2010

REPORT
ON THE ENVIRONMENT OF THE CZECH REPUBLIC

cenia

Ministry of the Environment of the Czech Republic

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Introduction

Pursuant to Act No. 123/1998 Coll., on the right to environmental information, as amended, and Government Resolution of 17 August 1994 No. 446/1994, the Report on the Environment of the Czech Republic (hereinafter the Report) is annually prepared and subsequently submitted for approval to the Government of the Czech Republic and for consideration to the Chamber of Deputies and the Senate of the Parliament of the Czech Republic.

The Report is a comprehensive document assessing the state of the environment of the Czech Republic, including its context. Since the 2005 edition, the compilation of the Report has been entrusted to CENIA, the Czech Environmental Information Agency.

The 2010 Report was discussed and approved by the Government on 11 January 2012, after which it was conveyed to both chambers of the Parliament of the Czech Republic. The Report is published in electronic form at http://www.mzp.cz and http://www.cenia.cz and also distributed in printed form.

The report comprehensively assesses the state of the environment in a given year based on available data and information. In 2010, both positive and negative trends were identified in individual areas of the environment.

The Ministry of the Environment of the Czech Republic has been implementing a number of both legislative and non-legislative measures in order to eliminate negative environmental trends. The main long-term priority is the improvement of air quality, namely those factors that have the most effect on human health. This mainly concerns the reduction of suspended particulate matter (abbreviated as PM_{10} and $PM_{2.5}$) and polycyclic aromatic hydrocarbons (such as benzo(a)pyrene). An important prerequisite for improving the current situation is a new law that focuses on polluters, including small sources, more than the existing law and also amends pollution changes. The new air protection law also includes the option of defining low emission zones.

Other areas that require attention and that the Ministry of the Environment of the Czech Republic considers priorities include anti-flooding measures, waste management and energy efficiency improvement, from both the production and energy consumption perspectives. All of the above objectives will be resolved through legislation by passing a new waste law, adopting conceptual and strategic documents regulating waste management and by co-developing legal regulations to increase the energy efficiency of buildings. Practical instruments include projects implemented within the Operational Programme Environment.

The Ministry of the Environment of the Czech Republic will also focus on soil protection where there has been a long-term trend of intensive and uncoordinated agricultural land appropriation. The objective of the measure is to slow down the decrease in agricultural land and its protection against degradation and pollution. In this respect, the Ministry of the Environment of the Czech Republic has been strengthening the existing instruments and introducing new ones as part of the amendment on the protection of agricultural land resources that is being prepared.

The Ministry of the Environment of the Czech Republic has not forgotten its other priority area of focus, nature conservation and landscape protection. As far as this area is concerned, the management of protected areas is being developed and improved so that individual natural parks and protected landscape areas serve people while preventing the destruction and degradation of natural territories. In addition to amendments to legal regulations, another important instrument is the involvement of a wider range of stakeholders in discussions concerning specific problems in this area. One such example is the issue of Šumava National Park.

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** change since 2003*

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 has been 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 standardly based on authorized data obtained from monitoring systems administered by organizations both from within and outside the environmental sector. Data for international comparison is provided by Eurostat, the European Environment Agency (EEA) and the Organization for Economic Cooperation and Development (OECD).

THE USE OF INDICATORS TO DESCRIBE THE STATE OF THE ENVIRONMENT

The methodical basis of the new Report are indicators, i.e. precisely methodically described indicators related to main environmental topics of the Czech Republic and objectives of the current State Environmental Policy of the Czech Republic for 2004–2010. Once a new State Environmental Policy of the Czech Republic has been prepared, the set of indicators should be harmonized so that new indicators are related to the new policy and can reflect annual fulfilment of the policy's objectives. Environmental indicators are among the most widely used environmental assessment instruments. Based on data, they demonstrate the state, specifics and development of the environment and can indicate new topical environmental issues. An assessment that uses indicators is clear and user-friendly. The new methodology based on indicators follows methodical trends applied in the EU and is in line with the gradual harmonizing process of reporting both at national and European levels.

ENVIRONMENTAL ASSESSMENT USING A SET OF KEY INDICATORS

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

The set of key indicators includes 39 indicators, selected using the following criteria:

- Relevance for current environmental issues;
- Relevance for the current implemented state environmental policy strategies and international commitments;
- Availability of quality and reliable data over a long period of time;
- Relationship to the sectoral concept and its environmental aspects;
- "Cross-section" nature of the indicator – the indicator covers as many causal links as possible, i.e. it was selected to represent both causes and consequences of other phenomena in the DPSIR chain;
- Link to indicators defined at the international level and detailed at the EU level.

In the future, the proposed set of indicators will not be static, but rather continuously modified to meet the needs of the applicable State Environmental Policy of the Czech Republic, the EEA set, environmental issues and the availability of underlying data sets. Over the last two years, two new indicators have been added to the thematic area entitled "Soil and Agriculture" and the question of ecosystem services were added to "Biodiversity". On the other hand, it was not possible to perform an annual update of some indicators because the data is reported over an interval of several years – such as indicator No. 12 "State of animal and plant species of Community importance" and indicator No. 13 "State of natural habitat types of Community importance". Indicators included in the set of key indicators were developed by specialised work centres in the Czech Republic that have dealt with the issue for many years, or were adopted from internationally acknowledged sets (EEA CSI, Eurostat, OECD and others).

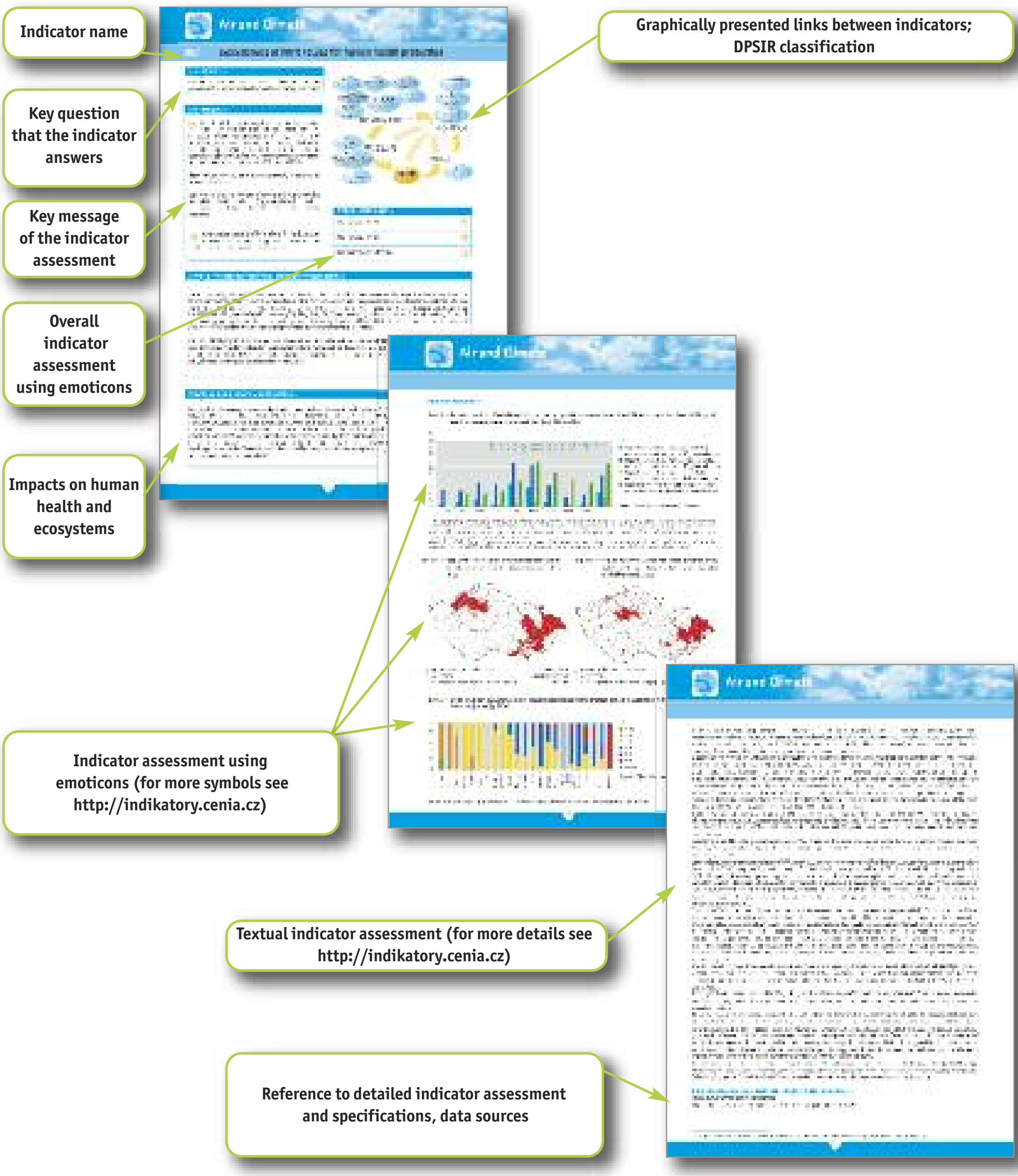
MESSAGES COMMUNICATED VIA INDICATORS

An indicator in the Report provides information across several hierarchical levels of detail. First, it provides comprehensible information – a key message, related (if currently possible) to a specific objective or another national or international obligation. General information also includes an overall trend assessment and impacts of the assessed phenomenon on human health and ecosystems. A detailed level of indicator assessment includes an assessment of the state and development as well as an assessment of international comparison. In indicators where verified data are available, the state of the environment is compared to other EU27 states. In some indicators, an international comparison beyond EU27 is included because of global importance of the topic (such as indicator No. 02 – Greenhouse gas emissions). Each indicator is assessed according to a unified template and simultaneously presented at http://indikatory.cenia.cz in a more detailed form than in the Report, together with methodology specifications and other meta data. The Report provides a link to the website for each indicator at the end of each chapter.

EMOTICON SYMBOL KEY

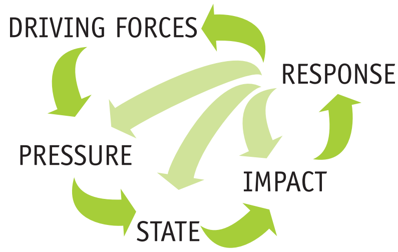
:)	The trend is developing positively in line with defined objectives.
:|	The trend is developing neither negatively nor positively and can be referred to as being stagnate.
:(	The trend is developing negatively and not in line with defined objectives.

INDICATOR ASSESSMENT STRUCTURE



RELATED INDICATORS

Indicators in the Report are arranged in thematic areas and their position within the internationally applied DPSIR model (D – Driving Forces, P – Pressure, S – State, I – Impact and 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 components (such as water, air, soil, etc.); pressure indicators (P) directly impact the state (such as emissions). The driving forces (D) are factors of pressure (such as the energy intensity of the economy, the structure of primary energy basis). Impact (I) means damage to the environment and human health and response (R) is implemented measures. Nevertheless, the classification of indicators may not be clear when taking into account the interpretation of individual dependences. Some indicators can be viewed as pressure, while from a different perspective they indicate the state. There is no definite classification.



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 technical terms and abbreviations used in the Report.

Key messages of the Report

2010 in the Czech Republic was a year of **economic recovery** in which industrial production in the processing **industry and energy generation increased**. There was a significant growth in the car industry and related industrial branches. This economic development together with the impact of transport, heating from local sources and climatic conditions affecting dispersion conditions resulted in a higher release of pollutants into the air. There was a year-to-year increase in the emissions of particulate matter and carbon monoxide from extremely large and large pollution sources that was significant especially in the Moravia Silesia Region. However, the emissions of acidifying substances continued to decline. Due to the 2008–2009 economic recession, there still is an evident **decline in the construction industry** that is also reflected in a decline in construction material consumption and overall waste production.

In terms of the long-term development, the state of the environment in the Czech Republic has **stagnated** in most areas since 2000 and environmental problems typical for the early 21st century such as **unsatisfactory air quality** in settlements and urban agglomerations and an **unsatisfactory state of natural habitats** remain. Worsened air quality continues to bring health risks for people living in affected areas. **The burden on ecosystems** caused by acidifying substances in the air **has been declining**, however, there is still a high overlimit concentration of ground-level ozone that has adverse effects on forest ecosystems and crop yields.

On a year-to-year basis, **the air quality with respect to human health protection worsened** in the Czech Republic in 2010, namely in terms of the size of the area with a worsened air quality. In addition to an increase in industrial pollution, the increase in adverse air quality was also largely affected by weather conditions in 2010, characterised by a colder heating season and the frequent occurrence of adverse dispersion conditions. Areas affected by worsened air quality remained the same as in previous years. The situation in the Moravia Silesia Region remains to be the worst, caused mainly by the industrial pollution of the entire Ostrava-Katowice basin, i.e. including cross-border effects from Poland. In 2010, decreased air quality also occurred in inversion locations (such as Kladno), in areas with intensive traffic (such as Prague) and in small settlements where heating from local furnaces prevailed. **Approximately one-half of the Czech Republic's population lived in locations with decreased air quality**; in 2009 it was 18%.

Pollutants that most frequently exceed the maximum concentration limits for the protection of human health include particulate matter (PM_{10} and $PM_{2.5}$) and benzo(a)pyrene. Particulate matter causes major health risks, namely in connection with respiratory diseases.

Although produced pollution released into surface water increased in 2010, **the quality of watercourses continues to improve very slowly**; however, water remains polluted in a number of locations. Still water is annually affected by eutrophication caused mainly by diffuse sources of pollution, which results in a diminished quality of bathing water.

Specific environmental burden, i.e. energy and material consumption and pollution production per capita and GDP unit, continue to decline in the Czech Republic. However, compared to the EU27 average, they continue to be above-average, among other things due to the structure of the national economy with a higher share of industry in GDP. Economic development and environmental burden are gradually becoming independent; more advanced technologies are being used and industrial production is shifting towards products with a higher added value. So far, an absolute separation between the trend in economic performance and environmental burden where absolute burden values would decrease when economic performance increased has not yet been reached.

Public transport, namely integrated transport systems in urban agglomerations and long-distance bus and railway transport, have maintained a stable share in total passenger transport performance. The individualisation of passenger transport has not been expanding. Due to increased industrial production, **freight road transport** experienced a significant year-to-year increase, namely international transport.

A major source of pressure on the environment is exerted by the **urban development of towns and the development of transport infrastructure**. Although the suburbanisation process, i.e. the moving of inhabitants from city centres to suburbs, has been slowing down, **urban agglomerations continue to grow and affect surrounding landscapes, interfering with its character** and functioning.

The difference in the quality of the environment has recently become more dynamic in relation to the **rapid fluctuation in both the national and global economies and the changing climate** that is connected with the more frequent occurrence of dangerous hydrometeorological phenomena (torrential rains, floods, longer drought periods, strong winds, etc.)

THE MAIN POSITIVE FINDINGS OF THE REPORT:

- The energy intensity of industry has been radically decreasing. This development means that during a period of economic growth, the final energy consumption (and hence the environmental burden caused by the energy sector) will be increasing at a slower pace than the economic growth.
- The generation of electricity from renewable energy sources has been increasing and the proportion of electricity from renewable energy sources in the Czech Republic's gross electricity consumption increased significantly from 6.8% to 8.3% in 2010. This means the indicative objective of the 8% share by 2010 was accomplished.
- The structure of household heating has been shifting towards more environmentally friendly methods of heating such as natural gas, biomass and a central heat source. The share of houses heated through solar collectors has been growing. Despite this positive development, households continue to be the most prominent source of air pollution.
- Between 2008 and 2009, greenhouse gas emissions significantly dropped to the lowest level since 1990 and the Czech Republic has been fulfilling currently valid commitments under the Kyoto Protocol since 1992. According to the current forecast, the Czech Republic will meet its obligations related to the EU Climate and Energy Package.
- The emissions of acidifying substances have been decreasing over the long term and the acidification burden on ecosystems has been decreasing. In 2010, the year-to-year decline was 3.2%; between 2000 and 2010, emissions dropped by almost 20%.
- The consumption of water by households and industry has been decreasing. The share of the population connected to public water systems continues to increase.
- The length of sewerage systems has been growing and the share of population connected to sewerage systems with a water treatment plant has been increasing.
- The proportion of deciduous trees in the total forest area and in afforestation in the Czech Republic has been recently increasing only slightly, but steadily. The area of natural forest renewal has been growing.
- Within agricultural land resources, there is a positive growth in the proportion of permanent grasslands at the expense of arable land. The forest area has been slightly increasing.
- The proportion of agricultural land under organic farming increases. In 2010, the proportion of agricultural land under organic farming in the total area of agricultural land resources reached 10.55% and the number of organic farms rose to 3 517. The target set by the State Environmental Policy of the Czech Republic was accomplished.
- The growing trend of passenger car and air transport performance stopped in 2010. Bus transport performance increased by 13.9% on a year-to-year basis. Public transport has maintained its position in passenger transport and the individualization of passenger transport did not expand.
- In 2010, the total waste production decreased by 1.4% on a year-to-year basis with hazardous waste experiencing the sharpest decline of 17%.
- The share of reused waste in total waste production was at 73.5% in 2010. Out of the total amount of generated packaging waste, 70% was used in recycling and 7.9% for energy purposes. The material use of municipal waste has been increasing and in 2010 it was at 24.3%. The Czech Republic is one of the countries with the lowest municipal waste productions per capita.

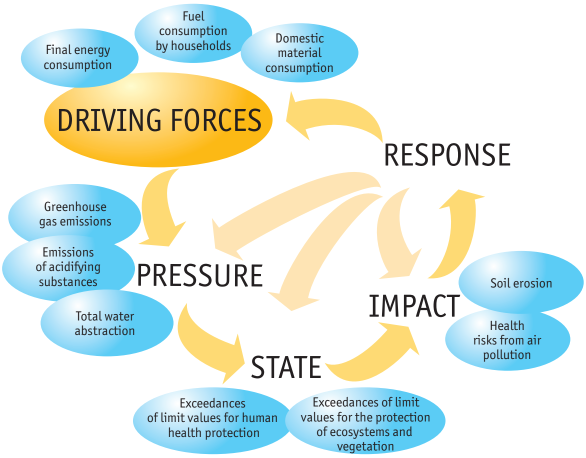
THE MAIN NEGATIVE FINDINGS OF THE REPORT:

- In 2010, the area in which the maximum concentration limits of particulate matter PM_{10} grew. The local 24-hour concentration limit for PM_{10} was exceeded in 21.2% of the area; 48% of the Czech Republic's population was exposed to overlimit PM_{10} concentrations (in 2009 it was 18%). In terms of pollution by particulate matter, the worst situation was reported in the Ostrava-Karviná region and in Kladno, where the overlimit concentrations of PM_{10} were exceeded more than 100 days a year.
- In 2010, a year-to-year decline was also registered in air pollution by benzo(a)pyrene, a carcinogenic polycyclic aromatic hydrocarbon; its overlimit concentrations occurred mostly in settlements and urban agglomerations. The target local concentration limit for benzo(a)pyrene was exceeded in 14.5% of the area in which approximately 65% of the Czech Republic's population lives. This represents a significant increase compared to 2009 (from 2.3% of the area and 35.5% of the population).
- In 2010, emissions of total suspended particles (TSP) increased by 1.8% and by 5.1% from REZZO sources. A significant increase in the emissions of suspended particulate matter from small stationary sources (REZZO 3) by 11.3% was caused by a cold winter season and the higher consumption of fuels for household heating.
- The energy intensity of the Czech economy grew by 2.9% on a year-to-year basis in 2010; however, between 2000 and 2010, there was a 19.0% decline.
- The reduction of final energy consumption stopped over the last three years and there was an 8.2% increase on a year-to-year basis in 2010. The total energy consumption in transport continues to grow; between 1999 and 2009 it increased by 91.5%.
- In 2010, the discharge of pollution into surface water slightly increased compared to 2009 in all monitored basic indicators (BOD_5, COD_{Cr}, NL, $N_{inorg.}$ and P_{total}), namely due to a higher volume of discharged waste water.
- The performance of freight road transport has been growing and returned to the level before the economic recession of 2008 – the year-to-year increase in transport performance in 2010 was 15.3%. Both the road system and air transport experienced a higher load due to increased freight.
- The number of registered motor vehicles in the Czech Republic (both new vehicles and imported used cars) continues to increase; however, the vehicle fleet is still very old due to the slow elimination of vehicles from the register. The average age of passenger vehicles in 2010 was 13.7 years and it has been stable for some time. More than 60% of all passenger vehicles (2.7 million vehicles) are older than 10 years and approximately 30% of vehicles are older than 15 years.
- The conservation status of 37% of animal and plant species of Community importance is assessed as unfavourable-inadequate and 35% of animal and 36% of plant species as unfavourable-bad.
- Almost three-quarters of natural habitats of Community importance are assessed as unfavourable-bad with respect to protection in the Czech Republic.
- The abundance of farmland bird species continues to decline. The main cause for the decline is the intensification of agricultural and the loss of agricultural land.
- Despite the slowdown in the pace of increase, the defoliation rate remains very high in the Czech Republic, actually the highest in Europe.
- Approximately 10% of the population lives in locations in Prague, Brno and Ostrava where noise limits are exceeded. In some municipalities, excessive noise, caused mainly by road transport, affects more than one-quarter of the population. This subsequently affects the quality of life in these municipalities and makes their further development difficult. An average of 600 people per 1 km of road live along main roads with excessive noise levels; this is approximately double the EU27 average.
- The structure of land use in the Czech Republic has been experiencing a growing share of developed and other areas that represent significantly destabilising elements in the countryside. Areas around some towns, mainly Prague, have been experiencing urban sprawl, i.e. unsystematic expansion of towns into the surrounding countryside.
- Landfilling continued to be the most frequent waste disposal method in 2010 and accounted for 95% of total waste disposal. The amount of produced packaging waste has been growing since 2003; in 2010, there was a 3% increase on a year-to-year basis.

01/ Temperature and precipitation characteristics

KEY QUESTION →

What were the temperature and precipitation conditions in the Czech Republic in 2010?



KEY MESSAGES →

After an unbroken string of exceptionally hot years beginning in 1996, the Czech Republic experienced a generally cooler and more humid year in 2010. The average annual air temperature of 7.2 °C was 0.3 °C lower than the 1961–1990 long-term mean, thus making 2010 the coolest year since 1996. With an annual precipitation of 867 mm (i.e. 129% of the 1961–1990 long-term mean), 2010 was the Czech Republic's most humid year since 1961.

2010 was characterized by a cold winter with plenty of snow, a very warm July and torrential rainfall in summer that resulted in several major floods.

INDICATOR SIGNIFICANCE AND CONTEXT →

Temperature and precipitation conditions are significant external factors that influence the burden on and state of the environment and, by extension, the successful implementation of environmental policies and measures. The trends in temperature and precipitation are indicative of longer-term climate trends and the progress of anthropogenic climate changes.

