Agricultural land which is extremely vulnerable to water erosion occupies 5.2% of the agricultural land resources (Chart 1), which means that the long-term average soil loss per one hectare is higher than 10.1 t.ha^{-1}.year^{-1}. In 2013, agricultural land which is medium to very strongly vulnerable occupied 30.7% of the total agricultural land and its loss was equal to 2–10 t.ha^{-1}.year^{-1}.

In case of heavily eroded soils, the average yields per hectare are reduced by 75% and the price of the land is lower by 50%. In addition to economic damage, loss of soil is also an environmental harm since the soil-forming process is very slow compared with the soil loss caused by water erosion. Currently, the maximum loss of land in the Czech Republic amounts to approximately 21 mil. t of topsoil per year.

From a long-term perspective, the biggest problem consists in loss of soil in areas where there is the most valuable land (the Elbe valley and Moravian valleys, Figure 1) and where there is also the largest proportion of soil under extreme threat. These are the most fertile areas with the longest history of agriculture and the most intensive cultivation.

The **maximum admissible value of the cover and management factor (C_p)** is another tool which serves for direct assessment of water erosion in the Czech Republic. This factor not only shows where and how the land is threatened, but also how to protect it effectively. If the factor's value is exceeded in a given site, erosion should be eliminated through a corresponding (framework) management method or anti-erosion measures. The framework management based on C_p is recommended for a total of 51.2% of agricultural land in the Czech Republic which is at least slightly vulnerable to water erosion (Figure 2, Chart 2). For instance, in case of potentially the most vulnerable agricultural land (only 0.03% in the Czech Republic in 2013), it is recommended to convert the respective land units or their parts into permanent grassland. For strongly vulnerable soil (1.04%) it is recommended to grow only perennial crops (e.g. clover, lucerne) and in case of the remaining part of vulnerable land it is recommended to exclude growing of wide-row crops and use soil-conserving technologies.

The C_p values have also been used to define strongly and slightly vulnerable **arable land** for the needs of **GAEC (good agricultural and environmental conditions)** standards which ensure that the management is in accordance with protection of the environment. Erosion threat that is assessed in this way is registered in the public land registry (LPIS). In the register, soil without erosion vulnerability (C_p above 0.1) accounts for 89.5% of the land, slightly vulnerable soil 10.1% (C_p 0.02–0.1) and heavily vulnerable soil 0.4% (C_p below 0.02).

Wind erosion[5] poses a potential threat to 18.4% of agricultural land (slightly vulnerable to most vulnerable soil) in the Czech Republic at present (Figure 3, Chart 3). The causes of wind erosion consist especially in excessive size of land units with one type of crop, missing windbreaks (alleys) or hedgerows. Along with loss of the most fertile parts of the soil profile and deterioration of its physical and chemical properties, wind erosion also damages sprouting plants, causes air pollution and other damage (e.g. aeolian topsoil deposit).

Potential vulnerability of agricultural land is difficult to compare interannually because the methodology to determine vulnerability of soil to water erosion was made more accurate. However, interannual changes in the overall extent of erosion are minimal and it is rather possible to follow changes in smaller territories which face soil denudation as a result of single precipitation episodes. In this context, there are local loss of crop, damage to roads, railways, buildings and buried services and water reservoirs siltation. Generally speaking, the state is getting worse in long terms, especially concerning water erosion, as a systematic protection of agricultural land resources is non-existent and the costs concerning removal of erosion-related damage and reconstruction of destroyed property owned by municipalities and other entities concerned have been growing over a long period. On the basis of estimated cost of the removal of sediments and nutrient loss, the annual damage caused by water erosion in average amounts to more than CZK 10 bil.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1897)

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[5] *It concerns a methodology used in the Melioration and Soil Protection Research Institute. Data on climatic regions (the sum of daily temperatures above 10 °C, the average moisture certainty during the growing season, probability of dry growing seasons occurrence, average annual temperatures, annual precipitation amount) and data on the main land units (genetic type of soil, parent material, soil texture, skeleton content, rate of hydromorphism) were taken from the BPEJ database. All areas are absolute or relative expressions of the given category's proportion in the total area of the agricultural land resources according to the BPEJ database.*

20/ Quality of agricultural land

KEY QUESTION →

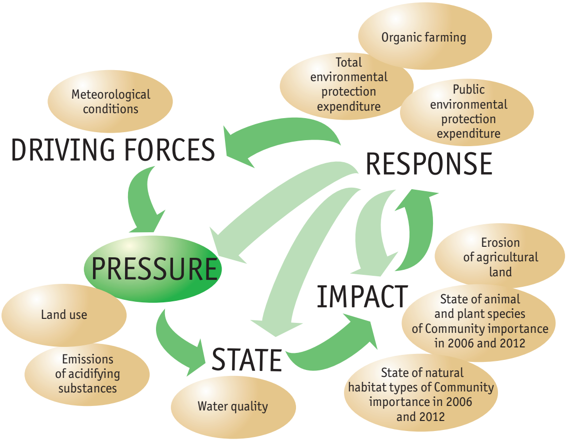
Is the amount of chemicals used in agriculture decreasing and what is their effect on the quality of soil?

KEY MESSAGES →

🙂 In 2013, the consumption of mineral fertilisers and plant protection products decreased interannually by 3.9% and 3.5% respectively. The cause of the decline lies mainly in the weather in 2013, which was characterized by very cold March, heavy precipitation in May and June and by drought in July and August. Concerning consumption of calcium materials, further growth by almost 26% continued, due to reducing high acidity of agricultural soils.

😐 Soil quality and its production capabilities are negatively affected only in case of one-sided application of mineral fertilisers without yard manure being added. Introduction of risky substances or of elements through agrochemicals is insignificant.

🙁 In case of selected high-risk substances, exposure limit values are being exceeded in long terms, predominantly in hazardous and potentially carcinogenic polycyclic aromatic hydrocarbons such as chrysene, anthracene and fluoranthene. A high degree of persistence in soil has been recorded for a group of persistent chlorinated pesticides – especially the DDT group and substances arising from DDT (DDD and DDE), where an excessive content was identified in 57.7% of the samples, which is an increase by 15.5 percentage points compared with 2012.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

In connection with the solution to negative impacts of agriculture on landscape and the environment and with the protection of soil against pollution-related agricultural activities, the **National Action Plan to Reduce the Use of Pesticides in the Czech Republic** was adopted in 2012. It has been prepared in accordance with the request of the **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. The main objectives of the National Action Plan include to reduce the risks resulting from the use of plant protection products and to optimise the use of these products, without reducing the extent of agricultural production and quality of plant products. The National Action Plan and the above Directive are closely linked to measures in the field of water protection, especially in connection with the **Council Directive 91/676/EEC** concerning the protection of waters against pollution caused by nitrates from agricultural sources (so-called Nitrate Directive). The Directive aims at reducing water pollution caused by nitrates from agricultural sources and at preventing such pollution in the future. The Action Plan, which is based on the Directive, represents a system of compulsory measures to be taken in so-called vulnerable areas in order to reduce the risk of nitrogen leaching into surface water and groundwater.

In 2006, **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013** has been adopted which also deals with the relations between agriculture and protection of the environment. It aims mainly at increasing competitiveness in agriculture, improving the environment and landscape through supporting environmentally friendly land management methods and enhancing the quality of life in rural areas. This is also related to the issues of using chemical products in agriculture within the **Action Plan of the Czech Republic for the Development of Organic Farming in 2011–2015.**

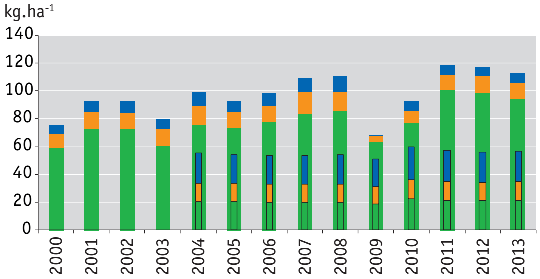
Environmentally friendly approach to land is also connected with the system of direct payments and other European aid to farmers, which is made dependent on, inter alia, fulfilment of the GAEC (good agricultural and environmental condition) standards, statutory management requirements (SMR) and the minimum requirements for the use of fertilisers and plant protection products within agri-environmental measures.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Inappropriate agricultural land management and other anthropogenic effects contribute to deterioration of the soil quality, causing a decline in biodiversity of soil micro-organisms. They also influence the quality of surface water and groundwater, disturb the balance of ecosystems and affect the food chain. Hazardous elements and substances which are not directly related to agricultural activities but for example with industrial production get into soil, too. A number of substances bind to soil particles and accumulate in the soil for a very long time. Through the food chains, these hazardous substances are getting into food, thus threatening human health. Being washed out of the soil, the pollutants (nitrates in particular) contaminate drinking water sources.

INDICATOR ASSESSMENT

Chart 1 ➔ **Development of the consumption of mineral fertilisers and yard manure in the Czech Republic [kg of net nutrients.ha^{-1}], 2000–2013**

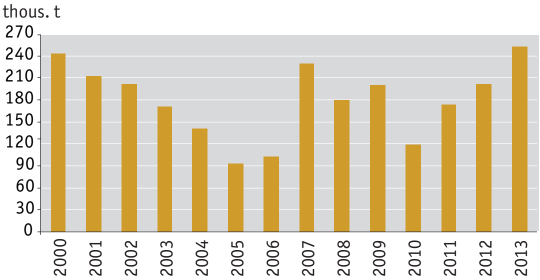


- 🟦 K_2O
- 🟧 P_2O_5
- 🟩 N

Source: Ministry of Agriculture

In the chart, mineral fertilisers are represented by wider columns and yard manure by narrower columns. In the case of yard manure, the data in the appropriate arrangement have been available since 2004.
On the basis of information from the Czech Statistical Office, acreage of so-called "utilised agricultural area" (3,521 thous. ha) was used in the 2013 calculation.

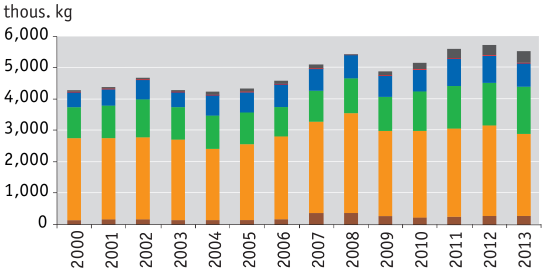
Chart 2 ➔ **Development of the consumption of lime substances in the Czech Republic [thous. t], 2000–2013**



- 🟧 Consumption of lime substances

Source: Ministry of Agriculture

Chart 3 ➔ **Trends in consumption of plant protection products in the Czech Republic [thous. kg of effective substance], 2000–2013**

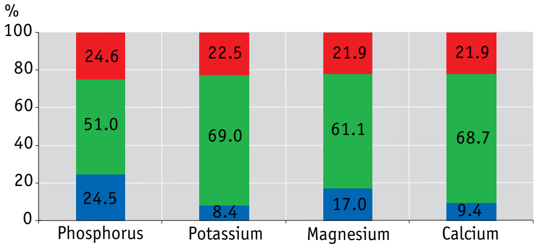


- ⬛ Others*
- 🟥 Rodenticides
- 🟦 Growth regulators
- 🟩 Fungicides, stains
- 🟧 Herbicides and desiccants
- 🟫 Zoocides, stains

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

**Others – auxiliary substances, repellents, mineral oils, etc.*

Chart 4 ➔ **Proportion of agricultural lands by content of available nutrients in agricultural land in the Czech Republic [%], 2007–2012**

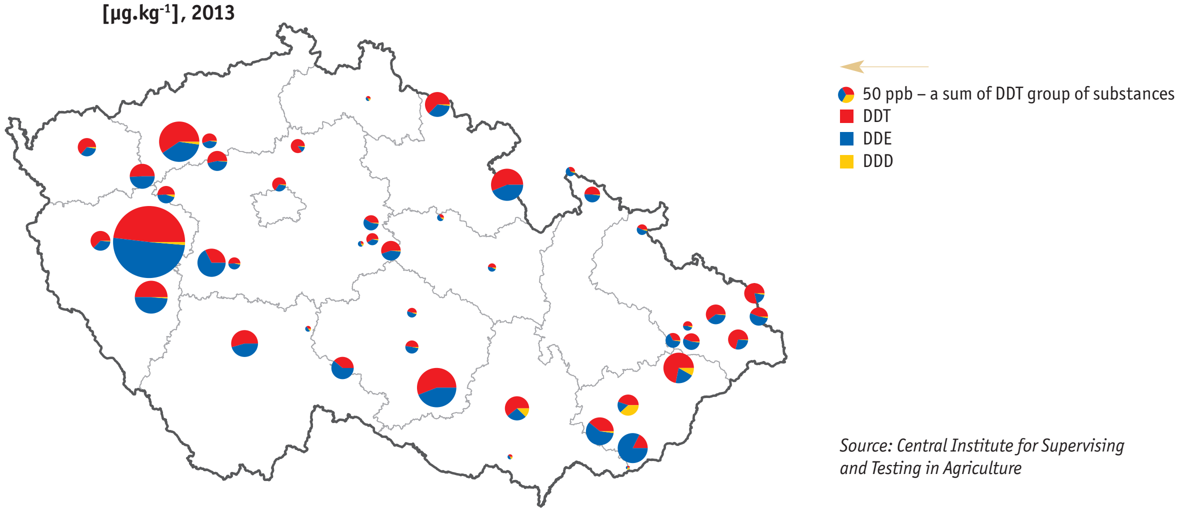


- 🟥 High to very high content
- 🟩 Satisfactory to good content
- 🟦 Low content

Source: Central Institute for Supervising and Testing in Agriculture

The results of Agro-chemical testing of agricultural soils. Sampling takes place on a regular six-year basis (the last completed cycle was 2007–2012, however, the results can be applied to the year 2013 as well). Nitrogen is not included in the monitoring. Intensive fertilisation is recommended for soils with low nutrient content, slight saturation with nutrients is recommended in case of satisfactory soil and fertilisation should not be done on soils with a high and very high content nutrients.

Figure 1 ➜ **Content of DDT group of substances in topsoil of agricultural land in the Czech Republic (within Basal Soil Monitoring) [μg.kg^{-1}], 2013**



Source: Central Institute for Supervising and Testing in Agriculture

The results of Basal Soil Monitoring (BMP). Determined in soil samples from 40 selected monitoring sites within Basal Soil Monitoring and five sites in protected areas (Giant Mountains National Park, Kokořín area, Pálava, White Carpathians, Orlické Mts.).

In the Czech Republic, **agricultural land quality** and its production capabilities are negatively affected especially in cases of incorrect, i.e. one-sided application of mineral fertilisers without yard manure being added. Long-term and one-sided fertilisation, especially if only nitrogen fertilisers are used, can thus reduce soil fertility substantially, including other negative manifestations such as acidification, reduced sorption capacity or decreased content of soil biomass. The negative effects of agrochemicals are usually transferred, namely in connection with erosion and resulting outwash from fields to watercourses or reservoirs, with typical manifestations such as eutrophication. Introduction of hazardous substances, especially heavy metals contained in mineral fertilisers (or sludge and sediments) or in plant protection products, is insignificant in the Czech Republic. The reason consists in the fact that there are legislative limits for the use of these potentially hazardous materials in the Czech Republic's agriculture so as their application does not cause soil contamination. Soil fertility and the resulting yields may also be influenced by the structure of crops and their rotation. Long-term absence of clover-based vegetation, i.e. perennial forage which increases and stabilises the yields of subsequent crops, has its negative manifestations in Czech Republic. Deterioration of soil quality can also occur within local contamination when chemicals or contaminated water are released during accidents, if waste is discharged directly into the soil or when landfill leachate gets into the environment.

In the case of **mineral fertilisers application**, there was a slight interannual decrease by 3.9% to 113.0 kg.ha^{-1} of net nutrients in 2013. By contrast, the total net deposit of nutrients from **yard manure (organic fertilisers)** increased by 1.2% to 56.9 kg.ha^{-1} (Chart 1). In the period since 2000, a growing trend of mineral fertilisers with regular fluctuations has been recorded. Concerning declines, adverse weather conditions are the most common cause, especially long-term drought in a number of the Czech Republic's areas (e.g. in July and August 2013); in case of growth, the reasons lie in the expected above-average harvest of agricultural crops. Showing a significant decrease, the year 2009 was atypical within this period since the drop was caused by high prices, in particular for phosphate and potassium fertilisers, and low exercise prices of agricultural products[1]. In the period 2000–2013, consumption of yard manure remains stable after an initial decrease caused by a decline in livestock production. In terms of the mineral fertilisers' composition, nitrogenous fertilisers prevail unequivocally with more than 75% of the total consumption. Concerning yard manure, the situation is not so unequivocal because potassium is the most represented component, with approximately 40% share. Generally speaking, fertiliser consumption mostly depends on climatic conditions (temperature, precipitation), the intensity of agricultural activities and type of crop. In addition, the financial position of farmers is the limiting factor of fertiliser consumption.

Due to a relatively big proportion of acid soils (see below), it is required to **apply calcium materials** on such land. In this context, there has been a positive growing trend in the last four years which was confirmed by the high annual growth in calcium consumption by almost 26% to 253 thous. t in 2013 (Chart 2).

The **consumption of plant protection products**, as another input of anthropogenic substances into soil, is affected by the actual occurrence of crop diseases and pests in the given year, which varies according to weather during the year, particularly air temperature

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[1] *Along with the contract price, the prices of selected kinds of agricultural products are concerned. They are determined using the state statistical statements for cooperative, private and government organisations. The prices do not include the value added tax and their average annual value is calculated as the weighted arithmetic mean from average monthly prices.*

and rainfall. This was also true in 2013, especially for dry summer months (July and August) which resulted in lower consumption of herbicides. That is why the 2013 consumption of plant protection products, after previous growth, decreased interannually by 3.5% to 5,519.8 thous. kg of active substances (Chart 3). Herbicides and desiccants (47.3%), fungicides and stains (27.4%) and growth regulators (13.6%) had the biggest proportions in the total consumption.

In the Czech Republic, evaluation of anthropogenic influences on soil quality is carried out by means of different soil monitoring methods, carried out by the Central Institute for Supervising and Testing in Agriculture or Melioration and Soil Protection Research Institute in particular. Within **monitoring of selected soil fertility parameters** (AZZP)[2], the impact of fertilisation intensity on soil properties is assessed in order to modify further use of fertilisers in the fertilisation plans. The parameters monitored within AZZP include the exchange soil reaction of agricultural land and the contents of essential nutrients in soil, i.e. phosphorus, potassium, magnesium and calcium[3]. The average value of soil reaction of agricultural land is pH = 6.0 (i.e. slightly acid) in the Czech Republic. However, more than 1,100 thous. ha of agricultural land (i.e. 33% of the total area) has acid to extremely acid soil reaction (i.e. pH up to 5.5). Due to the fact that another 41% of agricultural land has a slightly acid soil reaction, lime should be applied regularly on the total of 74% of agricultural land. Development of the exchange soil reaction has been negative in long terms; there is a noticeable growth in strongly acidic and acid soils, as a result of a substantial reduction in the consumption of calcium fertilisers in the second half of 1990s. Monitoring of the content of essential nutrients (Chart 4) shows that in average more than 20% of the Czech Republic's agricultural land is not recommended for fertilisation due to a high amount of available nutrients. However, it also shows that the average annual dose per hectare of land should amount to 100–120 kg of N, 30 kg of P_2O_5 and 50–150 kg of K_2O to maintain the achieved production and nutrient supplies in soil. It can be concluded from a comparison with the total 2013 consumption of mineral and organic fertilisers that while the recommendation is met for N and almost met for P_2O_5, the current annual dose is very low in case of K_2O.

In addition to AZZP, **monitoring of the content of hazardous elements and substances in soil (BMP)** is also carried out[4] as their presence does not necessarily have to be related to agricultural activities, but if so, it is mainly a result of application of plant protection products, wastewater treatment plant sludge or sediments from water reservoirs and watercourses. The basal soil monitoring focuses on both **inorganic pollutants and heavy metals** (e.g. As, Cd, Ni, Pb, Zn) and **persistent organic pollutants** (especially 16 indicator polycyclic aromatic hydrocarbons (16 EPA PAH), polychlorinated biphenyls (PCB, 7 congeners) and organochloride pesticides (HCH, HCB, DDT group of substances)). Concerning the presence of **inorganic pollutants (heavy metals)** in agricultural land, the contents of arsenic are most problematic in long terms (1998–2013) with more than 4% of above-limit samples in all soils (i.e. in light, medium and heavy soils), and also those of cadmium (2.8%), chromium (1.7%) and nickel (1.5%). In spite of that, in vast majority of cases, agricultural land in the Czech Republic is not dangerous for food chains in terms of the content of heavy metals.

Within **organic pollutants** monitoring, it is necessary to emphasise especially the long-term exceeding of the limit values for polycyclic aromatic hydrocarbons, namely anthracene, chrysene and fluoranthene, which are, except for anthracene, highly dangerous from toxicological point of view and potentially carcinogenic. Imperfect combustion of carbon (fossil) fuels is the main source of these substances. Another problematic organic pollutants are a group of persistent chlorinated pesticides – especially dichloro-diphenyl-trichloroethane (DDT) and DDT-based organochlorides (DDD and DDE), Figure 1. Although in the Czech Republic there is a ban on the use of DDT-based preparations since 1974, these substances are characterized by strong persistence in soil and they therefore cause its long-term load with proven carcinogenicity for humans. High persistence was also confirmed in 2013, when the permissible values were exceeded most frequently for DDT and DDE – a total of 57.7% of the samples (26 of 45) showed excessive values, which, compared to the previous year (42.2%), represents a relatively high increase.

The danger of hazardous elements and substances consists in their **easy transport to other environments and bio-accumulation** (accumulation in living organisms). This is also confirmed by the results of other monitoring which focused on sediments in watercourses and reservoirs and on plants grown on agricultural land. Concerning **sediments**, in 1995–2013, the highest percentage of samples exceeding the limit values was again recorded for PAH, in village ponds' sediments (62.5% of the samples) and watercourses (50.0% of the samples). Again, a high percentage of the samples did not meet the limit values for DDT in the category of village ponds' sediments (33.3%). Concerning monitoring of **high-risk substances in plants**, very low risk was found out because above-limit quantity of cadmium was detected in only one sample (of a total of 91) intended for use in food.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1898)

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[2] *Agrochemical testing of agricultural soils (hereinafter referred to as AZZP). Sampling takes place on a regular six-year basis (the last completed cycle was 2007–2012). During this period, almost the entire acreage of agricultural land is monitored in the Czech Republic. The basic chemical analyses include determination of exchange soil reaction, determination of carbonates (CO_3^{2-}), available phosphorus (P), potassium (K), magnesium (Mg) and calcium (Ca).*

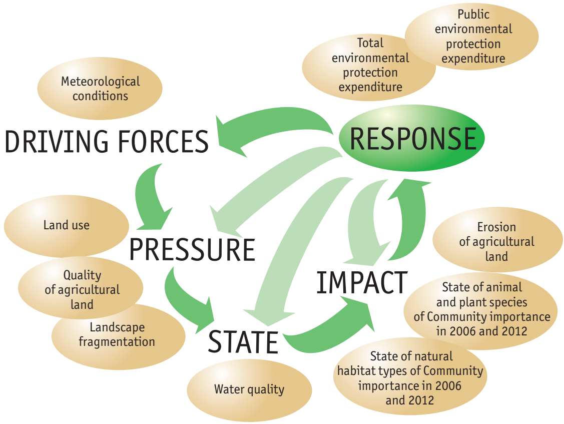
[3] *Within AZZP, the nitrogen content is not monitored due to relatively high variability and dependence on climatic conditions.*

[4] *Basal soil monitoring (BMP) is carried out either annually through sampling of plants in order to determine the contents of hazardous elements and substances in agricultural crops and through sampling of soil (in selected areas) aimed at monitoring of selected persistent organic pollutants (POPs), or in six-year cycles on all areas within the basic monitoring points network, or contaminated areas sub-network.*

21/ Organic farming

KEY QUESTION →

Is the proportion of agricultural land under organic farming increasing?



KEY MESSAGES →

☺ The proportion of organically cultivated agricultural land and the number of organic farms have been increasing in long terms. For the last 10 years, the area of agricultural land under organic cultivation increased almost twice in the Czech Republic, from 255 thous. ha to more than 493 thous. ha. In 2013, 11.7% of the total area of agricultural land resources was cultivated in accordance with the organic farming principles. In the same period, the number of organic farms increased five times from 810 to 4,060 entities. The organic food market is also developing – both the number of organic food producers and the total consumption of organic food are growing. The total amount of financial means allocated to organic farming within agro-environmental measures of the Rural Development Programme has also been growing.

😐 The trend of growing acreage of agricultural land under organic farming has slowed down in last two years; the last interannual increase amounted to only 0.5%. There was an interannual decrease of arable land and other areas within organic farming. Despite a growing tendency, the organic food market is still underdeveloped.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

In order to promote sustainable development principles, the European Commission adopted the **European Action Plan for Organic Food and Farming** in 2004. It aims, inter alia, at improving awareness of organic farming and to ensure its public support through rural development, organic food market development and strengthening research in this area. In 2010, the Czech Republic adopted the **Action Plan of the Czech Republic for the Development of Organic Farming in the years 2011–2015** which focuses on support to those areas of organic farming which are not developed sufficiently, e.g. research and education of farmers, domestic organic food market, public awareness, etc. One of the 2015 objectives of the Action Plan is to achieve a 15% proportion of organic farming in the Czech Republic's total agricultural land area, and at least a 20% proportion of arable land in the total acreage under organic farming. The Action Plan also aims at increasing the share of organic food in the total food consumption to 3% and at increasing the proportion of Czech organic food in the domestic market up to 60%.

Environment-friendly management of agricultural land is also dealt with by the **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013**, adopted by the Czech Republic's Government in 2006. It aims at increasing competitiveness in agriculture, improving the environment and landscape through supporting environmentally friendly land management methods and enhancing the quality of life in rural areas.

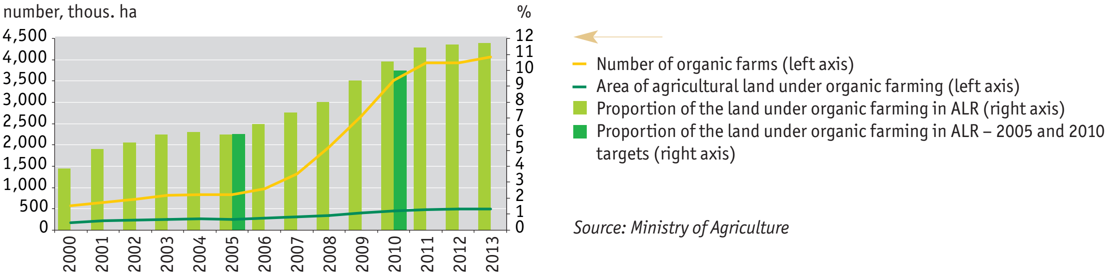
In the Czech Republic, the rules of organic farming are mostly regulated by the Act No. 242/2000 Coll. on organic farming, and on the EU level by the Council Regulation (EC) No. 834/2007 on organic production and labelling of organic products and the Commission Regulation (EC) No. 889/2008 laying down detailed rules for the implementation of the Council Regulation (EC) No. 834/2007.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Organic agriculture is characterized mainly by not loading the soil with mineral fertilisers or other chemical plant protection products. It has a positive effect on soil quality, the quality of produced food, on health of the livestock and indirectly on human health. Organic farming has a positive influence on soil micro-organisms, increasing biological diversity and ecological stability of the landscape. It also contributes to sustainable rural development and positively affects the conservation of landscape character by not applying the approaches of conventional agriculture such as creation of large land segments with monoculture crops.

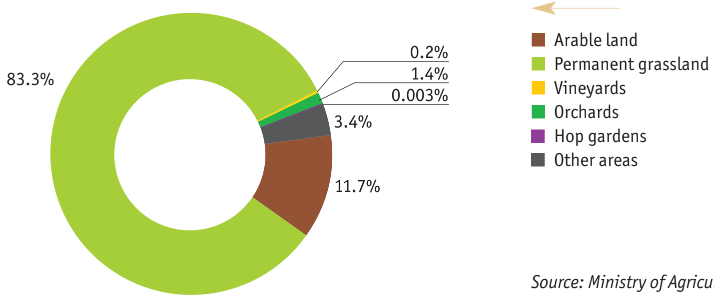
INDICATOR ASSESSMENT

Chart 1 ➜ **Organic farming trends in the Czech Republic [number, thous. ha, %], 2000–2013**



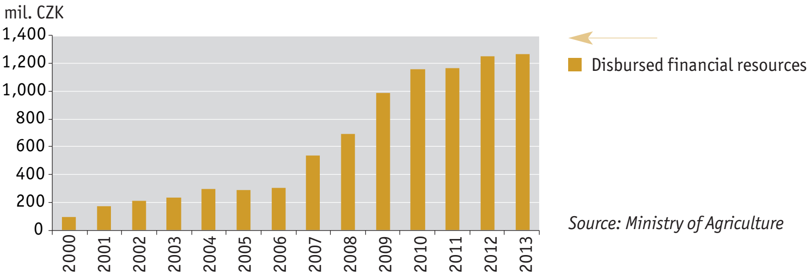
Source: Ministry of Agriculture

Chart 2 ➜ **Structure of land resources in organic farming in the Czech Republic [%], 2013**



Source: Ministry of Agriculture

Chart 3 ➜ **Financial resources disbursed within the "Organic Farming" agro-environmental measure [mil. CZK], 2000–2013**



Source: Ministry of Agriculture

Table 1 ➔ **Amount of organic farming subsidies per unit area in the Czech Republic [CZK.ha^{-1}], 2004–2013**

Culture	2004–2006 (HRDP[1]) [CZK.ha^{-1}]	2007–2009 (RDP[2]) [CZK.ha^{-1}]	2010 (RDP) [CZK.ha^{-1}][3]	2011 (RDP) [CZK.ha^{-1}][3]	2012 (RDP) [CZK.ha^{-1}][3]	2013 (RDP) [CZK.ha^{-1}][3]
Arable land	3,520	4,086	3,780	3,880	3,909	4,260
Permanent grassland	1,100	1,872	2,170/1,731[4]	2,232/1,781[4]	2,244/1,790	2,466/1,951
Vegetables and special herbs on arable land	11,050	14,869	13,755	14,149	14,223	15,499
Permanent cultures (orchards, vineyards)	12,235	22,383	20,707/12,438[5]	21,299/12,794[5]	21,410/12,861[5]	23,331/14,015[5]

Source: Ministry of Agriculture

[1] *Horizontal rural development plan (HRDP)*

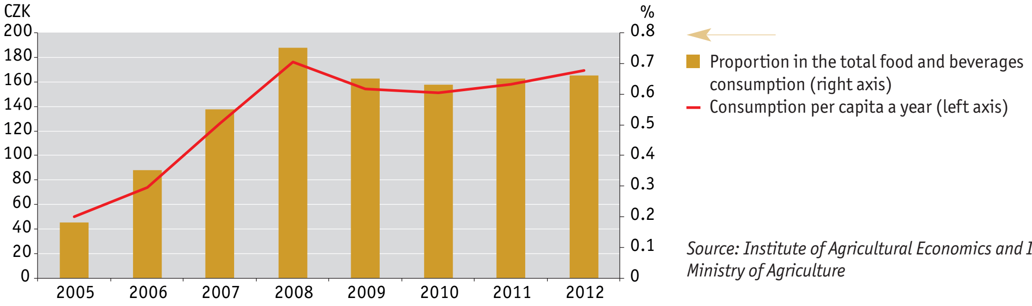
[2] *Rural development programme 2007–2013 (RDP)*

[3] *Calculation was carried out based on the EUR/CZK conversion rate which is published in the Official Journal of the European Union issued in the calendar year for which the payment is granted and on the rate which is stated for the date closest to the beginning of this calendar year.*

[4] *Permanent grassland management for a 100% organic farmer (without concurrence with conventional agriculture)/number of farmers with the concurrence.*

[5] *Management of vineyards, orchards or hop gardens/management of extensive fruit orchards.*

Chart 4 ➔ **Consumption of organic food in the Czech Republic [CZK, % of the total food and beverages consumption], 2005–2012**



Source: Institute of Agricultural Economics and Information, Ministry of Agriculture

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

The importance of organic farming continues to grow in the Czech Republic since the end of 1990s, in particular thanks to the system of European and national support and growing interest of the public in the products of organic farming (organic food). For the last 10 years, i.e. in 2003–2013, the **acreage of agricultural land under organic farming** increased almost twice from 255 thous. ha to more than 493 thous. ha in the Czech Republic. In 2013, about 11.7% of the total area of agricultural land resources was therefore cultivated in accordance with the principles of organic farming (Chart 1). In the same period 2003–2013, the **number of entities (organic farms) working in accordance with the principles of organic farming** increased 5 times from 810 to 4,060 entities (i.e. to approximately 13% of the registered agricultural entrepreneurs in the Czech Republic), Chart 1. However, the earlier significant growth rates in both the land under organic farming and the number of organic farms were replaced by stagnation or only slight increases in the past two years. The slow-down of growth is caused mainly by stopped submission of applications for inclusion into the measure "Organic Farming" within agri-environmental measures (AEM) for new applicants from 2012, due to the approaching end of the programme period and fulfilment of the absorption capacity of the subsidy title[1].

Concerning the **structure of using land under organic farming**, there is a long dominance of permanent grassland – it occupied 83.3% (411 thous. ha) in 2013, Chart 2. After an initial drop following the year 2003 (with the share being equal to 90.7%), the proportion of permanent grassland in the total area of organically cultivated land has not showed any significant change for several years, in spite of the fact that the area of permanent grassland grew by about 180 thous. ha in the same period. The interannual increase in the proportion of permanent grassland amounted to 0.3 percentage point in 2013. The second largest share in the area of land under organic farming is arable land with nearly 11.7% (approximately 58 thous. ha). While in 2003, the share of arable land in the land under organic farming was 7.7%, in 2013 it was 11.7%, despite a slight decline by 0.2 percentage points in the same year. The rest of the area of organically cultivated land is covered by permanent crops (vineyards, orchards, hop gardens) and other areas. The proportion of permanent agricultural cultures, despite their marginal representation, increased significantly from 0.36% to 1.6% (i.e. to 7,800 ha) in 2003–2013. The reason consists mainly in the increase of payments for the production of fruit and wine, as well as in higher awareness of the proper production in organic quality.

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[1] *There was an exception for applicants who specialized in grassing of land, which is related to efforts of the Ministry of Agriculture to struggle soil erosion.*

One of the main reasons for the high proportion of permanent grassland in organic farming lies in the setting of agri-environmental programmes which motivated the farmers greatly to fulfil environmental functions predominantly through taking care of permanent grassland at the expense of farming on arable land.

Although permanent grassland is not directly used for the production of vegetable organic products, but indirectly for organic livestock breeding, it has an indispensable landscape function. This fact has also played its role in the higher support for organic farming on permanent grassland. The landscape function of permanent grassland consists mainly in influencing the amount and quality of groundwater and surface water, in excellent anti-erosion and anti-floods effects and also in significant biodiversity protection. The enlargement, renewal and maintenance of grassland communities in landscape are among possible solutions to the protection of land resources.

