2012

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 2012 was discussed and approved by the Government on 23 October 2013 and then provided to the two chambers of the Parliament of the Czech Republic for information. The report is published in electronic form at 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 2013.

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. Data for international comparison 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 current National Environmental Policy of the Czech Republic. Within preparation of a updated National Environmental Policy of the Czech Republic (2012–2020), the set of indicators was modified so that the currently presented indicators are linked with the new policy and can report on fulfilment of its objectives annually. The data collection and creation of indicators laid down in the current National Environmental Policy (2012–2020), however, 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 a 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 Czech Republic's National Environmental Policy.

The set of key indicators includes 36 indicators selected using the following criteria:

- relevance to 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 Czech Republic's current State Environmental Policy, 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 of several chapters including the presented indicators. There have been greater modifications of the structure and number of indicators in the 2011 Report, when annual use of data with longer collection and evaluation periods was reviewed, e.g. in relation to reporting obligations resulting from e.g. 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 a result, the whole topic of biodiversity and ecosystem services 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). The structure of the 2012 Report respects the modifications made in the Report of the year 2011. However, the excluded indicators with the latest available data continue being presented separately on the ISSaR 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 2012 Report (e.g. Water quality instead of original Water quality in streams, Quality of agricultural land instead of Consumption of mineral fertilizers and plant protection products). 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.).

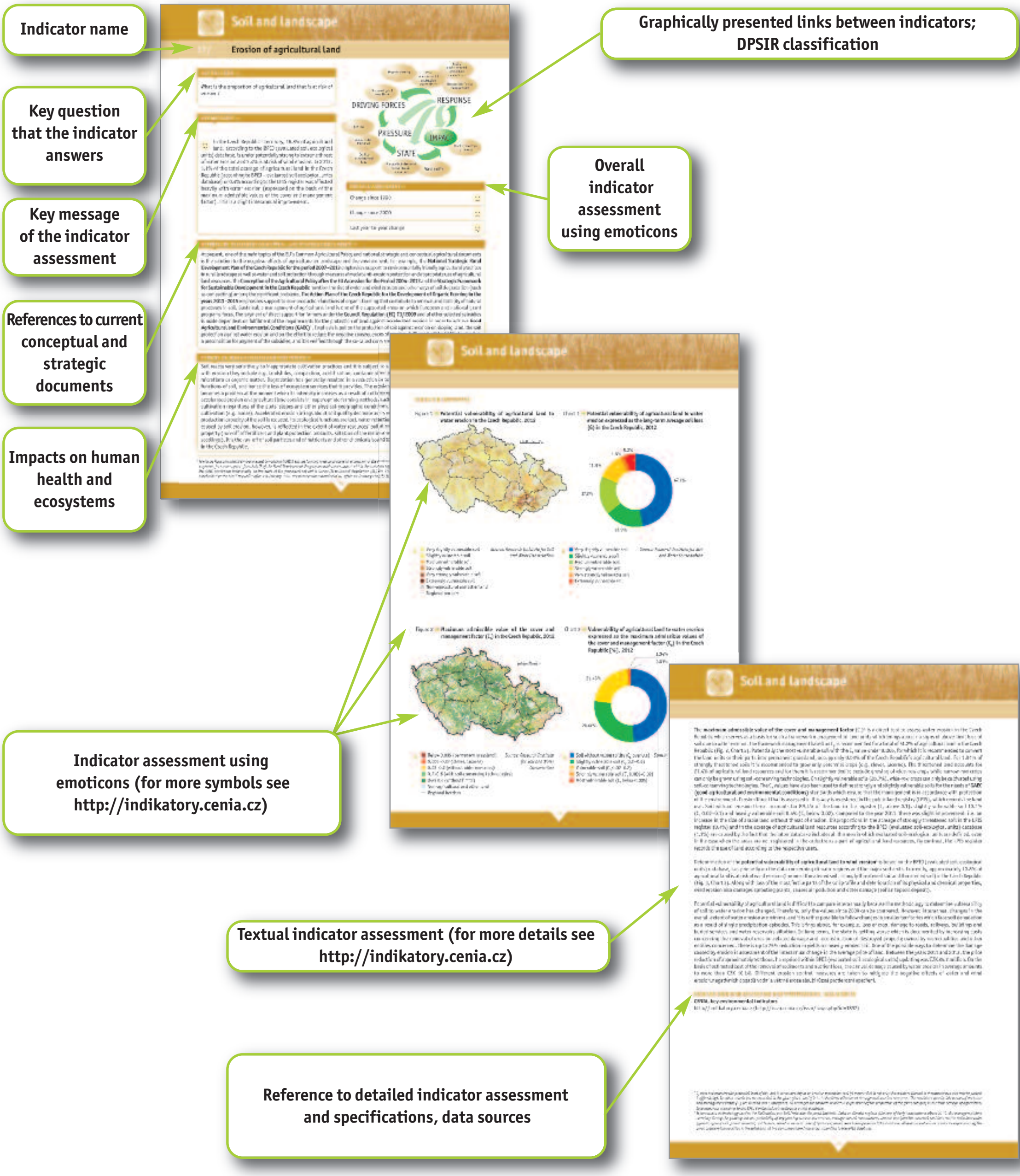
MESSAGES COMMUNICATED VIA INDICATORS

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 2012 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. A more detailed level of indicator assessment includes an assessment of the state and development as well as international comparison. Therefore, environmental conditions are compared with those in the other States of the EU27 where verified data are available for the respective indicators. For some indicators, international comparison beyond EU27 is included because of global importance of the topic, e.g. for the indicator 02 - Greenhouse gas emissions. 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 each indicator at the end of each chapter.

EMOTICON SYMBOL KEY

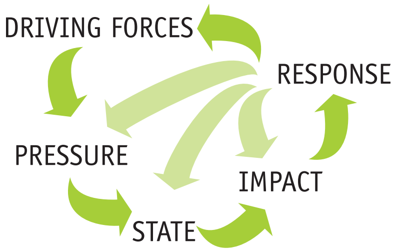
	The Trend is developing positively, in accordance with the objectives set.
	The Trend is developing neither positively nor negatively and can be referred to as stagnate.
	The Trend is developing negatively, not in accordance with the objectives set.

INDICATOR ASSESSMENT STRUCTURE



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 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.



GLOSSARY OF TERMS AND LIST OF ABBREVIATIONS

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

Key messages of the Report

The State of the environment in the Czech Republic is improving, albeit decline of the economy in 2012 contributed to the improvement. Interannually, both industrial production and household spending on final consumption decreased, only foreign trade had a positive effect on GDP. As a result of technological development and growth of material and energy efficiency of the economy, there is gradual decline in specific environmental burden per unit of GDP. The extent of the environmental impact of the economy has been decreasing in long terms, although it is still above the average in the context of the EU27 countries. This fact is due to the significant share of industry in the GDP creation, high mining/extraction and consumption of fossil fuels and the overgeneration of electric energy. As the negative environmental impact of large pollution sources is decreasing, the importance of household consumption is growing, in particular local heating, energy and water consumption and waste production, which affect the overall status and trends of the environment in the Czech Republic.

With regard to positive development of the environmental aspects of the Czech Republic's economy, emissions of acidifying substances, ozone precursors, emissions of primary particles and secondary particulate precursors as well as greenhouse gas emissions from manufacturing industry and surface and groundwater pollution have all been decreasing in long terms. Air pollution is closely linked to developments in the energy and industry sector and with household heating and transport. In the energy sector, electricity and heat generation from renewable energy sources has been growing, in 2012 this was mainly due to biogas stations. As opposed to the large increase in the proportion of photovoltaic power stations in electricity generation from renewable energy sources between the years 2010–2011, there was even a slight interannual decrease in 2012. The generation of electricity in coal-fired power stations and associated environmental pollution, however, is declining only very slowly due to significant exports of electricity. Although the air pollution limits set for concentrations of single pollutants are not generally exceeded, air quality in certain regions and localities still remains unsatisfactory. This concerns in particular the agglomeration of Ostrava/Karviná/Třinec, cities with heavy traffic and also small settlements in valleys and localities with frequent inversions where local resources from household heating represent the major burden, in spite of the fact that fuel consumption in households stagnated in 2012. Household heating is a major source of emissions of suspended particles, PM_{10} fraction. A positive development from the environmental perspective can be observed in the transport sector, where there is an increase in rail transport within the passenger transport and the fleet of motor vehicles is being modernized. However, the structure of freight transport remains a problem, as there is a great predominance of road transport and vehicles are being decommissioned only slowly, which causes a constant increase of the number of registered cars and lorries.

There is still high pressure on landscape connected with land use development, particularly in large urban areas, and with the construction of transport infrastructure, which are both associated with occupation of agricultural land resources. As a result of increasing extent of built-up and other areas, including transport infrastructure, landscape fragmentation has been growing. This increases pressure on the plants' and animals' habitats, migration patterns of animals are changing and there is an overall decline in biodiversity. Transport has a negative impact on the population and other organisms in adjacent areas, mainly due to increased noise and dust. Road transport also takes a significant part in the production of NO_x emissions. Although these emissions have been decreasing in long terms as a result of different measures in environmental protection, they still cause acidification of aquatic and terrestrial ecosystems, including agricultural land, and a high degree of defoliation of forest stands. NO_x emissions are also a precursor to ground-level ozone, which damages organs in plants and reduces their resistance to stress factors of the environment.

With the increasing proportion of built-up areas, there is a loss of natural environment and disruption of major landscape functions which also include the ability to retain water and protect landscape against the flood. Water retention in landscape is essential for recharge of water resources which are important not only to supply the population with drinking water but also for agricultural purposes. What is positive is the fact that there is still a decline in water consumption and the quality of surface water has been improving. As a result of the increasing share of treated wastewater, however, the significance of pollution from non-point sources, in particular agriculture, is growing. In the last two years, consumption of fertilisers and plant protection products was at the highest level since 2000. On the other hand, the increasing proportion of agricultural land under organic farming and increased growth in areas of natural forest regeneration are positive for landscape.

The development of the state of the environment is also affected by the funds allocated to implementation of environmental projects. Although in 2012, expenditure from the central public sources stagnated, and in the case of local budgets they have even declined, national and European subsidy programmes were implemented - e.g. the Program to support recovery of natural landscape functions, the State programme to support energy savings and use of renewable energy sources, and last but not least, the Operational Programme The Environment. In 2012, the second phase of the Green Savings Programme was under preparation, too.

THE MAIN POSITIVE FINDINGS OF THE REPORT:

- The total aggregate greenhouse gas emissions are falling in the Czech Republic, in 2011 they reached their lowest level since 1990. Emissions of pollutants into air have been decreasing in long terms. In 2012, there was an interannual decrease in emissions of acidifying substances (by 3.7%), emissions of ozone precursors (by 4.9%), emissions of primary particulate matter (by 4.1%) and secondary particulate precursors (by 4.7%). In 2012, the limit values for arsenic, cadmium, nickel and lead were not exceeded at any monitored site.

- The trend of reducing water consumption continues, the most significant reduction occurred in the energy sector (by 7.8%). The total amount of discharged waste water has also been reduced. From a long-term perspective, a trend in the reduction of pollution discharged from point sources continues. A total of 97.3% of wastewater discharged into sewage systems has been treated. Increase in the total number of wastewater treatment plants, and especially those with tertiary treatment, also continues.

- For all water quality parameters that are monitored, there was a long-term decrease in their concentrations in watercourses. Environmental quality standards, especially for $N\text{-}NO_3^-$, cadmium and COD_{Cr}, are not being exceeded.

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

- The acreage of intensively cultivated arable land declines and the area of permanent grassland increases.

- The proportion of organically cultivated agricultural land, the number of organic farms and the number of entities producing organic food has been increasing.

- In vast majority of cases, agricultural land in the Czech Republic is not dangerous for food chains in terms of the content of hazardous elements (heavy metals).

- The total amount of produced heat has been falling in the long term.

- Even though the heating season 2011/2012 was by 10.3% more heat-demanding than the previous season, the consumption of fuels in households increased by only 0.4%.

- Energy intensity of the Czech economy has been decreasing in long terms. Electricity generation in steam-based power stations is declining while electricity generation from renewable energy sources is rising.

- Within the fleet of registered vehicles, there is a growing proportion of cars and trucks that meet higher emission standards EURO 4 and 5. Individualization of passenger transport has not been growing.

- The material intensity of the Czech economy has been reduced in long terms, which indicates a decrease in specific environmental burden per unit of economic output.

- Interannually, the production of hazardous waste decreased by more than 11%. The share of selected methods of waste disposal in the total waste production has been declining in long terms; in 2012, the lowest value since 2003 was registered. In 2012, 69.9% of packaging waste was recycled and 3.7% of it was used for energy recovery.

THE MAIN NEGATIVE FINDINGS OF THE REPORT:

- Greenhouse gas emissions from electricity and heat generation do not decrease and they stagnate on the levels of the years 1990 and 2000. The emission intensity of the Czech Republic is by more than 70% higher than that in the EU27.

- Despite continuing decline in emissions since 2000, the air quality in the Czech Republic's territory is not improving; this concerns in particular areas with exceeded air pollution limits, which include especially the Moravian-Silesian region. Air pollution limits for suspended particulates, benzo(a)pyrene and ground-level ozone have been exceeded repeatedly. Air pollution limit for NO_2 is exceeded areas with heavy traffic; the limit value for benzene was exceeded locally.

- In 2012, there was an interannual increase in the concentration of some parameters within surface water quality monitoring, and a more significant growth was recorded for total phosphorus.

- Despite a slight decline in recent years, defoliation of forest stands is still very high in the Czech Republic and it belongs to the highest in Europe. This trend is strengthened by an increase in the age of forest stands (albeit growing forest age itself is not a negative phenomenon from environmental point of view). The area of forests certified within the more environment-friendly FSC system remains very low.

- The extent of built-up and other areas has been growing, which slowly reduces the total area of agricultural land and natural habitats outside of them. The landscape fragmentation process has continued.

- In the period 2000–2012, the consumption of mineral fertilisers and plant protection products has increased significantly. Concerning selected high-risk substances, the most significant exceeding of the values of allowable soil pollution was in the DDT group of substances in 2000–2012. The massive exceeding of allowable pollution for the single polyaromatic hydrocarbons seems to be problematic.

- Relative to the average of the EU27 states, the Czech Republic has about 7% higher per capita energy consumption, and it also belongs to the countries with high energy intensity per unit of GDP. The export-import balance for electrical energy generated in 2012 was 19.5%.

- The impact of household heating on the environment and, in particular, on public health is considerable as more than one third of the total emissions of PM_{10} comes from local heating units.

- The vehicle fleet is very old in the Czech Republic (the average age was 16.8 years in 2012). Exclusion of vehicles from the register is slow and, moreover, it declines, which complicates renewal of the fleet. With its share of 75.2%, the road freight transport dominates the structure of the freight transport performance.

- Roughly one-tenth of the population of large conurbations is exposed to excessive above-limit noise and more than 50% of the population is affected by noise pollution in those municipalities where there are main transit corridors of road transport.

- Domestic material consumption increased by 5.6% in the Czech Republic in 2011, due to higher consumption of fossil fuels. Material dependency of the Czech Republic on foreign countries has been rising. The material intensity of the Czech economy is above average within the European context.

- In 2012, the most common way of disposing municipal waste continued to be landfilling (i.e. deposition within or below the terrain level), which accounted for 53.7%.

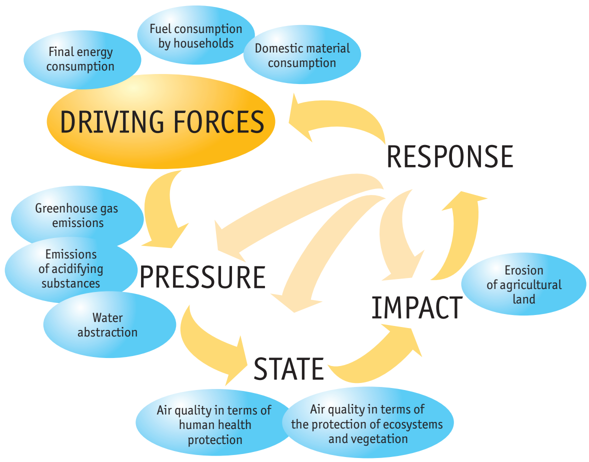
- The amount of packaging produced in 2012 increased by 33.6% compared to the year 2003. In comparison with the previous year, the volume of packaging waste increased slightly by 1.8%.

- In 2012, there was an interannual decline in expenditure from local budgets for environmental protection by about 11% to the total amount of 32.9 bil. CZK. This is a consequence of a decline in using financial means from national programmes and the EU funds to which co-financing resources from public budgets are bound and also of austerity measures taken by public authorities in connection with the economic crisis.

01/ Meteorological conditions

KEY QUESTION

What were the temperature and precipitation conditions on the Czech Republic's territory in 2012?



KEY MESSAGES

In 2012, there were above-average annual mean temperature and average precipitation on the territory of the Czech Republic. The average annual air temperature (8.3 °C) was by 0.8 °C higher than the long-term mean (1961–1990); the annual rainfall (689 mm) represents 102% of the long-term mean (1961–1990). Distribution of rainfall during the year has been uneven, both dry and very wet months have been recorded.

Most of the months in 2012 have had above-average temperatures, only February was significantly below average in terms of temperatures. On 20 August 2012, the meteorological station in Dobřichovice recorded 40.4 °C, which is a new maximum air temperature ever measured in the territory of the Czech Republic. The original record was from the year 1983. There were no major flood events in the Czech Republic in 2012.

INDICATOR SIGNIFICANCE AND CONTEXT

Temperature and precipitation rates affect the national economy and they also influence the level of environmental burden resulting from economic activity. Energy consumption, and hence the 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, energy consumption increases due to operation of air conditioning during hot days. The sectors of agriculture, water management and forestry are greatly dependent on the 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.

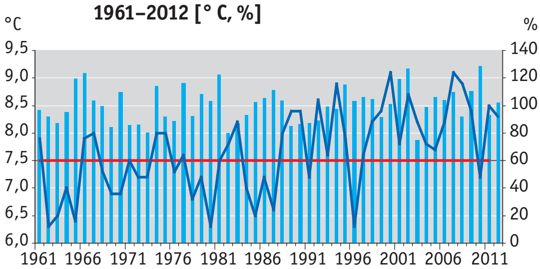
Indirect effect of the weather conditions consists in affecting the state of the environment. This concerns, in particular, the conditions for air pollutants dispersion, which are, together with the production of emissions, the main factor in air quality fluctuation and the cause of high concentrations of pollutants in certain locations. 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 still water and thus worsen the water quality for swimming.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Weather conditions have an impact on human health and ecosystems. Very 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. Chilling in freezing days may also have health effects, especially for the elderly and people without shelter. Increased concentrations of ground-level ozone, which are affected by higher temperatures and intense sunlight, have irritant effects on the respiratory system and they also damage green parts of plants. Torrential rainfall (soil erosion), strong wind (damage to forest stands, water and wind erosion) and long-lasting drought also have negative impacts on ecosystems.

INDICATOR ASSESSMENT

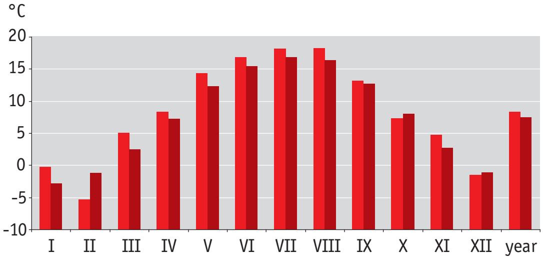
Chart 1 → **Long-term development of annual average air temperature and precipitation totals in the Czech Republic compared to the mean 1961–1990, 1961–2012 [° C, %]**



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

Source: Czech Hydrometeorological Institute

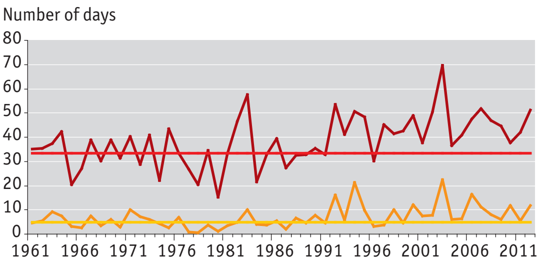
Chart 2 → **Monthly average air temperature in the Czech Republic (areal temperatures) compared with the 1961–1990 temperature mean [°C], 2012**



Air temperature, 2012
Long-term temperature mean (1961–1990)

Source: Czech Hydrometeorological Institute

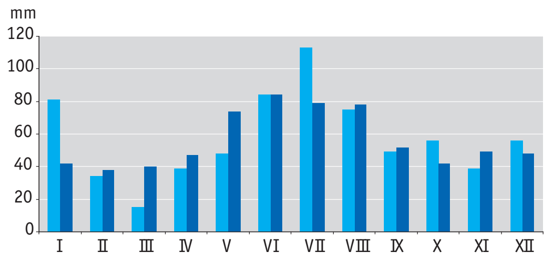
Chart 3 → **Average number of summer days and tropical days compared with the 1961–1990 mean [number of days], 1961–2012**



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

Source: Czech Hydrometeorological Institute

Chart 4 → **Monthly precipitation totals in the Czech Republic (areal averages) compared with the 1961–1990 long-term mean [mm], 2012**



Monthly precipitation totals, 2012
Long-term precipitation totals (1961–1990)

Source: Czech Hydrometeorological Institute

There were above-average temperatures on the territory of the Czech Republic in 2012; the average annual air temperature (8.3 °C) was by 0.8 °C higher than the long-term mean (1961–1990) (Chart 1). Although seven warm to very warm months were recorded, the year 2012 as a whole is slightly colder than the year 2011, particularly thanks to cold February. Temperature conditions of the year 2012 confirm the generally warmer character of the beginning of 21th century. In 1961–1999, only 5 years with an average annual temperature higher than that in 2012 were recorded (1989, 1990, 1992, 1994 and 1999), however, in the timeline of annual average temperatures after 2000, the year 2012 is on the level of the arithmetic mean and median.

According to the preliminary WMO report on the state of the climate in 2012, the global temperature of the Earth's surface was by 0.45 °C higher compared to the long-term average (1961–1990), which is 14.0 °C. From a global perspective, the year 2012 is therefore **the ninth warmest year for the entire duration of measurement** since 1880. In Europe, too, the 2012 temperatures were above the long-term average, however, the situations in the northern and southern Europe varied greatly. While in some countries of southern Europe there was one of the hottest summers ever recorded, in the northern part of Europe, by contrast, the 2012 summer temperatures were below average.

In the Czech Republic, February was **the coldest month of the year**; the average monthly temperature reached the value –5.2 °C, which is by 4.3 °C less than the mean in 1961–1990 (Chart 2). In the past 30 years, a lower average February temperature was recorded only in 1986 (–7.7 °C) and in 1985 (–5.7 °C). A significant decrease in the air temperature as a result of outbreak of cold Arctic air from the east was recorded already in late January, and the low temperatures continued till 13 February. The coldest day was 6 February, when the minimum air temperature fell below –14 °C throughout the territory of the Czech Republic, in some places it was –30 °C. At the meteorological stations of Jezerní slať and Rokytská slať in Šumava Mts., the temperatures reached –39.4 °C and – 38.1 °C respectively. Strong frosts associated with worsened dispersion conditions led to declaration of the smog situation, at first in the Moravian-Silesian region and then gradually in almost the whole of the Czech Republic. Cold weather that struck the whole Europe also took human lives; there also have been several victims in the Czech Republic.

The months of March and May were warm in comparison with long-term mean. The average air temperature in March was 5.1 °C which is by 2.6 °C higher than the mean in 1961–1990. The average May temperature (14.4 °C) was by 2.1 °C above the 1961–1990 mean. The hottest months of the year were July and August, with the same average temperature. In terms of temperature, **August was highly above the long-term mean**; its average temperature (18.2 °C) was by 1.8 °C above the 1961–1990 mean. During the summer, there were several heat waves in the Czech Republic. A significant heat wave occurred at the turn of the second and third decades of August, when **the maximum temperature ever recorded in the Czech Republic (in 1983) was exceeded** at the meteorological station in Dobřichovice in Central Bohemia on 20 August; the new maximum daily air temperature is 40.4 °C. In Moravia and Silesia, the highest daily maximum temperature for the year 2012 was also measured on 20 August; the station at Dyjákovice recorded 38.1 ° C.

In terms of temperature, November was also highly above the long-term mean; its average monthly temperature (4.8 °C) was by 2.1 °C above the 1961–1990 mean. As a result of temperature inversion, a smog situation was declared in mid November in the Moravian-Silesian region, which lasted until the beginning of the third decade of the month. At the end of the year, there were normal temperatures again.

In 2012, there have been in the average **51 summer days and 12 tropical days**, which are above-average values in both cases (Chart 3). There were also **110 frosty days and 38 icy days** recorded in 2012. Concerning icy days, the year 2012 was close to normal while the number of frosty days was slightly below average.

In terms of precipitation, the year 2012 has been normal on the territory of the Czech Republic; the average annual rainfall (689 mm) represents 102% of the long-term mean (1961–1990). The highest annual rainfall was recorded at the station Špičák (1652.7 mm) while the least annual rainfall was measured in Lednice where it amounted to 373 mm. January and July can be included in the very wet to wet months while March was the driest month of the year.

Concerning precipitation, January was highly above the long-term mean; its average rainfall (81 mm) represents 193% of the mean in 1961–1990 (Chart 4). Most precipitation fell in the Liberec region (140 mm, which is 203% of the normal value) and in the Karlovy Vary region (121 mm, which is 216% of the normal). As a result of above-average temperatures, snow cover occurred mainly in the mountains; in the low-lying areas it was only sporadic.

March was dry, the average March rainfall in 2012 was only 15 mm, which represents 38% of the long-term mean in 1961–1990. The least precipitation was recorded in the South-Moravian region; the rainfall amounted to 5 mm here, which is 17% of the long-term mean in 1961–1990. For the last 50 years, March 2012 was the third driest month among the spring and summer months in the territory of the Czech Republic. Only April 2007 with the total rainfall of 5 mm and March 2003, when the rainfall amounted to 14 mm, were drier. Below-normal rainfall was recorded also in May; the average rainfall (48 mm) represented 65% of the long-term mean in 1961–1990.

There was above-normal precipitation in July with the average rainfall of 113 mm, which is 143% of the long-term mean in 1961–1990. Most precipitation fell in the region of Liberec (162 mm, which is 182% of long-term mean) and in the region of Hradec Králové (156 mm, which is 188% of the long-term mean). Strong thunderstorms associated with torrential rain, hail and wind gusts occurred especially in the first decade of the month, rising of river levels has been recorded in some areas in the North and South of Bohemia. In the autumn and at the end of the year, precipitation was around normal levels; October was somewhat wetter with rainfall being 133% of the long-term mean, on the other hand, November was drier.

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

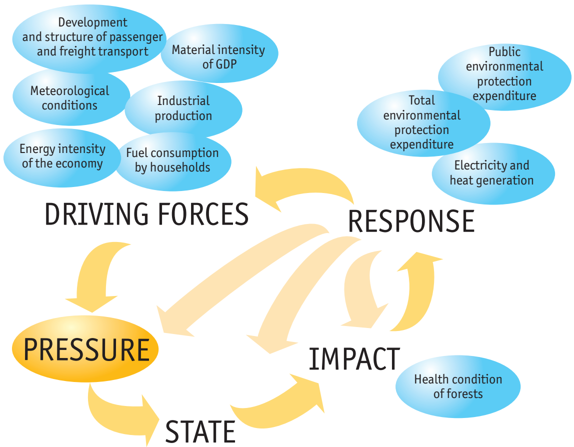
KEY QUESTION →

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

KEY MESSAGES →

The total aggregate greenhouse gas emissions in the Czech Republic in 2011[1] decreased interannually by 2.9%; since 2000 they have decreased by 8.5%. There is a decrease of these emissions from fuel combustion in the manufacturing industry. Emissions from transport, after a significant increase at the turn of 20th and 21st centuries, have been falling since 2007. The emission intensity of the Czech Republic's economy gradually decreases, however, it remains above the average in comparison with the other EU27 countries.

Greenhouse gas emissions from electricity and heat generation, which account for the greatest part in the country's total emissions (over 40%), do not decrease and they stagnate on the levels of the years 1990 and 2000. High emissions from the public energy sector are related to over-generation of electricity, a high proportion of coal-powered power plants in electricity generation and also to so far insufficient energy savings in households and services.



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**. The Kyoto Protocol binds the Czech Republic to reduce aggregate greenhouse gas emissions in the 2008–2012 control period by 8% compared to the base year 1990. In December 2012, an amendment to the Kyoto Protocol was concluded in Doha, which binds the EU to reduce aggregate emissions of greenhouse gases for the second commitment period (2013–2020) by 20% compared to the year 1990.

A Climate-Energy Package was adopted in December 2008 at the European Community level which defines the targets and instruments to achieve climate-energy goals by 2020. 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% by the year 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.

Reducing greenhouse gas emissions and the negative impacts of climate change is also one of the priorities of the current **State Environmental Policy of the Czech Republic** and other national strategic documents such as the **National Programme to Reduce the Impacts of Climate Change in the Czech Republic**. Reducing greenhouse gas emissions is one of the core areas in the **European competitiveness strategy Europe 2020**.

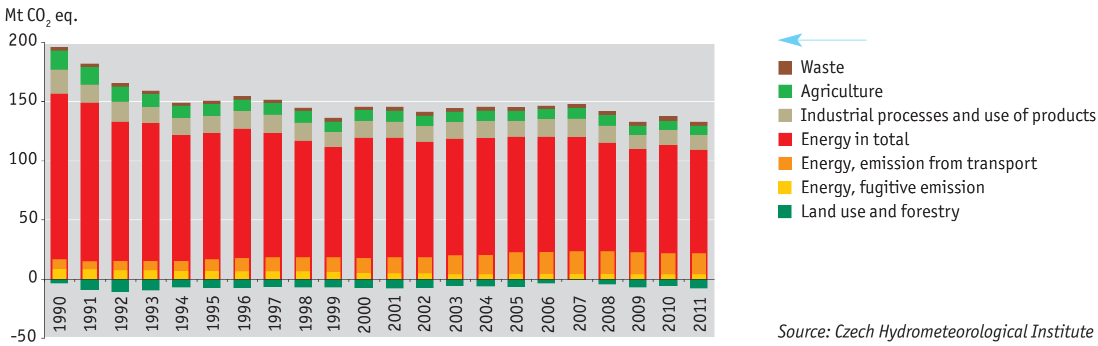
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Production of greenhouse gas emissions has minimal direct impacts on human health and ecosystems. However, climate change, affected by the production of anthropogenic greenhouse gases emission, is one of the largest global environmental problems which will have expected consequences for human health, quality of life and ecosystems in transboundary regions.

[1] *Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

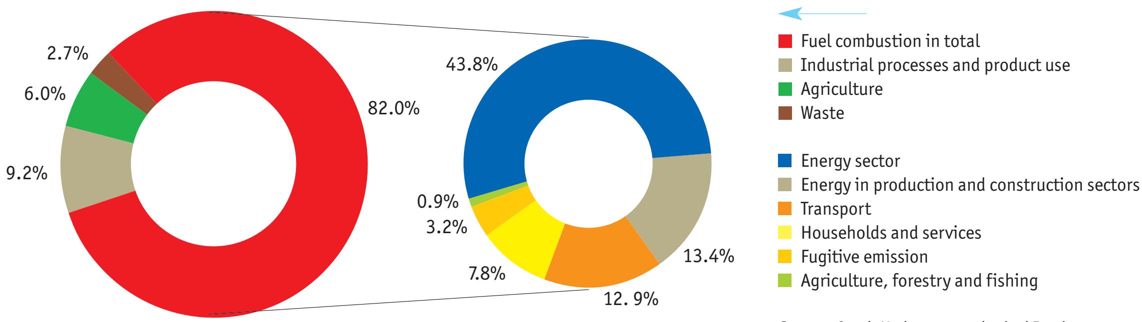
Chart 1 → **Development of aggregate greenhouse gas emissions by sector in the Czech Republic [Mt CO_2 eq.], 1990–2011**



Source: Czech Hydrometeorological Institute

Aggregate GHG emissions are expressed in CO_2 equivalent quantities of the same radiation/absorption effect as all the emitted greenhouse gases would have in total.
Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

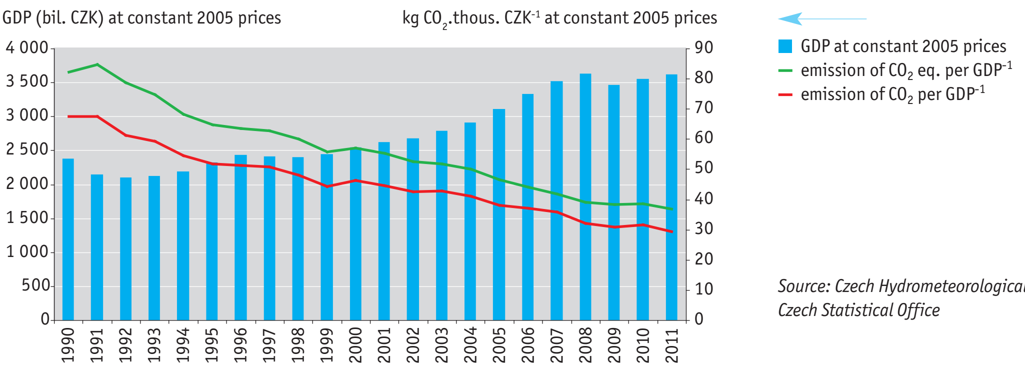
Chart 2 → **Structure of GHG emissions by major source categories [%], 2011**



Source: Czech Hydrometeorological Institute

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

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], 1990–2011 (excluding LULUCF[2])**

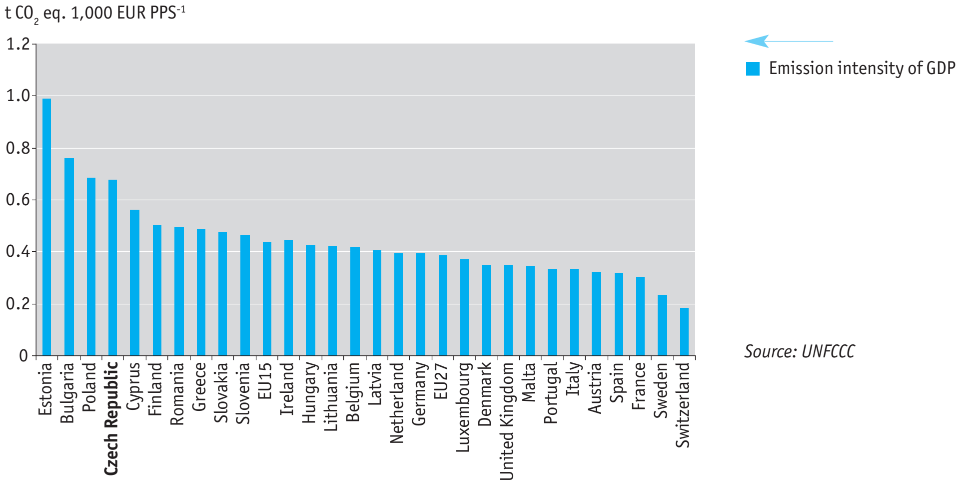


Source: Czech Hydrometeorological Institute, Czech Statistical Office

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

[2] *Emissions and removals from the LULUCF sector (Land Use, Land Use Change and Forestry Activities).*

Chart 4 → **Emission intensity of GDP, international comparison [t CO_2 eq. 1,000 EUR PPS^{-1}], 2010 (excluding the LULUCF sector)**



Source: UNFCCC

The **total aggregate greenhouse gas emissions** in the Czech Republic in 2011[3] decreased by 2.9% (3.9 Mt CO_2 eq.) to 133.5 Mt CO_2 eq. (excluding the LULUCF sector) and reached the lowest level since 1990 (Chart 1). Long-term development of the emissions is characterised by a significant decrease in the early 1990s, in connection with economic transformation and investments in environmental protection. After 2000, the emissions fluctuated depending on development of the Czech Republic's economy; there was a total decrease by 8.5% in the period 2000–2011. Compared with the year 1990, to which the obligations of the Kyoto Protocol are related, the aggregated emissions have fallen by 32% and the Czech Republic's commitment for the first control period was therefore met by a large margin.

Compared to 2010, the biggest **declines of emissions in 2011** were recorded in the **household and service categories**, including especially household heating (1.6 Mt CO_2 eq., i.e. by 13.4%) due to milder temperatures during the winter season, and in the category of **fuel combustion in manufacturing and construction industries** (1.5 Mt CO_2 eq., i.e. by 7.7%). Emissions from **the energy sector**, which includes the public energy (electricity and heat generation), petrochemical industry and manufacture of solid fuels, decreased interannually only slightly (by 0.8%). The long-term trend in emissions from fuel combustion in the manufacturing industry and construction (i.e. the industrial energy sector) has been decreasing significantly; in 2000–2011, the emissions decreased by 34%, and since 1990 by 63%. Emissions from the energy sector, however, are not declining; in 2011, they were higher by 0.8% compared to 1990, and since 2000 they have fallen by only 1.9%. Reducing emissions from this sector is limited by the increase in electricity and heat generation (by 12.5% since 2000), significant exports of electricity and a great proportion of steam power plants in electricity generation (approximately 62% in 2011).

Emissions from transport, after reaching their maximum in 2007, have been falling; the decline in 2007–2011 accounted for 10.3% (approx. 2 Mt CO_2 eq.). In 2011, the emissions from transport decreased by about 1% interannually, however, they were still by more than one third higher than in 2000 due to growth in road transport. **Emissions from agriculture** have stagnated at about half the level in comparison with the beginning of 1990s. **Emissions from waste** have been increasing gradually (in 2011 by 1.2%, i.e. by 55 kt), but due to their small share in the total emissions (2.7%), they have minimal impact on dynamics of the total emissions. After the minimum in 2007, the **declines in emissions from the LULUCF sector**, are increasing significantly and in 2011 they reached the highest value since 2000, namely almost 8 Mt CO_2 eq.

In 2011, **the largest share in the total GHG emissions** is represented by the energy sector (43.8%); almost a half of the total greenhouse gas emissions in the Czech Republic came from electricity and heat generation together with emissions produced by local heating of households and office buildings (Chart 2). In connection with development of emissions from the energy sector, its share in the total emissions has been going up gradually; since 2000 it increased by about 4 percentage points (since 1990 by 14 p.p.). On the other hand, there is an opposite trend in the manufacturing industry; since 2000, its share in the total emissions decreased by about 7 percentage points to approximately 23%.

[3] *Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

Companies involved in the **EU Emissions Trading System** (EU ETS) in the Czech Republic showed a decline in emissions by 1.8% in 2011. In 2012, the decline was much greater – by 6.6% (4.9 Mt of CO_2) to 69.3 Mt of CO2. In 2012, the decline in emissions within the EU ETS is larger in absolute terms than the decline in 2011 for the entire emission inventory, which implies not only continuation but even strengthening of the declining trend in the total emissions in 2012. What decreased most in 2012 was the emissions from the combustion of fossil fuels (i.e. the energy sector and fuel combustion in manufacturing industry) – namely by 6.9% (4.5 Mt CO_2), and from the production of cement and lime (by 0.3 Mt CO_2, i.e. by 9.8%).

In 2011, the **emission intensity of the Czech Republic's economy** decreased by 4.7% to 36.8 kg CO_2 eq. 1,000 CZK^{-1} at constant 2005 prices, and it was less than a half in comparison with the year 1990, and roughly one-third lower than in 2000 (Chart 3). In the European context, however, the Czech Republic's emission intensity is still above the average; GHG emissions per unit of economic output (GDP) in 2010 were by 56.0% higher than in the EU15 and by 76.6% above the EU27 average (Chart 4). The reason consists in the structure of the economy with a high proportion of industry in GDP generation, over-generation of electricity and high consumption of fossil fuels. Only Estonia, Bulgaria and Poland have significantly higher emission intensity than the Czech Republic. On the other hand, compared to countries like Italy, France or Austria, the emission intensity of the Czech Republic is more than doubled. The Czech Republic's GHG emissions per capita are also higher than the EU27 average (12.7 t CO_2 eq.$inhab.^{-1}$ in 2011, the EU27 average was 9.4 t CO_2 eq.$inhab.^{-1}$).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

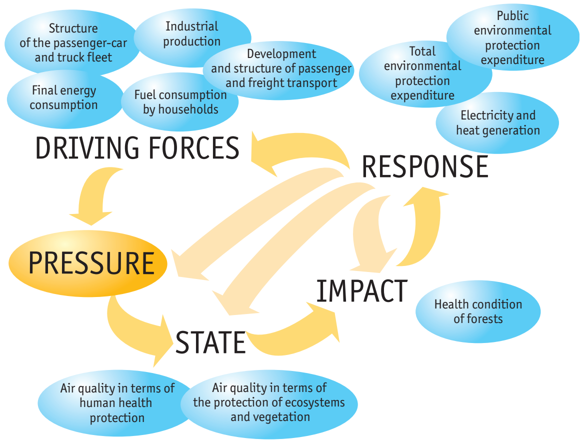
CENIA, key environmental indicators

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

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 into the air (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 83.1%, in 2011/2012 interannual comparison, an overall decrease of these emissions by 3.7% has been recorded.

Emission of SO_2 (36.9%) have occupied the biggest part of the total amount of acidifying substances while NO_x (34.4%) have taken almost the same proportion. The lowest share has been covered by NH_3 (28.7%).

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. 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 following emission ceilings have been met by the Czech Republic by the year 2010: SO_2 – 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%. In 2012, the **Potential for Reduce Emissions of Pollutants in the Czech Republic by the Year 2020** was also approved which sets 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

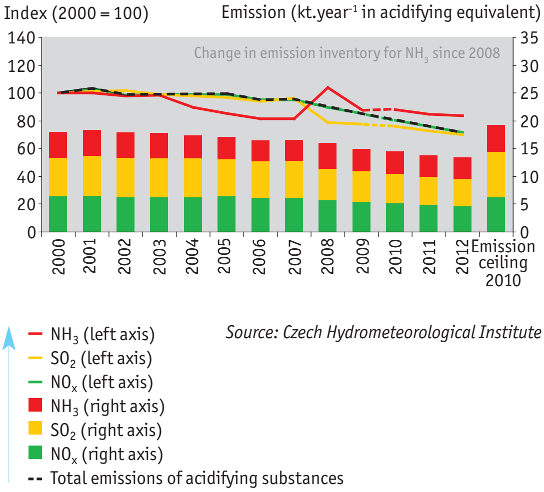
Short-term exposure to acidifying substances may irritate the respiratory system which may limit its activity and reduce the organism's resistance to infectious diseases. Exposure to acidifying substances worsens the problems of persons suffering from asthma (bronchoconstriction) and allergies (increased sensitivity to additional allergens). Long-term exposure to high concentrations of NO_2 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.).

Acidifying substances emissions increases 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.

[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

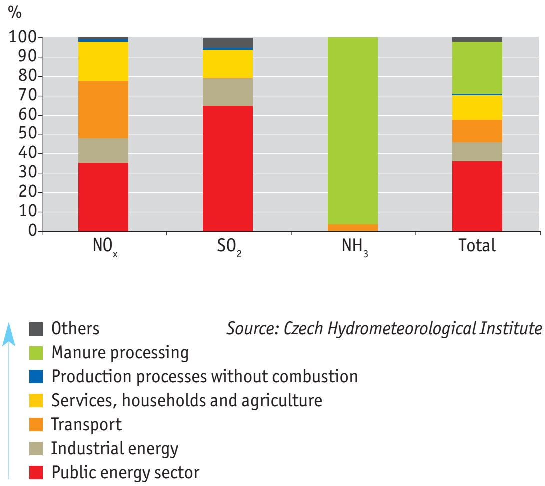
Chart 1 → **Total emissions of acidifying substances in the Czech Republic, 2000–2012 and the level of national emission ceilings for 2010 [index, 2000 = 100]; [kt.year^{-1} in acidifying equivalent]**



Source: Czech Hydrometeorological Institute

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

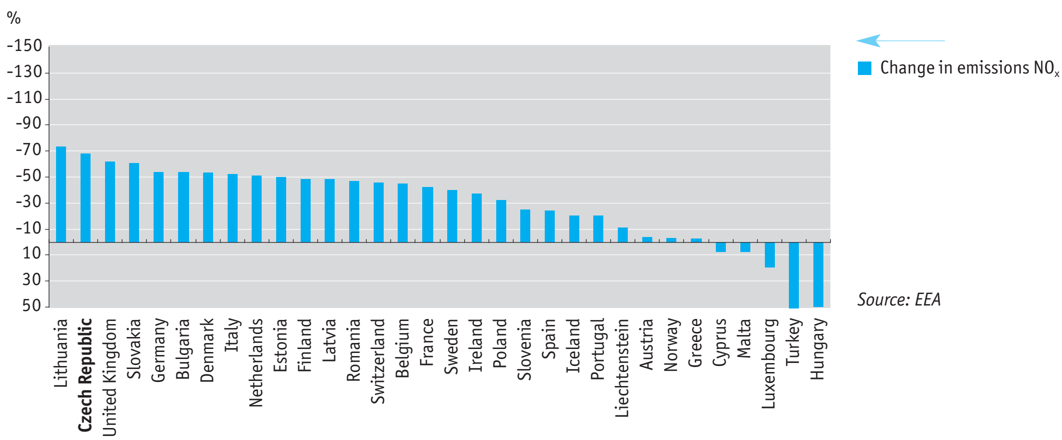
Chart 2 → **Sources of emissions of acidifying substances in the Czech Republic [%], 2011**



Source: Czech Hydrometeorological Institute

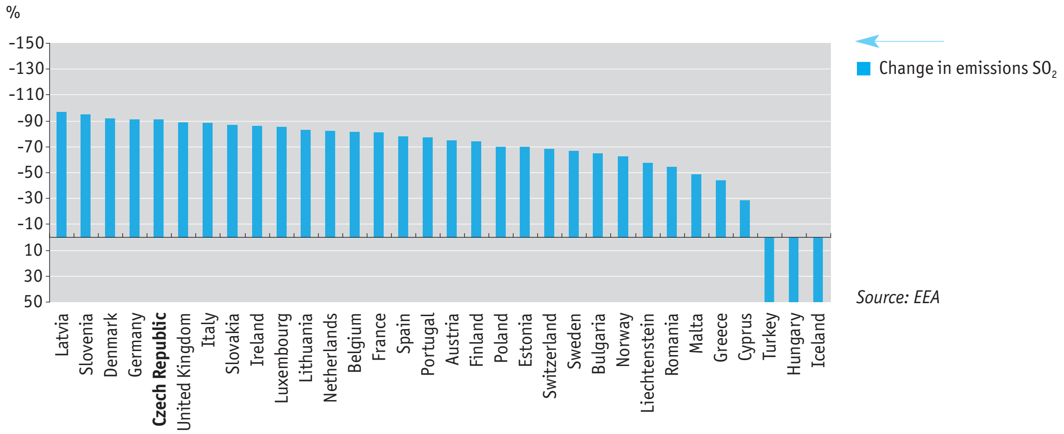
Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

Chart 3 → **International comparison of NO_x emission changes between the years 1990–2010 [%], 2010**



Source: EEA

Chart 4 → **International comparison of SO_2 emission changes between the years 1990–2010 [%], 2010**



In the long terms **(1990–2012)**, emissions of acidifying substances (SO_2, NO_x, NH_3), have been decreasing, namely by a total of 83.1%, from 79.0 to 13.3 kt. year^{-1} in acidifying equivalent. The rate of the decline, however, has slowed down significantly since 2000. In 1990–2012, the biggest drop in emissions of SO_2 was recorded, namely by 91.5% to 4.9 kt.year^{-1} in acidifying equivalent. The NO_x emissions decreased by 61.6% to 4.6 kt. year^{-1} in acidifying equivalent. The smallest decline was recorded for the emissions of NH_3, by 58.3% to 3.8 kt. year^{-1} in acidifying equivalent.

Between the years **2000–2012**, emissions of acidifying substances decreased by 25.9% from 18.0 kt.year^{-1} in acidifying equivalent, while the greatest decrease was recorded again for SO_2 emissions (by 29.9%). The emissions of NO_x dropped by 28.4% and those of NH_3 by 16.3% (Chart 1). Within this period, the most significant interannual decline occurred between the years 2008 and 2009, namely by 6.7%, which was caused by the recession of the national economy as a result of the economic crisis.

In the **interannual 2011/2012 comparison**, it is possible to track the decline in emissions of acidifying substances by 3.7%. The interannual decrease was mainly caused by decline in the reduction of NO_x emissions by 5.9% (in 2011, the value was 4.9 kt.year^{-1}). The SO_2 emissions dropped by 3.7% (5.1 kt. year^{-1} in acidifying equivalent in 2011). Likewise in previous years, there has been a decline in the emissions of NO_x and SO_2 from mobile sources[2] which is caused in particular by the renewal of vehicle fleet, meeting EURO emission standards, limiting the sulphur content in all automobile fuels and reduction of emissions from particularly large and large resources. On the other hand, slight interannual increase in emissions from small sources (household heating) has been recorded. In the 2011/2012 interannual comparison, emissions of NH_3 decreased by 1.0% (in 2011, the value was 3.9 kt.year^{-1} in acidifying equivalent). The NH_3 emissions have declined in all source categories.

[2] In accordance with the Act No. 86/2002 Coll. on air protection, the pollution sources are divided into different categories for the purposes of the emission balance: I. particularly large and large sources – REZZO 1, II. medium-sized sources - REZZO 2, III. small sources – REZZO 3, IV. mobile sources – REZZO 4.

The **main sources of emissions** of acidifying substances (Chart 2), based on data from the year 2011[3] include the public energy sector (36.4%, i.e. 5.0 kt.year^{-1} in acidifying equivalent), manure processing (26.8%, i. e. 3.7 kt.year^{-1} in acidifying equivalent), the sector of services, households and agriculture including emissions from household heating (12.4%, i.e. 1.7 kt.year^{-1} in acidifying equivalent) and the transport sector (11.7%, which is 1.6 kt.year^{-1} in acidifying equivalent). In comparison with the year 2000 there was no significant change in the sources structure. Emissions of SO_2 have been decreasing steadily since 2000, which is a result of reduction in energy intensity of the industry, changes in the fuel base in favour of high–grade fuels, use of fuels with a lower sulphur content, reducing the consumption of black and brown coal, together with the use of more advanced technologies in steam power plants. Decrease in NO_x emissions is due to the reduction in the consumption of solid fuels and particularly denitrification in particularly large, large and medium–sized sources. Decrease of NO_x emission since 2000 is closely related to decline in these emissions from the transport sector, and this change can be attributed to renewal of the car fleet, and thus the increasing share of vehicles equipped with catalytic converters. However, household heating remains a major source of SO_2 and NO_x emissions. It can only be controlled by urban regulations and subsidies to support the exchange of existing manually-filled boilers for solid fuels for new low–emission automatic ones. The sector of agriculture takes part in emissions of NH_3 (processing of manure and the use of mineral fertilisers), namely in 96.0%. NH_3 emissions from the energy sector and industry are insignificant; emissions of NH_3 from transport come mainly from road freight transport (3.4%).

In most of the **EEA member states** (20 of 32) there was a significant reduction in emissions of acidifying substances in 1990–2010, while the Czech Republic belongs to the states in which this reduction was highest (Chart 3, Chart 4). During these twenty years in the member states, emissions of SO_2 declined by 75.4%, NO_x emissions by 42.0% and NH_3 emissions by 28.1%. The global economic crisis in 2007–2010 significantly contributed to the decrease in emissions of acidifying substances. During these four years, emissions of SO_2 decreased by 27.0% and NO_x emissions by 16.0%. In 2010, agriculture (93.6% of NH_3 emissions), road transport (40.5% of NO_x) and generation and distribution of energy (57.4% of SO_2) were the main sources of emissions of acidifying substances in EEA member countries. Changes in these sectors have also contributed most to the total emission reductions since 1990. Since that year, there has been decline in livestock breeding and in the use of nitrogen and organic fertilisers, which affect the production of NH_3 significantly. Modernization of internal combustion technologies, and in the case of SO_2, also transition to better fuels with lower sulphur content have contributed to the decline in emissions of NO_x and SO_2.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

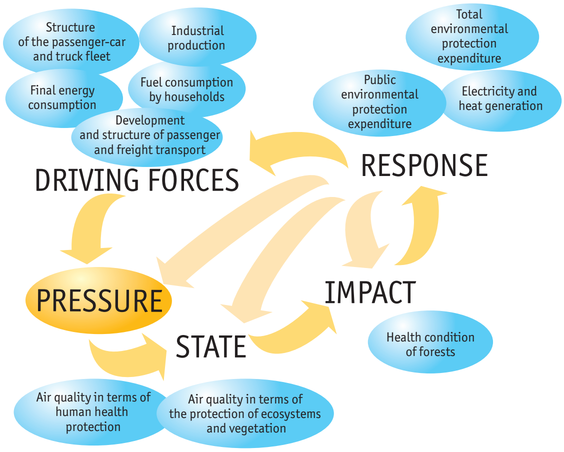
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1831)

[3] *Data for the year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

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) fell by 65.7% between the years of 1990–2012. Between the years 2011 and 2012, emissions of ground–level ozone precursors declined by 4.9%. NO_x emissions, which declined by 5.9%, contributed most to the interannual decrease in emissions.

In 2012, NO_x emissions accounted for 59.4% of the ground–level ozone precursor emissions, VOC emissions for 30.3%, emissions of CO for 8.7% and emissions of CH_4 for 1.6%.

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)**. In 2010, the Czech Republic managed to fulfil the national emission ceilings determined for 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%. In 2012, the **Potential for Reduce Emissions of Pollutants in the Czech Republic** by the Year 2020 was also approved which sets 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

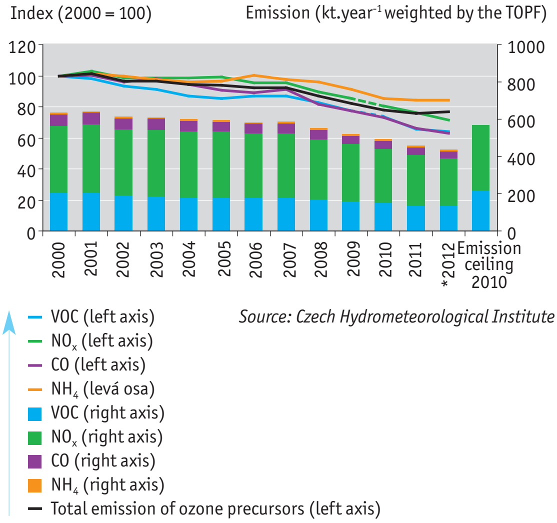
The existence of ozone in the atmosphere is of great importance for living organisms. While stratospheric ozone protects the Earth's surface and living organisms against the negative influence of biologically active ultraviolet radiation, tropospheric ozone, resulting from chemical reactions of so-called ground-level ozone precursors with participation of solar radiation, is considered an important pollutant. Exposure to increased concentrations of ground-level ozone causes irritation of the respiratory tract, eye and mucous membranes irritation, coughing and headaches. 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 reduce immunity of the organism.