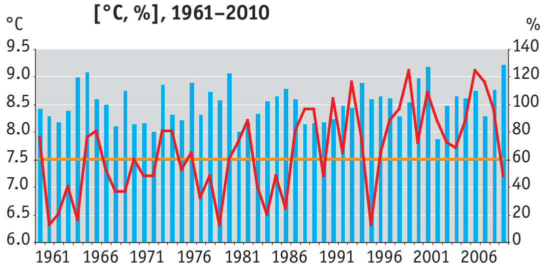
Trends in temperature and precipitation affect the national economy and the environmental effects of sectors such as electricity and heat generation (they influence energy consumption), water management (floods, erosion risk, irrigation), agriculture and forestry. Weather conditions also directly affect the state of the environment. They can affect the dispersion conditions for pollutants in the atmosphere and – in turn – air quality, especially in winter. In summer, high temperatures combined with intense solar radiation cause the formation of tropospheric ozone. High temperatures also increase the evaporation rate and when combined with a deficient in rainfall, they decrease soil humidity, affect drainage, increase the eutrophication rate of still waters and, last but not least, can also result in fires. Extreme weather conditions, such as floods, long-term drought periods and strong winds, can cause extensive damage to the national economy.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Tropical days are associated with increased cardiovascular and respiratory mortality. Increased mortality has been demonstrated especially in women of post-retirement age. Generally, health may be at risk in persons who are chronically ill, are dependent on the help of others, suffer from cognitive disabilities, have mobility problems or are socially excluded. Very cold days can affect health as well, especially in people over the age of 65 and homeless people.

INDICATOR ASSESSMENT

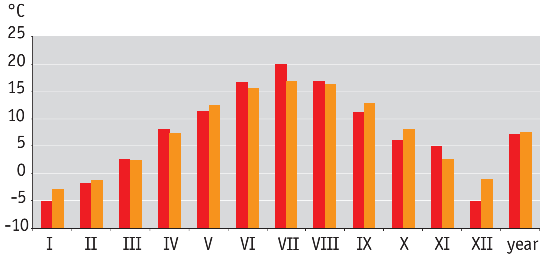
Chart 1 → **Long-term development of annual average air temperature and precipitation totals in the Czech Republic compared to the 1961–1990 mean [°C, %], 1961–2010**



- Average annual temperature
- Long-term temperature mean
- Annual precipitation (% of mean)

Source: Czech Hydrometeorological Institute

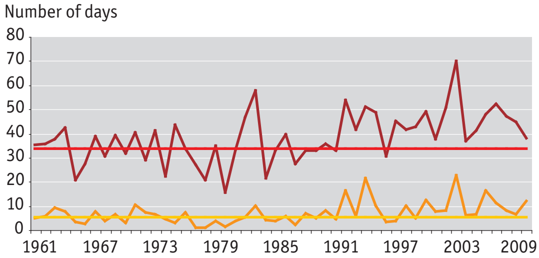
Chart 2 → **Monthly average air temperature in the Czech Republic (areal averages) compared to the 1961–1990 temperature mean [°C], 2010**



- Air temperature, 2010
- Air temperature mean (1961–1990)

Source: Czech Hydrometeorological Institute

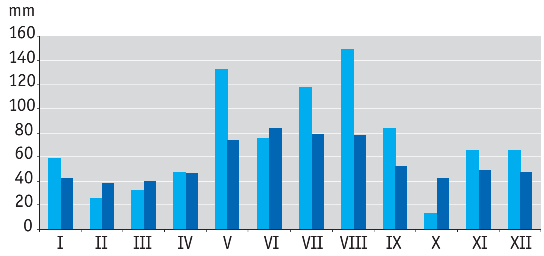
Chart 3 → **Average number of summer days and tropical days in the Czech Republic compared to the 1961–1990 mean [days], 1961–2010**



- Number of summer days per year
- Mean number of summer days (1961–1990)
- Number of tropical days per year
- Mean number of tropical days (1961–1990)

Source: Czech Hydrometeorological Institute

Chart 4 → **Monthly precipitation totals in the Czech Republic (areal averages) compared to the 1961–1990 precipitation mean [mm], 2010**



- Precipitation total, 2010
- Mean of total precipitation (1961–1990)

Source: Czech Hydrometeorological Institute

In terms of temperatures, 2010 was an average year in the Czech Republic, with an annual average temperature of 7.2 °C, which was 0.3 °C lower than the 1961–1990 temperature mean (Chart 1). Compared to previous years, 2010 with a deviation of –0.3 °C from the mean **was the coolest year since 1996**. It was 1.2 °C cooler that the preceding year. While average monthly temperatures fluctuated around or slightly below the mean values during most of the year, **the months of July and November were very warm compared to the mean, followed by a very cold December**.

In January, the average monthly temperature of –5 °C was 2.2 °C below the 1961–1990 long-term mean, so the month was exceptionally cold (Chart 2). All of Europe experienced heavy frost after 25 January, which culminated on the night between 26 and 27 January in the Czech Republic with temperatures in mountain valleys dropping below –25 °C. The lowest temperature of –32.6 °C was recorded on 27 January at the Rokytská slať station in the Bohemian Forest. Freezing weather resulted in deteriorated dispersion conditions and increased concentrations of airborne dust in the Moravian-Silesian Region. The second half of the winter and the spring months showed temperatures ranging around the mean.

July was exceptionally hot, with a monthly average temperature of 20 °C, which was 3.1 °C higher than the long-term mean (Chart 2). **It was the Czech Republic's fifth warmest July since 1961**, the warmest being July 2006 with an average temperature of 21.4 °C. Very hot weather with maximum temperatures in excess of 30 °C was experienced in most of the Czech Republic from 9 to 17 July. The highest maximum temperature in Bohemia (37.2 °C) was measured on 12 July at the Děčín station; the highest maximum temperature in Moravia (35.9 °C) was recorded on 17 July in Ostrava-Mošnov.

The greatest temperature differences between the beginning and the end of a single month were recorded in November – while there was very warm weather with maximum temperatures around 20 °C at the beginning of the month, an 'icy day' (i.e. a day with a maximum air temperature below the freezing point) was experienced in nearly all of the Czech Republic at the end of the month. Cold weather persisted in December. With a monthly average temperature of –4.9 °C (3.9 °C below the long-term mean) **this was the 5th coldest December since 1961**. Monthly average temperatures were only lower in December 1969, 1963, 1962 and 1996.

For the entire Czech Republic, an average of **11.7 tropical days were experienced in 2010** (i.e. more than twice the mean number of 5 tropical days per year), which confirms the exceptionally hot culmination of the summer (Chart 3). **The number of summer days (37.5) roughly corresponded to the mean. The numbers of frosty days and icy days were significantly above average in 2010**, which reflects the cool character of the winter season. The number of frosty days was 128 (the highest number since 2003) and the number of icy days was 65, which is the second highest number for the 40-year period since 1963.

The Czech Republic had **above-average precipitation** in 2010. With a total annual precipitation of 867 mm (i.e. 129% of the 1961–1990 long-term mean), **this was the Czech Republic's wettest year since 1961**. Above-mean and high-above-mean precipitation was recorded in January, May, July, August and September, while October was rather dry (Chart 4).

In January, sub-zero temperatures and heavy snowfall resulted in road transport difficulties and caused problems in rail transport and electricity supply. From 8 to 11 January, lower-altitude areas received more than 50 cm of fresh snow.

In May, all of Central Europe experienced heavy rainfall coupled with devastating floods. Within the Czech Republic, the floods affected the regions of northern Moravia and Silesia. In May, the monthly total precipitation was 133 mm in the Czech Republic, which corresponds to 179% of the 1961–1990 mean. In Bohemia, the measured totals were lower – on average 106 mm of rainfall, which represents 148 % of the 1961–1990 mean. In Moravia and Silesia, May 2010 was extremely wet, with the monthly total precipitation reaching 187 mm, i.e. 244% of the 1961–1990 mean. In the period since 1961, this is the highest May total of precipitation in Moravia and Silesia. When comparing monthly total precipitation for any single month, the only month to report a higher monthly total of precipitation was July 1997 (293 mm).

In July and August, the Czech Republic experienced intense storm activity coupled with torrential rainfall and hail. The August monthly total precipitation reached 149 mm, i.e. 191% of the 1961–1990 long-term mean, with the western portion of the Czech Republic receiving the majority of the rainfall. **In August, there were several significant rain events, most notably during the first ten days of the month, which resulted in devastating floods in northern Bohemia.** Over the course of three days from 6 to 9 August, some areas received more than over 300 mm of rainfall. Affecting mainly Central Bohemia and Prague, strong thunderstorms and damaging hail caused property damage that was estimated by insurance companies at CZK 2 billion.

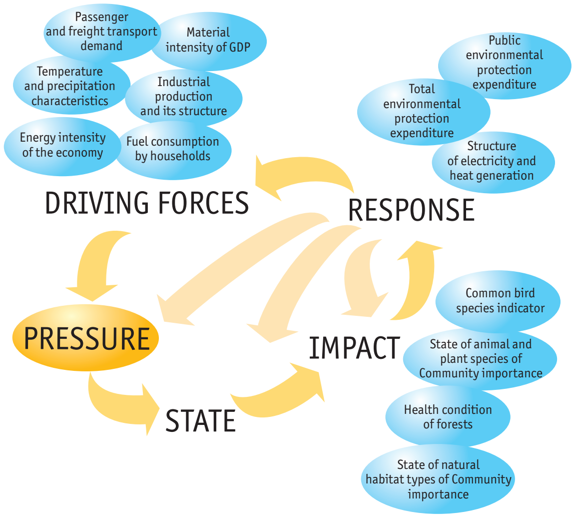
Total September precipitation of 84 mm represented 162% of the 1961–1990 mean. Most rainfall occurred during the last ten days of the month, mainly in northern Bohemia, where it resulted in elevated river levels and local flooding. After a dry October that only received 31% of the precipitation mean, the subsequent months were wetter, with a total precipitation corresponding to 132% and 135% of the mean. November had above-mean precipitation and December displayed levels around the mean.

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 →

Are the national and international greenhouse gas emission targets of the Czech Republic being successfully met?

KEY MESSAGES →

After a period of stagnation at the beginning of the 21st century, total aggregate greenhouse gas emissions significantly decreased in connection with the 2007–2009 economic crisis in the Czech Republic. The Czech Republic's current commitment to the Kyoto Protocol has already been met by a large margin. Between 2008 and 2009[1], annual emissions decreased by 5.8%, which is the largest year-to-year decline since 1994. The emission intensity of the economy has been decreasing, showing a 32.6% drop compared to 2000.

In 2010, greenhouse gas emissions renewed their growth within the emission trading scheme. In spite of favourable developments, the Czech Republic's specific greenhouse gas emissions per capita and GDP unit remain above the EU27 average. Within the structure of greenhouse gas emissions, there is an increasing proportion of emissions from transport, which accounted for 13.9% of the total national emissions in 2009.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The priorities of the current **State Environmental Policy of the Czech Republic for 2004–2010** include protecting the climate system and reducing greenhouse gas emissions.

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 1990 base year. New commitments after the end of the first control period have not been agreed upon.

A climate-energy package was adopted in December 2008 at the European Community level. The package introduces joint approaches and solutions in the area of climate protection, security of energy supplies and competitiveness of European economies. The package contains three directives and one decision[2] that are intended to help meet the EU target – to reduce the EU's total greenhouse gas emissions by at least 20% and achieve a 20% proportion of renewable energy sources in final energy consumption by 2020 as compared to the 1990 reference year. Through its climate-energy package, the EU committed itself to reducing emissions in industries that fall under the EU ETS by 21% by 2020 as compared to 2005. In sectors outside the EU ETS, the Czech Republic's commitment is to increase emissions by no more than 9% over the same period. However, if a higher reduction target is adopted at the EU level (30%), the Czech Republic's reduction targets will also increase significantly.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

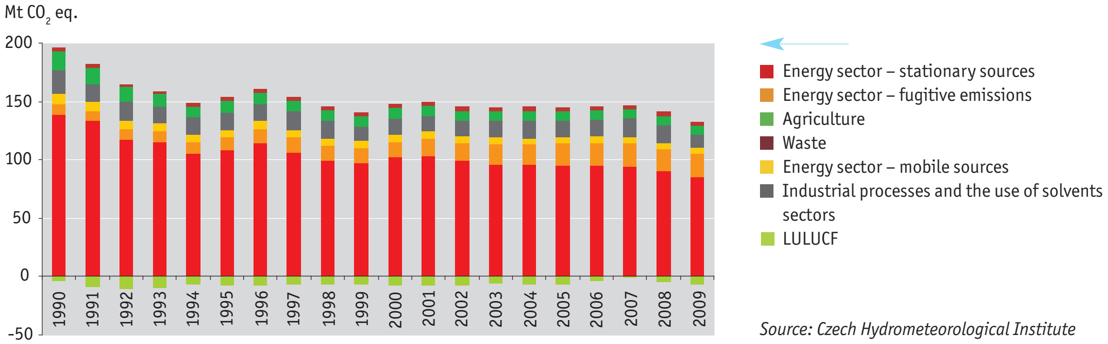
The production of greenhouse gases has a minimal direct impact on human health and ecosystems. However, given the linkage between the production of greenhouse gases and climate change, the indirect impacts of greenhouse gas production include all effects that are caused by climate change. Furthermore, since greenhouse gas emissions are usually produced together with other pollutants, we can conclude that increased greenhouse gas emissions mean increased air pollution and, in turn, an increased risk to human health and ecosystems resulting from air pollution.

[1] With respect to the data reporting methodology, the 2010 emission inventory data are not available as of the closing date of this publication. The results of the greenhouse gas inventory are regularly submitted to the Secretariat of the UN Framework Convention for the last processed year within 15 months from the end of the preceding year.

[2] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources; Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community; Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide; Decision No. 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

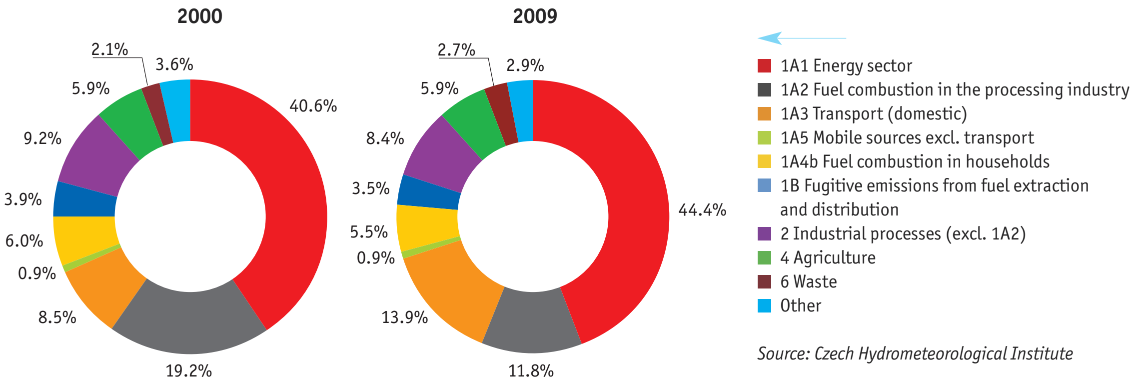
INDICATOR ASSESSMENT

Chart 1 → **Development of greenhouse gas emissions by sector in the Czech Republic [Mt CO_2 eq.], 1990–2009**



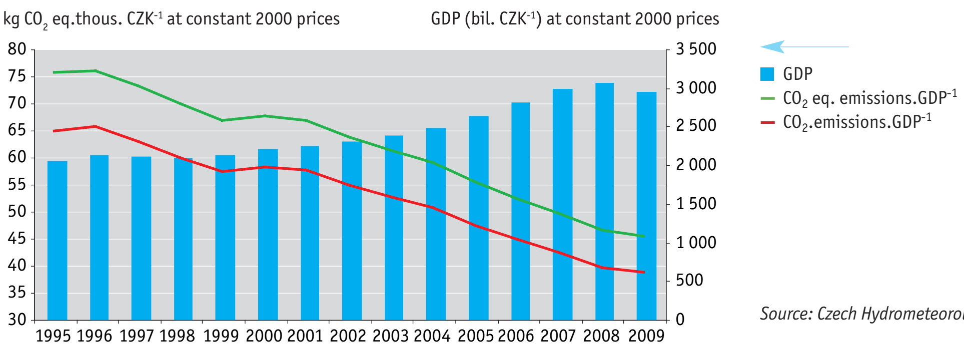
Source: Czech Hydrometeorological Institute

Chart 2 → **Structure of greenhouse gas emissions by source category in the Czech Republic [%], 2000 and 2009**



Source: Czech Hydrometeorological Institute

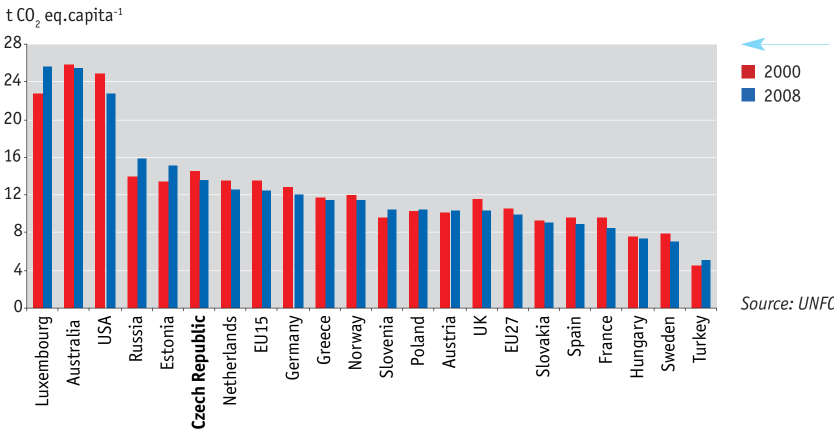
Chart 3 → **Trends in the emission intensity of the Czech economy [kg CO_2 eq.thous. CZK^{-1} at constant 2000 prices] and GDP [bil. CZK^{-1} at constant 2000 prices], 1995–2009 (excluding LULUCF[3])**



Source: Czech Hydrometeorological Institute

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

Chart 4 → **International comparison of greenhouse gas emissions per capita [t CO_2 eq.capita^{-1}], 2000 and 2008 (excluding LULUCF)**



Source: UNFCCC

Greenhouse gas emissions have been declining in the Czech Republic since 2007, with the 2009 level **being the lowest since 1990** (Chart 1). This decline followed a period of stagnation or slightly increased emissions at the beginning of the 21st century. However, the emission trends need to be viewed in the context of the Czech Republic's slowing and subsequently shrinking economy in 2009. **On a year-to-year basis, total aggregate emissions** (excluding LULUCF) decreased by 5.8% to 132.9 Mt CO_2 eq., which is **the largest year-to-year decrease since 1994**. Since 1990, the reference year for the Kyoto Protocol, emissions have dropped by 32%, i.e. the Czech Republic's commitment was met by a large margin. Compared with 2005 that is subject to the targets of the EU's climate-energy package, this was an emission reduction of 8.1%. In 2009, emission sinks in LULUCF increased to 6.9 Mt CO_2 eq., the aggregate emissions including LULUCF totalled 126.1 Mt CO_2 eq. (a 7.5% decrease over the preceding year).

In 2009, the largest decreases in emissions were achieved in the following categories: **the energy sector** (a decrease of 3 360 kt CO_2 eq., i.e. 5.4%), **industrial processes** (2 900 kt, i.e. 20.1%) and **fuel combustion in the processing industry** (379 kt, i.e. 2.4%). The reduction in industrial emissions mostly reflected the decline in the steel production sector (a production decrease of 1 890 kt of steel, i.e. 29%, which corresponds to 1 853 kt of emissions) and the cement production and lime production sectors (a year-to-year decrease in emissions of 16% and 21% respectively). The decline in industrial production in 2009 was connected with the year-to-year economic (GDP) contraction of 4.1%.

While **the proportion of large stationary sources in total emissions is decreasing** (Chart 2), emissions from the public energy sector and the processing industry account for the majority of emissions (68.1% in 2009, approximately 73% in 2000), which is one of the underlying causes of the emission intensity of the Czech economy. By contrast, the proportion of transport keeps increasing (from 8.5% in 2000 to 13.9% in 2009, i.e. by 5.4 percentage points – an increase from 12.6 to 18.5 Mt). Transport emissions are almost exclusively comprised of road transport (approximately 97% of transport emissions in 2009). The 'transport' item does not include international air transport (emissions of about 1 100 kt CO_2 eq. in the Czech Republic, an increase of about 100% since 2000) that is reported separately pursuant to the IPCC methodology. The proportions of other categories have remained approximately unchanged, including the public energy sector category that produces about 43% of total emissions.

Enterprises that are involved in the **Emission Trading Scheme (EU ETS)** reported CO_2 emissions totalling 73.8 Mt CO_2 in 2009, which represents a decrease of 8.2% from the previous year. The greatest declines in emissions were recorded in the public energy sector (4.3%) and the production of iron, steel and coke (20.1%), which is consistent with the data of the total national inventory. In 2010, emissions within the EU ETS totalled 75.6 Mt, which corresponds to an annual increase of 2.4% (1.8 Mt CO_2), so the strongly declining trend in total emissions cannot be expected to continue. Compared with 2005 that is subject to the targets of the EU's climate-energy package, emissions decreased by 10.5% prior to 2009 and by 8.3% before 2010. However, the emission reduction target of 21% by 2020 should be achieved through gradually reducing the amount of allocated emission permits in the 2013–2020 period in connection with reducing the proportion of permits that are allocated free of charge. In sectors that are not covered by the EU ETS, emissions decreased by 5.1% between 2005 and 2009, while European legislation permits an increase of up to 9% for the Czech Republic by 2020.

While **specific (intensity) indicators of greenhouse gas emissions have been declining in the Czech Republic**, they are still above the EU27 average (Chart 4). Between 1990 and 2009, per-capita specific aggregate greenhouse gas emissions decreased by approximately 33% to 12.7 t CO_2 eq. per capita. In 2008, greenhouse gas emissions per capita were 27% higher in the Czech Republic compared to the EU27 average (8.6% higher compared to the EU15); this margin has remained virtually unchanged since 2000. The emission intensity of the economy – i.e. the specific greenhouse gas emissions per unit of GDP – dropped by 32.6% to 45.4 kg CO_2 eq. / CZK 1 000 of GDP between 2000 and 2009 (Chart 3). However, the decoupling of economic growth from emission growth has only been relative to date – emissions did not decrease during periods of economic growth and even increased in 2000, 2004, 2006 and 2007. In the European context, the Czech Republic's specific emissions per GDP were 39.6% above the EU27 average (in 2000 this was ca 50%). The situation is therefore gradually improving with respect to this parameter. The countries that had a greater emission intensity of GDP included Poland and Estonia (more than 0.7 kg CO_2 eq. / USD 1 000) in Europe and Australia outside Europe. On the contrary, Sweden and Norway (approximately three times lower than the Czech Republic) have a very low intensity.

The **future outlook for greenhouse gas emissions** is influenced by many uncertainties that are associated with the development of the economy and the implementation of measures to reduce them. In the short term, a strong dependence of emissions on GDP trends is to be expected. Given the Czech economy's persistently higher emission intensity, no significant decrease in emissions can be expected if there is economic growth. Assuming an increasing demand for electricity, emissions from the energy sector will depend on the structure of the energy mix and on the proportion of low-emission sources. Total emission trends will most likely depend on the trends in the sectoral composition and the volume of industrial production and the trends in the transport sector. The proportion of transport in total emissions can be expected to increase further, as there is very little potential for emission reduction in transport, i.e. assuming that there is increasing transport performance. However, a number of policies and measures to improve energy efficiency and reduce greenhouse gas emissions have been adopted at the EU level over the past few years. According to recently prepared national projections for greenhouse gas emission trends, the Czech Republic should be able to meet the commitments derived from the climate-energy package through timely and effectively implementing the above policies and measures.