If the main ecological land use methods are related to the total area of the respective agricultural land resources (according to LPIS records), the permanent grassland under organic farming covered 41.5% of the total permanent grassland in 2013, on the other hand, arable land under organic farming occupied only 2.3% of the total area of arable land in the Czech Republic. Areas of fruit orchards (29.4% of the total orchards area) and vineyards (7.3% of the total vineyards area) under organic farming have thus greater representation in comparison to arable land.

Concerning the **production structure in organic farms**, hay from permanent grassland, fodder crops on arable land, cereals, fruits from the orchards, legumes and root crops prevail in the context of plant production (total of 1,266 thous. t in 2013). Animal-based production (total of 6.4 thous. t of biomass) is dominated by beef, followed by mutton/lamb, poultry and pork. In the context of milk production, 32.4 mil. l of milk, approximately 79 t of cheese and another approximately 250 t of milk products (e.g. yoghurt) were produced in 2013.

The **average size of an organic farm** slightly decreased interannually to 122 ha in 2013, and since 2001 (when it reached the largest acreage of 333 ha) it has been declining steadily. The reason lies especially in inclusion of new farms with smaller acreage and also in segmentation of the existing farms into smaller units. The average acreage of an organic farm is still greater than that of a conventional farm (around 80 hectares).

The **number of organic food producers** has been growing continuously. While in 2001, there were 75 organic food producers, in 2013 there were already 500 production facilities (471 producers). The maximum was reached in 2011, when there were even 646 organic food production facilities (422 producers) in the Czech market. The subsequent significant decrease in the number of production facilities was connected with reduced activities of the company Billa, which gradually ended baking of frozen organic bakery products in their shops in 2012–2013. Czech consumers buy most of the organic food at retail chains and in shops with healthy and organic food. Different forms of direct sale are on the rise, especially farmer's markets, a system of boxes or new farm shops in major cities. Nevertheless, it should be noted that despite the growing trend (Chart 4), the **Czech organic food market** is still underdeveloped – the average annual consumption of organic food per capita remains below CZK 200 and the share of organic food and beverages in the total food consumption ranges between 0.6 and 0.7%. The reason lies mainly in higher prices of organic food, which makes this market very sensitive to fluctuations in the economic cycle, i.e. to the economic situation of households (Chart 4). Long-term promotion and information campaigns for consumers, which are not currently implemented in the Czech Republic to the necessary extent, would also contribute to substantially increased demand for organic food.

In long terms, the **main organic food category** with the biggest volume of sales is the category "other processed foods" (especially ready-to-use meals such as baby food jars), followed by the categories "milk and milk products" and "fruit and vegetables".

The significant growth of organic farming is mainly due to the resumption of **European and state subsidies** (Chart 3, Table 1). Since 2007, traditional support for organic farmers (subsidies per area that is included in the transition period or in organic farming) is paid through the Rural Development Programme 2007–2013 (RDP), where organic farming is part of the agro-environmental measures under Axis II of the Rural Development Programme. Since 2007, organic farming has also been supported through a considerable point bonus in evaluating investment projects within the RDP investment measures that are part of Axes I and III. The total amount of financial means paid within the agro-environmental measure "Organic Farming" was more than CZK 1.25 bil. in 2013. Since 2007, there have been continual interannual increases within the RDP in the volume of organic farming subsidies calculated per 1 ha of agricultural land. The highest subsidies are provided for cultivating orchards, vineyards and hop gardens; in 2013, the subsidy for 1 ha of this land amounted to CZK 23,331. In addition, each year the Ministry of Agriculture of the Czech Republic financially supports the education of organic farmers and organic food producers; educational activities are mainly provided by non-governmental organisations.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1899)

Soil and landscape in the European context

KEY MESSAGES →

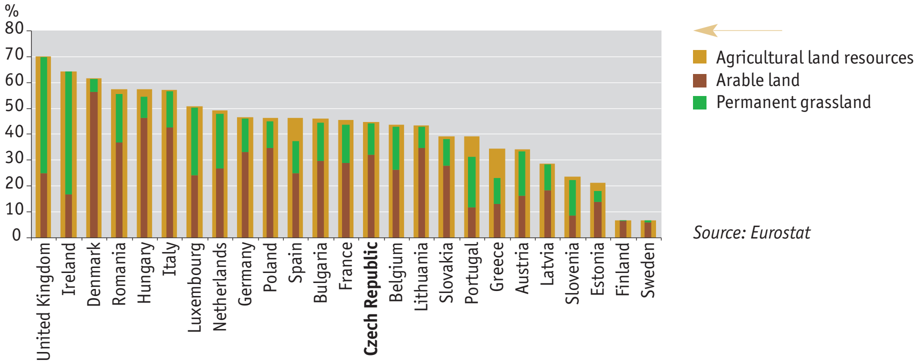
- The Czech Republic achieves excellent results in the framework of organic farming development. While in the EU27 the proportion of land under organic farming amounts to 5.4%, in the Czech Republic it is more than a double (13.1% of utilised agricultural area[1]). This also corresponds to the development and number of organic farms, which increased more than 5 times (within the EU27 by 66.8%) in the last 10 years. This generally positive trend is attributable mainly to the national and European support provided to the sector as well as to the growing demand for organic products.

- The use of mineral fertilisers in Czech agriculture is above the EU27 average. Development of organic farming is not considerably reflected in the consumption of mineral fertilisers in the Czech Republic so far, as opposed to other states where this type of agriculture is also applied to a greater extent. However, it is to be noted that the fertilisers consumption in individual states depends on a number of factors – in particular on temperature and precipitation conditions, intensity of agricultural activities as well as on cultivated crops and, last but not least, on the farmers' financial possibilities. The consumption (i.e. the sale) of plant protection products is average in the Czech Republic.

- In comparison with other Central and East-European countries, the Czech Republic's organic food market belong to the most developed markets with a growth potential. However, compared with Europe's developed countries, the annual per capita consumption of organic food (EUR 6 in 2012) is still at a low level. The reason lies, inter alia, in higher prices of organic food in the Czech market and its insufficient promotion.

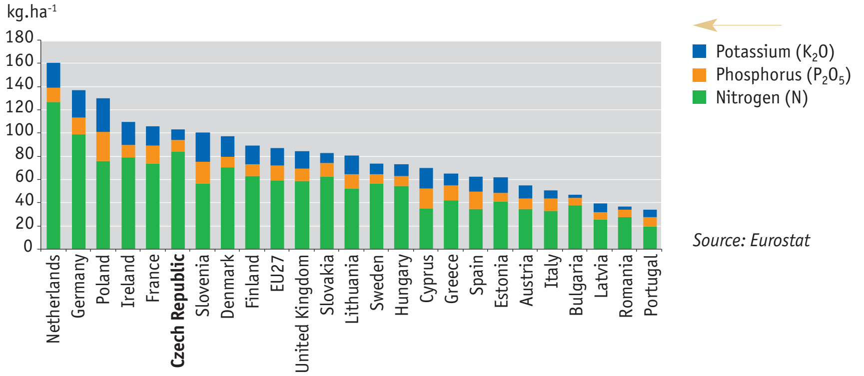
INDICATOR ASSESSMENT

Chart 1 → **Proportion of agricultural land, arable land and permanent grassland in the total territory [%], 2012**



Source: Eurostat

Chart 2 → **Consumption of mineral fertilisers (N, P_2O_5, K_2O) [kg.ha^{-1} of utilised agricultural area], 2011**



Source: Eurostat

Data for year 2011 are preliminary.

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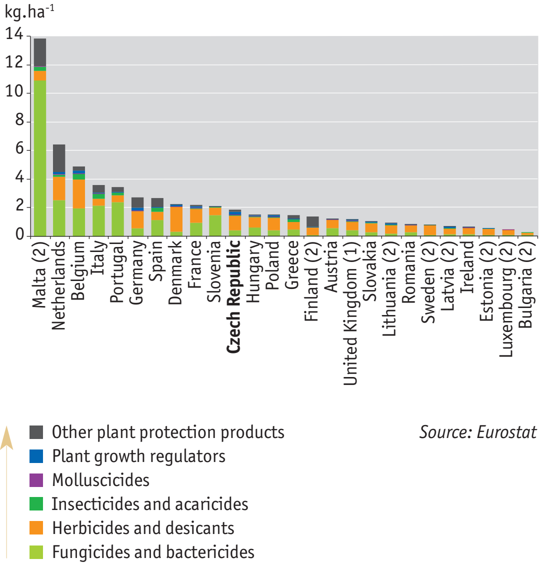
[1] *Utilised Agricultural Area (UAA) according to Eurostat methodology.*

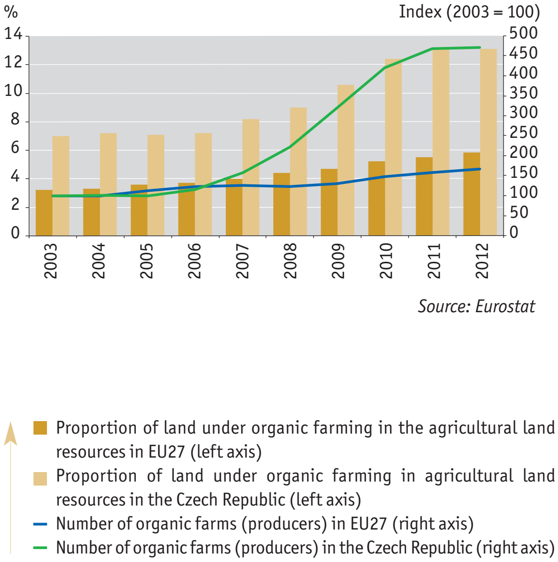
Chart 3 → Amount of plant protection products sold [kg.ha^{-1} of utilised agricultural area], 2012



Source: Eurostat

(1) data of the year 2011, (2) incomplete (individual) data

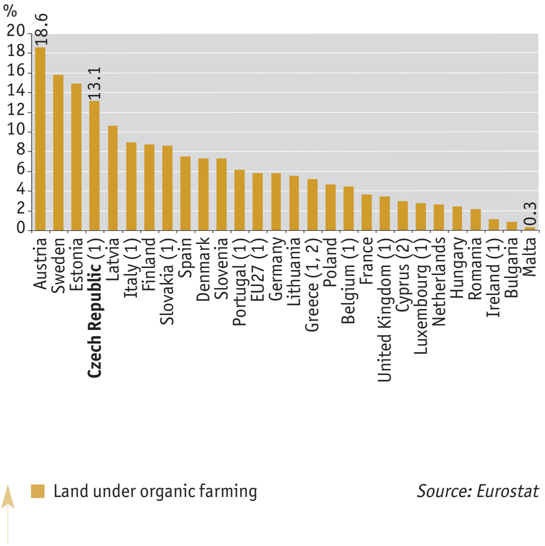
Chart 4 → Development of organic farming (proportion of land under organic farming in the total area of utilised agricultural area, the number of organic farms and producers) in the Czech Republic and in the EU27 [% UAA], [index 2003 = 100], 2003–2012



Source: Eurostat

The EU27 data are estimated in the whole time series, the 2012 data for the Czech Republic are preliminary.

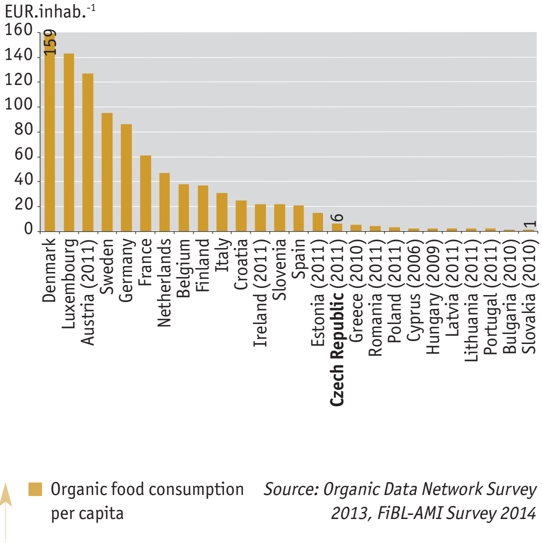
Chart 5 → Proportion of land under organic farming in the total area of utilised agricultural area [%], 2012



Source: Eurostat

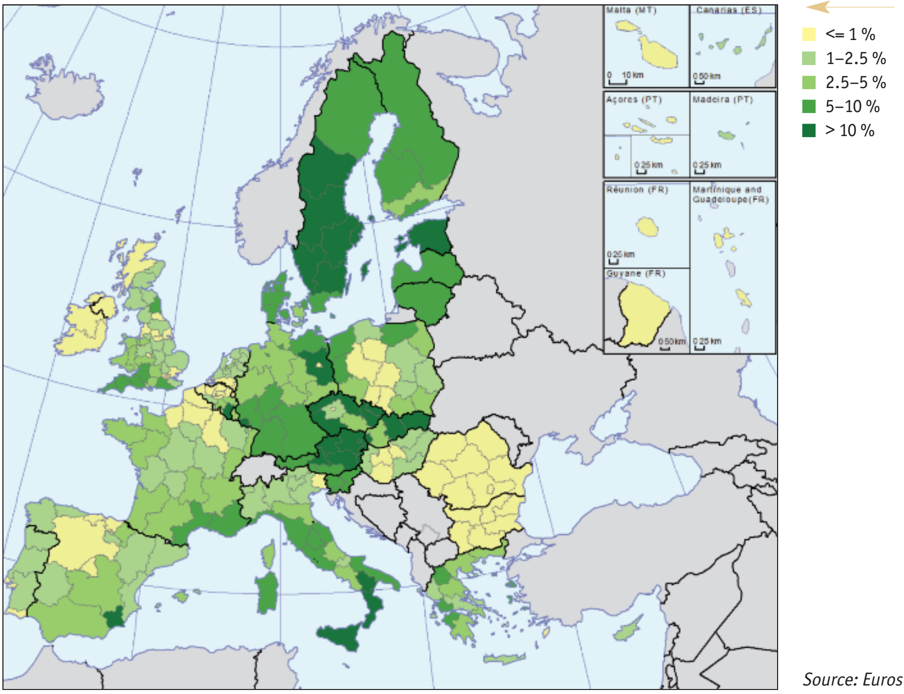
(1) estimate, (2) the 2011 data

Chart 6 → Annual organic food consumption per capita [EUR. inhabitant^{-1}], 2012



Source: Organic Data Network Survey 2013, FiBL-AMI Survey 2014

Figure 1 → **Proportion of the area under organic farming in the total area of utilised agricultural area at regional level [%], 2010**



Source: Eurostat, DG AGRI

In the individual states, the **acreage and composition of agricultural land** is affected by climatic and geographical conditions, character of the economies in the individual countries and by the requirements of international and national markets. In the Czech Republic, the proportion of agricultural land in the country's total area is 44.7%; in the EU27 the average is 41.7%. The highest shares of agricultural land are in the United Kingdom and Ireland, where, however, the majority of agricultural land is covered by permanent grassland. On the other hand, in Scandinavian countries, the share of agricultural land in the total area is very small (Chart 1), since most of the territory is covered by forests. The Czech Republic is characterized by a high proportion of arable land in agricultural land (71.5%), which is cultivated more intensively and therefore causes greater environmental burden than care for permanent grassland does. The general structure of land use is also closely related to the natural ecosystem burden that is caused by **landscape fragmentation**. In Europe, landscape fragmentation is affected especially by transport infrastructure and degree of urbanization, however, the type of agricultural land use, which is subject to geographical conditions of each member state, also contributes significantly. Given the above factors, Luxembourg, Belgium and the Netherlands belong to the most fragmented states; the Czech Republic, together with Poland, follow these countries with a slightly lower proportion.

In the Czech Republic, the potential agriculture-related environmental burden, especially that of surface water and groundwater, is above-average in comparison with the other EU27 countries. This follows mainly from an international comparison of **mineral fertilisers' consumption**, in which the Czech Republic consumes an above-average amount of fertilisers compared with the EU27 average (Chart 2). As far as development in the last years is concerned, there is an almost identical trend in the consumption in both the Czech Republic and within the EU27 average. The same situation is in the area of composition of the fertilisers consumed – application of nitrogen fertilisers clearly dominates in both the Czech Republic and the EU. The collected data show that fertilisers consumption in the individual states mostly depends on temperature and precipitation, intensity of agricultural activities, type of crop and also on the farmers' financial possibilities. Expansion of organic farming in the individual states also plays its role. In the other states which have developed this part of agriculture likewise the Czech Republic there is a below-average fertilisers consumption; however, this is not true for the Czech Republic.

As far as **plant protection products** are concerned, comprehensive international data are available not for consumed but for sold amounts of these products. In this respect, the Czech Republic shows the average values (Chart 3); most of the sold products fall within the category of herbicides. The states with a bigger volume of products sold per unit acreage of agricultural land are characterized by a higher proportion of fungicides. In the individual states, the consumption, i.e. sale of plant protection products is affected by the current occurrence of crop diseases and pests in the given year, which varies according to weather during the year, particularly air temperature and rainfall.

Within the EU, **organic farming** has been experiencing a relatively fast development. In 2012, organically cultivated agricultural land amounted to a total of approximately 10.5 mil. ha, which, compared to the year 2003 (5.9 mil. ha), represents a 76% increase, with the annual increase being approximately 500 thous. ha. The number of organic farms increased by 66.8% during the same period. Yet, the land under organic farming occupies only 5.4% of the total utilised agricultural area within the EU27. In the case of the Czech Republic, however, this proportion more than doubled, i.e. approximately 13.1%, (Chart 4), which rates the country among the leading countries of the whole EU (the highest proportion is achieved in Austria – more than 18%), Chart 5. With the area of 470 thous. ha in 2012, the Czech Republic is in the second place after Poland (660 thous. ha) within the countries that joined the EU in 2004 and later. Despite its slowdown in 2012, the dynamics of organic farming development is above average in the Czech Republic. In 2003–2012, the area of agricultural land under organic cultivation expanded by about 84% and the number of organic farms grew almost five times in the Czech Republic. This generally positive trend in development of organic farming indicators is attributable mainly to restructuring of the agricultural sector after 1990, market development and to the growing demand for organic products. In the Czech Republic, the main driving force in organic farming development, however, was primarily connected with the national and European financial support provided to this sector already before the Czech Republic joined the EU, with its subsequent increase after accession, and also with the introduction of national and European regulations which further stimulated the development of organic farming (see previous chapter).

Organic farming is implemented especially in regions with extensive livestock production systems based on permanent grassland (Figure 1); the importance of organic farming is generally lower in regions where intensive agricultural systems prevail.

Concerning situation in the European **organic food market**, there has been an interannual growth to the total of EUR 22.8 bil. in 2002. In Germany there is the largest organic food market; it represents almost a third of the total European turnover in organic food (EUR 7.0 bil., i.e. 100 times greater than in the Czech Republic). Information on the annual per capita consumption of organic food gives a more illustrative comparison. In 2012, this consumption was highest in Switzerland (EUR 189). At the opposite end there are consumers from Southern, Central and Eastern Europe who spend the least amounts for organic food (Chart 6). In the Czech Republic, the 2012 average annual consumption per capita amounted to only about EUR 6 (CZK 169). The reason lies mainly in higher prices of organic food, which makes this market very sensitive to the economic situation of households. Within the Central and East-European countries, however, the Czech organic food market is considered one of the most developed with the potential for further growth.

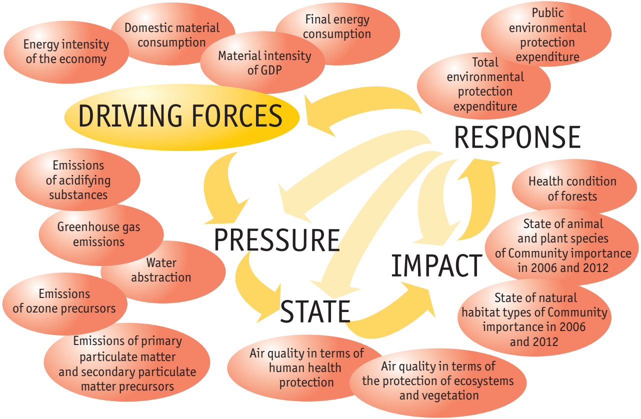
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1768)

22/ Industrial production

KEY QUESTION →

What is the environmental impact of the development of industrial production and its structural changes?



KEY MESSAGES →

🙂 The continued decline in the construction sector ensured a decrease of environmental burden from land take-over, landscape fragmentation and excavation of construction materials, and it also contributed to a decreased volume of construction waste.

In 2012, pollutant emissions from industry declined interannually for all monitored substances; the long-term trend of reducing environmental load from this sector therefore continues.

😐 The decline in industrial production slowed down; the interannual 2012/2013 change amounted to –0.1%.

KEY MESSAGES →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The objectives of the **State Environmental Policy of the Czech Republic** (2012–2020) include e.g. to reduce environmental burden of industry, in particular emissions of pollutants and greenhouse gases and to further reduce energy and material intensity of industry.
The **Czech Republic's Raw Material Policy** influences the search for and use of raw material resources in order to ensure the economy's functioning. Its objectives includes the following: to strengthen the country's raw-material security, to ensure protection of selected mineral deposits, to make use of domestic sources of raw materials to the maximum possible extent, to promote material-saving technologies, to use available stocks of brown coal economically and to evaluate the real potential of domestic brown coal resources, to ensure continuation of the domestic production of uranium as a super-strategic raw material, to continue modernising the mining and processing technologies, to improve social perception of the mining industry etc.
The main objectives of **Secondary Raw Materials Policy of the Czech Republic** include in particular: increasing the Czech Republic's self-sufficiency in raw-material resources by substituting the primary sources with secondary raw materials, support to innovation in extraction of raw materials in the quality suitable for use in industry, promoting the use of secondary raw materials as a tool to reduce the energy and material intensity of industrial production including simultaneous elimination of negative impacts on the environment and human health, and support to education focused on qualified workers in the secondary raw materials sector.
In July 2010, the European Commission issued a guidance document called **Non-Energy Mineral Extraction and Natura 2000**. These guidelines deal with possibilities of reducing the impact of mining activities on nature and biodiversity to the minimum or of preventing such impact entirely.
In February 2011, the European Commission adopted a new strategy which defines specific measures to ensure and improve the **EU's access to raw materials**. The objective of this strategy is based on the following three pillars: fair and sustainable supply of raw materials from world markets; support to sustainable supply of raw materials within the EU; increase of the resources' efficiency and promotion of recycling.
The **European REACH** legislation deals with the production, processing, import and use of chemicals and products containing chemicals in industry (and other sectors). This regulation aims at excluding from circulation the substances with the worst human-health and environmental impacts and to replace them with less harmful substances.

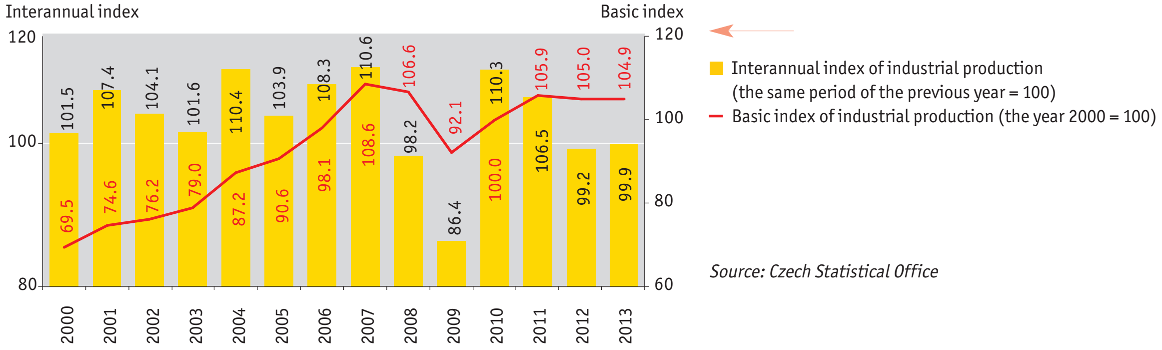
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The industrial sector is a consumer of significant quantities of natural resources, namely both raw materials and energy resources. Extraction of raw materials disrupts the landscape character; it affects the quality, quantity and level of groundwater at extraction sites. In the vicinity of the extracted deposits there can be increased dust and noise pollution, caused by not only the extraction itself but also by transport of the big amounts of material. These factors then influence the surrounding ecosystems and human population. Animals and plants that fail to adapt to the changes die or have to migrate. However, some excavation projects may be even beneficial for biodiversity, as they give rise to valuable ecological niches. Industrial areas often suffer from increased environmental pollution, especially air pollution, i.e. both with substances that are commonly monitored and with specific substances that are associated with concrete industrial production. Poor air quality has been proved to cause increased sickness rate, the incidence of allergies, asthma, respiratory and heart problems, cancer, reduced immunity etc. Noise pollution affects nervous systems of both humans and animals. The industry also produces, imports and processes chemical substances, mixtures and products whose properties are not always known in relation to toxicity for the environment and humans.

Industry and energy sector

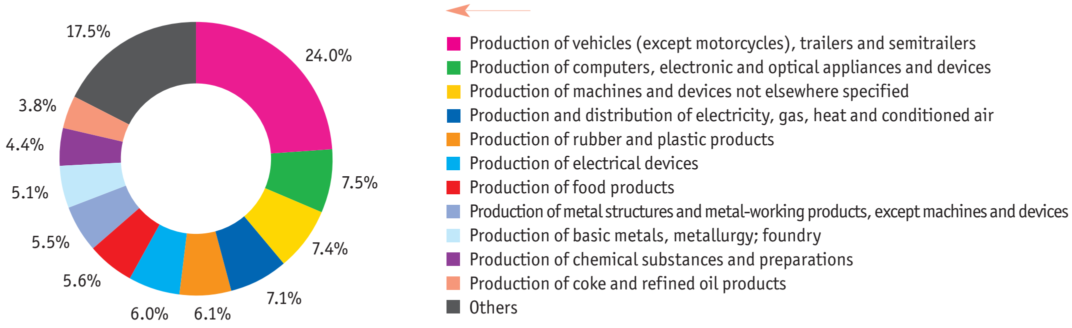
INDICATOR ASSESSMENT

Chart 1 ➔ **Index of industrial production in the Czech Republic, 2000–2013**



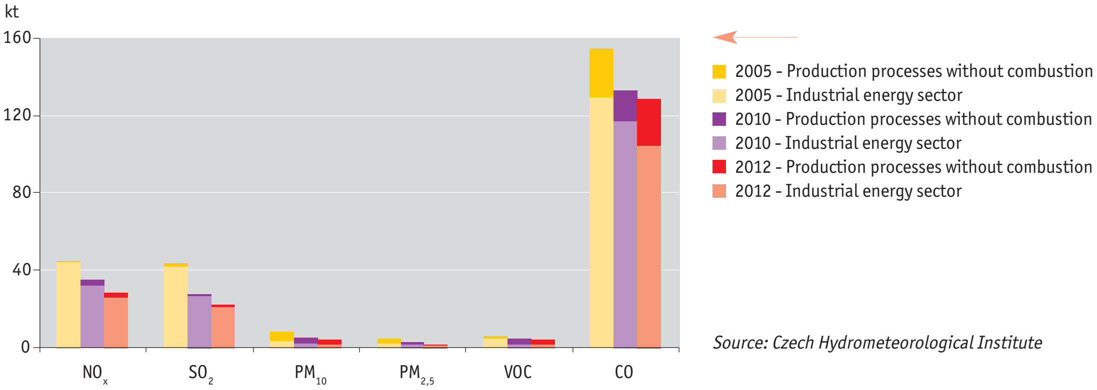
Source: Czech Statistical Office

Chart 2 ➔ **Structure of industrial production in the Czech Republic [%], 2013**



Source: Czech Statistical Office

Chart 3 ➔ **Pollutant emissions from industry in the Czech Republic [kt], 2005, 2010, 2012**



Source: Czech Hydrometeorological Institute

In terms of the environment, however, the industry sector is an important **producer of a wide range of emissions** of pollutants and waste products. It also consumes a significant amount of non-renewable natural raw materials and energy sources. On the other hand, it **creates approximately 30% of the Czech Republic's GDP** and it is therefore one of the crucial segments of its economy. Environmental impacts of this sector are concentrated in areas where there are large industrial plants, i.e. Moravian-Silesian region, the region of Ústí nad Labem and Central Bohemian region. In 2000–2013, environmental impacts of industrial production were decreasing.

In 2013, the **Czech Republic's total industrial production** decreased interannually by 0.1% while during the first half there was rather a decline and in the second half of the year a growing trend was recorded. Recovery of industry in the eurozone, particularly in Germany, was reflected here. In the Czech Republic, the decisive automobile industry then recovered thanks to a higher demand. Production of the supplying sectors was also growing and there was a favourable development in important sectors of the manufacturing industry – engineering, metallurgy and metal-working production, rubber and plastics industry.

The **construction sector** was on decline for the fifth year in a row in 2013. The construction production decreased by 6.7% interannually. This trend affected building construction and civil engineering and in that context, the number of employees was reduced in this sector. In relation to the environment, the decline in the construction sector can be considered a rather positive phenomenon since there is less new development (connected with loss of land) and landscape fragmentation; excavation of construction raw materials is reduced as well as the amount of construction waste. However, there was a decline also in constructions the purpose of which was to improve the environment, such as waste water treatment plants, landscape reclamation, removal of environmental contamination and accidents, constructions for recycling of raw materials, including construction waste, etc. In this case, the decline in construction in relation to the environment is a negative phenomenon.

Emission from the industry sector[1] (Chart 3) can be divided into two groups – emissions from the industrial energy sector and emissions from industrial processes without combustion of fuels. Emissions from the industrial energy sector include particularly NO_x and SO_2, and also CO the vast majority of which (as far as industrial sources are concerned) comes from the iron and steel works in Ostrava and Třinec. The industrial production processes without fuel combustion are production-type specific. These sources emit a wide range of emissions that affect the environment in different ways.

In 2012, the declining trend continued in the discharge of **pollutants** from the industry sector (Chart 3). There was a decrease in all monitored substances, emitted from both the industrial energy sector and industrial processes excluding fuel combustion. In general, NO_x emissions from industry declined by 7.2%, SO_2 emissions by 8.8%, PM_{10} emissions by 4.5%, $PM_{2.5}$ by 7.8%, VOC by 3.9% and CO emissions by 5.7%.

Since 2000, the **energy intensity of the industry** has been declining substantially, which is also reflected in a decrease of specific environmental burden per unit of industrial production. While in 2000, energy intensity of the industry sector was 685.8 MJ.thous. CZK^{-1}, in 2012[2] it was only 313.5 MJ.thous. CZK^{-1} (calculated as the proportion of the final energy consumption in industry and gross value added of the sector). This trend is positive for the environment, since higher energy consumption also means a higher burden on the environment in relation to its production. In 2012, there was a slight interannual decrease of GVA in the industrial sector (by 0.4%) but its energy consumption decreased a bit more significantly (by 3.3%). Generally, energy intensity of the industry has therefore decreased by 2.9%. The reason for the decline in energy intensity of industry consists in constant improvement and modernisation of the production technologies and application of BAT and other measures to save energy in industry.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1889)

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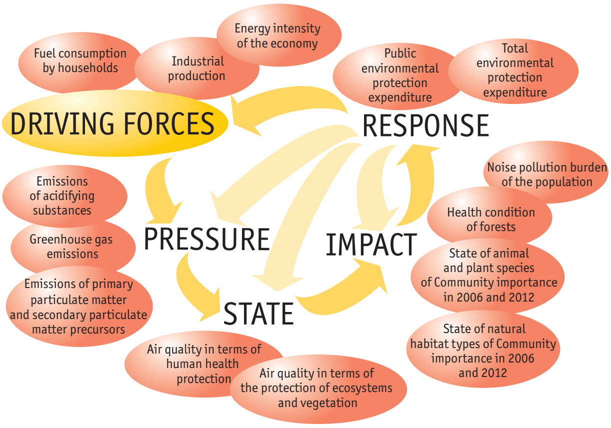
[1] *Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.*

23/ Final energy consumption

KEY QUESTION →

Are the final energy consumption[1] and subsequent potential environmental burden decreasing in the Czech Republic?



KEY MESSAGES →

😐 In recent years, the final energy consumption has been fluctuating; it is influenced by changes in the industry sector due to economic recession and its aftermath.

Most energy is consumed in the industry and also in households and transport.

KEY MESSAGES →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The strategic objectives of the **State Energy Concept of the Czech Republic** include increasing energy efficiency and achievement of energy savings in the economy and households.
The **Second Energy Efficiency Action Plan** is a national document elaborated in accordance with the requirements of the Directive of the European Parliament and of the Council No. 2006/32/EC. It aims at reducing the final energy consumption.
The **Czech Republic's National Action Plan for Energy from Renewable Sources** supposes that a 14% share of energy from renewable sources in gross final energy consumption and a 10.8% share of energy from renewable sources in gross final consumption in the transport sector will be achieved by 2020.
Adopted by the European Commission, the **Action Plan for Energy Efficiency KOM/2006/545** outlines a framework of policies and measures designed to strengthen the use of possibilities related to an estimated savings potential of 20 % of the EU's annual primary energy consumption by 2020.
The **Climate-Energy Package** is a legislation set which specifies measures to reduce greenhouse gas emissions and to increase the share of renewable energy sources in the final energy consumption. It also includes the Directive 2009/28/EC on the promotion of the use of energy from renewable sources which sets a target for the Czech Republic consisting in a 13% share of renewable energy sources in gross domestic final consumption in 2020.
The **Directive 2010/30/EU on information concerning the energy consumption** specifies how to inform end users about energy consumption during a product's use and provide supplementary information concerning energy-consuming products, thereby allowing end-users to choose more efficient products.
Directive 2010/31/EU on the energy performance of buildings promotes improving the energy performance of buildings.
The **Directive 2012/27/EU on energy efficiency** promotes energy efficiency in the EU in order to ensure fulfilment of the main goal by 2020, i.e. the 20% in energy efficiency and to further increase energy efficiency even after this date. In accordance with the Directive, the Czech Republic has set a national indicative target of 47.84 PJ (13.29 TWh) of new savings in final energy consumption by 2020.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Energy consumption itself does not have direct impacts on human health; however, its production is very important for the quality of the environment in relation to the Czech Republic's energy mix. Due to the large proportion of fossil fuels, it is a source of a considerable quantity of emissions of pollutants and greenhouse gases. Owing to production of greenhouse gas emissions, energy consumption contributes to climate change connected with increased occurrence of hydrometeorological extremes (drought waves, floods or extreme temperatures) forest defoliation and landscape disturbance. Electricity and heat production is also accompanied by air pollution, which influences public health.