Ground-level ozone is a powerful oxidizing agent that harms the assimilation organs of plants, affecting negatively not only forest stands but also other types of vegetation and having therefore an impact on agricultural production, too. As a result of ground-level ozone's effects, organisms are less resistant to the other biotic and abiotic factors such as insect pests and climatic fluctuations. Ground-level ozone also disrupts artificial materials and surfaces of buildings and artworks.

[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

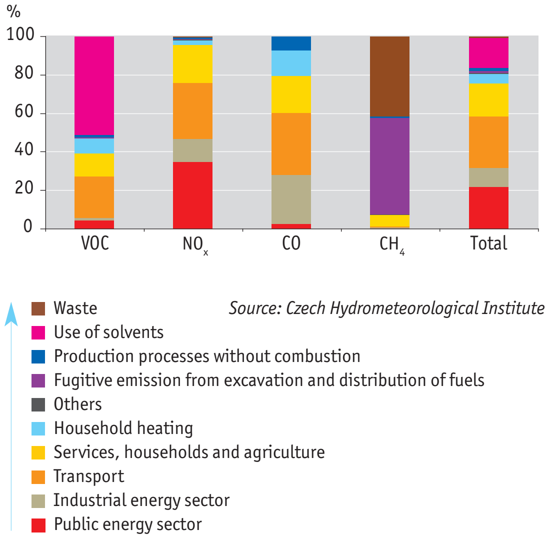
Chart 1 ➜ **Total emissions of ozone precursors in the Czech Republic and the levels of the national emission ceilings (for VOC and NO_x) for 2010 [index, 2000 = 100]; [kt. year^{-1} weighted by the TOFP], 2000–2012**



Source: Czech Hydrometeorological Institute

** Preliminary data for CH_4 emissions. Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

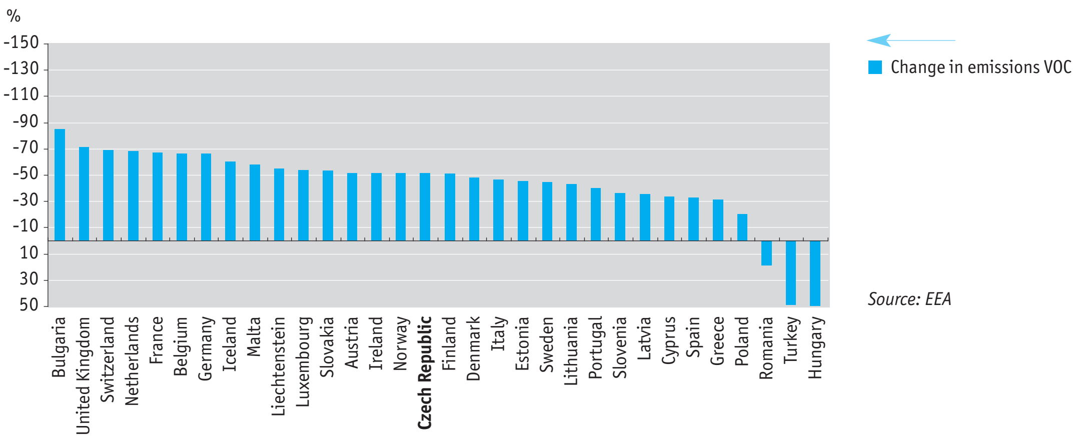
Chart 2 ➜ **Sources of ozone precursors emissions in the Czech Republic [%], 2011**



Source: Czech Hydrometeorological Institute

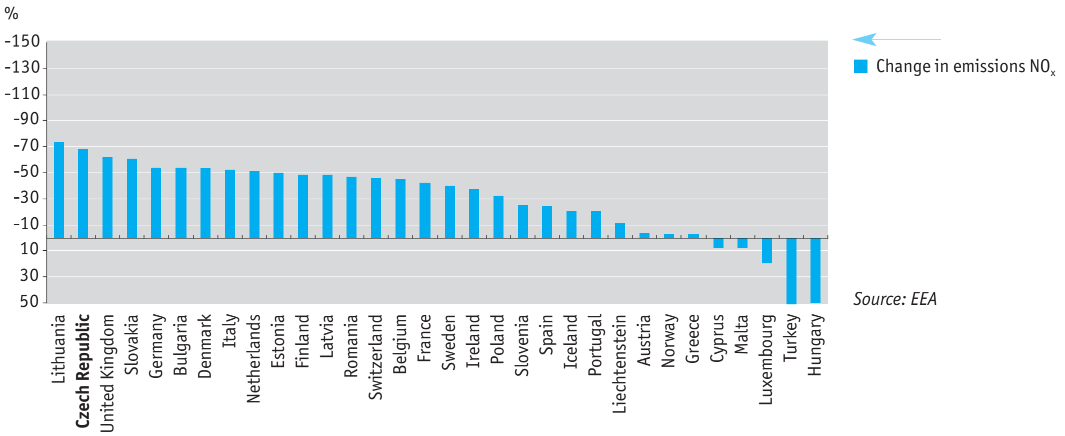
Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

Chart 3 ➜ **International comparison of changes in VOCs emissions in 1990–2010 [%], 2010**



Source: EEA

Chart 4 → **International comparison of changes in NO_x emissions in 1990–2010 [%], 2010**



Source: EEA

In **1990–2012**, ozone precursor emissions[2] fell by 65.7%, from 1265.8 to 434.0 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 1990–2012, the biggest decline was recorded for CO emissions, namely by 73.1 % to 37.7 kt.year^{-1} in TOFP, followed by a decline of VOC emissions by 70.2% (to 131.5 kt.year^{-1} in TOFP); NO_x emissions decreased by 61.6% (to 257.9 kt.year^{-1} in TOPF). The lowest decline was recorded for the emissions of CH_4 (by 44.6%, to 6.9 kt.year^{-1} in TOFP).

In the years **2000–2012**, there was a **reduction of ground-level ozone precursor emissions** by 31.6%, i.e. reduction from 634.2 kt.year^{-1} in TOFP (Chart 1). Within this period, the most significant decrease in emissions of ground-level ozone precursors occurred between 2008 and 2012. In the reference period, VOC emissions and CO emissions decreased most, namely by 36.2% and 36.9% respectively. The emissions of NO_x declined by 28.4% and the quantity of CH_4 emissions decreased by 15.5%.

In the **2011/2012 interannual comparison**, the overall decrease of ground-level ozone precursor emissions by 4.9% has been recorded, i.e. decline from the total of 456.2 to 434.0 kt.year^{-1} in TOFP. The reduction of NO_x emissions, which have decreased by 5.9% from the value of 274.1 kt.year^{-1} in TOFP in 2011, contributed most to the interannual decline. There was also a significant decrease recorded for CO emissions, namely by 4.9% (decline from 39.7 kt year^{-1} in TOFP in 2011), and for VOCs by 3.0% (from 135.5 kt.year^{-1} in TOFP in 2011). The interannual decline in emissions of ground-level ozone precursors was mainly caused by the decrease in particularly large and large sources as well as in mobile sources. Interannually, VOC emissions decreased, both in particularly large and large pollution sources and in small sources. Identically for the emissions of NO_x, CO and VOC, however, there was an interannual increase in medium-sized sources. Furthermore, the emissions of NO_x and CO have also increased interannually in small sources of air pollution (household heating emission).

[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 (59.4%) and VOC (30.3%) take the biggest parts in the ground-level ozone precursors emissions. CO accounts for 8.7% and CH_4 for 1.6%.

On the basis of **2011 data**, the **main sources** of ozone precursors emissions[3] include transport (28.2%, which is 129.0 kt.year^{-1} in TOFP), public energy sector (23.0%, i.e. 105.4 kt.year^{-1} in TOFP), the sector of services, households and agriculture, including emissions from household heating (17.8%, i.e. 81.4 kt.year^{-1} in TOFP) and also activities aimed at the use of solvents (16.5%, i.e. 75.4. kt.year^{-1} in TOFP). In comparison with the year 2000, there was no significant change in the sources structure. In 2000, transport (32.7%), public energy sector (21.1%), the use of solvents (17.7%) and the sector of services, households and agriculture, including emissions from household heating (16.2%) were the main sources of emissions of ground-level ozone precursors. The long-term decrease in NO_x emissions is related to the development of combustion technologies and reduction in the consumption of solid fuels. Reduction in the consumption and production of paints, adhesives and coatings contributes to the decrease in VOCs emissions. The CO emissions have also recorded a declining trend due to the decrease in emissions in the industrial energy sector and as a result of improved combustion processes. Reduced emissions of NO_x, VOCs and CO in the transport sector are closely connected with renewal of the vehicle fleet and increase in the number of vehicles equipped with catalytic converters. However, household heating using poor-quality solid fuels and boilers remains a significant source of NO_x, VOCs and CO.

In **EEA member states**, emissions of ground-level ozone precursors decreased substantially in 1990–2010 (Chart 3, Chart 4). In this period, emissions of NO_x fell by 42.0%, VOC emissions by 53.0%, those of CO by 61.1% and those of CH_4 by 32.0%. The global economic crisis in 2007–2010 also contributed significantly to the decrease in emissions of ground-level ozone precursors, in particular NO_x and VOC. In 2010, agriculture (49.9% of the CH_4 emissions), activities aimed at the use of solvents (42.1% of VOC emissions) and the transport sector (40.5% of NO_x emissions, 26.9% of CO emissions) were the main sources of ground-level ozone precursor emissions. Within the 32 EEA member states, the transport sector is the most dominant source of ground-level ozone precursor emissions. Nevertheless, this sector contributed most to an overall reduction of CO emissions (by 71.3%), NO_x emissions (by 41.1%) and VOC emissions (by 52.8%), mainly due to expansion of automotive catalytic converters and EURO standards concerning these emissions.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1832)

[3] *Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

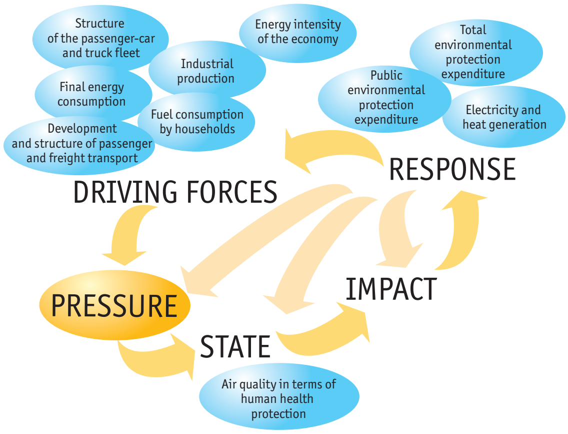
05/ Emissions of primary particulate matter and secondary particulate matter precursors

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 the period 1990–2012, there was a reduction of the emissions of secondary particulate matter precursors by 80.3%; between the years 2000–2012, these emissions decreased by 27.5%. In 2012, emissions of primary particulate matter of the fraction PM_{10} dropped by 4.1% on a year to-year basis.



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). **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)**. In 2010, the Czech Republic managed to fulfil the national emission ceilings determined for 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%. In 2012, the **Potential for Reduce Emissions of Pollutants in the Czech Republic by the Year 2020** was also approved which sets 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 →

Suspended particles in the air pose a variety of health risks. The effect of the particles depends on their size, shape, and chemical composition. 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, increases infant mortality and negatively affects the fertility of the population. The vulnerable group includes children, the elderly and persons with chronic diseases of the respiratory and vascular systems. If suspended particles are bound to PAH or heavy metals, they may also have mutagenic and carcinogenic effects.

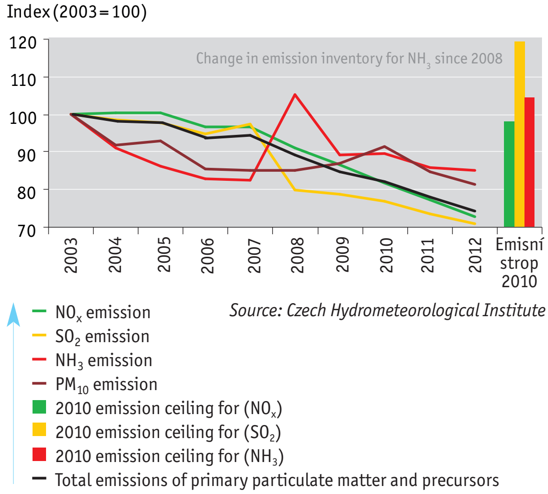
Suspended particulates also affect other organisms, not only humans. They cause mechanical dusting which reduces the plants' active area and enters the animals' respiratory tract. Solid particles also affect the Earth's energy balance because they scatter solar radiation back into space and they are also involved in the formation of clouds.

[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

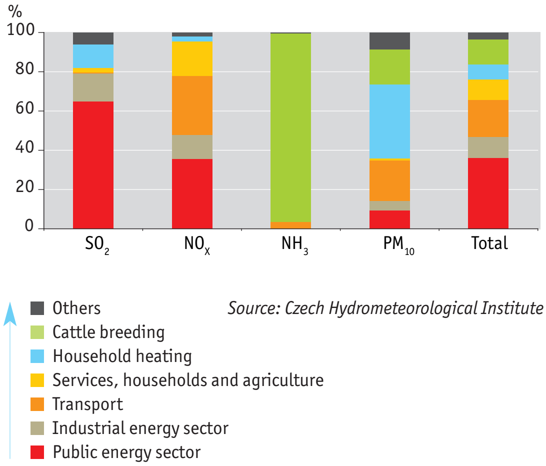
Chart 1 → **Development of emissions of primary particulate matter and secondary particulate matter precursors in the Czech Republic, 2003–2012 and the national emission ceilings (for NO_x, SO_2 and NH_3) for 2010 [index, 2003 = 100]**



Source: Czech Hydrometeorological Institute

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

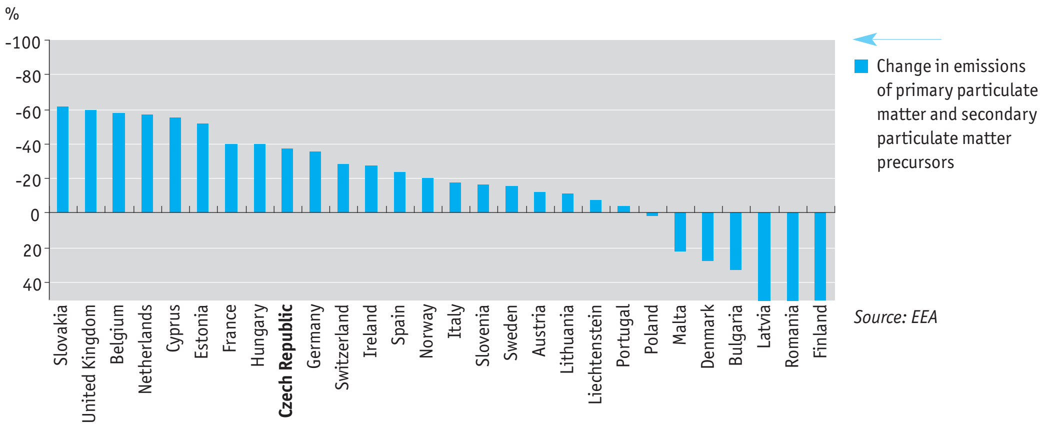
Chart 2 → **Emission sources of primary particulate matter and secondary particulate matter precursors in the Czech Republic [%], 2011**



Source: Czech Hydrometeorological Institute

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

Chart 3 → **International comparison of relative changes in emissions of primary particulate matter and secondary particulate matter precursors in 1990–2010 [%], 2010**



Source: EEA

In **1990–2012**, there was a reduction in emissions of secondary particulate matter precursors (NO_x, SO_2 and NH_3) by 80.3% from 1583.7 to 312.7 kt.year^{-1} in particulate matter formation potential. In this period, the biggest decline was recorded for the emissions of SO_2 (by 91.5%), NO_x emissions decreased by 61.6% and NH_3 emissions by 58.3%. The greatest decline in emissions of secondary particulate matter precursors had been recorded by the year 2000.

In 2000–2012, the emissions of secondary particulate matter precursors decreased by 27.5% (from 431.0 kt.year^{-1} in the particulate matter formation potential), while the largest decrease was recorded again for the emissions of SO_2 (29.9%), NO_x emissions decreased by 28.4% and those of NH_3 by 16.3% (Chart 1). Within this period, the most significant interannual decline occurred between the years 2008 and 2011; it was caused by recession of the national economy as a result of the economic crisis.

In **2011/2012 interannual comparison** a decline was recorded in the secondary particulate matter precursor emissions by 4.7% from 328.1 kt.year^{-1} in particulate matter formation potential in 2011. The NO_x emissions, which decreased by 5.9% (from 197.7 kt.year^{-1} in particulate matter formation potential in 2011), and SO_2 emissions, which decreased by 3.7% (from 88.3 kt.year^{-1} in particulate matter formation potential in 2011) contributed most to the interannual decrease. Likewise in the previous evaluated period, a decline in emissions from particularly large and large sources and from mobile sources took part in the interannual reduction of all emissions of secondary particulate matter precursors. In 2012, emissions of primary particulate matter of fraction PM_{10} decreased interannually by 4.1%, due to the decrease in emissions from almost all categories of stationary sources.

The main sources of emissions of primary particulate matter and secondary particulate matter precursors (Chart 2) on the basis of the 2011 data include the public energy sector (36.2%, i.e. 130.6 kt.year^{-1} in particulate matter formation potential), the transport sector (18.8%, i.e. 67.9 kt.year^{-1} in particulate matter formation potential), the sector of services, households and agriculture (18.1%, i.e. 65.3 kt. year^{-1} in particulate matter formation potential) including heating of households (7.7%) and emission from cattle breeding (dust from bedding material, fodder, excrements etc. 12.8%), with 96% of the total amount of NH_3 emissions and 18% of the total PM_{10} emissions coming under the last sector in this list. In comparison with the previous year and the year 2000, there were no significant changes in the structure of sources.

Emissions of primary particulate matter and secondary particulate matter precursors have continued to decrease since 2000. The decline in SO_2 emissions is a result of reduced energy intensity of the industry, changes in the fuel base in favour of high-grade fuels, the use of fuels with a lower sulphur content, reduced consumption of black and brown coal, together with the use of more advanced technologies in steam power plants. Decrease in NO_x emissions is due to reduction in the consumption of solid fuels. Decrease of NO_x emission since 2000 is closely related to decline in these emissions from the transport sector, and this change can be attributed to renewal of the car fleet, and thus the increasing share of vehicles equipped with catalytic converters. Reduced emissions of PM_{10} are connected with a decrease in construction works and, in recent years, with growing quality of combustion processes in the transport sector and energy and industrial enterprises. Household heating (PM_{10} from 37.6%), however, remains a major source of emissions of primary particulate matter and secondary particulate matter precursors, despite the fact that in the long term it has been decreasing.

In 1990–2010, the emissions of primary particulate matter and secondary particulate matter precursors decreased by 26% in the **EEA member states** (Chart 3). The most significant reduction of emissions of primary particulate matter and secondary particulate matter precursors occurred in Slovakia (61.7%), while the biggest increase in emissions of primary particulate matter and secondary particulate matter precursors was recorded in Romania (87.7%), and due to a change in the national reporting methodology also in Finland (175.2%). In the period concerned, the Czech Republic decreased these emissions by 37.1% (Chart 3). In the EEA member states, the main sources of emissions of primary particulate matter and secondary particulate matter precursors are the sectors of services and households (41.9% of total emissions), industrial energy (15.1%), road transport (14.4%) and agriculture (10.3% of the total emissions). In the EEA member states, there was a reduction of primary particulate matter and secondary particulate matter precursors in the sectors of energy generation and distribution (by 39.3%), in the industrial energy sector (by 24.6%) and in the transport sector (by 19.8%) in 1990–2010. This development has been mainly the result of increasing quality of industrial combustion installations, use of fuels with a lower sulphur content, use of natural gas instead of coal and oil, introduction of measures to improve environmental parameters in particularly large, large and medium-sized sources (desulphurisation, denitrification, removal of dust) and also the growing share of vehicles equipped with catalytic converters and using vehicles that meet EURO emission standards.

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 →

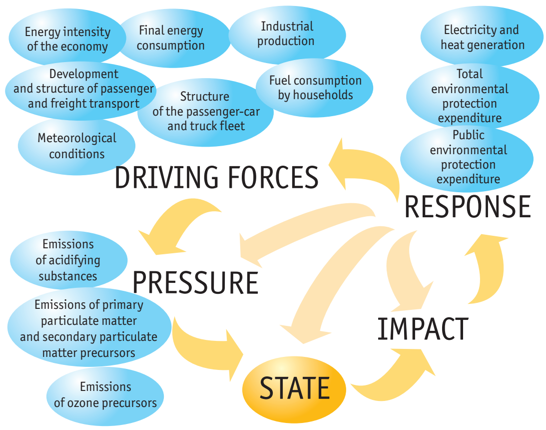
Are limit values that have been set for air pollutants in order to protect human health being met?

KEY MESSAGES →

Despite continuing decline in emissions since 2000, the air quality in the Czech Republic's territory is not improving; this concerns in particular areas with exceeded air pollution limits, which include especially the Moravian-Silesian region. Air pollution limits for suspended particulates, benzo(a)pyrene and ground-level ozone have been exceeded repeatedly. Air pollution limit for NO_2 is exceeded in areas with heavy traffic; the limit value for benzene was exceeded locally.

According to model calculations by the National Institute of Public Health, in the period 2006–2012 the estimates of premature mortality caused by exposure to suspended particulate matter PM_{10} within the Czech Republic and estimates of the individual lifelong risk of cancer due to exposure to As, Ni, BaP and benzene in urban localities in the Czech Republic for the years 2010–2012 show a comparable level, despite slight variability caused by meteorological influences.

The limit values for arsenic, cadmium, nickel and lead, as well as the limits for sulphur dioxide and carbon monoxide, have not been exceeded in 2012 in any monitored site. In comparison with the year 2011, air pollution limit for $PM_{2.5}$ was exceeded in fewer measuring stations.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

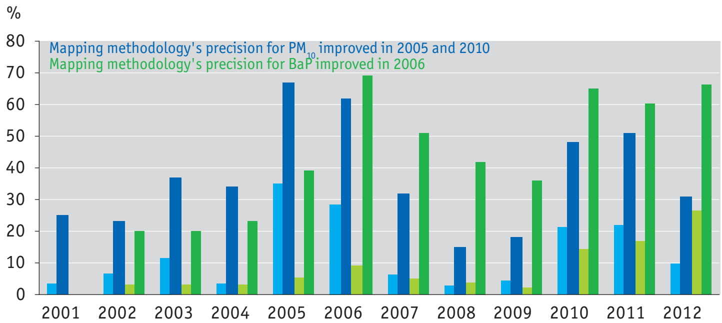
In its **Act No. 201/2012 Coll., on air protection**, the Czech Republic fully adopted the air pollution limits provided for by the **Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe and by the Directive 2004/107/EC of the European Parliament 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 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 10 „to reduce population 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 →

The impact of air pollutants on human health depends not only on their ability to affect the health conditions of the population, but it is also important for how long people are exposed to them and what are the concentrations. In long terms, suspended particulates of PM_{10} and $PM_{2.5}$ fractions including ultra-fine particles belong to the most important contaminants in relation to human health. Particle size determines whether and how the particles will penetrate and be deposited in the respiratory system. The effects of suspended particles include the rise in overall sickness rate and mortality, in particular for heart and vascular diseases, growing number of people hospitalized for respiratory diseases, an increase in infant mortality, the incidence of cough and respiratory distress, especially for asthmatics. Short-term effect of high NO_2 concentrations causes respiratory problems; long-term exposure to NO_2 is associated with an increase in overall cardiovascular and respiratory mortality and increases the incidence of asthma problems with children and adult population. The effect of PAH, expressed as benzo(a)pyrene, and the effect of benzene, arsenic and nickel consist in their toxic, mutagenic, and carcinogenic properties and ability to accumulate in environmental media and living organisms.

INDICATOR ASSESSMENT

Chart 1 → **Percentage of the Czech Republic's area and population exposed to above-limit 24 hour concentrations of PM_{10} and above-limit annual concentrations of BaP [%], 2001–2012**

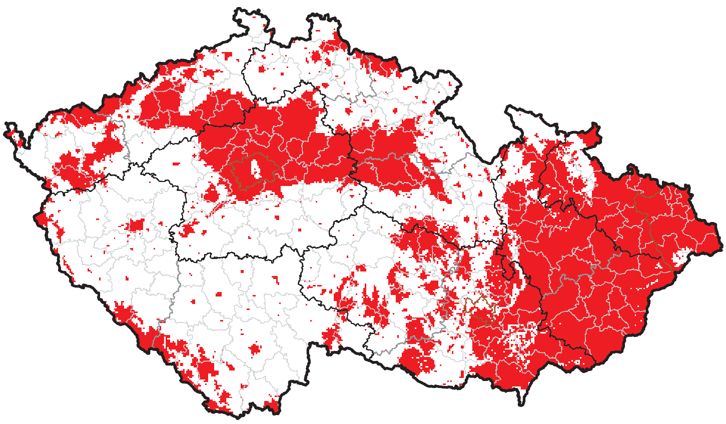


- Proportion of the Czech Republic's territory exposed to over-limit PM_{10} concentrations
- Proportion of the Czech Republic's inhabitants exposed to over-limit PM_{10} concentrations
- Proportion of the Czech Republic's territory exposed to over-limit BaP concentrations
- Proportion of the Czech Republic's inhabitants exposed to over-limit BaP concentrations

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.

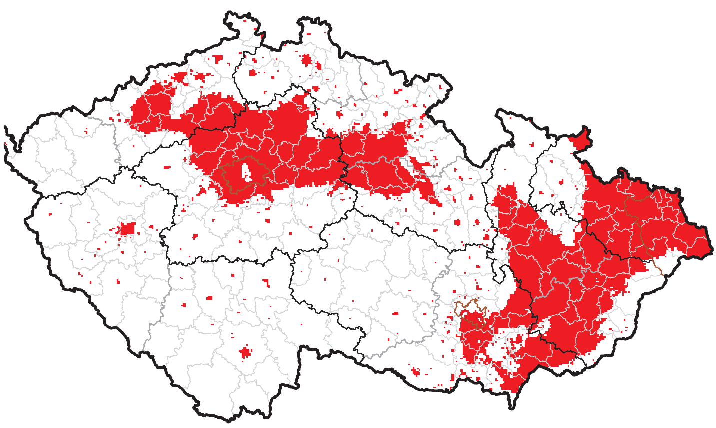
Figure 1 → **Areas within the Czech Republic with exceeding of the health protection limit values (ground-level ozone included), 2012**



- Area with LV exceedances 41,7 %
- Zones
- Agglomerations

Source: Czech Hydrometeorological Institute

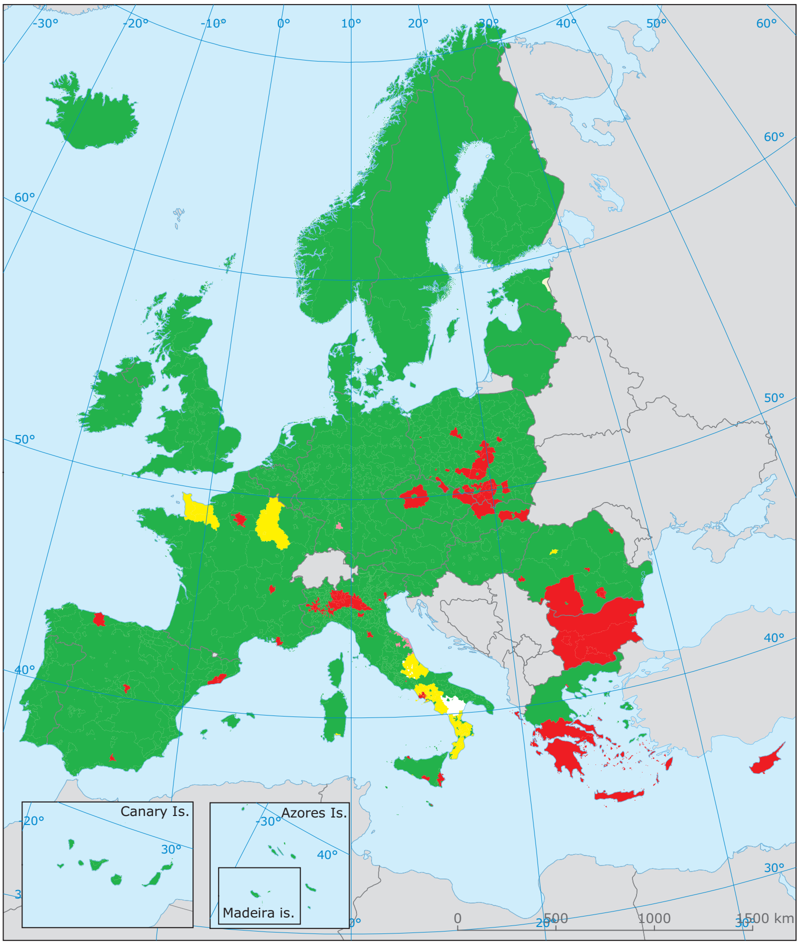
Figure 2 → **Areas within the Czech Republic with exceeding of the health protection values (ground-level ozone excluded), 2012**



- Area with LV exceedances 26,8 %
- Zones
- Agglomerations

Source: Czech Hydrometeorological Institute

Figure 3 → **EU27 territories with exceeded limit values for the average annual concentrations of suspended particulate matter [μg.m-3], 2009**



Source: EEA

Table 1 → **Total annual mortality increased by "premature death" [the number of premature deaths] – the span and mean for the Czech Republic, 2006–2012**

	2006	2007	2008	2009	2010	2011	2012
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)
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)

Source: National Institute of Public Health

The mean value for the Czech Republic was calculated for urban locations not exposed to extensive transport and industry.

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 ≤ 20 μg.m-3 (or PM_{10} ≤ 13.3 μg.m-3 for 75% representation of the $PM_{2.5}$ fraction) evaluated as 0. The values of total annual mortality rates in 2012 were taken from the CSO and "cleaned" – deaths caused by injuries and deaths of people younger than 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), 2006–2012**

Carcinogenic substances	2006		2007		2008		2009		2010		2011		2012	
Number of additional cases according to the type of burden and site	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Cities (over 5,000 to 5 mil. inhab.)	7.7	78.4	4.0	59.9	3.2	61.9	4.3	60.7	3.5	48.6	3.6	48.8	3.7	70.5
The sites without traffic burden	6.9	19.2	4.4	11.8	3.2	11.9	4.5	10.3	4.4	12.8	3.7	12.1	3.7	8.6
The sites with traffic burden	6.9	19.3	6.6	18.9	5.5	39.1	4.3	30.2	3.5	29.2	4.1	9.6	4.2	10.9
Industrial sites	16.2	78.1	15.4	76.3	11.4	61.7	12.4	60.7	11.4	48.0	12.9	66.7	8.7	73.5

Source: National Institute of Public Health

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 with 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 continuing decline in emissions at the beginning of 21st century, the concentrations of pollutants in the atmosphere do not decline and are accompanied by fluctuations which relate mainly to the dispersion conditions.

A serious problem in air quality in the whole territory of the Czech Republic consists in occurrence of high **concentrations of suspended particles PM_{10}**. In 2012, the air pollution limit for the 24-hour permissible concentration of PM_{10} was exceeded at 50 of 120 stations which meet the current rules. According to the rules used in previous years[1] however, the limit value for 24-hour permissible concentration of PM_{10} was exceeded at 56 stations out of a total number of 152 in 2012. Most stations where the limit values were exceeded are situated in the Moravian-Silesian and the region of Ústí nad Labem. In comparison with the previous year 2011, higher 24-hour PM_{10} concentrations have been measured. In 2012, the limit value for 24-hour average concentration of PM_{10} was exceeded in 9.6% of the Czech Republic's territory and 30.9% of the population were exposed to above-limit concentrations (Chart 1). In 2012, the limit value for the annual average concentration of PM_{10} was exceeded in 0.9% of the Czech Republic's territory (in 2011 it was 0.7%).

In the period evaluated, according to the estimate of the National Institute of Public Health, **exposure to suspended particulate matter PM_{10}** contributed to premature mortality of population in the industrial area of Ostrava-Karviná region in the range from unit percent to more than 10%. The risk is not distributed evenly in the population; it concerns sensitive population groups, particularly the chronically ill and elderly people. It can be estimated from these data that for the whole of the Czech Republic, the increase in overall mortality, caused, inter alia, by the exposure to PM_{10} fraction of suspended particulate matter (with estimated 50% representation of the $PM_{2,5}$ fraction), varies in average between two and more than four thousand people per year. In 2012, this concerned 1,800 people. If the proportion of $PM_{2.5}$ within the PM_{10} fraction is increased (i.e. estimated 75% mean representation of the fraction $PM_{2.5}$), the increase in total mortality in 2012 is estimated to be about 5.500 people (Table 1).

In 2012, the limit value for **annual concentration of suspended particles of $PM_{2.5}$** fraction was exceeded at 10 stations out of the total number of 43 (or 50, if the rules used in previous years are taken into account). The highest average concentrations were recorded at 8 sites in Moravian-Silesian region.

[1] List of stations that do not have a sufficient amount of data for the evaluation referred to in Annex 1 to the Decree No 330/2012 Coll., but according to the rules used in previous years, i.e. according to Government Regulation No. 42/2011 Coll. The number of stations is given because of follow-up of the evaluations in longer time periods.

Within European comparison[2], the inhabitants of Greece, Bulgaria, Romania, Poland, Italy, the Czech Republic, France and Spain (Fig.3) were struck most by exceeded limit values for annual PM_{10} concentrations to protect human health.

Concentrations of **ground-level ozone** are influenced by nature of the meteorological conditions (amount of sunlight, temperature, and precipitation) in the period from April to September when the highest concentrations are usually measured. In comparison with the previous year 2011, the concentrations of ground-level ozone have decreased. In the three-year period 2010–2012, the pollution limit was exceeded in 16.6% of the Czech Republic's territory and about 2.8% of the population were exposed to ozone concentrations which exceeded the health protection limits. In the previous evaluated period (2009–2011), the target limit value was exceeded in 17.1% of the country's territory and 10.1% of the population were exposed to above-limit concentrations. The decline in concentrations of ground-level ozone could probably be related to slight decrease in maximum temperatures during the period from April to September 2012 in comparison with the same period in 2009.

Just like in 2011, the limit value for **benzo(a)pyrene (BaP)** was exceeded in a number of towns and municipalities in 2012. This concerns about 26.5% of the territory where 66.3% of the population live. As opposed to the previous year (2011), there was a significant increase in the area where the limit values were exceeded and therefore the number of inhabitants affected by BaP has also risen. In 2011, the limit value was exceeded in 16.8% of the territory and 60.2% of the population was affected. In 2012, the BaP concentrations were monitored at 29 stations (or 31, according to the rules used in previous years), of which in 20 stations (or 21) the annual average concentration exceeded the limit value (1 $ng.m^{-3}$). The highest annual average concentration has been measured, likewise in the past, in Ostrava-Radvanice, where the value 10.8 $ng.m^{-3}$ was recorded.

In the Czech Republic, the **total increase in the individual lifelong risk of a tumorous disease** in urban localities in 2006–2012 for BaP has varied in the range between 0.5 and 10 cases of the disease per 10 thousand inhabitants during 70 years. From the values calculated for the different types of urban sites it can be estimated very roughly that in urban areas without a significant industrial load the impact of PAH emissions from transport, combined with emissions from local heating in some localities, could lead to an increase in health risk by 0.5 to 2 cases per 10,000 inhabitants. In locations affected by large industrial sources, the value of the individual risk was higher than in the other urban locations, and theoretically, it could pose an increase of health risks by 10 cases per 10,000 inhabitants (Table 2).

On the basis of maps showing areal distribution of air quality characteristics, a **area where the limit value was exceeded for 1 or more pollutants** (Fig. 1) has been delimited in 41.7% of the Czech Republic's area in 2012. This concerns areas in which the limit values to protect human health were exceeded for at least one of the pollutants (SO_2, CO, PM_{10}, NO_2, Pb and benzene). In 2012, the limit values for PM_{10} (see above), NO_2 (5, respectively 6 according to the rules used in previous years) and benzene (in Ostrava) have been exceeded.

On the basis of maps showing areal distribution of the respective air quality characteristics, the **areas where limit values are being exceeded** for at least one substance except ozone (As, Cd, Ni and BaP) were delimited in 26.8% of the Czech Republic's territory in 2012. The limit value for BaP was exceeded repeatedly in 2012 (see above). The limit values for arsenic (As), cadmium (Cd), nickel (Ni) and lead (Pb) were not exceeded in any monitored site in 2012. Since the measuring stations are located in line with legislation, **information concerning air pollution in smaller settlements is missing**. The issue of small settlements is only mentioned in case and as far as BaP is concerned, measurements are taken manually in rural locations but their number is too low. In the small settlements (with population below 10,000), where almost half the inhabitants of the Czech Republic live, increased to above-limit concentrations of air pollutants have been measured. This concerns, in particular, suspended particulate matter, PAH and heavy metals. This means that air pollution in smaller settlements can be comparable to larger urban agglomerations. The worsened air quality in Czech rural areas is caused, inter alia, by the burning of solid fuels, especially in local furnaces.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1835)

[2] *EEA 2007. Air pollution in Europe 1990-2004. EEA Report No 2/2007. Available from: http://www.eea.europa.eu/publications/eea_report_2007_2.*

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

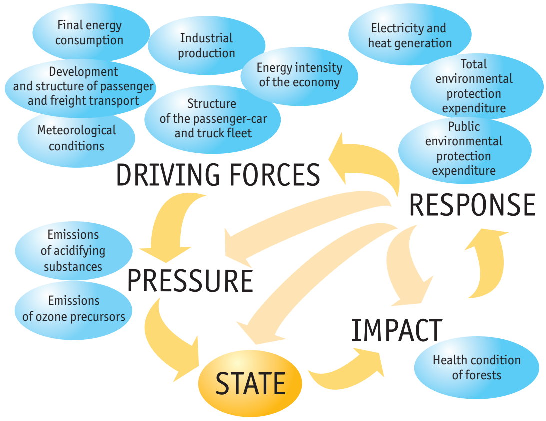
KEY QUESTION

Have the limit and target values to protect ecosystems and vegetation been exceeded?

KEY MESSAGES

In 2012, the limit value for ozone to protect ecosystems and vegetation was exceeded in only 5 (14.3% of all the total number of stations) out of the total 36 monitoring stations identified as rural or suburban. In 2011, this was in 21.6% of the total number of stations. The improving trend, therefore, continues. Likewise in the previous five years, the limit values for SO_2 and NO_x for the protection of ecosystems and vegetation have not been exceeded in any rural site in 2012. The limit value for SO_2 for the winter season 2011/2012 has not been exceeded either.

Since 2001 there has not been a significant reduction in the atmospheric deposition of sulphur, nitrogen, and hydrogen ions. In the 2011/2012 interannual comparison, the total atmospheric deposition increased slightly.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The air pollution limits and upper and lower limits for the assessment of pollution levels to protect ecosystems and vegetation for ground-level ozone, expressed as AOT40 exposure index[1], SO_2 and NO_x are provided for by the **Act No 201/2012 on air protection** and 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.

Reduction of the ground-level ozone precursors (NO_x and VOCs) emissions and impact of ozone on the environment are dealt with by the **protocols to the Convention on Long-Range Transboundary Air Pollution (CLRTAP)**, particularly the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone**.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

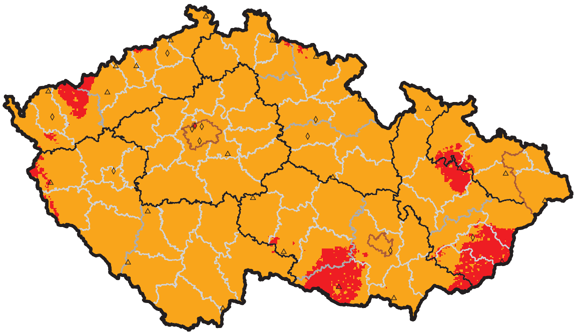
Ground-level ozone, precursors of ground-level ozone and atmospheric deposition have toxic impacts not only on humans but also on plants and animals. Increased concentrations of ground-level ozone cause headaches, eye irritation and pulmonary oedema and they also have negative impacts on the respiratory system.

The effects of ground-level ozone on vegetation are serious. Ground-level ozone influences vegetation at the biochemical, cellular and physiological levels. It causes degenerative changes and phytotoxicity, i.e. photosynthesis is interrupted temporarily and the plants therefore grow to a smaller size. The effects that ground-level ozone has on vegetation result in a negative influence on health of the whole ecosystems, which can also have an impact on human society, e.g. in reduced agricultural production. Vast forest areas are threatened by acidic atmospheric deposition; as a result of direct exposure to high pollutant concentrations in the air, subsequently there is major acidification of soil and aquatic ecosystems, and therefore disrupted health of the forest stands. Both atmospheric deposition and ground-level ozone reduce the resistance of vegetation against external influences and they also affect hydrological conditions and biodiversity.

[1] *Pro 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 8:00 and 20:00 CET (= 7:00 to 19:00 UTC), calculated from hourly values during the summer season (1 May–31 July).*

INDICATOR ASSESSMENT

Figure 1 ➜ **Fields of the AOT40 index values, a five-year average [μg.m⁻³.h], 2008–2012**

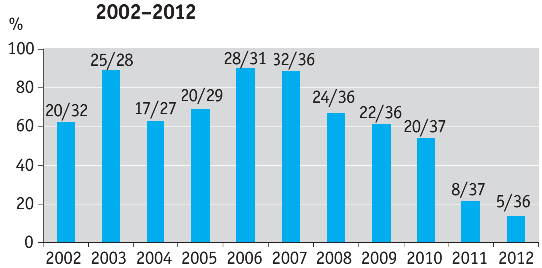


Classification of stations
- ◊ Suburban background
- △ Rural

AOT40
- ≤ 18 000 (≤ LV)
- ≥ 18 000 (> LV)

Source: Czech Hydrometeorological Institute

Chart 1 ➜ **Percentage of stations at which the limit value – expressed as AOT40 (5-year average) – for the protection of vegetation was exceeded [%], 2002–2012**

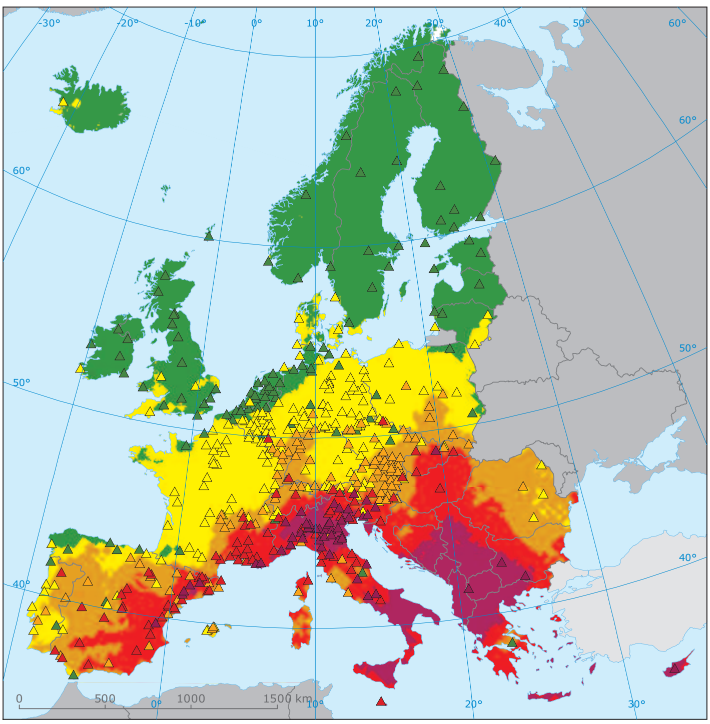


Number of stations where the target limit value was exceeded

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 background stations for which AOT40 calculation is relevant under the legislation.

Figure 2 ➜ **Map of the exposure index AOT40 values in Europe [μg.m⁻³.h], 2009**

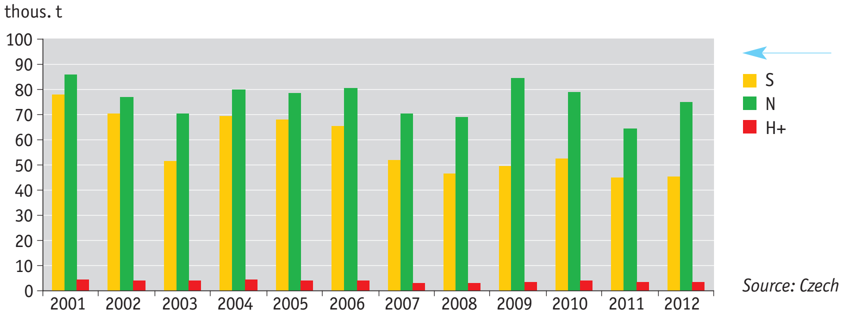


- < 6 000
- 6 000–12 000
- 12 000–18 000
- 18 000–27 000
- > 27 000
- Data missing
- Area with poor data coverage

Source: EEA

The calculation of the AOT40 index is based on ozone concentrations measured only in stations classified as rural stations.

Chart 2 → **Trends in the total atmospheric deposition of sulphur, nitrogen and hydrogen ions in the Czech Republic [thous. t], 2001–2012**



Source: Czech Hydrometeorological Institute

The **limit value for ozone (AOT40)** to protect ecosystems and vegetation (the relevant calculation according to the legislation) was not exceeded on most of the Czech Republic's territory in 2012. In comparison with the previous period assessed (2007–2011), there was a slight decrease in the area of the Czech Republic (Fig. 1).

Out of the total number of 36 rural and suburban stations, the ozone target value to protect ecosystems and vegetation (i.e. the average for 2008–2012) was exceeded at 5 stations according to the 2012 evaluation. In 2011, the limit value for ozone to protect ecosystems and vegetation was exceeded at 8 stations out of a total of 37 (Chart 1).

Interannual changes in the value of AOT40 exposure index are affected not only by the sum of ozone precursor emissions, but more particularly by meteorological parameters (temperature, precipitation, solar radiation) in the period from May to July for which the indicator is calculated. As opposed to the year 2011, the decline in the value of AOT40 index for the year 2012 was recorded in a comparable number of places as its rise. During the period of 2008–2012, the highest values were achieved in 2008 (if the year itself is to be assessed), when high temperatures and low rainfall had been recorded in long terms.

The annual limit values for SO_2 and NO_x to protect ecosystems and vegetation have not been exceeded in any rural site in 2012. The limit value for SO_2 for the winter season 2011/2012 to protect ecosystems and vegetation has not been exceeded either.

The highest AOT40 exposure index values **on the European continent** are recorded in southern, southeast and eastern Europe (Figure 2). This is caused by a combination of climatic conditions that are favourable for the formation of ground-level ozone in those areas (high temperatures and intense sunlight) and high emissions of ozone precursors. In 2009, the target limit value for AOT40 was exceeded approximately on 22% of the agricultural land in 32 EEA member states (with the exception of Turkey). In comparison with the year 2008, when 38% of agricultural land was exposed to ground-level ozone concentrations, lower values of AOT40 exposure index have been achieved in north-west Europe. In contrast, higher values were measured in south-east Europe. The worst year was 2006, when 70% of agricultural land was exposed to ground-level ozone concentrations exceeding the target limit value.

The total atmospheric deposition field (Chart 2) is the sum of wet and dry atmospheric depositions. Atmospheric deposition remains high in many areas of the Czech Republic. It is caused by emissions from domestic industrial sources and emissions from transport (particularly NO_x emissions), however, remote transfer from the area of Central Europe – Germany, Poland and Slovakia – also has its share. In 2012, the total atmospheric deposition of sulphur showed the overall level corresponding to the value of 45,675 t per the 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 (Krušne hory), where there are also the maximum values of the throughfall sulphur deposition. In 2012, the total deposition of nitrogen was equal to 75,133 t (oxidized + reduced forms) per year and km^2. The highest values of the total deposition of nitrogen have been recorded in the Giant Mountains (Krkonoše), and also in the Jizera Mts. (Jizerské hory) and Ore Mts. (Krušné hory). In the last decade, the value of the total nitrogen deposition was varying between 70,000 and 80,000 t per year as a result of NO_x emissions from mobile sources. In 2012, the total deposition of hydrogen ions was 3,313 t per year and area of the Czech Republic. The highest values of the total atmospheric deposition of hydrogen ions are recorded in the territory of the Ore Mts. (Krušné hory).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1836)

08/ Water abstraction

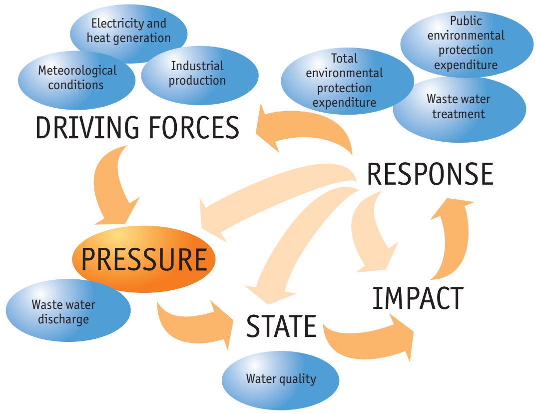
KEY QUESTION

Is water in the Czech Republic being used sustainably with respect to availability of water sources in the future?

KEY MESSAGES

The trend of decreasing water abstraction and consumption has continued. As in the previous year, in 2012 there was also a reduction of the total water consumption a part of which is attributed to abstraction from surface waters. Groundwater abstraction has stagnated. As opposed to the year 2011, the most significant reduction was recorded in water abstraction for the energy sector (by 7.8%). The volume of invoiced water has declined for all groups of customers; overall, this difference amounted to 1.1% in comparison with the previous year. The total water consumption in households has declined (88.1 $l.inhab.^{-1}.day^{-1}$) as well as the loss of water in water mains (19.3% in 2012, compared to 25% in 2000). In addition, the number of inhabitants connected to water supply networks has increased interannually.

Within the water abstraction structure, there was an interannual increase only in abstraction for agriculture (11.1%) as a result of inevitable request for irrigation water, and also in abstraction for the industry (5.0%), which, nevertheless, did not have an impact on any increase in the total abstraction. There is also an increase in the prices of water and sewer rates.



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, in particular 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** are important documents at the national level which are based on the Framework Directive. 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**, which also deals with securing a smooth supply of the population and other consumers with sanitary and high-quality water.

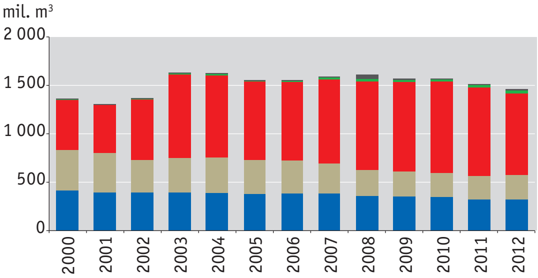
Also the **Conception of the Agrarian Policy of the Czech Republic for the Period after EU Accession (2004–2013)** and the **Conception of Water Management Policy of the Ministry of Agriculture of the Czech Republic till 2015** aim at similar tasks. These Conceptions focus on creating the conditions 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, 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.

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. m³], 2000–2012**

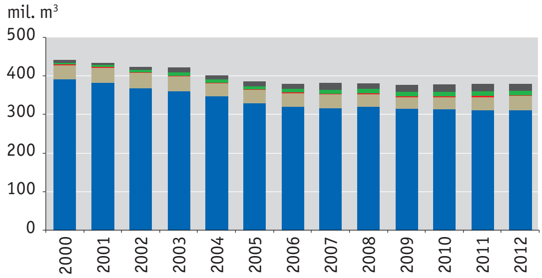


Others (incl. construction)
Agriculture, forestry and fishery
Energy sector
Industry (incl. mining)
Public water mains

Source: Ministry of Agriculture, T. G. Masaryk Water Research Institute

Water abstraction by users in excess of 6,000 m³ per year or 500 m³ 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. m³], 2000–2012**

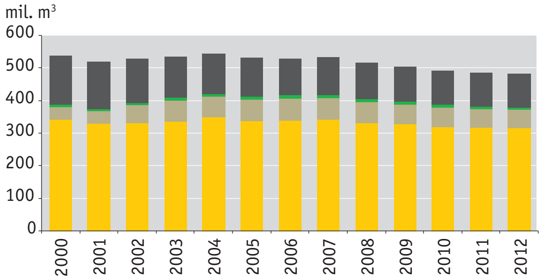


Others (incl. construction)
Agriculture, forestry and fishery
Energy sector
Industry (incl. mining)
Public water mains

Source: Ministry of Agriculture, T. G. Masaryk Water Research Institute

Water abstraction by users in excess of 6,000 m³ per year or 500 m³ 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. m³], 2000–2012**

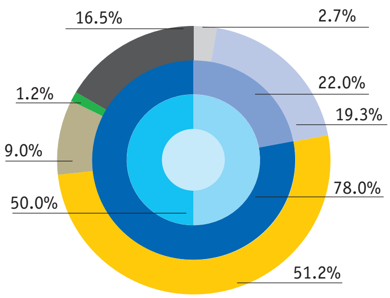


Source: Czech Statistical Office

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

Until 2003, only data for the main operators are provided. Invoiced drinking water is concerned.