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

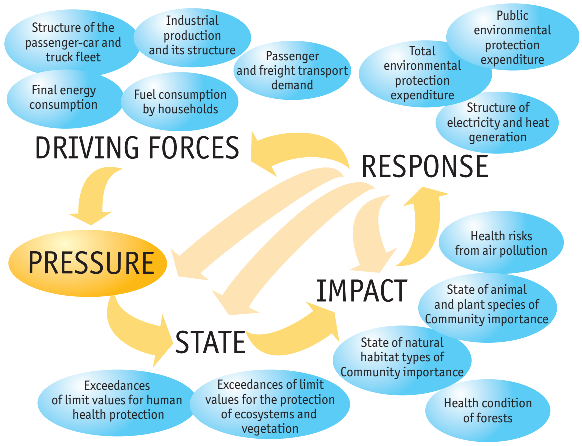
KEY QUESTION →

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

KEY MESSAGES →

The emissions of acidifying substances into the air (SO_2, NO_x and NH_3) have been steadily declining since the 1990s. Compared to 2009 (14.96 kt per year), the emissions of acidifying substances dropped by approximately 3.2%. The year-to-year changes in the emissions of acidifying substances were mostly attributable to NO_x 4.1%, SO_2 2.9% and NH_3 2.4%. The decrease in emissions has resulted from decreased emissions from mobile sources and the industrial energy sector.

The emissions of acidifying substances did not exceed the national emission ceilings for 2010.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Reducing the emissions of acidifying substances (SO_2, NO_x and NH_3) is addressed by the **National Emission Reduction Programme of the Czech Republic**. National emission ceilings for individual pollutants for 2010 were laid down by Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants, which is based – in part – on the relevant protocols of **the CLRTAP**. The following emission ceilings are to be met by 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].

The control and reduction of emissions of substances that acidify the environment is one of the objectives of the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to the Convention on Long-range Transboundary Air Pollution (CLRTAP)**. It can be expected that implementing the Protocol will reduce the areas in Europe affected by excessive acidification by more than 80% (from 93 million hectares in 1990 to 15 million hectares in 2010).

One of the sub-objectives within Priority Area 4 "Protection of the Earth's Climate System and the Prevention of the Long-range Transport of Air Pollution" of the **State Environmental Policy of the Czech Republic** is to reduce the transboundary transport of acidifying substances and to achieve the national emission ceilings for these substances.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

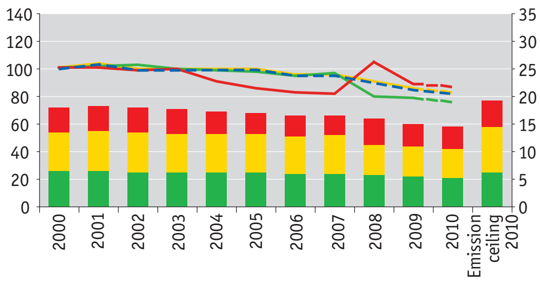
Acidifying substances lower the pH of soil and water and, in turn, adversely affect aquatic ecosystems (loss of biodiversity) and forests (disrupted nutrient flow and damage to root systems). The loss of forest cover can also lead to the disruption of runoff and increased erosion.

These substances affect health. In particular, they irritate the respiratory system and worsen the problems of persons suffering from asthma (bronchoconstriction) and allergies (increased sensitivity to additional allergens). In terms of health effects, NO_2 poses the greatest risk because long-term exposure may increase respiratory system morbidity, especially at high concentrations in susceptible persons (asthma).

[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 expressed in tonnes and multiplied by their respective acidifying equivalent factors.

INDICATOR ASSESSMENT

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

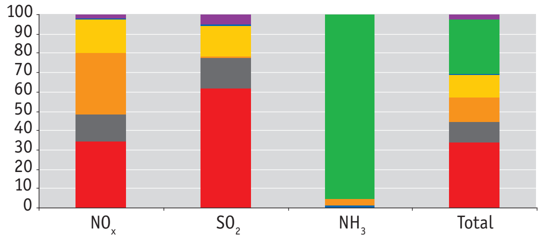


- NO_x (left axis)
- SO_2 (left axis)
- NH_3 (left axis)
- Total emissions of acidifying substances (left axis)
- NO_x (right axis)
- SO_2 (right axis)
- NH_3 (right axis)

Source: Czech Hydrometeorological Institute

* *The NH_3 emission balance has included from the use of nitrogen fertilizers since 2008.*

Chart 2 → **Sources of emissions of acidifying substances in the Czech Republic [%], 2009**

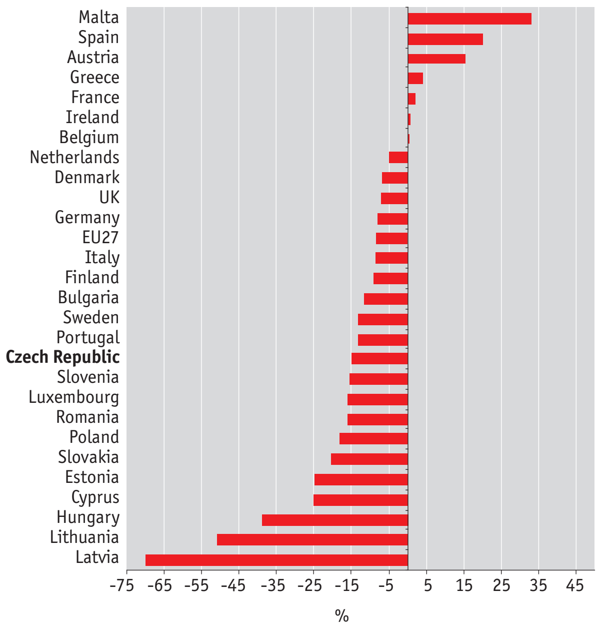


- Public electricity
- Industrial electricity
- Transportation
- Services, households and agriculture
- Manufacturing processes without combustion
- Manure processing
- Other

Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this publication.

Chart 3 → **Emissions of acidifying substances across the EU27 in 2008 (deviations [%] below or above the linear trend of emission reduction towards accomplishing national emission ceilings in 2010)**



- Deviations of emission levels relative to national emission ceilings

Source: EEA

Between 1990 and 2010, there was a **decrease in the emissions of acidifying** by more than 81% (from 78.97 to 14.47 kt per year weighed by the acidifying equivalent). The rate of decline slowed down at the beginning of the 21st century and the production of emissions decreased only slightly. In connection with the fulfilment of emission ceilings for extra large sources and the economic crisis, the decrease in emissions regained its momentum in 2008 and 2009. The decline in emissions between 2000 and 2010 was 20% from 18.02 to 14.47 kt per year of acidifying equivalent[2].

Compared to 2009 (14.96 kt per year), the emissions of acidifying substances dropped by approximately 3.2% in 2010. The year-to-year changes in the emissions of acidifying substances were mostly attributable to NO_x 4.1%, SO_2 2.9% and NH_3 2.4%. NO_x emissions decreased from 5.48 kt per year to 5.26 kt per year weighed by the acidifying equivalent (from 252.0 kt of NO_x emissions in 2009 to 241.8 kt of NO_x emissions in 2010); the year-to-year decrease was primarily due to emissions from mobile sources.

SO_2 emissions reached 5.29 kt per year weighed by the acidifying equivalent **in 2010** (in 2009, they were at 5.43 kt per year weighed by the acidifying equivalent), which corresponds to 169.5 and 174.65 kt of SO_2 emissions in 2010 and 2009 respectively; the year-to-year decline was mainly caused by a drop in large stationary sources. NH_3 emissions decreased from 4.02 kt in 2009 to 3.39 kt weighed by the acidifying equivalent, which corresponds to 68.33 and 66.67 kt of NH_3 emissions in 2009 and 2010 respectively (Chart 1).

Based on 2009 data[3], **the principal sources of the emissions of acidifying substances** (Chart 2) are the public energy sector (nearly 36% of the total emissions of acidifying substances, i.e. 5.34 kt per year weighed by the acidifying equivalent), manure processing (nearly 26%, i.e. 2.02 kt per year) and road transport (nearly 14%, i.e. 2.03 kt per year). Compared to 2000, the structure of sources has not changed much. The 2010 figures for the emissions of acidifying substances for the entire Czech Republic are below the ceilings set for 2010 (Charts 1 and 3).

In the 21st century, the trends in the emissions of acidifying substances are linked with the trends in the public energy sector, household heating and road transport. The declining trend in NO_x was attributable to decreased NO_x emissions from individual motor transport.

In spite of all improvements concerning emissions in Europe, serious effects of air pollution remain. In light of these facts, the Sixth Environmental Protection Plan called for formulating a Thematic Strategy on Air Pollution (hereinafter referred to as the Strategy) with the aim of reaching „a quality of air that does not show risk to human health and the environment and does not have serious negative effects upon them". In relation to acidifying substances, the Strategy suggests stricter national ceilings for SO_2, NO_x and NH_3 emissions. Compared to 2000, the Thematic Strategy on Air Pollution envisages the following emissions reduction for the European Union by 2020: SO_2 reduced by 82%, NO_x by 60% and NH_3 by 27%. By achieving these objectives, the burden on water and forest ecosystems caused by acid atmospheric dispositions would decrease and European ecosystems would be protected from atmospheric effects caused by nutritious nitrogen. The Strategy's implementation also envisages a review of the NECD directive. A draft reviewed directive is still under preparation. The reviewed directive sets 2020 national emission ceilings for acidifying substances and, naturally, also for VOCs and, in its latest version, for $PM_{2.5}$. At the same time, the Gothenburg Protocol is being revised at the CLRTAP level and new national emission ceilings beginning in 2020 are expected to be laid down.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

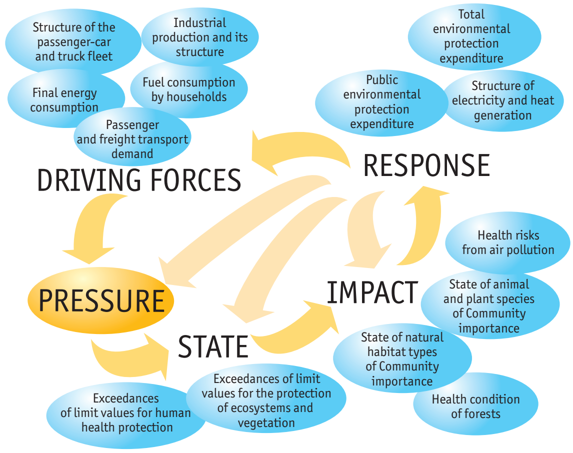
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1831)

[2] The proportions in the emissions of acidifying substances were as follows: SO_2 37.3%, NO_x 36.6% and NH_3 26.8%.
[3] With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this 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

Between 1990 and 2010, the emissions of ground-level ozone precursors (VOC, NO_X, CO and CH_4) dropped by approximately 61%. The decline in emissions for 2000–2010 was 22%.

The emissions of ozone precursors did not exceed the national emission ceilings (VOC, NO_X) for 2010.

In 2010, the emissions of precursors reached 492.90 kt per year weighted by the tropospheric ozone formative potential. Compared to 2009 (520.32 kt per year), the emissions of acidifying substances dropped by approximately 5.3%.

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 addresses reducing the emissions of ozone precursors (VOC and NOx) resulting from anthropogenic activities. National emission ceilings for individual pollutants for 2010 were laid **down by Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)**, which is based – in part – on the relevant protocols of the **Convention on Long-range Transboundary Air Pollution (CLRTAP)**. As of 2010, the following emission ceilings are to be met: for NO_x 286 kt per year, i.e. 349 kt per year weighed the tropospheric ozone formation potential (TOFP) and for VOC 220 kt per year, i.e. 220 kt per year weighed by the TOFP[1].

Controlling and reducing the emissions of ground-level ozone precursors is one of the objectives of the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to the CLRTAP**. The adoption of the Protocol is supposed to reduce the number of days with high concentrations of ozone in Europe by one-half and subsequently reduce the effects of ground ozone on human health.

One of the objectives within Priority Area 4 "Protection of the Earth's Climate System and the Prevention of the Long-range Transport of Air Pollution" of the **State Environmental Policy of the Czech Republic** is to reduce the transboundary transport of pollutants and to achieve the national emission ceilings.

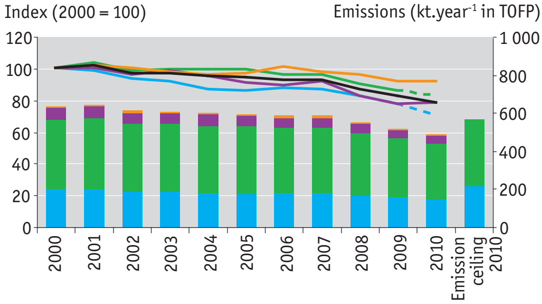
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Ground-level ozone is a powerful oxidizing agent that has a negative impact on forests, crops and human health. Ozone damages the assimilation portions of plants and weakens both forests and agricultural crops that, in turn, are then less resistant to other influences such as insects and climatic factors (wind, drought etc.). Impacts on human health include the acute irritation of the respiratory system (at high concentrations) and odour stimulation. Increased cardiovascular and respiratory morbidity have also been recorded. Health risks are caused not only by ozone, but also by some of its precursors (mainly NO_2).

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

INDICATOR ASSESSMENT

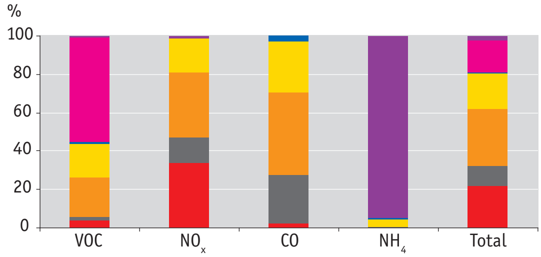
Chart 1 → **Total emissions of ozone precursors in the Czech Republic, 2000–2010, and the level of national emission ceilings (for VOC and NO_x) for 2010 [index, 2000 = 100]; [kt.year^{-1} weighted by the TOFP]**



- VOC (left axis)
- NO_x (left axis)
- CO (left axis)
- NH_4 (left axis)
- Total emissions of ozone precursors (left axis)
- VOC (right axis)
- NO_x (right axis)
- CO (right axis)
- NH_4 (right axis)

Source: Czech Hydrometeorological Institute

Chart 2 → **Sources of emissions of ozone precursors in the Czech Republic [%], 2009**

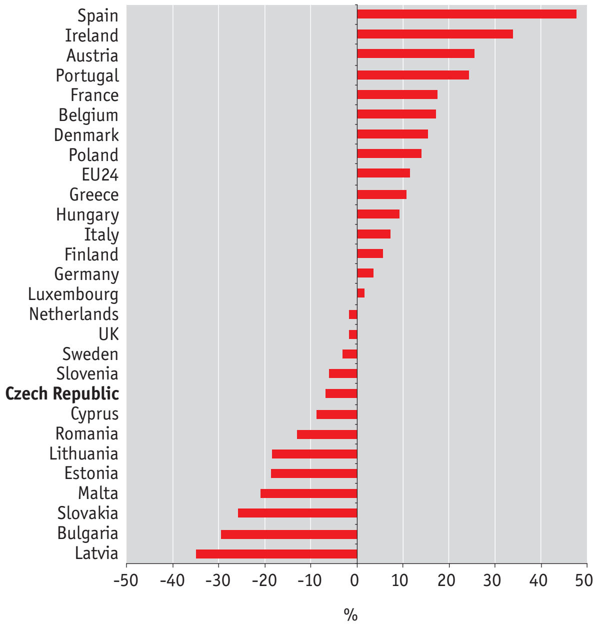


- Public electricity
- Industrial electricity
- Transportation
- Services, households and agriculture
- Manufacturing processes without combustion
- Use of solvents
- Other

Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this publication.

Chart 3 → **Emissions (NO_x and VOC) across the EU27 in 2008 (deviations [%] below or above the linear trend of emission reduction towards accomplishing national emission ceilings in 2010)**



- Deviations of emission levels relative to national emission ceilings

Source: EEA

Between 1990 and 2010 the emissions of ground-level ozone precursors[2] were reduced by almost 61% (from 1 266 to 493 kt per year weighed by the TOFP). While the rate of decline slowed down after 2000, a more pronounced decrease occurred in 2008–2009 due to the economic crisis. The decline in emissions between 2000 and 2010 is almost 22%, i.e. from 634 kt to 493 kt weighed by the TOFP per year (see Chart 1).

In 2010, the emissions of precursors reached 492.90 kt per year weighed by the TOFP. Compared to 2009 (520.32 kt per year), the emissions of acidifying substances dropped by approximately 5.3%. VOC emissions significantly contributed to the decrease (a decrease of 9.6%) and NO_x (a decrease of 4.1%). The year-to-year decrease was largely caused by a drop in emissions from mobile sources. In 2010, NO_x emissions amounted to 294.99 kt weighed by the tropospheric ozone formation potential (TOFP) (307.45 kt weighed by TOFP in 2009), VOC emissions dropped to 143.97 kt weighed by TOFP (159.38 kt weighed by TOFP in 2009) and CO emissions increased slightly to 46.52 kt weighed by TOFP (46.07 kt in 2009).

Based on data for 2009[3] (Chart 2), it is safe to say that **the principal emission sources of ozone precursors** are transportation (30% of all emissions of ozone precursors, i.e. 157 kt weighed by the TOFP), and the public energy sector (22% of emissions of ozone precursors, i.e. 113 weighed by the TOFP). Other significant sources include services, households and agriculture (collectively 18%) and the use of solvents (17%). Compared to 2000, the structure of sources has not changed much. The 2010 values of precursors of ground-level ozone, for national emission ceilings have been set (VOCs and NO_x), are below the level established by the national emission ceiling (Charts 1 and 3).

The long-term decrease in NO_x and CO emissions is related to the continuing decline in electricity generation in lignite burning power plants. The increase in CO production in 2010 (following a previous marked decline) can be linked to industrial production trends in the processing industry that grew significantly in 2010, after a sharp drop in 2009. The trends in NO_x emissions reflect the positive effects of decreasing emissions from individual motor transport, as the proportion of vehicles equipped with catalytic converters within the fleet increases.

The Thematic Strategy on Air Pollution (hereinafter referred to as the Strategy) notes that "air pollution and its effects on the health and quality of life of EU citizens are too significant for additional steps beyond those mandated by current legislation not to be taken". The Strategy proposes a significant reduction in emissions caused by air polluting substances. In relation to ground-level ozone, the Strategy proposes reducing VOC emissions by 51% and NO_x emissions by 60% by 2020 within EU member states as compared to 2000 levels. A draft of the reviewed NEC directive is under preparation. The reviewed directive sets national emission ceilings for two ground-level ozone precursors (i.e. NO_x and VOC) and, naturally, also for SO_2, NH_3 and recently for $PM_{2.5}$. The Strategy's implementation also envisages a review of the NECD directive. At the same time, the Gothenburg Protocol is being revised at the CLRTAP level and new national emission ceilings beginning in 2020 are expected to be laid down.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

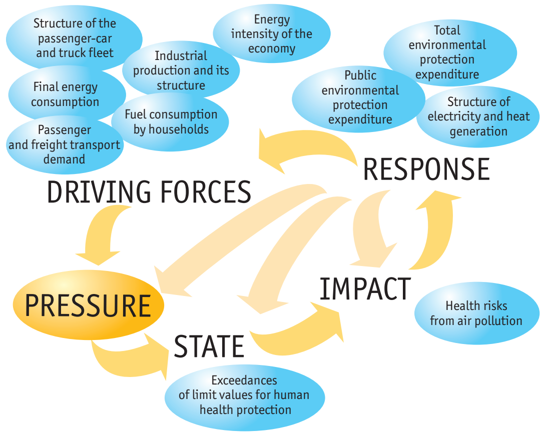
[2] Volatile organic compounds, nitrogen oxides, carbon oxide and methane belong among precursors of ground-ozone that is secondarily formed in the air. Adversal effects on both human health and vegetation were proved in ground-ozone. The main causes of ground-ozone formation were NO_x (59%) and VOC (31%). CO accounts for 9% and CH_4 for 1%. Compared to 2000, the situation has not significantly changed.

[3] With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this 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

Between 1990 and 2010, the emissions of secondary particulate matter precursors (NO_x, SO_2 and NH_3) dropped by nearly 78%. The decline in emissions for 2000–2010 was almost 20%. The emissions of secondary particulate matter precursors did not exceed the national emission ceilings for 2010.

Compared to 2009 (359.8 kt per year), the emissions of particulate matter precursors dropped by approximately 3.6%. Year-to-year, the emissions of PM_{10} increased by approximately 4.5% in 2010.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The requirement to reduce the emissions of primary PM_{10} and secondary particulate matter precursors is addressed by the **National Emission Reduction Programme of the Czech Republic**. National emission ceilings for individual pollutants for 2010 were laid down by **Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)**, which is based – in part – on the relevant protocols of **the Convention on Long-range Transboundary Air Pollution (CLRTAP)**. The following national emission ceilings are to be met by 2010: 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)[1]. As part of the ongoing review of the Gothenburg Protocol (CLRTAP) and of Directive 2001/81/EC, national emission ceilings for primary $PM_{2.5}$ will be set for 2020.

One of the objectives within Priority Area 4 "Protection of the Earth's Climate System and the Prevention of the Long-range Transport of Air Pollution" of the **State Environmental Policy of the Czech Republic** is to reduce the transboundary transport of pollutants and to meet the national emission ceilings.

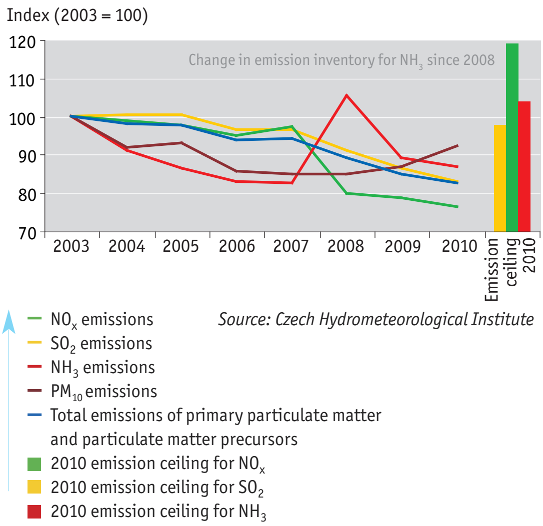
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

In terms of health, suspended particles are among the most dangerous pollutants that either form in the atmosphere or are emitted into the atmosphere. Particle size determines whether and how the particles will penetrate and be deposited in the respiratory system. Larger particles get trapped in the upper portions of the respiratory tract, PM_{10} proceed into the lower respiratory tract and the $PM_{2.5}$ penetrates all the way into the alveoli. Exposure to elevated concentrations of particles leads to reduced lung function in children and adults, increased morbidity from respiratory diseases, the occurrence of chronic bronchitis and reduced life expectancy mainly due to higher mortality from heart and blood vessel disease and probably also from lung cancer. There is no safe threshold concentration for the effects of suspended particles.