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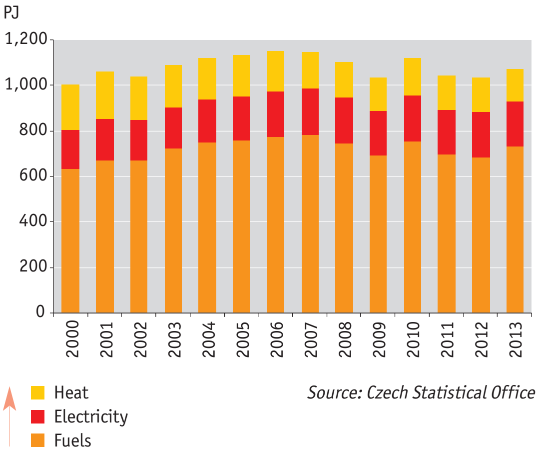
[1] *Final energy consumption is consumption that is determined before entry into the appliances in which it is used to produce the final useful effect, but not to produce another form of energy (with the exception of secondary energy sources).*

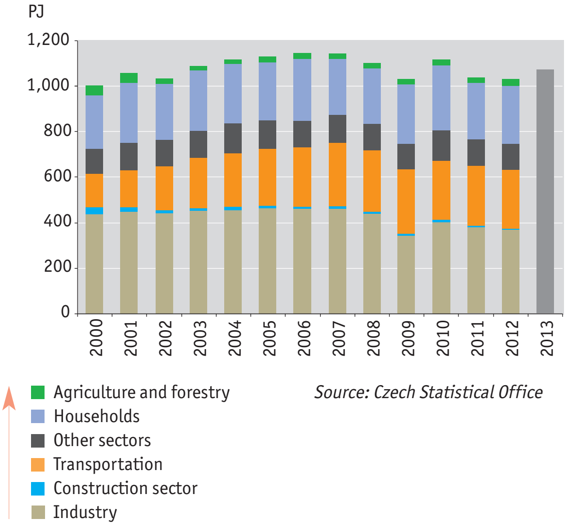
INDICATOR ASSESSMENT

Chart 1 ➔ **Final energy consumption trends by resource in the Czech Republic [PJ], 2000–2013**



Source: Czech Statistical Office

Chart 2 ➔ **Final energy consumption trends by sector in the Czech Republic [PJ], 2000–2013**



Source: Czech Statistical Office

With respect to the data reporting methodology, the 2013 data concerning energy consumption by sectors were not available as of the closing date of this publication.

There are many factors that affect energy consumption. For example, in the **sector of agriculture**, the effort to increase energy efficiency and productivity is the main driving force behind the consumption decrease. Changes in energy intensity in the area of **services** are the result of balancing among conflicting driving forces: on one hand efficiency of energy use is increasing, on the other hand, growing demands for the population's comfort work against the reduction of energy consumption in services. Higher energy consumption then occurs especially in connection with air conditioning and with a trend of growing use of information and communication technologies. The main factors leading to the reduction of energy intensity in services include thermal insulation of buildings and expansion of more efficient equipment for heating, air conditioning or lighting. Even in transport there are several opposing factors. The proportion of passenger car transport in energy consumption within the transport sector is permanently high but energy consumption per unit of transport performance is declining, as it is in road freight transport whose transport performance increases. In the household sector, there is a growing area of households, increased comfort level, a greater number of electric appliances, which increases energy consumption. On the other hand, heating efficiency improves, existing buildings are being thermally insulated and new buildings meet the low-energy standards.

The **final energy consumption** (Chart 1) has been fluctuating since the year 2000. In 2002 to 2006, it kept increasing but since 2007, the consumption has been declining or fluctuating interannually. In view of the fact that the consumption is influenced by the industry to a large extent, it is obvious that the economic crisis in 2008–2009 played its role, too. In 2010, there was a temporary increase in the total energy consumption, together with the growth of industrial production and the national economy as a whole, with subsequent decline in 2011 and 2012. In 2013, in accordance with growth of the Czech Republic's economy, there is again an interannual increase of final energy consumption (namely by 3.9%).

The highest final energy consumption (Chart 2) is recorded in the **industry sector** (35.6% in 2012). High energy consumption in this sector is caused by the energy intensity of industrial production and a high proportion of industry in the GDP. The sector of industry accounts for approximately 30% of GDP in the Czech Republic. While final energy consumption in this sector used to fluctuate interannually, it has been declining every year since 2006 due to the restructuring of industrial sectors and the efforts to introduce energy-efficient technologies. There was a huge interannual decline in consumption in 2009 as a result of the economic crisis, which affected this sector severely. In 2010, however, economic growth had its impact on energy consumption and the consumption in the industry sector increased by 18.0% interannually (2009–2010). In comparison with the consumption values from the period before the economic crisis, however, the slightly declining trend continued again in 2011 and 2012; the interannual energy consumption decreased by 3.3% in this sector. Within the processing industry, the most energy intensive branches are the production of metals and metallurgical processing, the production of non-metallic mineral products and the chemical and petrochemical industries.

Households are another important sector in energy consumption in the Czech Republic; they comprised 24.9% of the final energy consumption in 2012. The household energy consumption development is greatly influenced by character of the heating seasons. Interannually (2011–2012), there was an increase in household consumption by 4.0%, which is largely caused by lower temperatures in the 2012 heating season, compared to a milder winter in 2011. The **transport sector**, likewise households, accounted for 24.9% of the total consumption in 2012. This was the only sector in which energy consumption was growing in long terms, but in the last three evaluated years, the trend is rather varying. Interannually (2011–2012), energy consumption in transport decreased by 2.8%.

The **energy savings potential** lies in the areas of industry, services and households: efficiency of steam power stations and heating stations, BAT application, use of energy-efficient appliances, construction of energy-efficient buildings, use of high-quality insulating materials, energy audits, labelling of electric appliances, obligatory combining heat and power generation, etc.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1890)

24/ Fuel consumption by households

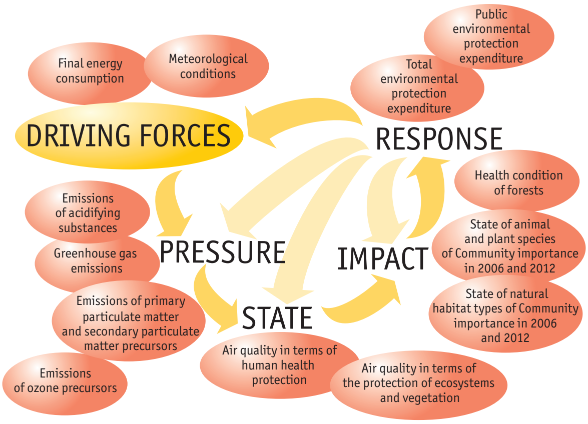
KEY QUESTION ➔

What progress has been made in reducing the negative impacts of local heating units on air quality and public health?

KEY MESSAGES ➔

😐 Since 2011, the household heating methods have not changed significantly in the Czech Republic. District heat supply (36.1%) and natural gas (34.4%) still prevail.

☹ In 2012, 40.9% of PM10 emissions originated from local heating units. Household heating has considerable influence on the environment and, in particular, on health of the inhabitants.



KEY MESSAGES ➔

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

The strategic objectives of the **State Energy Concept of the Czech Republic** include increasing energy efficiency and achievement of energy savings in the economy and households.

Air quality improvement in places where air pollution levels are exceeded, and, at the same time, maintaining of the present quality in places where air pollution limits are not exceeded are among the objectives of the **State Environmental Policy of the Czech Republic (2012–2020)**.

The different rates of tax burden imposed on individual commodities, provided for in the **Act No. 261/2007 Coll. on public budgets stabilisation**, shall encourage citizens to use cleaner fuels for heating. Since January 2008, excise duty (about 10% for coal, 1% for electricity for heating) has been imposed on fuels that produce greater amounts of air pollutants.

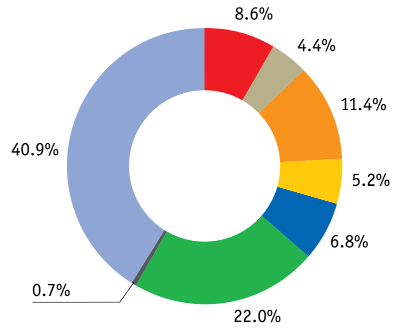
The **Act No. 201/2012 Coll. on air protection** provides for the minimum emission requirements for combustion sources using solid fuels, with the rated heat input below and equal to 300 kW which serve as heat sources for hot-water central heating system.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

The way of heating households and the given kind of fuel affect air quality in the immediate environment in which people live. Compared to emissions from large incinerators, emissions from local heating units are very dangerous because they are emitted directly into the environment where the inhabitants reside. Pollutants emitted from chimneys of low buildings, most frequently family houses, cannot disperse enough in the air and people are forced to breathe these substances directly. Incomplete combustion of solid fuels produces polyaromatic hydrocarbons, which have carcinogenic effects and contribute to a number of the population’s health problems, such as increased sickness rate, especially higher incidence of cardiovascular diseases and respiratory problems.

INDICATOR ASSESSMENT

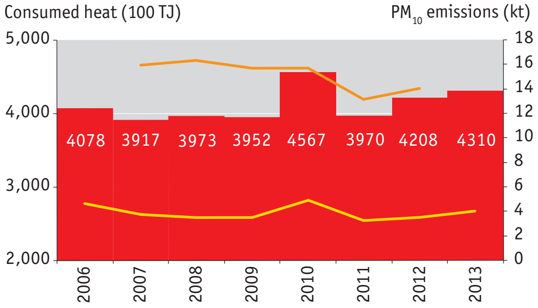
Chart 1 → PM$_{10}$ emissions from different economic sectors in the Czech Republic [%], 2012



Source: Czech Hydrometeorological Institute

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

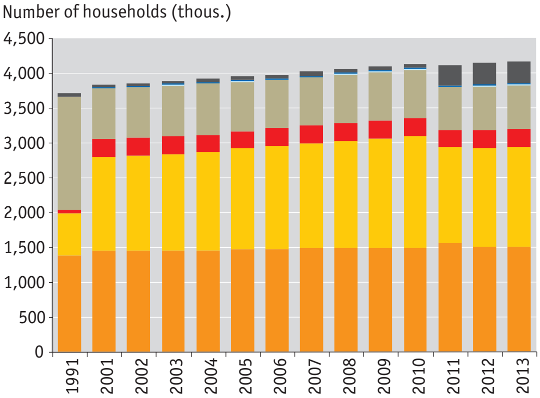
Chart 2 → Comparison of the heating season with consumed heat and PM$_{10}$ emission from household heating in the Czech Republic [number of day-degrees, 100 TJ, kt], 2006–2012 (2013)



Source: Czech Hydrometeorological Institute

Data for PM$_{10}$ emission in 2013 are not, due to the methodology of their reporting, available at the time of publication.

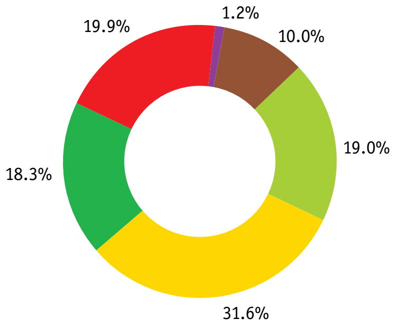
Chart 3 → Prevailing heating methods used in permanently inhabited households in the Czech Republic [thous. of households], 1991, 2001–2013



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 [%], 2013



Source: Ministry of Industry and Trade

There are many factors that affect household heating. **Heating intensity** in households is largely dependent on outside temperature in the given location. Another factor is related to the inhabitants' habits because e.g. the feeling of thermal comfort and ventilation intensity are very individual and have a substantial influence on heat consumption for heating. Due to increasing energy prices and the fact that a vast majority of energy is consumed for heating and hot water in households, home appliances are being replaced with more efficient ones and houses and flats are provided with thermal insulation.

The **heating method**, i.e. the kind of fuel used for heating, has a great environmental impact because it has a substantial influence on emissions and consequently the air quality, especially in connection with local furnaces. The choice of household heating fuel depends on its availability, price and comfort of use.

In 2012[1], 14.1 kt of **PM_{10} emission** came from local heating units, which is 40.9% of all emissions of this pollutant (Chart 1). Weather conditions have a vital impact on pollutants' emissions from household heating and also on the amount of heat that can be used for heating (Chart 2). In 2012, the total PM_{10} emissions amounted to 34.5 kt in the Czech Republic. Compared to the year 2011, the amount of PM_{10} emission from household heating increased by 7.6%. This increase is influenced mainly by particular characteristics of the heating season[2] which was relatively warm in 2011 (Chart 2).

Data concerning prevailing **household heating methods** are obtained from the population and housing census, which is carried out once every 10 years. In the meantime, the data are estimated and supplemented by the number of newly completed flats and information provided by distributors of fuels and energy. Since 2001, the household heating methods have not changed significantly in the Czech Republic and heating using solid fuels has also been declining only minimally. However, mostly coal and wood are included in this category and their exact division cannot be specified unequivocally as these two fuels are often burnt together (co-combustion) and their ratio depends on their current prices and availability. The charts show the prevailing heating methods but households are often heated using more kinds of fuel. The most common combinations include gas/wood and coal/wood, in rural areas also gas with electricity/coal/wood. In the last ten years, there is an increase of the proportion of firewood in the sector of local household heating while consumption of the other solid fuels decreases. This trend has resulted in an increase in $PM_{2.5}$ and B(a)P emissions. A more significant reflection of this increase in the emission balance was delayed (in 2011) as the results of the 2011 population and housing census were included in the emission model.

In 2013, the Czech Republic's inhabitants were using mostly **district heating** (36.1% of households) and **natural gas** (34.4% of households) to heat their households. **Solid fuels** were used in 15.1% of the households (Chart 3). In these households, there are combustion sources 36% of which, according to expert estimates, are old combustion devices with burning-through structures which have the worst properties in terms of emissions.

In 2013, the total amount of energy supplied to households was approximately 267,000 TJ, which is by 3.3% more than in 2012. This development is related to length of the heating season and to temperatures during the winter. Compared to the year 2013, the 2012 heating season was a bit milder and therefore less demanding in terms of heating (by 2.4%).

Interannual changes in household fuels consumption are not significant. A more important change has only been recorded for heat pumps and solar collectors (increase by 23.4%). Although these resources have developed greatly in recent years and production of heat from them increases annually by approximately 10–30%, their total proportion is only 1.2% (Chart 3). Solar collectors are used more frequently to warm up hot water and to preheat water for heating.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1891)

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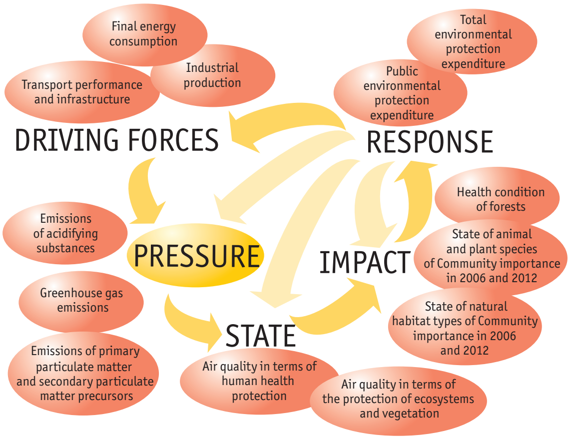
[1] Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

[2] The heating season is characterized by day-degrees, i.e. a unit which is the product of the number of heating days and the difference between average indoor and outdoor temperatures. Day-degrees thus show how cold or warm it was for a certain period and how much energy is needed to heat buildings.

25/ Energy intensity of the economy

KEY QUESTION ➜

Are the efforts in reducing energy intensity of the Czech economy successful?



KEY MESSAGES ➜

☺ Energy intensity of the Czech economy has been decreasing in long terms. In 2013, its value changed only minimally (a decrease by 0.1%), due to a slight decline in GDP and PES consumption.

In the PES structure, declining consumption of solid fuels can be seen since 2000; this decrease, however, is balanced by growing consumption of liquid fuels and electricity generation in nuclear power stations. The amount of energy obtained from renewable sources has also been growing.

KEY MESSAGES ➜

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➜

The **Climate-Energy Package**, which was approved by the EU Council and the European Parliament in 2008, contains a commitment to achieve reduction of greenhouse gas emission by at least 20% by the year 2020 in comparison with the year 1990. An increase in energy efficiency is the key element for the member states to comply with the requirements laid down in this decision. The aim consists in reducing the energy consumption by 20% by 2020.

The strategic priorities of the **State Energy Concept of the Czech Republic** include increasing energy efficiency and achievement of energy savings in the economy and households.

The **State Environmental Policy of the Czech Republic (2012–2020)** is, inter alia, focused on the protection and environment-friendly use of resources, the promotion of measures to increase energy efficiency and energy saving which help reduce the country's energy dependence. One of the objectives is to fulfil the commitment to increase energy efficiency by 2020.

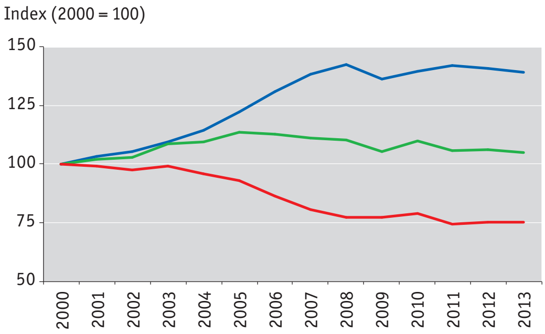
The **Czech Republic's Energy Efficiency Action Plan** has been elaborated in accordance with the requirements of the **Directive No. 2006/32/EC** on energy end-use efficiency and energy services. The **Second Energy Efficiency Action Plan** of the Czech Republic specifies the national indicative target of 9% saving in 2008–2016 to be 20,309 GWh.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➜

The impacts of high energy intensity on human health and ecosystems are enormous. The production of more energy results in higher emissions of pollutants and greenhouse gases. Due to greenhouse gas emissions, the energy sector contributes to climate change, forest defoliation and damage to the landscape. Air pollution generally contributes to increased incidences of respiratory problems, allergies, asthma or reduced immunity and mortality.

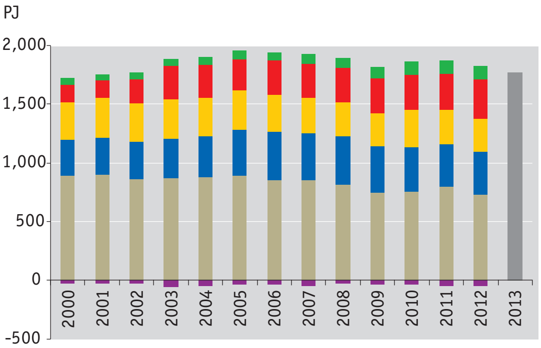
INDICATOR ASSESSMENT

Chart 1 ➔ **Energy intensity of Czech Republic's GDP [index, 2000 = 100], 2000–2013**



Source: Czech Statistical Office, Ministry of Industry and Trade

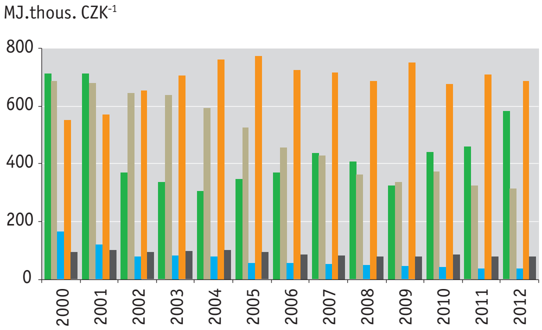
Chart 2 ➔ **PES consumption trends in the Czech Republic [PJ], 2000–2013**



Source: Czech Statistical Office, Ministry of Industry and Trade

With respect to the data reporting methodology, the 2013 data concerning the structure of the individual energy sources were not available as of the closing date of this publication.

Chart 3 ➔ **Energy intensity trends by sectors, expressed as the proportion of the sector's final energy consumption and its gross added value in the Czech Republic [MJ.thous. CZK^{-1}], 2000–2012**



Source: Czech Statistical Office

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

Energy intensity of an economy measures its energy consumption and its general energy efficiency. It represents the amount of energy necessary to ensure the given quantity of production, transport or services. Therefore, it corresponds to the demands that a certain industry or sector has on energy consumption. The objective is to ensure the greatest possible production and quality of services with the lowest possible requirements for energy sources.

Energy intensity of the Czech economy has been decreasing in long terms. Generally speaking, this is due to economic growth (GDP), but also due to decreased energy consumption, i.e. a higher proportion of production processes with lower energy intensity, using BAT, thermal insulation of buildings or savings in households. This relative indicator is obtained as a ratio of energy consumption and the GDP value; its decline therefore occurs 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 2008–2009, the financial and economic crisis influenced also the energy intensity of the economy. There was a decline in GDP and in consumption of primary energy sources, but in such proportions that the energy intensity of the economy increased temporarily again after a long-term decline. However, energy intensity of the economy continues in permanent slight decrease or stagnates since 2010. In 2013, there was a slight interannual decrease in PES consumption (by 1.0%), but also in GDP (by 0.9%). The economy's energy intensity reached 498.8 GJ.thous. CZK^{-1} (constant prices of base year 2005) and therefore it stagnated interannually (-0.1%). In longer term, i.e. since 2000 (when this value was 661.8 GJ.thous. CZK^{-1}), there was a total decline in energy intensity by 24.6%.

Since 2000, the PES consumption has been increasing in long terms by 0.7 to 5.6% in the Czech Republic (Chart 2). In 2005 the PES consumption achieved the highest value in the entire period since 2000. Then this trend was reversed, and the PES consumption began decreasing with small fluctuations. In 2013, there was an interannual decrease in PES consumption by 1.0%; its value reached 1,771.6 PJ.

In the **PES structure**, declining consumption of solid fuels since 2000 can be seen; this decrease, however, is balanced by growing consumption of liquid fuels and electricity generation in nuclear power stations (Chart 2). The amount of energy obtained from renewable sources has also been growing. Nevertheless, the share of solid fuels consumption is still prevailing; in 2012, it accounted for 40.8% of the total PES amount. Liquid fuels account for 20.3%, primary heat from nuclear power stations 18.5% and gaseous fuels 15.9%. Primary electricity (i.e. electricity generated in hydroelectric power stations (excluding pumped storage power stations), in wind and photovoltaic power stations plus the balance of import and export of electricity) amounts even to negative values (–2.5% in 2012) because electricity exported to foreign countries is included. Heat from renewable energy sources increases its proportion every year; in 2012 it was 6.7%, which is more than twice as much as in 2000 (in 2000 the proportion was 3.1%).

The **increased proportion of primary heat and electricity** in the total consumption can be explained by higher electricity generation in nuclear power stations, significant financial support to RES and by efficiency of the European Trading Scheme (EU ETS), which leads to greater use of emission-free sources (i.e. sources that do not produce greenhouse gases).

The sectors of transport, industry and agriculture account for the **biggest proportion in the economy's energy intensity by sectors** (Chart 3). While energy intensity of the industry sector has been decreasing steadily in the long term (in 2000–2012 there was a 54.3% decline), energy intensity of the transport sector was growing or varying in last five years. In 2012, there was an interannual decline in energy intensity of transport by 3.4%, in the case of industry there was a decrease by 2.9%. Unlike the other sectors, the energy intensity of transport is high because passenger car transport, which does not create any value added for the national economy, is included here. The share of passenger car transport in energy consumption in transport is approximately 53%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1892)

26/ Electricity and heat generation

KEY QUESTION →

What is the structure and amount of generated energy and what environmental impacts does electricity and heat generation have in the Czech Republic?

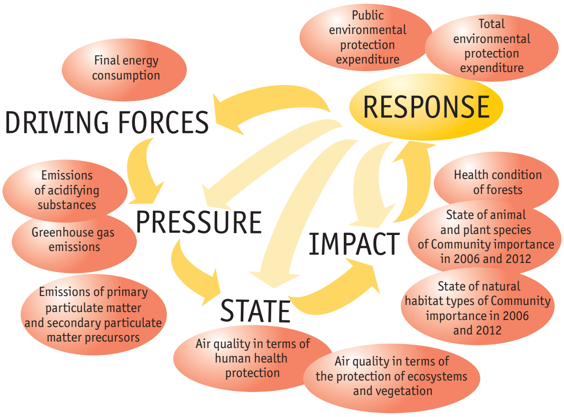
KEY MESSAGES →

🙂 With occasional fluctuations, electricity generation was growing in long terms; however, there is stagnation since 2012. In 2013, it decreased interannually by 0.6%.

Generation of electricity in steam power stations has been gradually decreasing while the importance of nuclear energy and renewable energy sources has been rising.

😐 In 2013, steam power stations, which burn mainly brown coal, produced 57.4% of electricity and nuclear power stations 35.3%.

🙁 The balance of electricity exports and imports amounted to -19.4% in 2013. In relation to the environment, prevailing electricity export is a negative phenomenon since emissions from generation of exported electricity were produced in the Czech Republic's territory.



KEY MESSAGES →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

In 2008, the European Parliament and the Council approved the **climate-energy package** that sets out measures both to reduce greenhouse gas emissions and to increase the share of renewable energy sources in the final energy consumption. Over the same period, accomplishing the EU objectives should result in a 20% increase in energy efficiency.

It also includes the **European Directive 28/2009/EC on the promotion of the use of energy from renewable sources**. The common European objective to achieve a 20% proportion of energy from renewable energy sources (RES) in the final energy consumption by 2020 was distributed among the EU member states through this Directive. The Czech Republic's objective was set at a 13% proportion of energy from renewable energy sources in the final energy consumption by 2020.

As far as the energy sector is concerned, the **State Environmental Policy of the Czech Republic (2012–2020)** aims, inter alia, at reducing GHG emissions, ensuring the 13% proportion of RES in the gross final energy consumption by 2020 and fulfilment of the obligation to increase energy efficiency by 2020.

The **State Energy Concept of the Czech Republic** includes maximum energy valuation, maximum effectiveness in acquiring and transforming energy sources, support to electricity and heat generation from renewable energy sources, optimisation of the use of domestic energy sources, optimisation of the use of nuclear energy, minimum emissions that damage the environment and minimum greenhouse gas emissions, optimisation of reserve energy sources.

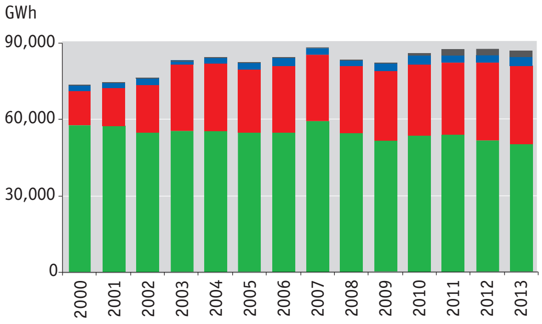
The **Raw-Material and Energy Security Concept of the Czech Republic**, which should be in accordance with the State Energy Concept and the State Raw-Material Policy of the Czech Republic, is under preparation.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The mix and the proportion of the different energy sources are closely linked to the production of pollutants and greenhouse gases emissions that are discharged into the atmosphere. Due to greenhouse gas emissions, the energy sector contributes to climate change; pollutants' emissions take part in forest defoliation and air-pollution load of ecosystems. Air pollution causes more frequent incidences of respiratory problems and allergies, asthma and increased morbidity and mortality in general. While predominant use of domestic fossil fuels provides a certain degree of energy security and independence, brown coal strip mining damages the landscape and, by extension, reduces attractiveness of the territory. Furthermore, many energy generation plants occupy large areas of land, affect the microcl

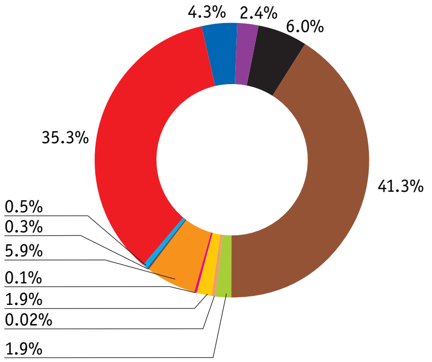
INDICATOR ASSESSMENT

Chart 1 ➔ Electricity generation by power plant type in the Czech Republic [GWh], 2000–2013



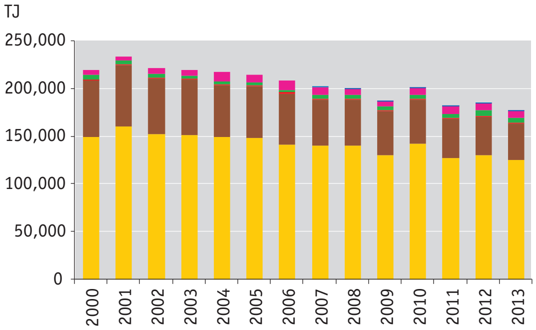
Source: Energy Regulatory Office

Chart 2 ➔ Electricity generation by fuel type in the Czech Republic [%], 2013



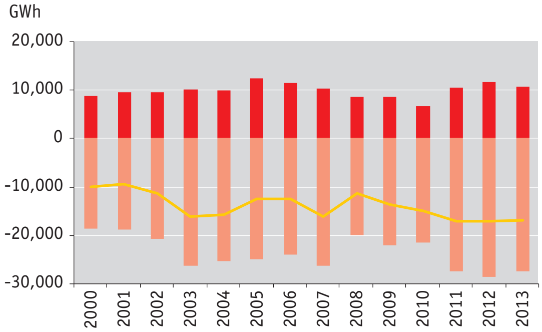
Source: Czech Statistical Office

Chart 3 ➔ Net heat productions by sources in the Czech Republic [TJ], 2000–2013



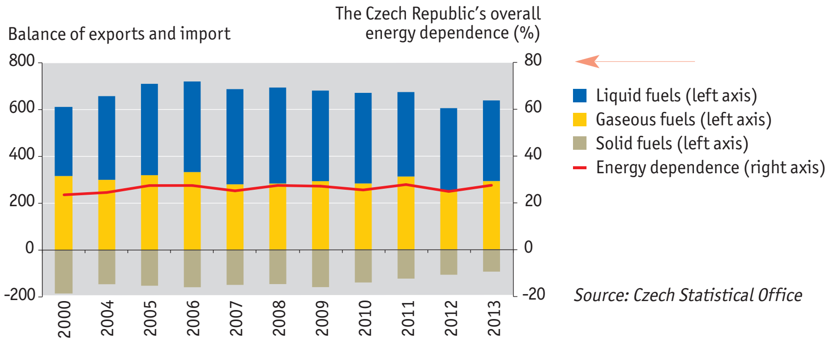
Source: Czech Statistical Office

Chart 4 ➔ Electricity imports and exports from the Czech Republic [GWh], 2000–2013



Source: Czech Statistical Office

Chart 5 ➜ **Export-import balance for different fuels, the overall energy dependence of the Czech Republic [PJ, %], 2000, 2004–2013**



Source: Czech Statistical Office

The amount of **heat and electricity generation** depends on its demand, and hence on consumption. The demand is influenced by industry to a great extent; this sector consumes approximately one-third of all energy utilised in the Czech Republic. Foreign trade is another important factor because a part of electricity produced in the Czech Republic is exported. However, there are many factors which influence the sources from which electricity and heat are produced and the degree of their use (energy mix). The most important factor is related to the sources of energy raw materials, their availability and also energy policy which sets the conditions for their use.

In the period 2000–2013, the **overall amounts of generated electricity** were rather varying but the long-term trend is slightly growing (Chart 1). Compared to the year 2000, more electricity was generated in 2013 (by 18.5%). The 2012/2013 interannual change has shown stagnation (-0.6%). In 2013, 87,065 GWh of electricity were generated (in 2012 it was 87,574 GWh).

The **Czech Republic's energy mix** is changing constantly in the course of time. In the Czech Republic, electricity generation was historically based on burning of brown coal whose supplies have always been sufficient in this country. The Dukovany nuclear power station was put into operation in 1985 and the Temelín nuclear power station began to work in 2002. Some coal power stations were shut down, some were modernised. Renewable energy sources develop in this situation; their proportion in the total energy mix is growing every year.

In 2013, **steam power stations**, which burn mainly brown coal, generated 50,009 GWh of electric energy, which is 57.4% proportion in the total electricity generation. Compared with the year 2012, their generation decreased by 3.3%; this was partly counterbalanced by higher generation in nuclear and hydro-electric power stations but also by a decrease in the total electricity generation. **Nuclear power stations** with 35.3% share (30,745 GWh) are in the second place. Their annual increase amounts to 1.4%. In 2013, **hydro-electric power stations** (including pumped storage power stations) generated most electricity since 2000, namely 3,762 GWh. The interannual increase amounts to 27.0%. This significant change is connected with suitable weather conditions because the installed output changed only minimally (it was increased by 0.6%). Electricity generation in hydro-electric power stations, likewise some other RES (wind generators, solar cells), are highly dependent on weather conditions.

The proportion of **electricity generation from RES** is growing every year. In 2013, 9,244 GWh of electricity were obtained from RES, which corresponds to 10.6% of the total amount of electricity generated in the Czech Republic (in 2012 the proportion was 9.2%).

In the Czech Republic, heat production (Chart 3) is ensured predominantly by power stations[1], heating plants[2] (70.7%) and heating stations[3] (21.4 %). The other sources take only a minor part in heat production (in single percent). Heat from these plants (Chart 3) is intended for sale as well as for use in the given company (in both the public and in-house energy systems); however, it is not intended for electricity generation. Due to the fact that heat for industrial use is also concerned, the 2008 decrease is reflected in the total amount of produced thermal energy because industrial production declined due to the economic crisis in that year.

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[1] *A power station with heat supply – a source intended primarily for electricity generation but it is also a source of heat in a partial heat-production operational mode.*
[2] *Heating plant – a source in which both heat and electricity are produced in a common cycle.*
[3] *Heating station - a separately-located heat source for a residential locality or industrial plant, supplying heat to the heating networks, or, where appropriate, to transfer stations.*

The **total amount of produced heat** has been decreasing in the long term, which is a proof of the economical use of thermal energy and of the efforts to reduce heat consumption in the industrial and public sectors. In 2013, the net heat production amounted to 177,544 TJ, which is a slight interannual decline by 4.3%.

The public and industrial energy sectors are important producers of emission of air pollutants and greenhouse gases. In 2012[4], these sectors accounted for 78.3% of the total SO_2 emissions, 51.7% of the total NO_x emissions, 66.1% of the total CO_2 emissions and 13.0% of the total PM_{10} emissions. Compared to the previous year, there was a decline in SO_2 emissions by 5.6%, in NO_x emissions by 8.7%, in CO_2 emissions by 4.2% and in PM_{10} emissions by 4.9% in this sector.

In 2013, 27.5 TWh of electricity, i.e. 31.5% of the total quantity generated, **were exported** (Chart 4). Nevertheless, 10.6 TWh of electricity were imported. The export-import balance is therefore –16.9 TWh, which is 19.4% of the total amount of electricity generated in the Czech Republic (87,065 GWh). Electricity export seems to be rather negative in relation to the environment since emissions from the generation of energy that is consumed abroad actually arise in the territory of the Czech Republic.