Chart 4 ➜ **The use of water in the Czech Republic [mil. m³], 2012**

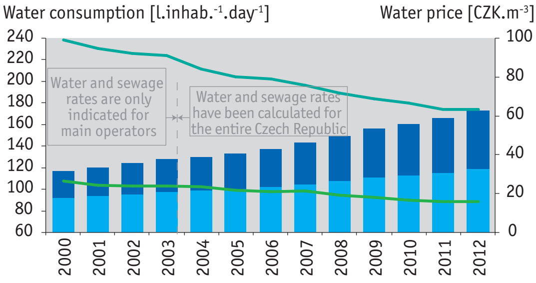


Source: Czech Statistical Office

Produced water intended for implementation 616.4 mil. m³
Groundwater 311.9 mil. m³
Surface water 311.6 mil. m³
Water not invoiced 135.7 mil. m³
Water invoiced 480.7 mil. m³
Water invoiced for households 315.9 mil. m³
Water invoiced for industry 55.6 mil. m³
Water invoiced for agriculture 7.2 mil. m³
Water invoiced for other users 102.0 mil. m³
Other not invoiced water 16.7 mil. m³

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}], 2000–2012**

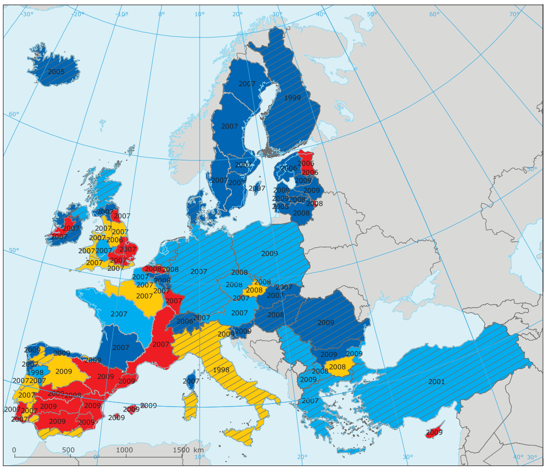


Source: Czech Statistical Office

- Specific consumptive use of water produced (left axis)
- Water consumption in households (left axis)
- Average sewage rate (right axis)
- Average water rate (right axis)

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.

Figure 1 → **International comparison of water shortage expressed as using renewable water resources by means of WEI index [%]**



Source: EEA

WEI index (%)
- 0–10 without stress
- 11–20 without stress
- 21–40 water stress
- over 40 extreme water stress

The WEI index (water exploitation index)[1] which expresses water shortage is calculated as a proportion of the total water abstraction in the volume of renewable water supplies. Depending on data availability, the Index values are provided for the period 1998–2009. The map shows the maximum currently available level of detail. Data at the level of states are hachured; those on the river basin level are not. The EEA has taken the background data over from the following sources: WISE, DG ENV, and Eurostat.

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 2012, the total water abstraction amounted to 1,840.7 mil. m^3, which represented a decrease by 2.7% compared to the previous year. Abstraction from surface sources accounted for 79.4% of the total volume of water abstracted.

The **structure of abstraction from surface water and groundwater** by user groups (CZ-NACE classification) has been stable since 2003 (Chart 1, Chart 2). Of the total water abstraction, the greatest part is made in the **energy sector** (45.7%, 840.7 mil. m^3 in 2012). In vast majority, this is abstraction of water for through-flow cooling of steam turbines, and therefore 99.8% of abstraction in the energy sector (839.2 mil. m^3), are taken from surface water. Compared to last year, this abstraction decreased by 7.7%. 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 lost by evaporation. On the other hand, the biggest volume of abstraction from groundwater sources (312.4 mil. m^3, 82.3% as opposed to 22.4% 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 2012, 50.0% of drinking water was produced from groundwater sources in the Czech Republic. In the Czech Republic, one-third 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 20.8%, 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.

[1] The WEI index describes the pressure that the total abstraction of water exerts on water resources and thus it 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.

In 2012, the **industry** was the third-largest consumer of water (i.e. surface water) (15.8% 290.4 mil. m³). Water abstraction for the industry sector accounted for 17.4% of abstraction from surface water sources and only 9.7% of abstraction from groundwater sources. Abstraction for the industry (including mining and quarrying) shows a long-term decline (since 2000 by 36.5%), however, within the 2011/2012 interannual comparison there was an increase in abstraction from both groundwater sources (by 5.0%) and surface sources (by 5.2%). This increase occurred in spite of the fact that the total industrial production showed an interannual decrease but for example in production of chemical substances and chemical preparations, which is a major consumer of water, the production increased interannually and was therefore reflected in increased abstraction. 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 (2.4% of the total abstraction in 2012); 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 has been an increase in water abstraction for agriculture by 11.1% (14.3% for surface water and 3.4% for groundwater). The abstraction increase was partly influenced by 2012 spring precipitation which was below the long-term mean. The interannual increase may not correspond fully to the actual abstraction, which is caused by the fact that according to the respective legislation, only a part of abstracted water is charged but, for the performance of water balance, all abstracted water must be reported and this increase is thus partly a result of improved reporting discipline.

Water companies belong to entities that abstract most water in the Czech Republic. In 2012, a total of 623.5 mil. m^3 of water were produced, of which 616.4 mil. m^3 were intended for implementation and 480.7 mil. m^3 was **drinking water** invoiced to households, industry, agriculture and other users (Chart 3, Chart 4). Since 2007, the amount of the invoiced drinking water has been decreasing continually (a decline by 9.6% between 2007 and 2012). Households, which accounted for 65.7% of drinking water abstraction (315.9 mil. m^3) in 2012, have been decreasing their consumption since 2004 (Chart 3). There was an interannual (2011/2012) decline in abstraction for all of the customers. Reduction of the quantity of water produced is also derived from the reduction of drinking water loss in distribution networks, which was 19.3% of the total volume of produced water intended for implementation in 2012 (in 2000 this was 25%). This means that 33.0 l of water were lost per each inhabitant in 2012 and **water consumption** per one inhabitant supplied from public water mains amounted to 174.0 $l.inhab.^{-1}.day^{-1}$ (specific consumptive use of the water produced). The per capita water consumption reflects the trends in water abstraction (Chart 5). In households 88.1 $l.inhab.^{-1}.day^{-1}$ were consumed in 2012, which is 81.9% of the value of the year 2000. Reducing water consumption in households is connected with 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 9.8 mil. people (93.5% of the Czech Republic's population). There is also a long-term influence of rising **water and sewer rates**, which have increased by another 6.1% compared to the year 2011, 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.

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 belongs to countries with a sufficient quantity of water resources relative to water consumption; only in the Morava catchment area, the volume of water abstraction is higher in relation to the supplies (Fig. 1). The most vulnerable regions are located in Spain, Portugal, Italy, Cyprus, southern and eastern France, in the south of the United Kingdom (England, Wales), in Belgium and Estonia. The lack of water in these areas is caused by adverse natural conditions (climate, character of the river network, geological conditions, etc.) and as a result of anthropogenic interventions in the water regime. Uneconomical use of water and an increase in abstraction, especially for agricultural production, have a greater impact on the overall water balance in these regions rather than in countries with enough water resources. 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), such as Sweden, Denmark, Finland, the Baltic states, Slovakia or Iceland, this condition is clearly influenced by the natural conditions (higher precipitation, river network density, water content of watercourses, area of still water).

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

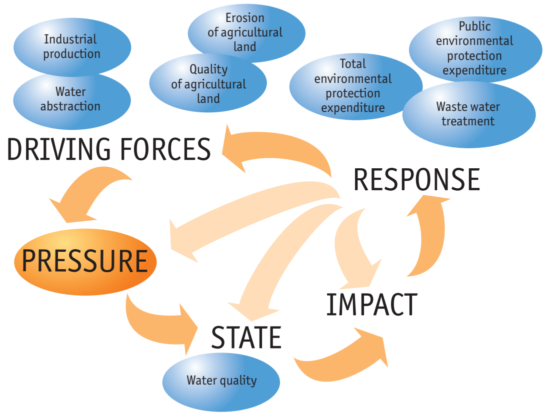
KEY QUESTION

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

KEY MESSAGES

Compared to the year 2011, the total amount of discharged waste water was reduced by 4.6%. The biggest decline was recorded for water discharged by the industry (8.6%). From a long-term perspective, the trend of reducing the pollution discharged from point sources continues. This trend is also reflected in the last interannual comparison. Since 1993, emissions of BOD_5 decreased by 93.9% (by 9.6% compared to the year 2011), COD_{Cr} by 87.1% (by 4.4% compared to 2011), suspended solids by 90.9%, i.e. by 6.2 % in comparison with 2011. $N_{inorg.}$ emissions have decreased by 25.4% (5.3% compared to the year 2011) and P_{total} by 33.6% since 2003.

The total amount of waste water discharged from point sources has stagnated in the last decade. Compared to the year 2011, the discharge of phosphorus increased slightly (by 1.1%).



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 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 wastewater treatment plants (in accordance with the requirements of Council Directive 91/271/EEC concerning urban wastewater treatment).

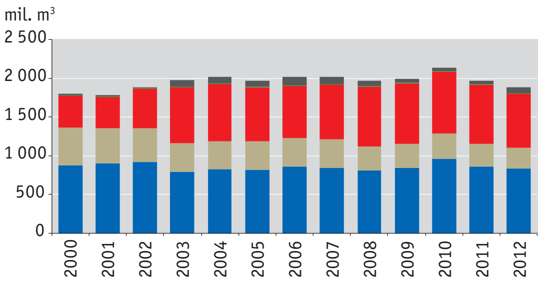
Among other things, the **Plan of Major River Basin Districts of the Czech Republic** stresses the need to introduce best available techniques (BAT) into production processes and best available technologies into waste water removal. Specific objectives and programmes of measures to improve the quality of surface water and groundwater are laid down by the **River Basins Management Plans**. Since 2010, the adopted programmes of measures are under implementation and in 2012 the state of and progress in implementation of these measures were assessed.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The amount of waste water, produced pollution and pollution that is discharged subsequently into surface water directly affects 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. 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. m^3], 2000–2012**

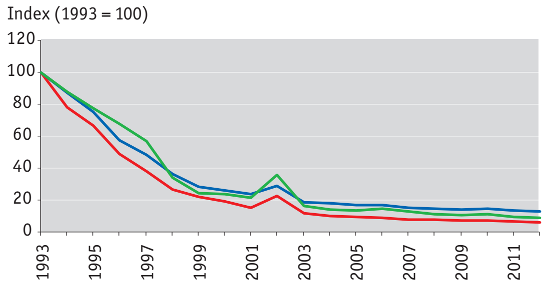


- Others (incl. construction)
- Agriculture (incl. irrigation, excl. fish farming)
- Energy sector
- Industry (incl. mining)
- Public sewerage

Source: Ministry of Agriculture and Povodí, state enterprise

Since 2002, the discharge of waste water or mining water in excess of 6,000 m^3 per year or 500 m^3 per month is kept on record – pursuant to section 10 of Decree No. 431/2001 Coll.

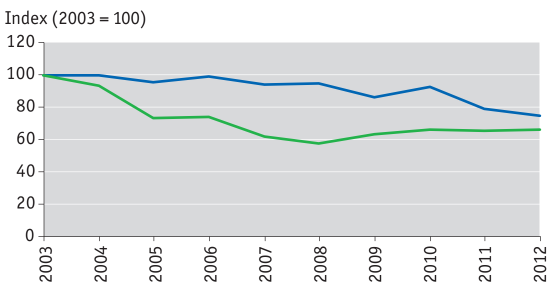
Chart 2 ➜ **Relative representation of pollution discharged from point sources – the BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 1993 = 100], 1993–2012**



- Suspended solids
- COD_{Cr}
- BOD_5

Source: Ministry of Agriculture and Povodí, state enterprise

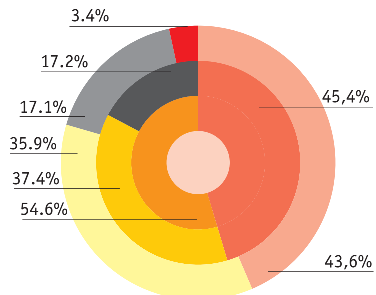
Chart 3 ➜ **Relative representation of pollution discharged from point sources – the $N_{inorg.}$ and P_{total} in the Czech Republic [index, 2003 = 100], 2003–2012**



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

Source: Ministry of Agriculture and Povodí, state enterprise

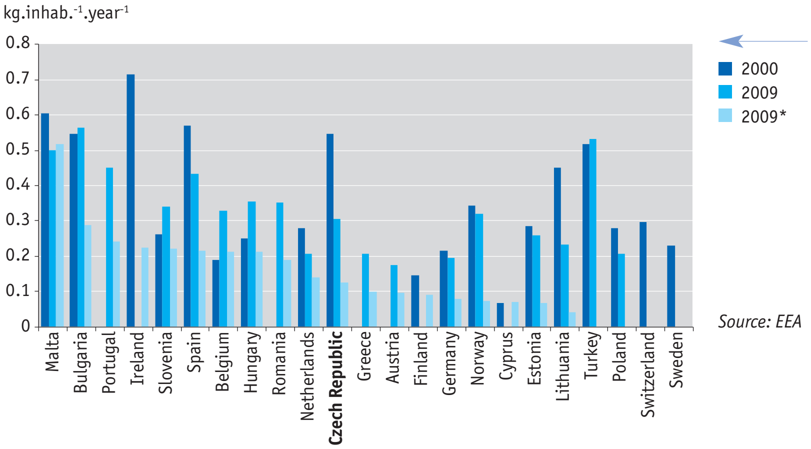
Chart 4 ➜ **The quantity of waste water discharged into surface water in the Czech Republic [mil. m^3], 2012**



- Water discharged into watercourses 866.2 mil. m^3
- Rainwater 393.0 mil. m^3
- Wastewater discharged into sewerage 473.2 mil. m^3
- Sewage 323.8 mil. m^3
- Industrial and other water 149.4 mil. m^3
- Treated rainwater 377.3 mil. m^3
- Treated sewage 311.2 mil. m^3
- Treated industrial and other water 148.2 mil. m^3
- Untreated wastewater and rainwater 29.5 mil. m^3

Source: Czech Statistical Office

Chart 5 ➜ **International comparison of emission intensity of phosphorus in household sector [kg. inhab.$^{-1}$.year^{-1}], 2000 and 2009**



The Chart shows the changes in phosphorus emission intensity in the household sectors of various European countries, sorted by the values for the year 2009. The calculation is based on the proportion of the volume of phosphorus discharged into watercourses from sewerage 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.*

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 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 sewer systems. The reason consisted in a higher total rainfall which increased the volume of collected rainwater. In 2012, the total volume of waste water discharged from point sources was only 1,884.9 mil. m^3 and compared to the previous year it fell by 4.6%; however, it is necessary to take into consideration that precipitation was above average in 2011.

The **waste water discharge structure** corresponds to the structure of the customers and it has not changed significantly for the last 10 years. Discharge from public sewers (44.3% and 835.7 mil. m^3) and the energy sector (37.4% to 704.7 mil. m^3) comprise the biggest parts. In 2012, there was a slight decrease in the volume of **municipal waste water** (sewage and rainwater) by 2.9%. These 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 only affects the temperature and oxygen content in water. In 2012, the volume of waste water discharged by the energy sector declined by 8.4%, which was caused by a significant decrease of registered entities discharging water from this sector. **Industrial waste water** is another major source of pollution (14.2% and 268.1 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 8.6%. The chemical, paper, mining and food industries belong to the biggest producers of industrial waste water. **Agriculture** is a specific polluter of surface water which discharged only 0.4% of the volume of waste water discharged from point sources (6.6 mil. m^3) in 2012 but 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 surface water and groundwater. Diffuse pollution is a major source of nitrates and pesticides and it also brings about acidification. The amount of the substances that get into water is also affected, inter alia, by application and dosing of fertilizers and application of plant protection preparations used in agricultural production, as well as the conditions for soil erosion of agricultural land. In 2012, a significant increase was recorded in the volume of waste water discharged from point sources in the category **„other sources"** (54.3%) which also includes the construction industry. The increase was due to a 30% increase in the number of registered entities that discharge waste water in this category.

Along with the volume of discharged effluent, the quantity of discharged pollution is also very important as it indicates potential water pollution. Since 1993 (and 2003) there has been usually a decline in the **quantity of pollution discharged from point sources** for the indicators monitored (Chart 2, Chart 3). Over the past 20 years, organic pollution expressed as **BOD_5** has decreased to 6,141 t, which represents 6.1% of the 1993 value; **COD_{Cr}** declined to 40,822 t, i.e. 12.9% of the 1993 value and **suspended solids** to 11,159 t, i.e. 9.1% of the 1993 value (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 both municipal and 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 was therefore reflected in the total volume of water discharged (Chart 1). The interannual change (2011/2012) confirmed further reduction of discharged pollution, namely for BOD_5 by 9.6%, COD_{Cr} by 4.4% and suspended solids by 6.2% (Chart 2). Discharge of **nutrients (nitrogen and phosphorus)** from point sources, the main originator of eutrophication, has been declining in recent years. Compared to the year 2011, the amount of discharged nitrogen ($N_{inorg.}$) has decreased by 5.3% and that of phosphorus (P_{total}) has increased slightly by 1.1% (Chart 3). From a long-term perspective, the improvement was much more significant - since 2003, the quantity of $N_{inorg.}$ decreased by 25.4% and that of P_{total} even by 33.6%. The long-term decline is caused by reducing the amount of phosphate 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).

International comparison of phosphorus discharged into surface water, calculated per capita (Chart 5), is an indicator to assess the level of decoupling for nutrient emissions into the aquatic environment and population growth in Europe. Emissions of phosphorus originate almost exclusively from washing powders and preparations for dishwashers. For the vast majority of countries, there was a decline in phosphorus emissions into surface water in comparison with the year 2009. In states with higher phosphorus emissions (Malta, Bulgaria, Portugal), a low proportion of treated water and predominance of primary and secondary treatment stages over the tertiary stage play the main role.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

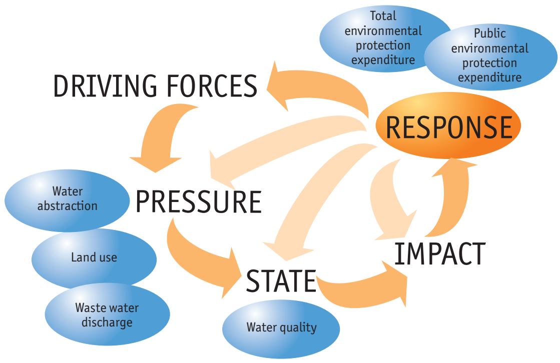
CENIA, key environmental indicators

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 sewerage systems and waste water treatment plants and what is the proportion of treated waste water?



KEY MESSAGES →

Increase of the number of inhabitants connected to public sewers continues. In 2012, 82.5% of the Czech Republic's population was connected to a public sewer, of which 94.9% were connected to a sewer system ending in a wastewater treatment plant. Compared to the previous year, the volume of waste water discharged into a sewage system (without precipitation water) decreased by 3.0%. A total of 97.3% of waste water discharged into sewage systems has been treated. Increase in the total number of wastewater treatment plants, and especially those with tertiary treatment, also continues. The average efficiency of a wastewater treatment plant measured by means of concentrations of the basic pollution indicators varies between 74.8% and 98.1%.

In the last interannual (2011/2012) comparison, there was slow-down in growth of the proportion of the population connected to a sewer system ending in a wastewater treatment plant.

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 municipal 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 the 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.

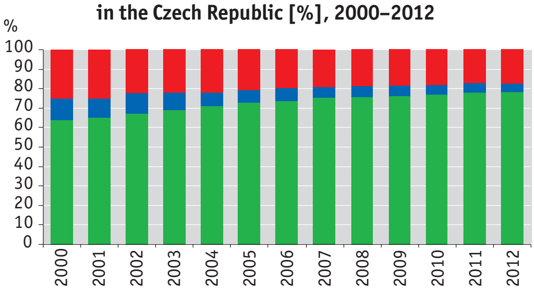
The basic conceptual document which actually deals with waste water treatment is the **Development Plan for Water Supply and Sewerage Systems of the Czech Republic**. This is a mid-term strategy of state policy concerning water supply and sewerage systems prior to 2015 that is linked to other strategic documents, while respecting the requirements of relevant EU legislation (e.g. Council Directive 91/271/EEC concerning urban wastewater 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.

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

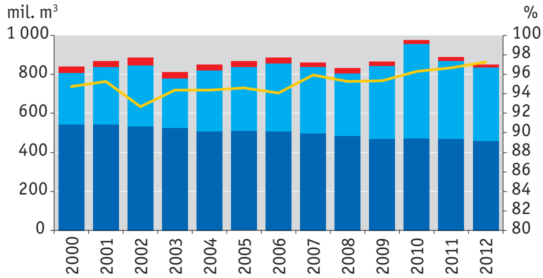
Chart 1 ➜ **Proportion of the population connected to sewerage systems and to sewerage systems ending in WWTPs in the Czech Republic [%], 2000–2012**



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, %], 2000–2012**

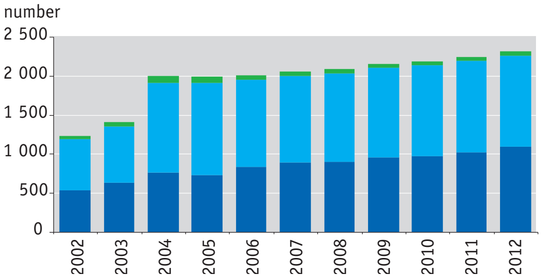


Source: Czech Statistical Office

- 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)

For the years 2000–2003, 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).

Chart 3 ➜ **Number of waste water treatment plants according to treatment stages in the Czech Republic, 2002–2012**

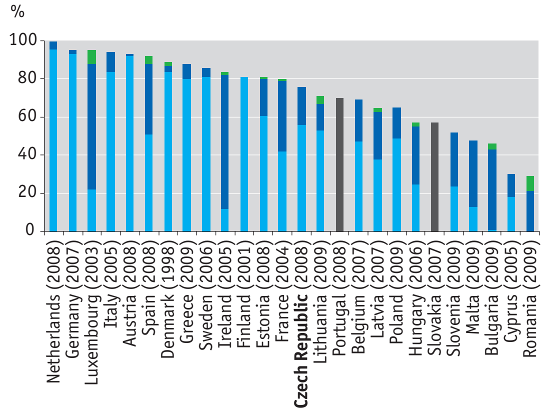


Source: Czech Statistical Office

- Tertiary treatment
- Secondary treatmetnt
- Primary treatment

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

Chart 4 ➜ **International comparison of the proportion of the population connected to WWTP according to treatment stages [%]**



Source: Eurostat

- Primary treatment
- Secondary treatmetnt
- Tertiary treatment
- Treatment stage not identified

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

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** in the Czech Republic rose from 77.7% to 82.5% in 2012 (Chart 1). The increase in the proportion of the population connected to a sewer system ending in a wastewater treatment plant was particularly positive. The interannual increase of the population connected to a sewerage system is slowing down. In 2012, there has been slight increase in the number of inhabitants connected to public sewers, but due to faster population growth, the final proportion of the connected population decreased. The cause consists in the fact that most sewer 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 2012, waste water produced by 21.6% 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 2011, the **total volume of water discharged to public sewerage systems** (without precipitation water) decreased by 3.0% and amounted to 473.2 mil. m³ in 2012, which represents almost half the volume of the year 1989. A total of 14 mil. m³ of this waste water was treated (Chart 2). Nevertheless, the **proportion of treated wastewater** that is discharged into sewerage is very satisfactory – in 2012 it was 97.3% 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 wastewater treatment plants that were affected by floods. A part of rainwater is also treated in WWTPs. Its quantity has shown large interannual fluctuations which correspond to precipitation levels in the respective years. In 2012, 377.3 mil. m³ of rainwater were treated.

In the Czech Republic, the **total number of WWTPs** for public use doubled to 2.318 compared with the year 2000 (Chart 3). Their total capacity decreased slightly (by 3.7%) because of reconstruction of older plants but the volume of wastewater discharged into sewage systems has been decreasing gradually, too. Due to construction and modernization of waste water treatment plants, the total number of WWTPs with nitrogen or phosphorus removal (tertiary treatment) increased by 72 in all agglomerations of the Czech Republic, the number of those with basic mechanical-biological treatment decreased by 5 and the number of mechanical WWTPs remained unchanged compared to the year 2011. 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. By the end of 2012, wastewater treatment for all agglomerations with PE over 2,000 had not been ensured as it is required by the Council Directive 91/271/EEC, but in the course of the year, new WWTPs were put into operation and the existing ones were reconstructed or extended.

In the Czech Republic, the **average efficiency of WWTPs** (the amount of pollution removed) is very high – in 2012 it was for BOD_5 98.1%, for suspended solids 97.5%, for COD_{Cr} 94.6%, for P_{total} 82.9% and for N_{total} 74.8 %. The values are similar to those in previous years, which is connected with the fact that reconstruction of most large waste water treatment plants is complete and the amount of pollution produced in individual agglomerations has stabilized.

In an **international comparison** (Chart 4), there is a generally better situation in the countries of northern, western and partly also southern Europe as far as the population's connection to WWTPs and treatment stages are concerned. The states of Eastern Europe and the Balkans lag behind the EU average. The Czech Republic holds the leading positions among the new EU member states in the share of the population connected to sewer with a waste water treatment plant and in the proportion of tertiary treatment. In these terms, the worst situation is in Romania and Bulgaria (EU members since 2007), which began to build sewerage infrastructure intensively with regard to implementation of the EU legislation in the last few years. Existence of great regional differences in these indicators between the cities and rural regions is also typical for these countries.

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

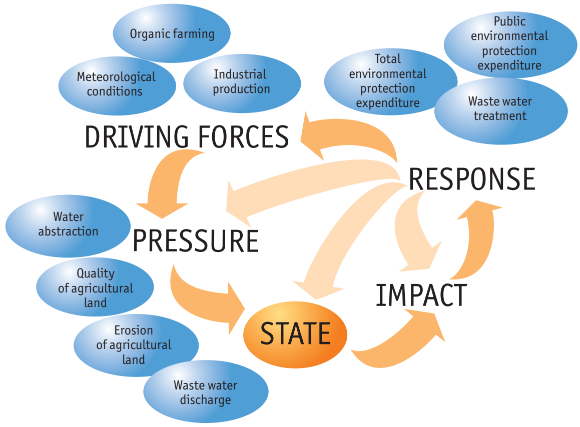
KEY QUESTION

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. Chlorophyll 'a' is the only exception; it shows a significant interannual fluctuation which is caused by close relation of this indicator to the course of temperatures in a given year. Environmental quality standards, especially for N-NO_3^-, cadmium and COD_{Cr}, are not being exceeded.

Interannually, there was an increase in concentrations of some quality indicators; slightly for COD_{Cr} (by 1.7%), N-NO_3^- (by 1.1%) and chlorophyll 'a' (by 4.8%). A more significant increase was recorded for total phosphorus (16.6%) and cadmium (19.8%). The situation regarding eutrophication of still and flowing waters is generally unsatisfactory and it is necessary to permanently reduce the burden of water with nutrients, especially compounds of phosphorus.



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 t**hat 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.

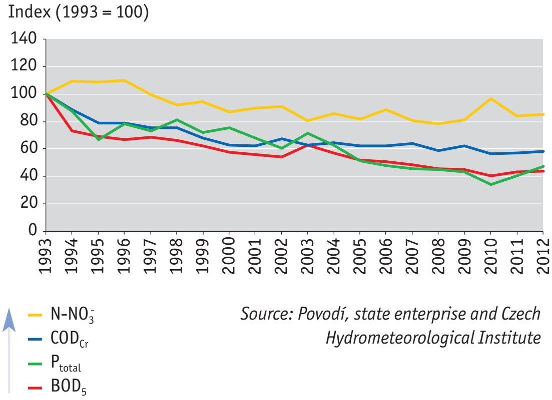
Diffuse pollution associated with agriculture is also a significant source of pollutants. One of the axes of the **National Strategic Rural Development Plan in the Czech Republic in 2007–2013** also deals with protection of the quality of surface water and groundwater sources through measures related 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 is problematic in the context of drinking water production and it poses a direct health risk within using surface water 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 settled hazardous substances also get into water with them.

INDICATOR ASSESSMENT

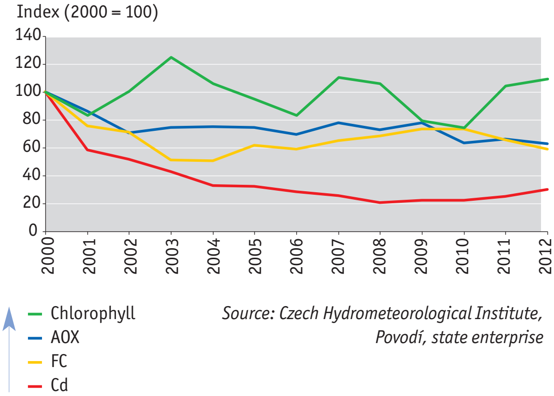
Chart 1 ➜ **Trends in concentrations of pollution indicators of watercourses in the Czech Republic [index, 1993 = 100], 1993–2012**



Source: Povodí, state enterprise and 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 the availability of data. The water quality assessment for BOD_5, COD_{Cr}, N-NO_3^- and P_{total} were carried out for the period 1993–2012, most frequently for a set of 68 stations.

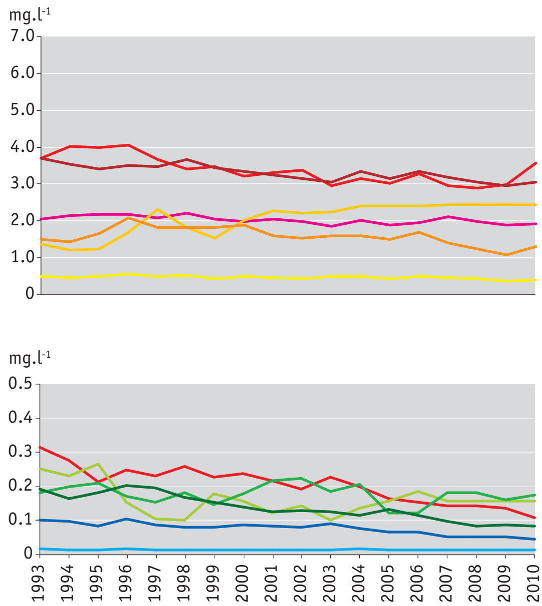
Chart 2 ➜ **Trends in concentrations of pollution indicators in watercourses in the Czech Republic [index, 2000 = 100], 2000–2012**



Source: Czech Hydrometeorological Institute, Povodí, state enterprise

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 the availability of data. The water quality assessment for AOX (29–61 stations), Cd (42–58 stations), FC (62–69) and chlorophyll 'a' (51–69 stations) was carried out for the period 2000–2012.

Chart 3 ➜ **Comparison of nutrient pollution in watercourses of the Czech Republic and European georegions [mg.l^{-1}], 1993–2010**



Nitrates
- **Czech Republic**
- western Europe (583)
- eastern Europe (302)
- south-eastern Europe (84)
- southern Europe (186)
- northern Europe (203)

Orthophosphates
- **Czech Republic**
- southern Europe (78)
- south-eastern Europe (32)
- western Europe (526)
- eastern Europe (190)
- northern Europe (201)

Source: EEA

Concentration of nitrate (total oxidizable nitrogen – Finland, Sweden, Denmark; some data such 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 12) 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, Slovenia, Slovakia; northern Europe – Finland, Norway, Sweden; southern Europe – Spain; south-eastern Europe – Albania, Bulgaria; western Europe – Austria, Belgium, Switzerland, Denmark, Germany, France, Liechtenstein, Luxembourg, the United Kingdom, Ireland (only for orthophosphates).

Figure 1 ➜ **Water quality in watercourses in the Czech Republic, 2011–2012**

- Class I and II – unpolluted or slightly polluted water
- Class III – polluted water
- Class IV – heavily polluted water
- Class V – very heavily polluted water

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[1] for the past 20 years was affected mainly by changes related to the amount of discharged waste water, access to wastewater treatment (the proportion of treated waste water, the treatment stages, construction and reconstruction of WWTPs) and the socio-economic and political development (change of industrial restructuring, growing living standard, accession to the EU). 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, especially in recent years, when the amount of pollution discharged from point sources does not change significantly. 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 the main sources of pollution in surface water and groundwater in the Czech Republic.

During the last 20 years, pollution represented as BOD_5 and P_{total}, whose average concentration in 2012 was 44% and 47% of the 1993 values (Chart 1), has been reduced most in watercourses of the Czech Republic. In this period, the concentrations of COD_{Cr} and particularly N-NO_3^- have not decreased so significantly but they still account for only 58% and 85% of the 1993 values.

Reduction of average concentrations of **organic pollution** in watercourses, 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 wastewater treatment plants. 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 (94.6% in 2012). The efficiency of BOD_5 removal is even higher (98.1%). In 2012, the final concentration of COD_{Cr} in the Czech Republic's watercourses reached 17.81 mg.l^{-1} and that of BOD_5 2.7 mg.l^{-1}, and there was no interannual change in concentrations.

[1] 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 by 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.

In long perspective, the average concentration of total **phosphorus** has also declined; in 2012 it was 0.15 $mg.l^{-1}$ in watercourses. 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 fertilizers 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 wastewater treatment plants are obliged to remove phosphorus. Although there has been an increase in its concentration in the last two years, this value is still below the long-term average for the years 1993–2012. This is caused by not only the application of phosphate fertilisers but also the growing popularity of dishwashers which are in about one-third of Czech households and which use detergents containing phosphorus. The regulation of phosphates in dishwasher detergents will be valid as late as in 2015.

The concentration of **nitrate nitrogen** in watercourses has not decreased significantly compared to the other indicators and since 2003 has a rather fluctuating trend (Chart 1). There was no substantial interannual change; the concentration amounted to 3.13 $mg.l^{-1}$ in 2012. 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 (74.8% in 2012) 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 rainfall-rich years. 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 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 still 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 the water processing plants.

Since 2000, **cadmium** has recorded the greatest decrease in comparison with the other evaluated indicators (Chart 2) in the Czech Republic's watercourses (by 69.9% to 0.1 $\mu g.l^{-1}$ in 2012). Cadmium belongs to hazardous substances and its EQS (0.3 $\mu g.l^{-1}$) almost has not been exceeded in the monitored profiles since 2003 (only 6% of the profiles are above EQS). In long terms, the average concentrations of **AOX** have been stagnating (21.2 $mg.l^{-1}$ in 2012) 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 (23.5%), 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 climate 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 2012, the average concentration of FC was 37.0 $CFU.ml^{-1}$ 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 climate 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 last two years 2011 and 2012 belonged to those with above-average temperatures. In 2012, there was an early beginning of high temperatures, and despite below-average temperatures in June and July, primary production increased; this was also supported by higher supply of nutrients due to higher summer rainfall. In the profiles monitored in the Czech Republic, the average concentration of chlorophyll 'a' has therefore been fluctuating since 2000 (Chart 2) and generally it has not decreased. The value of the year 2012 amounted to 16.9 $\mu g.l^{-1}$, which is above the average for the period 2000–2012 (15.2 $\mu g.l^{-1}$).

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 2012, the lowest proportion of profiles which exceed EQS was achieved for $N\text{-}NO_3^-$ (4.5%), cadmium (5.9%) and COD_{Cr} (7.5%). On the other hand, the highest were for total phosphorus (32.8%) and AOX (23.5%).

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 2012, total of 6,922 km (12.9%) of watercourses managed by Povodí, State Enterprise were included into the quality classes IV or V. This means that quality class IV or V was achieved for at least one of the indicators monitored. In long terms, quality of several watercourses in South Moravia (Litava, Kyjovka) has been worsened and some sections of the Bílina river and a section of the river Lužnice (below the confluence with Nežárka) have also shown the quality class V. In case of the Moravian watercourses it is related to intense agricultural activities; the river Bílina, on the other hand, is a watercourse with a heavy anthropogenic burden (significant pollution with municipal and industrial waste water). The river Lužnice is burdened with municipal pollution and intensive fishing.

Quality of surface water used for bathing 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 (160–188 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 2012 bathing season, 40.5% of bathing water was classified in the best quality category (according to the national evaluation standards); by contrast, bathing was prohibited in 10.4% of the sites, which is a 58.8% increase compared to the year 2011. The reason consists in above-average temperatures in the summer months (especially August) which supported the development of cyanobacteria and faecal pollution also played a role. According to the EU assessment standards, 75.0% of bathing water was included in the best category, i.e. excellent water quality.

In the **international context** it can be concluded that in 1993–2010 there has been a significant decrease in concentration of **phosphorus** (i.e. orthophosphates) in rivers of all regions monitored in Europe (Chart 3). This positive development is mainly brought about by implementation of national and European legislation aimed at reducing pollution discharged in municipal waters, and by introduction of phosphate-free detergents on the market. On average, the lowest concentrations of phosphates are recorded in the rivers of northern Europe; the highest concentrations are in the southern and south-eastern Europe in recent years, where there is a lower percentage of WWTPs with tertiary treatment. The situation regarding eutrophication of flowing and still waters in the Czech Republic continues being unsatisfactory within European comparison and it is necessary to go on reducing the burden on water with nutrients, especially compounds of phosphorus. Pollution with **nitrates** has not recorded such a significant decline; in the South of Europe, there was even a great increase in this type of pollution. The highest level of nitrate contamination has been recorded in the rivers of Western Europe. The pollution reaches the levels recorded in watercourses in the Czech Republic. The reason consists in the concept of intensive agricultural production and 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=1775)

12/ Health condition of forests

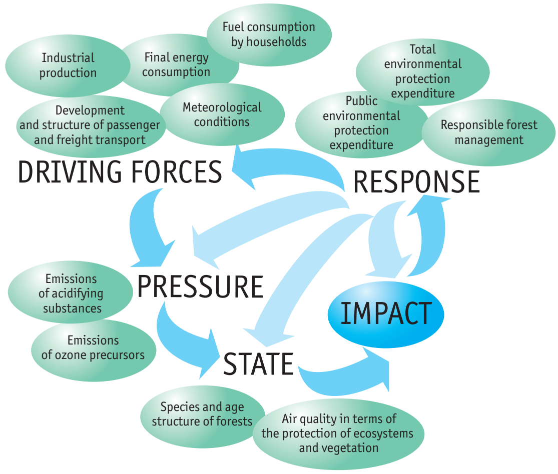
KEY QUESTION

What development has there been in the health condition of forest stands?

KEY MESSAGES

Damage to forest stands in the Czech Republic expressed as the percentage of defoliation has not been progressing as fast as it did in the past. This can be considered as a response of forest stands to air pollution improvement in the last two decades.

Despite slight decrease in the last year, the defoliation rate remains very high in the Czech Republic. Representation of older coniferous stands (over 59 years) in class 2 to 4[1] accounted for 72.5%, for younger coniferous trees (under 59 years) it was 21.8%, for older deciduous trees 39.8% and for younger deciduous trees 15.3% in 2012.



OVERALL ASSESSMENT

Change since 1990	N/A
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 „reducing the impacts of global climate change and extreme meteorological phenomena", „to 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 biodiversity of forest stands towards a natural species composition, enhancing the structural diversity of forests, naturally renewing species that are genetically suitable and improving the non-production functions of forest ecosystems.

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

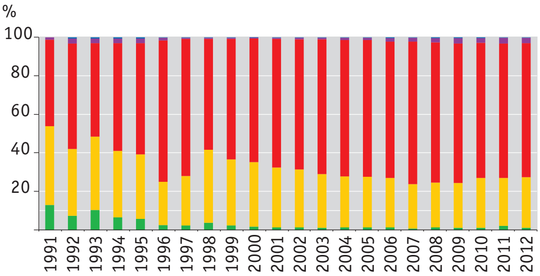
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Healthy forests are important not only as a sustainable source of wood and other material goods, but mainly as a source of non-productive functions (in particular protecting soil against erosion, promoting the water cycle, conserving nature, air quality, controlling floods and droughts, health-related and sanitary functions, recreational and spiritual functions). The declining health of forests has impacts on not only the ecosystems and species living in them, but also on the whole society.

[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

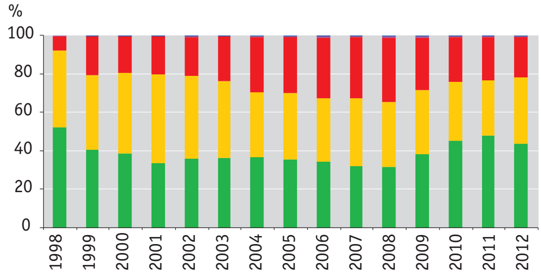
Chart 1 → **Trends in defoliation of older coniferous stands (over 59 years) in the Czech Republic according to classes[2] [%], 1991–2012**



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

Source: Forestry and Game Management Research Institute

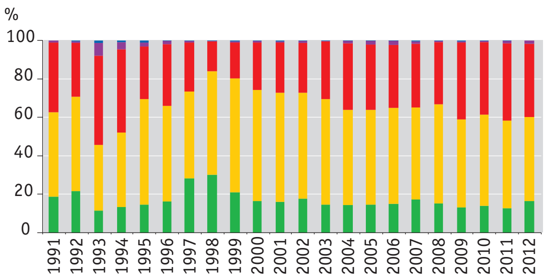
Chart 2 → **Defoliation of younger conifers (stands up to 59 years of age) in the Czech Republic according to classes [%], 1998–2012**



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

Source: Forestry and Game Management Research Institute

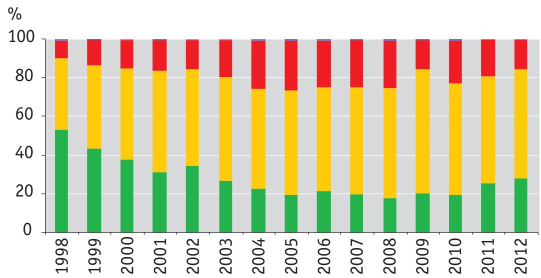
Chart 3 → **Defoliation of older deciduous trees (stands over 59 years of age) in the Czech Republic according to classes [%], 1991–2012**



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

Source: Forestry and Game Management Research Institute

Chart 4 → **Defoliation of younger deciduous trees (stands up to 59 years of age) in the Czech Republic according to classes [%], 1998–2012**

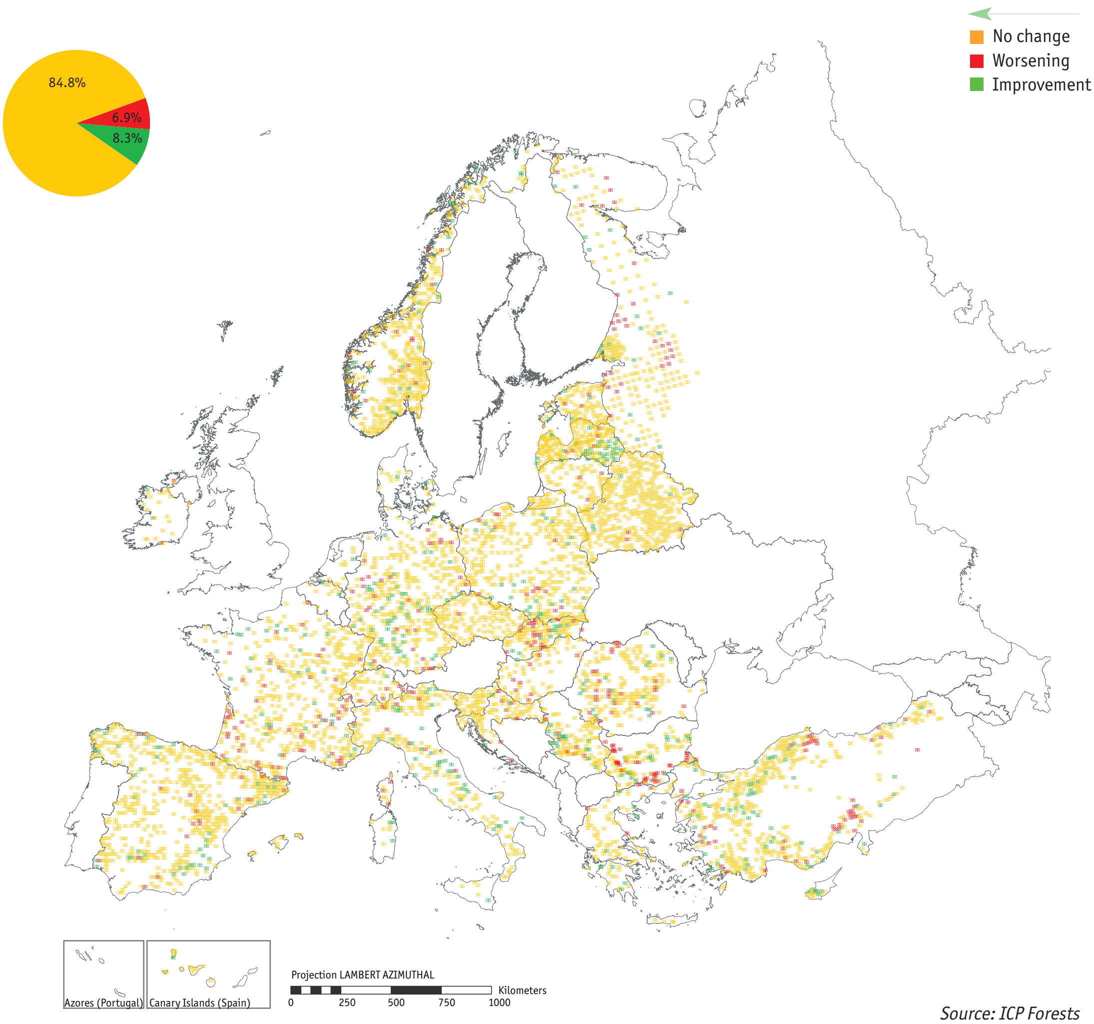


Class 4 (100 %)
Class 3 (> 60–< 100 %)
Class 2 (> 25–60 %)
Class 1 (> 10–25 %)
Class 0 (0–10 %)

Source: Forestry and Game Management Research Institute

[2] *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%).*

Figure 1 ➜ **Average defoliation of all tree species in Europe [%], 2009–2010**



Source: ICP Forests

The indicator assesses the health conditions of both older coniferous and deciduous stands (over 59 years) and younger coniferous and deciduous stands (under 59 years). The health condition of trees is identified by the defoliation percentage which is defined as a relative loss of assimilation in specific tree tops located within a stand compared to a healthy tree that is growing under the same conditions. Defoliation levels are divided into five basic classes (0 to 4), of which the last three (2 to 4) characterize significantly damaged trees.

In **older coniferous stands (over 59 years)**, there was a significant increase in defoliation in late 1980s and in the first half of 1990s. After the average defoliation had reached its peak in 1996, with a consequent significant improvement till the year 1998, the dynamics calmed down. In the following period, i.e. late 1990s and after the year 2000, there were only slight interannual changes. There was a negative trend in terms of growing defoliation and increasing representation in classes 2 to 4 (by 10.7% for the period 2000–2009) at the expense of classes 0 and 1 (Chart 1). In the last two years, slight improvement concerning the state of defoliation was recorded; in 2010, class 1 increased by 2.6% and in 2012, class 0 grew by 0.9%. The reason for the forest stands' poor health consisted in intense pollution load of the forest ecosystems in the past decades, which continues to the present albeit with significantly lower intensity. Although the environment improved and air pollutants decreased as a result of area desulphurisation since the mid-1990s, the forest stands respond to changes with a considerable delay. There is also another important factor, i.e. the fact that the stands that had been influenced significantly by poor air quality as early as in their young growth stages get into the higher age category at present. This is why their health conditions remain unsatisfactory.

Until 2008, representation of **younger coniferous stands (under 59 years of age)** was growing especially in defoliation class 2 (by 14.1% in 2000–2008) at the expense of classes 0 and 1 (Chart 2) while after 2008, there was a decrease of representation in defoliation classes 2 to 4 (by 12.6% till 2012) and a growth in defoliation class 0 (by 12.2% till 2012). Their generally better health conditions, assessed according to defoliation compared to older stands, are based on the fact that younger stands have greater vitality and ability to resist adverse environmental conditions. Another reason which must not be omitted consists in a significantly lower environmental burden than in the past.

Concerning **older deciduous stands (over 59 years of age)**, defoliation reached its peak in 1993 and in the following years, it was decreasing to get to its lowest level in 1998. In the next period, defoliation of older deciduous trees is growing slightly, with minor fluctuations. There is a negative trend consisting in growing defoliation and higher representation of stands in class 2 (by 13.4% in 2000–2012) at the expense of classes 0 and 1 (Chart 3). Concerning younger stands of deciduous trees (under 59 years), defoliation was growing till 2005 (classes 2–4 increased by 11.2% in 2000–2005), however, after 2005, the situation is improving slightly, especially in defoliation class 0, which increased by 8.4% in 2005–2012, at the expense of class 2 which dropped by 10.5% during the same period. The reason for the much lower defoliation of deciduous trees in comparison with coniferous stands consists in the fact that broad-leaved (i.e. deciduous) trees are generally more resistant to stress factors than conifers, because they recover all their assimilatory apparatus within one year, while in the case of conifers it is only a part of the stands (first year of age). In 2012, defoliation was increased by freezing of fresh shoots in May and then it was reduced by subsequent renewal as a result of favourable weather with enough moisture for most of the growing season.

The younger stands (up to 59 years) of both coniferous and deciduous tree species have generally lower values of defoliation in comparison with older stands. This difference is most pronounced for spruce and least significant for pine. In long terms, younger conifers (under 59 years) show lower defoliation than stands of younger deciduous trees. In older stands (older than 59 years of age), this comparison is reversed; older conifers have significantly higher defoliation than older broad-leaved stands. For both age categories, pine has the major share in the higher percentage of conifer defoliation.

In the **international context**, the state of Czech forests remains bad and belongs to the worst in Europe – despite the significant reduction in emissions in the 1990s. In 2010, within EU27 countries, the Czech Republic had the highest representation in defoliation classes 2 to 4 (54.2%), followed by the UK (48.5%), Slovakia (38.6%), France (34.6%) and Slovenia (31.8%); Estonia, Denmark, Belarus, Russia and Ukraine were below 10%.

Between 1998 and 2009, the **average defoliation in EU27** countries visibly increased to 24.4% of the area (mostly in the Mediterranean and the Czech Republic), while it decreased only in 14.9% of the area (mostly in Belarus). In 2010, it increased in 9.7% of the territory (mostly in Bulgaria, Romania and Slovakia) and, by contrast, it decreased in 12.4% of the territory compared to 2009 (Figure 1). Between 1995 and 1999, it dropped from 26% to 21.2%, after 2000 it increased again and recently, it has begun to slightly decline and reached 19.2% in 2009.

PODETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1850)

13/ Species and age structure of forests

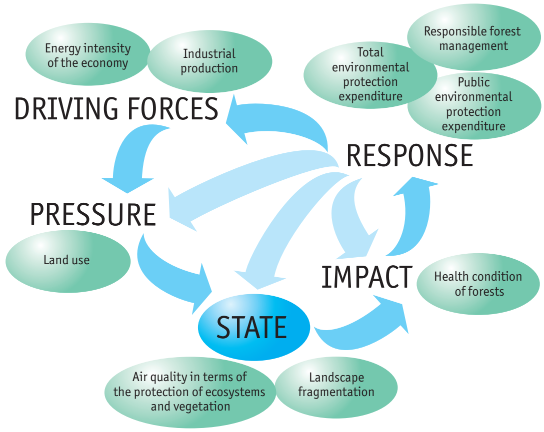
KEY QUESTION →

Is the species and age structure of the Czech Republic's forests satisfactory in ecological terms?

KEY MESSAGES →

The proportion of deciduous trees in the Czech Republic's forest area is rising slowly; during the period 2000–2012, it increased by only 3.3 p.p. to reach the value of 25.6%. Although this results in a favourable change in the species structure towards a more natural (and stable) composition of forest stands, the process is very slow.
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 0.9%) even though its share in artificial planting is 4.9%.
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; it increased by 1.9 p.p. for the period 2000–2012, which is good for biodiversity preservation.

The current composition of the Czech Republic's forests differs significantly from the reconstructed natural structure. While the present composition is dominated by coniferous forests, deciduous forests prevail in the reconstructed natural structure and their proportion should account to 65.3% of the whole of the Czech Republic's forest area (i.e. by 40 p.p. more than the current representation).



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** 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.

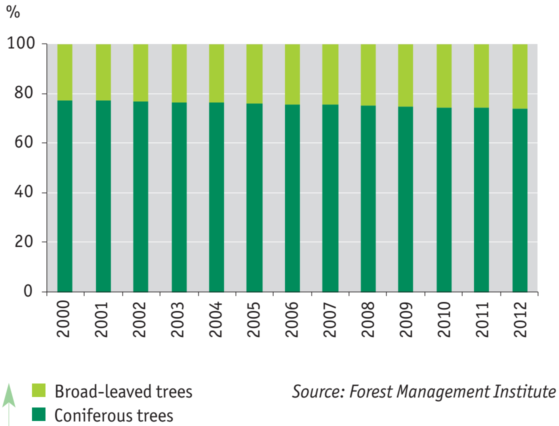
Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic**, which define the objective to increase the forest stands' species diversity towards the natural species structure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

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Forest stands are particularly important for the provision of ecosystem services, namely the provisioning services (wood production), the regulating services (protection against erosion, support to water regime), the supporting services (climatic function) as well as the cultural services (recreation and education). Planting mainly spruce and pine stands in the past has resulted in even-aged monocultures that are unable to resist abiotic and biotic factors, are characterized by worsened health conditions and thus cannot provide these services in full.