[1] *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

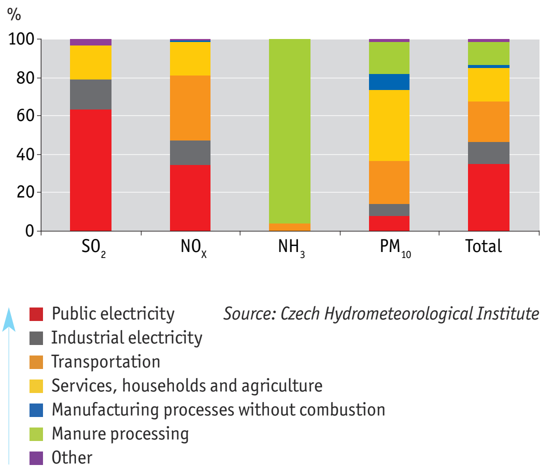
Chart 1 → **Development of emissions of primary particulate matter and secondary particulate matter precursors in the Czech Republic, 2003–2010 and the national emission ceilings (for NO_x, SO_2 and NH_3) for 2010 [index, 2003 = 100]***



Source: Czech Hydrometeorological Institute

* *The NH_3 emission balance has included from the use of nitrogen fertilizers since 2008.*

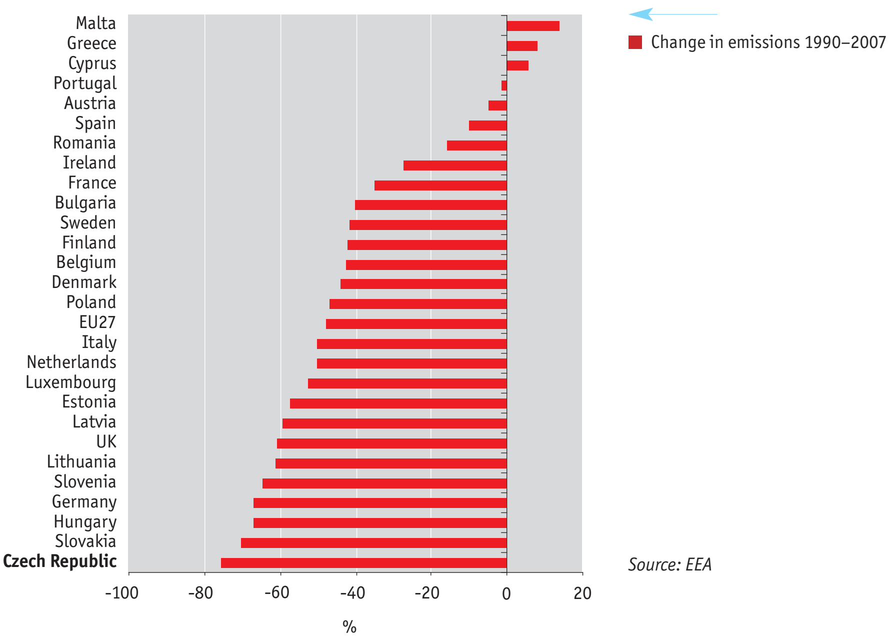
Chart 2 → **Emission sources of primary particles and secondary particulate matter precursors in the Czech Republic [%], 2009**



Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this publication.

Chart 3 → **Changes in the emission of primary particulate matter and secondary particulate matter precursors in 2007 compared to 1990 emission levels in selected European countries [%]**



Source: EEA

Primary PM_{10} are emitted directly from the source. Precursors of secondary particulate matter are pollutants from which these particles may form in the atmosphere (NO_x, SO_2 and NH_3).

Between 1990 and 2010, **the emissions of secondary particulate matter precursors**[2] (NO_x, SO_2 and NH_3) **decreased** by nearly 78%. Following a period of a moderate decline in emissions after 2000, more significant year-to-year declines in secondary particulate matter precursors were reported in 2008 and 2009, and the decreasing trend also continued in 2010. Between 2000 and 2010, the emissions of the different precursors dropped by 20% (from 431 to 347 kt per year weighted by the particulate matter formation potential). Compared to 2009, (359.8 kt per year weighted by the secondary particulate matter formation potential) the emissions of secondary particulate matter precursors decreased by 3.6% to 347 kt per year. This decline was largely attributable to NO_x emissions that showed a year-to-year decrease of 4.1% (reduced emissions from mobile sources). However, the emissions of primary PM_{10} increased by 4.5% year-to-year (from 35.4 kt per year in 2009 to 37.1 kt per year in 2010). This increase was mainly caused by the cold heating season (the coldest in the last 10 years) that affected the production of pollutants from both heat generation and local heating units. The emissions of secondary particulate matter precursors did not exceed the national emission ceilings for 2010 (Charts 1 and 3).

Based on 2009 data[3], the **main source of primary particulate matter emissions and secondary particulate matter precursors** (Chart 2) were the public energy sector (37.7%), transport (21.3%), services, households (including household heating), agriculture (15.5%) and manure processing (11.6%). While particulate matter precursor data are not yet available for the different sectors for 2010, we can expect that there was a year-to-year increase in emissions from household heating and industrial production. The trend in the transport sector is uncertain – the increase in road freight transport is likely to have caused an overall increase in primary particulate matter emissions from transport. By contrast, NO_x emissions are likely to have further declined.

The Thematic Strategy on Air Pollution (hereinafter referred to as the Strategy) notes that "air pollution and its effects on the health and quality of life of EU citizens are too significant for additional steps beyond those mandated by current legislation not to be taken". In connection with secondary particulate matter precursors, it proposes stricter national emission ceilings and requires greater integration of air protection policies into other sectoral policies. Compared to 2000, the strategy envisages the following emissions reductions for the European Union by 2020: SO_2 reduced by 82%, NO_x by 60% and NH_3 by 27%. In connection with primary particulate matter, the Thematic Strategy points to the risks of both PM_{10} and fine $PM_{2.5}$, which are more significant in terms of health.

A draft review directive is still under preparation. The review directive sets national emission ceilings for all secondary particulate matters precursors by (i.e. SO_2, NO_x and NH_3), as well as for VOCs. A new ceiling/percentage reduction for **$PM_{2.5}$** emissions will be redefined. The Strategy's implementation also envisages a review of the NECD directive. At the same time, the Gothenburg Protocol is being revised at the CLRTAP level and new national emission ceilings beginning in 2020 are expected to be laid down.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

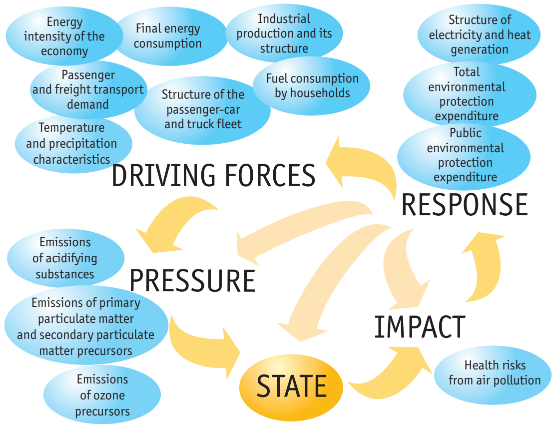
[2] All data presented in the charts and the text are based on emissions expressed as the particulate matter formation potential. The particulate matter formation potential factors are as follows for the below substances: PM_{10} = 1; NO_x = 0.88; SO_2 = 0.54 and NH_3 = 0.64. The value of the indicator 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.

[3] With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this publication.

06/ Exceedances of limit values for human health protection

KEY QUESTION →

Are limit values and target values that have been set for pollutants in order to protect human health being observed?



KEY MESSAGES →

In spite of the continuing drop in all emissions since 2000, concentrations of air pollutants remain the same. In 2010, higher concentrations of PM_{10}, $PM_{2.5}$ and benzo(a)pyrene were recorded in January, February, November and December, mainly due to poor dispersion conditions. Limit values for PM_{10} were exceeded at a greater number of measuring stations in 2010 than in 2009.

Limit values for NO_2 have been repeatedly exceeded in heavy-traffic areas.

Just like in 2009, a number of towns and municipalities exceeded limit values for benzo(a)pyrene (BaP). Limit values for benzene and limit values for arsenic were locally exceeded.

No exceedances of the limit values for lead, carbon monoxide and SO_2 or the target values for nickel and cadmium were recorded, as in previous years.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The main priority of Area 3 "Environment and the Quality of Life" of the **State Environmental Policy of the Czech Republic** is to improve air quality, which in turn alleviates health risks from polluted air and helps meet national and regional emission ceilings. The limit values that are defined by EU directives were fully transposed into Czech legislation through **Government Regulation No. 597/2006 Sb.**, that defines limit values (SO_2, PM_{10}, NO_2, Pb, CO and benzene) and target values (ground-level O_3, Cd, As, Ni and benzo(a)pyrene). National emission ceilings are laid down by Directive 2001/81/EC that is based – in part – on the relevant protocols to the **Convention on Long-range Transboundary Air Pollution (CLRTAP)**.

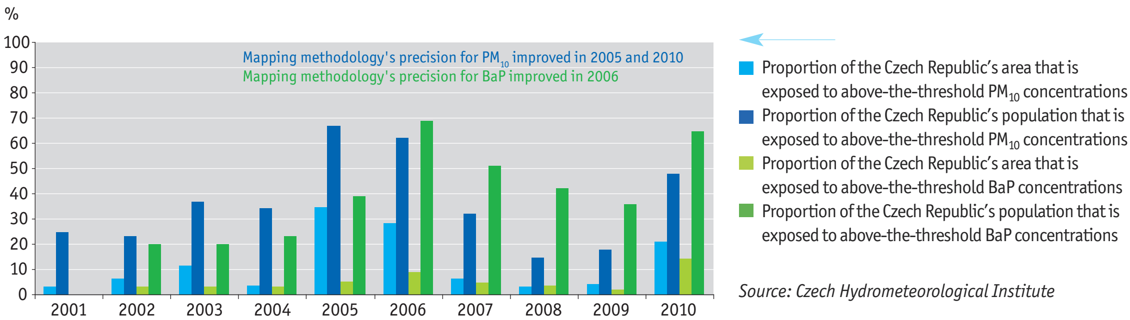
Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe sets new limit values (the limit values for local concentrations, target values, the exposure concentration obligation, national exposure reduction targets) for PM2.5. The directive has been transposed into Czech legislation, with the exception of the limit values for $PM_{2.5}$ that are expected to be transposed in early 2011.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Pollutants in the atmosphere adversely affect human health. In terms of health effects, the greatest risk is posed by the PM_{10} and $PM_{2.5}$ fractions of suspended particulate matter and polycyclic aromatic hydrocarbons (PAHs). The permissible concentrations for the above pollutants are often exceeded. Above-the-threshold concentrations of suspended particles increase the risk of respiratory disease, worsen the problems of persons suffering from asthma and allergies, increase infant mortality and have been proven to reduce life expectancy, mainly due to a higher mortality from heart and blood vessel disease. Together with other factors, they mainly affect the sensitive groups within the population. The effects of PAHs result from their toxic, mutagenic and carcinogenic properties. In addition to being classified as neuroendocrine disruptors, they affect birth weight and foetal growth and have immunosuppressive effects.

INDICATOR ASSESSMENT

Chart 1 → **Percentage of the Czech Republic's area and population exposed to overlimit 24 hour concentrations of PM_{10} and overlimit annual concentrations of BaP [%], 2001–2010**

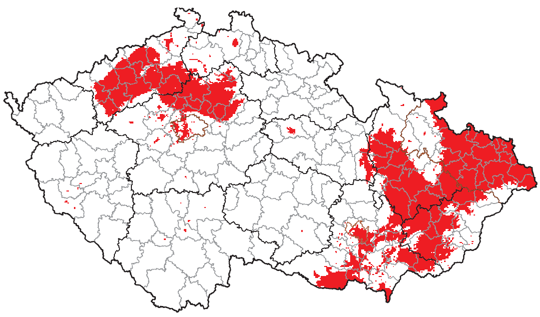


Source: Czech Hydrometeorological Institute

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 again redefined by applying the CAM_x 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 CAM_x models.

Between 2002 and 2007, the benzo(a)pyrene mapping methodology was gradually refined. In addition to increasing 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 target value for BaP was exceeded.

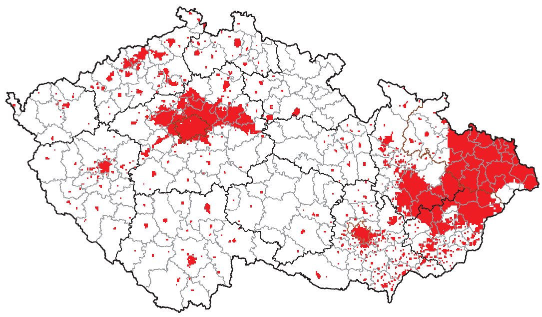
Figure 1 → **Map of the areas within the Czech Republic where health protection limit values were exceeded, 2010**



Areas with exceeded LV 21,21%
Regions
Municipalities with extended competence

Source: Czech Hydrometeorological Institute

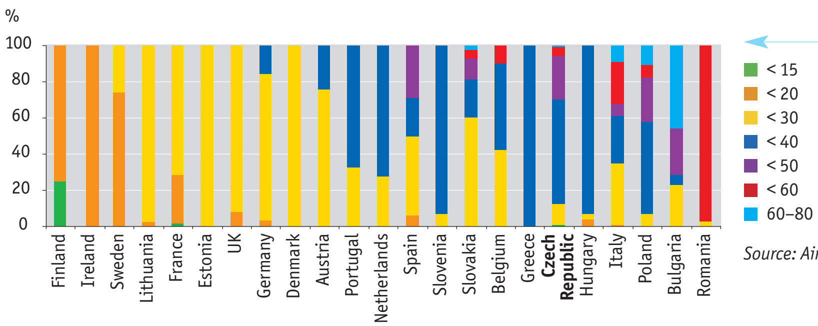
Figure 2 → **Map of the areas within the Czech Republic where health protection target values were exceeded (excluding ozone), 2010**



Areas with exceeded TV 14,47%
Regions
Municipalities with extended competence

Source: Czech Hydrometeorological Institute

Chart 2 → **Share of urban population [%] in selected states exposed to average annual concentrations of PM_{10} (concentration intervals [$\mu g.m^{-3}$]), 2006**



Source: AirBase, Eurostat

With respect to the data reporting methodology, the 2010 emission inventory data were not available as of the closing date of this publication.

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. At the beginning of the 21st century, air quality trends reflect fluctuations in air quality that have mainly been caused by the conditions for dispersing pollutants into the air. In 2010, higher concentrations of PM_{10}, $PM_{2.5}$ and benzo(a)pyrene were recorded in January, February, November and December, mainly due to poor dispersion conditions.
A major long-term problem with respect to air quality in the Czech Republic is caused by the **high concentration of PM_{10}**. The limit value for the permissible 24-hour concentration of PM_{10} was exceeded at 83 stations in 2010. The largest number of measuring stations where limit values were exceeded were in the Moravian-Silesian, the Central Bohemia, the Ústí nad Labem Regions and in Prague. In 2010, an increase in measured PM_{10} concentrations compared to the previous year was seen in most locations, namely because of the above weather and dispersion conditions and also so because of the coldest heating season in the last 10 years. In 2010, limit values for the 24-hour average concentration of PM_{10} was exceeded in 21.21% of the area; 48% of the Czech population was exposed to above-the-threshold concentrations (Chart 1). The limit for the annual average concentration was exceeded in 1.85% of the Czech Republic (in 2009, it was in 4.4% of the area and in 2008 in 0.44% of the area).
The limit value for annual concentrations of $PM_{2.5}$ was exceeded in 12 out of 38 locations in 2010 (in 2009, it was 10 out of 36). The highest average annual $PM_{2.5}$ concentrations were reported, similarly to PM_{10}, in the Ostrava-Karviná region. The limit values were exceeded in 7 locations there. The remaining locations with overlimit $PM_{2.5}$ values were found in the Brno agglomeration (3 locations) and in Přerov.
According to an EEA[1], the greatest exposure to PM_{10} is among the urban population in the Benelux countries, Poland, the Czech Republic, Hungary, Italy and Spain. The share of urban population in the Czech Republic exposed to overlimit concentrations is not negligible (Chart 2).
Ground-level ozone concentrations are influenced by weather in the warmer half of the year. Ground-level ozone concentrations decreased in 2010 compared to previous years. The target value was exceeded in 10.3% of the Czech Republic. Approximately 2.1% of the population was exposed to ground-level ozone concentrations exceeding limit values for human health protection in the period of question between 2008 and 2010. Compared to the previous three year period, the value of 120 $\mu g.m^{-3}$ was exceeded in almost 74% of the locations during the three year assessed period of 2008 to 2010. This decrease is probably related to slightly decreased maximum temperatures and global radiation values during the period of April to September 2010 compared to the period of April to September 2007.
Just like in 2010, a number of towns and municipalities exceeded limit values for **benzo(a)pyrene (BaP)**. This concerns 14.47% of the Czech Republic in which approximately 65% inhabitants live. Compared to 2009, there was a marked increase in the area in which the target value was exceeded and – above all – a sharp increase in the number of population affected. In 2009, this was 2.31% of the Czech Republic and 35.5% of the population. Benzo(a)pyrene concentrations continue to exceed the annual target value of 1 $ng.m^{-3}$ in a number of larger towns across the Czech Republic. However, it can be assumed that this limit value is also exceeded in smaller towns and municipalities. At many sites (especially in the Moravian-Silesian Region and in Kladno) the limit values were exceeded several times over in 2010. The highest annual average concentration was measured in Ostrava-Bartovice/Radvanice (7.2 $ng.m^{-3}$), similarly to previous years.
In 2010, based on maps of the spatial distribution of relevant air-quality characteristics, **areas with impaired air quality** (Figure 1) were identified in 21.21% of the Czech Republic (in 2009, this was 4.4%) and **areas where target values are exceeded** (Figure 2) for at least one pollutant apart from ozone (these include As, Cd, Ni and benzo(a)pyrene) were identified in 14.5% (in 2009, this was 2.3%).
In 2010, limit values were exceeded for PM_{10}, NO_2 (locations with heavy traffic) and benzene (in Ostrava). Target values were exceeded in BaP (see above) and As. The target value for As is repeatedly exceeded in Kladno. The remaining limit values (Cd, Ni, Pb) were not exceeded in 2010.
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. Alarming, however, is the fact that almost half of the Czech Republic's population (47% as of 31 December 2009) lives in even smaller settlements (up to 10 000 inhabitants). Increased to overlimit concentrations of pollutants were measured in smaller settlements. These are namely 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, among other things, by the burning of solid fuels, namely in local furnaces.
Air quality improvement and reducing impacts on human health and ecosystems are addressed by **the Thematic Air Quality Strategy**. At the national level, the issue of defining a specific cause of poor air quality and measures to improve it are addressed by the National Emissions Reduction Plan of the Czech Republic on which regional air quality improvement plans are based on.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

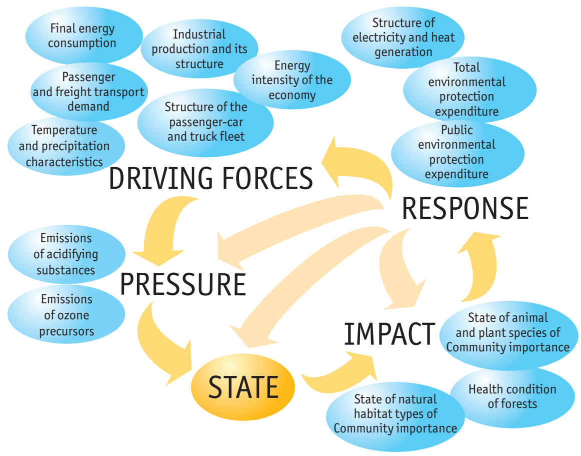
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1835)

[1] *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/ Exceedances of limit values for the protection of ecosystems and vegetation

KEY QUESTION

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



KEY MESSAGES

The target value for ground-level ozone – expressed as the AOT40 index (5-year average) has been regularly exceeded in more than 50% of rural and suburban measuring stations since 2003 that were chosen to determine this indicator. The year-to-year changes in the AOT40 index are affected by the amount of ozone precursor emissions and, more importantly, by meteorological parameters. The highest values measured between 2006 and 2010 were reached in 2006 (if individual years are assessed) when long-term high temperatures, high sunlight levels and low precipitation were measured.

Compared to the previous evaluation period of 2005–2009, the exposure index value decreased to 83% of rural and suburban areas in the 2006–2010 period. According to the 2010 evaluation, the ozone target value for the protection of vegetation was exceeded at 20 of 37 stations out (54%); in 2009 this was at 61% of the stations.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The target value – expressed as the AOT40[1] exposure index – and SO_2 and NO_x limit values for the protection of ecosystems and vegetation are set by **Government Regulation No. 597/2006 Coll., on air quality monitoring and assessment**.

Reducing the emissions of ground-level ozone precursors (NO_x, VOC) and the environmental impact of ozone is addresses by protocols to the Convention **on Long-range Transboundary Air Pollution (CLRTAP)** (in particular, the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone).

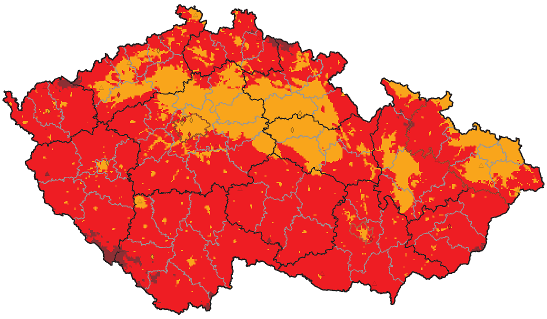
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Air pollution also adversely affects ecosystems and vegetation. The greatest risk is posed by ground-level ozone, which damages the green portions of plants and reduces the resistance of vegetation to external influences. Above-the-threshold concentrations of ozone reduce crop yields and affect the health of forests, while the disruption of forest ecosystems has a negative effect on runoff and biodiversity. The adverse effects of ozone on vegetation may be visible through damage and premature defoliation. Any direct impact on forest growth has not been definitively proven.

[1] The cumulative exposure to AOT40 ozone is calculated as the sum of the differences between the hourly ozone concentration and the threshold level of 80 μg.m^{-3} (= 40 ppb) for each hour in which this threshold value was exceeded. According to the requirements of Government Regulation 597/2006 Coll., AOT40 is calculated for a period of three months from May to July using ozone concentration measurements taken each day between 8:00 and 20:00 CET (= 7:00 to 19:00 UTC).