The **energy dependence** shows the extent to which the economy relies on imports to satisfy its energy needs. The Czech Republic is nearly self-sufficient only in electricity generation from coal since this raw material is mined domestically. Both coal and electricity are also exported (Charts 4 and 5). In the case of coal, this is nearly exclusively black coal, which is used in metallurgy thanks to its quality. At the same time, the Czech Republic imports black coal for the energy industry. The Czech Republic is dependent on **crude oil and gas supplies**. Although the Czech Republic is the only EU country which produces uranium, the nuclear fuel is imported to Czech nuclear power stations because the Czech Republic does not own the technology to produce nuclear fuel. The Czech Republic buys more than two-thirds of the crude oil/natural gas and all the nuclear fuel from Russia. The total energy dependency of the Czech Republic was 27.4% in 2013. In the period 2000–2013, this value was not changing very much; it varied between 23.5% and 27.8% (Chart 5).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1893)

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[4] *Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.*

27/ Renewable energy sources

KEY QUESTION ➔

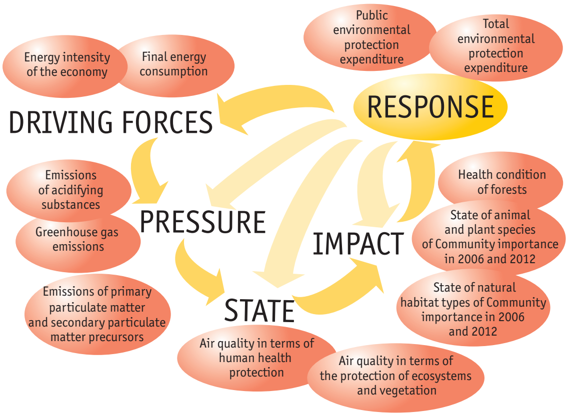
What is the structure and proportion of renewable energy sources in the total energy sources?

KEY MESSAGES ➔

🙂 In the Czech Republic, electricity generation from renewable sources is increasing in long terms. In 2013, these resources produced 9,244 GWh, which is by 14.6% more than in the previous year.

The growing amount of electricity generated from RES and a shift to a greater diversity of individual sources are beneficial in terms of greater energy independence and security.

😐 Heat production from renewable energy sources is most affected by consumption of wood for household heating.



KEY MESSAGES ➔

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

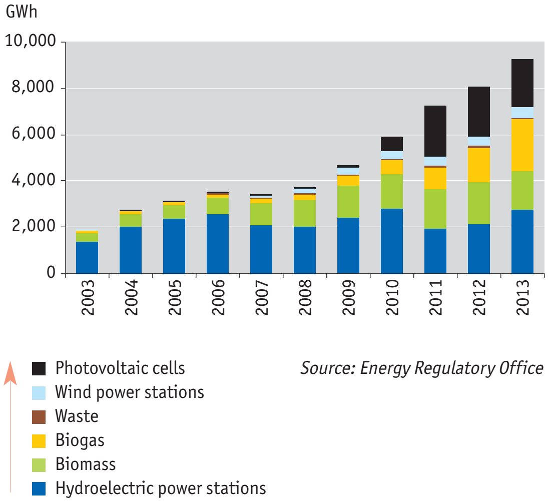
In 2008, the EU Council and the European Parliament approved the so-called climate-**energy package**. It is a set of documents that specify the measures to be taken to reduce greenhouse gas emissions and the measures to increase the share of RES in the final energy consumption. Achievement of the EU objectives should also lead to an increase in energy efficiency.
The package also includes the **European Directive 28/2009/EC on the promotion of the use of energy from renewable sources**. The common European objective to achieve a 20% proportion of energy from renewable energy sources (RES) in the final energy consumption by 2020 was distributed among the EU member states through this Directive. The Czech Republic's objective was set at a 13% proportion of energy from renewable energy sources in the final energy consumption by 2020.
The **State Environmental Policy of the Czech Republic (2012–2020)** aims, inter alia, at ensuring the 13% proportion of RES in the gross final energy consumption by 2020 (a target taken from above the European Directive) and also at fulfilling a 10% share of energy from renewable sources in transport by 2020.
The priorities of the **State Energy Concept of the Czech Republic** include, inter alia, development of economically efficient RES, with gradual removal of financial support for new resources. The Concept's objectives also include providing effective government support to network access for RES, making permitting processes more effective, promoting technological development and pilot projects and at the same time ensuring public acceptability of the RES development in order to achieve an above 15% proportion of RES in electricity generation.
The **Czech Republic's National Action Plan for Energy from Renewable Sources** supposes that a 14% share of energy from renewable sources in gross final energy consumption and a 10.8% share of energy from renewable sources in gross final consumption in the transport sector are achieved by 2020.
In 2012, the Government approved the **Biomass Action Plan of the Czech Republic for the period 2012–2020** the importance of which lies in determination of the potentials of various types of biomass for efficient energy use with the country's food safety being taken into account.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

RES are generally seen as clean and environmentally friendly, because in their operation they do not pollute the environment to such an extent as the sources burning fossil fuels do. They are important in terms of the Czech Republic's energy self-sufficiency, they do not cause direct load on the environment and their human health impacts are minimal in comparison with other energy sources. However, there can be negative effects, too.
A frequently discussed problem of renewable sources consists in the material and energy intensity that is usually associated with production of technologies for electricity generation from RES in view of the relatively small amount of energy generated. Another specific problem consists in taking up arable land to build photovoltaic power stations. Water resources may change microclimate in the given site. Wind power stations disturb the landscape's aesthetic value and character and their noise is also a frequently discussed problem because it may bring up stress, sleeping and attention disorders, headaches, fatigue and negative changes in mood and behaviour. In the case of biogas, there can be difficulties with odour in the storage of raw materials intended for its production in some types of biogas stations.

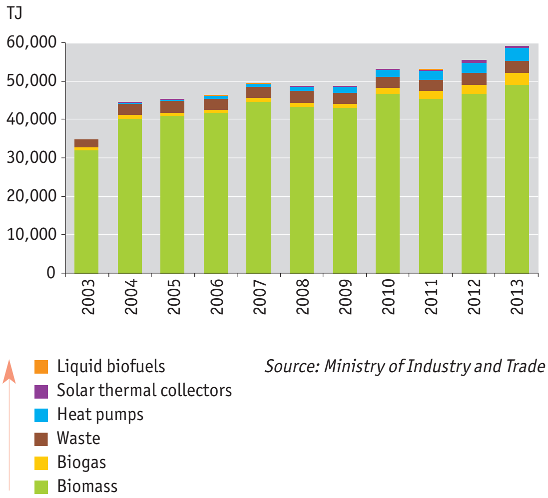
INDICATOR ASSESSMENT

Chart 1 ➜ **Electricity generation from RES in the Czech Republic [GWh], 2003–2013**



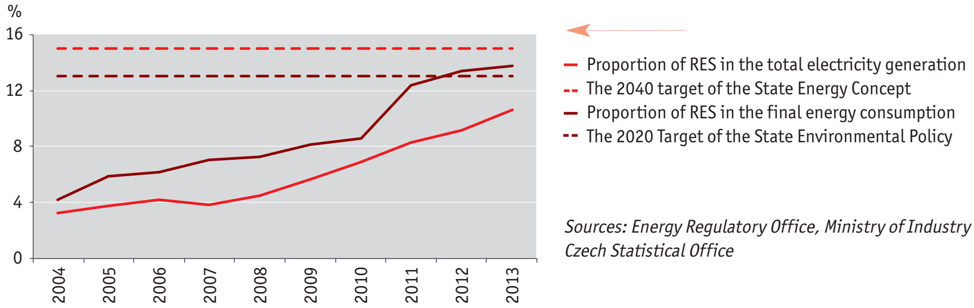
Source: Energy Regulatory Office

Chart 2 ➜ **Production of heat from RES in the Czech Republic [TJ], 2003–2013**



Source: Ministry of Industry and Trade

Chart 3 ➜ **Targets for RES and the state of their implementation in the Czech Republic [%], 2004–2013**



Sources: Energy Regulatory Office, Ministry of Industry and Trade, Czech Statistical Office

Renewable energy sources are an important part of the energy mix because they contribute to the reduction of GHG and air pollutants emissions. Moreover, as energy generated from them originates from the Czech Republic's territory, they also increase the country's energy security and independence on the international trade in energy raw materials. However, their disadvantage lies in considerable dependence on climatic, meteorological and geographical conditions, so they cannot be placed in any location and energy generation from these sources cannot be regulated according to the topical demand.

The **amount of energy from renewable energy sources** is growing every year in the Czech Republic (Chart 1). In 2013, 9,244 GWh were generated from these sources, which is by 14.6% more than in the previous year. This quantity corresponds to a 10.6% share of the total electricity generation. In 2012, this proportion amounted to 9.2%.

In 2013, hydro-electric power stations (29.6%) occupied the largest **share in electricity generation from RES**; they were followed by biogas (24.2%) and photovoltaic cells (22.0%). Another important source was biomass (18.1%). Wind power stations are being used for electricity generation in a much smaller scale (5.2%) as their potential is limited by natural conditions in the Czech Republic. Incineration of municipal solid waste is also a minor source (0.9%).

The biggest interannual jump occurred in **electricity generation from biogas**, where an increase by 52.7% was recorded. This development reflects favourable conditions and support provided to biogas stations. Other sources with a significant positive change in electricity generation are hydro-electric power stations and wind generators which increased production by 28.4% and 15.6% respectively. As far as these sources are concerned, significant interannual changes are caused by favourable weather conditions, because the installed output has changed only minimally in both source types.

Generally speaking, the **structure of electricity generation from RES** is relatively diverse in the Czech Republic and proportions of the individual sources are more or less balanced. This state developed during the last five years when the RES were provided considerable support. In the previous period, there was a single important renewable source, i.e. hydro-electric power stations, while the other sources were negligible.

Heat production from RES has been increasing in long terms; in 2013, there was an interannual increase by 6.7% (Chart 2). The largest share is covered by biomass (83.0%) for which the consumption of fuels (particularly wood) in households is the decisive factor. Heat production from biomass increased interannually by 5.1%. The other sources take much smaller parts in heat production (heat pumps 5.6%, waste 5.3%, biogas 5.1%, and solar thermal collectors 1.0%). A more significant interannual increase was recorded in heat production from biogas, namely by 22.3%, as the heat production increased from 2,452 TJ in 2012 to 3,000 TJ in 2013. Heat production from heat pumps has also increased, namely by 26.9%.

Having updated the State Energy Concept and the State Environmental Policy, the Czech Republic is now heading for **two indicative targets** concerning electricity generation from RES (Chart 3). The State Environmental Policy took over the objective resulting from the respective European Directive, i.e. the 13% share of RES in the gross final energy consumption by 2020. This target was met already in 2012 (the value amounted to 13.4%). In 2013, this share was even increased to 13.7%. The second objective arising from the updated State Energy Concept is to achieve a proportion of RES in electricity generation higher than 15%. In 2013, this share amounted to 10.6%.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

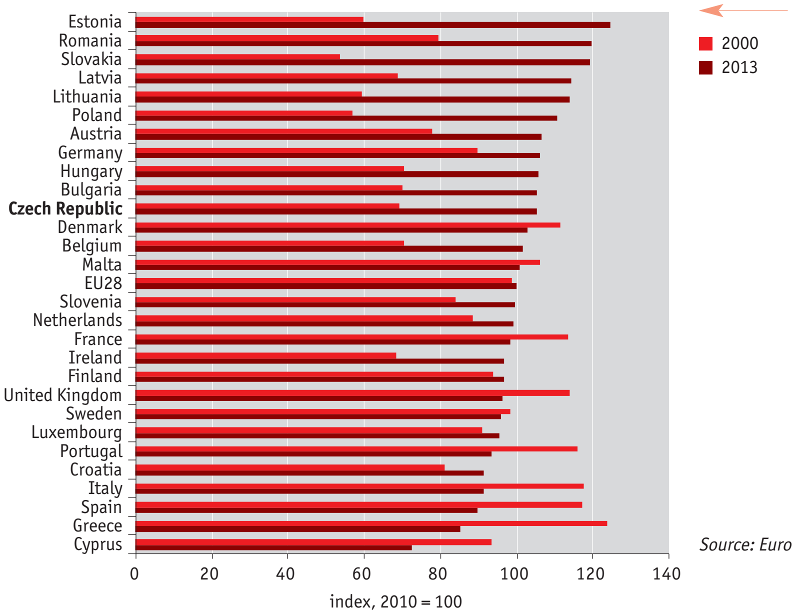
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1962)

Industry and energy in the European context

KEY MESSAGES →

- → The position of industry within the economy of individual EU28 countries depends on historical conditions, raw material sources, policies of the individual countries and on international trade. In the Czech Republic, the proportion of industry in GDP is highest in the EU.
- → Energy intensity of the EU28 countries, as well as of the Czech Republic, is declining. The Czech Republic's energy intensity is higher than the EU28 average; this is caused by the high share of industry in GDP.
- → The European countries import fossil fuels from countries outside of the EU. The average energy dependency in the EU28 amounts to 53.3%. The only country in the EU28 that is self-sufficient in energy is Denmark. The Czech Republic has brown coal and black coal supplies but liquid and gaseous fuels must be imported.

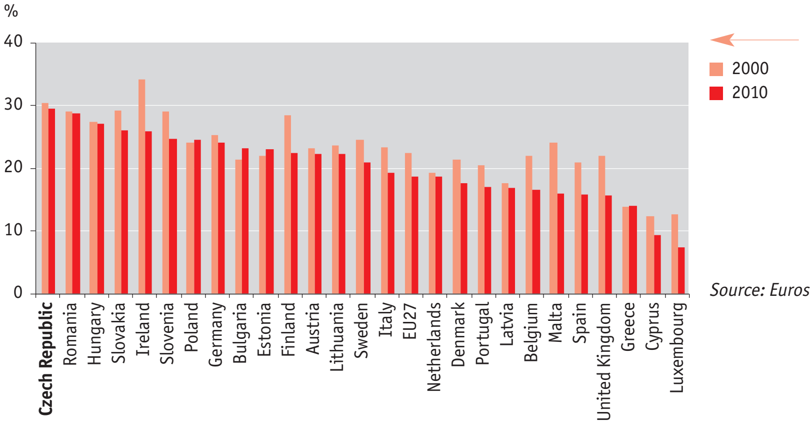
Chart 1 → **Industrial production Index [index, 2010 = 100], 2000 and 2013**



Source: Eurostat

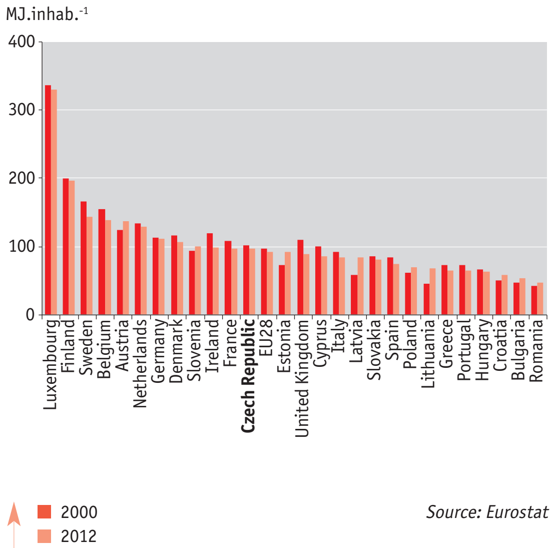
Industrial production is calculated from the sales of own products and services. This is the industrial production including mining, extraction, generation/production and distribution of electricity, gas, heat, conditioned air and water.

Chart 2 → **Proportions of gross added value of the industry in GDP in constant prices of base year 2000 [%], 2000 and 2010**



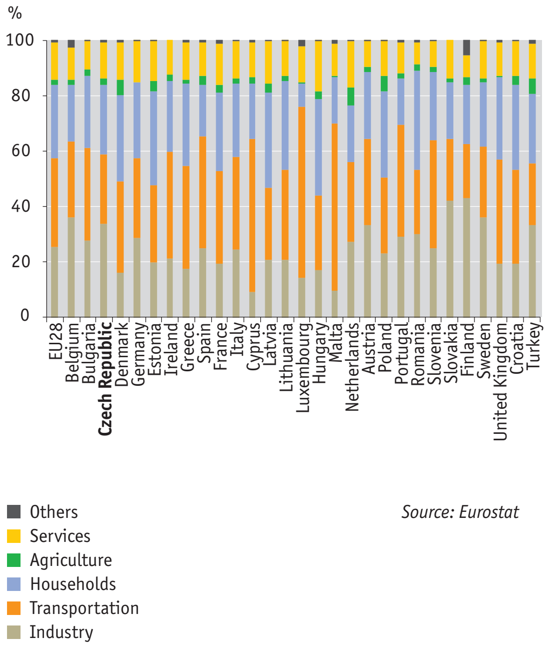
Source: Eurostat

Chart 3 → **Final energy consumption per capita, [MJ.inhab.$^{-1}$], 2000, 2012**



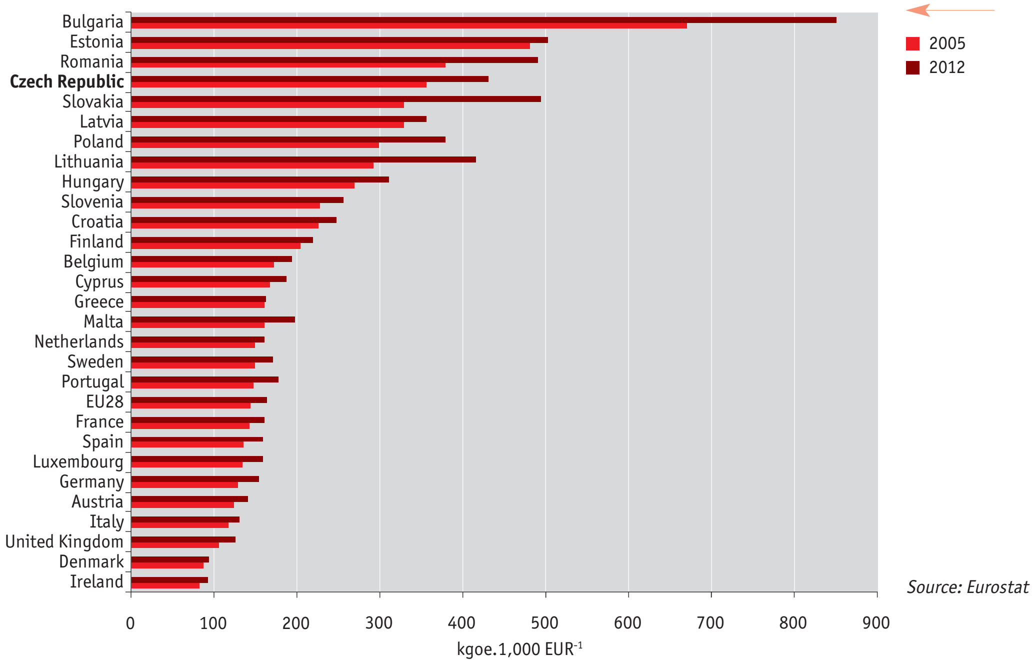
Source: Eurostat

Chart 4 → **Final energy consumption by sectors [%], 2012**



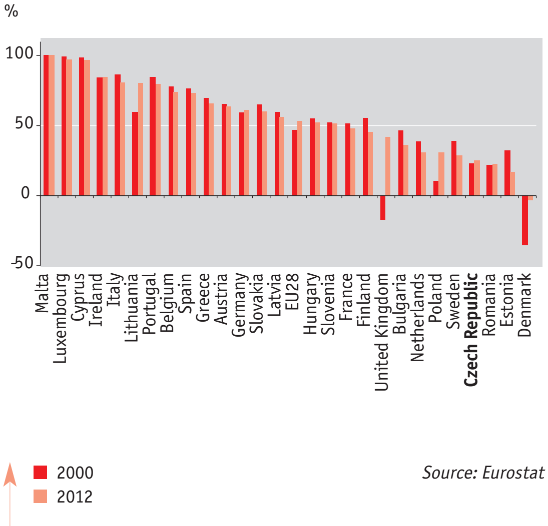
Source: Eurostat

Chart 5 → **Energy intensity of the economy [kgoe.1,000 EUR^{-1}], 2005 and 2012**



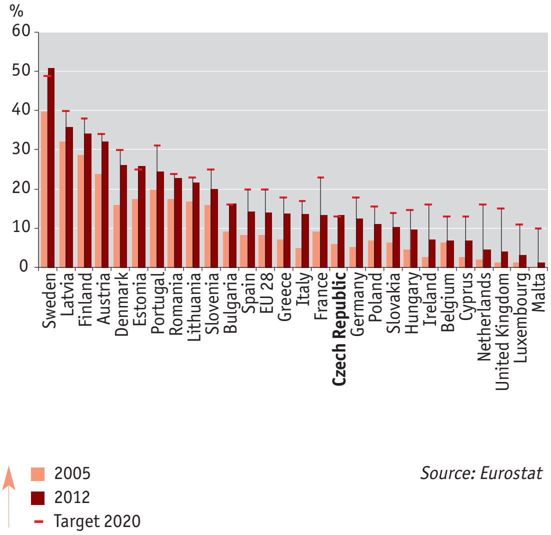
Source: Eurostat

Chart 6 ➜ **Energy dependence [%], 2000, 2012**



Source: Eurostat

Chart 7 ➜ **Proportion of renewable energy sources in final energy consumption [%], 2005, 2012**



Source: Eurostat

In European countries, **industrial production** develops in different ways (Chart 1). While e.g. in Slovakia, Poland or Estonia the industrial production index has increased by dozens since 2000, other countries experienced a big plunge (Spain, Greece, and Italy). These changes are related to stability of the national economy, interconnection of the national economies with other countries, openness in foreign trade, domestic markets and other economic, political and demographic factors.

The **share of industry in GDP** varies considerably among the EU28 countries (Chart 2). To a great extent, the focus on industry depends on presence of mineral deposits and energy raw materials in the individual countries. The national policy and historical development are the other factors. During the second half of 20th century, European countries have set out in two different directions. While the Western part applied market economy based on supply-demand balance, the Eastern part conformed to central planning which emphasised industrial production and industrialisation. Industry plays a significant role in the Czech economy; its share in creation of the Czech Republic's GDP has been about 30% in long terms. The reasons are historical – the Czech Republic has always been focused on industry and this heritage still persists. In 2010, the Czech Republic had the greatest proportion of **industry in GDP** in the EU, namely 29.5%. The EU27 average was 18.7%, mainly due to gradual dematerialisation of the economy and increasing imports of products made by the manufacturing sectors in countries outside the EU. By international comparison, proportions above 25% are only seen in five EU27 countries: the Czech Republic, Romania, Hungary, Ireland and Slovakia (Chart 5).

The **final energy consumption per capita** (Chart 3) is largely related to the climatic conditions of each country, since a significant part of energy is consumed for household heating. That is why the largest per capita consumption is in Scandinavian countries and the lowest is in countries of Southern Europe. The 2000/2012 comparison showed a decline in energy consumption per capita in most countries, which is in accordance with the general efforts to reduce energy intensity of the economy. By contrast, the growing energy consumption in states such as Austria, Slovenia or Estonia is influenced by the current economic development which is characterized by growth of industrial production (Chart 1). In the Czech Republic, per capita consumption is slightly higher (by 4.7%) than the EU28 average.

The **EU 28 total energy intensity** is declining (Chart 5). In most countries, the industry sector takes a great part in reducing energy consumption (Chart 4) as measures are taken to increase energy efficiency and less energy-demanding sectors are partly taking over. In the Czech Republic, energy intensity also decreases; however, it is still above the average in comparison with the EU28 due to the significant position of the industry in GDP creation.

European countries are greatly dependent on **imports of fossil fuels** from countries outside the EU (Chart 6). The high dependency on crude oil (approximately 90% of the consumption is imported) is caused by a big consumption of petrol and diesel in transport and the minimum own sources of this raw material. Imports of natural gas make up about two-thirds of European consumption. This fuel is used most often in households and industry. More than one third of solid fuels, which are used especially for heat and electricity generation, are imported to the EU28.

The net **energy dependence** differs considerably among the individual member states (Chart 6), reflecting the differences in domestic fossil resources' availability and the potential of renewable energy sources. In 2012, the Czech Republic's overall energy dependence amounted to 25.2%, which is the fourth best position among the EU28 member states (the average value of energy dependence in the EU28 is 53.3%). The lower energy dependence of the Czech Republic is influenced by the country's own sources of solid fuels (brown and black coal) that it also exports abroad. However, liquid and gaseous fuels are imported to the Czech Republic. The only European country that has negative energy dependence (exports are higher than imports) is Denmark which exports crude oil and natural gas from the North Sea and also supports renewable energy sources to a great extent.

In 2009, the European Commission adopted (in the framework of the climate-energy package) the Directive 2009/28/EC on **energy from renewable sources**, which sets the target for the EU27: the share of energy from renewable sources in the final consumption will be 20% by 2020. However, different member states have different **national targets** (national action plans) for the RES proportion in the consumption (Chart 7), because of the different RES potentials. For example Denmark, Finland or Estonia use wind generators considerably to produce electricity; the generators are located both on the sea and on mainland. Germany plans to develop photovoltaic cells but wants to complement its energy mix with wind generators on the sea, too. Austria has decided to focus on water energy and, thanks to pumped storage power stations, it can well regulate the RES with greater fluctuations in production (photovoltaic cells, wind). The other neighbouring states are supposed to also use this capacity, like Germany, which takes advantage of it already at present. Slovakia plans a uniform development of electricity generation from sunlight, wind and biomass. Sweden, Estonia and Bulgaria reached their national objectives as early as in 2012 (Chart 7). The Directive on the promotion of RES has obliged the Czech Republic to achieve a 13% share of energy from RES in the gross final energy consumption. According to Eurostat, the proportion of energy from RES amounted to 11.2% in 2012.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1766)

28/ Transport performance and infrastructure

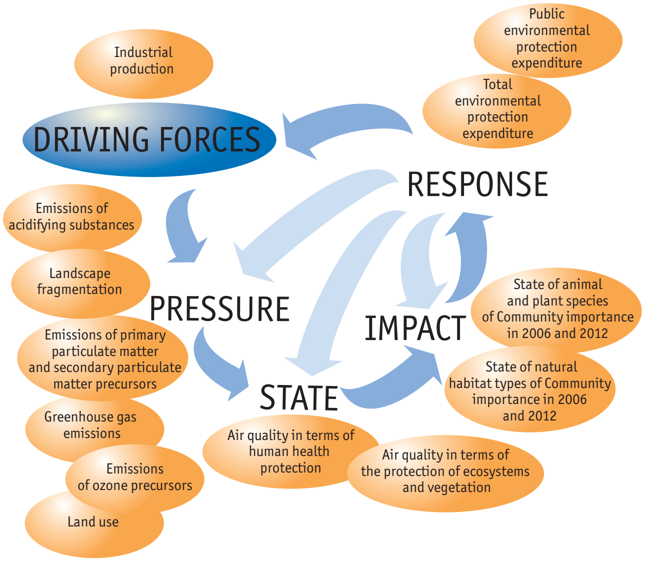
KEY QUESTION →

What is the development of transport and related environmental burden?

KEY MESSAGES →

☺ Environmental burden related to transport has been declining. In 2007–2013, the proportion of public transport in the total passenger transport performance increased by 3.6 p.p. to 33.7% as a result of growing passenger transport performance of railways and public transport in cities. Energy consumption in the transport sector has been declining after 2008. Land take of agricultural and forestry land for road infrastructure has alleviated its pace in recent years, despite ongoing development of the roads and motorways network.

☹ In 2013, there was a significant interannual increase of road freight transport performance, the proportion of which in the total freight transport performance increased to 76.8%. Road freight transport therefore continues to represent a considerable burden for both the environment and the road network and it also causes noise pollution.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

"Reducing the impact of transport on the environment and public health in accordance with the principles of sustainable development" is one of the key priorities of the **Transport Policy of the Czech Republic for the Period 2005–2013**. The **Transport Policy of the Czech Republic for the Period 2014–2020, with prospects till 2050** was approved by the Czech Government in June 2013. This strategic sector document was based mainly on the **White Paper – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system**. This is a new European transport policy for the period 2012–2020 with a prospect till 2050. Other cross-section strategic documents at the national and European levels are **Europe 2020**, the **National Reform Programme**, **European Cohesion Policy** and the **Strategic Framework for Sustainable Development of the Czech Republic**. The last-mentioned conceptual document aims at ensuring sustainable transport which is defined as energy-efficient transport with the least possible burden on air quality, areas of valuable nature and on human health.
The **State Environmental Policy of the Czech Republic 2012–2020** has media-related priorities whose successful fulfilment closely depends on development of the environmental impacts of transport. These are priorities of the thematic area "Climate protection and air quality improvement" (Reducing greenhouse gas emissions and limiting the impact of climate change and Reducing the air pollution level) and priorities of the thematic area "Nature and landscape protection", especially the priority Environmental quality improvement in settlements.

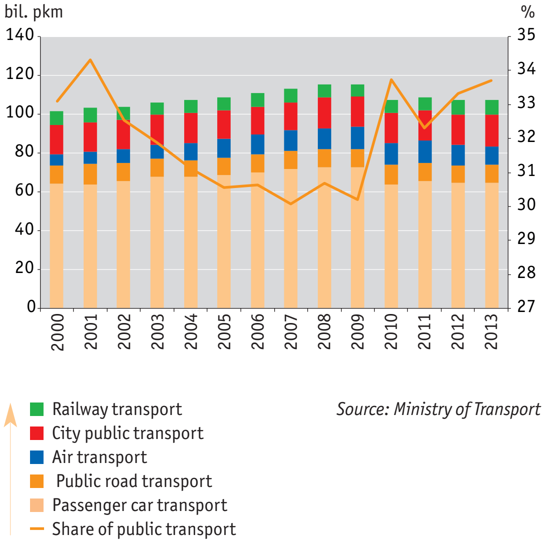
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The impacts of transport on ecosystems and human health come mainly from the actual traffic on roads (emission and noise pollution), however, the effects on landscape and biodiversity that are associated with development and operation of the transport infrastructure are significant, too. Transportation affects human health through air pollution, excessive noise and traffic accidents. Health impacts of transport are amplified by the fact that the greatest intensity of transport is usually in towns and cities where there is also the highest concentration of population. Ecosystems and vegetation are damaged especially by secondary air pollutants (e.g. ground-level ozone) that are formed from precursors produced by transport, mainly nitrogen oxides and volatile organic compounds. The linear transport infrastructure takes part in land take of agricultural and forest land; it causes landscape fragmentation and changes landscape character, thus causing biodiversity loss.

Transportation

INDICATOR ASSESSMENT

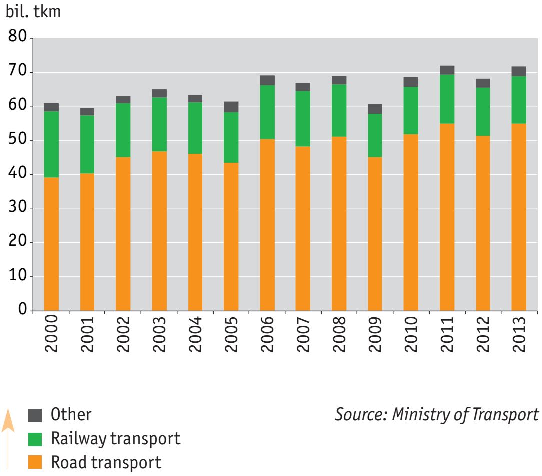
Chart 1 → **Development of passenger transport performance and the proportion of public transport in passenger transport in the Czech Republic [bil. pkm, %], 2000–2013**



Source: Ministry of Transport

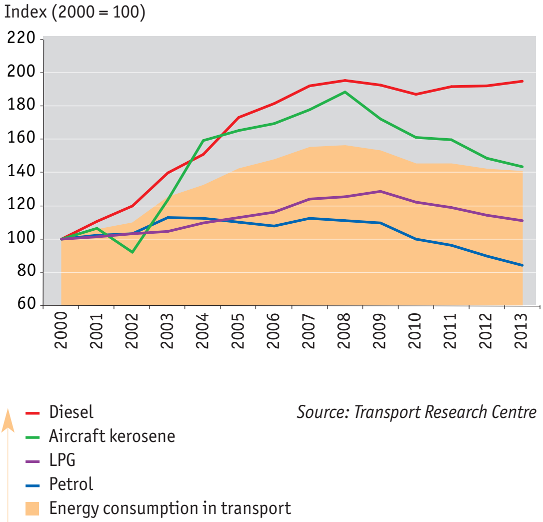
In 2010, there was a methodological change in calculation of the passenger car transport performance based on the national transport census. The proportion of public transport only includes ground-level transport performance, i.e. without air transport.

Chart 2 → **Development of freight transport performance in the Czech Republic [bil. tkm], 2000–2013**



Source: Ministry of Transport

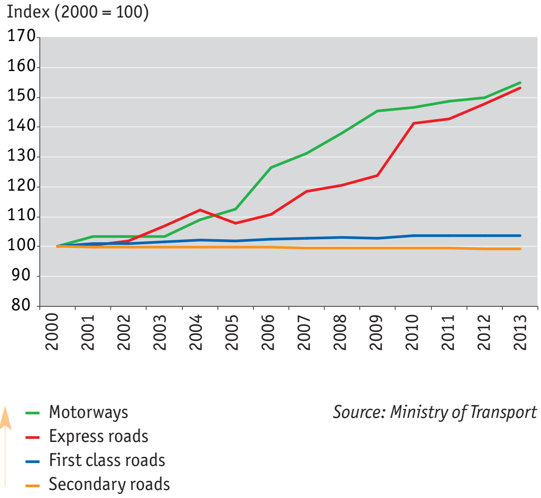
Chart 3 → **Consumption of fuels and total energy consumption in transport in the Czech Republic [index, 2000 = 100], 2000–2013**



Source: Transport Research Centre

The data on petrol and diesel consumption include the consumption of bio-components mixed into these fuels on an obligatory basis.

Chart 4 → **Development of road and motorway networks in the Czech Republic [index, 2000 = 100], 2000–2013**



Source: Ministry of Transport

Transportation

In the Czech Republic, transport is a significant and dynamically evolving environmental burden whose influence was growing significantly in 1990s and at the beginning of 21st century. Since 2007, however, environmental burden from transport is declining, especially as a result of positive development in passenger transport performance, fleet structure and from the environmental perspective, also due to the Czech Republic's economy, which was rather declining in this period, thus supporting the reduction of transport-related pressures on the environment.

After a constant growth, development of the **total passenger transport performance** gradually changed into stagnation in the Czech Republic after 2008[1] in the transport performance structure it is possible to observe a slight tendency towards strengthening public transport at the expense of individual transport in 2007–2013 (Chart 1). In 2007–2013, the proportion of public transport in the total ground-level transport (without air transport) performance increased by 3.6 p.p. to 33.7% while it amounted to 33.1% in 2000 and even 51.0% in 1990. The trend of passenger transport individualisation, typical for 1990s and early 21st century, has therefore come to a standstill. From the perspective of reducing the health and environmental impacts of transport, this fact is positive since the public (particularly rail) transport is more efficient and causes less environmental burden in comparison with passenger car transport.