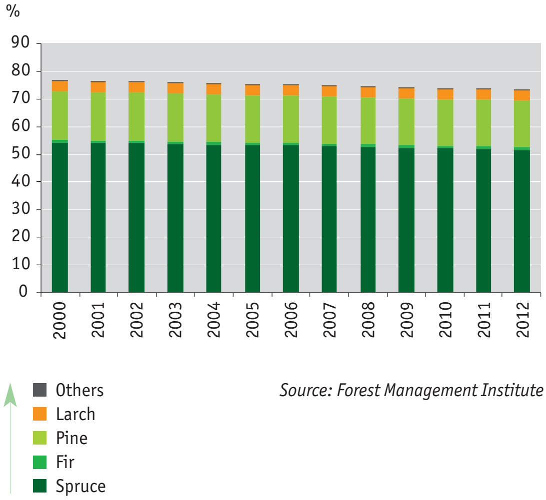
INDICATOR ASSESSMENT

Chart 1 → **Development of the proportions of coniferous and deciduous stands in the total forest area in the Czech Republic [%], 2000–2012**



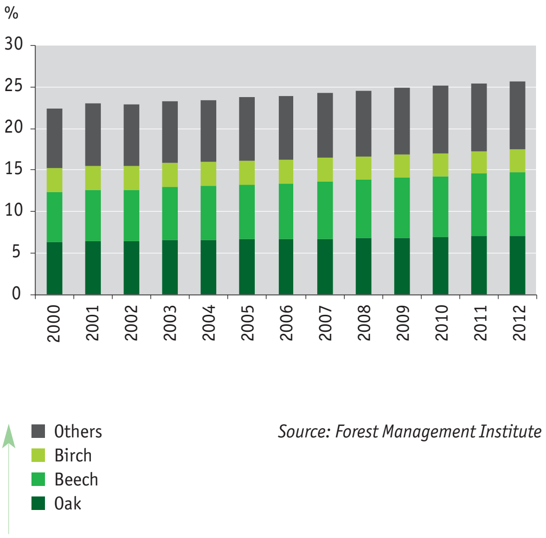
Source: Forest Management Institute

Chart 2 → **Development of the species composition of coniferous stands in the Czech Republic [%], 2000–2012**



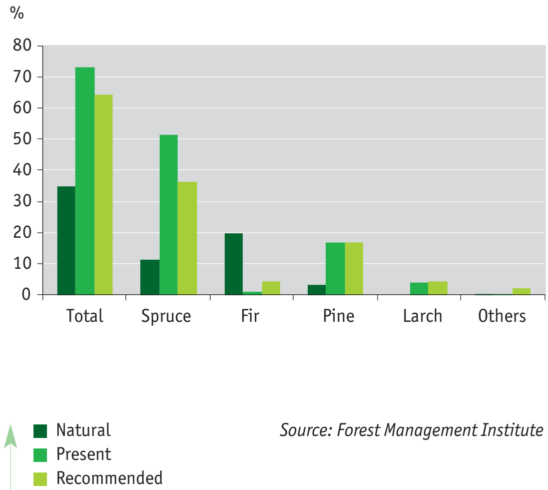
Source: Forest Management Institute

Chart 3 → **Development of the species composition of deciduous stands in the Czech Republic [%], 2000–2012**



Source: Forest Management Institute

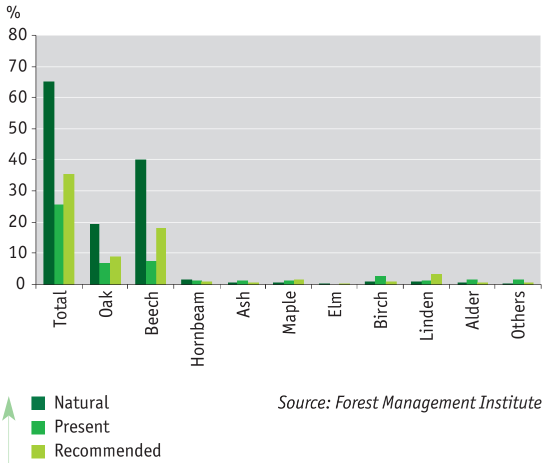
Chart 4 → **Reconstructed natural, present and recommended composition of coniferous forests in the Czech Republic [%], 2012**



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.

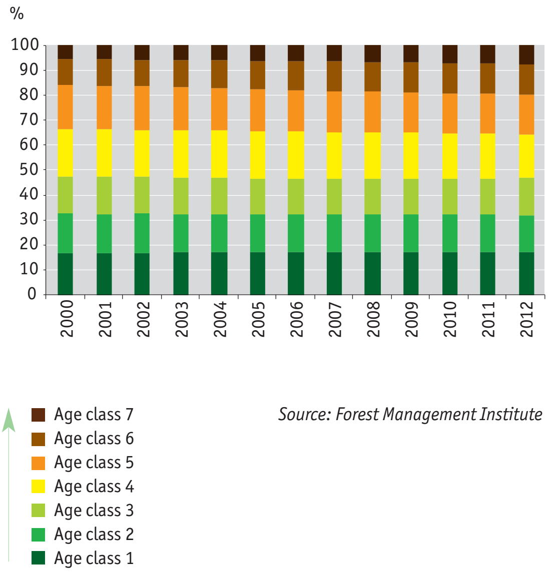
Chart 5 → **Reconstructed natural, present and recommended composition of deciduous forests in the Czech Republic [%], 2012**



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.

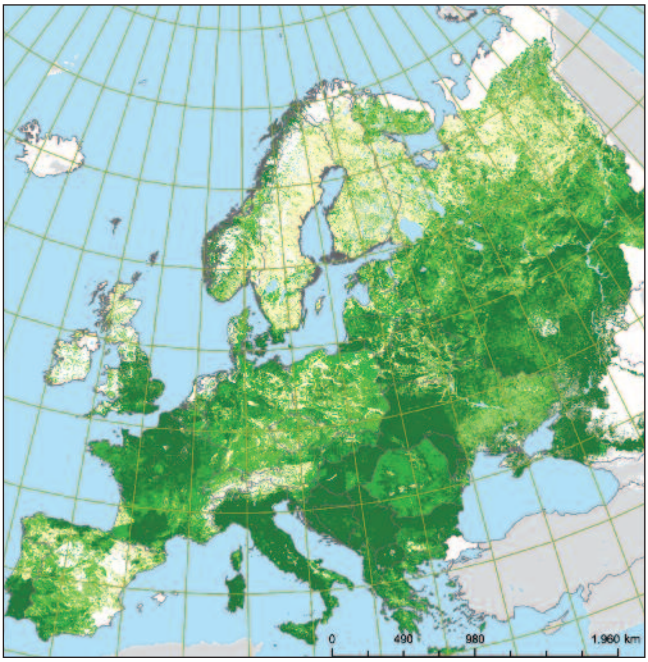
Chart 6 → **Development of the age structure of forest stands in the Czech Republic [%], 2000–2012**



Source: Forest Management Institute

Forest stands are classified in seven age classes according to their age: age class 1: 1–20 years; age class 2: 21–40 years; age class 3: 41–60 years; age class 4: 61–80 years; age class 5: 81–100 years; age class 6: 101–120 years; age class 7: > 121 years.

Figure 1 → **International comparison of the proportion of deciduous stands in the country's total area, 2005**



Broadleaved forest proportion of land area
- 0–1
- 2–10
- 11–25
- 26–50
- 51–75
- 76–100
- Water
- Outside data coverage

Source: European Forest Institute

The 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 population, and therefore increased demand for wood as the main energy source, fast-growing spruce and pine monocultures were planted in large areas in the past. For this reason, forests of the Czech Republic are made up of mostly coniferous stands and their monocultures, unfortunately, are susceptible to abiotic and biotic disturbances.

Deciduous tree species have been increasingly used in forest renewal (such as beech, oak, maple and rowan trees) at the expense of coniferous trees (spruce and pine). This results in a favourable change in species composition towards a more natural (and stable) structure of forest stands. The outlook for young forests with greater species diversity 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. This is caused by a relatively long rotation. In 2012, the share accounted for 25.6% of the total forest area (Chart 1). The **proportion of coniferous stands in the total forest area** in the Czech Republic in 2012 was 73.2%, while during the period 2000–2012 it fell by 3.3 p.p.

The Czech Republic's forests are composed of spruce (51.4%), however, its proportion in the total area of forest stands is falling steadily; it declined by 2.6 p.p. in 2000–2012. 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 and its proportion in afforestation grew from 2% in 1995 to 6.3% in 2009, but since 2010 it has decreased again to 4.9%. The very small increase in the proportion of fir in the total forest area is mainly due to extensive damage that is caused by hoofed game.

Deciduous stands are composed mainly of beech, whose share in the total forest area grew by 1.7 p.p. during the period 2000–2012 to achieve 7.7% in 2012. A slowly-growing trend has also been recorded for oak whose share increased by 0.7 p.p. over the period considered, reaching 7% of the total forest area in the Czech Republic in 2012. Beech and oak belong, together with fir, to soil-improving and strengthening species which fulfil several functions within the forest ecosystem; they e.g. improve the water regime, create more favourable microclimate in forest stands or reduce the stands' vulnerability to calamities caused by pests.

The current composition of the Czech Republic's forests differs a lot from **the reconstructed natural composition**[1] (Charts 4 and 5). While the present composition is dominated by coniferous forests, deciduous forests prevail in the natural structure and their proportion should account to 65.3% of the whole of the Czech Republic's forest area (i.e. by 40 p.p. more than the current representation). The differences between the current composition and the natural composition lie in the species structure, too. While the current composition of coniferous forests is dominated by spruce, in natural composition, fir should prevail (19.8%) and spruce should account for only 11.2% of the Czech Republic's total forest area. The difference between the natural and present compositions is significant for pine, which should occupy a smaller area (by 13.3 p.p.) of the Czech Republic's forests. The reconstructed natural composition of deciduous forests should be dominated by beech (40.2% of the Czech Republic's forest area) and oak (19.4%), which means by 32.5 p.p. and 12.4 p.p. respectively more than the two species are represented at present. Smaller differences are between the current and **the recommended compositions of the Czech Republic's forests**[2] according to which the area of deciduous forests should account for 35.6% of the Czech Republic's total forest area, i.e. by only 10.0 p.p. more than it is at present.

The **age structure of forests** is not proportional in the Czech Republic (Chart 6). In recent years, the area of overmature stands (over 120 years) is growing; it increased by 1.9 p.p. for the period 2000–2012. This may be caused by the forest management methodology applied in specially protected territories and in protective forests and by postponing the renewal of economically unattractive, less accessible or low-quality stands[3]. Old stands have reduced vitality and that is why there is also a higher proportion of incidental felling in them. On the other hand, this trend may have a positive effect on species linked to forests of higher age and with a big amount of dead wood. The area of stands younger than 60 years is below the required size and has a decreasing trend, which is caused by a growth in forest area between the second half of 19th century and half of 20th century, and also by longer rotation. The area of stands younger than 60 years has decreased by 0.5 p.p. during the period 2000–2012. There is only one exception – age class one, which had a growing trend until 2009 but since that year it is falling again; during the period 2009–2012 it dropped by 0.2 p.p.

In **international comparison**, it is obvious that the Czech Republic belongs, together with Poland, Ukraine, Austria and Scandinavian countries, to the states with the lowest share of deciduous stands in the country's total area (Figure 1), as opposed to Slovakia, Romania and Russia, which are among the states with the largest representation of deciduous forests.

PODETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

[1] *The reconstructed natural composition is close to the climax composition in the time before humans began influencing the forest.*

[2] *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.*

[3] *Report on the State of Forests and Forestry in the Czech Republic in 2010. Ministry of Agriculture of the Czech Republic.*

14/ Responsible forest management

KEY QUESTION

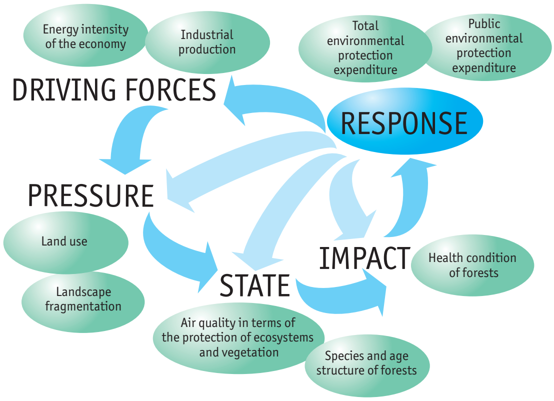
Has the development of forest management been positive from the environmental perspective?

KEY MESSAGES

The proportion of deciduous trees in the Czech Republic's forest area is rising very slowly but steadily; during the period 2000–2012, it increased by 3.3 p.p. Total forest stock has been increasing over the long term. The area of natural regeneration increased by 9.6% in 2012 compared with the year 2010. The proportion of deciduous trees in reforestation increased very slightly in recent years in the Czech Republic, but in 2012 it decreased interannually by 0.3 p.p.

While the proportion of fir in afforestation had been rising over the long term, there was a decline in the last two years (by 30.0%). However, the proportion of firs in the total area of the Czech Republic's forests has stagnated.

The forest area certified on the basis of sustainable forest management pursuant to PEFC peaked in 2006 and recently it has declined to its current level 68.6% of the Czech Republic's total forest area. 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).



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** 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".

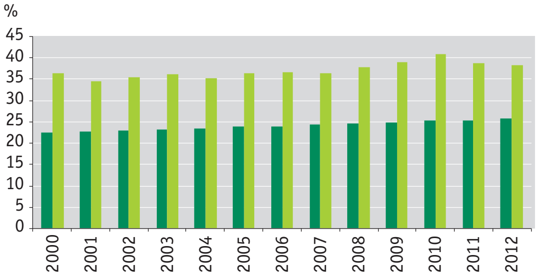
Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic** that aim at increasing biodiversity in forest stands towards a natural species composition, increasing structural 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

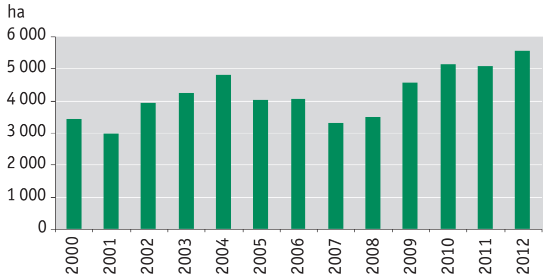
Chart 1 → **Proportion of deciduous trees in the Czech Republic's total forest area and in afforestation [%], 2000–2012**



Proportion of broadleaved trees in the total forest area
Proportion of broadleaved trees in afforestation

Source: Forest Management Institute, Czech Statistical Office

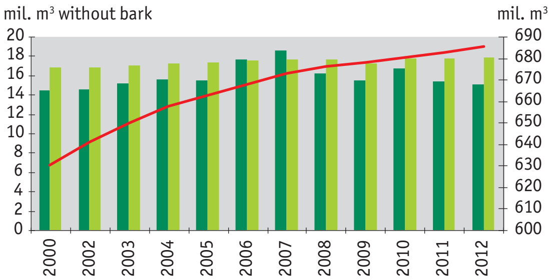
Chart 2 → **Development of natural renewal areas in the Czech Republic [ha], 2000–2012**



Natural regeneration area

Source: Czech Statistical Office

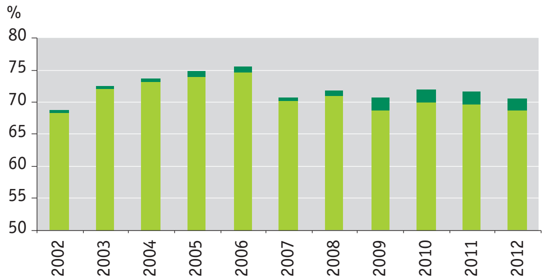
Chart 3 → **Comparison of wood felling and the total average growth [mil. m^3 without bark] and the total stock in the Czech Republic [mil. m^3], 2000–2012**



Felling (left axis)
Increment (left axis)
Stock (right axis)

Source: Forest Management Institute, Czech Statistical Office

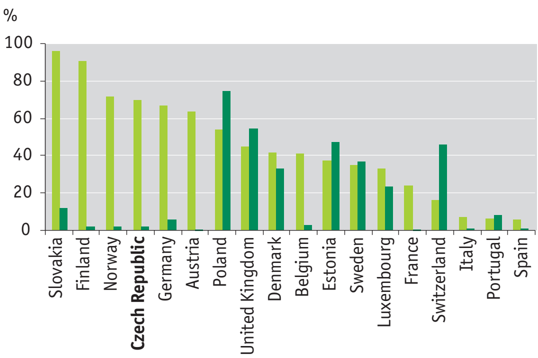
Chart 4 → **Development of the proportion of forest area certified pursuant to the PEFC and FSC principles in the Czech Republic's total forest area [%], 2002–2012**



FSC
PEFC

Source: FSC Czech Republic, PEFC Czech Republic

Chart 5 → **International comparison of the proportion of PEFC and FSC certified forests in the total forest area [%], 2011**



PEFC
FSC

Source: FSC Czech Republic, PEFC Czech Republic

In 2012, total of 19,900 ha were newly afforested in the Czech Republic (i.e. 0.7% of the country's total area), while afforestation with coniferous stands accounted for 61.8% and that with deciduous species for 38.2%. Thanks to responsible forest management in recent years, an increasing number of deciduous tree species (beech, oak and linden) are used in forest regeneration which contributes to a more natural and stable structure of forest stands. The **proportion of deciduous trees in afforestation** was at a stable level of 35% for long but has slightly grown over the last three years up to 40.7% in 2010. In 2012, however, there was a slight interannual decrease (by 0.3 p. p.) to 38.3% (Chart 1). The **proportion of deciduous trees in the total forest area** has been growing steadily to reach 25.6% in 2012.

The **natural forest regeneration** has almost tripled over the period in question (since 1995), which is a significant positive phenomenon from the forestry and environmental perspectives. In 2004–2007, the proportion of natural regeneration decreased but since 2008 it had been growing to reach 19% of the total forest regeneration in 2010 and 21.8% in 2012, i.e. 5,561 hectares (Chart 2).

The **total standing wood stocks** have been increasing over the long term, nevertheless, the growth dynamics has been slowing down in recent years. In 2012, they reached 685.6 mil. m^3 (Chart 3). A main reason for the increase in total wood stocks is that certain age groups of trees in above-normal areas are maturing and the mean age of trees has been increasing. Another reason is that **wood felling** has not exceeded the **total average growth** (Chart 3) over the long term. An exception was 2007 when maximum wood felling values were reported, 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). During the period in question, the amount of wood felling was about 15 mil. m^3 without bark per year and in 2012 it reached 15.1 mil. m^3. In 2012, the amount of salvage felling accounted for one fifth of the total completed felling, namely 3.2 mil. m^3, i.e. the lowest value since 2000; in this way, more favourable conditions have been created for planned forest management. The total average increment has increased steadily since 2000 from 17 mil. m^3 without bark to 18 mil. m^3 without bark.

The **area of forests certified in accordance with the principles of PEFC** (Programme for the Endorsement of Forest Certification Schemes), and **FSC**[1] (Forest Stewardship Council), 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 (by 4.7%), and since that year, it has been stable at about 70% of the Czech Republic's total forest area. 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 compliance with the demanding certification standards but also with financial requirements. Of the total number of issued certificates, most are PEFC (97.3%). For these certificates, a slight decrease was registered compared to last year (by 1.1%). The forest area certified under the FSC system, which is more stringent but also more environmentally sound, remains small (Chart 4), and in 2012, compared with the previous year, it increased slightly to the value 1.9% of the Czech Republic's total forest area (50,100 ha).

In international comparison, the Czech Republic has an above-average forest area certified according to the PEFC principles and it ranks right behind Slovakia, Finland and Norway, where the highest values are being achieved. The situation in the Czech Republic is quite opposite as far as comparison of the proportion of FSC-certified forest areas is concerned; it is much below the average unlike Poland, Estonia, the United Kingdom or Switzerland (Chart 5).

PODETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

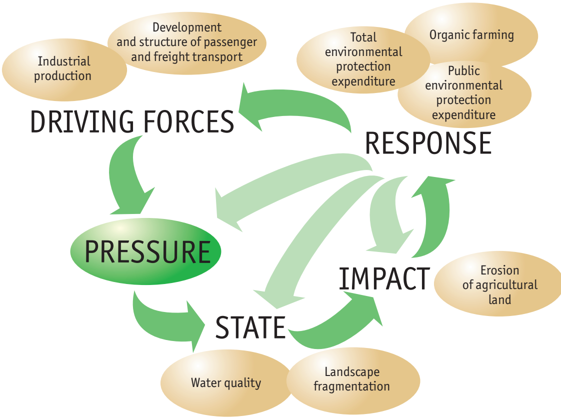
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1851)

[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.*

15/ Land use

KEY QUESTION →

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



KEY MESSAGES →

Development of the structure of the Czech Republic's agricultural land resources is positive from an environmental point of view; there is a decrease in acreage of arable land under intensive cultivation (for the period 2000–2012 by 2.9%) and an increase in the permanent grassland area (for the period 2000–2012 by 3.2%), which has a stabilising function in the landscape.

The total area of agricultural land has been declining slowly; at the end of 2012, the interannual decrease amounted to 4,800 ha (0.1%), in 2000–2012 it concerned 55,500 ha (1.3%). Approximately half of the agricultural land take-ups is a result of increase in built-up and other areas, which covered 10.6% of the Czech Republic's territory at the end of the year 2012 and its size has increased since 2000 by 3.3% (26,400 ha).

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 the landscape with a mosaic of interconnected biologically functional elements and parts that are able to withstand negative external influences.

The **Spatial Development Policy of the Czech Republic** is an instrument of land-use planning. Its priorities include, inter alia, to protect and develop natural, civilization and cultural values of the territory, to ensure sustainable development in the urban environment, to protect land that is not built-up (particularly agricultural and forest land) and to enhance the use of abandoned sites and areas (i.e. brownfields of industrial, agricultural, military or other origin).

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".

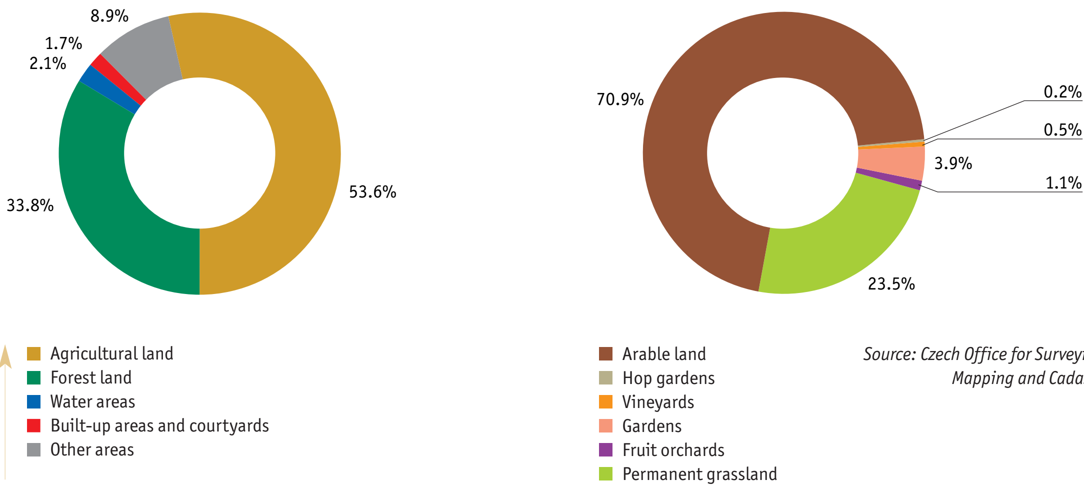
The Czech Republic's international obligations concerning sustainable land use stem from the **European Landscape Convention**. The main aim of the Convention is to provide for the protection of individual types of European landscape. Its importance lies in the fact that it promotes sustainable landscape conservation, management and planning and facilitates European cooperation in this area, mainly through formulating and implementing landscape policies at the national, regional and local levels.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Changes in land use and landscape development affect the landscape functions and ecosystem services. Human impact on landscape can cause reduction in the landscape's capacity to retain water, thereby increasing the risk of floods. It may also bring about reduction in groundwater level, decreasing the aesthetic value of the landscape and biodiversity. Loss of agricultural land at the expense of anthropogenic areas is detrimental to the national economy; larger artificial surfaces, especially in urban areas, affect the local climate and cause higher air temperatures, especially in the summer.

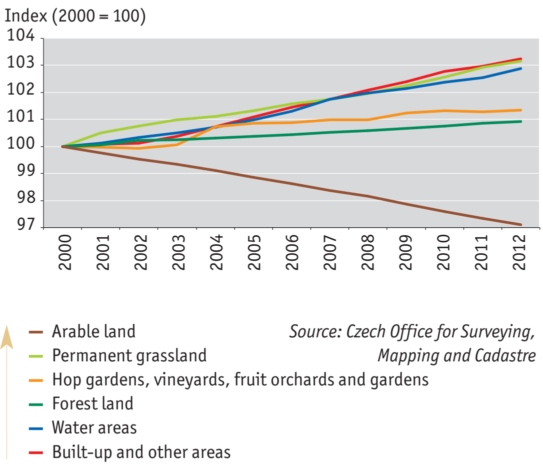
INDICATOR ASSESSMENT

Chart 1 ➜ **Land use (left) and the structure of agricultural land resources in the Czech Republic [%] 2012**



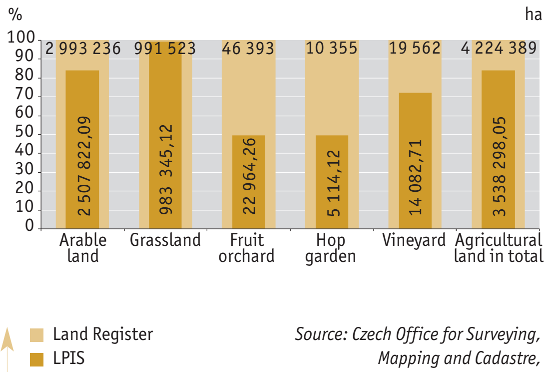
Source: Czech Office for Surveying, Mapping and Cadastre

Chart 2 ➜ **Land use development in the Czech Republic [index, 2000 = 100], 2000–2012**



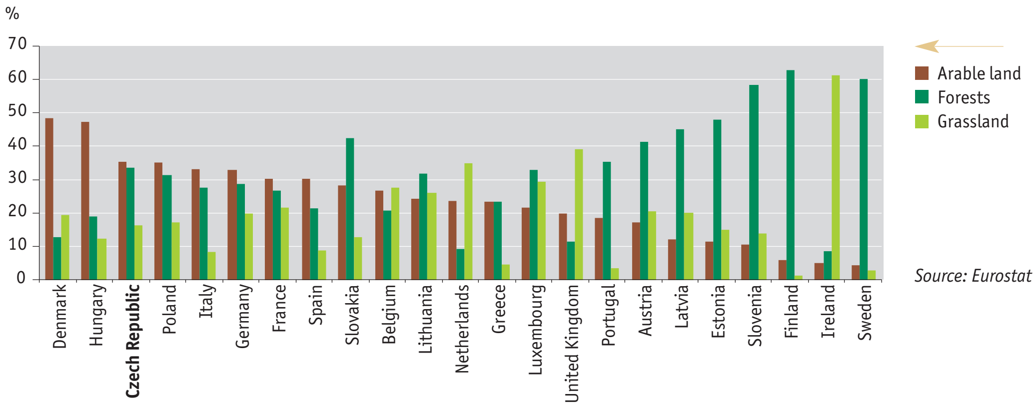
Source: Czech Office for Surveying, Mapping and Cadastre

Chart 3 ➜ **Total size of selected categories of agricultural land according to Land Register and the proportion of agricultural land registered in LPIS within agricultural land resources in the Czech Republic [ha, %], 2012**



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

Chart 4 ➜ **International comparison of the share of arable land, forests and permanent grassland in the total area [%], 2010**



Source: Eurostat

On the basis of data from the land registry at the end of 2012, the **largest part of the Czech Republic's territory is covered by arable land** (38%); forests account for 33.8% of the territory, other agricultural plots (permanent grassland in particular) for 15.6%, built-up and other areas for 10.6% and water surface account for 2% of the territory. The proportion of agricultural land in the Czech Republic's land resources is 53.6% (Chart 1).

Trends in land-use category changes after 2000 are characterised by gradual growth of built-up and other developed areas, forest areas and permanent grassland to the detriment of agricultural land (Chart 2). Within agricultural land resources, the acreage of arable land declines and the area of permanent grassland has gradually been growing. These changes are the result of so-called **extensification of the use** of 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. As a result of subsidy policy of the Government, however, some of the remote territories are used for agriculture again, which supports primarily further extension of permanent grassland. On the other hand, for the main agricultural areas and urban centres, **intensified use** is typical; its consequences are, in particular, increase in the size of built-up and other developed areas, sometimes also arable land, at the expense of the other land-use categories which are more valuable from the environmental point of view. While the former process is viewed rather positively from the landscape-ecology perspective, the intensification of use has definitely negative impacts.

Between the years 2011 and 2012, the total area of **arable land** decreased by 7,154 ha, i.e. by 0.2%; since 2000, the acreage of arable land has declined by 2.9%. Most of the decrease, approximately 53% of the lost arable land has been transformed into **permanent grasslands** (most of it being in the South Bohemian region and Moravian-Silesian region), another approximately 32% of the total decrease of arable land was transformed into **built-up and other areas**. In 2012, permanent grasslands have extended by 2,230 ha, i.e. by 0.2% (since 2000 by 3.2%). The extent of built-up and other areas, which include buildings, roads and other transport infrastructure, industrial sites, excavation sites and other categories of areas transformed by humans, increased interannually (2011/2012) by 2,204 hectares (0.3%), since 2000 by 26,366 ha (3.3%).

The **area of agricultural land** decreased by 4,779 hectares in 2012. The loss of agricultural land was caused by its transformation into forest land (2,052 ha, 0.1%), other areas (2,095 ha, 0.3%), built-up areas (109 ha, 0.1%) and water surface (544 ha, 0.3%). Within agricultural land resources, there was a decrease of acreage of arable land by 7,154 ha (0.2%, see above) and hop gardens by 99 ha (0.1%). These declines were offset partly by increase in permanent grassland by 2,230 ha (3.2%), gardens by 168 ha (0.1%), vineyards by 73 ha (0.4%) and fruit orchards by 3 ha (0.01%).

The highest proportions of arable land in the total land resources are in Central Bohemian region and South Moravian region (about 50%); the smallest proportion is, by contrast, in the regions of Karlovy Vary and Liberec (16%, respectively 21 %). The highest representation of permanent grassland and forest land is in the region of Liberec where these land use categories cover more than 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**[1] (Land Parcel Identification System), the area of arable land in the Czech Republic in 2012 was a total of 2,507,822 ha, which is 83.8% of the acreage of arable land registered in the cadastre (Chart 3). The difference in the data (approx. 485 thous. ha) arises from different methodologies of land registration in both systems. While in the LPIS, land parcels are registered by entities cultivating the given parcels, data in the cadastre are based on ownership of the individual cadastral parcels which can cover non-cultivated land, too. The kinds of plots of agricultural land remain unchanged in the cadastre, even if they were temporarily excluded from agricultural land resources. According to LPIS, the area of permanent grassland is by only 0.9% smaller (approximately 8,200 ha) than it is written in the cadastre, however, in case of hop gardens and vineyards, the differences are considerable. In 2012, the total area of agricultural land recorded in LPIS was 3,539 thous. ha (45% of the Czech Republic's territory).

The state of land use of the Czech Republic's territory in terms of economic, social and environmental pillars of sustainable development in 2012 has also been analysed for the purposes of the Report on Fulfilment of Spatial Development Policy of the Czech Republic 2008 in the document called Assessment of the Impact of the Spatial Development Policy of the Czech Republic 2008 on sustainable development of the territory (see http://www.uur.cz/pur-2011).

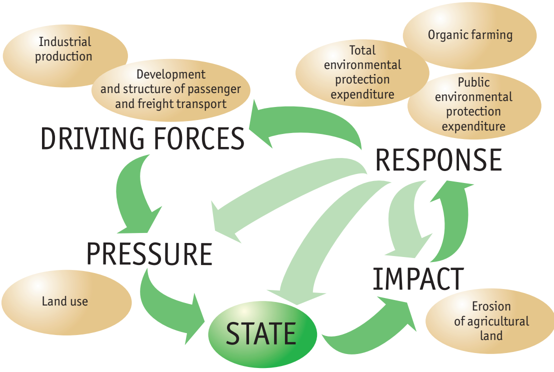
In comparison with the **EU27 countries**, the Czech Republic has an above-average proportion of arable land in the country's total area, and although its forest coverage is also higher it is only about half the size compared with Finland and Sweden, where it exceeds 60% (Chart 4). Only Denmark and Hungary have a significantly higher proportion of arable land than the Czech Republic. On the other hand, the smallest proportions are in Sweden and Finland (5–7%). The United Kingdom and Ireland have the highest proportions of permanent grassland in the country's territory (around 50%); in Central Europe it is Austria (20.6%). Land use structure in Poland is similar to that in the Czech Republic; Slovakia has higher forest coverage (approximately by 9 p.p.) and a lower proportion of arable land in the total area. Germany and Austria have a higher percentage of permanent grassland than 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=1852)

[1] *Geographic information system for recording the use of agricultural land. It is used for administration of state subsidies for agricultural land. More information is available at http://eagri.cz/public/app/lpisext/lpis/verejny/*

16/ 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.

At present, more than 6,000 transverse barriers are recorded in the Czech Republic's watercourses which may have an adverse impact on aquatic ecosystems (e.g. migration of water animals).

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

In 2002, the Czech Republic ratified the **European Convention on Landscape**, which 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 an instrument of land-use planning focused on sustainable development. 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 landscape fragmentation. 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. Protection of natural habitats concerns not only terrestrial ecosystems but also the aquatic environment, particularly watercourses.

A major water management problem at the national and international levels is to establish priorities for passability of the river network. 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 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 river habitats, thereby ensuring the reduction of mortality of eels due to human activity. The **Plan of Major River Basin Districts of the Czech Republic** aims at ensuring the protection of morphology of natural beds of watercourses and improving passability of watercourses for fish and other aquatic animals. The **Concept of Making the Czech River Network Passable** is an important strategic tool; it aims at a systemic solution to renewal of the river continuum, taking into account the needs of aquatic and water-related ecosystems in order to exclude species-selective passability of a migration barrier. 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.

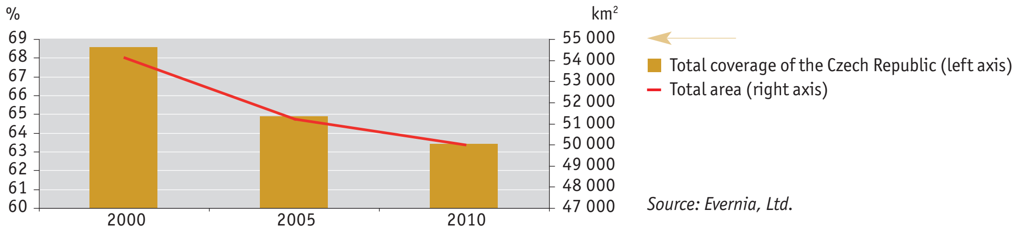
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Landscape fragmentation is closely linked with human activities and it affects the environment in a significant way. Fragmentation barriers in nature (settlement and transport infrastructure) cause a decline in public transport efficiency, reduce the landscape's potential for recreation and its passability allowing free movement of humans. There is also an increase of noise pollution in the environment concerned.

Gradual breaking of landscape into smaller parts also affects natural ecosystems and the plants and animals living in them. Within landscape fragmentation, natural habitats of individual species of organisms are directly taken over and made smaller, populations living in landscape are fragmented and migration of organisms is made impossible, while the quality of the habitats is affected most in the vicinity of line structures. This may result in limited use of food sources, reduced availability of breeding areas, which leads to loss of genetic variability and subsequent reduction in viability of the populations.

INDICATOR ASSESSMENT

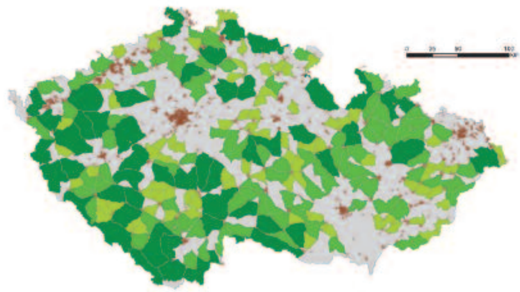
Chart 1 ➜ **Development of the Czech Republic's area that is not fragmented by traffic [%, km²], 2000, 2005 and 2010**



Source: Evernia, Ltd.

Assessed using UAT (Unfragmented Areas by Traffic) polygons which 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.

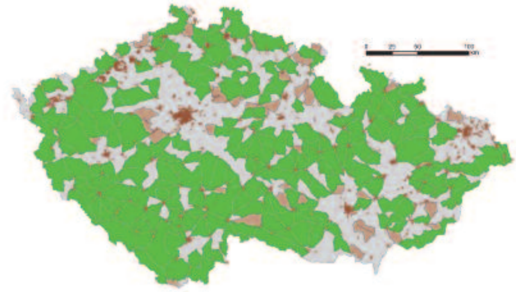
Figure 1 ➜ **Landscape fragmentation due to transport in the Czech Republic, 2010**



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

Source: Evernia, Ltd.

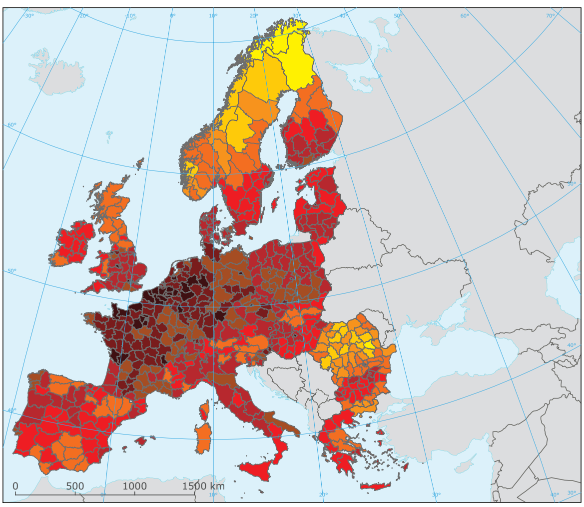
Figure 2 ➜ **Dynamics of landscape fragmentation due to transport in the Czech Republic between the years 2005 and 2010**



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

Source: Evernia, Ltd.

Figure 3 ➜ **International comparison of the landscape fragmentation by NUTS regions, 2009**



- < 0.10
- 0.11–0.25
- 0.26–0.50
- 0.51–1.00
- 1.01–5.00
- 5.01–10.00
- 10.01–25.00
- 25.01–50.00
- 50.01–100.00
- > 100
- Outside data coverage

Source: EEA

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

During the period 2000–2010, the **area of unfragmented landscape** decreased from 54,000 km^2 (68.6% of the Czech Republic's total area) to 50,000 km^2 in 2010 when it coved 63.4% of the country's total area (Chart 1). 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 urban sprawl and related transport infrastructure and also by the construction of motorways and express roads. In 2000–2010, a total of 4,590 ha of agricultural land and 357 ha of forest land were taken over for the construction of transport infrastructure in the Czech Republic. Most agricultural land was taken up in 2007–2012 in Central Bohemia, South Bohemian and South Moravian regions. Take-ups of agricultural land in these regions are associated with construction of motorways, city ring roads and extensive residential and industrial development. On the other hand, the Pilsen region belongs to regions with the highest number of unfragmented areas where there is lower density of the road network.

Fragmentation of the Czech Republic's river network (training of watercourses with transverse barriers) is an important anthropogenic pressure and it has adverse impacts 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. In the territory of the Czech Republic, more than 6,000 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 839 weirs were recorded in 2012, of which 193 are managed by state enterprise Povodí Labe, 339 by state enterprise Povodí Vltavy, 42 by state enterprise Povodí Ohře, 183 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.

From the international point of view, Luxembourg, Belgium and the Netherlands belong to **the most fragmented states in Europe** (Fig.3) because of very high population density and the related high proportion of development and extensive transport infrastructure on the whole territory. The Czech Republic, together with Poland and Germany which have similar topographic conditions, are also characterised by high landscape fragmentation. By contrast, Norway, Sweden, Romania and Finland are countries with the lowest fragmentation in Europe, which is related with a high degree of urbanization but low population density (the Nordic States) and with large protected areas without developed transport infrastructure (Romania).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1963)

17/ Erosion of agricultural land

KEY QUESTION →

What is the proportion of agricultural land that is at risk of erosion?

KEY MESSAGES →

In the Czech Republic's territory, 18.8% of agricultural land, according to the BPEJ (evaluated soil ecological units) database, is under potentially strong to extreme threat of water erosion and 5.4% is at risk of wind erosion. In 2012, 1.1% of the total acreage of agricultural land in the Czech Republic (according to BPEJ – evaluated soil ecological units database) or 0.4% according to the LPIS register was affected heavily with water erosion (expressed on the basis of the maximum admissible values of the cover and management factor). This is a slight interannual improvement.

OVERALL ASSESSMENT →

Change since 1990	:(
Change since 2000	:(
Last year-to-year change	:)

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

At present, one of the main topics of the EU's Common Agricultural Policy and national strategic and conceptual agricultural documents is the solution to the negative effects of agriculture on landscape and the environment. 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 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 programs focus. The payment of direct support for farmers under the **Council Regulation (EC) 73/2009** and of other selected subsidies 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)**[1]. 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.

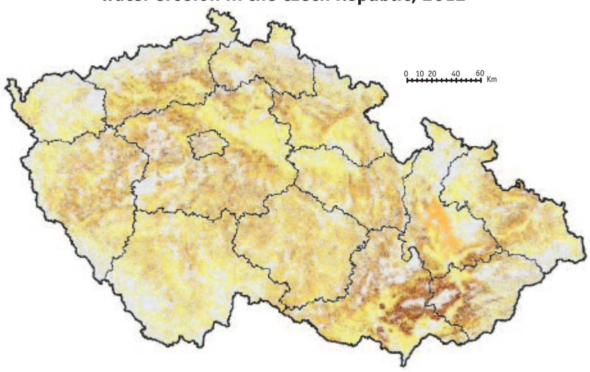
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Soil reacts very sensitively to inappropriate cultivation practices and it is subject to a number of degradation processes – along with erosion they include e.g. landslides, compaction, acidification, contamination and the loss of humidity, biodiversity, soil microflora or organic matter. Degradation has generally resulted in a reduction or total loss of productive and non-productive functions of soil, and hence the loss of ecosystem services that it provides. The erosion process itself is a natural phenomenon; it becomes a problem at the moment when its intensity increases as a result of anthropogenic activities. The most frequent cause of accelerated erosion on agricultural land consists in inappropriate farming methods, such as massive uniting of plots, monocultures, cultivation regardless of the plots' slopes and other physical-geographic conditions, or also inappropriate use of land for RSE cultivation (e.g. maize). 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 etc. Damage caused by soil erosion, however, is reflected in the extent of water resources' pollution, water reservoirs' siltation, in damage to property (run-off of fertilizers and plant protection products, siltation of the melioration and sewerage networks, loss of seed and seedlings). It is the run-off of soil particles and of nutrients and other chemicals bound to them which poses a risk to water resources in the Czech Republic.

[1] *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 GAEC 1 and GAEC 2 dealing with soil erosion.*

INDICATOR ASSESSMENT

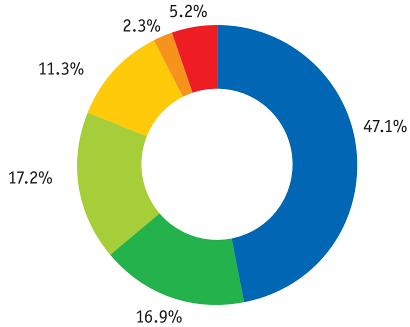
Figure 1 ➔ **Potential vulnerability of agricultural land to water erosion in the Czech Republic, 2012**



- Very slightly vulnerable soil
- Slightly vulnerable soil
- Medium vulnerable soil
- Strongly vulnerable soil
- Very strongly vulnerable soil
- Extremely vulnerable soil
- Non-agricultural and other land
- — Regional borders

Source: Research Institute for Soil and Water Conservation

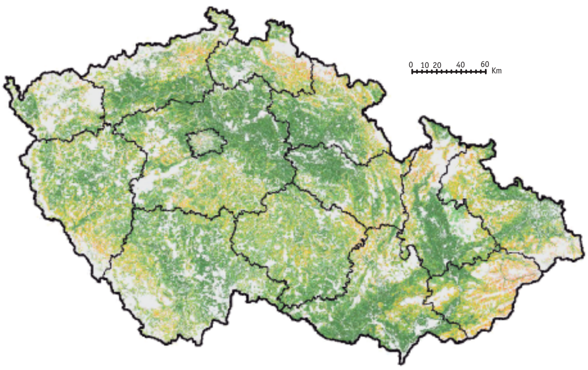
Chart 1 ➔ **Potential vulnerability of agricultural land to water erosion expressed as the long-term average soil loss (G) in the Czech Republic, 2012**



- Very slightly vulnerable soil
- Slightly vulnerable soil
- Medium vulnerable soil
- Strongly vulnerable soil
- Very strongly vulnerable soil
- Extremely vulnerable soil

Source: Research Institute for Soil and Water Conservation

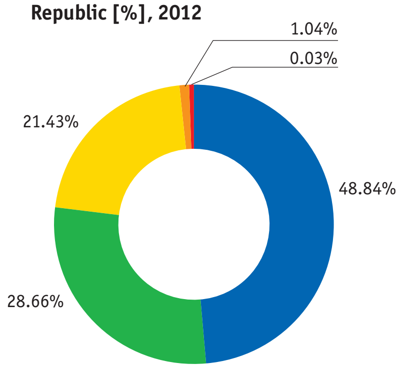
Figure 2 ➔ **Maximum admissible value of the cover and management factor (C_p) in the Czech Republic, 2012**



- 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: Research Institute for Soil and Water Conservation

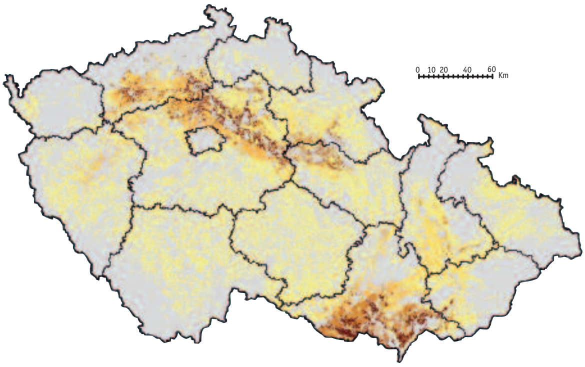
Chart 2 ➔ **Vulnerability of agricultural land to water erosion expressed as the maximum admissible values of the cover and management factor (C_p) in the Czech Republic [%], 2012**



- 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: Research Institute for Soil and Water Conservation

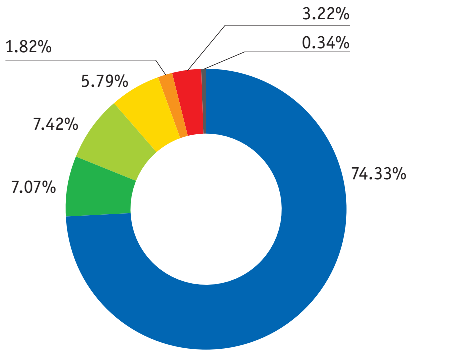
Figure 3 ➔ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2012**



- 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: Research Institute for Soil and Water Conservation

Chart 3 ➔ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2012**



- Soil without vulnerability
- Fractionally vulnerable soil
- Slightly vulnerable soil
- Vulnerable soil
- Strongly vulnerable soil
- Most vulnerable soil
- Not assessed soil

Source: Research Institute for Soil and Water Conservation

In the Czech Republic, a significant risk associated with soil consists in accelerated erosion of agricultural land that is conditioned anthropogenically. Predisposition of soil to erosion depends on natural factors (climatic conditions, soil conditions, morphology of the area, vegetation conditions), which, however, can be influenced secondarily by humans. Therefore, human activity can be the launching factor for accelerated erosion on land that is not otherwise threatened by erosion. Compared with the natural process, anthropogenically accelerated erosion can be of very high speed. By contrast, soil formation (pedogenesis) is always a very slow process.

The current erosion, expressing the present state of erosion threat and thus involving also 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.

In the Czech Republic, about half of the agricultural land is potentially threatened by water erosion. The annual loss of soil is estimated to be 21 mil. t in the Czech Republic. The potential threat to water erosion can be quantified by means of **long-term average annual soil loss** (G)[2] ($t.ha^{-1}.year^{-1}$). Agricultural land which is potentially extremely vulnerable to water erosion occupies 5.2% of the agricultural land resources and the G value for these soils is higher than 10.1 $t.ha^{-1}.year^{-1}$ (Chart 1). Agricultural land which is medium to very strongly vulnerable occupies 30.8% of the total agricultural land (G is equal to 2–10 $t.ha^{-1}.year^{-1}$). Slightly vulnerable soil covers 17.0% of the Czech Republic's territory. 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) 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.

[2] *The universal soil loss equation (USLE) is used to calculate the estimated average long-term soil loss (G, $t.ha^{-1}.year^{-1}$): $G = R \times K \times L \times S \times C_p \times P$. The following factors are included in the equation as inputs: rainfall and runoff erosivity factor (R), soil erodibility factor (K), topographic factor (LS), cover and management factor (C) 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.*

The **maximum admissible value of the cover and management factor** (C_p)[3] is a direct tool to assess water erosion in the Czech Republic which serves as a basis for such a framework management of land units which brings about no signs of above-limit loss of soil due to water erosion. The framework management based on C_p is recommended for a total of 51.2% of agricultural land in the Czech Republic (Fig. 2, Chart 2). Potentially the most vulnerable soil with the C_p value under 0.005, for which it is recommended to convert the land units or their parts into permanent grassland, occupy only 0.03% of the Czech Republic's agricultural land. For 1.04% of strongly threatened soils it is recommended to grow only perennial crops (e.g. clover, lucerne). The threatened land accounts for 21.4% of agricultural land resources and for them it is recommended to exclude growing of wide-row crops while narrow-row crops can only be grown using soil-conserving technologies. On slightly vulnerable soils (28.7%), wide-row crops can only be cultivated using soil-conserving technologies. The C_p values have also been used to define strongly and slightly vulnerable soils 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), which records the land use. Soil without erosion threat accounts for 89.4% of the land in the register (C_p above 0.1), slightly vulnerable soil 10.1% (C_p 0.02–0.1) and heavily vulnerable soil 0.4% (C_p below 0.02). Compared to the year 2011, there was slight improvement, i.e. an increase in the size of arable land without threat of erosion. Disproportions in the acreage of strongly threatened soil in the LPIS register (0.4%) and in the acreage of agricultural land resources according to the BPEJ (evaluated soil-ecological units) database (1.1%) are caused by the fact that the latter database includes all the area in which evaluated soil-ecological units are defined, even in the case when the areas are not registered in the cadastre as a part of agricultural land resources. By contrast, the LPIS register records the use of land according to the respective users.

Determination of the **potential vulnerability of agricultural land to wind erosion**[4] is based on the BPEJ (evaluated soil-ecological units) database, i.e. primarily on the data concerning climatic regions and the major soil units. Currently, approximately 10.8% of agricultural land is at risk of wind erosion (the most threatened soil, strongly threatened soil and threatened soil) in the Czech Republic (Fig. 3, Chart 3). 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 (eolian topsoil deposit).

Potential vulnerability of agricultural land is difficult to compare interannually because the methodology to determine vulnerability of soil to water erosion has changed. Therefore, only the values since 2009 can be compared. However, interannual changes in the overall extent of water 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. This brings about, for example, loss of crop, damage to roads, railways, buildings and buried services and water reservoirs siltation. In long terms, the state is getting worse which is documented by increasing costs concerning the removal of erosion-related damage and reconstruction of destroyed property owned by municipalities and other entities concerned. There is up to 75% reduction in yields on heavily eroded soil. One of the possible ways to determine the damage caused by erosion is assessment of the interannual change in the average price of land. Between the years 2011 and 2012, the price reduction of approximately 50 thous. ha reprised within BPEJ (evaluated soil-ecological units) updating was CZK 85.2 mil. 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. Different erosion control measures are taken to mitigate the negative effects of water and wind erosion.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1897)

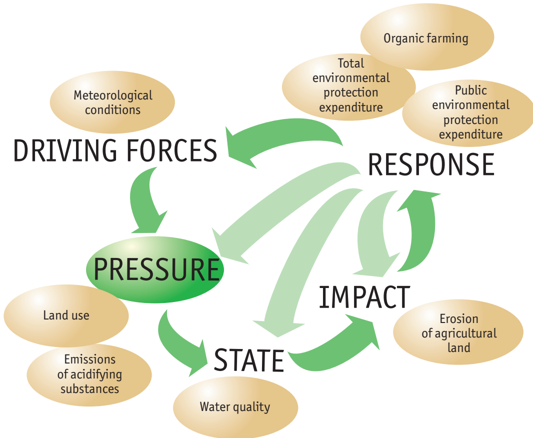
[3] C_p does not examine the potential level of risk, but it serves directly as an erosion protection tool (it means that it not only shows where the soil is threatened but also how to protect it effectively). Its value should not be exceeded in the given place, and if it is, it should be eliminated through anti-erosion measures. 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.

[4] 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.

18/ 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 2000–2012, the consumption of mineral fertilisers and plant protection products increased by 54.9% and 32.9% respectively. The consumption of lime substances has also been rising since 2006. Concerning selected high-risk substances, the most significant exceeding of the values of allowable soil pollution was in the DDT group of substances in 2000–2012. It concerned 42.2% of the samples. Massive exceeding of allowable pollution with individual polyaromatic hydrocarbons seems problematic, too.

In vast majority of cases, agricultural land in the Czech Republic is not dangerous for food chains in terms of the content of hazardous elements (heavy metals).

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

One of the main topics of the current agricultural policy is to address the negative impacts of agriculture on landscape and the environment. This issue also includes the protection of soil from pollution related to agricultural activities. The **National Action Plan to Reduce the Use of Pesticides in the Czech Republic**, adopted in 2012, has been prepared at 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, namely in the area of public health protection and the protection of water and the environment, 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. The main link leads to 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, in particular to ensure a sufficient amount of quality drinking water. 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 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. The **Action Plan of the Czech Republic for the Development of Organic Farming in the years 2011–2015** also deals with the use of chemical products in agriculture.