INDICATOR ASSESSMENT

Figure 1 → **Fields of the AOT40 index values, a five-year average in the Czech Republic [$\mu g.m^{-3}.h$], 2006–2010**

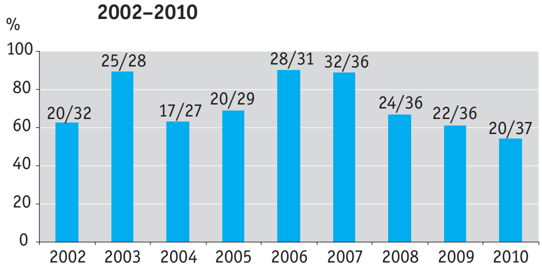


Clasification of stations
◊ Suburban background
△ Rural

AOT40
≤ 18 000 (≤ TV)
18 000–22 000
> 22 000

Source: Czech Hydrometeorological Institute

Chart 1 → **Percentage of stations at which the target value – expressed as AOT40 (5-year average) – for the protection of vegetation was exceeded [%], 2002–2010**

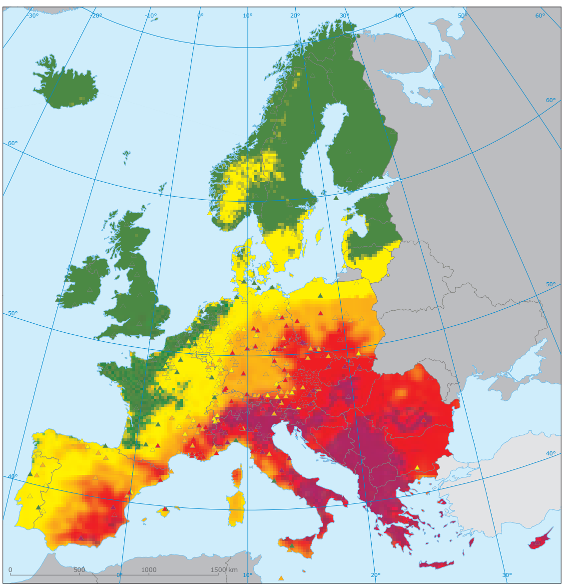


Percentage of stations at which the target value was exceeded

Source: Czech Hydrometeorological Institute

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

Figure 2 → **Map of the exposure index AOT40 values [$\mu g.m^{-3}.h$], 2007**



< 6 000
6 000–12 000
12 000–18 000
18 000–27 000
> 27 000
Non-mapped countries
Poor data coverage

Source: EEA

The calculation of the AOT40 index is based on ozone concentrations measured only in stations classified as rural stations and only for 2007 (May–July).

In 2010, the ozone **AOT40 target value** for the protection of ecosystems and vegetation (the relevant calculation was made according to legislation) was exceeded in most of the Czech Republic. However, in comparison with the previous 2005–2009 evaluation period, the areas with exceedances decreased significantly in Prague and in the Central Bohemia, Moravian-Silesian, Hradec Králové, Pardubice and Olomouc Regions (Figure 1).

Out of the total number of 37 rural and suburban stations, the ozone target value for the protection of vegetation (i.e. the average for 2006–2010) was exceeded at 20 station (54% of the total number of 37 measuring stations) according to the 2010 evaluation, in 2009, this was at 61% of the stations (Chart 1).

Year-to-year changes in the level of the AOT40 exposure index are affected by the volume 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.

Compared to the previous evaluation period of 2005–2009, the exposure index value decreased to 83% of rural and suburban areas in the 2006–2010 period. The highest values measured between 2006 and 2010 were reached in 2006 (if individual years are assessed) when long-term high temperatures, high sunlight levels and low precipitation were measured. Average monthly temperatures from April to September 2005 (not included in the five-year evaluation) were comparable to the same period in 2010. However, maximum temperatures and the values for the sum of the daily averages of GLRD values (global solar radiation) decreased in 2010 (compared to 2005) at about two-thirds of the sites that monitor those meteorological parameters. The local concentrations of precursors showed opposite trends – while NO_2 concentrations decreased in 2010 compared to 2005 to approximately 63% of the sites, the same percentage of the 30 substances categorised as VOC that are monitored at Košeráky and Libuš increased slightly in 2010 compared to 2005.

Taking into account the relatively complicated atmospheric chemical relationships, the termination of ozone, its dependence on both the absolute amount and relative presence of its precursors in air and on weather conditions, it is difficult to comment on the year-to-year changes.

In winter 2010, the SO_2 limit value for the protection of ecosystems and vegetation was only exceeded at one station out of 36. While the **SO_2 and NO_x** annual limit values for the protection of ecosystems and vegetation were not exceeded at any site that is classified as rural, the limit value for the winter average was exceeded in 2010/2011 for the first time since 2006, namely at the Komáří Vížka site and in the Ústí nad Labem Region (21.7 $ug.m^{-3}$).

As an **international comparison**, the highest AOT40 exposure index values are found in South and Southeast 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 2007, 36% of Europe's agricultural land was exposed to ozone concentrations exceeding the target limit. Compared to 2005 and 2006, when 49% and 70% of agricultural land was exposed to ozone concentrations exceeding the target value, there has been an improvement.

Environmental measures within the Thematic Strategy on air protection and the subsequent lowering of the national emission ceilings for ozone precursors for 2020 will also be beneficial in terms of reducing the size of the areas where damage to ecosystems due to air pollution may occur.

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/ Total water abstraction

KEY QUESTION

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

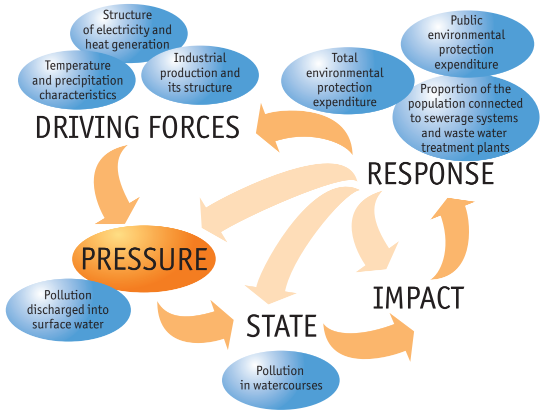
KEY MESSAGES

🙂 Since 2000, water abstraction for public water supply systems and industry has continued to decline, but at a slower rate than in the 1990s.

The proportion of the population connected to water supply systems have been increasing and 93% population of the Czech Republic is supplied with drinking water. The consumption of water from public water supply systems has been decreasing.

Between 2000 and 2010, drinking water losses in produced water intended for use decreased from 25.2% to 19.7%, or from 9.7 to 4.7 m^3 per km of the distribution systems per day.

😐 Since 2002, the declining trend in the development of total water abstraction has slowed down and recently it has showed fluctuation or stagnation. The sectors that have experienced a slight increase in water abstraction are mainly the energy sector and agriculture.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

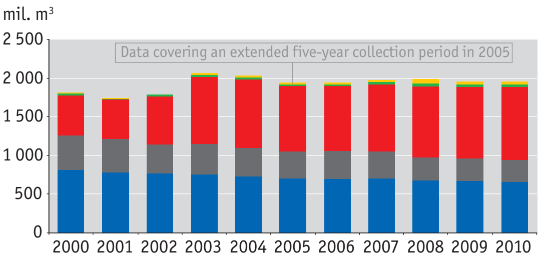
Pursuant to **Directive 2000/60/EC of the European Parliament and of the Council** establishing a framework for Community action in the field of water policy ("the Water Framework Directive"), the **State Environmental Policy of the Czech Republic** aims to allow for the sustainable use of water resources through reducing excessive water abstraction. Water abstraction needs to respect the requirements for water use and for the good condition and ecological limits of water bodies in order to prevent these resources and adjacent aquatic ecosystems from being damaged by overexploitation. Water abstraction can be further reduced through reducing water leakage from water supply systems, saving water and improving the technologies used. This is connected with requirements to decrease total water abstraction per capita and in particular water abstraction for public water supply systems. Speeding up the renewal of failing and obsolete water supply networks is one of the framework objectives for water management services within the **Plan of Major River Basins of the Czech Republic**. The mid-term strategy of state policy concerning water supply and sewerage systems before 2015 is presented in the **Plan of Water Supply and Sewerage Systems Development of the Czech Republic** that is linked to other strategic documents and departmental policy documents, while respecting the requirements of relevant European Union legislation. The number of opinions that are issued by the Ministry of Agriculture on proposed changes to the drinking water supply, sewerage services and waste water treatment increases every year for the Plans of Water Supply and Sewerage Systems Development of the Czech Republic's Regions.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

According to the 2010 Report on drinking water quality in the Czech Republic that was prepared by the National Institute of Public Health, 8.2 million inhabitants of the Czech Republic (84%) were supplied with drinking water from distribution networks in which no limit for the indicators that are limited by a maximum limit value pursuant to Decree No. 252/2004 Coll. were found to be exceeded in 2010. In terms of health risk, the nitrate and trichloromethane (chloroform) indicators appear to be the most problematic in public water supply systems.Based on data obtained as part of the national water quality monitoring movement between 2004 and 2010, it can be concluded that over that period the evaluated data showed no significant changes in the quality of drinking water that was distributed through public water supply systems, unlike the quality of drinking water from public and commercial wells. In the latter case, the limit values were relatively frequently found to be exceeded for the microbiological indicators of drinking water quality, as well as for the pH, manganese and iron indicators. In connection with climatic changes (more frequent and longer drought periods), water abstraction is expected to have a growing influence on water circulation in the landscape and on groundwater. A small amount of drinking water contains triazine pesticides that have neurodisruptive effects and a variety of hormones that – to a small extent – pass through waste water treatment plants and water treatment plants. However, previous studies have shown that the hormone concentrations that are found in drinking water in the Czech Republic do not pose any health risk.

INDICATOR ASSESSMENT

Chart 1 ➔ **Water abstraction by individual sectors in the Czech Republic [mil. m³], 2000–2010**

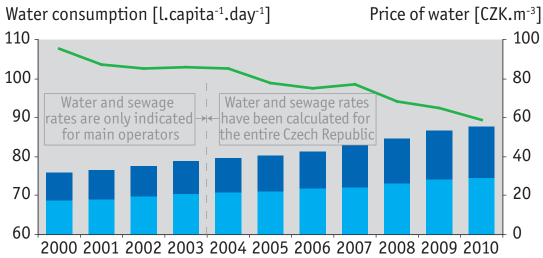


- Public water supply systems
- Industry (incl. abstraction)
- Energy sector
- Agriculture
- Other (incl. construction)

Source: 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 Decree of the Ministry of Agriculture No. 431/2001 Coll.

Chart 2 ➔ **Water consumption by households in the Czech Republic [l.capita⁻¹.day⁻¹] and the price of water [CZK.m⁻³], 2000–2010**

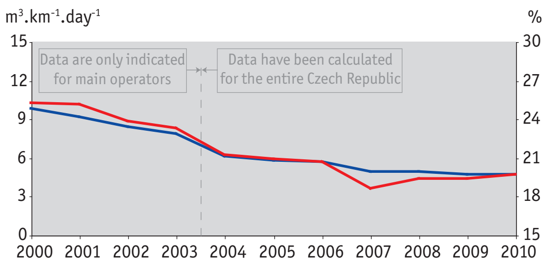


- Water consumption per capita per day (left axis)
- Average sewage rate (right axis)
- Average water rate (right axis)

Source: Czech Statistical Office

Water consumption per capita per day indicates the amount of invoiced water per one inhabitant that is supplied with water from a public water supply system per one day. Up until 2003 (incl.), water and sewage rates are only indicated for main operators, since 2004 the figures have been calculated for the entire Czech Republic. Water and sewage rates are shown exclusive of VAT.

Chart 3 ➔ **Water losses in distribution systems in the Czech Republic [m³.km⁻¹.day⁻¹, %], 2000–2010**

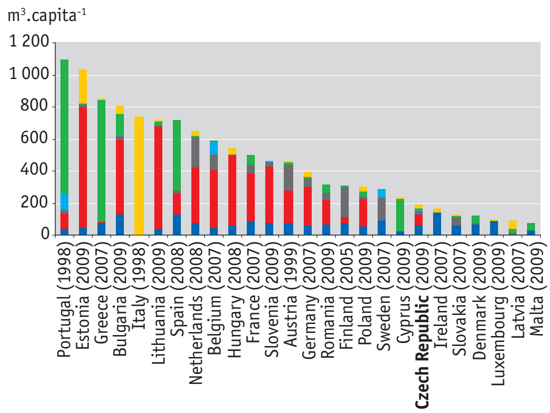


- Drinking water losses per 1 km of the distribution systems per day (left axis)
- Proportion of drinking water losses in produced water intended for use (right axis)

Source: Czech Statistical Office

Up until 2003 (incl.), data are only indicated for main operators, since 2004 the figures have been calculated for the entire Czech Republic.

Chart 4 ➔ **International comparison of water abstraction [m³.capita⁻¹]**



- Public water supply systems
- Cooling in electricity generation and distribution
- Processing industry
- Cooling in the processing industry
- Agriculture
- Unspecified

Source: Eurostat

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

Out of the total abstraction, 19.4% comes from groundwater sources that are of a better quality and require less treatment. On the other hand, groundwater is a more precious water source as the return time for groundwater is longer than in surface water. By abstraction, we are contributing to the decreasing of groundwater sources which is also evident in relation to changes in the intensity and seasonality of precipitation and a low infiltration into soil.

The marked long-term reduction in total water abstraction, which occurred in the context of declining industrial production due to the restructuring of the national economy and a reduced demand for water due to technological changes in the period after 1990, peaked at the end of the 1990s. With the start of the next decade, the decline was replaced by fluctuating or stagnant trend of development (Chart 1). Individual sectors account for differing proportions of water abstraction (1 951 million m^3 in 2010). Most water is abstracted for the energy sector (48.3%), followed by public water supply (34.0%) and industry (14.5%). Water abstraction in agriculture is traditionally low (1.9%).

Throughout the 1990s, the decrease in **water abstraction for the energy sector** was mainly influenced by reduced production and the shutdown of some thermal power plants. The sharp increase in 2002 and 2003, which also significantly affected total water abstraction, was largely caused by the start of the Temelín nuclear power plant's operation and the resumption of abstraction for once-through cooling at the Mělník power plant. While water abstraction for the energy sector more or less stagnated in the subsequent period, it has been slightly growing almost every year since 2006, which corresponds to the increased production of electricity by steam and nuclear power plants. However, most of that abstraction is only used for once-through cooling of steam turbines, with the quality of the discharged cooling water remaining unchanged (a higher temperature, a lower oxygen content). Water abstraction for **agriculture** is influenced in particular by irrigation, the fluctuation in water abstraction is mainly due to the variability in rainfall and the temperature conditions during the vegetation period. Between 2005 and 2009, there were slight annual increases in water abstraction for agriculture. As of 2010, it slightly declined. The category entitled '**other**', which also includes **construction**, has been showing a long-term trend of moderate growth or stagnation, with the exception of 2008. With regards to **water abstraction for public and industrial water supply systems**, it can be concluded that the trend of declining water abstraction continued after 2000 – in the case of public abstraction, this was due to reduced drinking water consumption and reduced losses in distribution systems. In the case of industry, this was mainly due to the use of new technologies. However, the decline is more gradual than in the 1990s, especially the early 1990s. The year to year (2009/2010) decrease in water abstraction for industry was 2,9% and for public use both from ground- and surface water sources by 1.4%. The development in water abstraction for public water supply systems is connected with the decreasing amount of **water that is produced for public use**.

In 2010, the actual amount of invoiced water was 493 million m^3, of which 65.0% was supplied to households; the rest of it was used by industry, agriculture and other consumers. Despite the decrease in supplied water, the **number of supplied inhabitants** has been growing consistently over the long-term. In 2010, a total of 9.8 million inhabitants were supplied with drinking water, representing 93.1% of the Czech Republic's population. The decline in the amount of produced water is mainly due to reduced drinking water losses in distribution systems (Chart 3) and lower water consumption by households (Chart 2). Between 2000 and 2010, drinking water losses in proportion to produced water decreased from 25.2% to 19.7%, or from 9.7 to 4.7 m^3 per km per day. Since 2004, there has been a slight decrease in **drinking water losses**. From 2000 to 2010, **water consumption by households** (Chart 2) decreased from 107.6 to 89.5 litres per capita per day. With respect to increasing **water rates** (Chart 2), the linear growth from recent years was continued with a year-to-year increase of 3.6%, i.e. the lowest figure for the past five years.

Compared to other European countries (Chart 4), the Czech Republic's total water abstraction per capita is below average, totalling 186 m^3 per capita per year. The situation is particularly problematic in southern European countries, i.e. not only due to extreme abstraction levels totalling as much as 700–1 100 m^3 per capita per year, but also due to a lack of water resources. In these areas, a large proportion of water is used for irrigation.

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/ Pollution discharged into surface water

KEY QUESTION

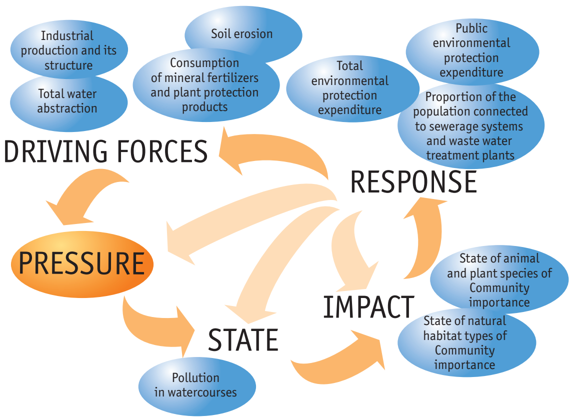
Have we succeeded in reducing the amount of pollution that is discharged by point sources and that pollutes surface water?

KEY MESSAGES

Between 1993 and 2010, there was a significant decrease in pollution discharged by point sources in the Czech Republic. Weighed by basic indicators, it was by 93% in BOD_5, by 86% in COD_{Cr} and by 89% in undissolved substances. The most significant decrease in the amount of discharged pollution occurred in the 1990s, mainly due to the restructuring of the national economy and also due to the extensive construction and modernization of waste water treatment plants. The trend in discharged pollution since 2003 has been gradually positive.

As far as discharged nutrients, there has also been a gradual decrease since 2003.

The positive declining trend in discharged pollution came to a halt in 2010. Compared to 2009, the amount of discharged pollution slightly increased year-to-year in all monitored indicators: BOD_5 increased by 0.5%, COD_{Cr} by 3.8%, undissolved substances by 4.7%, $N_{inorg.}$ by 7.6% and P_{total} by 10.4%.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Reducing the amount of pollution discharged into surface water is the principal means for improving water quality. The requirements under **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") include setting emission limits for individual pollution indicators. Emphasis is also placed on minimizing the entry of nutrients and hazardous substances into the aquatic environment. Pollution reduction and the prevention of further pollution with nitrates from agricultural sources are addressed by **Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources** („the Nitrates Directive"). A system of measures that are obligatory in vulnerable areas for four years starting on 4 April 2008 is presented in the Second Action Plan adopted pursuant to Article 5 of the Nitrates Directive through Government Regulation No. 108/2008 Coll.

Likewise, **national strategic documents**, mainly the **State Environmental Policy of the Czech Republic**, highlight the need to reduce the entry of pollutants into water, mainly through promoting the construction and modernisation of waste water treatment plants in accordance with the requirements of Council Directive 91/271/EEC concerning urban waste-water treatment. Among other things, the **Plan of Major River Basins of the Czech Republic** stresses the need to introduce best available techniques into production processes and best available technologies into waste water disposal. Specific objectives and programmes of measures to improve the quality of surface water and groundwater are laid down by the River Basins Plans that were approved in December 2009. At the beginning of 2010, the Ministry of the Environment used the River Basins Plans to draw up plans for the Czech Republic's portion or the international river basins of the Elbe, the Oder and the Danube Rivers. At the same time, the implementation period started for the adopted programs of measures. The national River Basin Plans will be updated by 2015 and subsequently at six-year intervals.

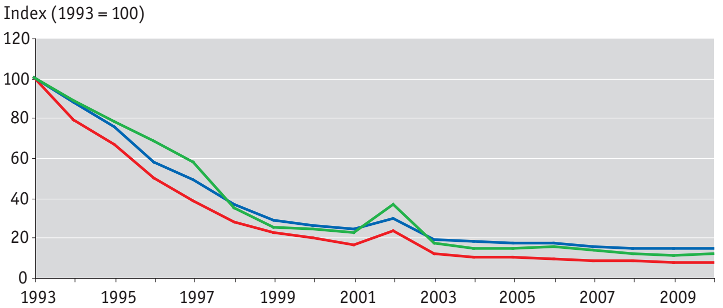
In 2010, three years of work on a major amendment to the **Water Act** were concluded and the amended act was adopted through Act No. 150/2010 Coll. that came into effect on 1 August 2010. Indicators and values for the permissible pollution of waste water from point sources were newly set by **Government Regulation No. 416/2010 Coll., on the indicators and values for the permissible level of waste water pollution and on the requirements for permission to discharge waste water into groundwater**. The regulation also includes the categories of certified products that are intended for treating waste water and from which waste water can be discharged into groundwater, provided that it cannot be discharged into surface water or a public sewerage system.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The amount of discharged pollution directly and mainly affects the quality of the receiving surface water. The amount of discharged nutrients (especially phosphorus) contributes, along with diffuse sources, to the eutrophication of rivers and reservoirs. The resulting water pollution affects the biodiversity of aquatic and water-bound species of animals and plants, the supply of drinking water from surface sources and may even cause direct health risks in natural bathing waters.

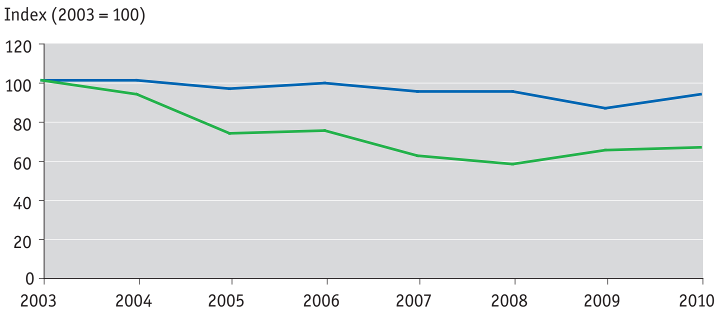
INDICATOR ASSESSMENT

Chart 1 ➜ **Discharged pollution in relative terms – the BOD_5, COD_{Cr} and undissolved substances indicators in the Czech Republic [index, 1993 = 100], 1993–2010**



Source: T. G. Masaryk Water Research Institute

Chart 2 ➜ **Discharged pollution in relative terms – the $N_{inorg.}$ and P_{total} indicators in the Czech Republic [index, 2003 = 100], 2003–2010**



Source: T. G. Masaryk Water Research Institute

The trend of the amount of pollution discharged by point sources that has the greatest impact on the quality of surface water is assessed using five basic indicators and it expresses the discharged amount of a given pollutant. Organic pollution is expressed through the BOD_5, COD_{Cr} and undissolved substances indicators; nutrients are represented by $N_{inorg.}$ and $_{Ptotal}$.

Between 1993 and 2010, the total level of **pollution discharged by point sources** decreased in the **BOD_5** indicator by 92.9% to 7 233 t in 2010, **COD_{Cr}** by 85.7% to 46 028 t in 2010 and **undissolved substances** by 88.6% to 14 054 t in 2010 (Chart 1). While in the first half of the 1990s the decline in the amount of pollution in waste water that was discharged into watercourses was mainly due to reduced production, the effects of extensive construction and technological modernisation of waste water treatment plants have been increasingly felt ever since the mid 1990s. Since 2003 (2002 was affected by catastrophic floods), the trend has only been moderately positive, which is related to the construction and completion of waste water treatment plants in smaller towns and municipalities. The last year-to-year change (2009/2010) even showed a slight increase in the above indicators of discharged pollution, namely BOD_5 increased by 39 t (0.5%), COD_{Cr} by 1 685 t (3.8%) and undissolved substances by 634 t (4.7%). This reflected both the effects of the increase in produced pollution (BOD_5 by 1.8% and COD_{Cr} by 1.3%), and the abundant rainfall in 2010, which increased the volume of treated rainwater by 31.4% compared to 2009. In addition, the amount of treated sanitary waste water (due to the connection of new waste water treatment plants) and the volume of discharged industrial waste water increased slightly. Large pollution sources already have newly-built or modernized waste water treatment plants. Almost all the data that were reported by the different Povodí state enterprises showed an increase in the amount of discharged pollution. The BOD_5 indicator in the river basin of the Ohře and the Morava and the COD_{Cr} indicator in the river basin of the Morava were the only indicators that showed a decrease. Also, there was a partial decrease in the undissolved substances indicator in the river basin of the Ohře and the Elbe Rivers.