The growth of **public transport** performance was caused by the increase of **public city transport performance** by 13.4% (1.9 bil. pkm) and the **railway passenger transport** performance by 10.1% (0.7 bil. pkm) in 2007–2013. The railway included in the integrated city transport systems, whose proportion in the railway transport performance increased by more than 10 p.p. to 13.4% in 2000–2013, has taken a fundamental part in the increase of railway transport performance. In 2012/2013 interannual comparison, the railway transport performance in passenger transport grew by 4.6% to 7.6 bil. pkm; the railways transported 174.5 mil. passengers, which is by 1.7 mil. passengers (1.0%) more than they transported in 2012. In 2010–2013, the average transport distance on railways was gradually increasing to 43.6 km, thereby exceeding significantly the average transport distance achieved by buses (26.5 km) and integrated city transport systems (32.2 km). This fact illustrates good competitiveness of long-distance railway transport, particularly in corridor tracks.

The **buses transport performance** except city public transport decreased by 5.1% (0.5 bil. pkm) in 2007–2013. There was an interannual stagnation of the buses transport performance and a slight decline in the number of passengers by 2.0% (7.0 mil.) in 2013.

In **air transport**,[2] the transport performance stagnated after 2007; the highest performance was achieved in 2011 (11.6 bil. pkm) and in 2013, it declined interannually by 9.5%. The performances of airports in passenger transport, however, increased interannually by 2.1% in 2013. The Czech Republic's airports checked in 12.1 mil. passengers, so generally speaking, a slight recovery can be seen in air transport.

The total **freight transport performances** fluctuate without a noticeable trend; in 2013, they grew interannually by 5.0% (3.4 bil. tkm) as a result of growing road freight transport performance by 7.1% (Chart 2). In 2013, there was a growth in freight transport despite a GDP decline by 0.9% and stagnation in the industrial production. The proportion of road freight transport in the total freight transport performance continues growing constantly; it increased by almost 13 p.p. to 76.8% in 2000–2013. From the environmental point of view, this is a negative trend, which is, however, counterbalanced partially by rapid modernisation of the fleet of lorries.

Concerning **fuel consumption** in the transport sector (Chart 3), it is possible to see a significant increase in diesel fuel consumption after 2000 as a result of growing transport performance of road freight transport and growing share of diesel vehicles in the fleet of passenger cars. The increase in diesel fuel consumption came to a standstill after 2008; the consumption development reflected the decline of road freight transport due to economic crisis in 2009, and in the next years, also modernisation of the fleet of lorries and passenger cars. In 2008–2013, petrol consumption declined by 24.2% (498.0 thous. t per year), in 2013, the interannual decrease was 6.0%. The decline in petrol consumption can be associated with gradual modernisation of the fleet, reduction of the average consumption in the vehicles and also with a decline in the proportion of petrol-powered vehicles in the passenger cars fleet. After 2000, the LPG consumption development had a similar pattern as petrol consumption; CNG consumption was growing sharply and since 2000 it had increased 7.5 times; in 2008–2013 CNG consumption grew threefold, i.e. by 200.0%. **Energy consumption in the transport sector** decreased by 10.0% in 2008–2013, while passenger car transport (energy consumption decrease by 13.0 PJ, i.e. by 8.8%) and road freight transport (decline by 6.8 PJ) contributed most notably to this decline. Despite this positive development, the energy consumption in transport was higher by 41.0% in 2013, compared to the year 2000.

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 being in 2003–2008. In 2000–2013, the motorways network expanded by more than a half of the original size to 776 km, the express roads network to 458 km (Chart 4). During the period concerned, the length of first class roads increased by 3.6% (about 219 km); on the other hand, a slight decrease was recorded in the length of the roads of lower classes (by 0.6%), mainly because some of these roads were included into the network of local roads in municipalities.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1894)

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[1] The 2010 deviation was of methodological nature and it was related to a change in calculation of the passenger car transport performance.

[2] The statistics include only carriers registered in the Czech Republic, including their transport performances registered abroad.

29/ Emission intensity of transport

KEY QUESTION →

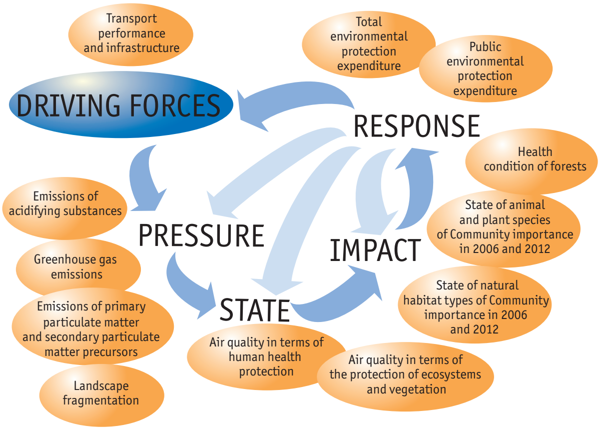
Is the emission intensity of transport, together with its impacts on the environment and public health, declining?

KEY MESSAGES →

☺ The dynamic structure of the vehicle fleet is being modernised. The proportion of vehicles not meeting any EURO emission standards dropped to less than 10%; vehicles meeting the EURO 4 standard cover the biggest share of the passenger car fleet under operation (30–50% depending on the road type).

Since 2007, emissions of pollutants from transport have been declining significantly and greenhouse gas emissions from transport also recorded a slight decrease in this period.

☹ The registered motor vehicle fleet is very old; in 2013, the average age of passenger cars reached 14.2 years and the trend is growing. A majority of the passenger car fleet, i.e. approximately 2.7 mil. vehicles, is older than 10 years; these vehicles are more emission- and energy-demanding than new vehicles due to outdated technologies. The intensity of excluding vehicles from the Central Register of Vehicles is insufficient, and in addition, the average age of the passenger car fleet is also affected negatively by imports of second-hand cars from abroad.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

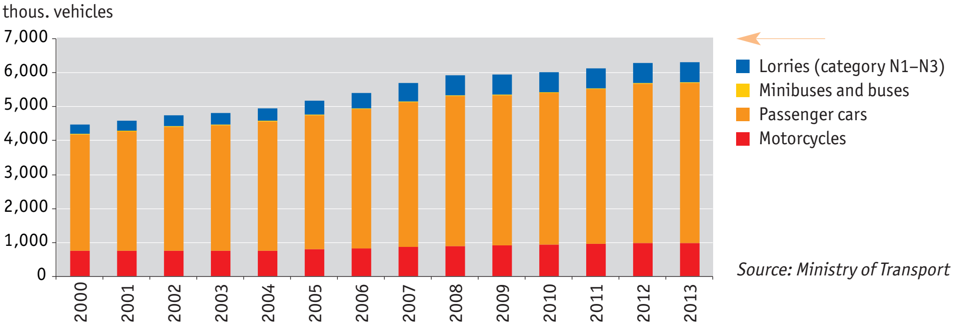
Environmental impacts of transport with a focus on emission production are treated by strategic documents of cross-sectional, media-related and sectoral character. The priorities of the **State Environmental Policy of the Czech Republic 2012–2020** include "Reducing GHG emissions and reducing the impacts of climate change" and "Reducing the air pollution levels". Implementation of these priorities is closely connected with transport, which is a major producer of emissions of pollutants and greenhouse gases. One of the cross-cutting priorities of the **Czech Republic's Transport Policy for the years 2005–2013** is "to limit the environmental and public health impacts of transport in line with sustainable development principles". In relation to the new European transport policy for the period 2012–2020, i.e. **White Paper – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system**, updated national sectoral strategy was created: **Transport Policy of the Czech Republic for the Period 2014–2020, with prospects till 2050**, which was adopted by the Government in 2013.
In order to accelerate renewal of the car fleet and reduce its emission intensity, the fee to support the collection, treatment, recovery and disposal of car wrecks was introduced pursuant to the **Act No. 185/2001 Coll.**, on waste and amendment of some other acts from 1st January 2009.
Within the priority axis 2 "Economy and Innovation", the cross-cutting document **Strategic Framework for Sustainable Development in the Czech Republic** defines objectives in the areas of increasing energy efficiency of transport, transport quality enhancement, strengthening competitiveness and reducing the negative environmental impacts of transport.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The production of transport-related emissions has a significant link to public health protection since the emissions are released in the ground-level layer of the atmosphere and their most serious effect manifests in densely populated areas especially. Transport contributes to air pollution load in settlements also because many towns and cities miss ring roads or by-passes to divert transit transport. In cities without significant industrial load, traffic is the main factor influencing air quality and thus the health effects associated with it, including reduced immunity, deterioration of asthma and allergies, and more frequent occurrence of diseases of the respiratory and cardiovascular systems. In addition to air pollution, transport is a quite dominant source of excessive noise pollution. Trough air pollution, transport also burdens ecosystems, namely by producing precursors of ground-level ozone which damages vegetation and reduces agricultural yields.

INDICATOR ASSESSMENT

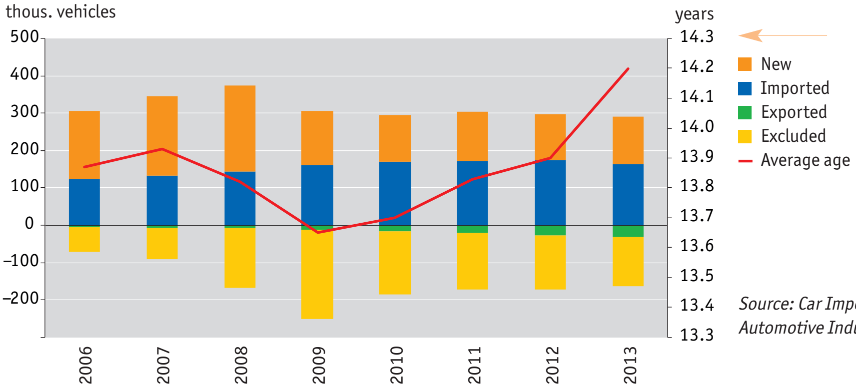
Chart 1 → **Development of the number of registered motor vehicles in the Czech Republic [thous. vehicles], 2000–2013**



Source: Ministry of Transport

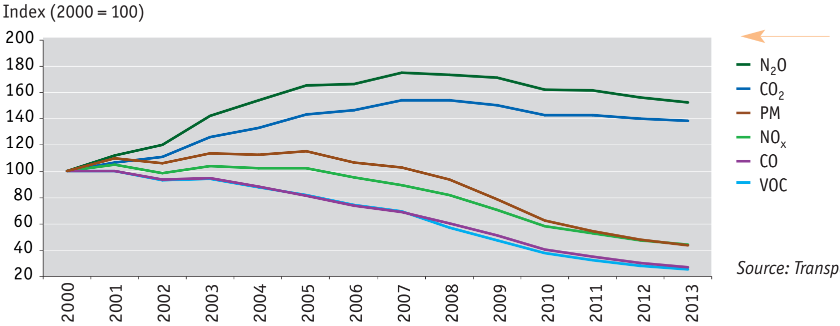
Due to transition to the new vehicle registration system in the Central Register of Vehicles in accordance with EU legislation, the data for 31st December 2012 are not available; the data for the year 2012 are related to 1st July 2013.

Chart 2 → **Numbers 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], 2006–2013**



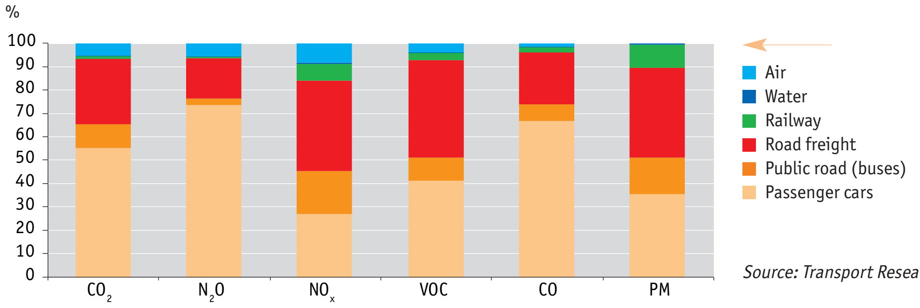
Source: Car Importers Association, Automotive Industry Association

Chart 3 → **Trends in transport-related air emissions [index, 2000 = 100], 2000–2013**



Source: Transport Research Centre

Chart 4 ➜ **Transport-related air emissions by means of transport [%], 2013**



Source: Transport Research Centre

Emissions from transport have been falling since 2007. This favourable trend is a result of reduced energy consumption in the transport sector and gradual replacement of the fleet of cars and lorries with vehicles equipped with modern technologies and lower emissions. In the general evaluation, it is important that the structures of the static[1] fleet of registered vehicles and that of the dynamic fleet in the actual operation on roads differ substantially according to the latest research.

The **number of vehicles registered** in the Central Register of Vehicles continues increasing as the numbers of first registrations of new and imported second-hand vehicles exceed the number of vehicles excluded from the register (in particular for passenger cars). At the end of 2013, a total of 6,319.0 thous. motor vehicles were registered in the Czech Republic[2] which means an increase of the number of vehicles since 1st July 2013[3] by 0.3% (approximately 21.0 thous. vehicles, Chart 1). The number of registered passenger cars increased by 0.5% (approximately 23.0 thous.) to 4,729.0 thous. vehicles; since 2000, their number grew by more than a third (+37.5%). The number of registered lorries (category N1–N3) grew, especially in 2000–2008, when it almost doubled; in the further development there was stagnation with an interannual decrease by 0.3% (approx. 2.0 thous. vehicles) in 2013. The number of registered motorcycles has been growing steadily since 2000; in 2013 it was approaching 1 mil. vehicles.

The fleet of **vehicles registered in the Czech Republic** is **very old** and its average age is even rising; in 2013, it achieved 17.0 years (interannual increase by 0.2 year) for the entire fleet of motor vehicles. The average age of passenger cars was 14.2 years (interannual increase by 0.3 year, Chart 2), for lorries it was 11.3 years. In 2013, 164.7 thous. **new passenger cars** were registered in the Czech Republic (interannual decrease by 5.3%) and the **fleet renewal coefficient** amounted to 3.5%, which is far below the optimum level of 8–10%. However, the main cause of the high average age of the fleet consists especially in the slow pace of excluding the vehicles from the register and import of second-hand cars from abroad. The number of excluded vehicles has been declining since 2009 (in 2009–2013 by 45.0%); a total of 164.8 thous. passenger cars were excluded from the register in 2013, which is an interannual decrease by 4.5%. A significant growth of re-exports, i.e. exports of vehicles already registered in the Czech Republic (in 2007–2013 it more than quadrupled), does not affect the fleet's age positively since most of the vehicles are exported within one year of registration of the new car. As a result of this development, vehicles older than 10 years, which are most intensive in terms of energy and emissions, comprise more than a half of the fleet and this proportion is not declining (57.4% in 2013).

In the passenger cars structure by propulsions, the proportion of petrol-powered cars decreases and the proportion of diesel vehicles, which increased from 11.1% in 2000 to 32.3% in 2013, grows gradually. In recent years, however, the increase of the number of diesel vehicles slowed down. The fleet structure by propulsions is important in terms of air quality impacts because diesel engines produce more emissions of NO_x and suspended solids. With the highest EURO emission standards, however, the difference in emissions

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[1] *The static fleet includes all vehicles registered for operation on roads in the Central Register of Vehicles to the given date. Therefore, this also concerns so-called veteran cars, which increase the average age of the fleet even more. However, the statistics does not include vehicles which are excluded temporarily or permanently from the Central Register of Vehicles, including car wrecks. The dynamic fleet, by contrast, includes only vehicles in actual operation on roads; its structure is determined by transport research in the actual traffic.*

[2] *The data do not include the number of special vehicles (vehicles of the integrated rescue system and other vehicles not included in the other categories), trailers and tractors. These data are not available for all the monitored time series.*

[3] *Due to transfer of the Central Vehicle Register from the Ministry of Interior to the Ministry of Transport, the data for 31st December 2012 are not available.*

produced by petrol-powered engines and diesel ones is minimal. The position of alternative fuels and propulsions in the fleet of vehicles of all kinds remains marginal.

The parameters of the fleet would be much more favourable, if we focus only on vehicles actually operating in traffic, on the so-called **dynamic fleet**, rather than the registered fleet. According to a study worked out by ATEM for the Road and Motorway Directorate of the Czech Republic in 2010, the average age of passenger cars was 8.5 years, light lorries 5.5 years, heavy lorries 7.6 years and buses 8.5 years. Passenger cars up to 5 years of age comprised 37.4% of the vehicles in actual operation (in the Central Vehicle Register it was 17.8%), while vehicles older than 25 years were represented in 0.9%. The significant differences between the static and dynamic fleets are caused by the fact that new vehicles are used more and make more kilometres than older cars. Compared to the results of previous studies (2001 and 2005), the average age of the dynamic fleet does not change significantly, which, however, means a **substantial modernization** due to the rapid technological development in the automotive industry. In 2001–2010, the proportion of vehicles not meeting any EURO emission standard decreased from 20–40% depending on the type of road (lower numbers refer to motorways) to 3–8% in 2010. While in 2001, vehicles meeting the EURO standards 1 and 2 were most represented in traffic, in 2010, vehicles complying with EURO standard 4 prevailed (30–50%) and the proportion of vehicles meeting the so far highest emission standard (EURO 5) varied between 4% and 10%.

The development of the fleet structure and transport performance is reflected in the development of **transport-related emissions**. While at the beginning of the first decade of 21st century most emissions of monitored substances were growing or stagnating (there was a slight decrease only in VOC and CO emissions), in 2005, the trend was reversed and the emissions began to decline (Chart 3). A more marked decrease was recorded for pollutants that are removable through modern technologies, such as three-way catalytic converter, Diesel Particulate Filter (DPF), exhaust gas recirculation (EGR) system and selective catalytic reduction (SCR) the use of which rose quickly in the fleet. In 2000–2013, NO_x emissions decreased by 55.8%, VOC emissions by 74.8%, CO by 73.1% and emissions of suspended particles declined by 56.6%. After 2008, greenhouse gas emissions from the transport sector were also decreasing, in the case of CO_2, the emissions decreased by 10.1% (about 2.0 Mt) in 2008–2013, however, in comparison with the year 2000, they were by 38.7% higher in 2013.

The **structure of emissions production by individual modes of transport** (Chart 4) shows that in the case of CO_2, N_2O, and CO emissions, passenger car transport is their main source with a majority share in the total transport-related emissions in 2013, the highest being for N_2O (73.6%). Road freight transport with approx. 40% share in the total transport-related emissions is the biggest source of NO_x, VOC and particulate matter emissions. The proportions of the other modes of transport in the emissions are much smaller; in 2013, air transport produced 8.3% of NO_x emissions and 9.8% of suspended particles came from railway transport.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

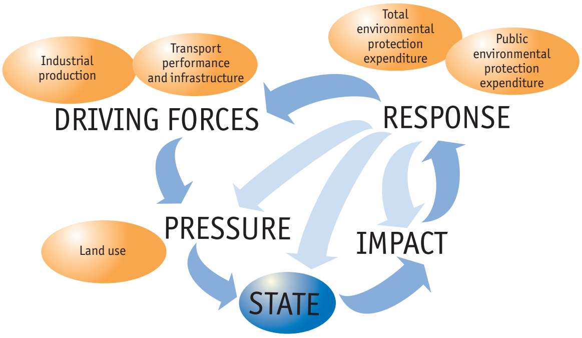
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1895)

30/ Noise pollution burden of the population

KEY QUESTION →

What is the state and development of noise pollution in the Czech Republic?



KEY MESSAGES →

🙂 Railway transportation and industry do not cause noise burden that would be important in terms of its area in the Czech Republic. The noise pollution in agglomerations of Liberec, Olomouc and Ústí nad Labem/Teplice is below the national average, as far as the proportion of the population living in areas with exceeded limit values for whole-day nuisance is concerned.

☹ In the Czech Republic, 2.8% of the population for the whole day and 3.3% at night are exposed to above-limit noise levels. Road transport is almost the exclusive source of excessive noise. On average for all agglomerations, the proportion of the population exposed to noise in urban agglomerations is more than doubled compared with the situation in the whole of the Czech Republic; the worst situation is in the city of Pilsen where 10% of the population for the whole day and 13% at night are exposed to noise nuisance.

OVERALL ASSESSMENT →

The data currently available from Strategic Noise Mapping do not enable to assess noise pollution trends since they were not collected in a longer time series, using the same methodology in multiple periods.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **Strategic Noise Mapping** aims at obtaining an overall view of the noise burden of the EU population and identifying the critical places where the limit values of noise indicators are being exceeded. On the basis of Strategic Noise Mapping, action plans of anti-noise measures will be created for the identified critical locations.

The strategic noise maps and the respective action plans are worked out on the basis of the requirements of the **Directive of the European Parliament and of the Council No. 2002/49/EC relating to the assessment and management of environmental noise (Environmental Noise Directive – END)**, which is implemented into the Czech legislation through the Act No.258/2000 Coll., on the protection of public health and amendment to certain related laws, as amended, and article XII of the Act No.222/2006 Coll., amending the Act No. 76/2002 Coll. on integrated prevention. In the Czech Republic, the limit values for noise indicators for the purposes of strategic noise mapping are determined by the **Decree No. 523/2006 Coll., on noise mapping**. The agglomeration are defined by the **Decree No. 561/2006 Coll., on the list of agglomerations for noise mapping** while respecting the minimum number of inhabitants specified in the above Directive. Roads, railways and airports which are included in the strategic noise mapping process are defined by the same directive for individual noise mapping rounds on the basis of transport intensity.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

At present, noise belongs to significant indicators of environmental quality and factors affecting the population's health. Excessive noise is a source of stress, which brings about of a number of diseases of affluence. Noise nuisance, i.e. 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 the effects on the hearing organs and cardiovascular system. As noise affects humans, it also has a similar impact on animals, which can lead to disruption of populations and loss of biodiversity.

INDICATOR ASSESSMENT

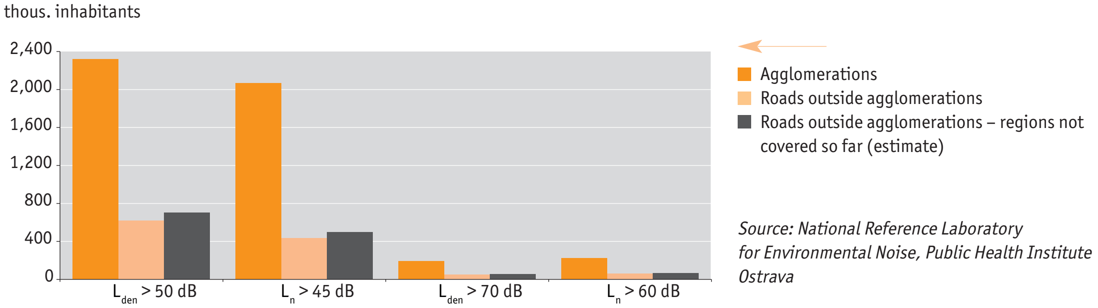
Table 1 ➜ **Limit values for noise indicators in the Czech Republic [dB], according to Decree No. 523/2006 Coll., on noise mapping**

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} – the limit value for day-evening-night to characterize all-day noise-related annoyance
L_n – the limit value for the night hours (11:00 p.m.–07:00 a.m.) to characterize noise-related sleep disturbance

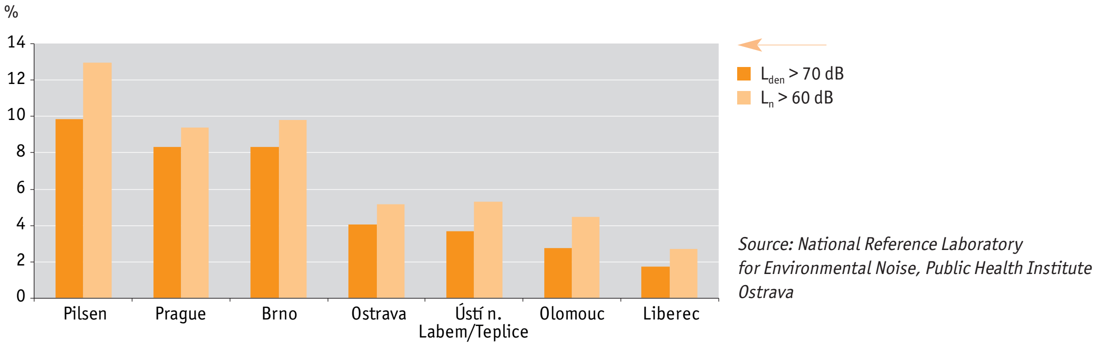
Chart 1 ➜ **The total number of the Czech Republic's population living in the given noise pollution categories for 24-hour (L_{den}) and night (L_n) noise pollution [thous. inhabitants], 2012**



Source: National Reference Laboratory for Environmental Noise, Public Health Institute Ostrava

The non-agglomeration data refer to noise burden of the major roads with transport intensity of more than 3 mil. vehicles per year. The estimate for the population burden which is caused by road traffic outside agglomerations in regions not covered so far was calculated using an average proportion of people living in individual noise pollution categories in the covered regions in the total population multiplied by the number of inhabitants in the non-covered regions minus the agglomerations' populations (agglomerations of Prague, Brno, Ostrava and Olomouc).
Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

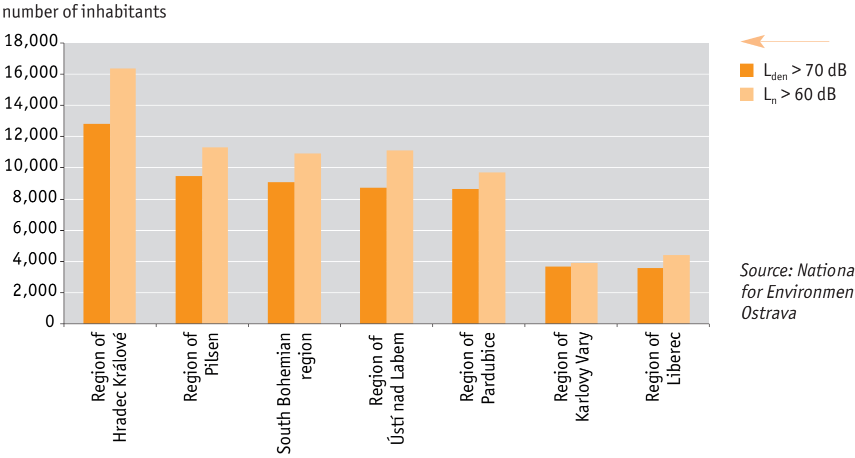
Chart 2 ➜ **Proportion of the population in the Czech Republic's agglomerations living in areas with exceeded limit values of noise indicators for day and night [%], 2012**



Source: National Reference Laboratory for Environmental Noise, Public Health Institute Ostrava

The data used for the agglomerations of Prague and Brno are from the first round of Strategic Noise Mapping.

Chart 3 ➜ **Number of inhabitants in the Czech Republic's regions exposed to above-limit noise pollution from the main roads [number of inhabitants], 2012**



Source: National Reference Laboratory for Environmental Noise, Public Health Institute Ostrava

Based on the currently available results of 1st and 2nd rounds of the **Strategic Noise Mapping**[1] 2.8% of the Czech Republic's population (about 292.0 thous. inhabitants) live in areas with above-limit noise burden laid down for 24-hour noise and 3.3% of the population (about 349.0 thous. inhabitants) are disturbed by excessive noise at night (Chart 1). The proportion of affected population is clearly higher in agglomerations of over 100.0 thous. inhabitants where a total of 188.8 thous. inhabitants, i.e. 6.8% of the population living in agglomerations, are exposed to 24-hour excessive noise and 225.3 thous. people, i.e. 8.1% of the agglomerations' inhabitants, are disturbed at night. Traffic on the main roads causes 24-hour noise burden for another approx. 1.3% of the population living in the evaluated regions (48.3 thous. inhabitants) and night noise disturbs 1.5% of the population (57.8 thous. inhabitants). More than a third of the Czech Republic's population (approx. 3.6 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[2].

Noise pollution in the Czech Republic's agglomerations[3] is worst in the agglomeration of Pilsen, where 10% of the population are exposed to noise exceeding the 24-hour limit values and 13% of the population are disturbed at night; an unfavourable situation is also in Prague and Brno, i.e. agglomerations where 8–10% of the population are exposed to above-limit noise levels (Chart 2). However, there is a better acoustic environment in the agglomerations of Liberec, Olomouc and Ústí nad Labem/Teplice, where the proportion of the population living in areas with exceeded noise indicators limit values are below the average for all the Czech Republic's agglomerations. The best situation is in the Liberec agglomeration where only 1.7% of the population (approx. 2.7 thous. inhabitants) for all day and 2.7% at night are exposed to excessive noise. In agglomerations, 52–97% of the population 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.

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). There are a total of 114 educational facilities exposed to excessive road transport noise, most of them in Prague (36), Pilsen (31) and Ostrava (20); above that, there are 20 schools exposed to excessive noise from industry in Pilsen.

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[1] *Strategic noise maps and action plans are worked out in five-year cycles, which are laid down in the END Directive. In the Czech Republic, there was the second round of strategic noise mapping in 2008–2013; however, at the end of 2013 only a part of the noise maps were finished, namely for agglomerations of Ostrava, Ústí nad Labem/Teplice, Pilsen, Liberec and Olomouc and for the main roads in South Bohemian region and the regions of Pilsen, Karlovy Vary, Ústí nad Labem, Liberec, Hradec Králové and Pardubice.*

[2] *The indicator L_{den} (day-evening-night) describes all-day noise disturbance; L_n is the noise indicator of sleep disturbance. The limit values of these noise indicators according to the Decree No. 523/2006 Coll. are listed in Table 1.*

[3] *The data used for the agglomerations of Prague and Brno are from the first round of Strategic Noise Mapping.*

Road transport is the dominant **source of excessive noise** in agglomerations. A significant excessive 24-hour railway-related noise burden has been recorded in Prague (12.0 thous. inhabitants, i.e. approximately 1% of the population), Brno (2.2 thous. inhabitants, i.e. 0.6%) and Ústí nad Labem/Teplice (360 inhabitants, i.e. 0.2%). Most excessive industry-related noise disturbs the residents of the Pilsen agglomeration; i.e. about 2.5 thous. people (1.4% of the population) over the course of the day, and 8.6 thous. inhabitants (4.8% of the population) at night.

According to Directive 2002/49/EC, **noise pollution related to traffic on main roads** outside agglomerations 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 residents who live in the vicinity of these communications. Likewise agglomerations, it therefore does not cover whole settlements. In terms of the total number of affected population, the biggest noise pollution is concentrated in regional centres. In Hradec Králové, about 4% of the population (3.7 thous. inhabitants) live in areas with exceeded 24-hour road traffic-related noise levels; in Pardubice it is 3.8% (3.3 thous. inhabitants) and in České Budějovice 2.8% (2.6 thous. people). In the case of smaller municipalities, much higher proportions of the population exposed to noise pollution were found out. According to available results, the situation is worst in villages of the Hradec Králové region (Bílsko u Hořic, Blešno and Ohařice) through which the main long-distance transport routes are going.

It follows from a comparison of road traffic noise pollution in the **Czech Republic's regions** (in agglomerations and outside of agglomerations) based on the results of Strategic Noise Mapping[4] that the worst situation is in the region of Hradec Králové where 12.8 thous. inhabitants (2.3% of the region's population) are exposed to 24-hour above-limit noise levels and 16.4 thous. people (3% of the region's population) are disturbed at night (Chart 3). The situation in this region is affected by transit traffic going through Hradec Králové and other villages on the roads to Ostrava (I/11) and Olomouc (1/35). Among the evaluated regions, it is the Liberec region where there is the lowest proportion of the population exposed to above-limit noise levels (only 0.8% in the course of the day and 1% at night).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1902)

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[4] *Except the capital city of Prague, which is evaluated as agglomeration.*

Transportation in the European context

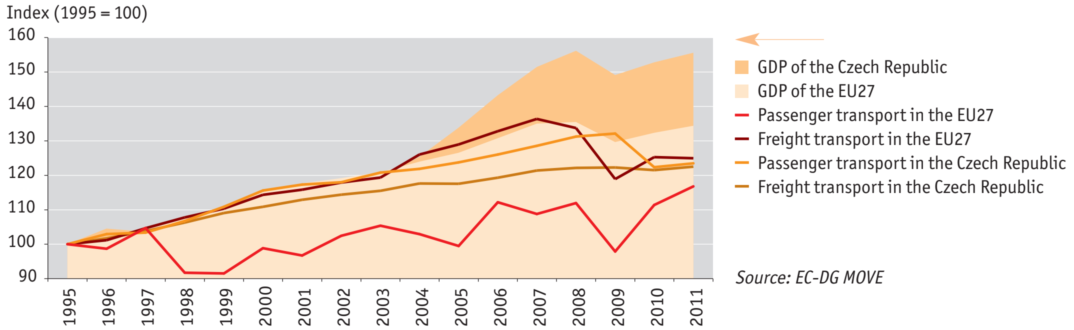
KEY MESSAGES ➔

- ➔ In the EU27, individual transport prevails significantly within passenger transport; it accounts for nearly three-quarters of the total transport performance in passenger transport. The proportion of the public transport performance in passenger transport in the Czech Republic is above average in the European context; the proportion of city public transport is especially high.

- ➔ In both the EU and the Czech Republic, the freight transport is characterized by approximately a three-quarter share of road freight transport in the total inland freight transport performance; the share of railways is somewhat higher in the Czech Republic than it is in the EU.

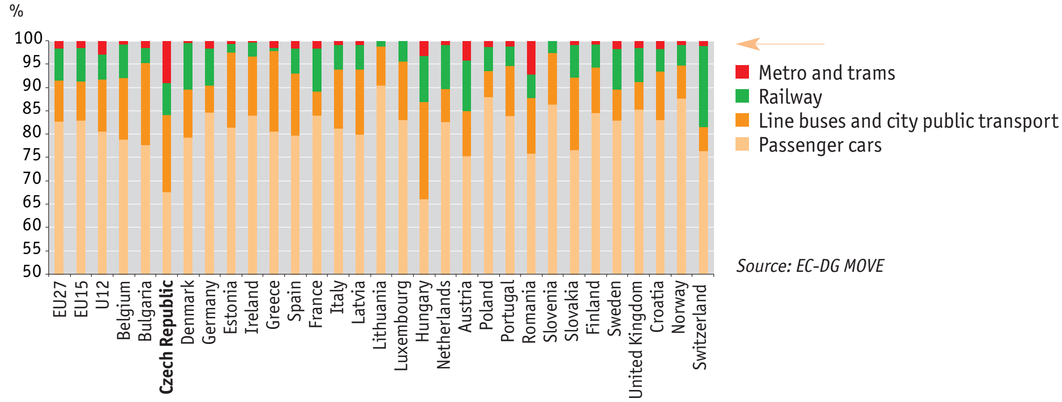
- ➔ In the Czech Republic, renewal of the vehicle fleet is insufficient; within the EU27, the Czech Republic has a below-average share of new vehicles in the total size of passenger cars fleet. Transport-related noise pollution in the EU and in the Czech Republic are comparable, but the Czech Republic has a higher proportion of urban population exposed to excessive noise levels; in West European countries, the situation is more favourable due to transit traffic diversion away from the centres of large cities.