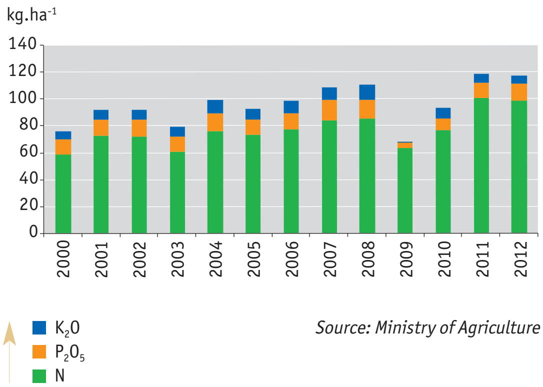
In the Czech Republic, direct payments and other European aid to farmers is made dependent on, inter alia, fulfilment of the GAEC (good agricultural and environmental condition) standards, statutory management requirements (SMR) and the minimum requirements for the use of fertilisers and plant protection products within agri-environmental measures.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Soil quality deterioration is caused not only by improper use of agricultural products, but also in local contamination with chemicals from accidents, release of contaminated water, discharge of waste directly into soil, landfill leaching, etc. Excessive or inappropriate use of mineral fertilizers and plant protection products contributes to soil quality deterioration, causing decline in the soil micro-organisms' biodiversity. It also affects the quality of surface water and groundwater, disrupts the ecosystems' balance and influences the food chains of animals including humans. 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. During soil erosion, these particles are released. 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

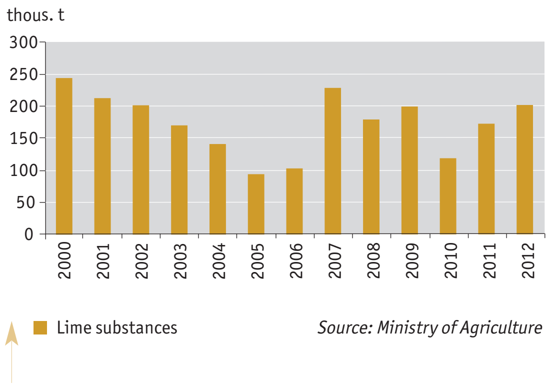
Chart 1 → **Development of the consumption of mineral fertilizers in the Czech Republic [kg.ha^{-1}], 2000–2012**



Source: Ministry of Agriculture

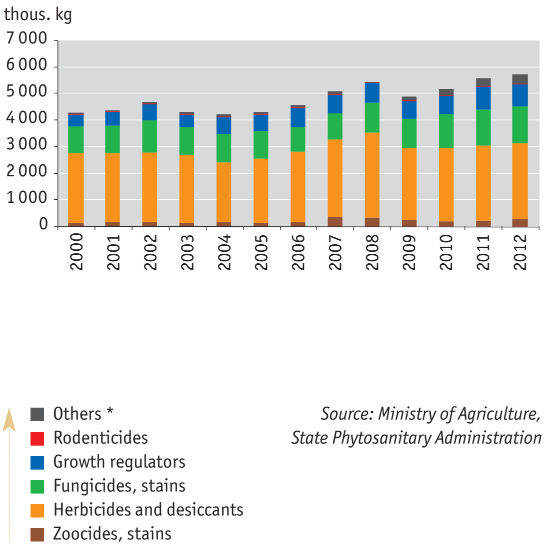
On the basis of information from the CSO, acreage of so-called "utilised agricultural land" (3,526,000 hectares) was used in the 2012 calculation.

Chart 2 → **Development of the consumption of lime substances in the Czech Republic [thous. t], 2000–2012**



Source: Ministry of Agriculture

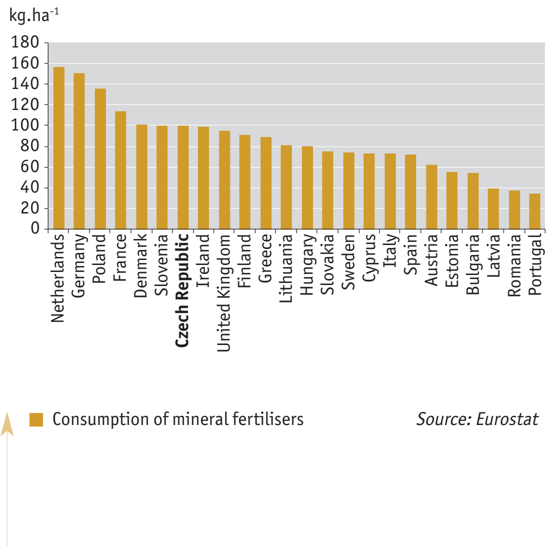
Chart 3 → **Development of the consumption of plant protection products in the Czech Republic [thous. kg of active substance], 2000–2012**



Source: Ministry of Agriculture, State Phytosanitary Administration

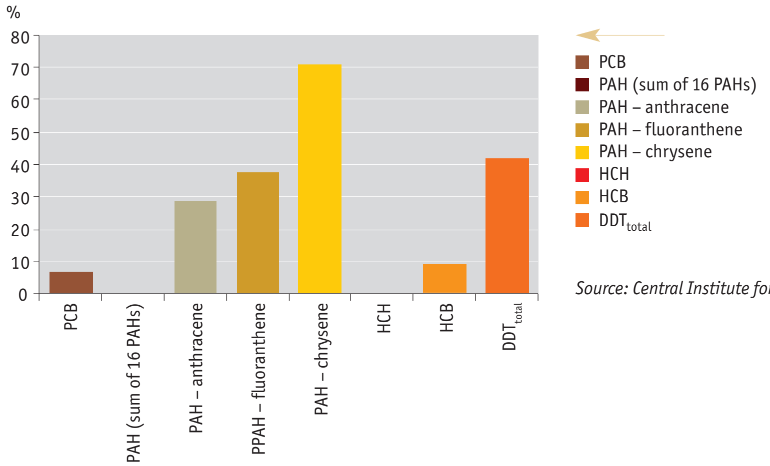
**Others – auxiliary substances, repellents, mineral oils, etc.*

Chart 4 → **Consumption of mineral fertilisers in selected EU member states [kg.ha^{-1}], 2010**



Source: Eurostat

Chart 5 → **The proportion of samples exceeding the limit values for hazardous substances in soil in the Czech Republic [%] 2012**



Source: Central Institute for Supervising and Testing in Agriculture

The organic pollutants are determined in soil samples from 40 selected monitoring sites within Basal Soil Monitoring (in the categories of arable land, hop gardens, permanent grassland) and five sites in protected areas (Giant Mountains National Park, Kokořín area, Pálava, White Carpathians, and Orlické Mts.). The limit values for the above hazardous substances are laid down in the Decree No. 13/1994 Coll.

The **total consumption of mineral fertilizers** has dropped significantly after 1990. While in the second half of 1980s, the total consumption of net nutrients supplied by mineral fertilizers was in average 223.8 kg per ha of agricultural land per year, in 1995 it was only 82.8 kg.ha^{-1}. Since 2000, the total consumption of mineral fertilisers began to increase again (Chart 1). In 2012 it amounted to 117.6 kg.ha^{-1} of net nutrients, which was a decrease by only 0.8% compared to the year 2011 when the maximum consumption of the period 2000–2012 was reached. The main reason for the reduction in application of mineral fertilisers was drought which stroke some areas of the Czech Republic and therefore the farmers did not apply fertilisers on some crops. The increase in consumption was disrupted significantly only in 2003 and 2009. In 2003, the lower consumption of fertilizers was caused, likewise in 2012, by reduced application as a result of drought. The reason for such a significant decrease in 2009 (by 38.5%) consisted in high prices, in particular for phosphate and potassium fertilizers, and in low exercise prices of agricultural products[1]. The main reason for the subsequent significant increase of mineral fertilizers' application in 2010 and 2011 lies in the fact that above-average harvest of agricultural crops was expected.

In terms of development in the different categories of mineral fertilisers, the consumption of phosphate and potassium fertilisers is more or less constant and in average it amounts to about 12 kg.ha^{-1} (in the content of P_2O_5 – phosphorus pentoxide) for phosphate fertilisers and 8 kg.ha^{-1} (in the content of K_2O – potassium oxide) for potassium fertilisers. In comparison with the year 2011, consumption of potassium fertilisers did not change and there was a decrease in consumption of phosphate fertilisers by 8.0%. Nitrogen fertiliser consumption (the values are provided in the content of N-nitrogen) takes part in growth of the total consumption of mineral fertilisers; in 2011 and 2012 (100.7 and 98.9 kg.ha^{-1} respectively) it even exceeded the average value of the years 1986–1990 (95.0 kg.ha^{-1}). Fertilizer 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 fertilizer consumption.

In 2012, the **consumption of lime substances** on agricultural land amounted to 201,000 t, displaying a 16.2% increase compared with the previous year (Chart 2). Following a steady decline in lime substance consumption starting in the mid 1990s, their consumption has increased significantly in 2007–2009 (Chart 2). This increase is probably caused by better financial conditions of the farmers and by education. Due to the decline in the use of lime substances in the past years, the share of agricultural land with increased acidity is growing; however, as application of these substances is going up gradually, decrease of the agricultural land's acidity can be expected.

[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.

The **consumption 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. In 2000–2012, the consumption of plant protection products increased by 32.9% and in 2012 by 2.2% compared with the previous year (Chart 3). This was caused by moderate to strong incidence of diseases and pests in cultivated crops due to above-average temperatures and rainfall deficit in the spring 2012. A total of 5,718,000 kg of active substances contained in plant protection products have been applied in 2012. Herbicides and desiccants (50.3%), fungicides and stains (24.0%) and growth regulators (15.2%) had the biggest proportions in the total consumption.

In **international comparison**, the Czech Republic has average values of mineral fertilisers' consumption per one hectare of agricultural land (Chart 4). The highest consumption of mineral fertilisers is in the Netherlands, Germany and Poland; by contrast, the lowest values were recorded in Portugal, Romania and Latvia.

Persistence of agricultural substances in soil can be several decades. Other substances that may be hazardous to the environment also get into soil. Hazardous substances (e.g. DDT, PAHs, PCBs, etc.) and hazardous elements (heavy metals) are monitored in agricultural soil where there is a risk of undesirable substances entering the food chain (e.g. after application of treated sludge from wastewater treatment plants or after application of excavated sediments on agricultural land). In the Czech Republic, most of the monitored **hazardous elements** exceeded the limit values in no more than 2% of the total number of samples analysed in 1995–2012. Only for arsenic 4.2% of the samples and for cadmium 2.8% of the samples exceeded the limits. The limit values for hazardous elements (for one or more hazardous elements) are exceeded more frequently in light soils. 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.

In 2000–2012, the values of **permissible pollution of soil with selected hazardous substances** were exceeded most in the content of **organochlorine pesticides** (substances such as DDT, HCH, HCB), specifically DDT and subsequently DDE. In 2012, the value of allowable pollution for the DDT group of substances (DDT_{total}) was exceeded in the total of 19 samples/surfaces, of which 2 samples were from permanent grassland (Chart 5), in total it concerned 42.2% of the samples, which means an improvement (by 7.8%) compared to the year 2011. In the Czech Republic, the use of DDT-based preparations has been banned since 1974, but these substances are characterized by high persistence in soil, causing its long-term load. Very low content in soil (below the detection limit) is typical of **hexachlorocyclohexane** (HCH), which is produced for its insecticidal effects; its use is not currently permitted in agriculture. Levels higher than the detection limit were determined only in five samples, of which one originated from the protected area of Kokořín. The value of allowable pollution has not been exceeded. In 2012, the value of allowable pollution with **hexachlorobenzene** (HCB) was exceeded at four monitoring sites in western Bohemia. In the Czech Republic, HCB is used as a fungicide, disinfectant and as an input material or intermediate product in production of certain chemicals. The contents of organochlorine pesticides are decreasing in the following order of categories: arable land, permanent grassland, protected areas. In 2012, the limit values for the content of **polychlorinated biphenyls** (PCBs, a sum of seven congeners) were exceeded at three localities with arable land in South Moravia. PCBs were manufactured as industrial chemicals and their production was banned in 1984. The situation is more problematic in the case of **polyaromatic hydrocarbons** (PAHs, total of 16 indicator PAHs) which get into the environment primarily from combustion of fossil fuels. In 2012, the limit for the sum of PAH was not exceeded in any of the areas monitored but there was massive exceedance of allowable pollution limits for the individual hydrocarbons: anthracene (13 samples of arable land in 2012), fluoranthene (17 samples in 2012) and chrysene (32 samples of arable land in 2012).

Hazardous substances and elements are also known to accumulate in sediments of watercourses and reservoirs. In the period 1995–2012, the highest percentage of samples exceeding the limit values (see the Decree No 257/2009 Coll.) was recorded for PAH in sediments of village ponds (60.0% of the samples) and watercourses (50.0% of the samples). Again, a high percentage of the samples didn't meet the limit values for DDT in sediments of the village pond category (33.3%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1898)

19/ Organic farming

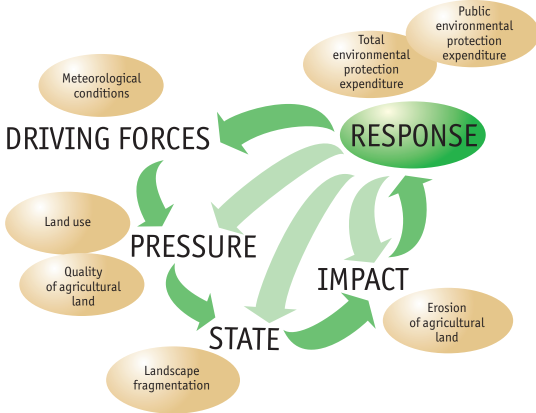
KEY QUESTION

Is the proportion of agricultural land under organic farming increasing?

KEY MESSAGES

The proportion of agricultural land under organic farming and the number of both organic farms and organic food producers increases. Between 1990 and 2012, the acreage of agricultural land under organic farming increased from 480 ha to 490,762 ha in the Czech Republic. In 2012, 11.6% of the total area of agricultural land resources was cultivated in accordance with the principles of organic farming. 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; the last interannual increase amounted to only 1.6%. There was an interannual decrease of arable land and other areas within organic farming.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Organic farming represents one of the principles of sustainable development. In order to promote organic farming, 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 encourage its public support through rural development, improving production standards 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**. This Action Plan supports especially 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 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%.

In 2006, the Czech Republic's Government adopted the **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013** which also deals with organic farming. 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.

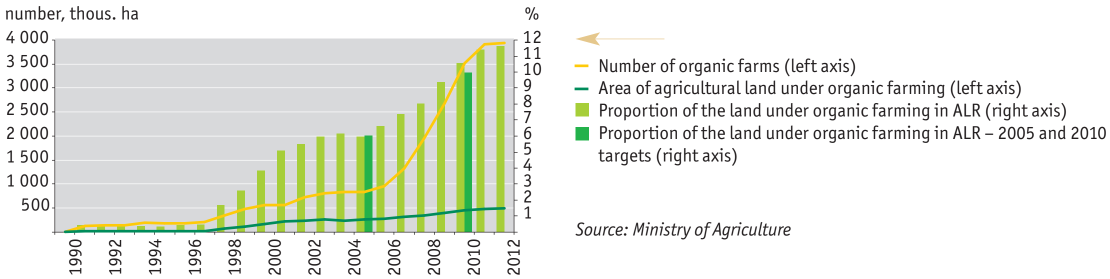
The rules of organic farming are mostly regulated by the Council Regulation (EC) No. 834/2007 on organic production and labelling of organic products, the Commission Regulation (EC) No. 889/2008 laying down detailed rules for the implementation of the Council Regulation (EC) 834/2007 and the Czech national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

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

As a cultivation method which does not burden soil with chemicals and agricultural machinery, organic farming has positive impacts on soil quality, livestock health and quality of produced food, and thus on human health. Organic farming has a positive influence on the quantity of 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 as large units with monoculture crops are not preferred.

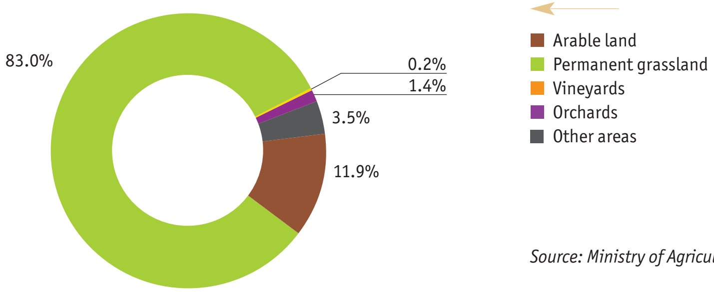
INDICATOR ASSESSMENT

Chart 1 ➜ **Organic farming trends in the Czech Republic [number, thous. ha, %], 1990–2012**



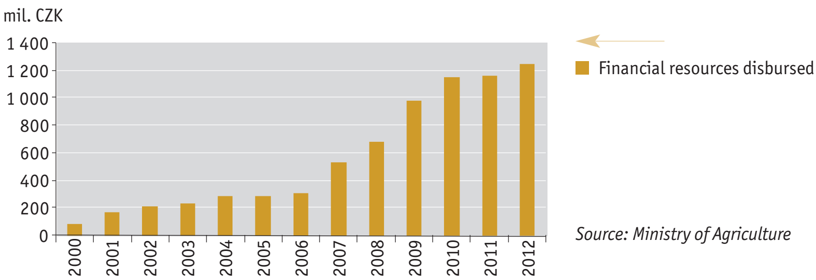
Source: Ministry of Agriculture

Chart 2 ➜ **Structure of land resources in organic farming in the Czech Republic [%], 2012**



Source: Ministry of Agriculture

Chart 3 ➜ **Financial resources disbursed within the „Organic Farming" agro-environmental measure [mil. CZK], 2000–2012**



Source: Ministry of Agriculture

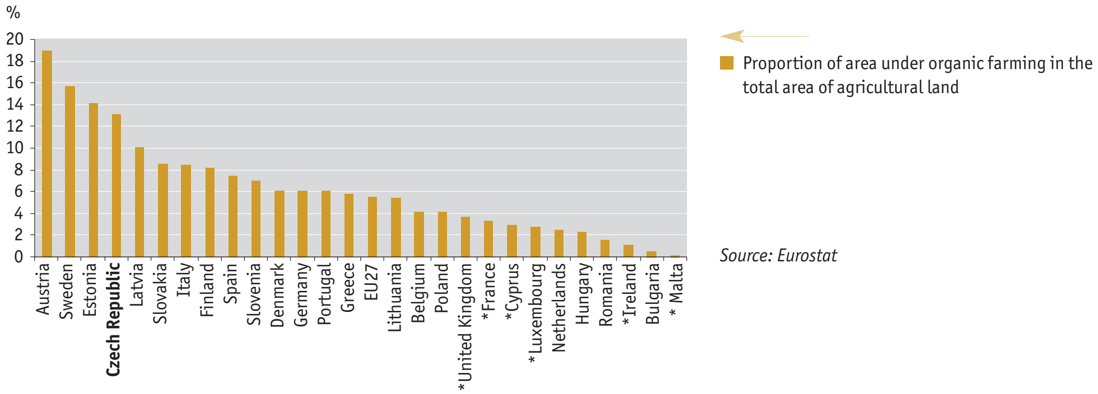
Table 1 ➜ **Amount of organic farming subsidies per unit area in the Czech Republic [CZK.ha-1], 2004–2012**

Culture	2004–2006 (HRDP[1]) [CZK.ha-1]	2007–2009 (RPD[2]) [CZK.ha-1]	2010 (RPD) [CZK.ha-1][3]	2011 (RPD) [CZK.ha-1][3]	2012 (RPD) [CZK.ha-1][3]
Arable land	3,520	4,086	3,780	3,880	3,909
Permanent grassland	1,100	1,872	2,170/1,731[4]	2,232/1,781[4]	2,244/1,790
Vegetables and special herbs on arable land	11,050	14,869	13,755	14,149	14,223
Permanent cultures (orchards, vineyards)	12,235	22,383	20,707/12,438[5]	21,299/12,794[5]	21,410/12,861[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 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 ➜ **Proportion of the area under organic farming in the total area of agricultural land in Europe [%], 2009**



Source: Eurostat

** Estimated value*

The importance of organic farming has been increasing in the Czech Republic since late 1990s. Since 2000, the **number of entities (organic farms) working in accordance with the principles of organic farming** has grown almost sevenfold to 3,934 farms in 2012 (Chart 1). The significant growth recorded in the last five years slowed down in the last interannual (2011/2012) comparison and at the end of 2012 there were only 14 organic farming entities (by 0.4%) more than in the previous year. The **number of organic food producers** has also been growing continuously. While in 2001, there were 75 organic food producers, in 2012 there were already 454 production facilities (432 producers). The maximum was reached in 2011, when there were even 646 organic food production facilities (422 producers) in the Czech market. The significant interannual decrease in the number of production facilities (by 29.7%) was connected with reduced activities of the company Billa, which ended baking of frozen organic bakery products in their shops during the year 2012. Czech consumers buy most of the organic food at retail chains and in shops with healthy and organic food.

Between 1990 and 2012, the **acreage of agricultural land under organic farming** increased from 480 ha to 490,762 ha in the Czech Republic. In 2012, 11.6% of the total area of agricultural land resources was therefore cultivated in accordance with the principles of organic farming (Chart 1). In the period of highest growth (1997–2001), the acreage of organically cultivated agricultural land increased interannually by roughly 20–50% and between 1997 and 1998 it was even by 253.9%. In the last five years, the interannual increase has been only about 8–17% and the last interannual growth was even only 1.6%.

The area under organic farming consists mainly of permanent grassland (83.0%) and arable land (11.9%) (Chart 2). The rest is permanent crops (vineyards, orchards, hop gardens) and other areas. In 2001–2011, the acreage of arable land under organic farming increased every year and between 2004 and 2011, the proportion of arable land in the total area of land resources in organic farming was also increasing every year. This increase, however, stopped in 2011 and in 2012, there was an interannual decrease in the proportion of arable land by 1.3%, and the acreage of arable land reached 58,489 ha. On the other hand, acreage of permanent grassland, orchards and vineyards increased interannually (permanent grassland by 2.3%, orchards by 3.4% and vineyards by 3.6%). Therefore, 2.3% of the total arable land in the Czech Republic (according to the LPIS records) was cultivated in accordance with the organic farming principles in 2012. The largest proportion of organically managed cultures in the Czech Republic's total area of agricultural land is occupied by permanent grassland (of which 41.4% is included in organic farming) and orchards (29.1%). Although permanent grassland, which has a high proportion in the total amount of organically cultivated agricultural land, is not directly used for the production of organic food, it has an indispensable function in the landscape. This function 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 possible solutions to agricultural over-production and at the same time to the protection of land resources.

Along with plant production, organic farming also includes livestock breeding and cattle breeding without commercial milk production accounts for the largest proportion of organic livestock breeding. In 2012, there were e.g. 11 bee-keepers working in the field of organic farming.

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 and subsequent investment measures under the Rural Development Programme that are part of Axes I and III: „Modernization of agricultural holdings", „Setting up of young farmers", „Adding value to agricultural and food products", „Promoting tourism" and „Diversification into non-agricultural activities". The total amount of financial means paid within the agro-environmental measure "Organic Farming" was CZK 1.25 bil., which represents approximately a 7% increase compared to the year 2011. Since 2007, there have been continual interannual increases within the RDP in the volume of subsidies calculated per 1 ha of agricultural land in organic farming. The highest subsidies are provided for cultivating orchards, vineyards and hop gardens; in 2012, the subsidy for 1 ha of this land amounted to CZK 21,410.

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. Greater awareness and better availability of information, along with growing consumers' interest in this kind of food, are other reasons behind the increased number of organic farmers and organic food producers.

In the EU, the rise in organic farming began already in early 1990s. In 2000, a total of 3.8 mil. ha of agricultural land were cultivated organically in the EU15. In 2011, the area of organically farmed agricultural land in the EU27 represented 5.5% of total agricultural land. In an **international comparison**, the proportion of organically farmed land is above average in the Czech Republic (Chart 4). Within a European comparison, the Czech organic food market belongs to markets with very small turnover. However, in the context of Central and East-European countries, it is still considered, along with the markets in Poland and Hungary, the most developed market with growth potential.

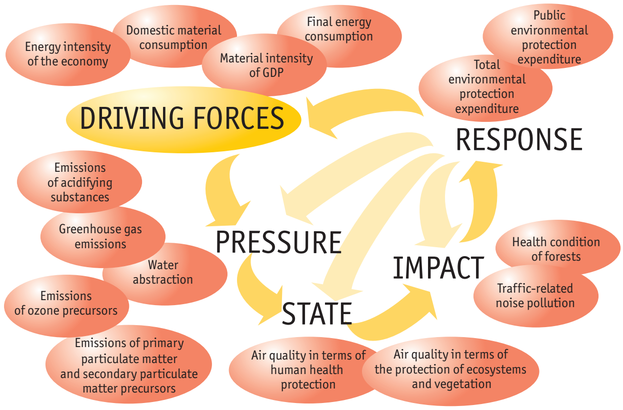
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

20/ Industrial production

KEY QUESTION →

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



KEY MESSAGES →

After two years of growth, the industrial production declined; the 2011/2012 interannual decline amounted to 0.8%. The negative development was influenced by weakening of industry in the Euro-zone, which, as a result of mutual links, was reflected in development of industrial production in the Czech Republic. Another factor which limits the growth is the fact that domestic demand is weak in long terms.

Similarly to the previous years, the construction sector was in a deep downturn also in 2012. In relation to the environment, this is rather a 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.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The currently valid **State Environmental Policy of the Czech Republic** puts emphasis on reducing harmful impacts of industry on the environment and human health. Within the part concerning the sectoral policies, the following measures are being introduced: to include environmental aspects in industrial policies more thoroughly; to develop industrial production towards more purposive and useful products with greater appreciation of inputs and more favourable environmental impacts; to support the widest possible introduction of best available techniques (BAT); to promote low-emission, low-waste and energy efficient technologies with closed production cycles; to support programmes focused on the development of environmentally focused mechanical engineering and on strengthening environmental investment in air quality protection, wastewater treatment and processing, waste disposal and treatment and introduction of „cleaner" technologies; to reduce emissions of pollutants into the air and water, not to pollute watercourses with industrial water and waste chemicals and to improve wastewater treatment; to reduce production, import and use of hazardous chemical substances and to replace them with alternative products.

The **Czech Republic's Raw Material Policy** includes the following objectives: to create conditions to meet the Czech Republic's demand for mineral raw materials, to strengthen the country's raw-material security, to ensure consistent 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 the continuation of 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.

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 also 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.

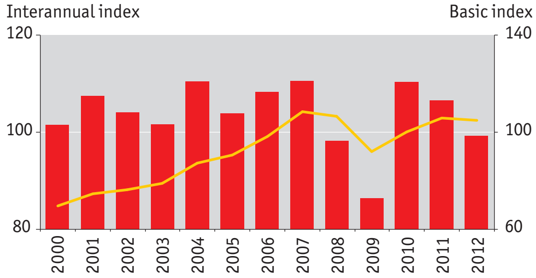
The production, processing, import and use of chemicals and products containing chemicals in industry (and other sectors) are addressed by the European **REACH** legislation. The objective is to eliminate the substances with the worst impacts on human health and the environment from circulation and to replace them with less harmful alternatives.

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 is 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. They cause death or migration of animals and plants that fail to adapt to the changes. Some excavation projects may be even beneficial for biodiversity, as they give rise to valuable ecological niches. Industrial areas 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, their mixtures and products whose properties are not always known in relation to toxicity to the environment and to humans.

INDICATOR ASSESSMENT

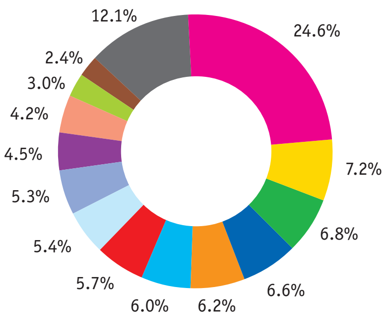
Chart 1 ➔ **Index of industrial production in the Czech Republic, 2000–2012**



- Interannual index of industrial production (the same period of the previous year = 100)
- Basic index of industrial production (the year 2010 = 100)

Source: Czech Statistical Office

Chart 2 ➔ **Structure of industrial production in the Czech Republic [%], 2012**

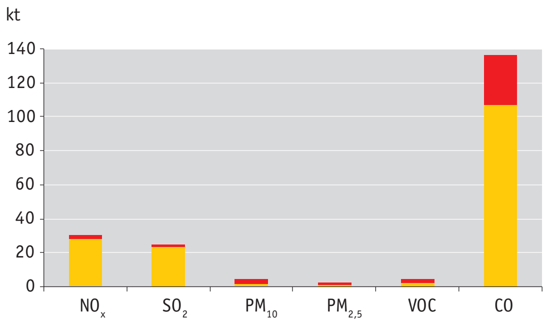


- Production of vehicles (except motorcycles), trailers and semitrailers
- Production of machines and devices not elsewhere specified
- Production of computers, electronic and optical appliances and devices
- Production and distribution of electricity, gas, heat and conditioned air
- Production of rubber and plastic products
- Production of electrical devices
- Production of food
- Production of basic metals, metallurgy; foundry
- Production of metal structures and metal-working products, except machines and devices
- Production of chemical substances and preparations
- Production of coke and refined oil products
- Production of other non-metal mineral products
- Mining and excavation
- Others

Source: Czech Statistical Office

Structure of industrial production by the sales of products and services. This is the industrial production including mining, extraction, generation/production and distribution of electricity, gas, heat and conditioned air for companies with more than 50 employees.

Chart 3 ➔ **Emissions from industry in the Czech Republic [kt], 2011**

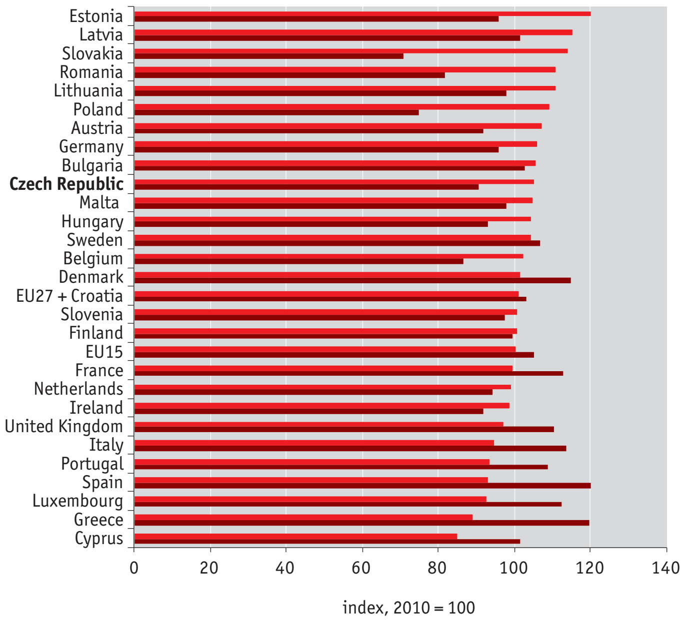


- Production processes without combustion
- Industrial energy sector

Source: Czech Hydrometeorological Institute

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

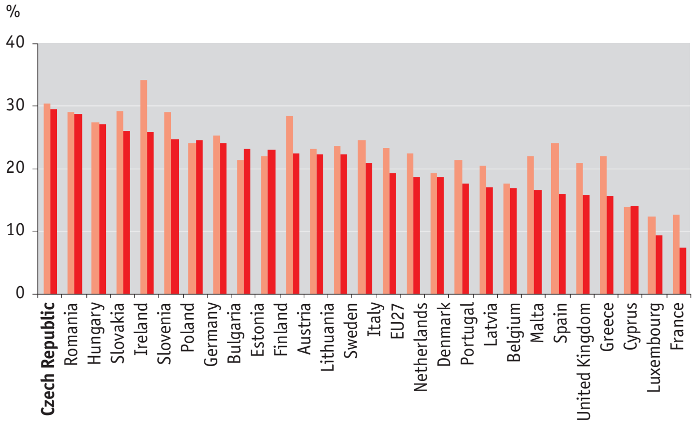
Chart 4 ➜ **International comparison of the industrial production index [index, 2010 = 100], 2005 and 2012**



Source: Eurostat

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

Chart 5 ➜ **International comparison of industry's proportion of gross value added in gross domestic product in constant prices of base year 2000 [%], 2000 and 2010**



Zdroj: Eurostat

In the Czech Republic, industry accounts for approximately 30 % of **GDP** and it is therefore one of the **key sources of the Czech Republic's economy.** In terms of the environment, however, it is also an important producer of many emissions of pollutants and waste products and a consumer of non-renewable resources and raw materials. That is why this sector has a significant environmental impact, especially in areas where big industrial enterprises are concentrated (the Moravian-Silesian region, the region of Ústí nad Labem and Central Bohemian region). In 2000–2012, the negative **environmental impacts** of industrial production were not increasing in the Czech Republic.

In 2012, deceleration of **industrial production** of the year 2011 continued. In the first half of the year, industrial production was growing, however, in the second half it began to decline. After two years of growth, there was an interannual decline in industrial production in 2012 which amounted to 0.8%. The negative development was influenced by weakening of industry in the Euro-zone, which, as a result of mutual links, was reflected in development of industrial production in the Czech Republic. Another factor which limits the growth is the weak domestic demand; particularly households decreased their consumption gradually.

There was an interannual decrease in the Czech **construction sector** by 6.5% in 2012. The construction sector has been showing negative values for four years. In comparison with the flourishing year 2008, the construction sector decreased by 17%. Low demand from the public sector (construction of railways, roads, etc.), which contributed significantly to the construction growth in previous years, remains a problem. The greatest decline was recorded in civil engineering, which struggled with austerity measures. Demand from the business and household sectors is also insignificant as investment decisions are postponed until a more favourable time. Residential development was also reduced greatly; the number of new flats the construction of which started in 2012 declined by 13.4%; on the other hand, completion of flats increased by 3.0%. In 2012, there was an interannual decrease in the above-ground construction sector by 3.4%; infrastructure constructions fell by 13.6%.

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.

Emissions from industry[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 comes from the iron and steel works in Ostrava and Třinec. The industrial processes without fuel combustion are production-type specific and they produce a variety of emissions that are harmful to the environment.

In 2008–2009, the economic crisis had its impacts on emissions from the industry, that is why there was a temporary reduction in the emissions from this sector. In 2010, revival of the industry also influenced emissions of pollutants from this sector and some of the emissions increased temporarily. In 2011, total emissions from the industry (in accordance with the downward curve of industrial production) recorded a decline again for most substances monitored. The only exception is emissions of CO, for which there was an interannual increase by 2.4%. A relatively significant drop has been recorded for all the other monitored substances: $PM_{2.5}$ by 23.3%, PM_{10} by 18.9%, NO_x by 14.1%, SO_2 by 12.5% and VOC by 7.2%.

Since the year 2000, the **energy intensity of the industry** has been decreasing significantly. While in 2000, the energy intensity in industry was 699 MJ/CZK 1,000, in 2011 it was 327 MJ/CZK 1,000 (calculated as final energy consumption in industry divided by the GVA of that 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 2011, there was a slight interannual increase of GVA in the industrial sector but its energy consumption decreased significantly (by 6.2%). Generally, energy intensity of the industry has therefore decreased by 12.2%. The reason for the decline in energy intensity of industry consists in introduction of modern technologies, BAT and measures in energy saving.

In an **international comparison**, the industry sectors in individual European countries develop differently. E.g. Slovakia, Poland and Romania show recovery and industrial production growth after the economic crisis while others, such as Spain or Greece, are facing deepening of the Eurozone debt crisis (Chart 4).

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 – Bohemia and Moravia have 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 **draft of the Czech Republic's Raw Material Policy** allows for necessary development of the extraction sector, which is in accordance with a European initiative. Support to dynamics of the extraction industry is desirable also due to re-starting the Czech economy. It is the extraction sector the products of which are the basic inputs for almost all industry and energy sectors; it has a strong ability to multiply and generate new jobs and business opportunities, and thus it can help to re-start the economy.

Recently, non-energy raw materials are playing an increasingly greater and more vital role in the EU economy and are essential for the development of modern environmentally friendly technologies.

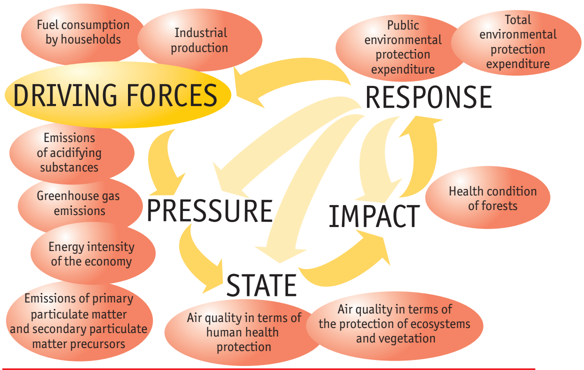
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

[1] *Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

21/ 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.

In international comparison, the energy consumption per capita in the Czech Republic is by 7% higher than the EU27 average.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The current **State Energy Concept of the Czech Republic** is aimed, inter alia, at increasing the heat savings in buildings belonging to the Government, municipalities, businesses as well as private consumers; at enhancing efficiency of electrical appliances and the use of energy-efficient appliances; increasing effectiveness of the energy-distributing systems in order to achieve energy-efficient distribution networks in terms of centralization and decentralization of energy sources and reduction of distribution loss.

Adopted by the Commission, the **Action Plan for Energy Efficiency KOM/2006/545** outlines a framework of policies and measures designed to implement an estimated savings potential of 20% of the EU's annual primary energy consumption by 2020.

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.

In 2008, the European Parliament and the Council approved the **Climate-Energy Package.** It sets out 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.

The **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** establishes a framework of measures to promote 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 create preconditions for further increasing of energy efficiency even after this date.

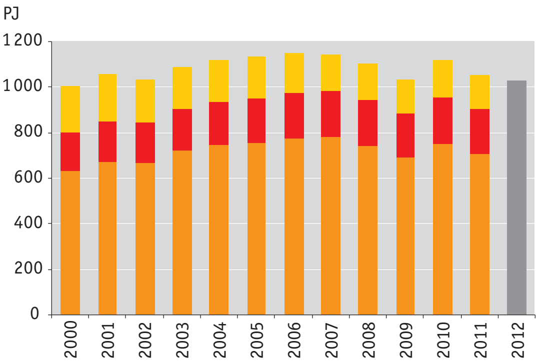
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Energy consumption 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 greenhouse gas emissions, energy consumption contributes to climate change (increased occurrence of hydrometeorological extremes – drought waves, floods or extreme temperatures), to forest defoliation and landscape disturbance. Final energy consumption is also accompanied by air pollution, which results in the increased incidence of respiratory problems, allergies, asthma and reduced immunity.

[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], 2000–2012**

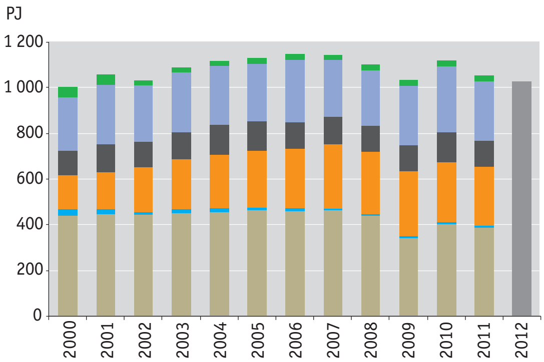


- Heat
- Electricity
- Fuels

Source: Czech Statistical Office

With respect to the data reporting methodology, the 2012 data concerning energy consumption by resources were not available as of the closing date of this publication.

Chart 2 → **Final energy consumption trends by sector in the Czech Republic [PJ], 2000–2012**

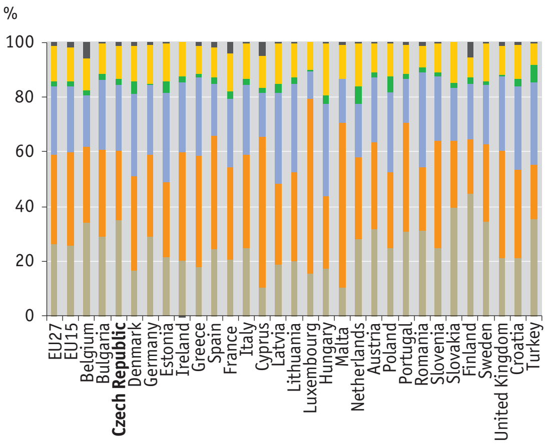


- Agriculture and forestry
- Households
- Other sectors
- Transportation
- Construction sector
- Industry

Source: Czech Statistical Office

With respect to the data reporting methodology, the 2012 data concerning energy consumption by sectors were not available as of the closing date of this publication.

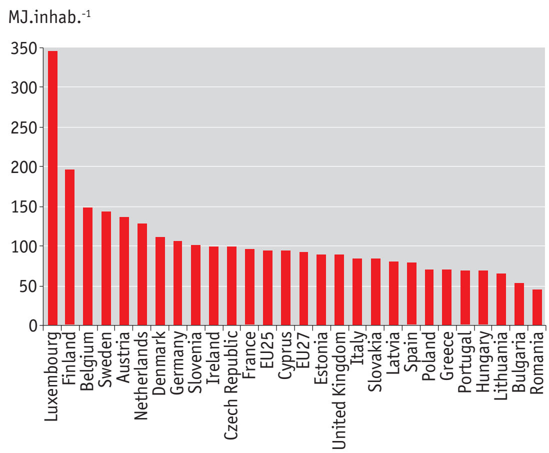
Chart 3 → **International comparison of final energy consumption by sectors [%], 2011**



- Others
- Services
- Agriculture
- Households
- Transportation
- Industry

Source: Eurostat

Chart 4 → **International comparison of final energy consumption per capita [MJ.inhab.$^{-1}$], 2011**



- Final energy consumption per capita

Source: Eurostat

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 there was the economic crisis in the years 2008–2009. 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, but in 2011 and 2012, interannual declines of the total consumption followed again in connection with the Czech economy's recession, namely by 4.0% and by 2.3% respectively.

The highest final energy consumption (Chart 2) is recorded in the **industry sector** (36.6% in 2011). While energy consumption in this sector used to fluctuate interannually, it has been declining every year since 2006 due to restructuring of the 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 also had its impact on energy consumption and the consumption in the industry sector increased by 20.2% 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; the interannual energy consumption decreased by 6.2% 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. In 2011, 24.6% of the total energy was consumed by households. Interannually (2010–2011), there was a decrease in households consumption by 9.4%, which is largely caused by above-average temperatures in the 2011 heating season, compared to a very cold winter in 2010. Heating has a major impact on energy consumption in households.

The **transport sector** accounted for 24.9% of the total consumption in 2011. This was the only sector in which energy consumption was growing in long terms, but in the last three years, the trend is rather varying. Interannually (2010–2011), energy consumption in the transport sector increased by 0.1%.

In an **international comparison** of the energy consumption structure by the sectors of the national economy (Chart 3), the Czech Republic, compared with the EU15 or EU27 average values, has a higher share of energy consumption in the industrial field, which is caused by the high proportion of energy-intensive industries in the Czech economy. On the other hand, lower consumption is recorded in the transport sector.

Generally, the Czech Republic belongs to the countries with slightly **higher final energy consumption** per capita (98.3 $MJ.inhab.^{-1}$ in the Czech Republic compared to 91.8 $MJ.inhab.^{-1}$ in EU27), i.e. by 7.0% more (Chart 4).

The **energy savings potential** lies in the area of energy transformation (efficiency of the existing steam power stations and heating stations) and in areas of final consumption – BAT application, use of energy-efficient appliances, construction of energy-efficient buildings, use of high-quality insulating materials, energy audits, labelling of electric appliances, increasing the energy cycles' efficiency, 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)

22/ Fuel consumption by households

KEY QUESTION

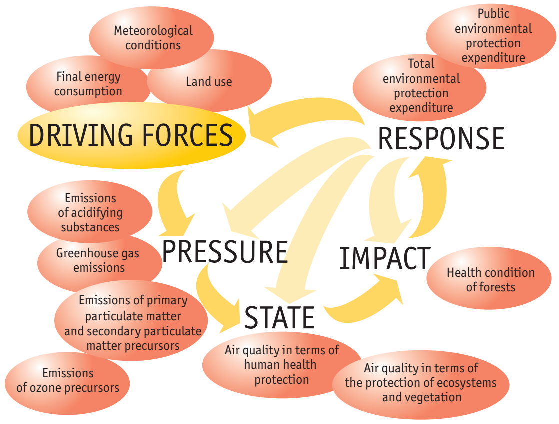
What progress has been made in reducing local heating units that have a negative impact on air quality and public health?

KEY MESSAGES

Even though the heating season was by 10.3% more heat-demanding, the consumption of fuels in households increased interannually by only 0.4%.

The ways of heating households in the Czech Republic do not change very much. District heat supply (36.7%) and natural gas (34.4%) still prevail.

In 2011, 37.6% of total PM_{10} emissions originated from local heating units. The impact of household heating on the environment and, in particular, on public health is considerable.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The **State Energy Concept** of the Czech Republic aims at promoting heat savings in buildings and supporting heat generation from renewable energy sources.

The **State Environmental Policy of the Czech Republic** aims, inter alia, at the reduction of local coal heating units where undisciplined combustion of municipal waste results in formation and emission of toxic substances.

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, about 1% for electricity for heating) has been imposed on fuels that produce greater amounts of air pollutants.

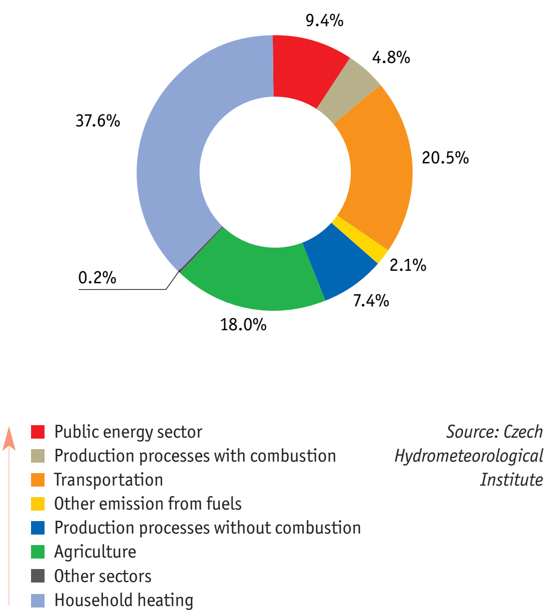
The **Act No 201/2012 Coll. on air protection** provides for the minimum emission requirements for combustion sources using solid fuels, with the rated heat input below and equal to 300 kW which serve as heat sources for hot-water central heating system.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The household heating mix affects air quality of the immediate environment in which people live. Compared to emissions from large incinerators, emissions from local heating units are more dangerous as they are emitted directly into the environment where the inhabitants reside. Pollutants emitted from chimneys of low buildings, most frequently family houses, cannot disperse in the air and people are forced to breathe these substances directly. Approximately one-third of the total emissions of primary particulate matter PM_{10} come from local heating sources. Incomplete combustion of solid fuels produces carcinogenic polyaromatic hydrocarbons, which contribute to a number of health problems in the population – increased sickness rate, especially increased incidence of cardiovascular diseases, cancer and respiratory problems. A limited possibility to regulate these small sources is another disadvantage, too.

INDICATOR ASSESSMENT

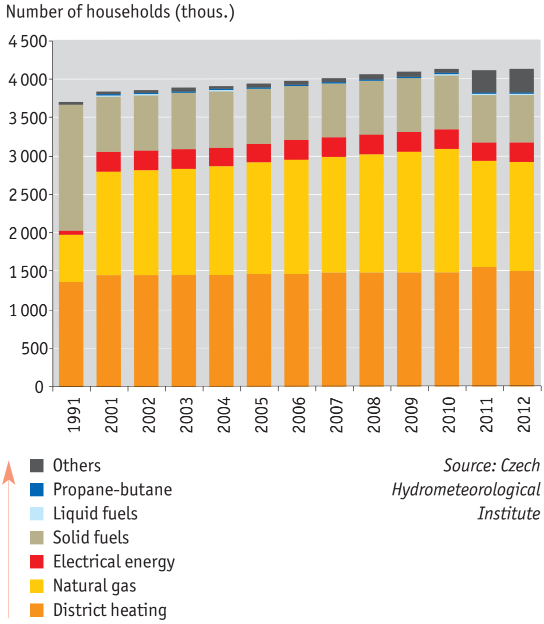
Chart 1 → **PM_{10} emissions from the different economic sectors in the Czech Republic [%], 2011**



Source: Czech Hydrometeorological Institute

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

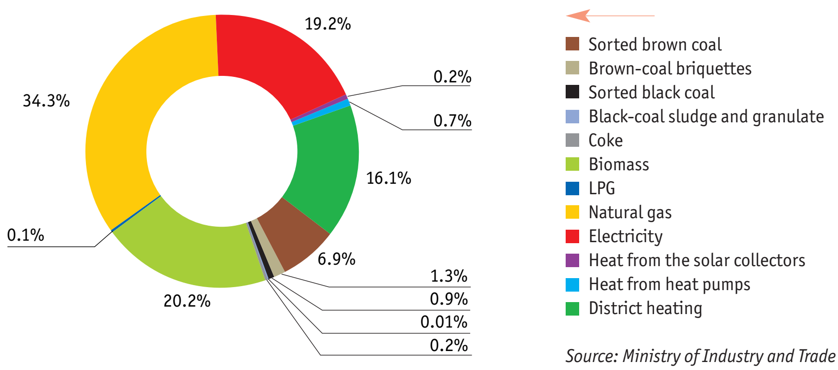
Chart 2 → **Prevailing heating methods used in permanently inhabited households in the Czech Republic [thous. of households], 1991, 2001–2012**



Source: Czech Hydrometeorological Institute

Based on data from the population and housing censuses in 1991, 2001 and 2011.
By 2011, flats with the boiler-room located outside of the house and flats with the boiler-room located in the house with more than 20 flats are included into households heated from a district heat supply in order to determine the boundaries between two categories of the Register of Emissions and Air Pollution Sources.
The category "Others" includes the other or unidentified ways of heating.

Chart 3 → **Fuel and energy consumption by households (the proportion of energy contained in individual sources) in the Czech Republic [%], 2012**



Source: Ministry of Industry and Trade

The environmental and health impacts of household heating are considerable. In 2012, 15.1% of households used **solid fuels** for heating. These households operate 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. These devices have a lifetime period of up to several tens of years and they are still being sold due to lower prices. Combustion gases from small sources are discharged at low height above the ground and therefore cannot spread out.

In 2011[1] 37.6% of the total PM_{10} emission came from **local heating units** (Chart 1). Compared to the year 2010, the total PM_{10} household heating emission decreased from 13.8 kt to 12.4 kt in 2011. This decrease was influenced by the heating season's character, which was relatively warm in 2011. The total PM_{10} emission amounted to 33.0 kt in the Czech Republic in 2011.

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. The data recorded in 1991, 2001 and 2011 are included in Chart 2. Since 2001, the household heating methods have not changed significantly in the Czech Republic. District heat supply (36.2%) and household heating using natural gas (34.4%) still prevail. Heating using solid fuels has been declining only minimally. However, more fuels are included in this category and their division (mostly among coal and wood) cannot be specified exactly as these two fuels are very often burnt together (co-combustion) and the users use and exchange them depending on their current prices. In Chart 2, this concerns „the main heating". Nevertheless, households often use multiple types of fuel for heating – the most common combinations include gas/wood and coal/wood, in rural areas also gas with electricity/coal/wood.

In 2012, the **total amount of energy** which was delivered **to households** from the individual sources was approximately 274,100 TJ; this is by 0.4% more than in 2011. This development is related to the length of the heating season and to temperatures during the winter. Compared to the thirty-year average, the 2011 heating season was relatively warm; the year 2012 was a little colder and therefore more heat-demanding (by 10.3% more compared to the year 2011). The disproportion between a greater change of the heating season and a smaller change of heating fuels consumption can be caused by thermal insulation of houses and other measures to prevent heat loss from buildings.

Interannual changes in fuels consumption in households are not significant; they vary below 3% for all fuels. A more important change has only been recorded for heat pumps (increase by 21.0%) and solar collectors (increase by 12.0%). Although these resources have developed greatly in recent years and production of heat from them increases by approximately 10–30% every year, their total proportion is still in units per mille (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

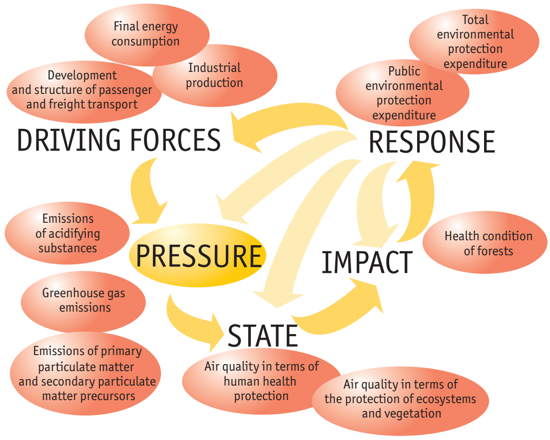
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1891)

[1] Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

23/ 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 2012, there has been only a slight decrease of energy intensity (by 1.1%) because the decline in energy consumption was greater than the decline in GDP.

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.

In international comparison, the Czech Republic is still among the countries with high energy intensity per unit of GDP.

OVERALL ASSESSMENT

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The long-term objectives of the **State Energy Policy (SEP) of the Czech Republic** include accelerating and subsequent stabilising of the decrease in the GDP energy intensity at an annual rate of 3.0–3.5% (indicative objective) and accelerating and subsequent stabilising of the decrease in the GDP electricity intensity at an annual rate of 1.4–2.4% (indicative objective).

The current **State Environmental Policy of the Czech Republic** aims at reducing the energy intensity (energy consumption per GDP unit) in accordance with objectives of the State Energy Concept. Another goal is to reduce the energy intensity of the national economy by developing regional energy policies, performing energy audits and engaging in activities directed at reducing energy losses during energy transfer.

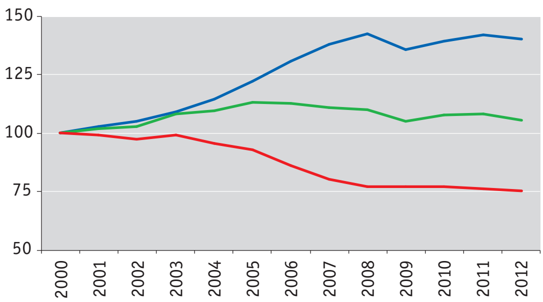
The **Climate-Energy Package**, which was approved by the EU Council and the European Parliament in 2008, contains a commitment to achieve reduction of greenhouse gas emission by at least 20% by the year 2020 in comparison with the year 1990. An increase in energy efficiency is the key element for the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

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. More than 65% of the total greenhouse gas emissions come from the public and industrial energy sectors. Energy also account for 79% of the SO_2 emission, 47% of the NO_x emission and 15% of the PM_{10} emission. In the Czech Republic, this is connected with a large proportion of coal in primary energy sources. Due to greenhouse gas emissions, the energy sector contributes to climate change (increased incidence of hydrometeorological extremes – drought waves, floods and extreme temperatures), emissions of pollutants cause forest defoliation and landscape disruption. Air pollution generally contributes to increased incidences of respiratory problems, allergies, asthma or reduced immunity and mortality.