A major problem for water receiving bodies is the discharge of nutrients – **nitrogen and phosphorus** that cause water eutrophication. In the 1990s, nutrients also saw a significant reduction in the **amount of pollution discharged by point sources**. The reduction was mainly attributable to the fact that both biological nitrogen removal and biological and chemical phosphorus removal are specifically applied in waste water treatment technology within new and intensified waste water treatment plants. Since 2003, there has been a gradual decrease in the amount of discharged nutrients (Chart 2). In 2010, the amount of discharged pollution was 13 816 t for $N_{inorg.}$ and 1 201 t for P_{total}. Compared to 2009, despite a reduction in the amount of produced pollution (11.4% for the $N_{inorg.}$ indicator and 5.6% for P_{total}), the amount of discharged pollution increased by 979 t for the $N_{inorg.}$ indicator (7.6%) and by 45 t for the P_{total} indicator (3.9%). As before, this probably reflected the increased amount of discharged waste water.

Significant pollution sources, particularly with regards to nitrates, pesticides and phosphorus, also include **diffuse sources** – farming and sheet erosion in the landscape and atmospheric deposition. The amount of these substances that gets into water is also affected by the dosing of nitrogen fertilizers and the application of substances used for plant protection in agricultural production, as well as the conditions for the erosion of agricultural land.

Only a gradual reduction or stagnation in pollution discharged by point sources can be expected **in the future**. This is because major pollution sources (industrial enterprises) and 77% of the Czech Republic's population has been connected to waste water treatment plants. The only issue that remains to be addressed is the conducting and treating of waste water in smaller municipalities where, compared to the population living in major towns, connection to a sewerage system with a waste water treatment plant is more demanding in terms of time and funds because of scattered housing development. Due to the requirement for tertiary treatment in the construction of new waste water treatment plants and in the modernization of existing waste water treatment plants, a continued reduction in discharged nutrients can be expected. In addition, the modernization and intensification of the Central Waste Water Treatment Plant in Prague (scheduled for 2015 to 2016) is expected to help significantly reduce the amount of discharged pollution, especially nitrogen.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

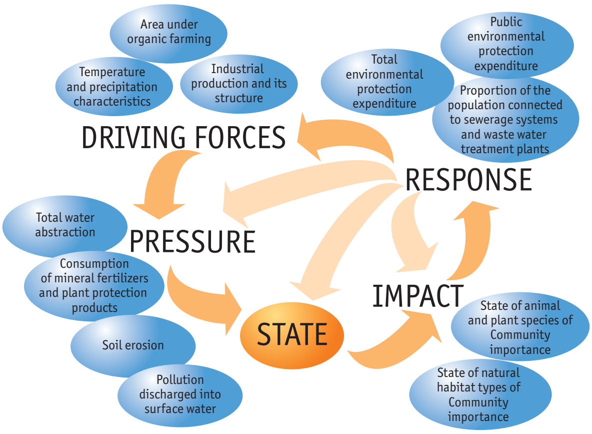
CENIA, key environmental indicators

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

10/ Pollution in watercourses

KEY QUESTION

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



KEY MESSAGES

The evaluation of water quality using the basic indicators according to CSN 75 7221 reveals that the gradual improvement in the water quality of watercourses is continuing. Most evaluated portions of watercourses are classified as water quality class I to III.

For all of the monitored pollution indicators (BOD_5, COD_{Cr}, N-NO_3^-, P_{total}, cadmium, adsorbable organohalogens (AOX), thermotolerant coliform bacteria (FCOLI) and chlorophyll) the average annual concentrations decreased in the watercourses within the Elbe River basin between 1993 and 2010.

Compared to the preceding decade, the average concentrations for most of the above indicators only showed a moderate decline or stagnation in the last ten years.

While the proportion of profiles within the Elbe River basin at which environmental quality standards are exceeded has been steadily declining (with the exception of AOX), environmental quality standards continue to be exceeded at 47% of profiles for AOX and at up to 15% of profiles for the N-NO_3^-, BOD_5, COD_{Cr} and P_{total} indicators.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The basic requirements for improving water quality are based on **Water framework Directive 2000/60/EC** establishing a framework for the Community action in the field of water policy. One of the main objectives is to achieve a „good status" of surface water bodies. Specific objectives and programmes of measures to improve water quality are laid down by the **River Basins Plans** that were approved in December 2009. At the beginning of 2010, the Ministry of the Environment used the River Basins Plans to draw up plans for the Czech Republic's portion of the international river basins of the Elbe, the Oder and the Danube Rivers. At the same time, the implementation period started for the adopted programs of measures. In 2010, three years of work on a major **amendment to the Water Act** were concluded and the amended act was adopted through Act No. 150/2010 Coll. that came into effect on 1 August 2010. Notable major changes include a new approach to water planning (the 8 river-basin areas that are currently used will be replaced with plans for 10 sub-basins) and support for revitalizing watercourses.

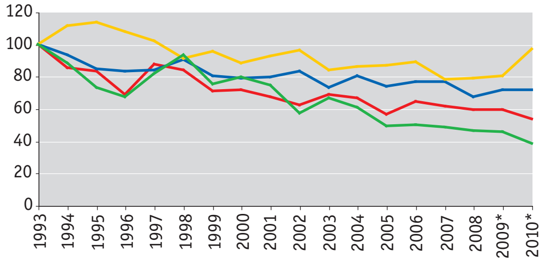
An important instrument for water protection from priority hazardous substances is new **Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy**. The standards have to be achieved by the end of 2015.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Water quality affects the biodiversity of aquatic and water-bound species of animals and plants as well as the adjacent ecosystems (e.g. river floodplains) and the degree of treatment required for drinking water from surface sources. Excessive amounts of nutrients (especially phosphorus) contribute to the eutrophication of water (especially in reservoirs). If inadequately treated, such water in turn poses a health risk when ingested, and using such surface water for bathing is also risky. In the Czech Republic, the main health risks that are associated with the quality of natural bathing waters include contracting infectious diseases and exposure to substances produced by cyanobacteria that cause diarrhoea and skin rashes. In summer, cyanobacteria often prevent water bodies from being used for recreation. Water is tested by regional hygiene stations and the test results are made publicly available.

INDICATOR ASSESSMENT

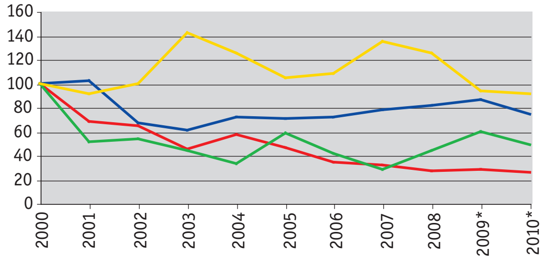
Chart 1 ➜ **Trends in the concentrations of the pollution indicators of watercourses within the Elbe River basin [index, 1993 = 100], 1993–2010**



- BOD_5
- COD_{Cr}
- $N\text{-}NO_3^-$
- P_{total}

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

Chart 2 ➜ **Trends in the concentrations of the pollution indicators of watercourses within the Elbe River basin [index, 2000 = 100], 2000–2010**



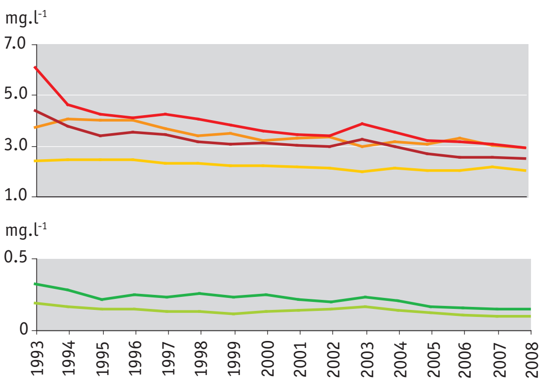
- AOX
- Cd
- FKOLI
- Chlorophyll

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

The indices for individual indicators against the selected base year, provided in Charts 1 and 2, were calculated with arithmetic means for each year using annual average values for individual profiles within the Eurowaternet network in the Labe river basin (16 to 26 stations depending on data availability).

** The figures for 2009 and 2010 in Charts 1 and 2 reflect the smaller number of profiles for which data were available.*

Chart 3 ➜ **Comparison of the average values of pollution indicator concentrations in watercourses in the Czech Republic and in Eastern Europe [mg.l^{-1}], 1993–2008**



- $N\text{-}NO_3^-$ (Eastern Europe)
- $N\text{-}NO_3^-$ (CZ)
- BOD_5 (Eastern Europe)
- BOD_5 (CZ)
- Orthophosphates (Eastern Europe)
- P_{total} (CZ)

Source: EEA, Czech Hydrometeorological Institute

The average for Eastern Europe is expressed as the average annual concentration of the profiles within the Eurowaternet network in the following countries (weighted by the number of profiles in each country): Czech Republic, Slovakia, Estonia, Lithuania, Latvia, Hungary, Slovenia, Poland (only N-NO$_3^-$).

Figure 1 ➜ **Water quality in the watercourses in the Czech Republic, 2009–2010**

Source: T. G. Masaryk Water Research Institute, based on data provided by Povodí

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

The overall assessment of the following indicators: BOD_5, COD_{Cr}, $N\text{-}NH_4^+$, $N\text{-}NO_3^-$, P_{total} and the saprobic index of macrozoobenthos.

When assessing water quality based on CSN 75 7221 (Figure 1), the water quality improved rather than worsened in more sections of watercourses (in all cases by one class) between 2009–2010, as compared to 2008–2009, based on a comparison of maps. Water quality deteriorated in the lower and middle course of the Jizera River and in the Želivka and the Olše Rivers. Despite the gradual improvement in water quality, there are still several portions of watercourses that are classified as Class V (i.e. the worst class) according to the basic classification of indicators that were monitored in 1991. However, most of the evaluated portions of watercourses are classified within water quality classes I through III.

Within the indicator, water quality trends are only evaluated for **watercourses within the Elbe River basin** using the concentrations of eight selected basic indicators of pollution. Organic pollution is expressed using the BOD_5 and COD_{Cr} indicators, nutrients are represented by $N\text{-}NO_3^-$ and P_{total}. Chlorophyll was selected as a biological indicator and cadmium as a heavy metal indicator. The general indicators include adsorbable organohalogens (AOX). Microbiological indicators are represented by thermotolerant (faecal) coliform bacteria (FCOLI).

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 the limit values for **organic pollutants and total phosphorus** in the Labe river basin (Charts 1 and : BOD_5, COD_{Cr}, P_{total}). In 2010, the average concentrations calculated for indicators that were measured at profiles within the Eurowaternet network in the Labe river basin equalled 2.6 $mg.l^{-1}$ for BOD_5, 19.4 $mg.l^{-1}$ for COD_{Cr} and 0.09 $mg.l^{-1}$ for $P_{total.}$ The improvement of water quality was significantly affected by the restructuring of industry and industrial technologies, especially in the first half of the 1990s. Subsequently, the construction and the modernization of sewerage systems and both industrial and municipal waste water treatment plants helped to improve water quality. Regarding nutrient removal from waste water, the addition of tertiary treatment is applied. The decline in phosphorus inputs was further supported by restrictions concerning the use of phosphates in laundry detergents beginning from October 2006. Over the past two years, the use of phosphate fertilizers in agriculture has decreased rather significantly. **Nitrate** concentrations (Chart 1: $N\text{-}NO_3^-$) showed a fluctuating trend – 3.55 $mg.l^{-1}$ in the Elbe River basin in 2010. There has been little success in reducing nitrate concentrations, largely due to diffuse pollution, even though the application of nitrogenous agricultural fertilizers has decreased over the past two years. The stagnation and the 2010 increase in nitrogen discharges by point pollution sources also played a role. Environmental quality standards, expressed as annual average values according to Government Regulation No. 61/2003 Coll., as amended by Government Regulations Nos. 229/2007 Coll. and 23/2011 Coll. for the above indicators, were not exceeded at more than 15% of the profiles within the Elbe River basin in 2010.

Since 2000, a marked positive trend has been seen with **cadmium** (Chart 2), which is classified as a hazardous substance. The environmental quality standard of 0.3 $\mu g.l^{-1}$ for Cd was not exceeded at any monitored profile within the Elbe River basin in 2010. In 2010, the average Cd concentration was 0.05 $mg.l^{-1}$. While the average **AOX** concentration in the Elbe River basin has basically stagnated since 2002 (26.9 $mg.l^{-1}$ in 2010), the proportion of profiles at which the environmental quality standard for AOX (25 $\mu g.l^{-1}$) was exceeded has increased from 26% to 47%. The concentrations of **FCOLI** and **chlorophyll** are rather volatile and their current levels in the Elbe River basin are basically at the 2002 level.

If we **compare the average concentrations** of the nitrates, the BOD_5 and the total phosphorus indicators from Eurowaternet stations in the Czech Republic and in Eastern European countries (one of which is the Czech Republic), the average concentrations of the above indicators are slightly higher in the Czech Republic (Chart 3). However, average concentrations are also influenced by the specific conditions of watercourses, especially their discharge. The declining trend is comparable. Generally, the best quality water is found in Northern Europe. Concentrations in the Czech Republic are similar to average concentrations in Western European countries.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

11/ Proportion of the population connected to sewerage systems and waste water treatment plants

KEY QUESTION

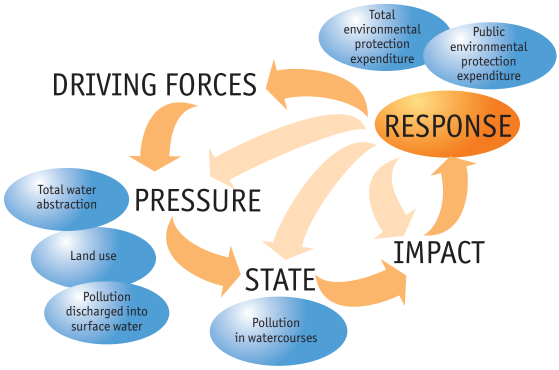
How much of the Czech Republic's population is connected to sewerage systems and waste water treatment plants?

KEY MESSAGES

Development in the area of waste water management is documented by extensions to public sewerage systems (between 2000 and 2010 by 89%) which means the proportion of the population connected to sewerage systems increased from 75 to 82%, the number of waste water treatment plants grew (it has doubled since 2000) and consequently the proportion of the population connected to sewerage systems ending in waste water treatment plants grew (from 70 to 77% between 2000 and 2010).

Recently, attention has focused on the development of waste water treatment plants and sewerage systems in municipalities of 2 000 to 10 000 population equivalent. In the category of greater than 2 000 population equivalent, 15 new municipal waste water treatment plants were completed and 24 were either modernized or extended in 2010.

In terms of meeting the requirements of Council Directive 91/271/EEC concerning urban waste-water treatment, the key problem is the modernization of the Central Waste Water Treatment Plant in Prague that is currently scheduled to be completed sometime in 2015 or 2016. By the end of 2010, an additional 8 agglomerations had neither secured financing nor completed investment preparation.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Requirements for waste water treatment that follow from **Council Directive 91/271/EEC concerning urban waste-water treatment** and their fulfilment are important objectives set by the **State Environmental Policy of the Czech Republic**. The requirements included constructing missing water management infrastructure (particularly waste water treatment plants and sewerage systems), modernizing and improving the technology of waste water treatment in all agglomerations with a greater than 2 000 population equivalent (p.e.) within a transition period, i.e. by the end of 2010. For 54 selected agglomerations with a greater than 10 000 p.e., waste water treatment had to be ensured by the end of 2006. Furthermore, according to the State Environmental Policy of the Czech Republic, the desirable trend includes increasing the proportion of the population connected to public sewerage systems and increasing the proportion of the population connected to sewerage systems ending in waste water treatment plants. The mid-term strategy of state policy concerning water supply and sewerage systems prior to 2015 is presented in the **Plan of Water Supply and Sewerage Systems Development of the Czech Republic** that is linked to other strategic documents and departmental policy documents, while respecting the requirements of relevant European Union legislation. The number of opinions that are issued by the Ministry of Agriculture on proposed changes to the drinking water supply, sewerage services and waste water treatment increases every year for the Plans of Water Supply and Sewerage Systems Development of the Czech Republic's Regions.

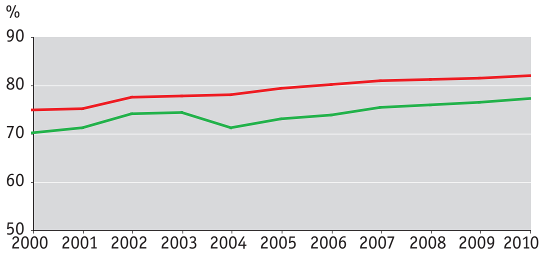
In 2010, a major **amendment to the Water Act** (implemented through Act No. 150/2010 Coll.) brought about some significant changes, including the approach to rainwater and the regulation of waste water and its relationship to rainwater, the introduction of a product-based approach for waste water treatment plants up to a capacity of 50 p.e., the regulation of changes to waste water management permits and the simplification of the water rights procedure.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The availability of sewerage services to residents ensures that sewage is collected safely, thus significantly reducing the risk of infection. The treatment stage that is used for waste water collected via sewerage systems affects the quantity and the nature of discharged pollutants and, by extension, the quality of the receiving water bodies (e.g. the tertiary treatment reduces the amount of discharged phosphorus and nitrogen, thus helping reduce the impact on water eutrophication). As a result, waste water treatment plants affect the use of water for drinking water supply and the quality of natural bathing waters.

INDICATOR ASSESSMENT

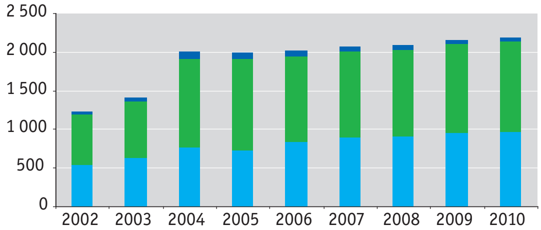
Chart 1 → **Proportion of the population connected to sewerage systems and to sewerage systems ending in waste water treatment plants in the Czech Republic [%], 2000–2010**



Proportion of the population connected to the sewerage systems
Proportion of the population connected to sewerage systems with waste water treatment plants

Source: Czech Statistical Office

Chart 2 → **Number of waste water treatment plants according to treatment stages in the Czech Republic, 2002–2010**

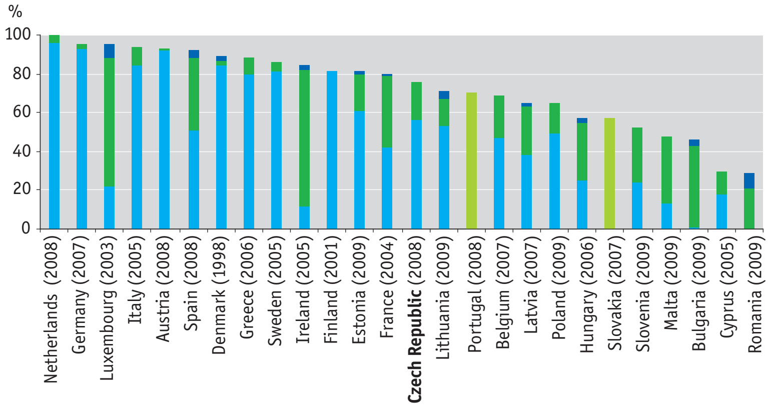


Primary treatment
Secondary treatment
Tertiary treatment

Source: Czech Statistical Office

Primary treatment = mechanical waste water treatment plants; secondary treatment = mechanical-biological waste water treatment plants without nitrogen or phosphorus removal; tertiary treatment = mechanical-biological waste water treatment plants with further nitrogen or phosphorus removal.

Chart 3 → **International comparison of the proportion of the population connected to waste water treatment plants according to treatment stages [%]**



Primary treatment
Secondary treatment
Tertiary treatment
Treatment stage unspecified

Source: Eurostat

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

Waste water treatment reduces the amount of discharged pollution and is therefore an essential tool for improving surface water quality. Since 2000, the length of sewerage systems in the Czech Republic has almost doubled, thus increasing the proportion of the population connected to public sewerage systems from 74.8 to 81.9% in 2010 (Chart 1). By year-to-year comparison (2009/2010), sewerage systems were extended by 1 135 km to 40 902 km and the population connected to sewerage systems consequently increased by 1.0% to 8.6 million people in 2010. The extension of sewerage systems is more extensive than the increase in the connected population because both waste water treatment plants and sewerage systems have mostly already been built in larger cities and it is now necessary to gradually cover smaller municipalities in which the concentration of the population is lower. Even today, not all waste water that is discharged into sewerage systems is treated. Over the monitored period since 2000, the proportion of waste water that is discharged into sewerage systems and that is treated has stagnated at 94–96%. According to data from the Czech Statistical Office, 96.2% of the 490 million m^3 of waste water discharged into sewerage systems was treated in 2010 (in 1990, the proportion was only 75%).

Compared to 2009, the **total number of waste water treatment plants** in the Czech Republic increased by 30 to 2 188 waste water treatment plants, excluding domestic waste water treatment plants (Chart 2). Due to the construction and the modernization of waste water treatment plants, the number of waste water treatment plants with nitrogen or phosphorus removal increased by 11, the number of waste water treatment plants with basic mechanical-biological treatment by 20, while the number of only mechanical treatment plants decreased by 1. If we examine **waste water treatment plants with a capacity greater than a population equivalent of 2 000**, 15 new municipal waste water treatment plant were completed in 2010. If we look at waste water treatment plants with a capacity greater than 2 000 p.e., 24 municipal waste water treatment plants were either modernized or extended.

The transitional period for meeting the requirements of Council Directive 91/271/EEC concerning urban waste water treatment expired on 31 December 2010. At the end of January 2010, 395 out of 633 agglomerations with a population equivalent greater than 2 000 had met the requirements under current national legislation, while for an additional 200 agglomerations, project implementation was either under way or was scheduled to start in 2010. Since the end 2010, a total of 29 agglomerations have not completed adequate investment preparation for project implementation. A total of 8 agglomerations have neither secured financing nor completed investment preparation – the key problem is the modernization of the Central Waste Water Treatment Plant in Prague (approximately 14% of the total load for municipalities with a population equivalent greater than 2 000) that is scheduled to be completed sometime in 2015 or 2016. An overview of compliance indicates a real possibility of a penalty being imposed on the Czech Republic by the European Court of Justice unless all necessary projects are started in 2011 and completed in the shortest possible time (by the time the decision is issued by the European Court of Justice, which is expected in 2013). At the same time, all 633 agglomerations will be verified using actual data on discharged pollution and their population equivalent will be verified as well in order to allow for comparing actual data with the limits laid down by the directive that – in some cases – are less stringent than the requirements of water rights permits issued under national legislation.