Chart 1 ➔ **Development of transport performance in passenger and freight transport and GDP in the Czech Republic and EU27 [index, 1995 = 100], 1995–2011**



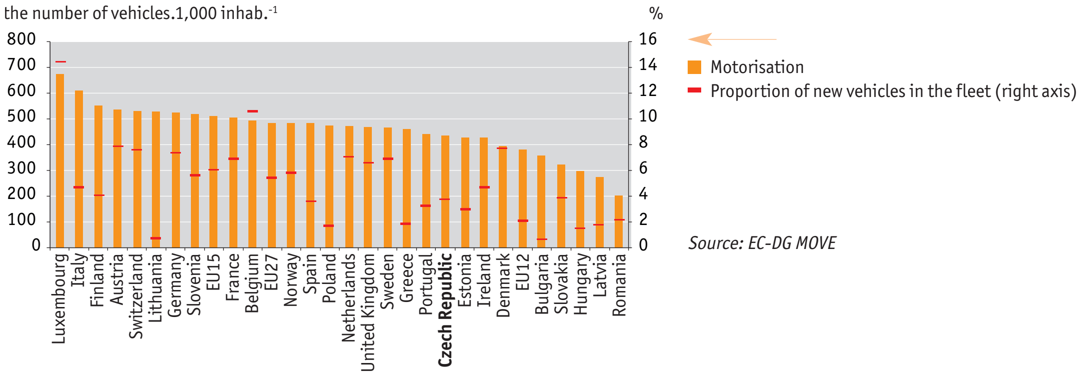
Source: EC-DG MOVE

Chart 2 ➔ **The structure of passenger transport performance according to modes of transport, excluding air transport [%], 2011**



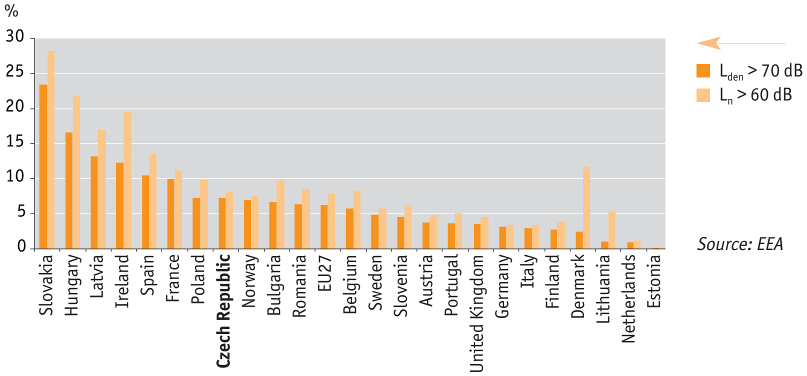
Source: EC-DG MOVE

Chart 3 → **Motorisation and the proportion of new vehicles in the total size of passenger cars fleet [the number of vehicles.1,000 inhab.$^{-1}$, %], 2011**



Source: EC-DG MOVE

Chart 4 → **Road transport noise pollution in agglomerations over 250.0 thous. inhabitants which exceeds the limit values provided for by the Czech Republic's legislation for 24-hour (L_{den}) and night (L_n) noise burden [% of exposed population in agglomerations], 2009**



Source: EEA

In 1995–2011, the **total transport performance** of passenger and freight transport was growing in the EU and in the Czech Republic and was developing in close relation to the economies' performances (Chart 1). In the Czech Republic in 1990s, the growth of freight transport was less significant than in the EU27 due to changes in the economy and decline in high-volume shipments; in the freight transport development in both the EU and Czech Republic there was a distinct drop in 2009 which was related to global economic crisis.

Within the EU27 **passenger transport**, there is a clear dominance of passenger car transport which comprised 82.7% of the total passenger transport performance in 2011 (excluding air transport, Chart 2). In the Czech Republic, the degree of transport individualisation, likewise in most EU12 countries, is below average in the European context. In the EU27, the Czech Republic has the highest share of city public transport (metro, tram) in the passenger transport performance (approx. 9%) and also an above-average proportion of city and line buses in the total passenger transport performance (16.4%; the EU27 average is 8.8%).

In the EU27, road transport (71.8% in 2011) has the highest proportion in the structure of inland **freight transport performance**; in the Czech Republic it is 76%. On the other hand, Czech railway transport has a slightly higher share in the total freight transport performance than in the EU27 (19.9% in the CR, 17.4% in the EU27), which is connected with a significant role of industry and raw materials excavation in the Czech Republic's economy.

In the Czech Republic, **motorisation** is slightly below the EU27 average; however, it is among the highest in the EU12 countries (Chart 3). There are, however, big differences in motorisation among the Czech Republic's regions. In the city of Prague, motorisation (over 600 vehicles.1,000 inhabitants^{-1}) has one of the highest values in the whole EU27. In the CR, renewal of the passenger cars fleet is clearly slower than the EU27 average and particularly slower than the EU15 average. In 2011, the proportion of new passenger cars in the fleet was 3.8% in the Czech Republic, 5.4% in the EU27, and in Belgium and Luxembourg even over 10%.

In the Czech Republic, **expenditures on transport** represent a lower proportion (9.4%) in the total households consumption than the EU27 average (13.2%). In monetary units, the distance between the EU27 and the Czech Republic is even more significant because of different price levels; in 2011, the annual expenditure on transport represented an average of EUR 700 in the Czech Republic while in the EU27 it was EUR 1,900. The lowest share of transport in the households consumption is in Slovakia (7.3%). In the East-European states with lower per capita GDP, the transport expenditures in absolute numbers are much lower than in West-European countries but their share in the total households consumption is high – e.g. in Bulgaria, where transport makes up about 17% of the household expenditures.

In the Czech Republic, **transport-related noise pollution** in agglomerations over 250.0 thous. inhabitants is slightly above the EU27 average (Chart 4). In the EU27, 6.3% of inhabitants living in large agglomerations are exposed to 24-hour noise pollution above 70 dB; in the Czech Republic it is 7.2% of the inhabitants. In these terms, the worst situation is in Slovakia where the proportion of inhabitants living in high noise pollution is higher than 20%. In the Czech Republic, 82.7% of the agglomerations' inhabitants are exposed to 24-hour noise levels above 55 dB; in the EU27 this figure is 58.2%. A major cause of lower noise burden in agglomerations of Western and Northern Europe consists in transit traffic diversion away from city centres and traffic restrictions in residential areas (bans, speed limits, etc.). Within the EU27, transport-related noise pollution on main roads outside agglomerations is highest in France where 1.4% of the total population are exposed to 24-hour noise above 70 dB and 2.4%, i.e. 1.5 mil. people, are disturbed by noise above 60 dB at night. In the Czech Republic, this concerns about 0.9% of the population for the whole day and 1.2% of the population at night, which are slightly above-average values within the EU27.

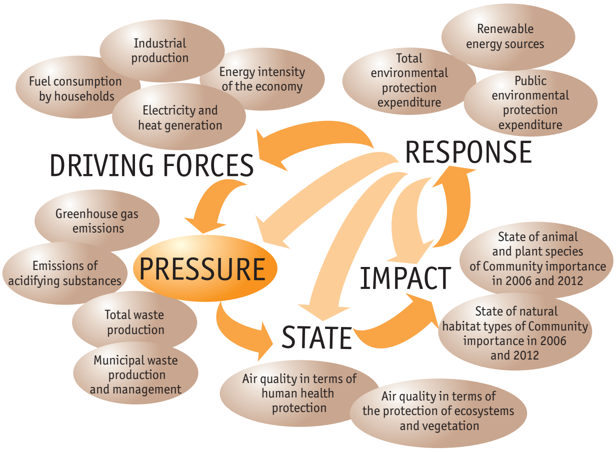
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1767)

31/ Domestic material consumption

KEY QUESTION ➔

Is the environmental pressure that is associated with material extraction and consumption decreasing in the Czech Republic?



KEY MESSAGES ➔

🙂 The Czech Republic's domestic material consumption decreases. In 2012, the interannual decline amounted to 11.1% and in 2007–2012, material consumption decreased by 20%. In this period, material consumption development was influenced by a decline in consumption of building materials, fossil fuels and biomass.

☹ Material dependency of the Czech Republic on foreign countries has been rising. The proportion of renewable resources in domestic material consumption is very low in the Czech Republic.

OVERALL ASSESSMENT ➔

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

The **Strategic Framework for Sustainable Development in the Czech Republic** is the fundamental document that sets out the goals and strategies in the field of material consumption and material intensity of the economy. Under priority axis 2 "The Economy and Innovation", the strategy aims at promoting sustainable material economy and achieving a sustainable relationship between the economic efficiency of material consumption and the environmental impact of material flows. Reducing material consumption is also dealt with in the **National Programme of Reforms of the CR 2013**, which declares support to manufacture of high value added products through supporting research and new technologies, transfer of their results into practice, innovative processes and skilled workforce. Material effectiveness and reduced material consumption are not explicitly mentioned in the current version of the **State Environmental Policy of the Czech Republic 2012–2020**, however, it mingles through several thematic areas of this document, in particular the Protection and Sustainable Use of Resources.

Introduction of circular economy based on the use of secondary raw materials, which is a subject of the EU package of activities focused on circular economy, especially COM(2014)398 – Towards a Circular Economy: A Zero Waste Programme for Europe, can contribute to the reduction of material consumption and hence of the economy's material intensity. The **Secondary Raw Materials Policy of the Czech Republic** is a national document which addresses the principles of circular economy and that the Government has taken note of in October 2013.

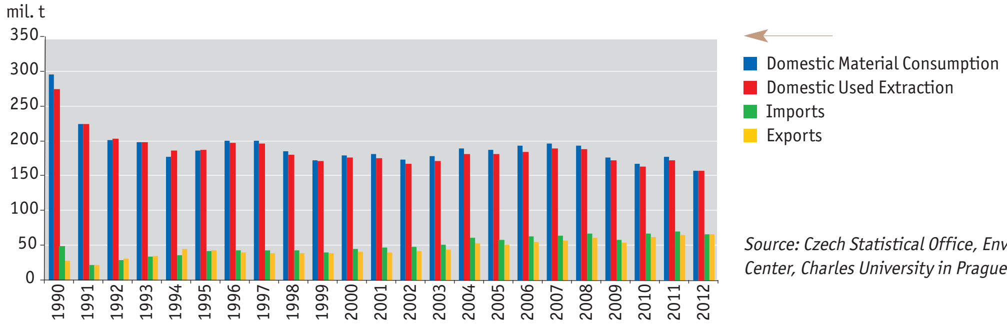
Protection and management of natural resources and sustainable production/consumption belong to the key objectives of the renewed **EU Sustainable Development Strategy**. The need to improve efficiency in transforming materials into economic output and to reduce the environmental burden connected with material consumption has also been highlighted by the **EU Thematic Strategy on the Sustainable Use of Natural Resources** and the **Recommendation of the OECD Council on Material Flows and Resource Productivity**. Efficient use of resources is one of the main topics in the **EU Strategy of Competitiveness – Europe 2020** and the follow-up "Resource-efficient Europe flagship initiative".

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

Domestic material consumption influences the extent of environmental burden caused by using natural resources. Raw materials extraction and biomass growing in the large agricultural systems bring about interventions into landscape, influence the state of ecosystems, may lead to biodiversity loss and surface water and groundwater quality decline. The materials consumption and use in the national economy and in households produce waste flows in a form of waste and emissions into air and water. Consumption of materials therefore influences human health, and burning of fossil fuels is also a significant source of greenhouse gas emissions.

INDICATOR ASSESSMENT

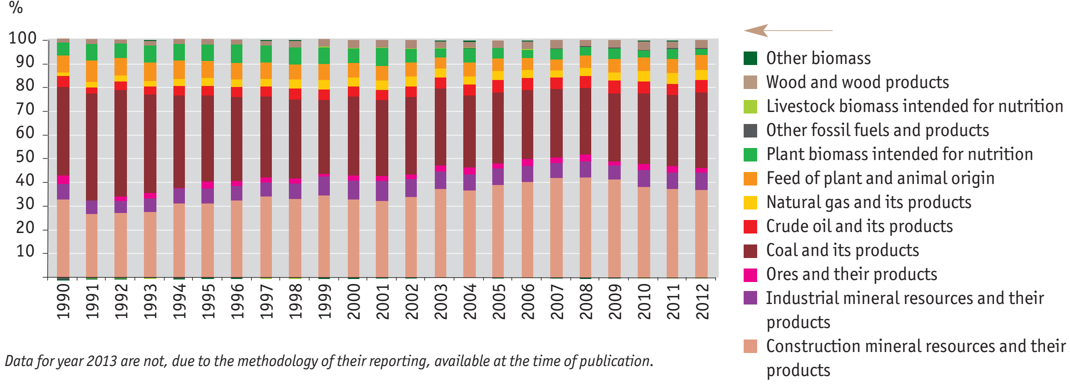
Chart 1 ➜ **Development of domestic material consumption and its components in the Czech Republic [mil. t], 1990–2012**



Source: Czech Statistical Office, Environment Center, Charles University in Prague

Data for year 2013 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 by material groups in the Czech Republic [%], 1990–2012**



Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

Source: Czech Statistical Office, Environment Center, Charles University in Prague

In 2012, **Domestic material consumption** (DMC)[1] decreased interannually by 11.1%; in 2007–2012 it declined by about one-fifth, most in 2009 and 2012, when there was an interannual decrease of the Czech Republic's economy. In 2012, environmental burden associated with natural resources extraction and materials consumption was at approximately half the value compared to the beginning of 1990s (Chart 1).

In 2007–2012, development of the total DMC was most influenced by the consumption of fossil fuels, biomass and mineral resources used in the construction sector (Chart 2). The **consumption of mineral resources** decreased in the reference period by 29% (23.8 mil. t) and in 2012 interannually by 11.3% (7.4 mil. t). These data indicate a decline in domestic demand for building materials which is related to the decline in the construction sector in the reference period; in 2012 there was an interannual decrease by 7.6%.

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[1] *DMC is calculated as the domestic used extraction minus exports plus imports. It measures the quantity of materials consumed by the economy for production and consumption. The value of the domestic used extraction corresponds to the burden and impacts related to extraction of raw materials and production of biomass.*

Consumption of fossil fuels, which makes up about 42% of material consumption in the Czech Republic, decreased by 9.5% in 2007–2012. In this period, the consumption of brown coal decreased by 4.3 mil. t, i.e. by 10.7% (in 2012 interannually by 6.6%), and it clearly reflected development of electricity generation in steam power stations (in 2007–2012, a decline by 16.7%) as a result of gradual changes in the energy mix. Black coal consumption followed the development of industrial production in this period, with a significant drop in 2009; in 2012 it was by 10.7% lower than in 2007.

In 2007–2012, **crude oil consumption** decreased by 1.6 mil. t (16.3%); the declining energy intensity of transport showed in the oil consumption development. The total consumption of energy in transport decreased by 8.5% in the reference period. The **natural gas consumption** varied depending on temperature conditions of heating seasons in the reference period. The natural gas consumption is clearly influenced by households; 33.9% of the energy value of the total consumed gas was used for households heating in 2012. In 2007–2011, the gas consumption according to the DMC indicator was rising; however, in 2012 it decreased by 15.6% (approx. 1.3 mil. t), although the real natural gas consumption, by contrast, increased slightly in comparison with the year 2011 (8,158 mil. m^3 in 2012, 8,086 mil. m^3 in 2011). The disproportion in the 2012 real consumption and DMC development can be explained by the fact that in 2012, a greater part of domestic demand was met from gas storage tanks in comparison with the year 2011, which is not covered by the DMC indicator.

The **consumption of metal minerals and non-metal industrial mineral raw materials** clearly follows the trends in industry development; in 2007–2012, the consumption was decreasing dramatically in the periods of declining industrial production. The consumption of metal minerals dropped interannually by 34.7% (1.9 mil. t) in 2012. The level of domestic used extraction of metal minerals is very low in the Czech Republic (the Czech Republic only extracts uranium ore on its territory) and the size of direct material input, i.e. the sum of domestic production and imports (19.5 mil. t in 2012), is several times higher than the DMC, due to a large amount of exported finished metal products and intermediate products (16 mil. t in 2012), in which export of the automobile industry takes a fundamental part. Producing metal products intended for export, the Czech Republic thus burdens its environment substantially.

After stagnation in 2007–2011, **biomass consumption** decreased significantly by 20% (4.7 mil. t) in 2012, namely as a result of reduced domestic biomass production and its export increase by 10%. The biggest decrease in production was recorded for cereals (interannually by 20%); the 2012 decline in cereals production compared to the previous year was caused by lower hectare yields (about 1.1 $t.ha^{-1}$, i.e. 19%) and by a slight reduction of areas with cereals by about 25.0 thous. ha, i.e. 1.7%. The proportion of renewable resources in the DMC decreased interannually by 1.4 p.p. to 11.7%; the positive trend of growing proportion of renewable resources in the DMC (2008–2011) therefore ended.

Material dependence on foreign countries, i.e. the proportion of imports in DMC, increased again (to 42.3%) in 2012. Concerning material groups, the Czech Republic is significantly or completely dependent on imports of crude oil, natural gas and metal minerals. Manufacture of products from metals, in particular for export, increases the Czech Republic's material dependence.

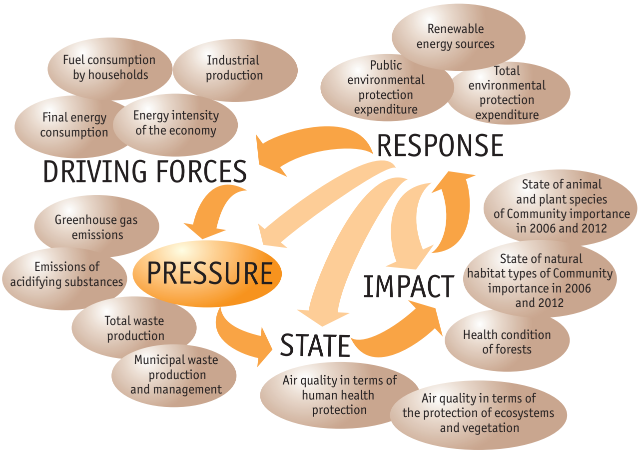
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1842)

32/ Material intensity of GDP

KEY QUESTION ➜

Is the material intensity of GDP generation decreasing in the Czech Republic?



KEY MESSAGES ➜

☺ Material intensity of the Czech Republic's economy is being reduced. The 2012 interannual decline[1] amounted to 10.2%; since 1990, the material intensity has decreased to about one-third. The decline in material intensity results in reduced environmental burden caused by material consumption per unit of GDP generated.

☹ In long terms, the Czech Republic is not able to achieve the absolute separation of development of material consumption and development of the economy's performance (decoupling). Interconnectedness of the economic development and material consumption continues being considerable and material intensity of the Czech Republic's economy is above average in the European context.

OVERALL ASSESSMENT ➜

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➜

Increasing material and energy efficiency and achieving the Czech Republic's independence on foreign energy sources is among the priorities of the **Strategic Framework for Sustainable Development in the Czech Republic**. Within the priority axis 2 "Economy and Innovation", priority 2.2 "Ensuring the energy security of the state and increasing the energy and material efficiency of the economy," the document aims at achievement of a sustainable relationship between the economic effectiveness of material consumption and environmental impacts of material flows. The **National Reform Programme of the Czech Republic** also aims at reduced material consumption. The currently valid **State Environmental Policy of the Czech Republic 2012–2020** does not explicitly mention reducing of the material consumption and material intensity of the economy, however, related objectives are a part of several thematic areas in this document, in particular Protection and Sustainable Use of Resources.

Growth of the economy's material effectiveness, which contributes to the solution to the Czech Republic's material security, is one of the subjects of the strategic document **Secondary Raw Materials Policy of the Czech Republic**.

The objectives focused on increasing effectiveness in transforming materials into economic output and reducing environmental burden per unit of economic performance are included in the renewed **EU Sustainable Development Strategy**, the **EU Thematic Strategy on the Sustainable Use of Natural Resources** and the **OECD Council Recommendation on Material Flows and Resource Productivity**.

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. Environmental burden is also connected with material consumption (see the indicator Domestic Material Consumption). This burden results in public health impacts caused by deteriorated air and water quality, changes in land use and biodiversity loss. Material intensity is also closely linked to the intensity indicators of GHG emission per capita and per unit GDP, and thus to the potential of the total emissions reduction.

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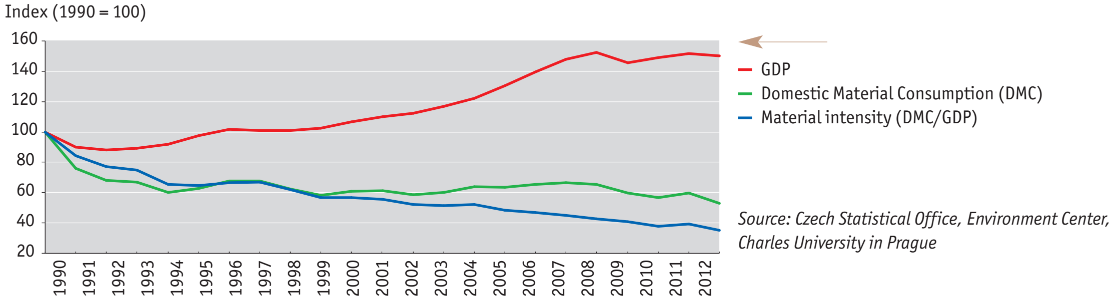
[1] *Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

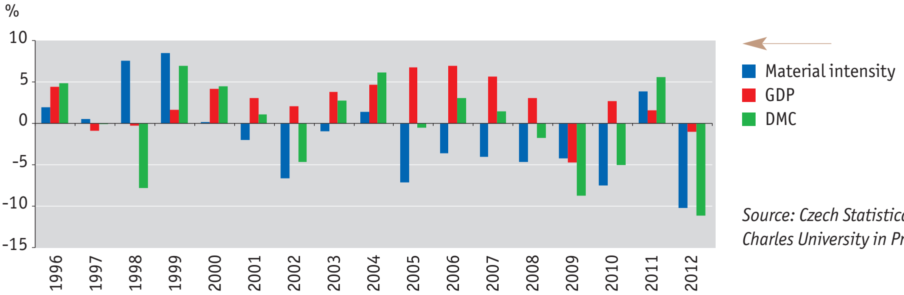
Chart 1 ➜ **Material intensity, domestic material consumption and GDP in the Czech Republic [index, 1990 = 100], 1990–2012**



Source: Czech Statistical Office, Environment Center, Charles University in Prague

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 ➜ **Interannual changes in material intensity, DMC and GDP [%], 1996–2012**



Source: Czech Statistical Office, Environment Center, Charles University in Prague

Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

Material intensity of the Czech Republic's economy has been decreasing in long terms; in 1990–2012 it was reduced by about 65%, i.e. approximately one-third in comparison with the early 1990s (Chart 1). In 2007–2012, material intensity declined by 21.3%; in 2012, it decreased interannually by 10.2%, namely as a result of a significant interannual drop of domestic material consumption (by 11.1%), with a slight reduction in the economy's performance (by about 1%). The 2012 interannual decline in material intensity was (in relative figures) the biggest since 1995 (Chart 2). Decreasing material intensity is a positive trend that indicates an increased efficiency of the transformation of input material flows into economic output and also a decreased environmental impact per unit of GDP.

In 1990–2000, there was a **material intensity decrease**, especially as a result of a decline in domestic material consumption caused by structural changes in the national economy (GDP was changing insignificantly and at the beginning of 1990s it even declined). In 2000–2007, economic growth was the main factor of declining material intensity; however, such growth was accompanied by a slight increase of material consumption. In these years, the significant economic growth was based on material-intensive sectors such as construction, manufacture of machinery, metalworking products and equipment and the manufacture of motor vehicles. After 2008, there were fluctuations in performance of the Czech Republic's economy within the global economic crisis and, with the exception of the year 2011, there were also declines in DMC, which resulted in a material intensity decrease, again with a slight temporary increase in 2011.

Development of material intensity in 1990–2012 as a whole is represented by so-called **decoupling**, i.e. separation of development of the economy's performance and environmental burden. In the long term, however, the Czech Republic is unable to achieve the absolute decoupling, i.e. a state in which the economy is growing and the environmental burden represented by material consumption is decreasing. There was a relative decoupling (when the trends in material consumption and in the economy have the same direction) as a result of economic growth (with DMC growing) in 2000–2001, 2003–2004 and 2006–2007 and as a result of DMC decline (with the economy declining) in 1990–1992, 1998, 2009 and 2012. Within the reference period, there was absolute decoupling only in 1993–1994, 1999, 2002, 2005, 2008, and 2010.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

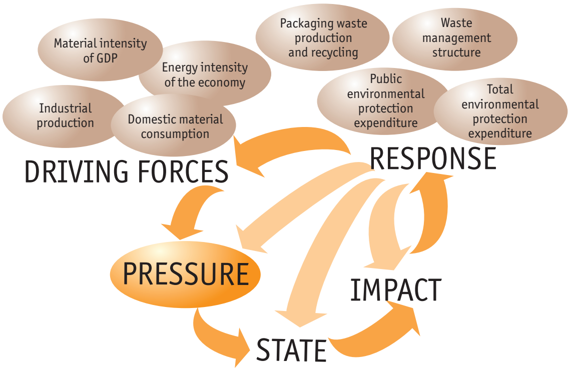
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1843)

33/ Total waste production

KEY QUESTION →

Is the total waste production declining?



KEY MESSAGES →

🙂 In the period evaluated, (since 2009), the total waste production has a stagnant to slightly declining trend.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The basic strategic document in the field of the environment is the **State Environmental Policy of the Czech Republic 2012–2020**. The area of waste falls under the chapter "Protection and Sustainable Use of Resources". Primarily, it stresses the need to prevent creation of waste and to reduce its negative environmental impacts.

The strategic document concerning waste management is the **Government Regulation No. 197/2003 Coll., on the Waste Management Plan** which provides for waste management objectives and measures and is in harmony with sustainable development principles. One of the Plan's goals deals with hazardous wastes – with the management and possibilities of preventing their generation.

While the **Directive 2008/98/EC of the European Parliament and of the Council on waste** sets out general requirements for waste management, the **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**, the **Directive 2000/53/EC of the European Parliament and of the Council on end-of life vehicles** and the **Directive 2012/19/EU of the European Parliament and of the Council on Waste Electrical and Electronic Equipment** focus on specific solutions. The Directives have been transposed into the **Act No. 185/2001 Coll., on waste**, as amended.

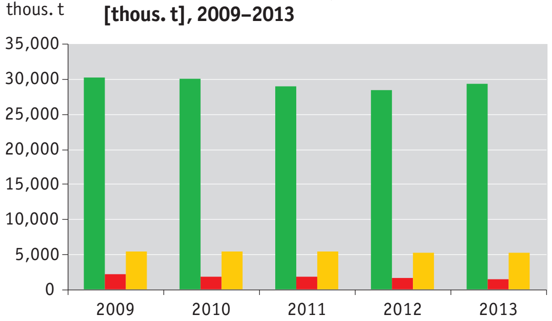
In 2013, a draft **Waste Prevention Programme of the Czech Republic** was submitted to the European Commission whose elaboration is imposed on all member states by the **Framework Directive on Waste**. The Waste Prevention Programme seeks to reduce the amount of waste and its hazardous properties which have adverse impacts on the environment and public health. Reuse of products and respective preparation are also considered a part of prevention.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Waste is an unavoidable product of human activity and, therefore, emphasis is put on minimizing the generation of waste and on BAT application. Due to its composition and quantity, waste may pose a risk factor for both human health and ecosystems. Production of waste and its subsequent treatment may be associated with activities during which unnatural substances are released into the atmosphere or water and soil environment is contaminated. Through the food chains, the substances contained in waste are then getting into the human body.

INDICATOR ASSESSMENT

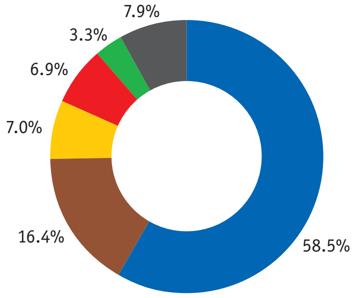
Chart 1 ➜ **Total waste production by category (hazardous, non-hazardous and municipal) in the Czech Republic [thous. t], 2009–2013**



Source: CENIA

The data were determined according to the methodology Mathematical Expression of the Calculation of "Waste Management Indicator Set", applicable for a given year.

Chart 2 ➜ **Structure of total waste production in the Czech Republic [%], 2013**



Source: CENIA

The data were determined according to the methodology Mathematical Expression of the Calculation of "Waste Management Indicator Set", applicable for a given year.

The **total waste production** declined between the years 2009 and 2013. Since 2009 it is possible to see a stagnant to slightly declining trend, to 30,620 thous. t in 2013, however, in 2012–2013 the total waste production increased by 2.0%. Several factors influence the indicator's value. However, construction activities resulting from government contracts (Chart 2) are reflected most in this indicator because 58.5% of the produced waste come from construction (Group 17 in Catalogue of Waste).

The **total non-hazardous waste production** (Chart 1) follows the same trend as the total waste production. Since 2009, the total non-hazardous waste production has been decreasing to 29,177 thous. t.

Hazardous wastes represent a relatively small proportion of the total waste production, only 4.7%. No unequivocal development trends can be described for hazardous waste production. Hazardous waste production mainly depends on the state of the economy and industry. The increased amount of hazardous waste resulted from remediations of old environmental contaminations which were carried out in the respective years. The trend of decreasing specific hazardous waste production is positive. In 2012 and 2013, the total hazardous waste production decreased interannually by 11.8%.

In the entire reference period, the **total municipal waste production** has been stagnant; its value fluctuates above the value of 5 mil. t.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1844)

34/ Municipal waste production and management

KEY QUESTION ➜

Is the municipal waste production decreasing and is the municipal waste management structure changing?

KEY MESSAGES ➜

😐 The quantity of produced municipal waste has been stagnating since 2009.

🙂 Although landfilling continues prevailing in municipal waste disposal, this removal method has been declining in favour of energy and material use since 2009.

OVERALL ASSESSMENT ➜

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➜

The strategic documents – **State Environmental Policy of the Czech Republic 2012–2020** and **Waste Management Plan** – emphasise the general objective: to dispose of waste in accordance with the waste management hierarchy and to prevent waste generation. They also deal with the area of municipal waste, especially in the context of increasing the proportion of waste that is used in terms of material and energy.

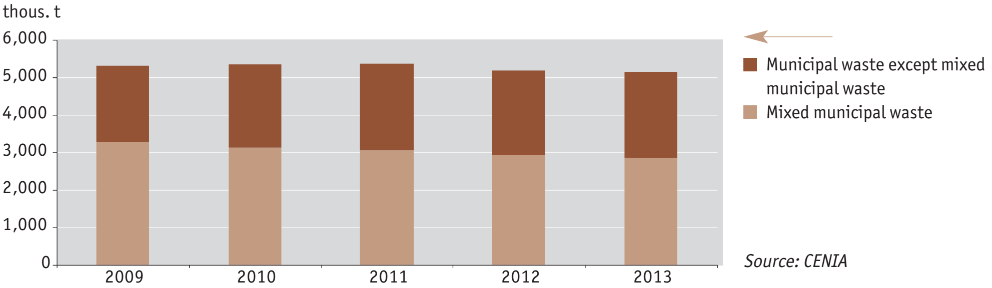
As a follow-up to the **Council Directive 1999/31/EC on the landfill of waste**, the targets were set out to reduce the maximum amount of biodegradable municipal waste (BMW) deposited in landfills in 2010 to 75% (by weight) of the total BMW quantity produced in 1995, to reduce (in 2013 at the latest) the amount of landfilled BMW to 50% (by weight) of the total BMW quantity produced in 1995 and to reduce (by 2020 at the latest) the amount of landfilled BMW to 35% (by weight) of the total BMW quantity produced in 1995.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➜

Most often, human society is in contact with household waste. Municipal waste generation is closely connected with the place of residence of each individual and can influence health of the human society and its aesthetic perception. Although mixed municipal waste is not generally referred to as dangerous, hazardous components such as batteries, accumulators, paints, solvents and drugs can appear in it if sorting is absent. If managed improperly, substances contained in these hazardous components can get into the environment, particularly into the air, water and soil. Here they can accumulate in biomass in long terms and spread on through the food chain. Other impacts of municipal waste production and management also include influence on and negative interference into landscape features and functions in connection with operation of municipal waste management plants.

INDICATOR ASSESSMENT

Chart 1 ➜ **Total municipal waste production in the Czech Republic [thous. t], 2009–2013**



Source: CENIA

The data were determined according to the methodology Mathematical Expression of the Calculation of "Waste Management Indicator Set", applicable for a given year.

Table 1 ➜ **Municipal waste management mix relative to the total municipal waste production in the Czech Republic [%], 2009–2013**

Management method [%]	2009	2010	2011	2012	2013
Data provided by	CENIA	CENIA	CENIA	CENIA	CENIA
Proportion of municipal waste used for energy recovery (R1)	6.0	8.9	10.8	11.8	11.9
Proportion of municipal waste used for material recovery, (R2–R12, N1, N2, N8, N10, N11, N12, N13, N15)	22.7	24.3	30.8	30.4	30.2
Proportion of landfilled municipal waste (D1, D5, D12)	64.0	59.5	55.4	53.6	52.2
Proportion of municipal waste disposed of in incinerators (D10)	0.04	0.04	0.04	0.04	0.05

The data were determined according to the methodology Mathematical Expression of the Calculation of "Waste Management Indicator Set", applicable for a given year. Selected waste management codes are described in detail in Table 2.

Source: CENIA

Table 2 ➜ **Selected waste management methods**

Management code	Management method
Use of waste for energy recovery	
R1	Use of waste as fuel or in another method to generate energy
Use of waste for material recovery	
R2	Solvent reclamation/regeneration
R3	Reclamation/regeneration of organic substances
R4	Recycling/reclamation of metals
R5	Recycling/reclamation of other inorganic materials
R6	Regeneration of acids and bases
R7	Recovery of substances used for pollution abatement
R8	Recovery of components from catalysts
R9	Used oil refining or other reuses of previously used oil
R10	Land treatment resulting in benefit to agriculture or ecological improvement
R11	Use of wastes obtained from any of the operations numbered R1 to R10
R12	Pre-treatment of waste for the application of any of the methods numbered R1 to R11
N1	Use of waste for reclamation, landscaping, etc.
N2	Transfer of sludge from WWTP for use on agricultural land
N8	Transfer of parts and waste for reuse
N10	Sale of waste as a raw material ("secondary raw material")
N11	Use of waste for landfill reclamation
N12	Depositing waste as technological material to secure landfills
N13	Composting
N15	Tyre retreating
Waste disposal in landfills	
D1	Depositing into or onto land (landfilling)
D5	Specially engineered landfilling
D12	Permanent storage
Waste disposal in incinerators	
D10	Incineration on land

Source: Decree No. 383/2001 Coll., on waste management details, as amended.

Since 2009, the **total municipal waste production** has been stagnating and fluctuating above 5 mil. t.

As municipal waste is closely related to human activities, development of its **per capita amounts** is an important indicator. In 2009–2013, the average municipal waste production per one inhabitant amounted to 503.3 kg. In 2013, this indicator amounted to 491.7 kg and thus there was a drop by 15.8 kg compared with 2009.