INDICATOR ASSESSMENT

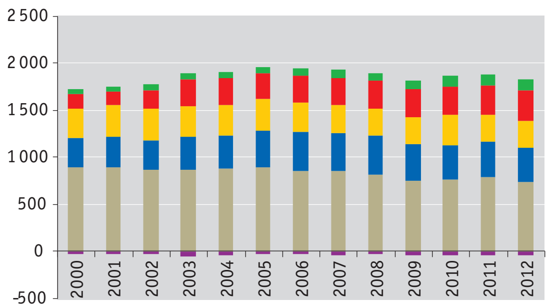
Chart 1 ➔ **Energy intensity of Czech Republic's GDP [index, 2000 = 100], 2000–2012**



- GDP
- Consumption of PES
- Energy intensity of GDP

Source: Czech Statistical Office, Ministry of Industry and Trade

Chart 2 ➔ **PES consumption trends in the Czech Republic [PJ], 2000–2012**

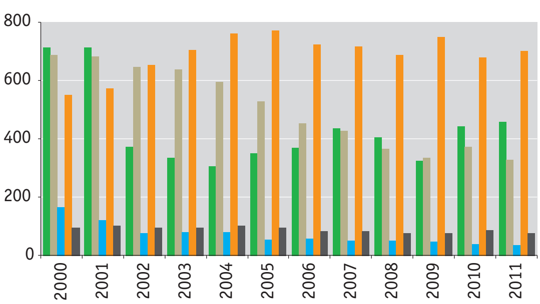


- RES without electricity
- Primary heat
- Gaseous fuels
- Liquid fuels
- Solid fuels
- Primary electricity

Source: Ministry of Industry and Trade

In the Chart, primary heat means the heat produced in nuclear reactors. Primary electricity is electricity generated in hydroelectric power plants (excluding pumped storage power stations), wind and photovoltaic power stations plus the balance of import and export of electricity.

Chart 3 ➔ **Energy intensity trends by sectors, expressed as the proportion of the final energy consumption in the sector and gross value added of the sector in the Czech Republic [MJ.thous. of CZK^{-1}], 2000–2011**

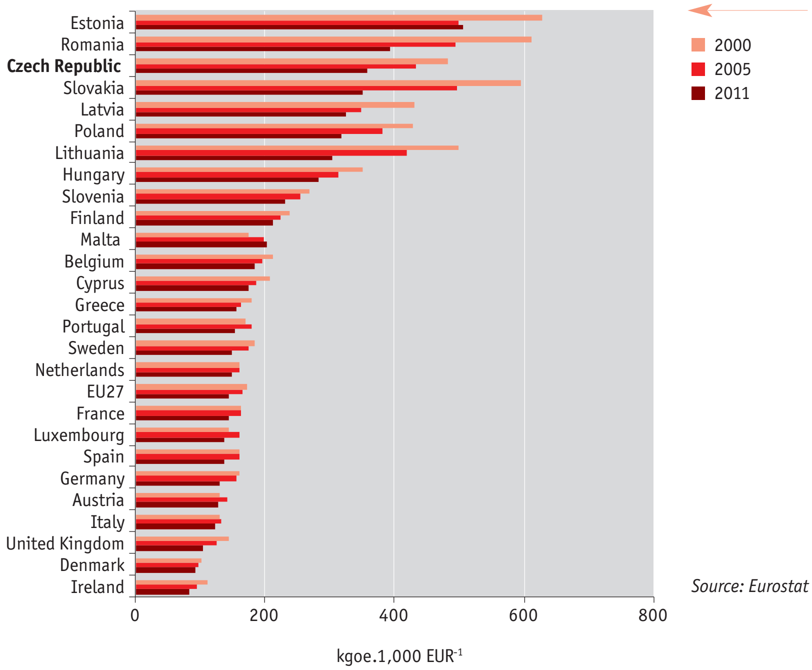


- Agriculture and forestry
- Industry
- Construction sector
- Transportation
- Other

Source: Ministry of Industry and Trade

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

Chart 4 ➜ **International comparison of energy intensity of the economy [kgoe.1,000 EUR^{-1}], 2000, 2005, 2011**



Source: Eurostat

In the Chart, the energy intensity is calculated as the proportion of gross energy consumption in GDP at constant prices of base year 2000.

The unit kgoe (Kilogram of Oil Equivalent) corresponds to the energy obtained from 1 kg of crude oil (41.868 MJ or 11.63 kWh).

Energy intensity is 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 achieve the greatest possible production and to ensure the range and quality of services with the lowest possible requirements for energy sources.

The energy intensity of the Czech Republic's economy **has been decreasing** in long terms. This is due to the growth of the economy (GDP), but also due to the use of technologies with lower energy intensity, BAT, thermal insulation of buildings or savings in households. Given the fact that this relative indicator is obtained by dividing energy consumption by the GDP value, it is declining if the change in energy consumption is lower than the change in GDP 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 major decline. However, the energy intensity of the economy continues in the permanent slight decrease since 2010.

In 2012, there was a slight interannual decrease in **PES consumption** (by 2.3%), but also in GDP (by 1.2%). The economy's energy intensity has reached 498.8 GJ.CZK 1,000^{-1} (constant prices of base year 2005) and therefore it decreased by 1.1% interannually. In longer term, i.e. since 2000 (when this value was 661.8 GJ.CZK 1,000^{-1}), there was a total decline in energy intensity by 24.6%.

Since 2000, the **PES consumption** has been increasing interannually by 0.7 to 5.6% in the Czech Republic (Chart 2). In 2006, this trend was interrupted and the PES consumption began to vary. In 2007, the PES consumption achieved the highest value in the entire period since 2000. Since that year, it has had a downward trend. In 2012, there was an interannual decrease in PES consumption by 2.3%; its value reached 1,784.4 PJ.

In the **PES structure**, declining consumption of solid fuels since the year 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 40.9% of the total PES amount. Liquid fuels account for 20.4%, 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) for greenhouse gas emissions that 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 2000–2011 there was a 52.3% decline), energy intensity of the **transport sector** was growing or varying in last five years. In 2011, there was an interannual increase in energy intensity of transport by 3.7%; in case of industry, a decrease by 12.2% was recorded. 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 the passenger car transport is approximately 53%.

In an **international comparison** (Chart 4), the Czech Republic still belongs to the countries with high energy intensity per unit of GDP; however, it keeps heading for lower values. As opposed to the EU27 average, the Czech Republic's energy intensity of GDP creation is approximately 2.6 times higher. The reason consists in the high proportion of energy-intensive industries in the Czech economy.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

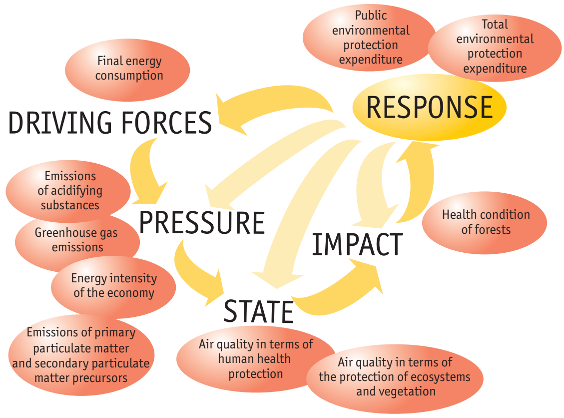
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1892)

24/ Electricity and heat generation

KEY QUESTION →

What is the structure and amount of the energy produced?



KEY MESSAGES →

Electricity generation has been growing in long terms but in 2012 it remained on the 2011 level.

Steam power stations, which burn mainly brown coal, produced 59.0% of electricity and nuclear power stations 34.6%.

Generation of electricity in steam power stations has been decreasing while the importance of nuclear energy and renewable energy sources has been rising. The total amount of produced heat has been falling in the long term. In comparison with other European countries, the Czech Republic's energy dependence is relatively low.

The balance of exports and imports of electricity in 2012 amounted to 19.5%. In relation to the environment, this is a negative phenomenon since emissions from its generation were produced in the territory of the Czech Republic.

OVERALL ASSESSMENT →

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 final energy consumption by 2020.

The **State Environmental Policy of the Czech Republic** aims at the maximum possible replacement of non-renewable sources with renewable sources. Partial objectives of this document are, for example, greater use of renewable and secondary energy sources and potential savings, reduction of emissions from combustion resources, introduction of modern high-efficiency technologies, promotion of low-carbon fuels, regulated building of the renewable energy sources and energy savings in the heating and cooling of buildings.

The objectives of the **State Energy Concept of the Czech Republic** include maximum energy valuation, maximum effectiveness in acquiring and transforming energy sources, support to the production of electricity and heat 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.

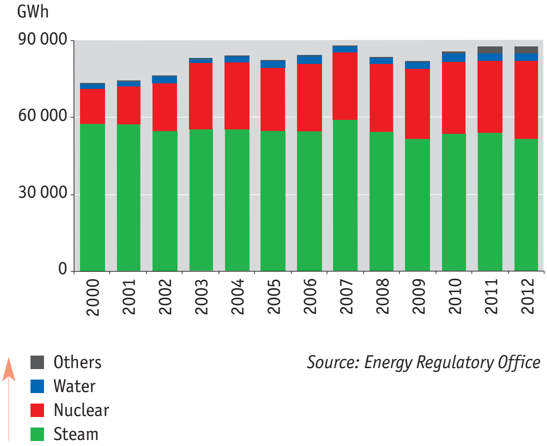
The **Raw-Material and Energy Security Concept of the Czech Republic**, which will be in accordance with the State Energy Concept and the State Raw-Material Policy of the Czech Republic, is under preparation.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The mix and the proportion of the different energy sources are closely linked to the composition of the emissions of pollutants and greenhouse gases that are discharged into the atmosphere. Due to greenhouse gas emissions, the energy sector contributes to climate change (increased incidence of hydrometeorological extremes – drought waves, floods and extreme temperatures), emissions of pollutants cause forest defoliation and landscape disruption. Air pollution generally contributes to increased incidences of respiratory problems and allergies, asthma and increased morbidity and mortality. While the 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 the attractiveness of the territory. Furthermore, many energy sources occupy large areas of land, affect the microclimate of the given site and interfere with the aesthetic and recreational functions of the landscape.

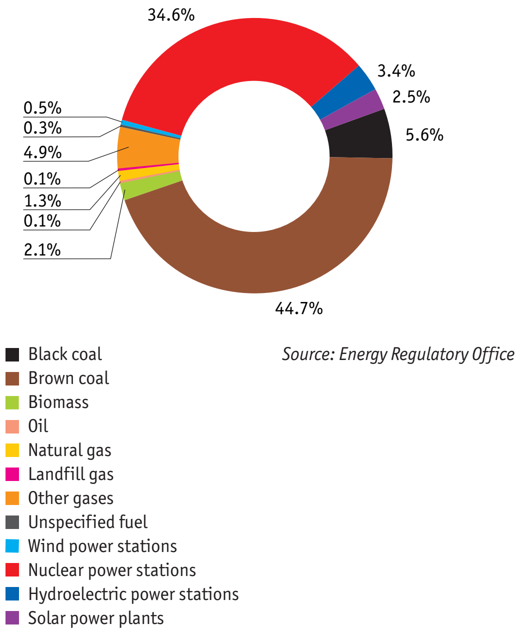
INDICATOR ASSESSMENT

Chart 1 → **Electricity generation by the type of power stations in the Czech Republic [GWh], 2000–2012**



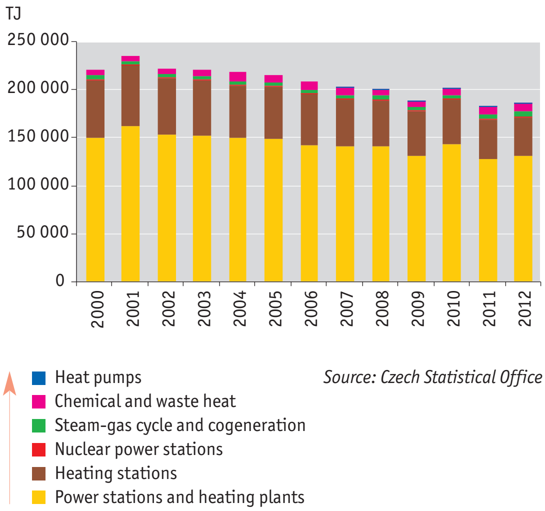
Source: Energy Regulatory Office

Chart 2 → **Electricity generation by fuel type in the Czech Republic [%] 2012**



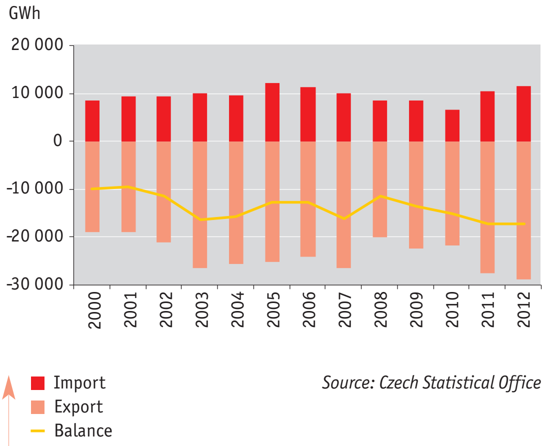
Source: Energy Regulatory Office

Chart 3 → **Net heat production by sources in the Czech Republic [TJ], 2000–2012**



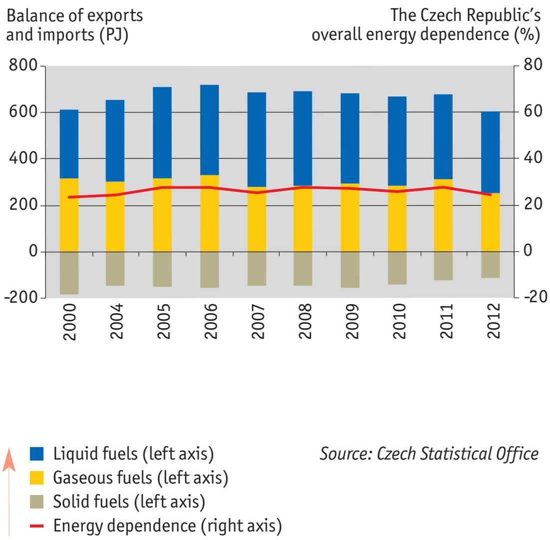
Source: Czech Statistical Office

Chart 4 → **Electricity imports and exports in the Czech Republic [GWh], 2000–2012**



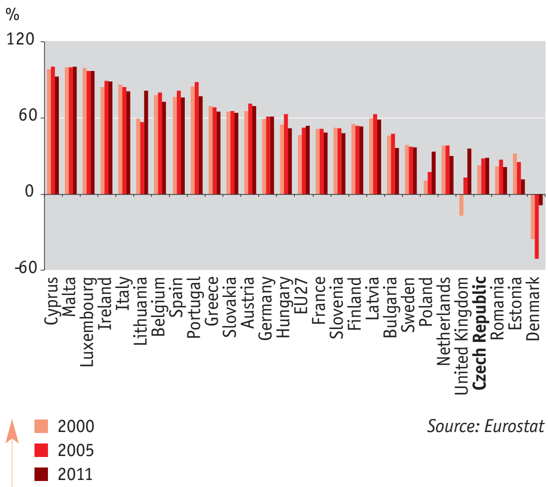
Source: Czech Statistical Office

Chart 5 ➜ **Export-import balance for different fuels, the overall energy dependence of the Czech Republic [PJ, %], 2000, 2004–2012**



Source: Czech Statistical Office

Chart 6 ➜ **International comparison of the energy dependence [%], 2000, 2005, 2011**



Source: Eurostat

In the period 2000–2012, the **overall amounts of generated electricity** were rather varying but the long-term trend is growing (Chart 1). Compared to the year 2000, more electricity was generated in 2012 (by 19.2%). The 2011/2012 interannual change is minimal as in 2012, 87,574 GWh of electricity were generated (in 2011, it was 87,561 GWh).

In comparison with the year 2011, there was a change in the **proportions of the different sources** in 2012. In 2012, there was an interannual decrease in electricity generation in steam power stations burning mainly fossil fuels (by 4.1%), on the other hand, electricity generation has grown in all the other sources: nuclear power stations (by 7.2%), hydroelectric power stations (by 4.5%) and in the category „others", which includes electricity from wind and solar power stations (by 3.0% in total).

In the Czech Republic, **steam power stations** still account for the largest proportion of electricity generation (59.0%), i.e. mainly brown-coal-fired power stations (Chart 2). In 2012, 51,696 GWh of electricity were generated in steam power stations. The **nuclear power stations** (in Dukovany and Temelín) have the second biggest proportion in the Czech Republic; with a total production of 30,324 GWh, they accounted for 34.6% of electricity generated in 2012.

Renewable sources increase their proportion in electricity generation every year (Chart 3). In 2012, 8,056 GWh of electricity were generated in these sources, which corresponds to a 9.1% share in the total quantity of electricity generated in the Czech Republic (in 2011, this proportion was 8.3%).

In the Czech Republic, **heat production** (Chart 3) is ensured predominantly by power stations[1] and heating plants[2] (70.9%) and heating stations[3] (22.8 %). 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. 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 2012, the net heat production accounted to 185,589 TJ, which is a slight interannual increase by 1.6%.

[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 public and industrial energy sectors are important producers of **emission of air pollutants** and greenhouse gases. In 2011[4] these sectors accounted for 79.1% of the total SO_2 emissions, for 47.9% of the total NO_x emissions and for 66.4% of the total CO_2 emissions. Compared to the previous year, there was a decline in SO_2 emissions by 4.9% in this sector and in NO_x emissions by 5.8%. On the other hand, CO_2 emissions from the energy sector have been increasing slightly, namely by 0.1%.

In 2012, 28.7 TWh of electricity, i.e. 32.8% of the total quantity generated, were exported (Chart 4). Nevertheless, 11.6 TWh of electricity were imported. The **export-import balance** is therefore 17.1 TWh, which is 19.5% of the total amount of electricity generated in the Czech Republic (87,574 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. In addition, the Czech Republic exports both coal and electricity (Charts 5 and 6). 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 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 24.6% in 2012. In the period 2000–2012, this value was not changing very much; it varied between 23.5% and 27.6% (Chart 5).

In comparison with the other European countries (Chart 6), the Czech Republic's energy dependence is relatively low (the fourth lowest in 2011). The average energy dependency of EU27 countries is 53.8%, which is almost a double. The only EU country that is not dependent on imports of energy sources is Denmark (2010), which exports crude oil and natural gas from the North Sea and also supports renewable energy sources to a great extent.

According to the **long-term projections** presented in the State Energy Policy of the Czech Republic, the Czech Republic's imports of energy sources will increasingly exceed the exports. At the end of the period concerned (2030), energy imports will be dominated by nuclear fuel (35%) followed by natural gas (34%), liquid fuels (15%), and black coal and coke (9% of all imports of energy sources). The Czech Republic will be fully dependent on natural gas, crude oil and nuclear fuel, and highly dependent on black coal (55%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

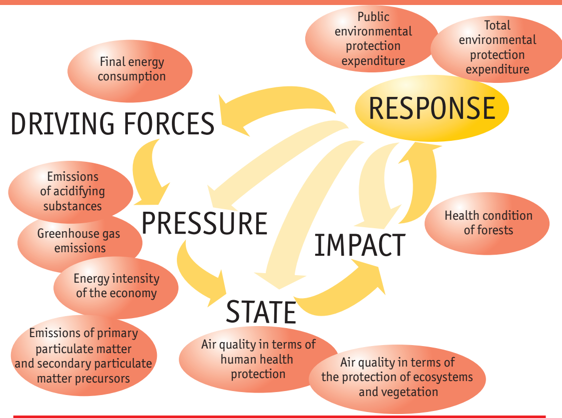
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1893)

[4] *Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

25/ Renewable energy sources

KEY QUESTION →

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



KEY MESSAGES →

Generation of electricity from RES has been growing in long terms; interannually, it increased by 11.2%. Electricity generation from biogas contributed to it with the greatest part.

The ratio of the quantities of electricity generated from the single RES is relatively balanced, contributing to the Czech Republic's greater energy security.

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

OVERALL ASSESSMENT →

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.

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 final energy consumption by 2020.

The current **State Environmental Policy of the Czech Republic** aims at the maximum possible replacement of non-renewable sources with renewable sources and also at the use of biomass and primarily wood as a widely-used raw material instead of non-renewable resources. Other requirements include creating the conditions for a gradual increase in the proportion of RES in the domestic consumption of primary energy resources in the amount of at least 15% in 2030 and achievement of at least 15% share of electricity from RES in the gross electricity consumption in 2030.

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.

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.

Objectives of the **State Energy Concept of the Czech Republic** include minimisation of greenhouse gas emissions, support to and use of RES to generate electricity and produce heat or higher use of alternative fuels in the transport sector.

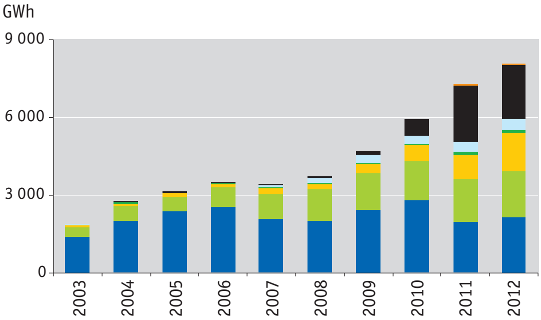
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

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 frequent problem of renewable sources consists in the material and energy intensity that is usually associated with their production 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 the 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], 2003–2012**

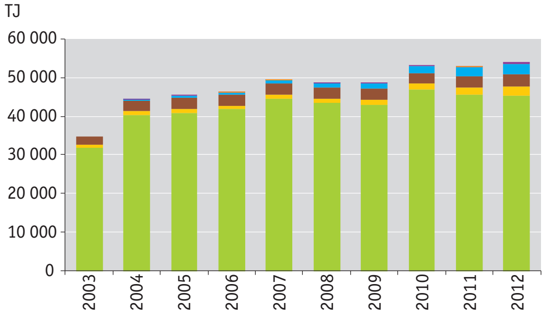


- Liquid biofuels
- Photovoltaic cells
- Wind power stations
- Solid municipal waste (biodegradable municipal waste)
- Biogas
- Biomass
- Hydroelectric power stations

Source: Ministry of Industry and Trade

There are preliminary data and estimates in the Chart. Final data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 ➔ **Production of heat from RES in the Czech Republic [TJ], 2003–2012**

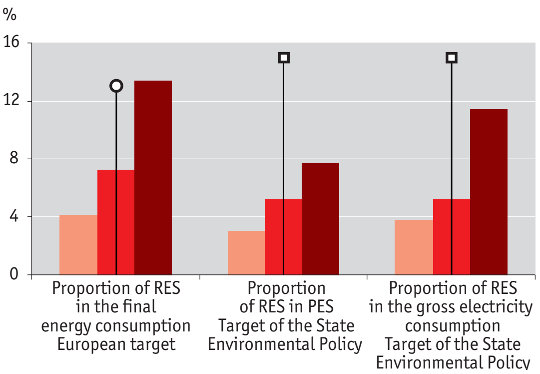


- Liquid biofuels
- Solar thermal collectors
- Heat pumps
- Waste
- Biogas
- Biomass

Source: Ministry of Industry and Trade

There are preliminary data and estimates in the Chart. Final data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

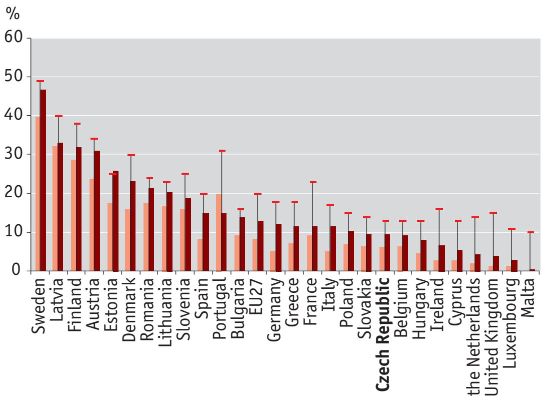
Chart 3 ➔ **Targets for RES and the state of their implementation in the Czech Republic [%], 2004, 2008, 2012**



- 2004
- 2008
- 2012
- Target in 2020
- Target in 2030

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

Chart 4 ➔ **International comparison of proportions of RES in gross electricity consumption [%], 2005, 2011**



- 2005
- 2011
- Target in 2020

Source: Eurostat

The **importance of RES** has been growing in the Czech energy sector. The amount of energy produced by them, as well as their proportion in the total energy produced in the Czech Republic, increases every year (Chart 1).

In 2012, 8,056 GWh of **electricity were generated from RES** which corresponds to a 9.2% share in the total quantity of electricity generated in the Czech Republic (in 2011, this proportion was 8.3%). Compared to the year 2011, there has been an increase by 11.2%. This increase is mainly caused by significant increase in electricity generation from biogas (by 58.4%). As opposed to the trend in the previous four years, when there was a several-fold interannual increase of electricity generation from photovoltaic power plants, this category declined slightly in 2012 (by 1.5%). This stagnation can be explained by cessation of installations of new photovoltaic power stations in 2011 in response to probable development of the subsidy policy and purchase prices of electricity from these sources.

There was an interannual increase of the amount of electricity generated from biomass (by 7.5%) and in wind power stations (by 4.8%). Generation of electricity from municipal waste decreased slightly (by 3.5%). Electricity generation in hydro-electric power stations is dependent on hydrological conditions and the amount of rainfall; that is why interannual fluctuations are relatively usual. After a marked decline in 2011, when there was the lowest electricity generation in hydro-electric power stations since 2004, it increased by 8.5% in 2012.

Until 2010, hydro-electric power stations had been the main and largest source of electricity from RES in the Czech Republic. Thanks to the support to renewable sources, however, the importance of the other RES types was growing and now the **structure of electricity generation from RES** is relatively diversified (Chart 1), and the ratios among the single sources are balanced (Chart 1). In 2012, photovoltaics accounted for the largest proportion of electricity generation from RES (26.7%), closely followed by hydro-electric power stations (26.4%). Biomass (22.4%) and biogas (18.3%) were the next in order. Wind power stations are being used in a relatively small scale (5.2%); their potential is limited by natural conditions in the Czech Republic. Incineration of municipal solid waste is also a minor source (1.1%).

The **production of heat from RES** has been increasing in long terms; in 2012, there was an interannual increase by 1.8%. The largest share is covered by biomass (83.8%), for which the consumption of fuels (particularly wood) in households is the decisive factor. However, production of heat from biomass decreased interannually by 0.5%. The other sources take much smaller parts in heat production (waste 5.7%, heat pumps 4.9%, biogas 4.6%, solar thermal collectors 1.0%). A more significant interannual increase was recorded for the production of heat from biogas, namely by 30.8%, as the heat production increased from 1,911 TJ in 2011 to 2,500 TJ in 2012. Heat production from heat pumps has also increased, namely by 21.1%.

The **indicative targets** for the 2010 proportion of RES have been met within the given period, and currently the Czech Republic is heading for other objectives, namely for the years 2020 and 2030 (Chart 3). The proportion of electricity generated from renewable energy sources in the Czech Republic's gross electricity consumption increased interannually from 10.3% to 11.4%, while the indicative target of the Czech Republic's State Environmental Policy for the year 2030 is 15% and the indicative target in the NAP for RES in 2020 is 14%. The share of energy from RES in the total consumption of PES was 7.8% in 2012; the target of the State Environmental Policy of the Czech Republic is to achieve a 15% share in 2030. The Directive 28/2009/EC on the promotion of RES has obliged the Czech Republic to achieve a 13% share of energy from RES in the final gross energy consumption. This target was met in 2012, as the share of energy from RES amounted to 13.4%.

The support of electricity generation from RES results in an increase of electricity prices. This is problematic especially for large customers, for example in metallurgy, chemical, paper or glass industry. The increase of prices may threaten their competitiveness or even their very existence.

By **international comparison with other EU countries**, the Czech Republic is among the countries with a low proportion of renewable energy sources in total electricity consumption (Chart 4). The problem consists in the limited RES potential that is available in the Czech Republic; the potential for hydroelectric power stations is not as great as it is in Norway or Austria or the potential for wind power stations is not as great as it is e.g. in Germany. However, the potential for biomass use is comparable to other Central European countries.

RES are an important part of the **reduction of emissions** of greenhouse gases and air pollutants. Due to the fact that the renewable sources originate from the Czech Republic's territory, they also help contribute to a greater energy security and independence on the international trade in energy raw materials. However, **their benefits are discussed** because they are favoured as opposed to the prevailing traditional fossil resources, they affect energy prices for the consumers and their installation may disturb the socio-economic links and landscape character.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

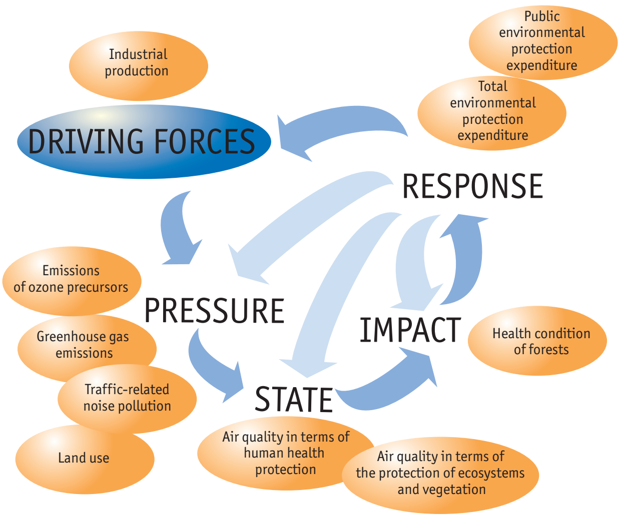
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1962)

26/ Development and structure of passenger and freight transport

KEY QUESTION

What are the trends in the Czech Republic's transport characteristics and the associated environmental burden?



KEY MESSAGES

Transport performance of environmentally friendly modes of public transport has been increasing in the Czech Republic. In 2012, the railway transport performance increased by 8.3%, and that of public transport in cities by 3.5%. The Czech Republic is in the first place in the proportion of public transport in the total performance of passenger transport among the EU27 states. Transport-related emissions of pollutants and greenhouse gases are decreasing due to renewal of the vehicle fleet and ceased growth of the transport performance in those modes of passenger and freight transport which produce more pollution.

The proportion of road freight transport in the freight transport performance has been growing. It reached 75.2% in 2012, which indicates continuation of high potential environmental burden since the road freight transport is the main source of emissions of NO_x, VOC and suspended particles.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Within its Priority Axis 2 (Economy and Innovation) the **Strategic Framework for Sustainable Development of the Czech Republic** aims at improving transportation, making it more effective and increasing its security. The objective is based on the need to ensure sustainability of transport, to reduce emissions in the air and to increase energy efficiency of transport. The objective's fulfilment also includes completion of the basic road and railway network and development of cycling infrastructure. The priorities focus on the transit road traffic bypassing towns and villages, increasing the smoothness of traffic and reducing the negative impacts of transport on valuable nature territories.

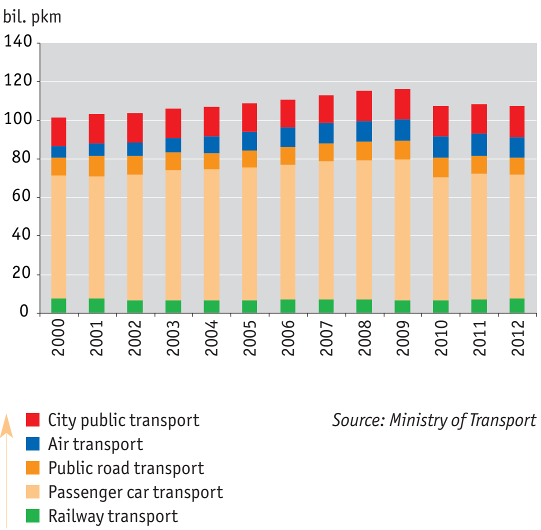
The updated **Transport Policy of the Czech Republic for the period 2005–2013** was approved by the Czech Republic's Government in 2011. The updated Policy is based on the creation and updates of other strategic documents at the European and national levels which are related to transport policy, and on current development in the transport sector.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Transport, especially road transport, produces air pollution and causes noise pollution. Fundamental risks to human health arise from the fact that intensive road traffic often affects densely populated areas (towns, cities and urban agglomerations). As far as human health is concerned, the most risky pollutants are suspended particulate matter (PM_{10}, $PM_{2.5}$) The effects of increased daily concentrations and long-term burden with suspended particulates include higher morbidity and mortality, the increase in respiratory diseases, increased incidence of cough and respiratory distress, especially for asthmatics, and reduced lung function with children and adults. Ecosystems and vegetation are damaged especially by secondary air pollutants (ground-level ozone) that are formed from ground-level ozone precursors produced by transport, in particular nitrogen oxides and volatile organic compounds. The linear transport infrastructure causes landscape fragmentation and thus it disturbs the landscape's functions.

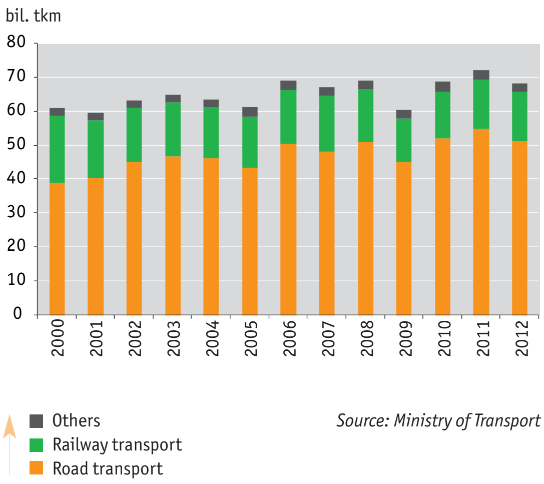
INDICATOR ASSESSMENT

Chart 1 → **Development of the performance in passenger transport in the Czech Republic [bil. pkm], 2000–2012**



Source: Ministry of Transport

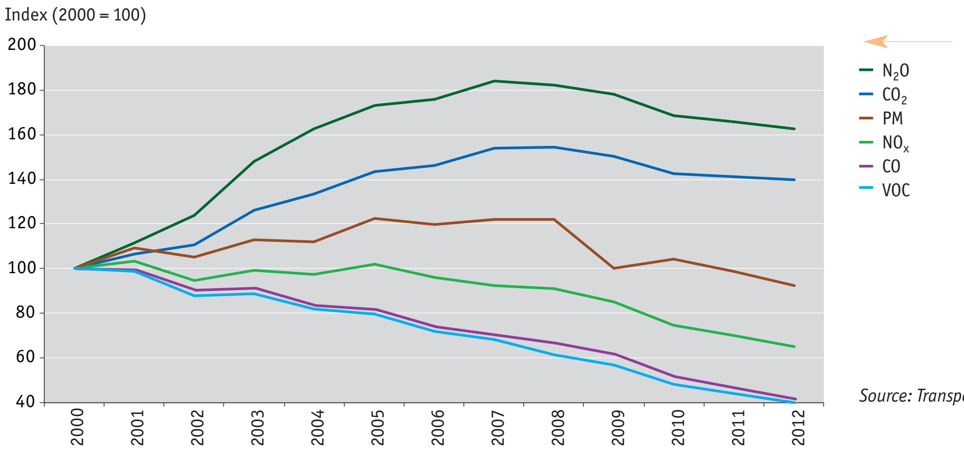
Chart 2 → **Development of the freight transport performance in the Czech Republic [bil. tkm], 2000–2012**



Source: Ministry of Transport

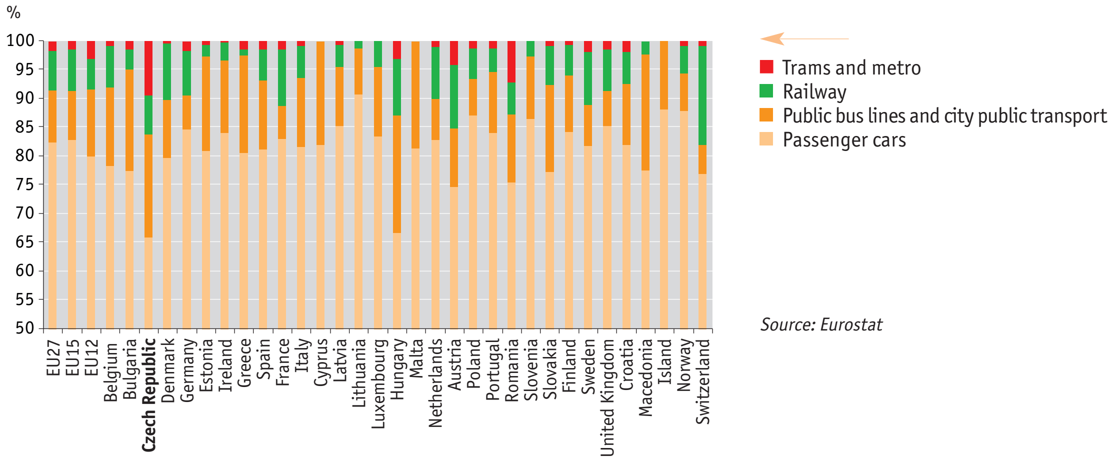
In 2010, there was a methodological change in calculation of the passenger car transport performance.

Chart 3 → **Emissions of transport-related air pollutants [index, 2000 = 100], 2000–2012**



Source: Transport Research Centre

Chart 4 → **International comparison of passenger transport structure by transport modes (without air transport) [%], 2010**



Source: Eurostat

The **total performance**[1] in **passenger transport**, after a continuous growth in 1990–2009, fluctuated after 2010 in the Czech Republic. In 2012, it decreased interannually by 1.3% to 107 bil. pkm, particularly as a result of the decline in passenger car transport performance by 1.9% (Chart 1). In 2010–2012, there was a slight increase in performance of railway passenger transport and the track-bound sections of city public transport, i.e. modes of transport that are more friendly to the environment. The proportion of passenger car transport in the total passenger transport performance (including air transport) reached 60.1% in 2012; since 2000 it declined by 3.0 p.p. Passenger transport individualisation, typical for 1990s, has therefore stopped.

The **railway passenger transport** performance has been growing since 2010. In 2012, it increased by approximately 550 mil. pkm (8.2%); the railways carried by approximately 5 mil. passengers more than in the previous year. This is the largest interannual increase in railway passenger transport performance since 1990. In 2012, the city public transport performance also increased (by 3.5%), the total number of passengers carried by city public transport grew by about 95 mil., which is 4.0%. The greatest increase was recorded in the Prague metro in 2012; it transported by about 60 mil. passengers more than in 2011. Transport performance and the number of passengers carried by **buses not included in city public transport** have been falling. In 2012, the transport performance of buses decreased by 2.8%, the number of passengers declined interannually by approximately 20 mil. (5.6%). There was an increase only in the number of passengers using international bus transport (by approx. 400 thousand). In the Czech Republic, the dominance of bus transport over the rest of public transport has been decreasing gradually although buses still carry twice more passengers per year than railways. Service improvement in railways (associated with competition on some routes) and also greater use of railways within integrated city transport systems become evident.

In **passenger air transport**, there was an interannual (2012/2011) decline in the performance of air carriers registered in the Czech Republic by 8.4%, the number of passengers dropped by 1.1 mil. to 6.4 mil. passengers in 2012. The overall performance of airports in passenger transport also decreased (by 7.3%) in 2012; airports in the Czech Republic checked in 11.8 mil. passengers in 2012, which is by about 930 thousand passengers less than in 2011. There is a significant decrease of the number of passengers in domestic air transport, which declined by 25.6% to approx. 90,600 in 2012; this was only 0.8% of all passengers checked in at airports in the Czech Republic.

[1] Transport performance specifies the actual transport (of load or passengers). It is defined as transport output (i.e. the distance travelled by the vehicles) multiplied by the number of persons or the quantity of goods that were transported. It is expressed in passenger-kilometres (pkm) and tonne-kilometres (tkm).

Freight transport performance in the Czech Republic[2] fluctuated after the year 2000, depending on development of the economy and industrial production. In comparison with the year 2000, it was higher by 12.0% in 2012 and interannually (2011/2012) it decreased by 5.5% to 68.1 bil. tkm (Chart 2). The structure of freight transport performance is dominated by road freight transport (75.2%) the transport performance of which decreased by 6.6% to 51.2 bil. tkm in 2012. The structure of freight transport is not favourable from the environmental point of view, however, air pollution from road freight transport decreases significantly due to renewal of the vehicle fleet.

In 2000–2012, **energy consumption** in transport increased by 42.1% to approximately 243.7 PJ. Transport was the third greatest consumer of energy after the industry and households. In 2005–2012, the growth in energy consumption in the transport sector stopped; the passenger car transport has shown a 4.0% decrease and the total energy consumption in the transport sector decreased by 0.3% in this period. The increase in energy consumption in the road freight transport (by 10.7%) during the economic growth in 2005–2008 was of crucial importance for this development.

Emissions of pollutants and greenhouse gases from transport are decreasing (Chart 3). In the period 2000–2012, there was a decrease of VOC emissions from transport by 60.2%, CO emissions by 58.2% and NO_x emissions by 35.1%. In 2000–2005, the primary emissions of particulate matter grew by 22.5%, due to increased performance of road freight transport and also because of a rising proportion of diesel vehicles in the passenger car fleet. Nevertheless, in the period 2005–2012 the emissions of solid particles from transport declined by 24.4%, mainly as a result of decreased emissions from road freight transport, and in 2012 they were by 7.4% lower than in 2000. Greenhouse gas emissions from transport have shown a significant increase in 2000–2007, and despite a decline in the following years, CO_2 emissions were higher in 2012 by 39.9% and N_2O emissions by 62.6% compared with the year 2000.

In 2010, the proportion of passenger car transport in passenger transport performance in the Czech Republic was one of the lowest in the **EU27** – it amounted to 65.8%. The EU27 average is 82.5% (Chart 4). In the Czech Republic, an above-average proportion of public transport in passenger transport is mainly caused by the high performance of city public transport. The proportion of metro and trams belonging to the city public transport in the total passenger transport performance in the Czech Republic was far the highest in the EU27; it amounted to 9.3%, while the EU27 average was 1.6%. In the European context, the Czech Republic also has very developed bus services (city public buses and inter-city buses); its proportion in passenger transport was 18.1%. Only Hungary and Macedonia have a higher proportion than the Czech Republic. The proportion of railways in the passenger transport performance in the Czech Republic is on the level of the EU27 average; the highest proportion of railways in the passenger transport performance in Europe is in Switzerland (17.2%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

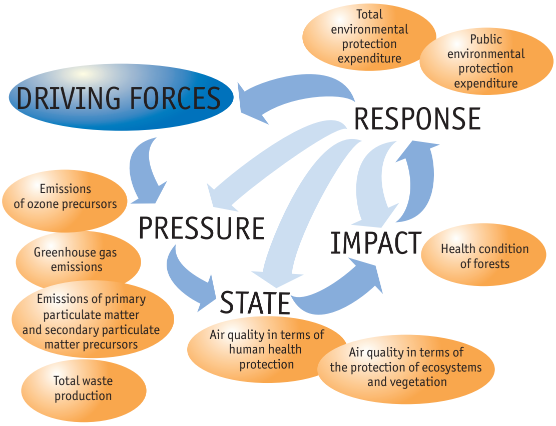
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1894)

[2] Transport performance of carriers registered in the Czech Republic including cabotage in the territory of third countries.

27/ Structure of the passenger-car and truck fleet

KEY QUESTION →

Has there been improvement in the parameters of the road vehicle fleet and, in turn, a reduction in transport-related environmental burden?



KEY MESSAGES →

The number of registered cars and trucks that meet higher emission standards (EURO 4 and EURO 5) has been rising. Newer vehicles with higher emissions standards have the greatest representation in the dynamic structure of the vehicle fleet (i.e. vehicles in the actual traffic), the average age of which is 8.5 years for passenger cars. This fact is a good prerequisite for further reduction of pollution from road transport.

In 2012, registrations of new passenger cars, despite the economic recession, kept the 2011 values and since 2005 they have been growing.

The age of motor vehicles registered in the Czech Republic is very high and their renewal is insufficient. In 2009–2012, the number of cars excluded from the registry and disposed of has decreased by 39.2%. If the 2012 pace of excluding vehicles continues, all passenger cars that are now older than 10 years would be excluded as late as in about 17 years.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Within its Priority Axis 2 (Economy and Innovation), priority 2.1 (Support to the national economy's dynamics and strengthening competitiveness), the **Strategic Framework for Sustainable Development of the Czech Republic** aims at „improving transportation, making it more effective and increasing its security". Fulfilment of the objective also includes an increase of energy efficiency and economic effectiveness of transport and reducing of its negative environmental impacts. This objective is closely related to the vehicle fleet structure as older vehicles are more energy demanding and produce more pollutants.

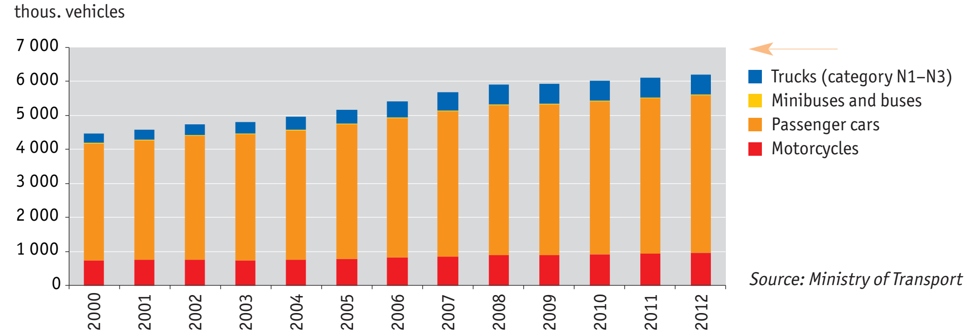
One of the cross-cutting priorities of the **Czech Republic's Transport Policy for the years 2005–2013** is „to limit the environmental and public health impacts of transport in line with sustainable development principles". In 2011, the Government approved the updated version of the Transport Policy. The updated Policy is based on the creation and updates of other strategic documents at the European and national levels which are related to transport policy, and on current development in the transport sector.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Replacement and modernization of the vehicle fleet is one of the main assumptions to reduce the environmental impact of road transport, particularly as regards the reduction of pollutant and greenhouse gases emissions. Poor air quality as a result of traffic burden occurs mainly in inner cities and other densely populated areas, where there is a high risk to human health. The highest risk is connected with suspended particulate matter of smaller size fractions, which may have their primary origin in fuel combustion in engines and the secondary origin on the surface of roads, tires and brake lining. Air pollution from transport burdens ecosystems, especially with increased concentrations of ground-level ozone which is formed in the atmosphere from pollutants produced by transport.

INDICATOR ASSESSMENT

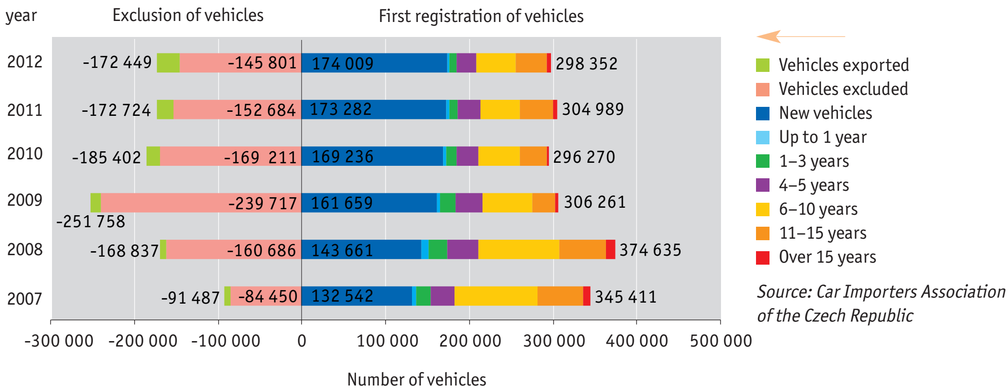
Chart 1 → **Development of the number of motor vehicles registered in the Czech Republic [number of vehicles], 2000–2012**



Source: Ministry of Transport

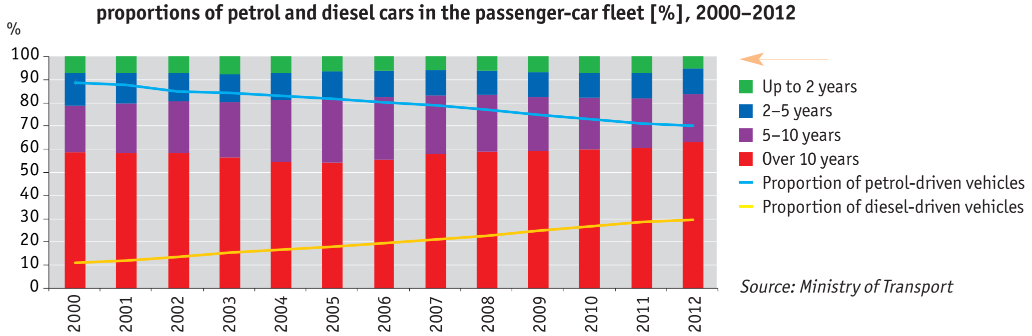
Data for the year 2012 are covered till 30 June, 2012.

Chart 2 → **Registrations of new cars, the first registrations of used cars by their age and exclusion of vehicles from the Central Vehicle Register [number of vehicles], 2007–2012**



Source: Car Importers Association of the Czech Republic

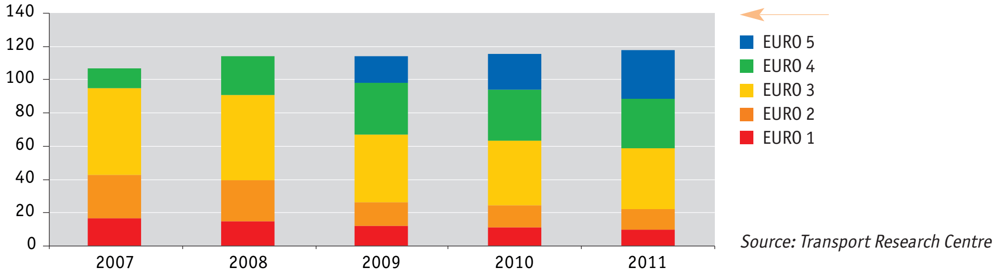
Chart 3 → **Development of the age structure of the passenger-car fleet registered in the Czech Republic [%] and the proportions of petrol and diesel cars in the passenger-car fleet [%], 2000–2012**



Source: Ministry of Transport

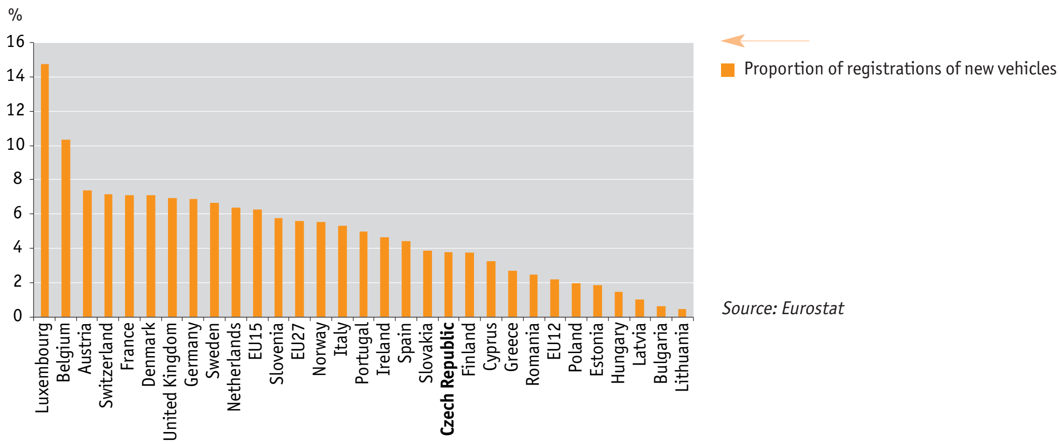
Data for the year 2012 are covered till 30 June, 2012.

Chart 4 ➜ **Development of the total number of registered heavy trucks (categories N2 and N3), meeting the single EURO emission standards [thous. vehicles], 2007–2011**



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

Chart 5 ➜ **International comparison of the proportion of registrations of new vehicles in the total size of the passenger car fleet [%], 2010**



According to the data of the Central Vehicle Register on 30 June 2012[1], 6.463 mil. motor vehicles and 987 trailers were registered, which is a total of 7.450 mil. road vehicles of all categories. Compared with the end of 2011, the number of registered vehicles increased by 1.2%. In 2012, the number of **registered passenger cars** (category M1) grew by 1.9% to 4.638 mil. (increase in registrations by 55,469 vehicles). Since 2000, the number of registered passenger cars has grown by approx. 1.2 mil. vehicles, i.e. by more than one third (Chart 1). The **number of trucks**, i.e. vehicles in categories N1 through N3, has more than doubled since 2000, reaching 589,200 in 2012; after 2008 the number has stagnated. The number of registered motorcycles has been growing; in the first 6 months of 2012 it increased by 1.6% (15.500 vehicles). In comparison with the year 2000, by 28.3% more motorcycles were registered in 2012. This is also reflected in the increasing proportion of motorcycles in the traffic flow structure on roads.

In 2012[2], the number of registrations of **new passenger cars** increased slightly compared with the previous year by 0.4% (i.e. by 727 cars) to 174,008 vehicles (Chart 2). Despite the economic recession, the sale of new cars has not decreased in the Czech Republic and its trend is growing. Since 2005, the number of newly registered vehicles per year increased by 36.6% (approximately 50,000 vehicles). The first registration of **imported used passenger cars** decreased interannually by 5.6% (7,364 vehicles) to 124,343 vehicles. Passenger car import has been declining since 2008 when a record number of about 230,000 vehicles were imported

[1] Due to transfer of the Central Vehicle Register from the Ministry of the Interior to the Ministry of Transport, the data for 31 December 2012 are not available at the time of publication.
[2] Data for the whole year 2012.

to the Czech Republic. Imports of vehicles are declining due to prices development in the markets of used cars in the Czech Republic and abroad, and also because of the increasing availability of new cars. The age structure of imported vehicles has not changed significantly in comparison with the previous years, the highest proportion accounts for the category of 6–10 years, namely 38.7% of the total number of imported vehicles.

In 2012, total of 172,449 cars were **excluded** from the Central Vehicle Register (interannual decrease by 0.2%); of this number, approximately 146,000 vehicles were disposed of (compared with 2011 this is a decline by 4.5%) and 26,600 vehicles were exported (an increase by 33%). The **decline in vehicle exclusion** by their cancellation in 2009–2012 by 39.2% in total (approx. 94,000 vehicles per year) is not positive for renewal of the vehicle fleet as it results in enlargement of the fleet, without the average age of the vehicles being reduced. With the current exclusion pace, the number of cars which is currently in the oldest age category (over 10 years) would be excluded as late as in about 17 years. The increase in exports does not solve the fleet's renewal as nearly half of the vehicles were exported within one year after the first registration.