The Czech Republic has a very high average **waste water treatment plants efficiency** (i.e. the ratio between the amount of pollution at the inflow and at the outflow) for BOD_5 and undissolved substances – with up to 97% of all pollution being removed. The efficiency for COD_{Cr} is about 94%, for total phosphorus 83% and for nitrogen compounds 71%. The values are similar to those in previous years, which is connected with the fact that the modernization of large waste water treatment plants is virtually complete and the amount of pollution produced in individual agglomerations has stabilized. The construction of new sewerage systems and waste water treatment plants has translated into a continuing increase in the **proportion of the population connected to sewerage systems ending in waste water treatment plants**. This figure reached 77% in 2010 (Chart 1) – this is consistent with the objectives set by the State Environmental Policy of the Czech Republic. By international comparison (Chart 3), countries of northern, western and southern Europe are generally doing better; most countries of Eastern Europe are doing worse.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

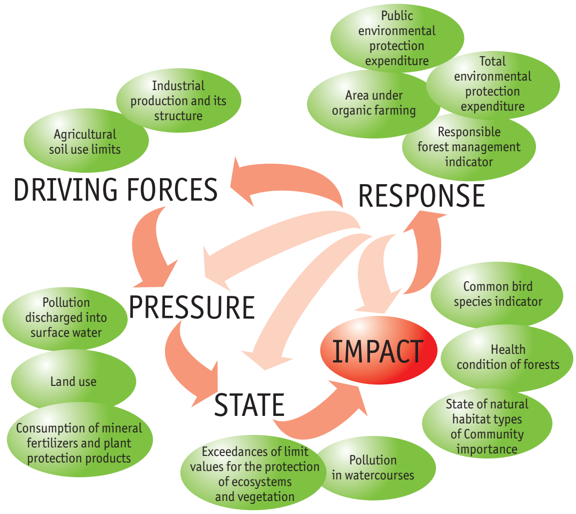
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1776)

12/ State of animal and plant species of Community importance between 2000 and 2006

KEY QUESTION ➜

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



KEY MESSAGES ➜

The conservation status of 37% of animal and plant species of Community importance is assessed as unfavourable-inadequate and 35% of animal and 36% of plant species as unfavourable-bad in 2000–2006.

The status of animal and plant species in the Czech Republic is unfavourable. The evaluation of their overall status can be considered reliable, even though it is based on the Europe-wide selection of animal and plant species[2].

OVERALL ASSESSMENT ➜

An assessment of the status of animal and plant species of Community importance was made for the 2000–2006 period; the data for the 2007–2012 period will be available in 2013. For this reason, it is not possible to assess longer-term trends. This will only be possible for all species of Community importance after 2013.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➜

The **Habitat Directive** (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) is crucial in this area. Sites of Community Importance (SCI) and Special Protection Areas (SPA) that together form the Natura 2000 network were identified pursuant to the Directive.

The general framework for biodiversity protection is provided by the **Convention on Biological Diversity** (CBD, 1992). Its main objectives are the conservation of biological diversity (incl. halting its loss), the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising from the utilization of genetic resources. At the EU level, these objectives are detailed in additional strategic documents:

Adopted in 2002, the **Sixth Environmental Action Programme of the European Community, "Our Future, Our Choice"** defines the conservation of biological diversity as one of the four main areas to be addressed.

The **EU Strategy for Sustainable Development** sets the objective of halting the loss of biodiversity and restoring natural habitats and natural systems by 2010.

The main political framework is provided by the **Communication from the Commission – Halting the Loss of Biodiversity by 2010** and the **Biodiversity Action Plan** (BAP) that was adopted by the European Commission in 2006. In 2010, the European Commission issued a **Communication concerning the Options for an EU vision and target for biodiversity beyond 2010** and, on the basis of this document, the Council adopted a new target for 2020 on 15 March 2010: "To halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020."

Other important strategic documents include the **National Biodiversity Strategy of the Czech Republic** that aims – among other things – to protect ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment, and the **State Nature Conservation and Landscape Protection Programme of the Czech Republic** that aims to maintain and improve the ecological stability of the landscape, ensure the sustainable use of the landscape and ensure adequate care for the system of Special Protection Areas and a well-defined Territorial System of Ecological Stability that conserves both biological diversity and the functioning of natural processes.

As part of priority area 1 "Nature protection, landscape and biodiversity conservation", the **State Environmental Policy of the Czech Republic** aims at halting the loss of biodiversity, developing the Natura 2000 system and functionally connecting it to the existing system of specially protected areas and managing biotopes for specially protected species of plants and animals.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➜

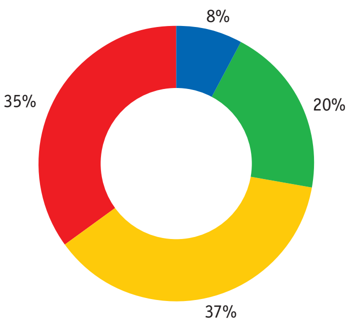
In addition to the aesthetic and ethical implications of the unfavourable status of important plant and animal species, the loss of such species impacts entire ecosystems and human society. The loss of global biodiversity results in a reduced ecological stability of the landscape, reduced genetic resources for natural medicines and the disappearance of pollinators that are important for agricultural production. All of the above consequences impact, both directly and indirectly, ecosystem services that are so extensively used by us.

Category of ecosystem service	Subcategory	Typical examples	Condition – Czech Republic (possibly the world)	Trend CR/world
Provisioning	food	food (crops, livestock, game, fish, ...)	increased production (fishing – declining due to population depletion)	🙂 / 🙁
	genetic resources	genetic material that can be used for breeding species and biotechnology	loss due to extinction and loss of crops	🙁 / 🙁
Regulating	pollination	the pollination of plants, primarily by insects	loss of bees and other insects	🙁 / 🙁
	biological regulation	pest and disease control (predators of pests and disease carriers, physical barrier)	natural spreading is impaired due to the use of pesticides	🙁 / 🙁
Cultural	aesthetic and existential values	nice scenery, quiet, aesthetic value, awareness of the availability of resources	urbanization of the landscape (reduced quantity and quality of natural areas)	🙁 / 🙁
	recreation and tourism	recreation, (eco)tourism, camping, educational trips	mass tourism reduces the value of the service	😐 / 😐

Source: Millennium Ecosystem Assessment: Ecosystems and human well-being, 2005

INDICATOR ASSESSMENT

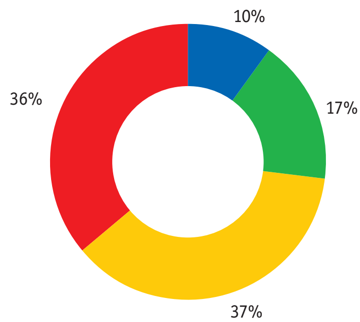
Chart 1 → **State of animal species of Community importance in the Czech Republic [%], 2000–2006**



- Favourable status (FV)
- Unfavourable-inadequate status (U1)
- Unfavourable-bad status (U2)
- Unknown status (XX)

Source: Agency for Nature Conservation and Landscape Protection of the Czech Republic

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



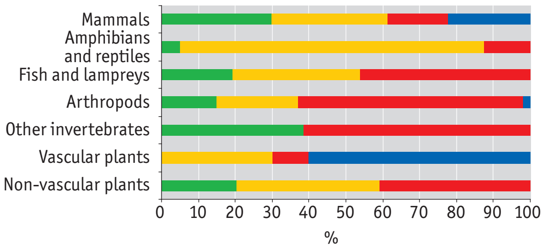
- Favourable status (FV)
- Unfavourable-inadequate status (U1)
- Unfavourable-bad status (U2)
- Unknown status (XX)

Source: Agency for Nature Conservation and Landscape Protection of the Czech Republic

[1] *Species of Community interest ("species of European importance") are species in the European territory of European Community member states that are endangered, vulnerable, rare or endemic and that are defined by European Community legislation. The indicator does not evaluate all species of European importance, but only the species defined by the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora). Therefore, the evaluation does not include birds, because bird species of European importance are defined by the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds).*

[2] *Based on the state of plant and animal species of Community importance, the overall state of plant and animal species in the Czech Republic can be assessed even though the indicator only deals with species of Community importance. A similar assessment of the state of animal and plant species cannot be applied at the national level because this indicator does not exist.*

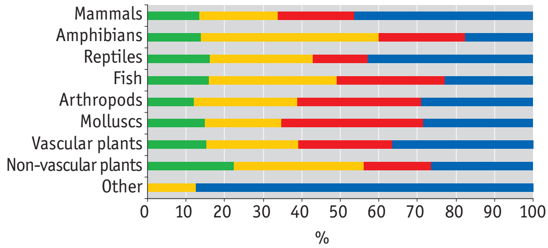
Chart 3 → **State of animal and plant species of Community importance in the Czech Republic according to taxonomic groups [%], 2000–2006**



- Favourable status (FV)
- Unfavourable-inadequate status (U1)
- Unfavourable-bad status (U2)
- Unknown status (XX)

Source: Agency for Nature Conservation and Landscape Protection of the Czech Republic

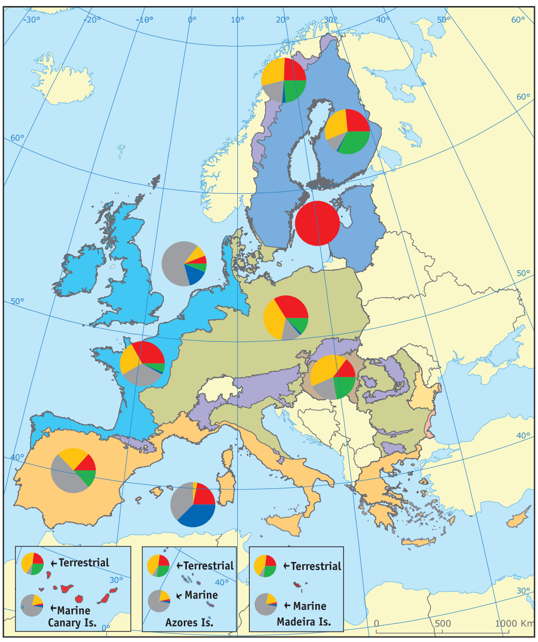
Chart 4 → **State of animal and plant species of Community importance in EU25 according to taxonomic groups [%], 2000–2006**



- Favourable status (FV)
- Unfavourable-inadequate status (U1)
- Unfavourable-bad status (U2)
- Unknown status (XX)

Source: ETC/BD

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



Pie charts
- Favourable status
- Unfavourable-inadequate status
- Unfavourable-bad status
- Unknown status
- Not classified

Biogeographic regions
- Alpine
- Atlantic
- The Black Sea
- Boreal
- Continental
- Macaronesian
- Mediterranean
- Pannonian
- Steppe

Source: ETC/BD and EK-DG Environment (adopted from the Agency for Nature Conservation and Landscape Protection of the Czech Republic)

Determining the overall status of each species requires looking at **four sub-parameters**: area, population, habitat and likely development. If one of these parameters is assessed as unfavourable, the overall status of the species is also assessed as unfavourable.

The status of approximately one-third of the **animal species of Community importance** is assessed as unfavourable-bad and one-third as unfavourable-inadequate and their habitats are probably more or less disrupted (Chart 1). It is quite difficult to document any direct link to the type of habitat: the most endangered species include species found in natural watercourses (which have been adversely affected by regulations and changes in watercourse dynamics), species that are tied to old and decaying wood (which is much less abundant in Czech woods), and groups of species that are tied to a fine landscape mosaic (butterflies, amphibians and reptiles). In the Czech Republic, only 20% of all animal species of Community importance have a favourable conservation status (some mammal and invertebrate species).

Similarly to animal species, the status of approximately one-third of the **plant species of Community importance** is assessed as unfavourable-bad and one-third as unfavourable-inadequate and their habitats are probably more or less disrupted (Chart 2). Only 17% of all plant species of Community importance have a favourable conservation status.

Indicator assessment according to taxonomic groups

Analogically to the overall indicator, sub-indicators of animal species of Community importance have been defined for the taxonomic groups of monitored animals – mammals, amphibians and reptiles, fish and lampreys, arthropods and other invertebrates (Chart 3). Under European legislation, birds have a special position based on the fact that the Birds Directive (1979) was adopted much earlier than the Habitats Directive (1992). Therefore, birds are not subject to evaluation according to the European evaluation reports.

Within these groups, invertebrates groups have a considerably worse assessment – the unfavourable-bad status covers more than one-half of both arthropods and other invertebrate groups [species that are important to the European Community include molluscs and the European medical leech (*Hirudo medicinalis*)]. Arthropods (insects, crustaceans, and pseudoscorpion *Anthrenochernes stellae*) include a wide range of species that are tied to the above-mentioned types of endangered biotopes, ranging from structurally (age and species) rich forests and solitary trees, to heterogeneously managed non-forest habitats and largely unaltered aquatic habitats. This is mainly due to the different approach for selecting species classified as species of importance to the European Community. Among the much more numerous invertebrates, severely endangered species were primarily selected. By contrast, for vertebrates – whose species are less numerous – species have often been selected that are only endangered in some parts of Europe. The situation is also striking in the case of mammals, which have the highest proportion of favourable assessments – due to the inclusion of a greater number of species that are mainly endangered in Western (i.e. considerably more urbanized and fragmented) Europe.

Analogically to the overall indicator, sub-indicators of plant species of Community importance have been defined for groups of monitored plants – vascular and non-vascular (Chart 3). In the case of non-vascular plants (species of Community importance include lichens and bryophytes), the fact that the group has only been studied to a limited extent has the greatest effect (a high proportion of the "unknown" category), especially when compared to vascular plants that have a long history of research. By contrast, vascular plants show a one-third proportion of species with an unfavourable-bad status, in spite of the long-term care for and conservation of specially protected plant species and their habitats.

From the international perspective, the status of animal and plant species that are important to the European Community can be compared on several levels: at the interstate level, at the level of bio-geographical areas, and possibly at the European-wide level. The status of species of Community importance in the Czech Republic reflects the European-wide trend and shows average results at this level (Chart 4, Fig. 1). The strategic and political objective of the EU is to maintain the favourable status (as defined by the Habitats Directive) of the components of the natural environment or, as the case may be, to prevent worsening their status and ideally to improve it. Six-year intervals have been set for assessment monitoring – these intervals will allow for assessing possible trends and their direction.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

13/ State of natural habitat types of Community importance between 2000 and 2006

KEY QUESTION →

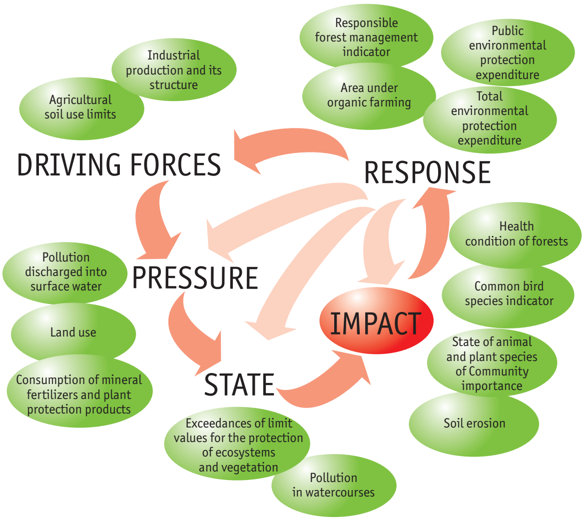
What is the state of natural habitat types of Community importance[1] in the Czech Republic?

KEY MESSAGES →

The state of almost three-quarters of natural habitats in the Czech Republic is assessed as unfavourable between 2000 and 2006, 14% as less favourable and only 12% of natural habitats are assessed as having a favourable conservation status.

The status of forests, grassland communities and small habitats such as halophytic habitats is evaluated as unfavourable.

The condition of natural habitats in the Czech Republic is unsatisfactory. The evaluation of the overall status of the Czech Republic's natural biotopes can be considered reliable, even though it is based on the Europe-wide selection of natural habitat types.



OVERALL ASSESSMENT →

An assessment of the status of natural habitats was only made for the 2000–2006 period; the data for the 2007–2012 period will be available in 2013. For this reason, it is not possible to assess the trend. This will only be possible (for all natural habitat types that are important to the European Community) after 2013.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **Habitat Directive** (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) is crucial in this area. Sites of Community Importance (SCI) and Special Protection Areas (SPA) that together form the Natura 2000 network were identified pursuant to the Directive.

The general framework for biodiversity protection is provided by the **Convention on Biological Diversity** (CBD, 1992). Its main objectives are the conservation of biological diversity (incl. halting its loss), the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising from the utilization of genetic resources. At the EU level, these objectives are detailed in additional strategic documents:

Adopted in 2002, the **Sixth Environmental Action Programme of the European Community, "Our Future, Our Choice"** defines the conservation of biological diversity as one of the four main areas to be addressed.

The **EU Strategy for Sustainable Development** sets the objective of halting the loss of biodiversity and restoring natural habitats and natural systems by 2010.

The main political framework is provided by the **Communication from the Commission – Halting the Loss of Biodiversity by 2010** and the **Biodiversity Action Plan** (BAP) that was adopted by the European Commission in 2006. In 2010, the European Commission issued a **Communication concerning the Options for an EU vision and target for biodiversity beyond 2010** and, on the basis of this document, the Council adopted a new target for 2020 on 15 March 2010: "To halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020."

Other important strategic documents include the **National Biodiversity Strategy of the Czech Republic** that aims – among other things – to protect ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment, and the **State Nature Conservation and Landscape Protection Programme of the Czech Republic** that aims to maintain and improve the ecological stability of the landscape, ensure the sustainable use of the landscape and ensure adequate care for the system of Specially Protected Areas and a well-defined Territorial System of Ecological Stability that conserves both biological diversity and the functioning of natural processes.

As part of priority area 1 "Nature protection, landscape and biodiversity conservation", the **State Environmental Policy of the Czech Republic** aims at halting the loss of biodiversity, developing the Natura 2000 system and functionally connecting it to the existing system of specially protected areas and managing biotopes for specially protected species of plants and animals.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The unfavourable status of the different natural habitat types results in the disruption of ecosystem services that are important both for the species living in those habitats and for human society that uses these functions. They include the production of wood, carbon storage in plants, the regulation of the water cycle and erosion and the resistance to invasive species, as well as cultural and aesthetic services.

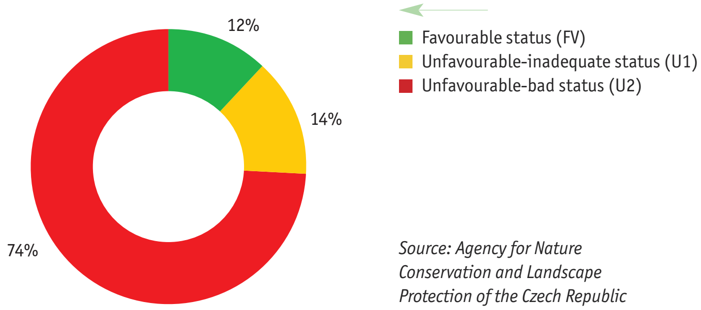
[1] *Natural habitat types of Community interest ("European habitats") are natural habitats in the European territory of European Community member states that are in danger of disappearance in their natural range, have a small natural range following their regression or by reason of their intrinsically restricted area or present outstanding examples of typical characteristics of one or more biogeographical regions that are defined by European Community legislation.*

Category of ecosystem service	Subcategory	Typical examples	Condition – Czech Republic (possibly the world)	Trend CR/world
Regulating	water cycle regulation	natural drainage, irrigation, water retention, drought prevention, replenishing aquifers	partial problems (regional problems)	☺ / ☹
	erosion regulation	the role of vegetation in preventing erosion (grass, trees, forests, ...)	22% of agricultural land is at risk of water erosion and 8.5% of wind erosion	☹ / ☹
Supporting	life-cycle preservation	photosynthesis, accumulation of energy and nutrients, nutrient cycle in nature, the environment for reproduction	threats to native biotopes and biotopes for reproduction	☹ / ☹
	gene pool conservation	biodiversity conservation	loss of species, many only exist in gene banks	☹ / ☹
Cultural	aesthetic and existential values	nice scenery, quiet, aesthetic value, awareness of the availability of resources	urbanization of the landscape (reduced quantity and quality of natural areas)	☹ / ☹
	recreation and tourism	recreation, (eco)tourism, camping, educational trips	mass tourism reduces the value of the service	☺ / ☺
	the spiritual dimension	spiritual and religious values and their use	decline in and destruction of sacred places in the landscape	☺ / ☺

Source: Millennium Ecosystem Assessment: Ecosystems and human well-being, 2005

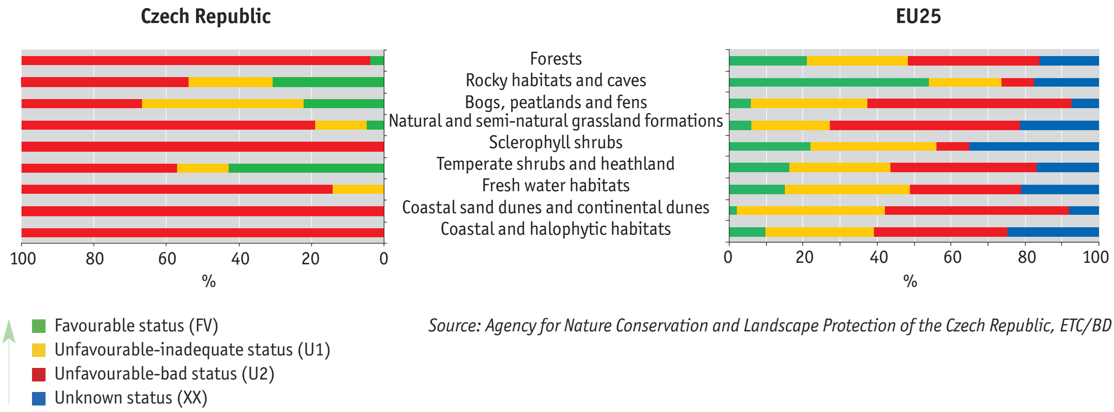
INDICATOR ASSESSMENT

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



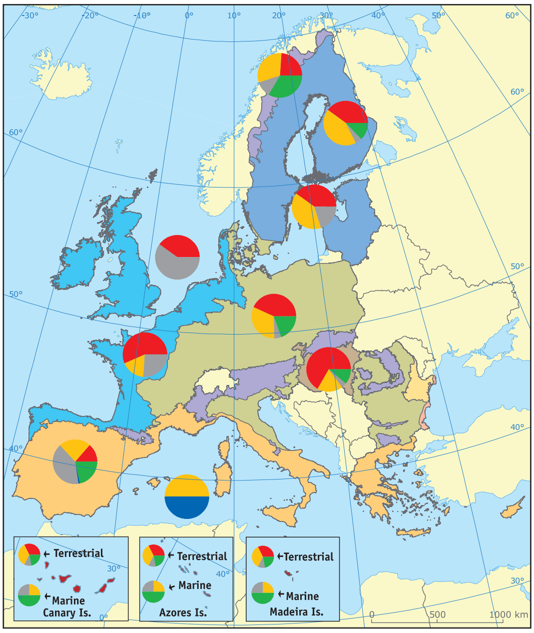
Source: Agency for Nature Conservation and Landscape Protection of the Czech Republic

Chart 2 → **State of natural habitats of Community importance in the Czech Republic and EU25 according to individual formation groups [%], 2000–2006**



Source: Agency for Nature Conservation and Landscape Protection of the Czech Republic, ETC/BD

Figure 1 → **Comparison of the state of natural habitats of Community importance in EU countries according to bio-geographical areas, 2000–2006**



Pie charts
- Favourable status
- Unfavourable-inadequate status
- Unfavourable-bad status
- Unknown status
- Not classified

Biogeographic regions
- Alpine
- Atlantic
- The Black Sea
- Boreal
- Continental
- Macaronesian
- Mediterranean
- Pannonian
- Steppe

Source: ETC/BD and EK-DG Environment (adopted from the Agency for Nature Conservation and Landscape Protection of the Czech Republic)

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

Determining the overall status of each natural habitat type requires looking at **four sub-parameters**: current size, potential area, structure and function, and prospects for the future. If one of these parameters is assessed as unfavourable, the overall status of the species is also assessed as unfavourable.