The category of **mixed municipal waste** includes waste of the catalogue number 20 03 01. This is the unsorted waste which came from both households and companies where it arises during non-productive activities. The fact that the mixed municipal waste production has been declining constantly since 2009 is particularly positive. The proportion of mixed municipal waste in the total municipal waste production amounts to 55.3%. Production of these wastes decreased interannually (2012–2013) by 2.5%. Likewise for the total municipal waste production, the per capita amount is an important indicator for mixed municipal waste, too. There was a decrease of per capita mixed municipal waste by 40.9 kg between the years 2009 and 2013.

The different waste management methods are identified using codes that are defined by the Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste management details, as amended. According to the Mathematical Expression of the Calculation of "Waste Management Indicator Set", which defines the procedure to calculate the various indicators in waste management, the municipal waste management methods can be divided mainly into:

- the use of municipal waste for material (recovery, recycling and others),
- the use of municipal waste for energy (using waste in a manner similar to fuels and in other ways to generate energy),
- the disposal of municipal waste in landfills (landfilling),
- the disposal of municipal waste in incinerators (incineration on land).

The different municipal waste management codes are described in detail in Table 2.

Municipal waste is a specific group of wastes and this fact is reflected in the respective **management methods**. Unlike other groups of wastes, removal through landfilling dominates here (Table 1). Since 2009, there has been a gradual slight decrease in the amount of municipal waste deposited in landfills every year (Table 1). In 2013, the proportion of landfilled municipal waste was 52.2%, and interannually (2012/2013), this proportion decreased by 1.4%. Another well-represented municipal waste management method is material use, the proportion of which has been growing gradually; material use of municipal waste increased from 22.7% in 2009 to 30.2% in 2013. The importance of using municipal waste to generate energy is growing, too. Since 2009, the amount of waste used to generate energy has been growing; in 2009–2013, it increased from 6.0% to 11.9%. The situation is diametrically different in incineration which is used to treat only a negligible amount of municipal waste.

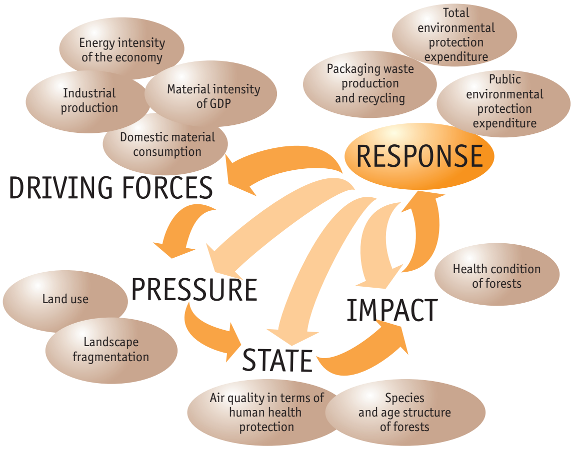
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1845)

35/ Waste management structure

KEY QUESTION →

How does the waste management structure change?



KEY MESSAGES →

☺ Between the years 2009–2013, the proportion of waste used for material recovery increased from 72.5% to 76.1%. Even though only a small part of the total waste production is used to generate energy, there is a long-term growing trend in applying this method. The proportion of landfilled waste in the total waste production was declining in 2009–2013.

😐 Incineration of waste has been rather stagnating in long terms.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The basic strategic document concerning the environment is the **State Environmental Policy of the Czech Republic 2012–2020** which aims at respecting the valid waste management hierarchy. Waste prevention is in the first place, followed by reuse, material and energy recovery. Waste disposal is in the last place of the hierarchy. This hierarchy has been implemented in the national legislation through the **Act No. 185/2001 Coll., on waste**, as amended.

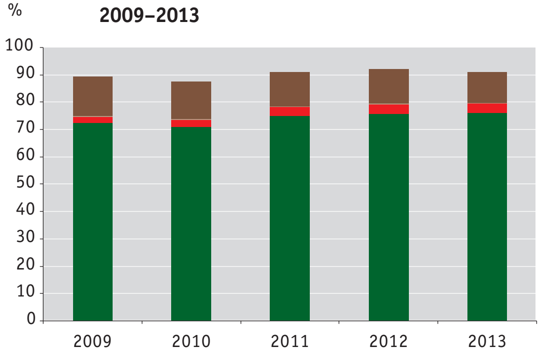
Attention is paid to waste management also in the core document of this sector, i.e. in the **Government Regulation No. 197/2003 Coll., on Waste Management Plan of the Czech Republic**. First of all, the Plan recommends to create a uniform and adequate network of waste management plants and not to support building of new landfills using public financial resources.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

There should be compliance with the waste management methods hierarchy, while greatest emphasis should be placed on waste prevention. Within the individual waste management methods, pollutants can release into the single environmental media (especially into the air, water and soil), may become a part of the food chains and can subsequently cause health complications. Interference into landscape character and functions which is associated with waste management facilities' building and operation may also be a negative impact of waste management.

INDICATOR ASSESSMENT

Chart 1 ➜ Proportions of waste management methods in the total waste production in the Czech Republic [%], 2009–2013

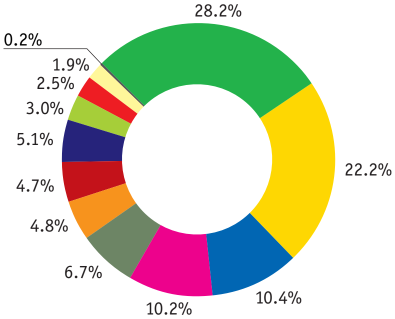


- 🟫 Proportion of landfilled and otherwise deposited waste
- ▨ Proportion of waste incineration
- 🟥 Proportion of waste used for energy recovery
- 🟩 Proportion of waste used for material recovery

Source: CENIA

The data were determined according to the methodology Mathematical Expression of the Calculation of "Waste Management Indicator Set", applicable for a given year.

Chart 2 ➜ Structure of material recovery of waste in the Czech Republic [%], 2013



🟩 N1	🟥 N12
🟨 R5	🟦 R11
🟦 R12	🟩 N10
🟪 R4	🟥 R3
🟩 R10	🟨 N13
🟧 N11	⬜ Ostatní (R2, R6, R7, R8, R9, N2, N8, N15)

Source: CENIA

The data were determined according to the methodology Mathematical Expression of the Calculation of "Waste Management Indicator Set", applicable for a given year.

Table 1 ➜ Selected waste management methods

Management code	Management method
Use of waste for energy recovery	
R1	Use of waste as fuel or in another method to generate energy
Use of waste for material recovery	
R2	Solvent reclamation/regeneration
R3	Reclamation/regeneration of organic substances
R4	Recycling/reclamation of metals
R5	Recycling/reclamation of other inorganic materials
R6	Regeneration of acids and bases
R7	Recovery of substances used for pollution abatement
R8	Recovery of components from catalysts
R9	Used oil refining or other reuses of previously used oil
R10	Land treatment resulting in benefit to agriculture or ecological improvement
R11	Use of wastes obtained from any of the operations numbered R1 to R10
R12	Pre-treatment of waste for the application of any of the methods numbered R1 to R11
N1	Use of waste for reclamation, landscaping, etc.
N2	Transfer of sludge from WWTP for use on agricultural land
N8	Transfer of parts and waste for reuse
N10	Sale of waste as a raw material ("secondary raw material")
N11	Use of waste for landfill reclamation
N12	Depositing waste as technological material to secure landfills
N13	Composting
N15	Tyre retreating
Waste disposal in landfills	
D1	Depositing into or onto land (landfilling)
D5	Specially engineered landfilling
D12	Permanent storage
Waste disposal in incinerators	
D10	Incineration on land

Decree No. 383/2001 Coll., on waste management details, as amended.

The different **waste management methods** are identified using codes that are defined by the Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste management details, as amended. In terms of the Mathematical Expression of the Calculation of "Waste Management Indicator Set", the waste management structure can be divided into waste utilisation in material recovery (regeneration, recycling etc.), waste utilisation in energy recovery, waste incineration and waste disposal through landfilling (deposition in landfills etc.). The different waste management codes are described in detail in Table 1.

Since 2009, there has been a positive trend as the ratio of **waste utilisation** to waste disposal has been growing gradually. This was mainly the result of new technologies that have improved efficiency both in the manufacturing sector (minimizing waste production) and in waste management itself as well as the need for substitutes for primary materials (as it is waste which can be a good source of these substitutes), financial support to waste utilisation (OP – The Environment) etc.

There was a positive trend in **waste utilisation in material recovery**; the proportion of waste used for material recovery grew from 72.5% to 76.1% in 2009–2013 (Chart 1). In terms of the structure of the material recovery methods, there were no significant changes in recent years. Use of waste for reclamation and landscaping (especially in case of construction waste and demolition debris) and recycling or recovery of other inorganic materials continue being the most frequent methods (Chart 1).

Only a small part of the total waste production is **used to generate energy**. In long terms, there is positive development in the amount of waste used in energy recovery. Between the years 2009 and 2013, the proportion of the energy recovery in the total waste production increased from 2.2% to 3.4%.

The proportion of **waste disposal** in the total waste production has been declining constantly. In recent years, the reason may consist in a greater degree of recycling, using waste instead of primary raw materials, and last but not least, in the introduction of modern waste treatment technologies.

The most frequent way of disposing of all kinds of waste continued to be **landfilling** (i.e. deposition within or below the terrain level). Of the total waste production, this management method showed a positive trend since 2009. Between the years 2009 and 2013, the proportion of landfilling in the total production declined from 14.6% to 11.3%.

Other waste disposal method is **incineration**. In long terms, waste incineration has been more or less stagnating. About 0.3% of produced waste is burnt every year.

The correct waste management, as well as the operational conditions of waste management facilities, are subject to regular check-ups by the Czech Environmental Inspection. In the area of waste management and chemical substances, a total 3,150 inspections were carried out in 2013, out of which 1,149 were planned and 2,001 were unplanned, of which 532 inspections were carried out on the basis of an accepted initiative. The amount of fines imposed within these inspections was CZK 92,941,100 in 2013. In comparison with the previous year, there was a significant increase, namely by CZK 56,101 thous.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

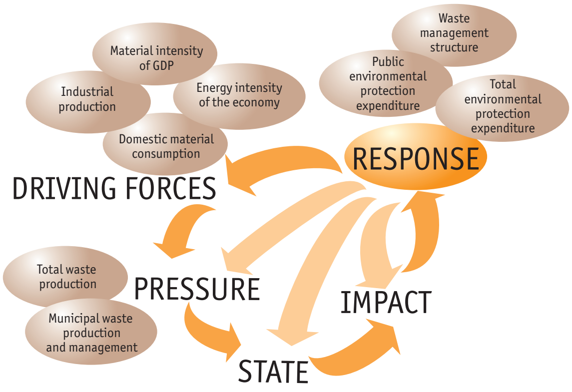
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1847)

36/ Packaging waste production and recycling

KEY QUESTION →

Is the amount of produced packaging waste decreasing and the proportion of packaging waste utilization increasing?



KEY MESSAGES →

😐 In 2009–2013, the production of packaging waste increased by 12.5%.

Production of packaging waste grows gradually; the highest production since 2009 was achieved in 2013, however, the extent of recycled packaging waste increases, with the highest rates of recycling being achieved in 2013. Recycling and energy recovery are the most common ways of utilisation.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The basic strategic document in the field of the environment is the **State Environmental Policy of the Czech Republic 2012–2020**. Along with minimising the amount of used packaging, the State Environmental Policy of the Czech Republic set out the target of 70% for the level of material recovery and 80% for the total packaging waste utilisation level by 2020.

As well as the issues of waste in general, the specific area of packaging waste is also regulated by the basic strategic document, i.e. the **Government Regulation No. 197/2003 Coll., on Waste Management Plan of the Czech Republic**. Along with general emphasis on preventing the waste production, in terms of packaging, it mentions especially the need to establish the conditions to promote returnable and reusable packaging, which is a prerequisite to reduce packaging waste production, influencing the total municipal waste production.

The main legislative document concerning packaging waste management at the EU level is the **European Parliament and Council Directive 94/62/EC on packaging and packaging waste** which has been amended by the **Directive 2004/12/EC**, **Directive 2005/20/EC** and **Directive 2013/2/EU**. The obligations following from the European Directives have been implemented through the **Act No. 477/2001 Coll., on packaging**, as amended.

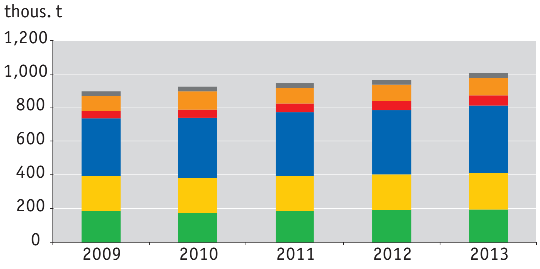
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Production of packaging waste is one of the manifestations of the consumer society. On one hand, production of packaging waste represents increased pressure on the environment, however, its material recycling decreases this pressure significantly. Environmental burden can be caused by packaging production but also by packaging waste management plants, especially in relation to pollutants discharged into the air or aquatic environment, which then affects human health.

Packaging waste in landscape affects the landscape character and can change development of individual plant and animal species and influence their habitats.

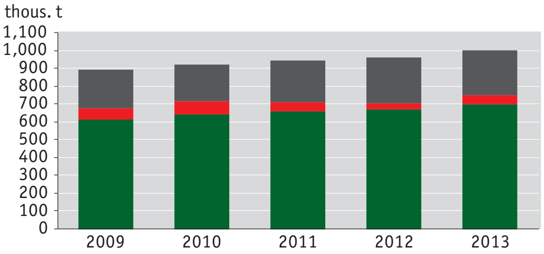
INDICATOR ASSESSMENT

Chart 1 ➔ **Packaging waste and packaging waste composition mix produced in the Czech Republic [thous. t], 2009–2013**



Source: Ministry of Environment

Chart 2 ➔ **Utilisation of packaging waste in the Czech Republic [thous. t], 2009–2013**



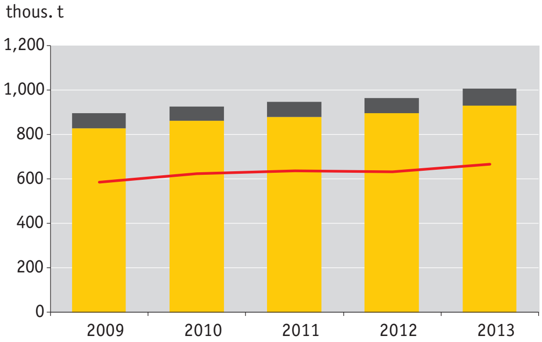
Source: Ministry of Environment

Table 1 ➔ **Number of entities involved in the EKO-KOM system that are obligated to utilise packaging waste or to provide take-back, and the number of municipalities involved in the EKO-KOM system, 2009–2013**

Year	Number of clients involved in the EKO-KOM system	Number of municipalities involved 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

Source: EKO-KOM

Chart 3 ➔ **Produced packaging waste and its utilisation within the EKO-KOM system and other packaging waste in the Czech Republic [thous. t], 2009–2013**



Source: Ministry of Environment

The increase of **packaging waste production**, which has been growing over a long period in the Czech Republic, is one of the most characteristic manifestations of consumer society. The packaging waste production grew by 12.5% in 2009–2013. In 2013, more than 1,005 thous. t of packaging waste were produced in the Czech Republic which represented an interannual increase by 4.5%. The interannual rate of growth in packaging waste production has an increasing tendency since 2009; the annual growth rate has been about 3% (Chart 1).

In terms of the **packaging waste structure**, the most represented is paper and cardboard packaging (39.7%), with a large margin followed by plastics (21.4%) and glass (19.7%). The structure is relatively stable in the course of years. Within interannual comparison, the proportions of the individual packaging waste types vary in the range of 5%.

Given the increasing production of packaging waste, it is very positive that the **packaging waste recycling rate** has been growing (Chart 2). Packaging waste recycling is the most frequent way of utilising it and in 2009–2013 there was an increase of recycled packaging waste by 87.7 thous. t. The second most frequently represented category is energy recovery, which, however, decreased from 7.0% in 2009 to 4.8% in 2013. Nonetheless, an interannual increase by 0.4% has been recorded.

The issues of packaging waste are dealt with in the Act No. 477/2001 Coll., on packaging, which requires that all entities that market or put into circulation packaging or packed products have the obligation, inter alia, to utilise their packaging waste. This obligation can be met by the relevant entities either on their own, or collectively **through the authorised packaging company** EKO-KOM. Within comparison of the numbers of entities that meet their obligations resulting from the Act on packaging through the authorized packaging company, there were no significant changes in 2009–2013 (Table 1), however, when we look at the individual years in this period, we can see a more pronounced dynamics associated with the gradual involvement in or abandonment of the collective system. The greatest number of entities involved in the EKO-KOM system was registered in 2010 and since that year, the number of entities has been decreasing gradually. The situation is usually caused by termination of business activities or by a merger of several companies. In 2013, the number of clients involved in the system of the authorized packaging company EKO-KOM therefore reached 20,233. In terms of the number of municipalities involved in the EKO-KOM system, there is a different trend: the number of municipalities has been increasing gradually and 6,057 municipalities (out of a total number of 6,245 municipalities in the Czech Republic) with a total of 10,457 thous. inhabitants (approx. 99% of the Czech population) were involved in the system in 2013. A total of 32 municipalities got newly involved in the system in 2013. At present, there are still 196 municipalities in the Czech Republic which solve the problems related to packaging waste outside of the authorised company EKO-KOM. In 2013, thanks to functioning of the EKO-KOM system, 71.8% of all packaging waste (Chart 3) that is covered by this company was therefore utilised, which is 66.4% of all packaging waste (this also concerns recycled excluded packaging that is reusable) produced in the Czech Republic and thus there was an interannual slight increase (by 5.1%) of the total amount of utilised EKO-KOM packaging waste in 2013.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1848)

37/ Total environmental protection expenditure

KEY QUESTION →

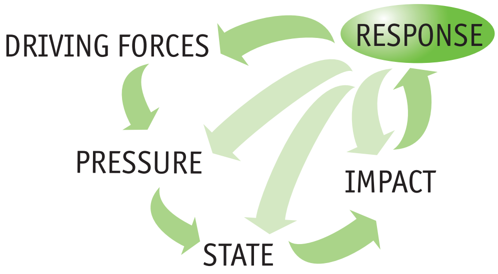
How much financial means is expended in a form of investment expenditure or non-investment costs to improve and protect the environment?

KEY MESSAGES →

🙂 A long-term rising trend of total expenditure on environmental protection, which increased interannually by 1.8% to CZK 83.6 bil., was confirmed in 2013. The growth was caused by an increase in investment expenditure on environmental protection, which grew interannually by 5.9% to CZK 27.1 bil. Thanks to the total expenditure growth, there was also a slight interannual increase of its proportion in GDP (current prices) from 2.1% in 2012 to 2.2% in 2013.

Concerning the single programmes' focuses, most funds were spent in waste management (total CZK 40.7 bil.), followed by wastewater treatment with a total amount of CZK 20.3 bil. and air quality and climate protection (CZK 9.7 bil.).

😐 In 2013, non-investment costs, which constitute two-thirds of the total environmental protection expenditure, stagnated interannually (CZK 56.5 bil.).



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).

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 AND STRATEGIC DOCUMENTS →

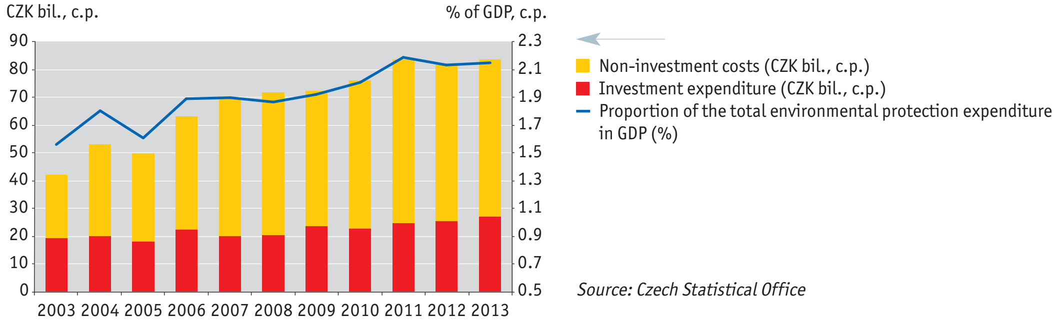
The **State Environmental Policy of the Czech Republic (2012–2020)** emphasises introduction of the concept of sustainable (i.e. low-carbon or wasteless) economy that is based on support to environmentally friendly behaviour. This is related to greater stress on increasing investment in the use of clean technologies, renewable energy sources and better management of non-renewable resources. Other investment areas should be the protection and conservation of ecosystem services, biodiversity protection and development of sustainable use of landscape.

One of the preconditions for the Czech Republic's sustainable development and especially for its competitiveness is the increased proportion of investment to enhance science, research and innovation, which also follows e.g. from the N**ational Research, Development and Innovation Policy of the Czech Republic for the Period 2009–2015**. Environmental protection as an integral part of the quality life of the population is considered one of the core areas in which research and development should be supported.

The **National Strategic Reference Framework of the Czech Republic (2007–2013)** characterises the Czech Republic as an economy which is open to a great extent and its foreign trade is focused particularly on the EU member states. This is related to high environmental requirements for goods and services traded within the EU, which can only be achieved through investments into environmental protection projects. Companies should therefore actively reduce their environmental impacts through technological innovation, BAT introduction, recycling and energy savings. Analogical objectives concerning the total expenditure on environmental protection are also in the **Strategic Framework of Sustainable Development of the Czech Republic** which puts emphasis mainly on the area of innovation and related competitiveness of the Czech Republic.

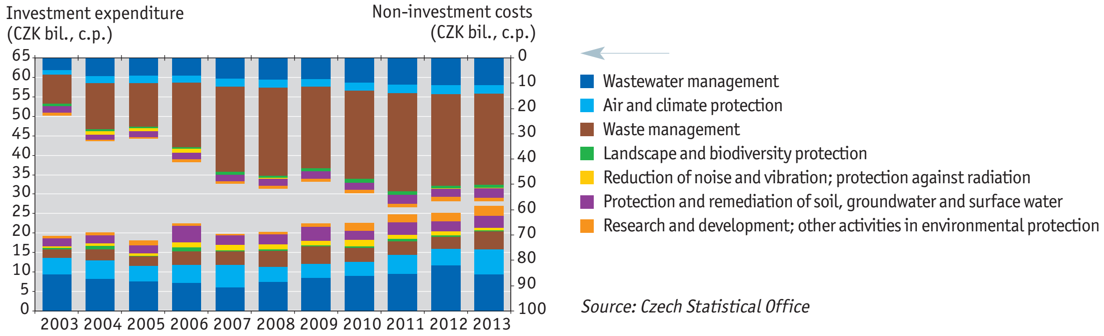
INDICATOR ASSESSMENT

Chart 1 ➜ **Total environmental protection expenditure in the Czech Republic [CZK bil., % of GDP, current prices], 2003–2013**



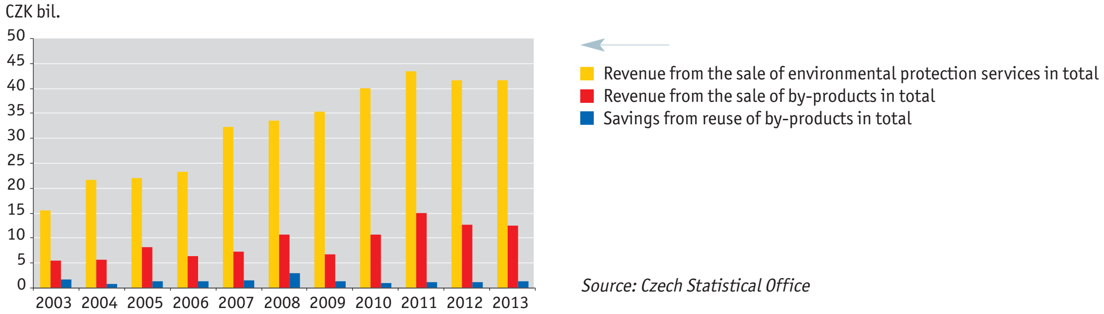
Source: Czech Statistical Office

Chart 2 ➜ **Investments and non-investment costs for environmental protection in the Czech Republic according to programme focus [CZK bil., current prices], 2003–2013**



Source: Czech Statistical Office

Chart 3 ➜ **Economic benefits of environmental protection activities in the Czech Republic [CZK bil.], 2003–2013**



Source: Czech Statistical Office

Total environmental protection expenditure

The total statistically monitored environmental protection expenditure 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 or operating 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 2013, the **total expenditure** on environmental protection amounted to CZK 83.6 bil., so there was a slight increase by 1.8% compared to the year 2012. In the general growth, the decisive role was played by **investment expenditure**, which increased interannually by CZK 1.5 bil. (5.9%) to CZK 27.1 bil. and thus confirmed the steadily growing trend in the amount of investment funds dedicated to environmental protection. As in previous years, **non-investment** costs dominate to the total expenditure on environmental protection also in 2013; despite their interannual stagnation at the level of CZK 56.5 bil., they comprised more than two-thirds of the total expenditure on environmental protection. Thanks to the total expenditure growth, there was also a slight interannual increase of its proportion in GDP (current prices) from 2.1% in 2012 to 2.2% in 2013 (Chart 1).

Investment in environmental protection

In the last decade, most investment in environmental protection is spent especially in the areas of wastewater management, air and climate protection and waste management. This trend was confirmed in 2013 as well – these three areas dominated in the amounts of financial means invested into projects to reduce the negative impacts.

In terms of **interannual investments development**, the growing trend of investment expenditure, which grew to CZK 27.1 bil. (+5.9%) in 2013, can be confirmed. As in the past years, most of the investment goes to integrated installations where an integrated approach to environmental protection based on the introduction and use of BATs and other innovation is applied. This approach aims at gradual and general modernisation of the manufacturing and operating devices which leads to a reduction of the negative effects caused by the polluters' activities.

Concerning the **single programmes**, most of the 2013 funds were invested in waste water management (CZK 9.4 bil.), air and climate protection (CZK 6.4 bil.) and waste management (CZK 4.7 bil.). Compared to the year 2012, investments in air and climate protection increased most (by CZK 2.2 bil., i.e. by 52.4%), especially at the expense of waste water management which showed the biggest interannual decrease by CZK 2.4 bil. (–20.3%). Despite the decline, this area remains one of the main priorities of environmental investments (Chart 2).

In terms of **economic sectors** of the investing entities (CZ-NACE), the largest proportions in the total investment have been recorded in the following sectors in long terms: public administration, defence and compulsory social security (33.5% of the total 2013 investment) and water supply and activities related to waste water, waste and remediation (24.5% of the total investment). The manufacturing (18.3% of the total investment), the production and distribution of electricity, gas, heat and conditioned air (17.0% of the total investment) also amount to a significant proportion of the total investment.

Concerning the division into **corporate and public (government) sectors**, it can be concluded that in 2013, private and public non-financial companies invested about CZK 17.8 bil. and the government (on both central and regional levels) sector invested CZK 9.3 bil. As opposed to the year 2012, when both sectors took roughly the same parts in environmental investments, there was a significant shift in favour of the corporate sector in 2013. Within the corporate sector, this is application of the polluter-pays-principle as the main responsibility for protecting the environment needs to be transferred onto private entities, thus reducing the public sector's involvement.

Investment in environmental protection is also closely connected with **economic benefits of the activities to protect the environment**. The economic benefits consist in revenue from the sale of environmental protection services, revenue from the sale of by-products and savings related to by-products reuse (Chart 3). In all the above-mentioned groups of benefits, the area of waste management dominated unequivocally in 2013 and thus it confirmed a position of the most profitable area in environmental protection in long terms. While this area comprised 72.4% in revenues from the sale of services, its proportion in the sales of by-products was 94.4%.

Non-investment costs of environmental protection

Non-investment costs of environmental protection have been monitored by the Czech Statistical Office since 2003. In that period, the costs have showed a growing trend in long terms despite short fluctuations; in 2013 they amounted to CZK 56.5 bil., likewise in the previous year. Non-investment costs thus constitute a substantial proportion of the total environmental protection expenditure (more than 2/3 in 2012). The biggest amount of non-investment costs was spent on material and energy consumption and wages, especially in waste and wastewater management. Other long-term priority areas are air and climate protection and the protection and remediation of soil, groundwater and surface water.

Concerning the **single programmes**, most of the funds were spent on waste management (CZK 36.0 bil., which in sum with the investment expenditure accounts for the biggest part of the total environmental protection expenditure) and on wastewater management (CZK 10.9 bil.) in 2013, Chart 2. As regards the interannual change within the individual programmes, no significant decline or increase of non-investment costs has been recorded.

In terms of **economic sectors** of the investing entities (CZ-NACE) in 2013, the biggest proportion of non-investment costs for environmental protection was spent (as well as in 2012) in the sector of water supply and activities related to wastewater, waste and remediation (50.3% of the total non-investment costs), in manufacturing industry (21.4% of the total non-investment costs), in the sector of public administration, defence and compulsory social security (16.5%) and in production and distribution of electricity, gas, heat and conditioned air (4.3%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1903)

38/ Public environmental protection expenditure

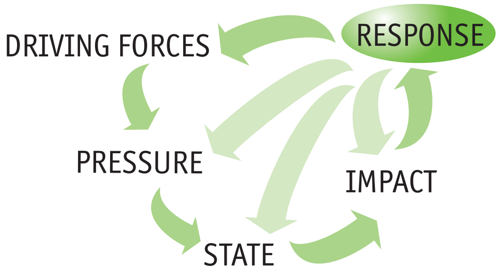
KEY QUESTION →

What is the structure and amount of financial means expended from the national and international public resources to protect the environment?

KEY MESSAGES →

😐 In 2013, there was a significant decrease in expenditure on environmental protection from central sources by CZK 8.6 bil., i.e. by 25.0%, to a total of CZK 25.9 bil. (0.67% of the GDP in current prices). The reason consists especially in a smaller amount of subsidies paid by the State Environmental Fund of the Czech Republic within the Green Savings Programme. In June 2013, the New Green Savings Programme was launched with a total allocation of CZK 1 bil. and at the end of 2013, the Czech Government approved continuation of this programme with larger amounts of allocated funds. The decline in expenditure on environmental protection from the State Environmental Fund of the Czech Republic was mitigated by growth of funds from the state budget as the main central source, namely by 5.7% to CZK 21.0 bil. In the case of expenditure from local budgets, there was a slight decrease by CZK 0.5 bil., i.e. by approx. 1.5%, to a total of CZK 32.4 bil. (0.83% of the GDP in current prices); despite of that, territorial budgets represent the main source of expenditure on environmental protection.

🙁 In the framework of environmental protection financing from the EU, the subsidies of the OP – Environment were the strongest resource, however, the use of the OP has been problematic. By the end of the year, projects corresponding to 87% of the allocation for the programming period have been recommended for funding and the Decisions to Grant a Subsidy were issued for 54% of the total allocated amount but only 43% of the allocation were actually used. The reason for the slow use consisted in accumulation of many aspects during the entire implementation of the OP – Environment, especially in inactivity of the managing authority in 2010, when a significant disproportion was already apparent between the projects registered for support and the projects to which the Decision to Grant a Subsidy was issued.



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 AND STRATEGIC DOCUMENTS →

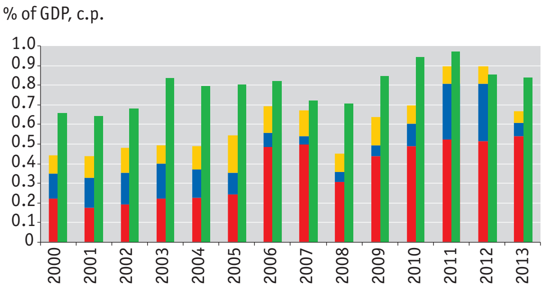
Generally, the **State Environmental Policy of the Czech Republic (2012–2020)** aims primarily at promoting environmentally friendly behaviour, i.e. supporting the use of clean technologies, renewable energy sources and more careful management of non-renewable sources or sustainable use of landscape while maintaining ecosystem services. In case the state budget's financial sources intended for environmental policy expenditure are limited, the document supposes the EU funds and grants to be used to the maximum possible extent, in full accordance with the budgetary possibilities.

In the framework of specific measures, the Policy focuses on financial support to e.g. development of sustainable management in agriculture, fishing and forestry, to biodiversity conservation and improvement of the state of landscape, ensuring the passability of migration barriers, support to operation of the national air pollution monitoring network or creation of tools and technologies to monitor and mitigate natural hazards and their impacts. Last but not least, financial support is necessary for research and development, e.g. in the area of climate change scenarios and the monitoring of its impacts or in the areas of identifying and evaluating anthropogenic influence on the individual environmental media in order to eliminate and prevent the negative effects of human activity on the environment and human health.

The **National Strategic Reference Framework of the Czech Republic** for the years 2007–2013, in the priority axis No. 2 ("Economy and Innovation") provides that public expenditure on environmental protection must be directed to activities which ensure adequate competitiveness of Czech products and services in international trade and will promote economic growth of the Czech Republic. The principles of expending funds from the Czech Republic's public sources on environmental protection are also mentioned in the **Strategic Framework of Sustainable Development of the Czech Republic** (2010), which also emphasises increase of public expenditure and generally enhanced efficiency of cooperation between the public and private sectors in research and development, which is one of the main factors of innovation in the production sectors.

INDICATOR ASSESSMENT

Chart 1 → Proportion of the public environmental protection expenditure in GDP in the Czech Republic by source type [% of GDP, current prices], 2000–2013

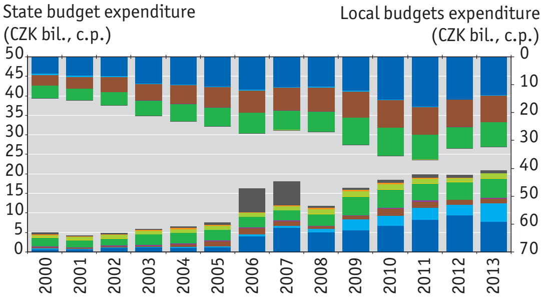


Source: Ministry of Finance of the Czech Republic, Czech Statistical Office

- 🟩 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 was dissolved as of 1 January 2006. Both its competencies and the financial means spent on the removal of old contaminated sites originated prior to privatisation are now administered by the Ministry of Finance of the Czech Republic. The marked increase in the state budget expenditure between 2005 and 2006 resulted from the involvement of funding from the European funds. A part of public environmental expenditure by the local budgets may be a duplication of expenditure from the central sources.