The **average age** of all motor vehicles registered in the Czech Republic in mid–2012 amounted to 16.8 years (at the end of 2011 it was 16.7 years). Motorcycles (32.2 years) and tractors (30 years) had the highest average age, while vans of the category N1 were the youngest (9.5 years). The average age of the passenger car fleet increased slightly to 13.9 years. In the age structure of registered cars (Chart 3), the category over 10 years prevailed in mid–2012 with a proportion of 63.0% (2.9 mil. vehicles); the proportion of this category has been growing constantly (since 2005 there was an increase by 8.6 p. p.). The age structure of trucks was more favourable; the proportion of the oldest age category (over 10 years) was about 40%, however, the youngest vehicles (up to 2 years) accounted for approximately 5% of the truck fleet, likewise for passenger cars.

The age 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[3] compiled by the company ATEM on the basis of its own research for the Road and Motorway Directorate of the Czech Republic, the average age of the dynamic passenger car fleet was 8.5 years in 2010, which is a value comparable with western Europe. Vehicles produced in 2009 and 2008 (7.7% and 6.6%) had the highest representation in traffic; vehicles younger than 5 years accounted for 37.5% of the passenger car fleet (according to the Central Vehicle Register, the proportion of this age category in the total fleet is 16.3%). In terms of **the fleet's structure by drives**, the proportion of **diesel passenger cars** in the total number of registered cars is increasing significantly. While in 2000 diesel cars represented about one-tenth of the fleet (383,000 vehicles), in 2012, their proportion approached one third (1.4 mil. vehicles, i.e. 29.7 %). However, since the production of emissions from diesel vehicles is gradually approaching the level of petrol-powered cars due to improvement of engines and use of terminal technologies (oxidation catalyst and particulate filter), this trend does not have a significant impact on the production of emissions from car traffic. **Alternative fuels and propulsions** account for a very small (and not growing) proportion in the passenger car fleet, with only conversions of petrol engines to LPG being relatively more frequent; in 2012 this concerned 141,100 vehicles. All alternatively powered vehicles account for approximately 2% of the road vehicle fleet.

The number of registered vehicles which comply with the **EURO emission standards** has been increasing; in 2007–2011[4], the number of passenger cars and vehicles of the category N1 which meet the standards EURO 4 and EURO 5 almost tripled from 555,000 to 1,456,000 vehicles (31.4% of the fleet). In the case of large trucks, the increase was even fivefold to about 59,000 vehicles (Chart 4). The increase in the number of less polluting vehicles within the fleet and the fact that they are also being used more than others is a prerequisite for reducing the production of transport-related emissions.

In 2010, the **motorisation rate** reached 427 cars per 1,000 inhabitants in the Czech Republic which is by 11.7% less than in the EU27 and 18.4% below the average for the EU15 countries. In the city of Prague, however, the motorisation rate (557 vehicles per 1,000 inhabitants in 2010), exceeded the EU15 average by 10.2%. The proportion of newly registered cars in the total size of the fleet (Chart 5), which indicates the rate of the fleet's renewal, was 3.8% in the Czech Republic, which is a good result in the EU12, but still below the EU27 average (by approximately 2 percentage points). In this rate, the entire fleet would be renewed in 25 years (assuming that it will not increase) while in the West European countries (e.g. Belgium, Luxembourg) it would have been for less than 10 years.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

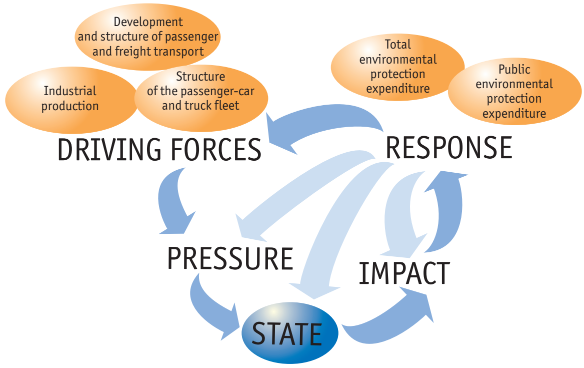
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1895)

[3] An analysis of the current dynamic compositions of the fleet on the Czech Republic's roads and its emission parameters in 2010.
[4] Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

28/ Traffic-related noise pollution

KEY QUESTION →

What is the state and development of noise pollution in the Czech Republic?



KEY MESSAGES →

In the Czech Republic, railway transport, air transport and stationary sources (in particular industry), according to the data available, do not cause noise burden that would be important in terms of its area.

According to current noise maps, 3% of the population are exposed to excessive noise which exceeds the respective health-protection limits. In the three largest urban agglomerations, it is about 10% of the population. The main source of above-limit noise pollution is road transport, which causes considerable noise burden also for the population living outside of urban agglomerations.

OVERALL ASSESSMENT →

The currently available data from the Strategic Noise Mapping do not enable to assess the noise pollution trends. The development of traffic noise will depend on the construction of new roads and their routes, and also on the development of performance in passenger and freight transport. The intensity of noise pollution is being evaluated as early as during the process to assess environmental impacts of roads (EIA), i.e. before their construction begins.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Health-care limits for noise are laid down by the **Regulation No. 272/2011 Coll., on the protection of health from adverse effects of noise and vibration**. In the Czech Republic, the limit values of noise indicators for the purposes of strategic noise mapping are laid down in the **Decree No. 523/2006 Coll., on noise mapping**.

At the European level, the issues of noise exposure are provided for by the **Directive of the European Parliament and of the Council No. 2002/49/EC relating to the assessment and management of environmental noise (END)**, adopted in 2002. The END Directive was transposed into the national legislation by an amendment to the **Act No. 258/2000 Coll., on public health protection and in the Decree No. 523/2006 Coll., on noise mapping**. The Directive aims at determining the level of exposure to environmental noise through noise mapping, using standard assessment methods common to all member states. The Directive also concerns the disclosure of information on noise and its effects, and, on the basis of the noise mapping results, the adoption of action plans by the member states in order to prevent and reduce environmental noise.

According to the Directive, strategic noise maps must be worked out by the end of 2012 (and then every five years) for all agglomerations, main roads and main railway tracks.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Exposure to excessive noise causes stress and interferes sleeping, which can together contribute to immunity reduction, increased susceptibility to infectious diseases, and development of certain civilisation diseases (e.g. allergies). A high level of noise exposure can also affect both hearing and other organs. Long-term exposure to noise above 65 dB is associated with effects on the cardiovascular system, especially in terms of the impact on development of coronary ischaemia and high blood pressure. In West European countries, excessive noise causes a loss of 1.5 mil. years of healthy life every year, which includes the years lost due to premature death and the years of illness significantly limiting the people concerned. As noise affects humans, it also has a similar impact on animals, which can lead to disruption of food chains and loss of biodiversity.

INDICATOR ASSESSMENT

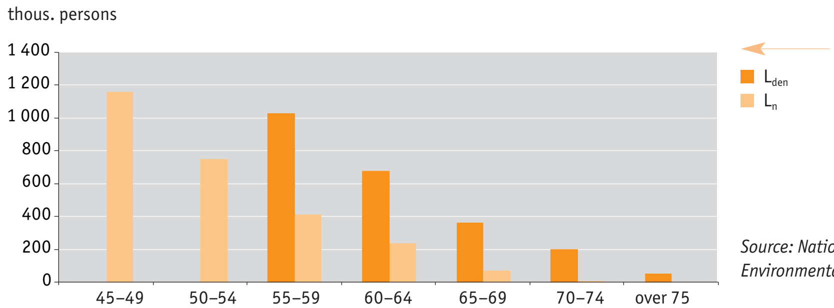
Table 1 ➔ **Limit values for noise indicators in the Czech Republic [dB], according to Decree No. 523/2006 Coll., on noise mapping**

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

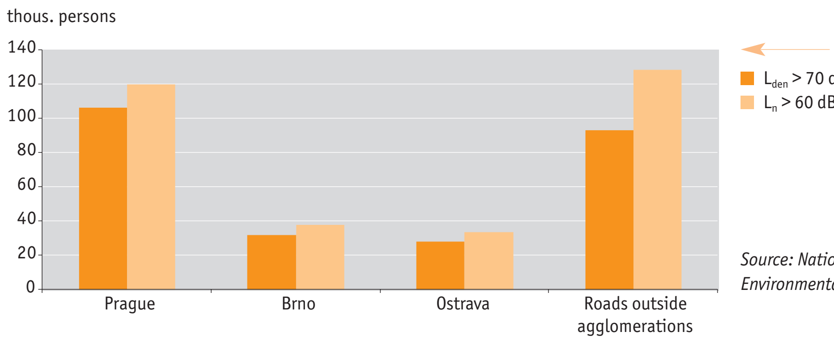
L_{den} – the limit value for day-evening-night to characterize all-day noise-related annoyance
L_n – the limit value for the night hours (11:00 p.m. – 07:00 a.m.) to characterize noise-related sleep disturbance

Chart 1 ➔ **Czech Republic's population living in the individual noise categories according to the indicators L_{den} and L_n, a sum from all sources and areas [thous. persons], 2010**



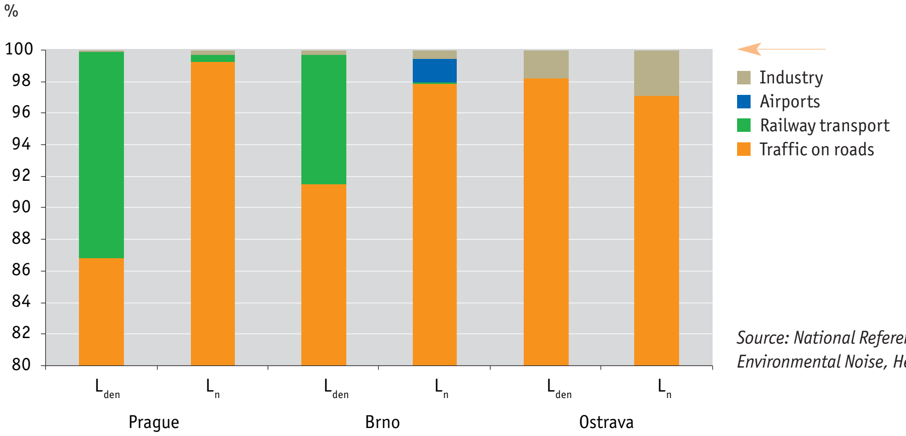
Source: National Reference Laboratory for Environmental Noise, Health Institute

Chart 2 ➔ **The number of the Czech Republic's inhabitants exposed to noise exceeding the limit values in agglomerations and in vicinity of major roads outside agglomerations [thous. persons], 2010**



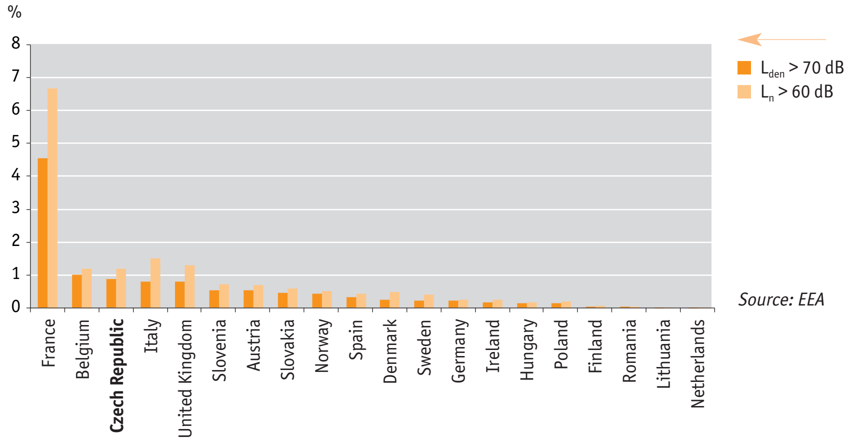
Source: National Reference Laboratory for Environmental Noise, Health Institute

Chart 3 → **Structure of noise sources exceeding the limit values in the agglomerations of Prague, Brno and Ostrava [%], 2010**



Source: National Reference Laboratory for Environmental Noise, Health Institute

Chart 4 → **International comparison of the proportion of population affected by excessive noise from traffic outside urban agglomerations in the total population [%], 2007**



Source: EEA

In the Czech Republic, according to the results of the **1st phase of strategic noise mapping** (SNM), a total of 258,800 people (2.5% of the population) from the perspective of full-day noise pollution and 319,600 people (3% of the population) as regards excessive night noise live in areas where the noise exceeds the health-protection limits (Chart 1). The values refer to the indicators L_{den} (above 70 dB) and L_n (above 60 dB)[1]. Roughly 40% of the total number of persons annoyed by above-limit noise live in Prague, around 10% in Brno and Ostrava and another 40% of them live in vicinity of busy roads outside of urban agglomerations (Chart 2). In the Czech Republic approximately 2.3 mil. people, i.e. 22% of the population, are exposed to all-day noise level exceeding 55 dB[2]. However, it is necessary to emphasize that these results do not cover smaller urban agglomerations (e.g. Pilsen or Ústí nad Labem), roads and railways with lower traffic burden and also smaller airports. The second phase of strategic noise mapping will provide a comprehensive look at the state of noise pollution and probably also higher values of the population exposed to excessive noise pollution. The results will be available gradually in 2013–2014, according to the state in 2012.

[1] *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.*

[2] *All-day exposure to this noise level can cause health defects.*

Road transport, which accounts for approximately 90% of evidenced noise pollution, is unambiguously the **main source of above-limit noise**. Traffic on the roads is the predominant source of noise in major agglomerations, too. In Prague, road traffic accounts for 87% of the daily noise annoyance and about 12,000 people in Prague suffer from railway-related noise. At night, road traffic is almost the only source of excessive noise in Prague and Brno (Chart 3). Václav Havel Airport in Prague causes excessive noise exposure for 1,600 people during the day and for 1,900 people at night (there are lower noise limits for air transport – 60 dB and 50 dB), especially in villages outside of Prague. In Brno, this concerns about 500 people at night. In Ostrava, along with road traffic, it is also the industry which annoys a greater number of people with excessive noise; specifically, this concerns about 3% of the population affected by night noise pollution (i.e. about 1,000 people).

Outside urban agglomerations, so far the situation is described only in the vicinity of roads with great traffic intensity (more than 6 mil. vehicles per year), which includes in particular the motorways and roads of 1st class, and also the surroundings of main railway lines. In these areas, road transport causes excessive noise pollution for 93,000 inhabitants during the day and for 128,000 people at night. In the municipalities which are situated in vicinity of a motorway or main road or through which these roads are going, a much greater number of people than in urban areas are affected by noise pollution from intensive transit traffic. The worst situation is in the villages of Ostrovačice (South Moravian region), Polom (Olomouc region) and Slavníč (the region of Vysočina) where traffic noise affects more than 50% of the population. In the affected locations, excessive noise pollution can cause, in addition to the health risks, also socio-economic problems, including a decline in real estate prices and a change in the social structure of the population.

It is also possible to find out from the SNM results the **number of buildings affected by excessive noise**. In the Czech Republic, there are 46 hospitals and other medical buildings exposed to excessive noise during the day (65 at night) and 175 schools. Out of them, 14 hospitals and 36 schools are in Prague. In the Czech Republic, total of approximately 30,000 residential houses are affected in the daytime and 42,500 residential houses are disturbed at night. The higher number of buildings affected at night results from stricter noise limits, not from higher noise pollution.

Noise pollution in the Czech Republic is comparable **in the context of the EU27 countries**; in terms of the total number of residents affected by excessive noise, however, it is higher in the category of road traffic noise pollution outside the urban agglomerations. In the EU27 countries, about 115 mil. people are exposed to daily noise levels above 55 dB, which is about a quarter of the total population. Approximately two-thirds of the people exposed to excessive noise pollution live in large urban agglomerations. In France, there is the greatest number of people who are exposed to excessive noise pollution (according to the Czech legislation) from road traffic outside cities (2.9 mil. people, i.e. 4.6% of the population, at night even 6.7% of the population). In the Czech Republic, this concerns 0.9% of the population during the day and 1.2% at night, which are slightly above-average values in the EU27 (Chart 4). On the other hand, in the Netherlands, which is a country with the densest motorway network in the EU, only 0.01% of the population is affected by traffic noise outside cities all day; even in Germany the situation is better than in the Czech Republic (0.3% of the population).

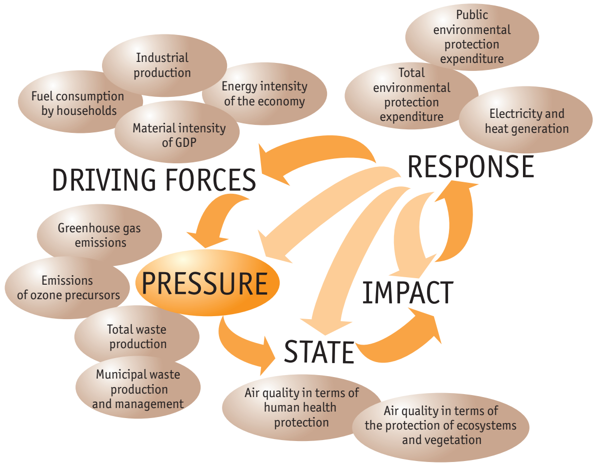
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1902)

29/ 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 proportion of renewable sources in the domestic material consumption is growing in the Czech Republic. The increase in consumption of plant biomass accounted for about a half of the interannual growth in material consumption in 2011[1].

In 2011, the domestic material consumption increased interannually by 5.6% in the Czech Republic. Consumption of fossil fuels increased by 5.4% (approx. 3.5 mil. t), there was a significant interannual increase of brown coal mining – by approximately 3 mil. t (6.6%). In comparison with the EU27 average, the Czech Republic consumes more materials per capita, which indicates a higher environmental burden.

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 of the Czech Republic**, which is valid since January 2010, is the fundamental document that sets out the goals and strategies in the field of material consumption and material intensity of the economy. Within priority axis 2 "Economy and innovation", the document sets the objectives concerning achievement of maximum independence of the Czech Republic on the import of energy and material resources and the promotion of sustainable material management. Similar priorities are also contained in the **National Programme of Reforms**, which the Government approved in 2010, and in the **Energy Security Strategy**, which the Government took into account in 2011. Reducing the material consumption and material intensity of the national economy is not explicitly mentioned in the current State Environmental Policy of the Czech Republic, however, it mingles through several thematic areas of this document, in particular protection and sustainable use of resources.

The need to improve efficiency in transforming materials into economic output and to reduce the environmental burden connected with material consumption has been highlighted by the updated **EU Sustainable Development Strategy,** 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."

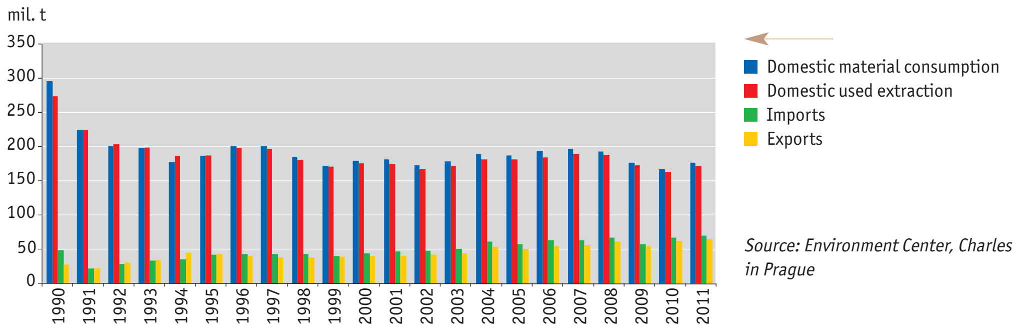
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Extraction and consumption of materials cause environmental burden and have an impact on human health. Consumed materials ultimately leave the economy as waste streams such as waste, emissions into air and water. Fuels account for almost one third of the domestic material consumption; their use is then connected with emissions of greenhouse gases and air pollutants. Raw material extraction and processing, production of products and waste management (landfilling), i.e. activities related to material consumption, damage the landscape and disrupt ecosystem functions.

[1] *Data for the year 2012 are not, due to the methodology of their reporting, available at the time of publication.*

INDICATOR ASSESSMENT

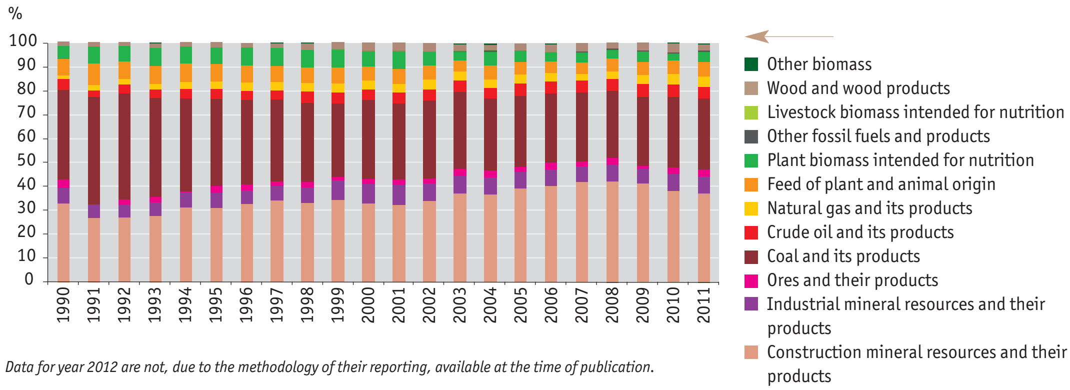
Chart 1 ➜ **Development of domestic material consumption and its components in the Czech Republic [mil. t], 1990–2011**



Source: Environment Center, Charles University in Prague

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

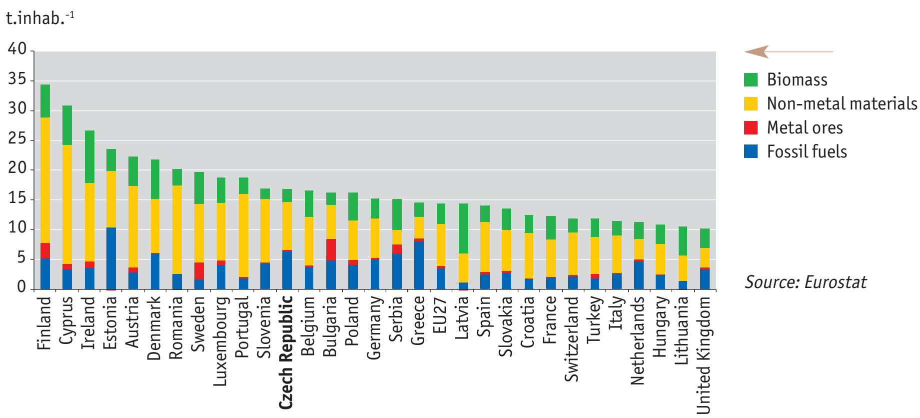
Chart 2 ➜ **Development of the DMC structure in the Czech Republic by material groups [%], 1990–2011**



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

Source: Environment Center, Charles University in Prague

Chart 3 ➜ **International comparison of domestic material consumption by groups of materials [t.inhab.$^{-1}$], 2009**



Source: Eurostat

In 2011, **domestic material consumption** (DMC)[2] has increased interannually by 5.5% to 177 mil. t in the Czech Republic (Chart 1), after a period of a significant decline in 2009–2010. Nevertheless, the environmental burden associated with using natural resources and material consumption was much lower in 2011 than it was in early 1990s; in 1990–2011, the DMC decreased by about 40%. After the year 2000, development of material consumption is varying depending on development of the economy and there is no noticeable trend.

Development of the total DMC in the reference period was influenced most by development of consumption of construction raw materials, coal and coal products, and in recent years also biomass (Chart 2). **Consumption of construction raw materials**, which accounts for the greatest proportion of the DMC (approximately 37% in 2011), was highest in 2006–2008. In the following years it dropped significantly (in 2006–2011 by approximately 12 mil. t) and this decrease was the main cause of the declining trend in the total DMC in this period. In 2011, the consumption of construction raw materials increased slightly by 1.7 mil. t (2.7%).

The **consumption of coal**, which accounts for roughly 30% of the Czech Republic's material consumption, stagnated after 2000 at values between 55 and 60 mil. t per year; after a temporary drop in the consumption in 2009–2010, coal consumption grew interannually by 6.8% to 53.1 mil. t in 2011 and this increase had the greatest influence on the interannual development of the total DMC in 2011. This fact was influenced significantly by development of brown coal mining, which increased by about 3 mil. t. **Crude oil consumption**, after an increase in 2005–2008 when it reached almost 10 mil. t, decreases gradually. In 2011, there was an interannual decrease in crude oil consumption by 6.5% (0.6 mil. t). In **development of natural gas consumption** there was no distinctive trend after 2000; only fluctuations were recorded depending on temperature conditions of the heating seasons. After 2009, the DMC of natural gas is clearly growing to reach its highest value of 8.1 mil. t in 2011 (interannually by 6.4%). However, in 2011, development of the DMC was influenced by the decline in exports of natural gas (interannually by about 32%) and by the creation of reserves. The actual consumption of natural gas decreased by about 900 mil. m^3 (9.9%) in 2011 because of warmer winter in comparison with the year 2010. Consumption of fossil fuels accounts for approximately 40% of the total DMC; the proportion of fossil fuels in the domestic used extraction is approximately 34%.

The **consumption of biomass** increased significantly in 2011; the interannual increase amounted to 12.8% (approximately 2.6 mil. t) and, together with growing consumption of coal, it took the greatest part in the growth of the total DMC in 2011. After a decrease in 2010, the consumption of plant biomass intended for nutrition increased significantly by 2.2 mil. t, i.e. by 44%; grain production development took a principal part in this growth. Even so, in comparison with late 1990s, only about a half of the food crops is currently consumed in the Czech Republic. Consumption of plant fodder, which accounts for the greatest part of the total DMC from renewable sources (approx. 11 mil. t in 2011, i.e. 6%), increased by 1.5 mil. t (16%) compared to the year 2010. In long-terms, however, its development is stagnant. In long terms, the proportion of renewable sources in the DMC is low; in 2011, however, it increased by 0.8 p.p. to 13.1%.

The **volume of foreign trade in raw materials** has been increasing, on the side of both exports and imports. In 2011, the actual balance of foreign trade reached approximately 5 mil. t. In the reference period, it had the highest value in 2008, namely 8.8 mil. t. The Czech Republic imports more materials than it exports and therefore it is greatly dependent on foreign countries for materials. Within material groups, fossil fuels achieved the highest values in the positive balance – approximately 12 mil. t in 2011. Concerning crude oil and natural gas, the Czech Republic is almost a sole importer. On the other hand, the balance of biomass and non-metal materials (e.g. construction materials) was negative; the Czech Republic exported surpluses of these raw materials in 2011. In 1991–2010, the proportion of imports in DMC (i.e. **material dependence on foreign countries**) increased significantly from 9.8% in 1991 to 39.7% in 2011; between the years 2000 and 2011 there was an increase by 14.9 p.p.

In the **European context**, the environmental burden related to extraction and consumption of materials is above average in the Czech Republic. In the Czech Republic, the DMC per capita is by 14.1% higher (Chart 3) than the EU27 average. In some European countries, however, the DMC per capita is significantly higher than in the Czech Republic. In Ireland, Finland, Romania, Austria and Portugal, the high per-capita DMC value is caused by a high consumption (i.e. extraction) of non-metal materials, and in Estonia by extraction of fossil fuels. By contrast, biomass consumption in the Czech Republic is the third lowest one after Slovenia. In Bulgaria and Romania, the proportion of renewable sources in the DMC is similar to the one in the Czech Republic. On the other hand, in Ireland, Denmark, Latvia, or Lithuania, the proportion of renewable sources in the DMC is more than doubled in comparison with the Czech Republic.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

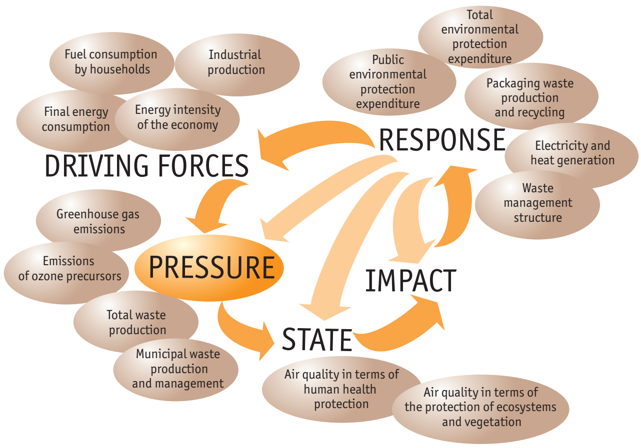
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1842)

[2] DMC is calculated as the domestic used extraction minus exports plus imports. It measures the quantity of materials consumed by the given 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.

30/ Material intensity of GDP

KEY QUESTION

Is the material intensity of GDP generation decreasing in the Czech Republic?



KEY MESSAGES

The material intensity of the Czech economy has been declining since 1990, however, it is still far above the European average, which is caused by the Czech economy's structure with a high proportion of the processing industries and extraction of fossil fuels. Continuation of this trend could ensure a gradual decline of the environmental load in the Czech Republic.

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). That is why the prediction of the material consumption development during economic recovery is not favourable. In 2011[1] the Czech Republic's material intensity increased by 3.8%, which can be explained by increased consumption of materials in the processing industry and, on the other hand, by a decrease in household consumption and the government sector, which had an adverse impact on the GDP development.

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 of the Czech Republic** that the Government approved in January 2010. This objective is defined in the framework of 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." Similar priorities are also contained in the **National Reform Programme**, which the Government approved in 2010, the **Strategy of Energy Security**, which the Government has taken into account in 2011, and in the draft update of the **State Raw-Material Policy of the Czech Republic**. Reducing the material consumption and material intensity of the national economy is not explicitly mentioned in the current **State Environmental Policy of the Czech Republic**, however, it mingles through several thematic areas of this document, in particular the protection and sustainable use of resources.

The objectives to improve efficiency in transforming materials into economic output and to reduce the environmental burden per unit of economic performance have been highlighted in the **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**. 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".

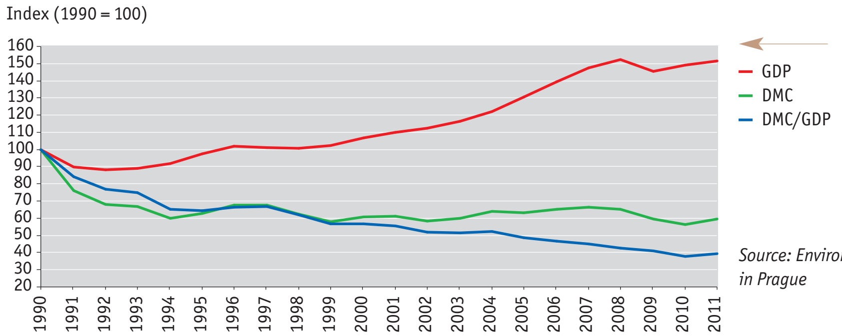
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The material intensity of GDP reflects the effectiveness in transforming primary materials into economic output and is therefore indicative, among other things, of the extent to which the economy affects ecosystems and human health (see also the indicator Domestic material consumption). Material consumption is associated with air pollution and the subsequent health effects such as respiratory and cardiovascular diseases and immune disorders (e.g. allergies). Material consumption disrupts ecosystems through air pollution and landscape interventions that are caused by mineral extraction and waste disposal.

[1] Data for year 2012 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], 1990–2011**



Source: Environment Center, Charles University in Prague

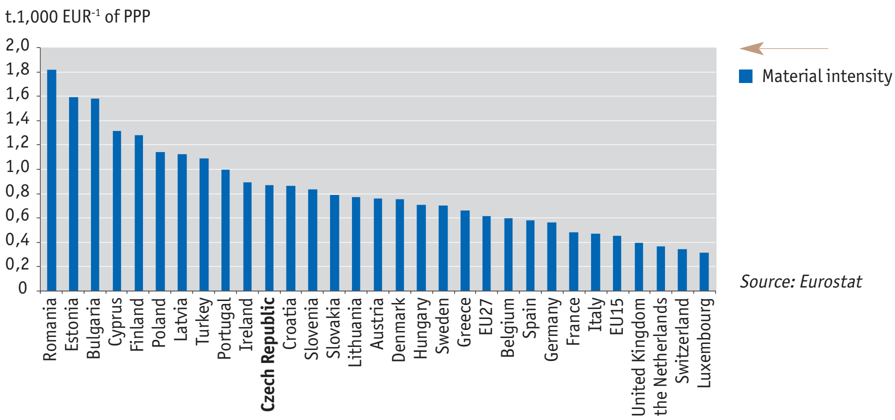
Data for year 2012 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2 ➜ **Interannual changes in material intensity, DMC and GDP [%], 1996–2011**

Source: Environment Center, Charles University in Prague

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

Chart 3 ➜ **International comparison of material intensity[2] [t.1,000 EUR^{-1} of PPP], 2009**



Source: Eurostat

[2] *GDP conversion is based on purchasing power parity (PPP).*

In 1990–2011, the **material intensity of the Czech Republic's economy** decreased by about 61%, since the year 2000 it has declined by 30.8% (Chart 1). 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 decrease of material intensity as a result of a decline in material consumption (GDP has changed insignificantly and at the beginning of 1990s it even declined); after 2000, growth of the economy was the main factor of the decline in material intensity. The fact that the strong economic growth between 2003 and 2007 was associated with a DMC increase was, among other things, caused by GDP being based on material-intensive industries such as construction, the manufacture of machinery, metalworking products and equipment and the manufacture of motor vehicles.

Development of material intensity in 1995–2011 is represented by so-called decoupling, i.e. separation of the 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 the years 2001, 2003, 2006 and 2007, and as a result of DMC decline (with the economy declining) in 1998 and 2009. The absolute decoupling was showed in 1999, 2002, 2005, 2008, and 2010.

In 2011, there was (for the first time since 2004) an **interannual increase in material intensity** (by 3.6%) and the DMC increase by 5.6% was accompanied by only slight GDP growth by 1.9% (Chart 1 and Chart 2). However, since the development of the GDP indicator was affected by a decline in actual expenditures of households and the Government for the final consumption in 2011, while the industrial production was growing (interannually by 6.9%) together with performance of the material-intensive sectors of the national economy, the importance of the temporary increase of material intensity cannot be overestimated and considered as a beginning of a change in the so far declining trend.

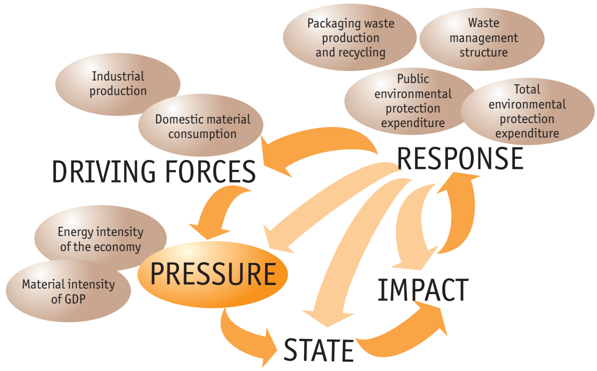
The Czech Republic is a country with high material intensity of the economy, which follows from the economy's structure with a relatively high proportion of industry, and within the industry, with a high representation of material-intensive sectors such as the traditional automotive industry and the related sectors. In 2009, the Czech Republic's **material intensity was by 29.1% higher than the EU27 average**. In comparison with the EU15 average, its material intensity was by 47.7% higher (Chart 3). The Czech Republic's above-average material intensity is related to a higher DMC per capita which arises from the national economy's structure and, in comparison with West European countries, it is caused by lower economic performance. A material intensity higher than that of the Czech Republic is in those EU27 countries where the per capita GDP is lower than that in the Czech Republic – e.g. Estonia, Latvia, Romania, Bulgaria and Poland. This also concerns countries with a very high per capita DMC such as Finland and Portugal.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1843)

31/ Total waste production



KEY QUESTION

Is the total waste production declining?

KEY MESSAGES

In the last interannual comparison, production of hazardous waste decreased by more than 11%; in the longer term (between the years 2003 and 2012), there has been a decline by 7.8%.

In 2003–2012, the total waste production decreased by 16.8%, however, interannually it only decreased by 2.1%.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The key document concerning waste management is the **Government Regulation No. 197/2003 Coll., on the Waste Management Plan** (here-in-after referred to as the Plan) which provides for the basic measures and principles for all substantial aspects of this sector. In relation to the current trend, dominated by efforts to prevent waste generation or to minimise it, there are measures leading to the support of changes in production processes and it is also recommended to work out life cycle analyses for products in this respect. The Plan largely deals with hazardous wastes – with the management and possibilities of preventing their generation.

Another important document which roofs the area of waste management is the **State Environmental Policy of the Czech Republic** which is based on the key measures set out in the Plan. The area of the waste falls under the chapter “Sustainable use of natural resources, material flows and waste management". Primarily, it stresses the need to prevent the use of primary raw material sources and, on the other hand, to use the secondary sources more efficiently through their reuse and recovery.

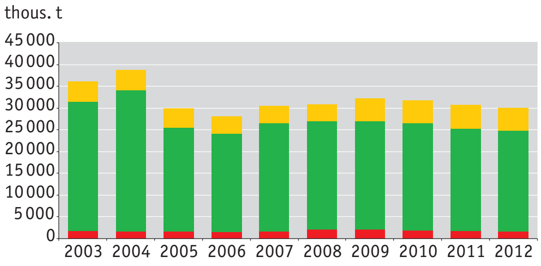
In terms of European legislation, the key document is the Directive 2008/98/EC of the European Parliament and of the Council on waste which sets out general requirements for waste management while specific solutions are always provided for by the national legislation. The requirements of the European Directive were implemented through an amendment to the **Act No. 185/2001 Coll. on waste**, as early as in 2010, however, in the following years there were further amendments to this main legal regulation and its implementing regulations.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Waste production and its trends are closely related to human activities and the types of the activities are then reflected in composition of the waste. In many cases, waste shows a number of properties that are hazardous for both human health and preservation of undisturbed ecosystems. For this reason, emphasis is put on minimising the production of waste and the introduction of new production technologies which eliminate the use of substances dangerous to human health.

INDICATOR ASSESSMENT

Chart 1 ➜ **Total waste production by category (hazardous, non-hazardous and municipal) in the Czech Republic [thous. t], 2003–2012**

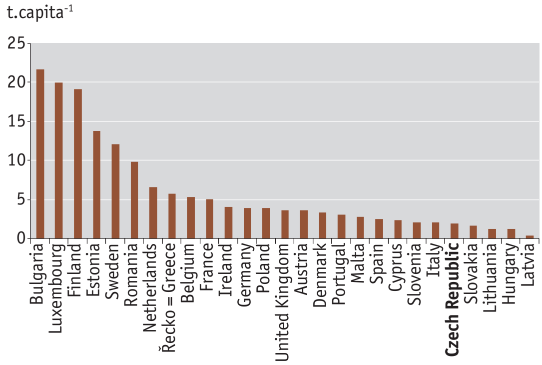


Municipal waste production
Non-hazardous waste production excluding municipal waste
Hazardous waste production

Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

The data were determined according to the methodology applicable for a given year – on the basis of the Mathematical Expression of Calculation of „Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2012.

Chart 2 ➜ **International comparison of total waste production per capita [t.capita^{-1}], 2010**



Total waste production per capita

Source: Eurostat, Czech Statistical Office

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data collection and processing methodologies.

In 2003–2012, there has been a major change in the indicator of the **total registered waste production** (hereinafter "the total waste production") because of the decrease by 16.8% (Chart 1). This decline is mainly influenced by changes in the industrial production structure, i.e. development of industrial technologies and waste treatment and processing technologies which increase production efficiency. The economic influence consisting in the growth of prices for primary raw materials is not negligible either. Since 2007, the value of the total waste production has been oscillating slightly above the value 30 mil. t. The oscillation is caused primarily by fluctuations in the economic situation; this is reflected, inter alia, also in decline or increase in construction activity which is one of the areas that produce large quantities of waste. The last interannual trend was also positive as there was a slight decrease in the total waste production, namely by 2.1%.

The same trend as in the case of the total waste production has been recorded in the **category „other waste"**. Since 2003, there has been a gradual decrease of production. The greatest interannual change occurred in 2004–2005, however, in the years 2009–2012, the interannual decline in the production of other waste varies in the range between 0.3% and 4.0%, too.

In terms of protection of the environment, there is a very positive trend in the area of **hazardous waste production**, which has registered an interannual decline by 11.1%. This situation may be related to the economic recession, which is associated with lower industrial production the manifestations of which also include generation of specific types of hazardous waste. Nevertheless, in the case of hazardous waste production the trend has been rather unstable since 2003; the highest value was registered in 2009.

In terms of **international comparison** of the total waste production per capita (Chart 2), the situation in the Czech Republic improved slightly. In 2010, the Czech Republic was in the fifth best position with the value of 1.9 t.capita^{-1}. The highest value of the total waste production is in Bulgaria; by contrast, the lowest value was reached in Latvia.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1844)

32/ Municipal waste production and management

KEY QUESTION

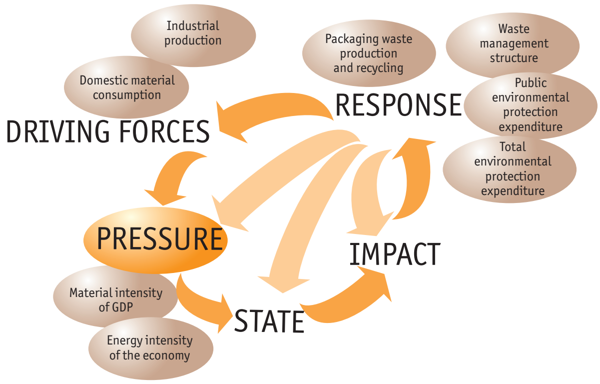
Is the proportion of landfilled municipal waste decreasing?

KEY MESSAGES

In the last interannual comparison, there was a decline in the total production of both municipal waste (by 3.7%) and mixed municipal waste (by 4.4%). This trend also corresponds to the increasing proportion of sorted components of waste. Due to the decrease in the total waste production, there was a decline in municipal waste per capita (for the first time since 2009). Interannually, this value decreased by approx. 20 kg to 493.7 kg in 2012.

Gradually, there is a positive shift in connection with the structure of municipal waste management. Interannually, there was a decrease of landfilled municipal waste by 1.7 p.p. in 2012 in comparison with the year 2011. At the same time, there was a slight increase in the proportion of municipal waste used for energy recovery.

Since 2009 there has been a permanent decline in the production of mixed municipal waste, even per capita.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Municipal waste belongs to those types of waste which are given considerable attention, especially because people are in daily contact with it. That is why this topic is dealt with by most strategic documents focused generally on the environment (**State Environmental Policy of the Czech Republic**), but also strategic and conceptual documents covering the single media. The most important one is the Government Regulation No. 197/2003 Coll., on the **Waste Management Plan** of the Czech Republic (the Plan).

Both the Plan and **State Environmental Policy of the Czech Republic** deal mainly with municipal waste reduction and improvement of the municipal waste sorting and collection system.

Municipal waste is specific mainly due to its high proportion of organic constituents decomposition of which results in release of large amounts of greenhouse gases. That is why the strategic documents put emphasis on increasing the proportion of material recovery of municipal waste. In pursuance of **Council Directive 1999/31/EC on the landfill of waste** an objective is set out to reduce the maximum amount of landfilled biodegradable municipal waste (BMW) so that the proportion of this component is no more than 75% (in weight by 2010), 50% (in weight by 2013) and eventually 35% (in weight by 2020) of the total amount of BMW produced in 1995.

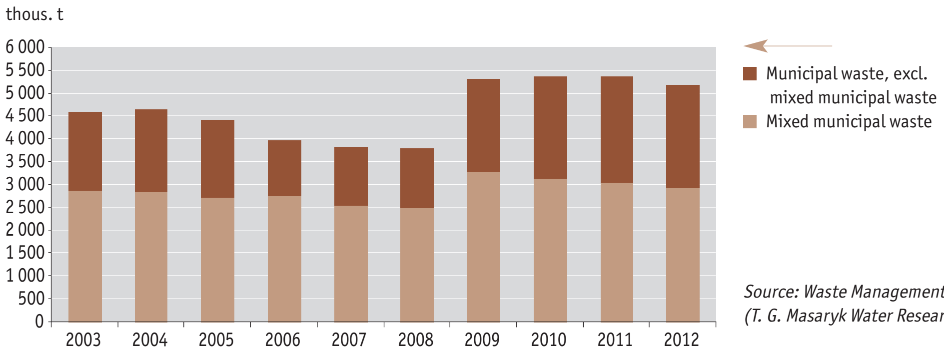
Given the growing efforts to increase the use of secondary raw materials, it is recommended, again through a number of follow-up documents, to comply with the waste management hierarchy. One of the basic documents is the **Effective Raw Materials Strategy for Europe** as one of the flagship initiatives within the **Europe 2020** strategy.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

People most commonly come into contact with municipal waste, which may or may not have a number of hazardous properties as is the case e.g. for waste resulting from specific industrial production, but it still can cause serious complications when handling, etc. In its greatest part, municipal waste is composed of biogenic components, particularly food residues. Municipal waste is most commonly disposed of in landfills and its biogenic component is of great importance in terms of environmental impact as it releases significant amounts of methane, one of the key greenhouse gases which plays a role in climate change.

INDICATOR ASSESSMENT

Chart 1 ➜ **Total municipal waste production in the Czech Republic [thous. t], 2003–2012[1]**



Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

The data were determined according to the methodology applicable for a given year – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2012.

Table 1 ➜ **Municipal waste management mix relative to the total municipal waste production in the Czech Republic [%], 2003–2012[1]**

Management method [%]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Data provided by	WRI	WRI	WRI	WRI	CENIA	CENIA	CENIA	CENIA	CENIA	CENIA
Data	Final	Final	Final	Final	Final	Final	Final	Final	Final	Final
Proportion of municipal waste used for energy recovery (R1)	4.8	8.7	9.4	9.5	9.8	9.6	6.0	8.9	10.8	11.8
Proportion of municipal waste used for material recovery (R2–R12, N1, N2, N8, N10, N11, N12, N13, N15)	10.9	11.8	15.5	20.0	21.1	24.2	22.7	24.3	30.8	30.3
Proportion of landfilled municipal waste (D1, D5, D12)	63.3	64.4	69.3	81.0	86.2	89.9	64.0	59.5	55.4	53.7
Proportion of municipal waste disposed of in incinerators (D10)	4.80	0.05	0.04	0.05	0.07	0.05	0.04	0.04	0.04	0.04

Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

The data were determined according to the methodology applicable for a given year – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2012.

[1] Waste disposal codes D3 and D4 are not included in the Chart 1 and the Table 1 because these categories contain zero values.

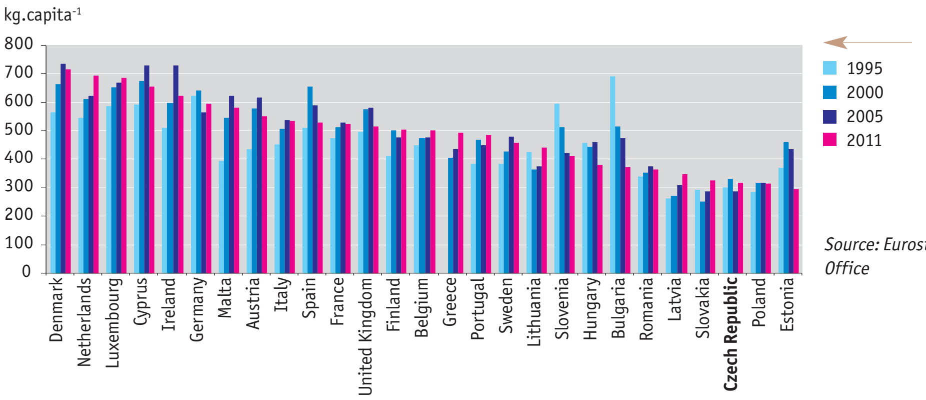
The reason why the registered disposal volume is greater than the registered production volume lies in the exclusion of below-the-threshold producers from the total waste production. (Below-the-threshold producers are producers that did not exceed the reporting limits set by section 39 of the Act No. 185/2001 Coll., on waste, and thus have no reporting obligation and are not included in the total registered production. However, their waste is included in registered disposal because final waste disposal facilities are always obliged to report waste.) Due to the growing difference between registered and actual waste production, starting from 2009, the processing of final data that are collected under the Waste Act must include recalculation of the total amount of produced waste to include waste from the below-the-threshold producers.

Table 2 ➜ **Selected waste management methods**

Management code	Management method
Use of waste for energy recovery	
R1	Use of waste as fuels or in another method to generate energy
Use of waste for material recovery	
R2	Solvent reclamation/regeneration
R3	Recycling/reclamation 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	Despositing waste as technological material to secure landfills
N13	Composting
N15	Tyre retreating
Waste disposal in landfills	
D1	Depositing into or onto land (landfilling)
D3	Deep injection
D4	Surface impoundment
D5	Specially engineered landfilling
D12	Permanent storage
Waste disposal in incinerators	
D10	Incineration on land

Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

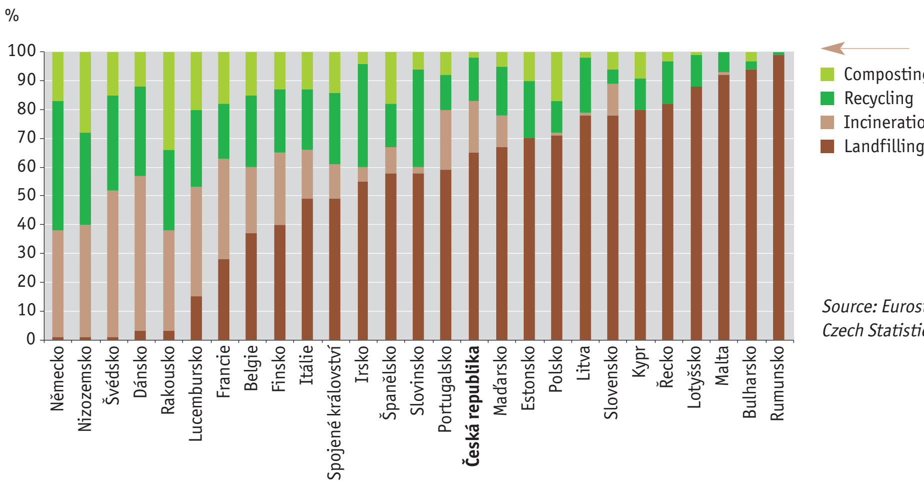
Chart 2 ➜ **International comparison of municipal waste production [kg.capita^{-1}], 1995, 2000, 2005, 2011**



Source: Eurostat, Czech Statistical Office

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data collection and processing methodologies.

Chart 3 ➜ **Municipal waste management methods in EU27 [%], 2010**



Source: Eurostat, Czech Statistical Office

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data collection and processing methodologies.

Within evaluation of development of the **total municipal waste production**, it is necessary to take into account the fact that the data reporting methodology was modified in 2009. That is why it is possible to compare among each other only the periods before or after introduction of the methodology. In 2004–2008, there has been a gradual reduction of the total municipal waste production, namely by 18.0% within the whole period. Since 2009, there has been a slight increase of the total municipal waste production, however, the values vary only slightly, in units of percent as maximum. Interannually, there was a decrease of municipal waste production by 3.7%.

Within comparison of **municipal waste production per capita**, there is a significant change in connection with the above-mentioned introduction of the new methodology. In 2003–2008, the average municipal waste production per capita amounted to 411.1 kg; in 2009–2012, this value grew by approx. 100 kg. Specifically, in 2012, this indicator amounted to 493.7 kg, so there was an interannual decrease by approximately 20 kg, which is the highest recorded difference since the methodology was modified.

The category of **mixed municipal waste** consists mainly of residual (unsorted) waste originating mostly from households and small businesses which generate waste within non-productive activities predominantly. What is particularly positive is the fact that, since 2009, which was the year when a new calculation methodology was introduced, there has been a constant decline in production of this waste category. This fact thus correlates with the growing proportion of sorted waste. There has been an interannual decrease of mixed municipal waste by 4.4%. Likewise in previous years, the proportion of mixed municipal waste in the total municipal waste production decreased, namely by 0.4 p.p. to the value of 56.5%.

The different methods of waste management are identified using codes that are defined by Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste management details, as amended (Table 2). According to the Mathematical Expression of 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, waste pre-processing 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.

Landfilling remains one of the most common **methods of municipal waste management** (Table 1), however, since 2008 there has been a steady decline in this category's proportion. In 2012, the proportion of landfilled municipal waste amounted to 53.7%, so there has been an interannual decline by 1.7 percentage points; in 2003–2012, the difference was even 9.6 p.p. The use for material recovery, the proportion of which has been growing since 2003, also belongs to significantly represented municipal waste management methods. In 2012, nevertheless, a slight interannual decrease was recorded. In 2012, 30.3% of municipal waste was used for material recovery. The importance of energy recovery of municipal waste has also been growing; in 2012, 11.8% of municipal waste was used in this way and 0.04% of municipal waste was incinerated.

Within an **international comparison**, there is a problem of using different methodologies and definitions of municipal waste; that is why the data for different countries are comparable only with regard to this fact. The Czech Statistical Office sends the data for the Czech Republic to Eurostat; possible data deviations between the Czech Statistical Office and the Waste Management Information System are caused by different data collection and processing methodologies. From this point of view, it is better to compare the shifts that are between different time horizons and whether the development is similar in all the reporting countries.

The Czech Republic has one of the lowest levels of municipal waste production in the EU27 (Chart 2). Apart from the above-mentioned differences in definitions of the actual term “municipal waste”, the reasons for lower municipal waste production are also closely related to the population's purchasing power, consumer behaviour and the frequency of consumer goods replacement which is lower in the Central and Eastern European countries than in the countries of Western Europe. In Western countries, the municipal waste production is rather stagnant, in some countries it grows while in the EU12, the trend is opposite.

In terms of municipal waste disposal, the situation in the Czech Republic is not as good as it is in case of the municipal waste production itself (Chart 3). According to Eurostat, landfilling of the produced waste prevails in the Czech Republic while in the developed West European countries, the amount of landfilled waste is minimal. By contrast, in Bulgaria and Romania, basically all the produced municipal waste is deposited in landfills.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1845)

33/ Waste management structure

KEY QUESTION

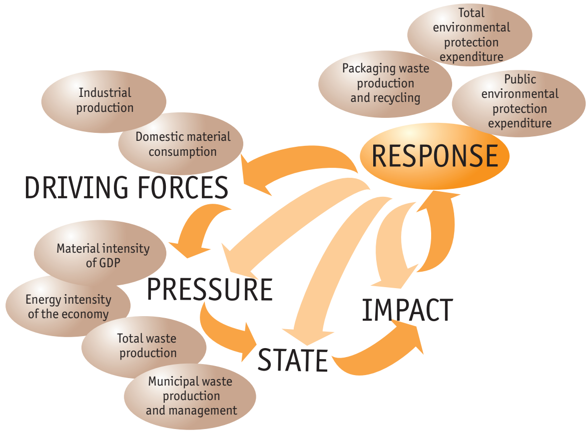
Is the proportion of waste utilization increasing compared to waste disposal?

KEY MESSAGES

The proportion of selected waste disposal methods in the total waste production has been declining in long terms; in 2012, the lowest value since 2003 was registered.

The proportion of selected waste utilization methods in the total waste production increased from 62.2% in 2003 to 79.3% in 2012; there was a slight interannual increase by 1.0%.

In 2012, depositing into or onto land (landfilling) was still the most common waste disposal method.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The area of waste management is governed primarily by the **Waste Framework Directive**, which, inter alia, defines the basic 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 was recommended for implementation into the national strategic and legislative documents. At the level of the Czech Republic, this concerns primarily the **Act No. 185/2001 Coll. on waste** and its subsequent amendments and implementing regulations, and the **Government Regulation No. 197/2003 Coll., on Waste Management Plan of the Czech Republic** (the Plan). In 2012, preparation of **Waste Prevention Plans** was also launched as all member states are obliged to work them out on the basis of the Waste Framework Directive.

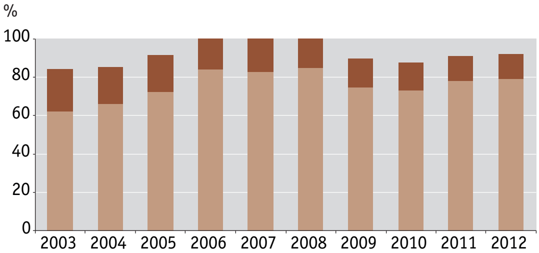
The issue of waste management hierarchy, i.e. the preference for re-use and material or energy recovery, is dealt with in other strategic documents, too. This concerns in particular the **State Environmental Policy of the Czech Republic** and the **Strategic Framework for Sustainable Development of the Czech Republic**. In these documents, it is recommended to create an integrated and adequate network of waste management facilities, while emphasis is placed on not supporting the building of new landfills – in accordance with the waste management hierarchy. The Life Cycle Assessment (LCA) studies can support the preventive approach in the area of waste management, as well as putting other related legislation in practice, especially with emphasis on the use of BATs.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Waste management can have significant impacts on human health, since a significant proportion of waste has hazardous properties. This concerns primarily toxicity, causticity and carcinogenic character of waste. These wastes require special disposal methods in order to eliminate possible contact with the human body. Some waste management methods can affect ecosystems or landscape character. In the Czech Republic, landfilling is the most common method of waste disposal but landfills are considered a disruptive element in the landscape. If the conditions for operation of a waste management facility are not met, there could be a release of substances into water or air, which may affect cenoses even in great distances from the waste handling facilities.

INDICATOR ASSESSMENT

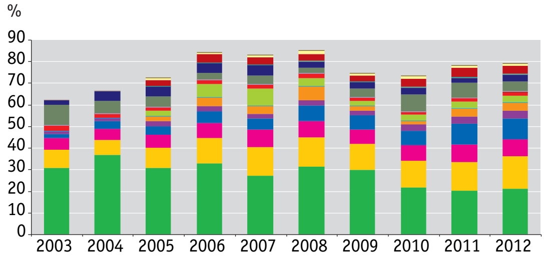
Chart 1 ➔ **Proportions of selected waste management methods in the total waste production in the Czech Republic [%], 2003–2012**



Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

- Proportion of selected waste disposal methods in the total waste production (D1, D3, D4, D5, D10, D12)
- Proportion of selected waste utilisation methods in the total waste production (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, N1, N2, N8, N10, N11, N12, N13, N15)

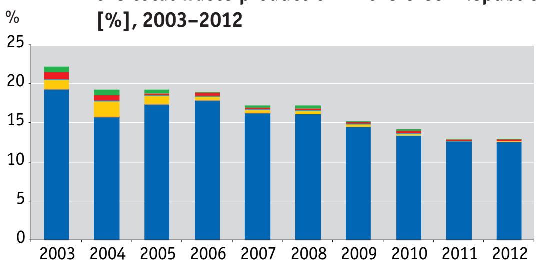
Chart 2 ➔ **Proportion of selected waste utilisation methods in the total waste production in the Czech Republic [%], 2003–2012**



Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

- N1
- R5
- R4
- R12
- R1
- N11
- R2
- N10
- R3
- R6
- R7
- R8
- R9
- R10
- R11
- N2
- N8
- N12
- N13
- N15

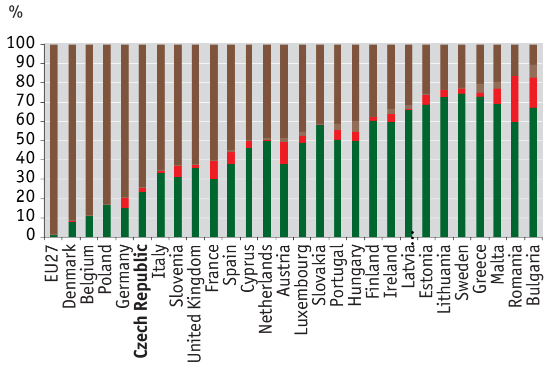
Chart 3 ➔ **Proportion of selected waste disposal methods in the total waste production in the Czech Republic [%], 2003–2012**



- D12
- D10
- D5
- D4
- D3
- D1

Source: Waste Management Information System (T. G. Masaryk Water Research Institute, CENIA)

Chart 4 ➔ **International comparison of waste management structure [%], 2010**



- Disposal
- Incineration
- Energy use
- Material use

Source: Eurostat, Czech Statistical Office

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data collection and processing methodologies.

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 Calculation of "Waste Management Indicator Set", the waste management structure can be divided into waste utilisation (recovery, recycling, waste pre-treatment etc.) and waste disposal (landfilling, incineration on dry land etc.)[1]. Similarly, the different waste management codes are described in detail in Table 2 (indicator 32).

Since 2003, 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. The proportion of waste disposal has been declining slightly since 2009, which may be due to the effects of the financial crisis in industry and, at the same time, the transfer of a part of produced waste that is suitable for utilisation to the category of by-products (Chart 1).

There was a positive trend in waste utilisation; in the years 2003–2008, the proportion of selected waste utilisation methods grew from 62.2% to 85.3% (Chart 2). In 2009, however, the growth rate dropped, probably due to economic stagnation, to 74.7%, and since that year there has been a gradual increase to 79.3% in 2012. Interannually, there was a slight increase by approximately 1.0%. In terms of the structure of selected waste utilisation methods, there were no significant changes in recent years. Use of waste for reclamation and landscaping (21.0%) and recycling or recovery of other inorganic materials (15.1%) continue being the most frequent waste utilisation methods.

In terms of the proportion of **waste disposal** in the total waste production, there was a positive trend in 2003–2012 as it declined by almost 10 p.p. Within the selected disposal methods, depositing into or onto land (landfilling) remains the most frequently used waste disposal method, accounting for 96.9% in 2012 (Chart 3). Incineration on dry land is another method that is dominant among the selected disposal methods.

The correct waste management, as well as the operational conditions of waste management facilities, are subject to regular inspections by the Czech Environmental Inspection. In the field of waste management and chemical substances, a total 2,892 inspections were carried out in 2012, out of which 1,151 were planned and 1,741 were unplanned, of which 502 inspections were carried out on the basis of an accepted initiative.

In most EU member states, waste utilisation dominates the waste management. Only in 6 of them it is waste disposal, in particular landfilling, which prevails. There is an extreme situation in Bulgaria, where 97.7% of produced waste is landfilled. On the other hand, West European countries use the waste for energy or material recovery; the highest percentage of recycled waste is in Belgium, Denmark and Germany (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=1614)

[1] The method to calculate the indicator of material recovery of waste is based on a methodology approved by the Ministry of Environment, which respects in full the provisions of the Act No. 185/2001 Coll. on waste and its implementing regulations, taking into account national, more accurate management methods' codes which are not used in the EU. The applied methodology thus ensures fulfilment of the definition of material recovery of waste laid down in the European regulations concerning waste management.

34/ Packaging waste production and recycling

KEY QUESTION

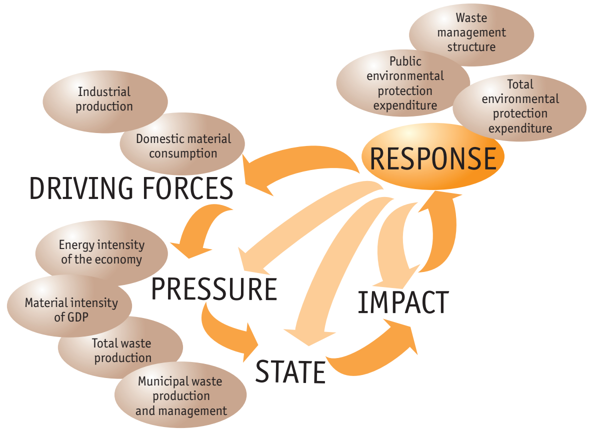
Is the amount of produced packaging waste decreasing and the proportion of packaging waste utilization increasing?

KEY MESSAGES

In 2012, 69.9% of the total amount of produced packaging waste was recycled and 3.7% were used for energy recovery, which is, in case of recycling, a value similar to that achieved in previous years. However, in case of energy recovery, there was a decrease of the value by about 2 p.p. in comparison with the year 2011.

In 2003–2008, there was a continual and significant increase in utilisation of recorded packaging waste. In 2008–2011, this trend slowed down gradually and in 2009 there was even a decline in the amount of packaging waste in comparison with the previous year. In 2012, there was a slight growth in the quantity of utilised packaging waste and the value of packaging waste which was recycled or the energy of which was recovered exceeded 73% of the total packaging waste production.

The amount of packaging produced in 2012 increased by 33.6% compared with the year 2003. In comparison with the previous year, the volume of packaging waste increased slightly by 1.8%.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

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 emphasis on reducing 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 municipal waste production in particular.

Another strategic document which pays a great attention to waste management and in many cases refers to the above-mentioned Government Regulation is the **State Environmental Policy of the Czech Republic**. In the second priority axis, which mainly deals with technical protection of the environment, there is a topic explicitly mentioned which concerns making the waste management more effective and sophisticated. In case of packaging waste, it is recommended to improve management of the products, packaging and related waste. This section also refers to the specific recommendations following from the Czech Republic's Implementation Programme for Packaging and Packaging Waste.

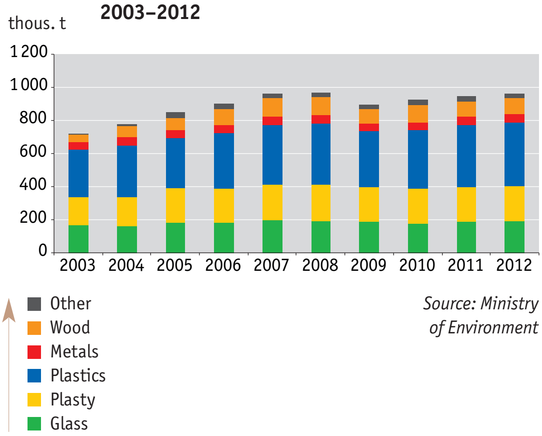
The main legislative document concerning packaging waste management at the EU level is the **European Parliament and Council Directive 94/62/EC on packaging and packaging waste** which has been amended by Directive 2004/12/EC and Directive 2005/20/EC. The obligations following from these European directives have been implemented through the **Act No. 477/2001 Coll., on packaging**, as amended.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The growing population on Earth produces an increasing amount of waste which includes a great deal of packaging waste being a part of a vast majority of consumer goods. So-called littering takes part in disruption of the positive way in which humans perceive landscape. In connection with an emphasis on the use of secondary raw materials, the proportion of sorted waste has been increasing in the last decade, which at least partially eliminates the use of primary sources of raw materials, and thus the negative effects on the landscape character.

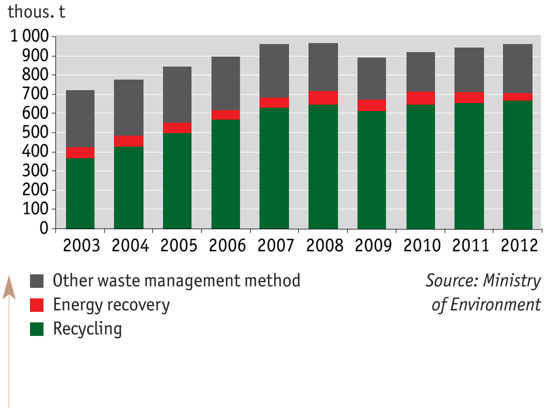
INDICATOR ASSESSMENT

Chart 1 ➜ **Packaging waste and packaging waste composition mix produced in the Czech Republic [thous. t], 2003–2012**



Source: Ministry of Environment

Chart 2 ➜ **Utilisation of packaging waste in the Czech Republic [thous. t], 2003–2012**



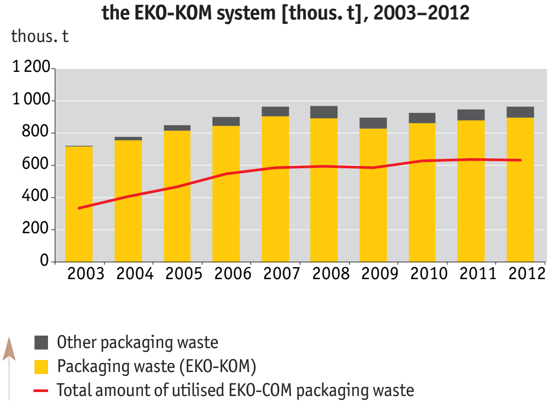
Source: Ministry of Environment

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, 2003–2012**

Year	Number of clients involved in the EKO-KOM system	Number of municipalities involved in the EKO-KOM system
2003	20,754	4,358
2004	21,164	4,932
2005	21,502	5,337
2006	20,946	5,481
2007	20,798	5,668
2008	20,822	5,791
2009	20,573	5,861
2010	20,591	5,904
2011	20,482	5,993
2012	20,241	6,025

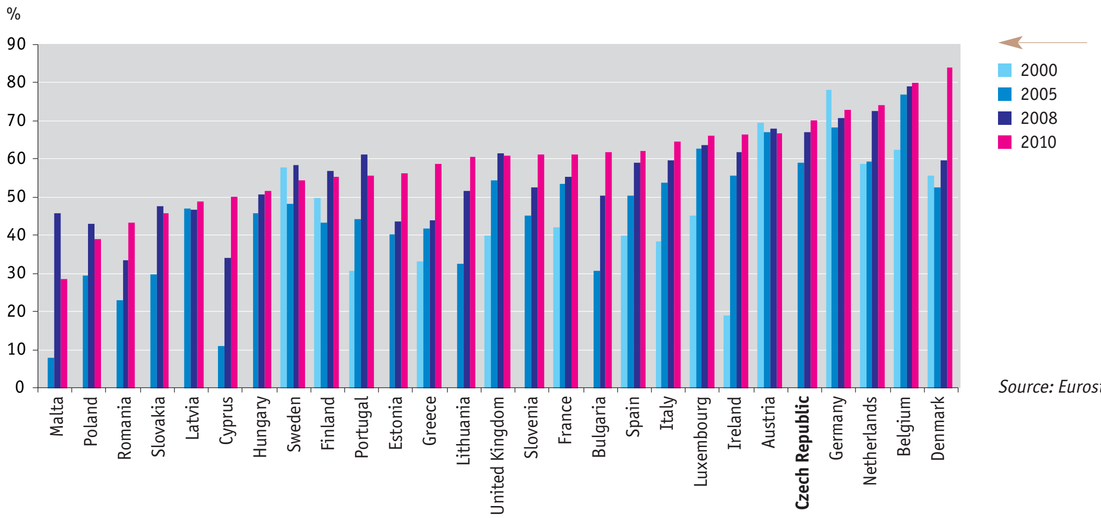
Source: Ministry of Environment, EKO-KOM, Co.

Chart 3 ➜ **Utilisation of packaging waste in proportion to the total amount of produced packaging waste in the Czech Republic within the EKO-KOM system [thous. t], 2003–2012**



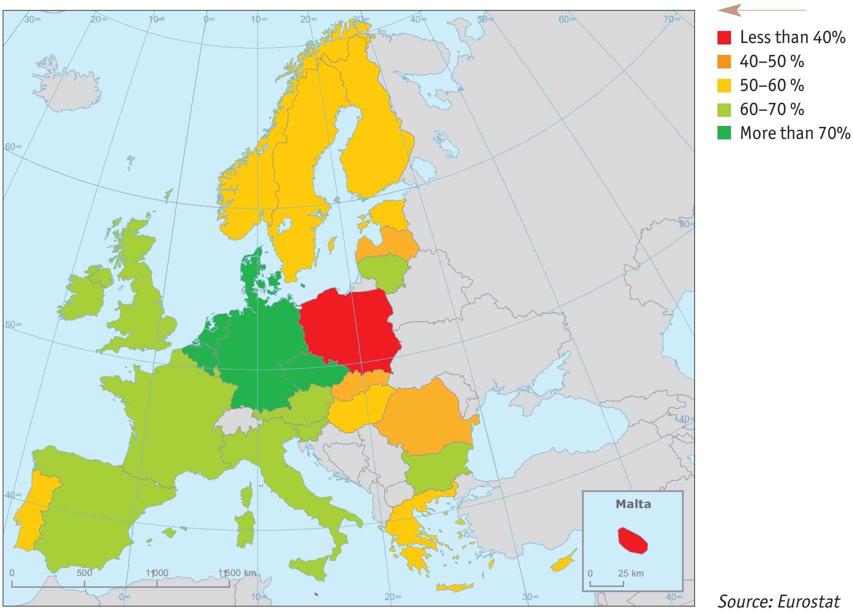
Source: Ministry of Environment

Chart 4 ➜ **International comparison of the packaging waste recycling rate [%], 2000, 2005, 2008, 2010**



Source: Eurostat

Figure 1 ➜ **Packaging waste recycling rate in the EU countries [%], 2010**



Source: Eurostat

One of the most characteristic manifestations of a consumerist society is the increase in **packaging waste production**, which has been growing over a long period in the Czech Republic. Between 2003 and 2012, the quantity of produced packaging waste grew by 33.6%. In 2012, more than 962,000 t of packaging waste were produced in the Czech Republic which represented an interannual increase by 1.8%. However, it is necessary to state that especially in the first years (Chart 1), the interannual rate of increase in packaging waste production was much higher – around 8%. In 2009, probably in connection with the economic crisis, there was a decrease in the production, however, the previous trend returned in 2010. Since 2010, the interannual growth varies between 2% and 3%.

In terms of the **packaging waste structure**, the most represented category is paper and cardboard packaging (39.6%), with a large margin followed by plastics (22.1%) and glass (19.8%). This structure is relatively stable in long terms and the order in the first three places does not change at all. In an interannual comparison, the proportions of the single categories vary in a range up to 5% and in the last interannual evaluation, the representation of the categories has not changed at all (deviation max. 0.1 %).

Given the increasing production of packaging waste, it is very positive that the **recycling rate of packaging waste** has been growing (Chart 2). Packaging waste recycling is the most frequent way of using them; since 2003, there has been an increase of the proportion of recycled packaging waste by almost 20 p.p. In terms of the quantity of recycled packaging waste, there was an increase by more than 80% between the years 2003 and 2012. The second most frequently represented category is energy recovery, which varied between 5% and 7% for a long period but in 2012 it declined to 3.7%. Therefore the interannual decrease amounts to almost one-third. 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 2003–2012 (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 2005 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 2012, the number of clients involved in the system of the authorized packaging company EKO-COM therefore reached 20,241. 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 6,025 municipalities (out of a total number of 6,245 municipalities in the Czech Republic) were involved in the system in 2012. About 10,457,000 inhabitants, which is roughly 98% of the Czech population, lived in these municipalities in 2012. Thirty two new municipalities got involved in the system in 2012. At present, there are still 220 municipalities in the Czech Republic which solve the problems related to packaging waste outside of the authorised company EKO-KOM. In 2012, 71% of all packaging waste (Chart 3) which is covered by the authorised packaging company was therefore utilised, which is nearly 65.8% of all packaging waste produced in the Czech Republic. There was a slight interannual decrease (by 0.4%).

European legislation which regulates packaging waste management provides for an obligation for the member states to achieve packaging waste recycling of at least 55% of the packaging weight. The deadlines for these obligations to be fulfilled were set with regard to the year in which the member states joined the EU. In the old EU Member States (EU15), this requirement is fulfilled; the situation in Greece is positive as this country also meets the obligatory limit (58.7%) in 2010. For the states which joined the EU later, the deadline to meet this obligation was postponed to the years 2012–2015.

For a long period, the countries with the lowest recycling rate are Malta (28.5%) and Poland (38.9%), followed by Romania which has already exceeded 40% recycling rate. On the other side of the ranking, there are usually advanced states of Western and Northern Europe (Denmark, Belgium, the Netherlands), however, the Czech Republic is also very successful in this category because it is in the first place (70.0%) among the new EU member states.

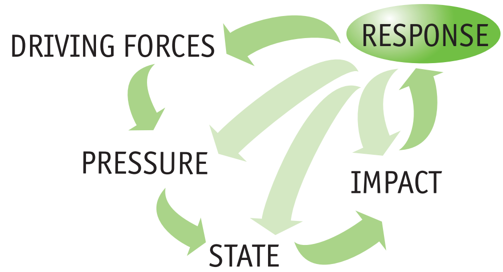
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1848)

35/ Total environmental protection expenditure

KEY QUESTION

How much financial means do we expend in a form of investment expenditure and non-investment costs to improve and protect the environment?



KEY MESSAGES

Despite a slight interannual decrease (by 2%) of the total expenditure on environmental protection in 2011/2012, there has been a growing trend in the amount of financial means allocated to protection of the environment in a longer period (2003–2012). The last interannual development was caused by a reduction of non-investment costs by 4.3%, namely in the area of waste management. However, the decrease in non-investment costs was partially offset by a slight growth of investment expenditure (by approx. 3%), especially in the area of wastewater management.

In 2012, the total expenditure on environmental protection amounted to CZK 82.1 bil., which represents a decrease by CZK 1.7 bil. compared to the year 2011. The proportion of the total expenditure in GDP amounted to 2.1%. In terms of the programmes and focus of the total expenditures, likewise in 2011, most of the funds have been allocated to the area of waste management (a total of CZK 39.3 bil.), followed by wastewater management (CZK 22.7 bil.) and air and climate protection (CZK 7.7 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 EXPENDITURE

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

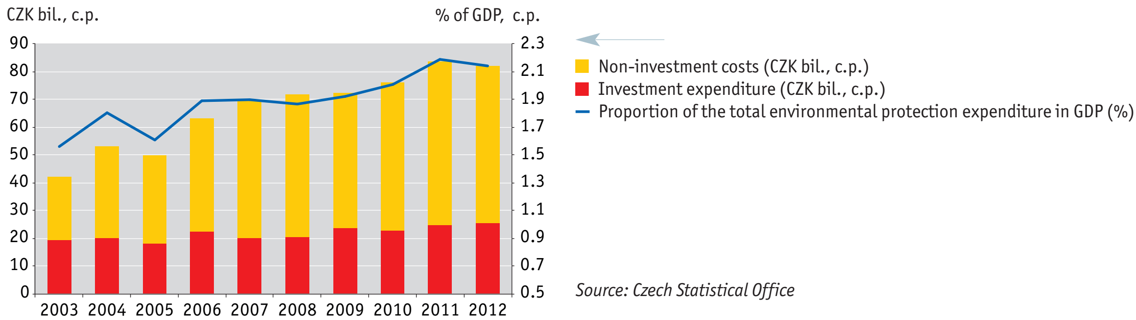
According to the current **State Environmental Policy of the Czech Republic**, it is possible to assume that increasing emphasis will be put on introduction of the concept of the sustainable (i.e. low-carbon or wasteless) economy that is associated with the support to environmentally friendly behaviour. Greater stress will be laid on increasing investment in the use of clean technologies, renewable energy sources and better management of non-renewable resources as well as on the protection and conservation of ecosystem services, the biodiversity protection and development of the sustainable use of landscape.

One of the preconditions for further economic, social and environmental development of the Czech Republic is the increased proportion of investment to support science, research and innovation, which also follows e.g. from the **National Research, Development and Innovation Policy of the Czech Republic for the Period 2009–2015**. If investment in science, research and innovation is growing, increased competitiveness of the Czech Republic can also be supposed. 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.

It follows from the **National Strategic Reference Framework of the Czech Republic for the year 2007** that the Czech Republic's economy is open to a great extent and its foreign trade is focused particularly on the EU member states. The goods and services traded within the EU are therefore subject to high environmental standards, which can be achieved mainly through investment in environmental protection projects. The projects must meet the criterion of cost efficiency, i.e. to optimise the costs while maximising the benefits achieved. Manufacturers should therefore actively reduce their environmental impacts through technological innovation, BAT introduction, recycling and energy savings. Similar statements concerning total expenditure for environmental protection are also in the **Strategic Framework for Sustainable Development of the Czech Republic** which puts emphasis mainly on the area of innovation and related competitiveness of the Czech Republic.

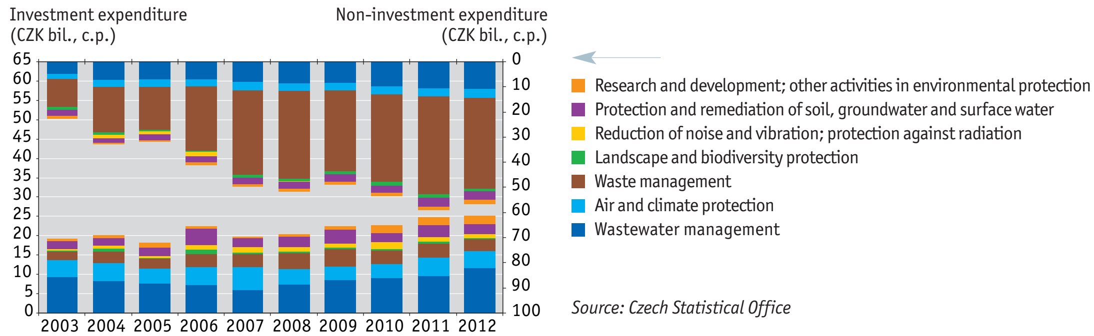
INDICATOR ASSESSMENT

Chart 1 → **Total environmental protection expenditure in the Czech Republic [CZK bil., % of GDP, current prices], 2003–2012**



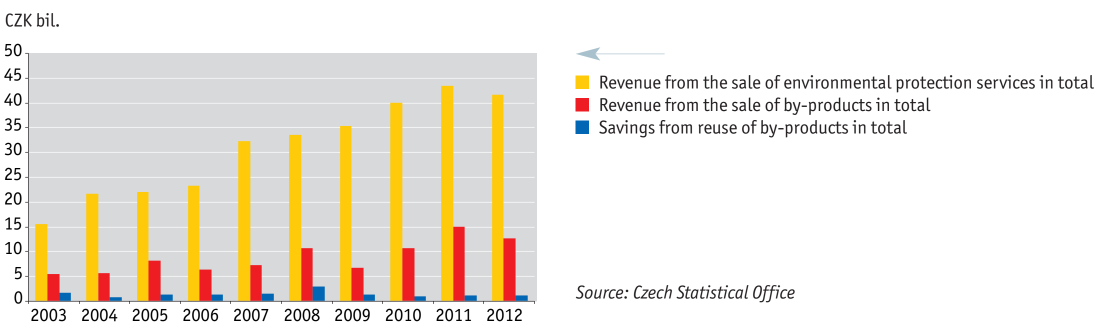
Source: Czech Statistical Office

Chart 2 → **Investments and non-investment costs for environmental protection in the Czech Republic according to programme focus [CZK bil., current prices], 2003–2012**



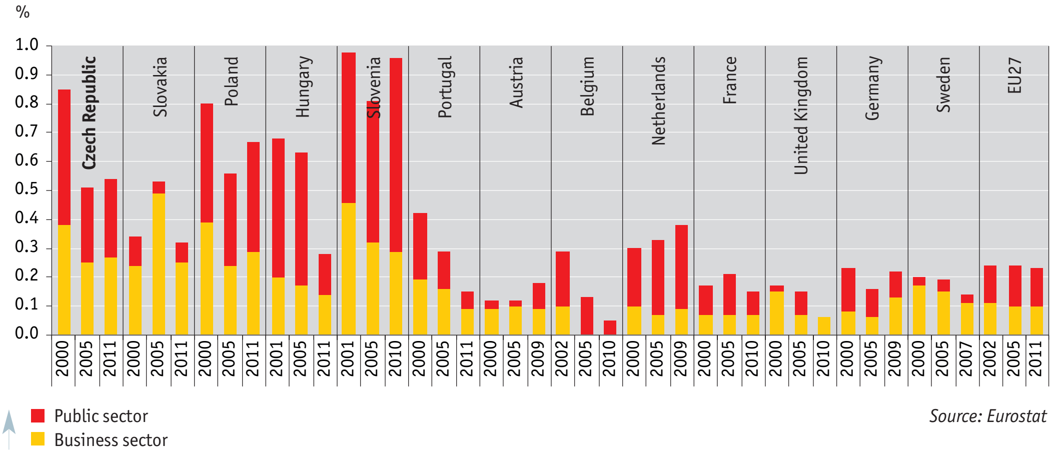
Source: Czech Statistical Office

Chart 3 → **Economic benefits of environmental protection activities in the Czech Republic [CZK bil.], 2003–2012**



Source: Czech Statistical Office

Chart 4 → **International comparison of proportions of investment expenditure on environmental protection by the business and the public sectors in GDP [% of GDP], 2000, 2005 and the last available year or the closest years available**



Source: Eurostat

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 2012, the total expenditure on environmental protection amounted to CZK 82.1 bil., so there was a slight decline by 2.0% compared to the year 2011. The overall decline was mainly caused by the decreased amount of financial means spent within non-investment costs by CZK 2.5 bil. (–4.2%) to the final amount of CZK 56.5 bil. On the other hand, investment expenditure confirmed the upward trend and grew interannually by CZK 0.8 bil. (+3.2%) to CZK 25.6 bil. Likewise in previous years, the 2012 total environmental protection expenditure is also dominated by non-investment costs, which amounted to 2.2fold of the investment expenditure. In the last five years, there has been a balanced trend also in the proportion of the total expenditure in GDP (current prices) which amounted to 2.1% of the GDP in 2012 (Chart 1).

Investment in environmental protection

In the long term (since 2000), most investment in environmental protection is traditionally spent in the areas of wastewater management, air and climate protection and waste management. The year 2012 was no exception and these three areas dominated in the amounts of financial means invested into projects to reduce the negative impacts of activities in these areas.

As regards **development of investments in 2012**, there has been a slight increase again in the amount of expenditure to the total of CZK 25.6 bil. compared to the year 2011. 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. In the future, investment costs are expected to slightly decline interannually as a result of gradual modernization of the polluters' production and operating facilities. However, this trend has not been reported over the past five years.

Concerning the **single programmes**, most of the 2012 funds were invested in waste water management (CZK 11.8 bil.), air and climate protection (CZK 4.2 bil.) and waste management (CZK 3.1 bil.). Compared to the year 2011, investments in wastewater management increased most (by CZK 2.2 bil.), by way of contrast, the most significant decrease was recorded in the area of air and climate protection (by CZK 0.6 bil.). Despite the decline, this area remains one of the main priorities (Chart 2).

In terms of **economic sectors** of the investing entities (CZ-NACE), the largest proportions in the total investment were traditionally recorded in the following sectors: public administration, defence and compulsory social security (43.6% of the total investment) and water supply and activities relating to waste water, waste and remediation (21.3% of the total investment). The manufacturing (15.4% of the total investment), the production and distribution of electricity, gas, heat and conditioned air (7.3% of the total investment) and the transport and storage sector (6.8% of the total investment) also amount to a significant percentage of the total investment.

Both the **corporate and public sectors** take approximately equal parts in the investment in environmental protection. In 2012, companies invested about CZK 13.2 bil. and the government (on both central and regional levels) invested CZK 12.4 bil. 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 are divided into the revenue from the sale of environmental protection services (in 2012 dominated by the waste management sector with the amount of CZK 30.4 bil.), revenue from the sale of by-products (again dominated by waste management with the amount of CZK 12.0 bil.) and savings related to by-products reuse (again dominated by waste management with the amount of CZK 1.0 bil.). Waste management therefore represents the most profitable area of environmental protection, see Chart 3.

Non-investment costs of environmental protection

Non-investment costs of environmental protection have been monitored by the Czech Statistical Office since 2003. In 2012, they reached the value of CZK 56.5 bil. and as in previous years, most of the funds have been spent in waste management, wastewater management and air and climate protection. Compared to the year 2011, there was a slight decrease of this expenditure by 4.2% (by CZK 2.5 bil.), namely because of a decline in the amount of expenditure in waste management. Non-investment costs constitute a substantial proportion of the total environmental protection expenditure (almost 70% in 2012). The biggest amount of non-investment costs was spent on material and energy consumption and wages.

Concerning the **single programme**s, in 2012 – as well as in previous years – most of the funds were spent on waste management (CZK 36.1 bil., which in sum with the investment expenditure accounts for the biggest part of the total environmental protection expenditure) and on wastewater management (CZK 10.8 bil.), Chart 2. As regards the interannual change within the individual programmes, except the above-mentioned area of waste management, no significant decline or increase of non-investment costs has been recorded.

In terms of **economic sectors** of the investing entities (CZ-NACE) in 2012, the biggest proportion of non-investment costs for environmental protection was incurred in the sector of water supply and activities related to wastewater, waste and remediation (51.1% of the total non-investment costs), in the manufacturing (20.4% of the total non-investment costs), in the sector of public administration, defence and compulsory social security (16.0%), and in the sector of production and distribution of electricity, gas, heat and conditioned air (5.3%).

International comparison

In an international comparison with the other EU countries, the Czech Republic, along with the other post-communist countries, spent considerably more financial means on environmental protection than the West European countries (Chart 4). Logically, this trend is attributable mainly to the higher environmental burden that had resulted from long and neglected environmental problems associated with intensive industrial production and mining, which had to be solved through increased investment. Another reason for increased investment consisted in the necessity to meet the EU requirements (in particular investments in the area of water protection).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

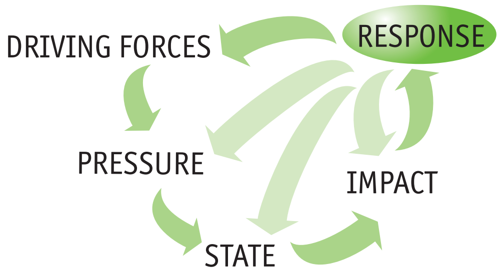
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1903)

36/ Public environmental protection expenditure

KEY QUESTION

What is the structure and volume of financial means expended from central sources and local budgets for environmental protection?



KEY MESSAGES

In the history of recording public expenditure on environmental protection, 2012 was the first year in which the expenditure from central government sources (i.e. from the state budget and state funds) exceeded the spending from local budgets, even though in the long term the local budgets constitute the main component of the total public expenditure. This fact has been caused primarily by an interannual decrease of the expenditure from the local budgets by CZK 4.1 bil., i.e. by approximately 11% to the total of CZK 32.9 bil. (0.86% of the GDP in current prices) and also by significant strengthening of the role of the National Environmental Fund of the Czech Republic in 2011, which the Fund kept in the following year, namely in relation to the Green Savings Programme. Expenditure from the central sources has grown slightly by CZK 0.25 bil., i.e. by 0.7% to the total of CZK 34.5 bil. (0.90% of the GDP in current prices).

Concerning the single programmes in 2012, the central sources supported most the areas of air protection (CZK 11.8 bil.), water protection (CZK 10.2 bil.) and the protection of biodiversity and landscape (CZK 5.0 bil.). The local budgets provided most of their finances to water protection (CZK 15.3 bil.), waste management (CZK 9.6 bil.) and the protection of biodiversity and landscape (CZK 7.7 bil.).

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

According to the current **State Environmental Policy of the Czech Republic**, it is necessary, in the context of adverse economic prospects, to take into account limited financial sources from the state budget to be allocated to environmental policy. Therefore, it is mainly the financial means from the EU funds and grants that are supposed to cover implementation of the measures outlined in the Policy to the maximal possible extent, in full accordance with the budgetary conditions. Generally, the Policy 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.

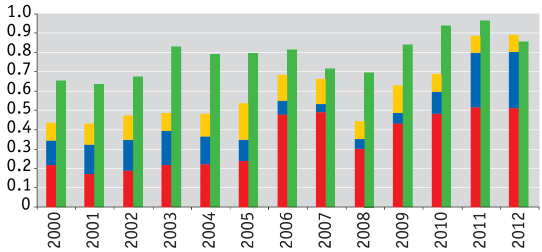
In the framework of specific measures, the Policy focuses on financial support of e.g. development of sustainable management in agriculture, fishing and forestry, of biodiversity conservation and improvement of the state of landscape, ensuring the passability of migration barriers, support to operation of the national air pollution monitoring network or creation of tools and technologies to monitor, predict, prevent 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 with a focus on elimination and prevention of 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 expenditure from the central sources and local budgets, i.e. public spending 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 for Sustainable Development of the Czech Republic** (2010), which also states that it is essential to increase public expenditure and generally enhance the 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], 2000–2012

% of GDP, c.p.



Source: Ministry of Finance of the Czech Republic, Czech Statistical Office

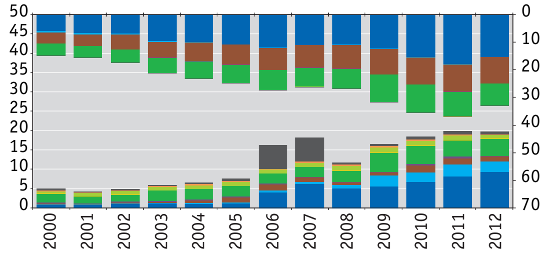
- Proportion of the local budgets' expenditure on environmental protection in the GDP
- Proportion of the National Property Fund's expenditure on environmental protection in the GDP
- Proportion of the state environmental protection funds' expenditure in the GDP
- Proportion of the state budget expenditure 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], 2000–2012

State budget expenditure (CZK bil., c.p.)

Local budgets expenditure (CZK bil., c.p.)

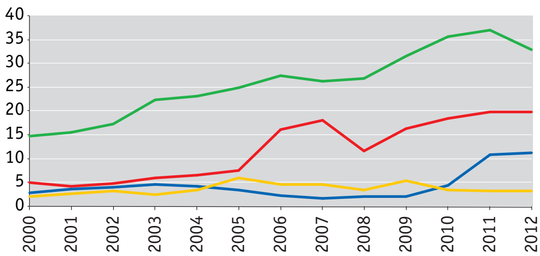


Source: Ministry of Finance of the Czech Republic

- Other activities in ecology
- Environmental research
- Administration in environmental protection
- Reduction of physical factors' impacts
- Biodiversity and landscape protection
- Soil and groundwater protection
- Waste management
- Air protection
- Water protection

Chart 3 ➜ Public environmental protection expenditure in the Czech Republic by source type [CZK bil., current prices], 2000–2012

CZK bil., c.p.



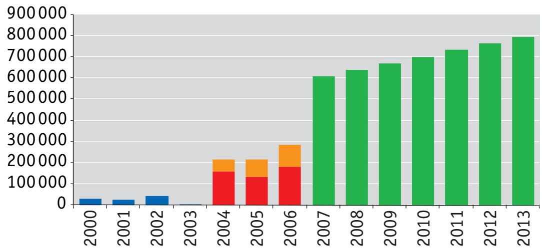
Source: Ministry of Finance of the Czech Republic

- 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

EUR thous.



Source: Ministry of Environment

- Operational Programme – the Environment (2007–2013)
- 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 public environmental protection expenditure is not a simple sum of the central and local budgets, because a part of the public expenditure from the local budgets is a duplication of expenditure from the central sources. 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, in environmental protection, too. Despite the recession, in which the Czech Republic was in 2012, there was a stable level particularly in the expenditure from central sources, both in absolute terms and in relation to GDP, amounting to 0.90% of the GDP (in c.p., Chart 1). In the case of expenditure from local budgets, there was a decrease from 0.97% to 0.86% of the GDP (in c.p.) which was caused by a partial decline in using financial means from national programmes and from the EU funds to which co-financing from public budgets is bound. Another reason could be austerity measures taken by public authorities in connection with the economic crisis.

Public expenditure from central sources
Financial means (subsidies or returnable financial aid) coming from the state budget are the most significant central source. Within environmental protection expenditure from public funds, additional important central sources include environmental protection financing through the State Environmental Fund of the Czech Republic and the now-defunct National Property Fund[1] the remaining competences and resources of which are now administered by the Ministry of Finance of the Czech Republic. These are financial resources that are used by the Ministry of Finance of the Czech Republic to finance the remediation of old environmental damage that had been caused prior to privatization and – to a lesser extent – by the Ministry of the 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 34.5 bil. in 2012. 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 which are considered to be the means of the state budget from which the projects to protect the environment are pre-financed.

Likewise in previous years, the **state budget** was the major central source of public expenditure on environmental protection in 2012, too. Compared to the year 2011, expenditure from the state budget was stagnating more or less – it decreased slightly by 0.6% to CZK 19.9 bil.

Over the long term, **water protection** is the most supported environmental medium, in particular in connection with waste water collection and treatment. In 2012, CZK 9.4 bil., i.e. by CZK 1.2 bil. more than in 2011 (+14.5%), were spent for water protection. It was followed by **biodiversity and landscape protection** with the amount of approximately CZK 4.5 bil. (+0.16 bil., i.e. +3.7% compared to the year 2011). In this area, the most resources have been spent for erosion control, avalanche control, fire prevention and the promotion of protected areas. In last four years, great emphasis is put on **air protection**, which was a priority throughout 1990s. In 2012, CZK 2.6 bil. (–0.53 bil., i.e. –17% compared to the year 2011) were expended in this area, in particular in connection with the energy-saving and thermal insulation programmes (Chart 2).

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 consist mainly of the fees for environmental pollution and in recent years, also of the proceeds from the sale of greenhouse gas emission units (AAU)[2] intended for sale of the greenhouse gas emissions abroad within the mechanism that is based on the Kyoto Protocol. Expenditure from this source continued growing in 2012, too, namely by CZK 0.4 bil. (i.e. by 3.4%) to a total of CZK 11.3 bil. The importance of this resource has increased significantly in the previous period, especially in connection with payments based on applications for subsidies under the Green Savings programme. Financial means for this programme came from the sale of AAUs.

[1] *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.*

[2] *The Assigned Amount Unit (AAU) is a unit defined under the Kyoto Protocol, which represents a tradable right of a country to discharge into the atmosphere one tonne of greenhouse gas emissions in the period 2008–2012. A country which reduced its emissions more than it had undertaken within the Kyoto Protocol may sell the surplus to the other countries. The assigned amount units are actually "the emissions budget" of each industrially developed country that the country received on the basis of its emission targets under the Kyoto Protocol.*

The State Environmental Fund of the Czech Republic uses its own resources to co-finance expenditure from the European funds in an amount of 4% of the total allocated subsidy but it also administers **collection of fees** related to environmental protection. The purpose of the fees is to return them directly to environmental protection, which is different from environmental taxes. In 2012, the greatest part of the income from collecting fees came from the areas of air pollution (CZK 398.2 mil.), the exclusion of land from the agricultural land sources (CZK 225.7 mil.) and waste water discharge into surface water (CZK 211.6 mil.). The fees are the source for providing financial aid within the State Environmental Fund's competences. This support is then used primarily in a form of loans, subsidies and payment for a part of interests from loans, and it goes to air protection, water protection, biodiversity and landscape protection and waste management (i.e. to the priority areas of environmental protection in the Czech Republic).

In 2012, CZK 3.4 bil. (the same amount as in 2011) from the financial means of **the National Property Fund** were spent; these funds are **administered by the Ministry of Finance of the Czech Republic** and directed to removal of old environmental contamination (Chart 3).

Public expenditure from local budgets
Financial resources originating from **local budgets of municipalities and self-governing regions** constitute the second main part of public expenditure. As in the case of expenditure from the central sources, there was also a substantial expenditure increase in 2000–2012 from CZK 14.9 bil. to CZK 32.9 bil. (i.e. +120%). This happened despite the 2012 decline which amounted to CZK 4.1 bil. (i.e. –11% compared to the year 2011). The reason for this development consisted in a partial decrease of using financial means from national programmes and from the EU funds which are bound to co-financing from public budgets. The decline has been recorded especially in the field of water protection (wastewater collection and treatment) and biodiversity and landscape protection (e. g. protection of species and habitats or care for appearance of towns and villages and for public greenery). 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. In the history of recording public expenditure on environmental protection, 2012 was the first year in which the expenditure from central government sources exceeded the spending from local budgets. However, it can be concluded that local budgets continue being the most significant public source of funding for environmental protection in the Czech Republic (Chart 3) in comparison with the central resources (i.e. especially the state budget and the State Environmental Fund of the Czech Republic). 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 local budgets of municipalities and regions, **water protection** is the main priority (in particular waste water collection and treatment) – a total of CZK 15.3 bil. in 2012 (–2.5 bil., i.e. –14.0% compared to the year 2011), see Chart 2. **Waste management** (in particular municipal waste collection) was the second greatest item in financing (total CZK 9.6 bil., i.e. –0.2 bil. and –2.4% compared to the year 2011), 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 7.7 bil., i.e. –1.1 bil. and –12% compared to the year 2011).

Financing by 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.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1904)

Global and European context of driving forces affecting the state of the environment

The Czech Republic is a small, open, export-oriented economy that is dependent on the situation of the global economy and Eurozone economy. It has particularly strong ties to the German economy. Development of global megatrends, trading in the World's commodity exchanges or decisions of transnational business entities can affect the state of the Czech Republic's environment beyond capabilities of the national regulation.

The megatrends are the main social, economic and environmental forces that affect development of the society. Knowing the likely vectors of future developments may help to improve our understanding of the state of the environment in the Czech Republic.

Socio-economic megatrends:

1. For most OECD countries, **aging of the European and American population** is at the top of the political agenda due to changes in the labour market structure, declining competitiveness and re-distribution of public funding. Given the envisaged future massive dematerialization of the economy, the job structure will come under great pressure and jobs may be transferred to countries outside the OECD. The exposure of the aging population to the effects of pollutants is longer, which is why the threshold-values for the risks posed by substances are being reviewed.

2. **Globalization** and the worldwide movement of people, goods, services and knowledge reduce the extent to which national development can be controlled. Although globalization may be at its peak and future trends may lead to regionalization, transnational corporations may – through their decisions – move production both into and out of the Czech Republic, thereby changing the employment structure, the need for transport services and, consequently, the state of the environment.

3. **Technological development** provides solutions to existing problems but it also brings about entirely new problems to which no solutions are available. New energy sources, nanotechnology, genetic modification, virtualisation, new compounds and manufacturing processes are examples of areas the impacts of which may fundamentally transform the topics that are discussed in this Report.

4. Prosperity and economic growth result in a new **imbalance** between the slow-growing Euro-American society and the breakneck growth that is experienced especially in Brazil, Russia, India, China and South Africa (BRICS). BRICS countries are characterized by economic growth of around 10%, young population, emerging middle class and an aggressive approach to gaining access to natural resources, at the expense of OECD countries. There will be changes to business models, product trends, capital movements, but there will also be increase in waste, which may not suit the Czech Republic.

5. **Individualization** comes hand in hand with pressure on the mode of transport (passenger car transport), housing (suburbanization), but also reduced interest in public affairs and environmental protection.

6. **Commercialization** is closely tied to the other megatrends. The speed of the market response to any demand anywhere in the world results in consumerism that was inconceivable some fifty years ago. On the other hand, ongoing digitisation will speed up the shift towards a knowledge economy. Commercialization limits personal decision-making, 'relativises' moral values and, consequently, reduces the people's interest in their surroundings including the environment.

7. **Interest in health and the environment**, as opposed to commercialization, represents a global trend that is typical of the middle and upper classes within the society. Sports, spas, organic products and interest in the origin of goods and the impacts of consumption are trends that, if well regulated, may benefit the environment. Through promoting product labelling (e.g. the Forest Stewardship Council at the international level, the Flower at the European level, and the Environmentally Friendly Product and Environmentally Friendly Service at the national level) and certification systems for companies (the Eco-Management and Audit Scheme, Corporate Social Responsibility), many countries intend to promote more efficient protection of ecosystem services. The codes of many corporations now include sustainability and socially and environmentally responsible behaviour.

8. The speeding up of product marketing, innovation cycles, **intensive research**, improved marketing surveys, continuous optimization and modification result in an increased pressure on the ability to regulate real problems.

9. The interconnectedness between social, economic and technological networks provides a **basis for accelerated economic and social changes**. At the same time, dependence on critical infrastructures is growing, as is the cost of their security.

10. **Urbanization** allows for creating nodes in networks and is massively taking place especially in developing countries. It tends to be associated with commercialization and the increasingly poor evaluation of work in the primary industry.

Environmental megatrends:

1. **Global environmental pollution increases**. Both the amount and diversity of pollutants increase. Suspended particulate matter, sulphur oxides, nitrogen oxides, ground-level ozone and greenhouse gases, which are currently receiving considerable attention, are merely the tip of the iceberg. The main mass of that iceberg comprises substances such as endocrine disruptors, persistent organic compounds and nanoparticles, whose independent or joint action within the environment is understood to only a very small extent.

2. Declining resilience of ecosystems and **loss of ecosystem services**. Provisioning, cultural, regulating, supporting and other services constitute a quantifiable natural capital that is exploited in order to sustain humanity. Finding a balance between the exploitation of ecosystem services by the society and their sustainability for future generations has been the leitmotif of environmental protection.

3. **Climate trends** affect the availability of ecosystem services, including water supply, conditions for business (primarily in agriculture) and ocean acidification. The possible impacts of these trends are being studied intensively.

4. The growing **risk of pandemics** and the spread of non-native diseases and pests are caused by the global movement of goods and services, the climate trends and the reduced resilience of ecosystems. New human, animal and plant diseases can spread all over the world extremely quickly. Fear of pandemics has a major impact on global markets.

5. **Environmental debt** represents the accumulated environmental burdens that have not been included in prices in the real economy. The unrealistic financial evaluation of the real economy is what has led to the financial crisis. The situation resulted in a crisis of confidence in the real economy, leading to a crisis of governance, during which economies were experiencing reduced confidence in regulation. The characteristic effects of that crisis include destruction of the value of economic and natural capitals and investment, and the increasing risk of inflation of values.

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 (evaluation of the state of the animal and plant species of Community importance and natural habitat types of Community importance). The other areas are not covered by regular monitoring or they can be evaluated in a long perspective only, in connection with non-periodical data updating. In many cases, the one-year interval, in which the Report is submitted, therefore does not correspond to the possibilities of evaluation in this area and the data used in the Report are always updated depending on the evaluation terms of the individual monitoring types.

For the above reasons, the chapter **Biodiversity and Ecosystem Services** is not included in the Report. In the past, three indicators were presented in the Report – "State of animal and plant species of Community importance", "State of natural habitat types of Community importance" and "Common bird species indicator". In order not to repeat identical data, the indicators describing the "State of animal and plant species of Community importance", the "State of natural habitat types of Community importance" will only be included in the Report in those years in which these data are reported to the European Commission, i.e. in a six-year period. The term for submitting the next evaluation is in 2013 and the respective data will be included in the Report for that year. The given indicators continue being presented at http://indikatory.cenia.cz.

The state of Common bird species 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. Similarly, the possibility of adding other indicators based on the State Environmental Policy 2012–2020 or the standard indicator sets used in the EU to evaluate biodiversity (SEBI indicators) is also limited mainly in relation to financial resources available in the sector.

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. 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.

Data on the agricultural land use limits in the Czech Republic

In the past, the indicator „Agricultural land use limits" was presented in the Report which focused on evaluation of data concerning potential vulnerability of lower soil strata by compacting, potential vulnerability of soil by acidification and point yield evaluation of agricultural land. However, data for this indicator are updated annually for small territories only (in km^2) and that is why the given indicator will be evaluated in the Report for an interval longer than one year. Nonetheless, the indicator will continue being presented at the Information System of Statistics and Reporting (ISSaR).

[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 JRC	Directorate General Joint Research Centre
DH	district heating
DMC	domestic material consumption
EAFRD	European Agricultural Fund for Rural Development
EC	European Communities
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
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
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
WRI	T. G. Masaryk Water Research Institute

Glossary of terms

AAU Unit. The Assigned Amount Unit (AAU) is a unit defined under the Kyoto Protocol, which represents a tradable right of a country to discharge into the atmosphere one tonne of greenhouse gas emissions in the period 2008–2012. A country which reduced its emissions more than it had undertaken within the Kyoto Protocol may sell the surplus to the other countries. The assigned amount units are actually "the emissions budget" of each industrially developed country that the country received on the basis of its emission targets under the Kyoto Protocol.

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.

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.

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.

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.

DH. District heating. In a DH system, heat is generated at a single centralised source and subsequently distributed via grids to multiple buildings. DH is also known as teleheating.

Domestic material consumption. This term covers all materials entering the economy. It is calculated as the sum of all direct material input (domestic extraction, including extraction-related indirect material flows) and imports less exports.

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).

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.

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.

Greenhouse gases. Gases that are naturally present in the atmosphere or produced by humans; they have the ability to absorb longwave 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 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.

Motorization. The number of registered passenger cars in proportion to the population. It is expressed as the number of vehicles per 1 000 inhabitants.

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. Non-investment costs for environmental protection, also referred to as current or operating expenditures, 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.

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.

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 sum of all distances travelled by all vehicles within a monitored category for a certain period of time, regardless of their payload ratio. It is measured in vehicle-kilometres (vkm).

Transport performance. The number of passengers or the volume (possibly 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 that are registered in the Central Vehicle Register as of a given date.

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.).