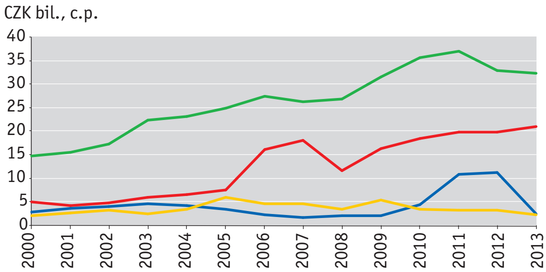
Chart 2 → Public environmental protection expenditure from the state budget and local budgets in the Czech Republic by programme orientation [CZK bil., current prices], 2000–2013



Source: Ministry of Finance of the Czech Republic

- 🟦 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

Chart 3 → Public environmental protection expenditure in the Czech Republic by source type [CZK bil., current prices], 2000–2013

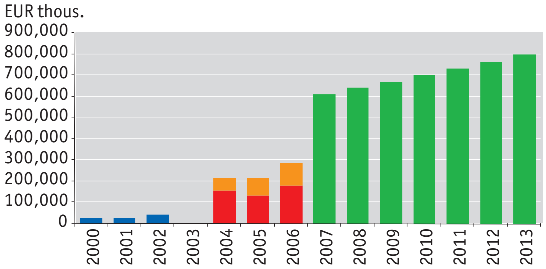


Source: Ministry of Finance of the Czech Republic

- — 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

The National Property Fund was dissolved as of 1 January 2006. Both its competencies and the financial means spent on the removal of old contaminated sites originated prior to privatisation are now administered by the Ministry of Finance of the Czech Republic.

Chart 4 → Estimated allocation of financial means from the EU funds for environmental projects in the Czech Republic [EUR thous.], 2000–2013



Source: Ministry of Environment

- 🟩 Operational Programme – the Environment (2007–2013)
- 🟧 Operational Programme – Infrastructure (2004–2006)
- 🟥 Cohesion Fund (2004–2006)
- 🟦 ISPA (2000–2003)

Public environmental protection expenditure is comprised of environmental protection expenditure from central sources and local budgets. However, given the data collection methodology (the data are collected by the Ministry of Finance of the Czech Republic), the total public environmental protection expenditure cannot be considered a simple sum of the central sources and local budgets. The reason consists in the fact that a part of public environmental expenditure by the local budgets is taken from central sources and therefore these expenditures are duplicate. The public expenditure includes both capital and current environmental protection expenditure.

As well as 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. While continuing recession, which affected the Czech Republic in 2013, did not show very much in the case of expenditure from the main central source (i.e. the state budget), its indirect impact was apparent in expenditures from the local budgets (Chart 1). In 2013, the proportion of the local budgets' expenditure in the GDP continued (although slightly) declining to 0.83% (–0.02 p.p.), in the case of expenditure from the central sources, however, there was a significant decrease from 0.89% to 0.67% of the GDP. Nonetheless, the decline was mainly due to the reduction in expenditure by the State Environmental Fund of the Czech Republic because of a drop of financial means paid within the Green Savings Programme; on the other hand, the proportion of expenditure from the State budget was growing.

Public expenditure from central sources

The state budget is the most significant central source of financial means, especially of subsidies or returnable financial aid. Other major central sources of expenditure on environmental protection are the State Environmental Fund of the Czech Republic and the remaining financial means of the dissolved National Property Fund which are now administered by the Ministry of Finance. These are financial resources that are used by the Ministry of Finance of the Czech Republic to finance especially the remediation of old environmental damage that had been caused prior to privatization and – to a lesser extent – by the Ministry of Environment of the Czech Republic to remediate damage that had been caused by the presence of Soviet troops in the Czech Republic.

When evaluating long-term trends in public expenditure from the central sources, we can observe a substantial growth in expended financial means from the total amount of CZK 10.1 bil. in 2000 to the final CZK 25.9 bil. in 2013. To a great extent, the growth of expenditure was covered by financial means 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 means of the state budget from which the projects to protect the environment are co-financed.

As in previous years, the **state budget** was the biggest central source of financial means intended for environmental protection in 2013, too. Compared to the year 2012, the state budget expenditures grew by 5.7% to CZK 21.0 bil.

Water protection, in particular in connection with waste water collection and treatment, belongs to areas that are **supported most from the state budget in long terms**. In 2013, CZK 7.7 bil., i.e. by CZK 1.7 bil. less than in 2012 (–18.1%), were spent for water protection (Chart 2). It was followed by biodiversity and landscape protection with the amount of CZK 5.0 bil. (+CZK 0.5 bil., i.e. +11.1% compared to the year 2012). In this area, most resources have been spent for erosion control, avalanche control, fire prevention as well as for support to protected areas and soil remediation after extraction and excavation activities (the total costs of the mining companies amounted to approximately CZK 18 bil. since 1993). In the last five years, great emphasis is put on air protection again, especially in connection with support to heat insulation and energy savings programmes. In 2013, CZK 4.7 bil. were spent on air protection (+CZK 2.1 bil., i.e. +80.8% compared to the year 2012).

Concerning environmental protection expenditures from the state funds, the **State Environmental Fund of the Czech Republic** (and also the State Agricultural Intervention Fund or the State Transport Infrastructure Fund etc.) is the largest extra-budgetary central source of environmental protection financing. Its revenues come mainly from payments for pollution of or damage to environmental media or from repayments of loans, and since 2009 also from the sale of greenhouse gas emission units related to the Green Savings Programme. In 2013, there was a significant decrease in expenditure from the State Environmental Fund of the CR, namely by CZK 8.7 bil. (i.e. by 77.7%) to the total CZK 2.6 bil. The importance of this source is currently associated mainly with the provision of subsidies within the **Green Savings Programme** which falls under the measures to reduce the GHG production. In 2013, the follow-up New Green Savings Programme (2013) was launched to which the amount of CZK 1 bil. was allocated. In November 2013, the Government of the Czech Republic approved another follow-up New Green Savings Programme (2014) which will be funded primarily by the 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 will be administered by the State Environmental Fund, however, these are financial means 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 in an amount of 4% of the total allocated subsidy and it also administers collection of fees related to environmental protection as the Fund ensures direct return of the fees back to environmental protection, as opposed to environmental taxes for which such return is not a necessary precondition. In 2013, the greatest part of the income from collecting fees came from the areas of air pollution (CZK 265.3 mil.), the exclusion of land from the agricultural land sources (CZK 203.3 mil.) and waste water discharge into surface water (CZK 205.3 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 interests from loans and it goes primarily to the priority areas of environmental protection in the Czech Republic, i.e. air protection, water protection, biodiversity and landscape protection and waste management.

CZK 2.3 bil., i.e. by CZK 1.1 bil. less than in 2012, from the **financial means 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 2013 (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 32.4 bil. (i.e. +117%). This happened despite the 2012–2013 decline which amounted to a total of CZK 4.6 bil. compared to the year 2011. In 2013, the decline was mitigated interannually by CZK 0.5 bil., i.e. by 1.5%. The reason of this development consisted in a partial decline in using financial means from national programmes and the EU funds to which co-financing resources from public budgets are bound. The decline has been recorded especially in the field of water protection within wastewater collection and treatment. Another reason was the austerity measures taken by the different institutions within state administration in the context of the economic crisis as some investment projects were interrupted primarily for savings purposes. However, it can be concluded that territorial budgets continue being the most significant public source of funding for environmental protection in the Czech Republic (Chart 3). At the levels of municipalities and self-governing regions, the expenditures are implemented continually based on the competences of the given municipalities and self-governing regions. However, in a great part they consist of 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 the long-term priority, despite an interannual decrease by CZK 1.6 bil. (i.e. –10,5%) to the total of CZK 13.7 bil. in 2013 (Chart 2). Waste management, especially municipal waste collection, was the second greatest item in financing (in total CZK 9.5 bil., i.e. CZK –0.1 bil. and –1.0% compared to the year 2012), 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 8.8 bil., i.e. CZK +1.1 bil. and +14.3% compared to the year 2012).

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 the direct support from the EU and a 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. At present it is especially the Norwegian and the EEA Financial Mechanisms, the Swiss-Czech Cooperation Programme and the Operational Programme – the Environment which is the largest source in terms of subsidies, is linked thematically to the OPI (Chart 4) and from which a total of EUR 4.9 bil. are allocated to finance environmental protection in 2007–2013. Within the OP – the Environment, almost 23 thous. project proposals have been submitted from the beginning of the programming period till the end of 2013, with a request for financing from the EU funds in the amount of EUR 9.3 bil., which exceeds the original total allocation substantially. However, projects corresponding to only 54% of the total original allocated amount have reached the final Decision to grant the subsidy by the end of 2013 and only 43% of the allocation were actually used. The total 2013 loss in using the funds within the OP – the Environment will be between CZK 7.2–CZK 8.2 bil., depending on acceptance by the European Commission of the documents concerning the 2014 loss reduction. The reason for the insufficient use consisted especially in the absence of calls in 2010, and in a lengthy and demanding administration of the programme. On the basis of these facts and with the aim of reducing the total loss, the Ministry of Environment continued taking the optimisation and acceleration measures in 2013, especially as regards acceleration of the calling process, shortening and streamlining the projects evaluation process and shortening the payment procedure.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1904)

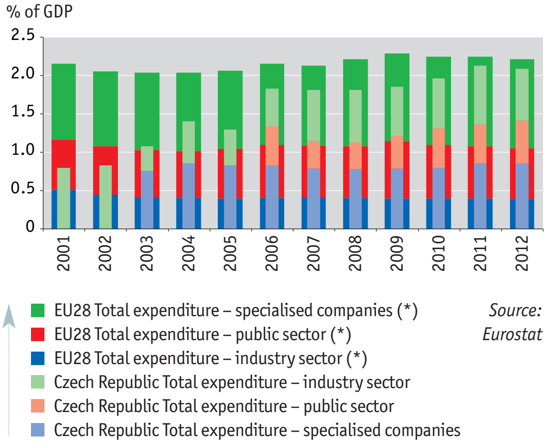
Environmental protection expenditure in the European context

KEY MESSAGES

- Compared with the EU28 average, the Czech Republic invests above-average financial means into environmental protection in long terms, both within the public and industrial sectors. Together with the sector of specialised companies providing environmental services, these investments amounted to a total of 0.64% of the GDP in 2012, compared with 0.40% of the GDP in the EU28. The reason for increased investment consisted in remediation of high environmental burden which resulted from age-long unresolved problems related to intensive industrial production and mining in the last century. Another, a bit more topical reason lied in necessity to fulfil the EU's conditions and requirements of the relevant European legislation.
- Due to a smaller amount of current expenses spent on environmental protection, however, the total expenditure (i.e. the investments and current expenses together) on environmental protection remained slightly below the EU average (2.09% of the GDP in the Czech Republic, 2.22% of the GDP in the EU28).

INDICATOR ASSESSMENT

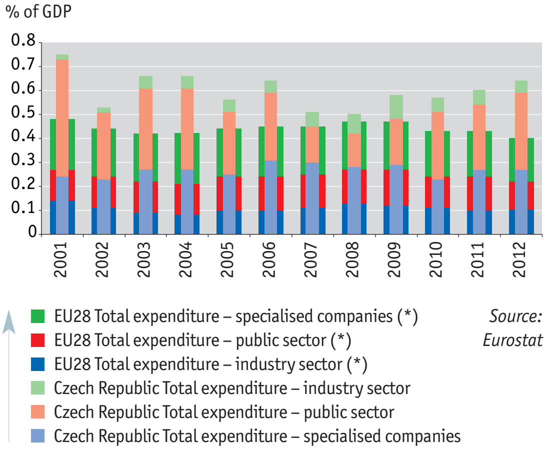
Chart 1 **Total environmental protection expenditure by the main sectors in the Czech Republic and in the EU28 [% of GDP], 2001–2012**



Source: Eurostat

** Estimate. Data for all sectors monitored in the Czech Republic are available since 2006.*

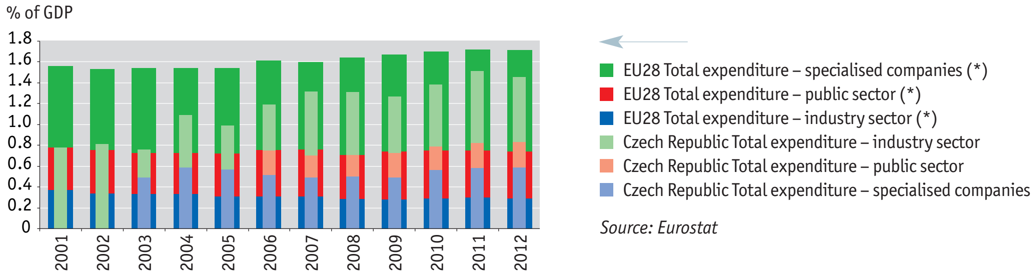
Chart 2 **Investment in environmental protection by the main sectors in the Czech Republic and EU28 [% of GDP], 2001–2012**



Source: Eurostat

** Estimate.*

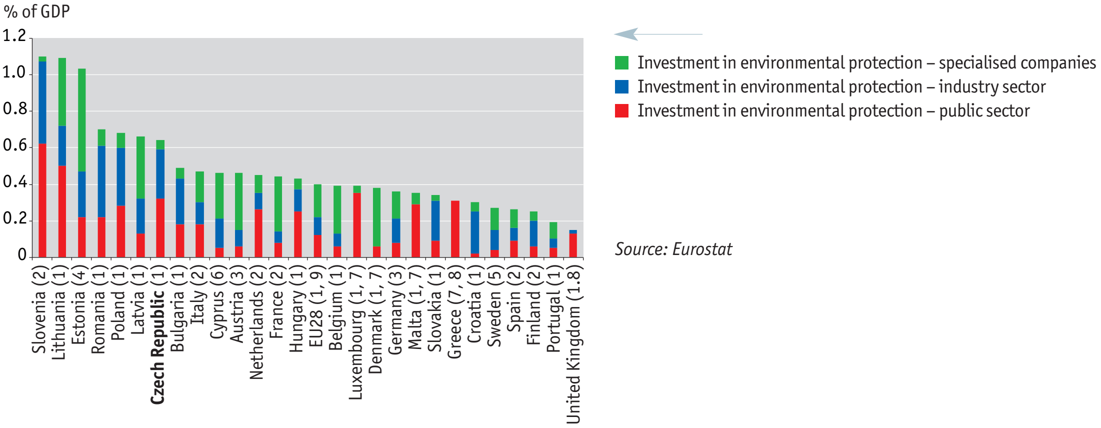
Chart 3 **The non-investment costs (current expenses) on environmental protection by the main sectors in the Czech Republic and EU28 [% of GDP], 2001–2012**



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) 2012, (2) 2011, (3) 2010, (4) 2009, (5) 2006, (6) 2004, (7) data for the industry sector are not available, (8) data for specialized companies are not available, (9) 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).

As well as 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.

Concerning the **total expenditure on environmental protection**, the Czech Republic has slightly below-average values in comparison with the EU average (2.09% of GDP in the Czech Republic, 2.22% of 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).

From the perspective of **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, as well as other "new" 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 indicator "Total environmental protection expenditure").

The Czech Republic shows worse investment activity in the sector of specialised companies providing environmental services, 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 caused, inter alia, by the fact that some of the specialised companies' services can be provided by the public sector itself (e.g. investment in waste collection or wastewater 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 in these devices then increase investment activities of the industrial companies at the expense of specialised companies which also deal with recycling.

The corresponding **current expenses on environmental protection**, which include, in addition to the costs of maintenance and the devices' operation, especially labour costs, payments for rent, energy and other material, are also closely linked with investments. 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, companies specialised in environmental services cover the greatest part as well as 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).

As regards comparison of trends in the total expenditure on environmental protection (i.e. investment and non-investment cost), a contradictory trend is evident in these expenditures – while in the Czech Republic they have been growing in the past five years, in the EU28 the trend is opposite (Charts 1–3). This fact can be explained primarily as different impacts of the financial and economic crisis on the economies of the individual EU member states.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1771)

Availability of data in the Report

With respect to the Report's preparation schedule, some data are not available as of its closing date. Subsequent updating of the data will take place within settlement of the inter- and intra-sectoral comments or, if need be, in the time period before the Report is submitted to the Government of the Czech Republic for approval. If some data are available in a final form after this date, they will be updated in the electronic version only, i.e. on the website of CENIA, in the framework of the Information System of Statistics and Reporting (ISSaR)[1].

Although the indicators described in the Report link up with the State Environmental Policy of the Czech Republic 2012–2020, only a limited amount of data, based on the data currently available, is included in the Report. For a number of indicators, which should be monitored in connection with evaluation of environmental policy and the state of the environment in general, no systematic data collection is ensured or necessary data sets are not available. This concerns to a great extent the indicators evaluating the state of biodiversity, landscape and ecosystem services. As far as nature and landscape and related biodiversity are concerned, most of the changes are slow and long-term, and necessary data collection demands specialised professionals, a lot of time and funding because greater data sets are usually necessary to describe the changes, and the data collection cannot be provided, with some exceptions, by automated technical devices. At present, regular monitoring is ensured only for a limited spectrum of phenomena, especially in relation to reporting obligations resulting from the EU regulations.

Due to the six-year evaluation period (2007–2012), as laid down in Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive), the 2013 Report contains the thematic chapter on Biodiversity with the indicators: State of animal and plant species of Community importance and State of natural habitat types of Community importance. In order to prevent repetition of the same data, the indicators will only be provided in the years when these data are reported to the European Commission. In the past, the Common Bird Species Indicator was also presented in the Report. This indicator continues being monitored and evaluated by the Czech Ornithological Society as a non-governmental professional organisation and CENIA decided to exclude this indicator for financial reasons only. The indicator with the latest available data continues being presented at http://indikatory.cenia.cz.

In relation to financial resources available to the Ministry of Environment, the possibility of including additional indicators to assess the state of biodiversity and landscape based on the objectives of the State Environmental Policy of the Czech Republic 2012–2020 or the standard indicator sets used within the EU to assess biodiversity (SEBI indicators) is limited. For this reason, these indicators are not fulfilled on a regular basis and are not covered by regular monitoring, or they can be evaluated only in longer terms, as follow-up of rather non-periodic data updates. The one-year interval in which the Report is presented therefore, in most cases, does not correspond to evaluation possibilities in this area and the data used in the Report are thus updated always depending on the evaluation deadlines of the individual monitoring types. For the above-mentioned reasons, the chapter Biodiversity does not cover the thematic area in its entirety.

In 2010, the Ministry of Environment, in co-operation with Agency for Nature Conservation and Landscape Protection of the Czech Republic, issued the Report on Fulfilling the 2010 Target in Biodiversity Protection in the Czech Republic, which deals with evaluation of the key area of the Convention on Biological Diversity, i.e. "the state and trends of biodiversity components". This Report can be used as a summary of the state of biodiversity in the Czech Republic along with the Report. Altogether 21 indicators are presented in the Report. Along with the indicators "State of animal and plant species of Community importance" and "State of natural habitat types of Community importance", which were evaluated in the CENIA documents, the Report also covers e.g. the numbers and distribution of selected species (butterflies and birds), the Red List Index (RLI) or the size of specially protected areas established at the national level.

In the chapters concerning evaluation of the given issue in the European context, it is necessary to take account of the fact that data sets are used which correspond to the approved uniform European methodology, for example Eurostat and the EEA methodologies, and which are different from the data processing methodologies applied at the national level. Given the differences in data processing methodologies at the national and international levels, evaluation of the international comparison was included at the end of each thematic unit in the 2013 Report. Because of the differences in methodologies, it has been decided to exclude the chapter Waste and Material Flows in the European Context.

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[1] *http://indikatory.cenia.cz*

List of abbreviations

ALR	agricultural land resources
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
BPEJ	evaluated soil-ecological unit
BOD_5	biochemical oxygen demand over five days
CEHAPE	Children's Environment and Health Action Plan for Europe
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 dichromate
Coll.	Czech collection of laws
c.p.	current prices
CRF	Common Reporting Format
CSN	Czech state standard
CZK	Czech crown
DDT	dichlorodiphenyltrichloroethane
DG Environment	Directorate General Environment
DG JRC	Directorate General Joint Research Centre
DH	district heating
DMC	domestic material consumption
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EC-JRC	The European Commission – Joint Research Centre
EEA	European Environment Agency
EEC	European Economic Community
EFMA	European Fertilizer Manufacturers Association
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
ETC/BD	European Topic Centre on Biological Diversity
EU	European Union
EU ETS	European Union Emission Trading System
EUR	Euro
Eurostat	Statistical Office of the European Union
FC	thermo-tolerant (faecal) coliform bacteria
FSC	Forest Stewardship Council
GAEC	Good Agricultural and Environmental Conditions
GDP	Gross Domestic Product
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane
HRDP	Horizontal Rural Development Plan
ICP	Forests International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
IPPC	Integrated Pollution Prevention and Control
IPR	Integrated Pollution Register
ISPA	financial assistance instrument for supporting investment projects
ISSaR	Information System for Statistics and Reporting
IUCN	International Union for the Conservation of Nature
LPG	liquefied petroleum gas
LV	limit value
LULUCF	Land Use, Land Use Change and Forestry
MT	margin of tolerance
NECD	National Emission Ceiling Directive
NIS	National Inventory System
N/A	data not available

OCPs	organochlorine pesticides
OECD	Organisation for Economic Co-operation and Development
OPE	Operational Programme Environment
OPI	Operational Programme Infrastructure
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
p.e.	population equivalent
p.p.	percentage point
PEFC	Programme for the Endorsement of Forest Certification Schemes
PES	primary energy sources
PM	particulate matter
POPs	persistent organic pollutants
RDP	Rural Development Programme
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RES	renewable energy sources
SEBI	Streamlining European Biodiversity Indicators
SEP	State Energy Policy
SAIF	State Agricultural Intervention Fund
SFTI	State Fund for Transport Infrastructure
SMR	Statutory Management Requirements
TSES	Territorial System of Ecological Stability
TV	target value
UAT	Unfragmented Areas by Traffic
UN	United Nations
UNFCC	United Nations Framework Convention on Climate Change
USLE	Universal Soil Loss Equation
VAT	value added tax
VOC	volatile organic compounds
WHO	World Health Organization
WMIS	Waste Management Information System
WMO	World Meteorological Organization
WWTP	waste water treatment plant

Glossary of terms

Acidification. The process whereby the substance's pH decreases, resulting in increased acidity. It primarily affects air and secondarily affects water and soil. Acidification is caused by the emission of acidifying substances (i.e. sulphur oxides, nitrogen oxides and ammonia) into the air.

Agricultural land resources. Agricultural land resources include land that is cultivated in agriculture, i.e. arable land, hop-gardens, vineyards, gardens, fruit orchards, meadows, pastures (here-in-after called "agricultural land") and land that was cultivated and should be cultivated in the future but is not cultivated at present (temporarily not cultivated land). Agricultural land resources also include ponds to breed fish or water poultry and non-agricultural land that is necessary to ensure 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. This is the target value for ground-level ozone levels from the perspective of ecosystem and vegetation protection. This refers to the accumulated exposure over a threshold of 40 ppb ozone. The AOT40 cumulative exposure to ozone is calculated as the sum of the differences between the hourly ozone concentration and a 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., AOT40 is calculated over a three-month period from May to July from ozone concentration measurements taken each day between 8:00 and 20:00 CET.

AOX. These are adsorbable organically bound halogens. The summary indicator AOX is expressed as chlorides, expressed as the equivalent weight of chlorine, bromine and iodine contained in organic compounds (e.g. trichloromethane, chlorobenzene, chlorophenols etc.) that, under certain conditions, adsorb onto activated carbon. The main source of these substances is the chemical industry. While generally poorly degradable and water-soluble, these compounds are soluble in fats and oils, and thus easily accumulate in adipose tissues.

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. The techniques mean both the technology used and the way in which the respective device is designed, built, operated, maintained and put out of operation. The available techniques mean techniques that have been developed on a scale which allows their introduction in the relevant branch of the economic sector, under economically and technically acceptable conditions taking into consideration the costs and benefits, if they are available to the operator of an installation under reasonable conditions, no matter if they are used or produced in the Czech Republic or not. The best technique means a technique that is most efficient in attaining a high level of protection of the environment. Within identification of the best available technique, standpoints listed in Annex 3 to this Act must be taken into account.

Biomass. As a general concept, biomass includes all organic material that is involved in the energy and element cycles within the biosphere. This especially includes plant and animal substances. For the purposes of the energy sector, biomass includes plant material that can be utilised for energy (e.g. wood, straw etc.) and biological waste. The energy that is accumulated in biomass originates from the sun, similar to fossil fuels.

BMW. Biodegradable municipal waste is the biologically degradable component of municipal waste that undergoes anaerobic or aerobic decomposition, such as food and garden waste, as well as paper and cardboard.

BOD_5. This represents the five-day biochemical oxygen demand. BOD_5 is the amount of oxygen that is consumed by microorganisms during the biochemical oxidation of organic substances over five days under aerobic conditions at 20 °C. This is therefore 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. It expresses the main soil and climatic conditions that affect the productive 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 the natural conditions of any specific location. It affects the character of the landscape and whether it can be used for anthropogenic activities. It is geographically contingent and reflects the latitude, altitude and the degree of ocean influence.

CO_2 eq. This carbon dioxide emission equivalent measures aggregating greenhouse gas emissions. It expresses a unit of any greenhouse gas recalculated to CO_2 radiation efficiency that is taken as 1; other gases have higher coefficients.

COD_{Cr}. Chemical oxygen demand determined by the dichromate method. COD_{Cr} is the amount of oxygen that is consumed for oxidizing organic substances 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.

Cross compliance. A system of conditionality check-ups which enables using of European financial support on one hand and makes this use dependent on compliance with the given requirements and standards on the other. All of these requirements and standards are based on valid European and national regulations and their fulfilment was monitored within national check-up before the Cross Compliance system was introduced.

Day-degree. A unit characterising the heating season. It is the product of the number of heating days and the difference between average indoor and outdoor temperatures. Day-degrees thus show how cold or warm it was for a certain period and how much energy is needed to heat buildings.

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 bioaccumulation, toxicity, carcinogenic effects and contribution to reduced fertility.

Decade. In climatology, this term stands for a set of ten subsequent days within a month. The first decade always begins on the first day of the month and each month is therefore divided into three decades. In general conception, a decade is a set of ten subsequent 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 (economic output increases while pressure decreases) or relative (economic output increases while pressure also increases, yet at a slower rate).

Dependence on foreign countries for materials. It expresses the proportion of imports in domestic material consumption. It is usually evaluated for certain groups of materials (e.g. oil) for which it indicates whether and to what degree the country's economy is dependent on the imports of that material.

District heating. In a district heating system, heat is generated at a single centralised source and subsequently distributed via grids to multiple buildings. Teleheating is an equivalent to district heating.

Domestic material consumption. This term covers all materials consumed in an 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.

Ecosystem services. Ecosystem services are the benefits that people obtain from ecosystems. They are further divided into provisioning services (food, wood, medicines, and 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 – Exhaust Gas Recirculation. The technology is used to reduce exhaust gases emissions from Diesel vehicles. Its principle consists in back-sucking of exhaust gas from the exhaust pipe into a cylinder which reduces the oxygen content in the combusted air and thus the production of nitrogen oxides. The system's disadvantage lies in the engine's lower output, higher fuel consumption and higher production of solid particulates (due to imperfect combustion) which have to be removed subsequently in filters.

Emissions. The discharge or release of one or more pollutants into the environment. These substances may originate from natural sources or human activity.

Equivalent noise level. Equivalent noise level A is the average energy of the instantaneous levels of acoustic pressure A and is expressed in dB. The equivalent noise level is thus a constant noise level that has approximately the same effect on the human body as time-varying noise.

EU ETS. European trading system in GHG emission allowances. One of the key tools of the EU GHG emission reduction policy. The system is to 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 GHG emissions specified in the Kyoto Protocol. The system covers big industrial and energy companies and its legislative basis is laid down in the Directive of the European Parliament and of the Council No. 2003/87/EC.

Eutrophication. The enrichment of water with nutrients, especially nitrogen and phosphorus. Eutrophication is a natural process where 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 fertilizer 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.

Farm manure. Fertilisers in a form of livestock excrements, including plant residues, compost, straw, tops and green manure. The main components are organic matter of plant or animal origin (saccharides, cellulose, amino acids, proteins etc.). Along with these substances, farm manure also contains nutrients (N, P, K, Ca, Mg and others).

Greenhouse gases. Gases that are naturally present in the atmosphere or produced by humans; they have the ability to absorb long wave radiation that is 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 exhibiting one or more hazardous characteristics that are listed in Annex 2 to Act No. 185/2001 Coll., such as explosiveness, flammability, irritability, toxicity, and others.

Investment in environmental protection (= investment expenditure). Investment expenditure on environmental protection includes all expenditures for acquiring tangible fixed assets that are spent by reporting units in order to acquire fixed assets (through purchasing or through their own activities), along with the total value of tangible fixed assets that are acquired free of charge, transferred under applicable legislation, or reassigned from private use to business use.

Lime fertilizers. 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 fertilizers is waste materials from industry – carbonation sludge, cement dust, phenol lime etc., and natural lime fertilizers of local importance. Lime material is used as fertilizer either directly (possibly after mechanical processing) or as a fertilizer produced through a chemical process (burnt lime, slaked lime etc.).

Local concentration of pollution. A pollutant that is present in the air and comes into contact and affects the recipient (humans, plants, animals, materials). It results from the physical and chemical transformation of emissions.

LULUCF. The category that covers the emission and removal of greenhouse gases resulting from land use, changes in land use and forestry activities. 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 there are rapid changes in the landscape towards the cultural landscape.

Material intensity of GDP. The amount of materials that a given economy needs to produce a unit of economic output. High material intensity indicates that the economy causes high potential pressure on the environment and vice versa. The pressure results not only from the extraction of materials, but also from waste flows, e.g. emissions and waste.

Meteorological conditions. The weather trend over several days, months, or even longer periods selected with regard to the influence on certain economic activities (e.g. the energy sector) and the state of environment (air quality). The term should not be confused with climatic conditions (climate).

Mineral fertilizers (inorganic, industrial, chemical fertilizers). Fertilizers containing specific inorganic nutrients that are obtained through extraction and/or physical and/or chemical industrial processes.

Mixed municipal waste. Mixed municipal waste is defined in the Decree No. 381/2001 Coll., the Catalogue of Wastes and this kind of waste was attributed the number 20 03 01: Waste that remains after the separation of usable components and hazardous components from municipal waste is sometimes also called 'residual' waste.

Motorisation. It stands for the number of registered vehicles per 1 000 inhabitants. Together with other indicators (vehicle fleet's age and structure by propulsions etc.), motorisation measures the extent to which the fleet influences the environment. Most often, the indicator is used for passenger cars.

Municipal waste. This is all waste that is produced in a municipality by natural persons and that is listed as municipal waste in an implementing legal regulation, with the exception of waste produced by legal persons or natural persons that is authorised for business activities.

Non-investment expenditure in environmental protection. Current or operating expenditures which include payroll costs, payments for material and energy consumption, repairs and maintenance etc. and payments for services whose main purpose is preventing, reducing, treating or disposing of pollution and pollutants etc. that are generated by the production process of a given business.

OCPs. A group of substances known as organochlorine pesticides that includes DDT, HCH (hexachlorocyclohexane) and HCB (hexachlorobenzene) derivatives and others. These are persistent lipophilic substances that were once used as pesticides.

Organic food. Food produced from organic farming produce under the conditions laid down in legislation. It meets specific requirements for quality and health safety (e.g. without using artificial fertilisers, harmful chemical sprays or GMO). It does not contain chemical additives, preservatives, stabilisers, artificial colours etc.

Other waste. Waste that is not included in the list of hazardous waste in Decree No. 381/2001 Coll. and does not show any hazardous characteristics listed in Annex 2 to the Act on Waste.

PCBs. Polychlorinated biphenyls is the collective term for 209 chemically related compounds (congeners) that differ in the number and position of chlorine atoms bound to the biphenyl molecule. In the past, PCBs used to have a wide range of commercial uses. Their production has been banned due to their persistence and bioaccumulation capability. 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 is the sum of domestic and imported energy sources expressed through energy units. Primary energy sources are a key indicator of the energy balance.

POPs. Persistent organic pollutants are substances that remain in the environment for long periods of time. They accumulate in the fatty tissues of animals and enter humans through the food chain. Even at very low doses, they can cause reproductive disorders, affect the hormonal and immune functions and increase the risk of cancer.

Population equivalent. Population equivalent is a number that expresses 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. A population equivalent of one corresponds to the pollution production of 60 g of BOD_5 per day.

Regional temperatures and precipitation. The values of meteorological components related to a given territory that represent the mean value of the given parameter in that area.

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 solar radiation and some of its indirect forms are 'inexhaustible' energy sources. RES includes wind energy, solar energy, geothermal energy, water energy, soil energy, air energy, biomass energy, landfill gas energy, sludge gas energy, and biogas energy.

SCR. The selective catalytic reduction is a technology to reduce NO_x emissions from compression-ignition engines to the level of higher EURO emission standards (4–6). It is used in heavy lorries and buses and its principle consists in injection of reduction agent (a solution of urea, so-called AdBlue) into the exhaust pipe, which reduces nitrogen oxides into nitrogen and water.

Sorption capacity (ability) of soil. The ability of soil to bind (to sorb) ions or whole molecules of different compounds from soil solution into the solid particulates of the soil. Depending on the kind and intensity of sorption, the sorbed substances (nutrients) are protected against wash-out, they create a supply of nutrients that are easily accessible for plants, they enable gradual nutrient intake during the vegetation period and reduce substantially the undesirable increase of salt concentration in the soil solution.

State Energy Policy. The State Energy Policy defines the Czech Republic's goals and priorities for the energy sector and describes the specific implementation tools available within the country's energy policy. The State Energy Policy is an essential component of the Czech Republic's economic policy.

Suspended particles. Solid or liquid particles that remain air-borne for a long period of time due to their negligible stalling speed. Particles in the air rare a significant risk factor for human health.

Traffic performance. The indicator evaluates the road network load. It is calculated as transport intensity expressed as a number of vehicles which pass through a certain road per a certain time period, multiplied by the road length. If we add up traffic performance of all roads we get the traffic performance in the whole network. Traffic performance is measured in vehicle-kilometres (vkm) and does not depend on the vehicles' loading.

Transport performance. The number of passengers or weight of goods transported over a distance of 1 kilometre. It is measured in 'passenger-kilometres' (pkm) and 'tonne-kilometres' (tkm).

Transport volume. The number of passengers that were 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 an interconnected set of natural and altered, yet near-natural ecosystems that maintain a natural balance. A distinction is made between local, regional and supra-regional systems of ecological stability.

UAT. Unfragmented Areas by Traffic. This is a method used to determining 'areas that are unfragmented by traffic'; the method assumes a traffic intensity greater than 1 000 vehicles/24 h and an area greater than 100 km^2.

Vehicle fleet. All vehicles within a monitored category. There is 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 that a person disposes of, or that a person intends to or is obligated to dispose of and that belongs to any of the waste groups specified by Annex 1 to Act No. 185/2001 Coll.

Weather. A term referring to the state of the atmosphere above a certain point on the earth's surface at a specific time. Weather is described using a set of meteorological parameters (temperature, pressure, precipitation, wind direction and wind speed etc.), including the vertical profiles of these parameters, and meteorological phenomena (usually non-quantifiable – icing, fog, thunderstorms, hail etc.).