Area, size and prospects for the future were mostly assessed as favourable and less favourable. However, the quality of structure and function is much worse since these mainly concern the biological value of the habitat and thus also its ability to resist external pressure. 95 natural habitat types were assessed – 11 have a favourable status, 13 have a less favourable status and 71 an unfavourable status (Chart 1). In the Czech Republic, the assessment is unfavourable for habitats that are not very large (juniper pasturelands, coastal and halophytic habitats) and for forests. On the contrary, the assessment was relatively the most favourable for heaths, rocky habitats, peatlands and fens (Chart 2).

From the international perspective, the status of natural habitats of Community importance can be compared on several levels: at the level of interstate comparisons, at the level of bio-geographical areas, and possibly at the European-wide level. The status of species of Community importance in the Czech Republic reflects the European-wide trend and shows average results at this level (Chart 2, Fig. 1).

The strategic objective of the EU is to maintain a favourable status (as defined by the Habitats Directive) of the components of the natural environment or, as the case may be, to prevent worsening their status and ideally to improve it. Six-year intervals have been set for assessment monitoring – these intervals will allow for assessing possible trends and their direction.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

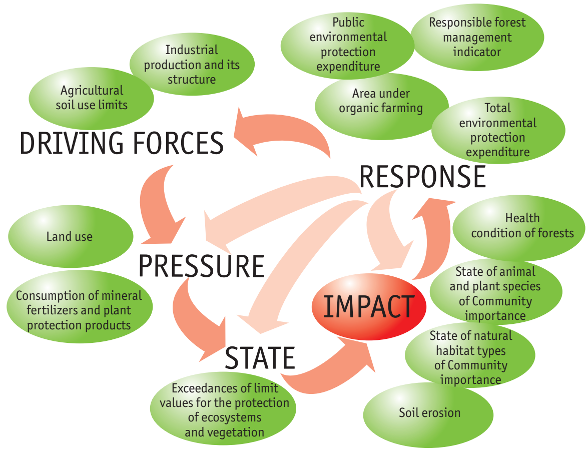
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1839)

[2] *A similar assessment of the state of sites cannot be applied at the national level because this indicator does not exist.*

14/ Common bird species indicator

KEY QUESTION →

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



KEY MESSAGES →

While the abundance of woodland bird species has been stagnating over the long-term, it has been slightly declining since 1997.

The abundance of farmland bird species continues to decline. This shows that the state of landscape and biodiversity in the Czech Republic has been worsening.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

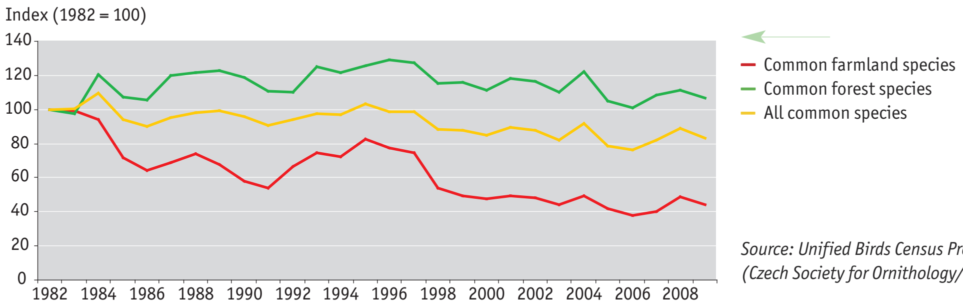
Key significance is attached to the **Bird Directive** (Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds) pursuant to which Special Protection Areas (SPA) are declared that – together with Sites of Community Importance (SCI) – form the Natura 2000 network in Europe.
The general framework for biodiversity protection is provided by the **Convention on Biological Diversity** (CBD, 1992). Its main objectives are the conservation of biological diversity (incl. halting its loss), the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising from the utilization of genetic resources. At the EU level, these objectives are detailed in additional strategic documents:
Adopted in 2002, the **Sixth Environmental Action Programme of the European Community, "Our Future, Our Choice"** defines the conservation of biological diversity as one of the four main areas to be addressed.
The **EU Strategy for Sustainable Development** sets the objective of halting the loss of biodiversity and restoring natural habitats and natural systems by 2010.
The main political framework is provided by the **Communication from the Commission – Halting the Loss of Biodiversity by 2010** and the **Biodiversity Action Plan** (BAP) that was adopted by the European Commission in 2006. In 2010, the European Commission issued a **Communication concerning the Options for an EU vision and target for biodiversity beyond 2010** and, on the basis of this document, the Council adopted a new target for 2020 on 15 March 2010: "To halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020."
Other important strategic documents include the **National Biodiversity Strategy of the Czech Republic** that aims – among other things – to protect ecosystems and natural habitats, including maintaining and restoring viable populations of species in their natural environment, and the **State Nature Conservation and Landscape Protection Programme of the Czech Republic** that aims to maintain and improve the ecological stability of the landscape, ensure the sustainable use of the landscape and ensure adequate care for the system of Specially Protected Areas and a well-defined Territorial System of Ecological Stability that conserves both biological diversity and the functioning of natural processes.
Within Priority Area 1 "Nature protection, landscape and biodiversity conservation", the **State Environmental Policy of the Czech Republic** aims to halt the loss of biodiversity, develop the Natura 2000 network and its functional linkage to the existing system of special protection areas, manage biotopes for specially protected animal and plant species and ensure that measures are put into place to minimize the risk of injury and death of birds due to electric power lines.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

A decline in the number of common farmland bird species and common woodland bird species is an indicator of the overall decline in biodiversity that, in turn, reduces the ecological stability of the entire ecosystem. The disappearance of individual species can have a direct impact on human society (loss of genetic resources for natural medicines, loss of pollinators that are important for agricultural production, pest infestation etc.).

INDICATOR ASSESSMENT

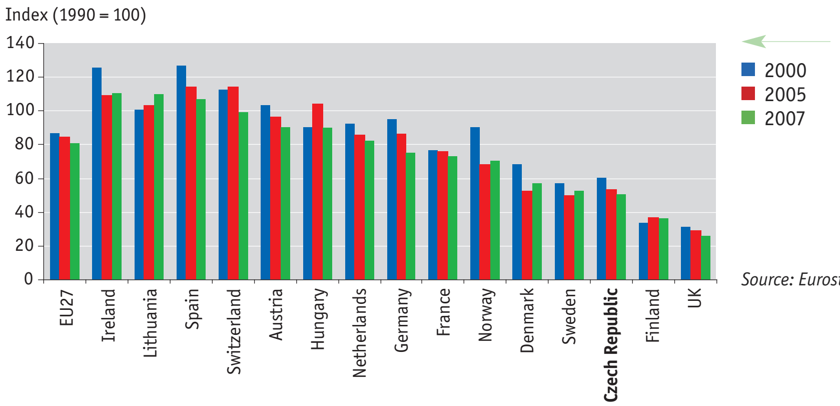
Chart 1 → **Development of the common farmland bird species indicator, the common woodland bird species indicator and the overall indicator of all common bird species in the Czech Republic [index, 1982 = 100], 1982–2009**



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

Current data for 2010 is not available.

Chart 2 → **Farmland bird species indicator, an international comparison [index, 1990 = 100], 2000, 2005 and 2007**



Source: Eurostat

The main indicators of both the **condition and the development of biodiversity** include the abundance and the distribution of selected species. The main indicators defined in the Convention on Biological Diversity include population trends of selected taxonomic groups. Changes in the abundance of different species that make up the diversity of a monitored area may help to timely identify possible negative factors threatening biodiversity. However, relevant data are not available for all constituents of biodiversity, meaning that indicators must be constructed based on data for well-studied groups. The best-studied taxa, for which relevant indicators of the development of their abundance and distribution within the Czech Republic can be constructed, include birds.

The common farmland bird species indicator and the common woodland bird species indicator are a subset of the overall indicator of the abundance of all common bird species. Over the monitored period, the total value of the abundance of all common bird species declined. Also, the division of the indicator into groups according to the main types of environment shows the differences between these groups (Chart 1).

The abundance of **common farmland bird species** declined mostly during the first half of the 1980s. After 1989, the abundance started to stabilize and in the early 1990s, it started to grow. Between 1994 and 1995, the index grew to 80% of the 1982 level. Subsequently, however, another decline occurred. According to a published scientific study[1] the main cause of the decline of field birds was the intensification of agriculture. In addition, the declining abundance of populations is also affected by the reduction of agricultural land. The reduction of agricultural land also affects the declining abundance of populations. According to the Czech Society for Ornithology, the abundance of common farmland bird species in Europe has decreased by about one-half over the past 25 years. Some species that used to be common – such as the Eurasian tree sparrow (*Passer montanus*), the northern lapwing (*Vanellus vanellus*) and the skylark (*Alauda arvensis*) – are now on the list of rapidly declining species. The situation in the new EU member states, where the situation with respect to field birds has been better, is now also deteriorating[2] (Chart 2).

The abundance of **common forest bird species** has been more or less stable over the monitored period; only the representation within different groups continues to change. Species that typically live in coniferous forests are gradually being replaced by deciduous forests species. This may be related to the growing area of deciduous forests compared to coniferous forests[3]. In spite of some favourable changes in the state of forests and farming methods, the abundance of forest bird species has started to slightly decline after increasing over the last 15 years. Based on the assessment of population trends for common bird species, it is obvious that a decline in biodiversity in the Czech Republic is continuing and unless nature protection measures are adopted across all sectors of human activities, this trend will most likely continue after 2010.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1840)

[1] REIF, J., VOŘÍŠEK, P., ŠŤASTNÝ, K., BEJČEK, V. & PETR, J. Agriculture intensification and farmland birds: new insights from a central European country. Ibis, 2008. doi: 10.1111/j.1474-919x.2008.00829.x.

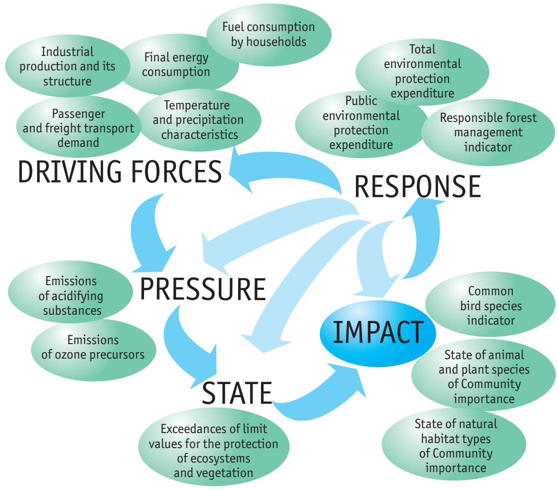
[2] VOŘÍŠEK, P., PAZDEROVÁ, A. Z Evropy i nadále mizí ptáci zemědělské krajiny (The farmland bird species remain in disappearing from Europe). The Czech Society for Ornithology, 2007. Available from: http://www.birdlife.cz/index.php?ID=1609 (in Czech).

[3] REIF, J., STORCH, D., VOLÍNEK, P., ŠŤASTNÝ, K. & BEJČEK, V. Bird habitat associations predict population trends in central European forest and farmland birds. Biodiversity Conservation, 2008. doi: 10.1007/s10531-008-9430-4.

15/ Health condition of forests

KEY QUESTION →

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



KEY MESSAGES →

🙂 Damage to forest stands expressed as the rate of defoliation (the loss of foliage) has not been progressing as fast as it used to. Over the past two years, the pace of the increase in defoliation rate has slowed down due to reduced air pollution.

🙁 Despite the slowdown in the pace of increase, the defoliation rate remains very high in the Czech Republic. The proportion of older conifers (over 59 years) that belong to defoliation[1] classes 2 to 4 was 72.9% in 2010; in younger conifers (under 59 years) it was 24.1%; older and younger deciduous trees account for 38.6% and 22.8% respectively.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

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

The objectives of the **State Environmental Policy of the Czech Republic** for forestry are as follows: promoting the continual increase in the proportion of amelioration and compacting tree species in forest renewal and afforestation, reducing damage to wetlands by logging, and reducing the drying out of these areas; conserving and utilizing the forest genetic fund; promoting the renewal of forest ecosystems in highly polluted areas; promoting the certification process within the framework of the PEFC system (Programme for the Endorsement of Forest Certification Schemes) and using sound forest management technologies.

The Forest Ecosystems area 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 biodiversity.

Another important document is the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** that defined 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 nonproduction functions of forest ecosystems.

From the international perspective, the **ICP Forests programme** that 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 that is being implemented under the **LIFE+** programme and aims to develop a long-term forest monitoring system.

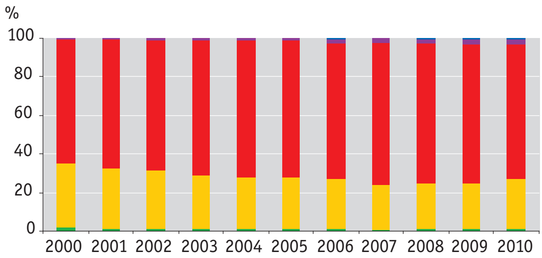
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Healthy forests are important not only as a sustainable source of wood and other material goods, but also as a source of non-productive functions (in particular protecting soil against erosion, promoting the water cycle, conserving nature, controlling floods and droughts, health-related and sanitary functions, recreational and spiritual functions, supplementing food with crops containing antioxidants that help prevent cardiovascular diseases and cancer). The declining health of forests impacts not only ecosystems and the species living in them, but also on all 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

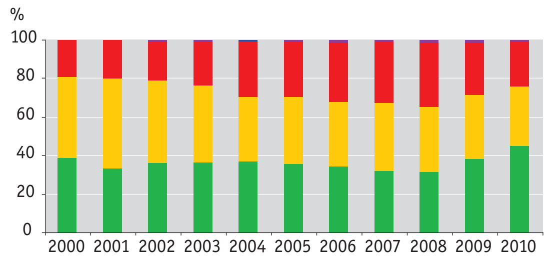
Chart 1 → **Defoliation of older conifers (stands over 59 years of age) in the Czech Republic according to classes [%], 2000–2010**



- 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

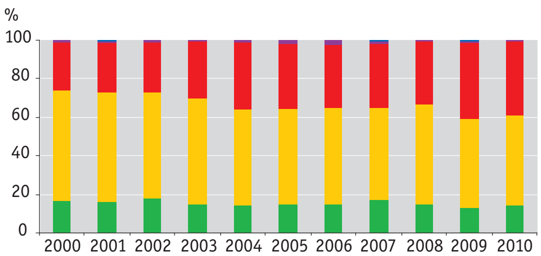
Chart 2 → **Defoliation of younger conifers (stands up to 59 years of age) in the Czech Republic according to classes [%], 2000–2010**



- 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

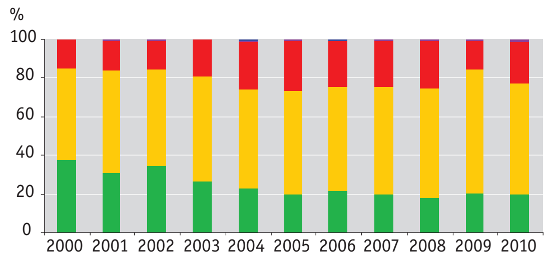
Chart 3 → **Defoliation of older deciduous trees (stands over 59 years of age) in the Czech Republic according to classes [%], 2000–2010**



- 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 [%], 2000–2010**

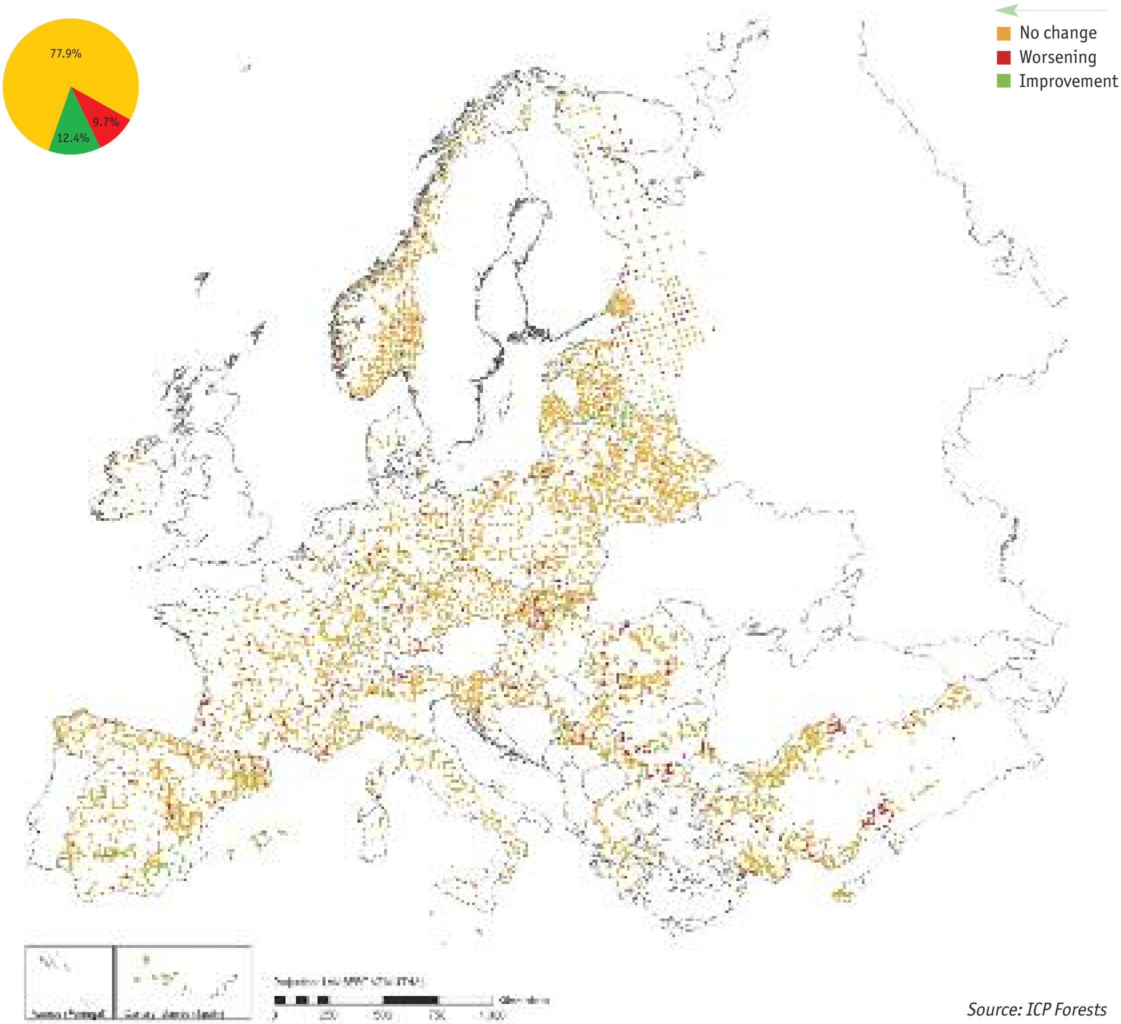


- Class 4 (100%)
- Class 3 (>60–<100%)
- Class 2 (>25–60%)
- Class 1 (>10–25%)
- Class 0 (0–10%)

Source: Forestry and Game Management Research Institute

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 degree, 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 conifers (over 59 years)**, defoliation has been increasing with the proportions of classes 2 to 4 growing (by 8.1% since 2000) at the expense of classes 0 and 1 (Chart 1). In 2010, the proportion of class 1 slightly increased (by 2.6%) compared to 2009. Similarly, **younger conifers (up to 59 years)** showed an increase in defoliation class 2 on a long-term basis (by 4.7% since 2000) at the expense of classes 0 and 1 (Chart 2), which might have been caused by adverse abiotic factors and pests in weak forests affected by pollution. However, there has been improvement since 2008 – the proportion of vegetation in defoliation classes 2 to 4 has decreased (by 10.2% up to 2010) while the proportion of defoliation class 0 has increased (by 13.6% up to 2010). There were no major difference in basic older coniferous species as to the degree of defoliation; the proportion in classes 2 to 4 ranged from 66.5% in larch (*Larix decidua*) to 83.9% in pine (*Pinus sylvestris*). Similarly, the greatest amount of defoliation in younger conifers was in pine (*Pinus sylvestris*) – 69.7% in classes 2 to 4 and the lowest defoliation in fir (*Abies alba*) – 45.2% in class 0 and 52.4% in class 1.

In **older deciduous trees (over 59 years)**, the degree of defoliation has been worsening with the percentage of stands in class 2 increasing (by 13.1% compared to 2000), at the expense of classes 0 and 1 (Chart 3). Similarly, the degree of defoliation has been increasing in **younger stands (under 59 years)** on the long-term run (Chart 4).Unlike older stands, there has been a slight increase in class 1 (by 1.4%) and, to a smaller extent, in class 0 (by 1%) in 2010 compared to 2009 , at the expense of classes 2 and 3. The largest defoliation in basic tree species in older deciduous stands was reported in oak (*Quercus sp.*) – 73.1% belonged to classes 2 to 4; on the other hand, the lowest defoliation was registered in beech (*Fagus sylvatica*) – 89.3% in classes 0 and 1 and alder (*Alnus sp.*) – 88.5% in classes 0 and 1. As far as basic younger deciduous trees species are concerned, the largest defoliation was registered in birch (*Betula pendula*) – 43.6% of the stand falls into classes 2 to 4; on the other hand, the lowest defoliation was reported in beech (*Fagus sylvatica*) – 47.3% in class 0 and 46.3% in class 1.

Older coniferous trees show a higher degree of defoliation that younger ones (the proportion of older conifers in class 2 to 4 was higher by 48.8% than in younger conifers in 2010). Similarly, older conifers show a higher degree of defoliation than older deciduous trees; on the other hand, younger conifers show a lower degree of defoliation than younger deciduous trees on the long-term basis.

Decreased pollution over the past two decades has undoubtedly improved the total dynamics of defoliation. Nevertheless, defoliation has been slightly increasing. This trend is usually manifested in both age groups of coniferous and deciduous trees by a decrease in class 1 and increase in class 2. Such a trend indicates a significant delay in the forests' response to positive environmental changes.

In the **international context**, the condition of Czech forests remains bad and is the worst in Europe – despite the significant reduction in emissions in the 1990s. In 2010, the Czech Republic had the most trees in EU27 countries 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.

The amount of the forest ecosystem that is identified by a higher stability, biodiversity and resistance to adverse environmental effects increases with age. A good health condition of forests is important with respect to the use of ecosystems by humans (ecosystem services). The **ecosystem services** in a healthy forest include provisioning services (food, medicines, energy, materials etc.), regulating services (the regulation of micro- and mesoclimate, floods, erosion etc.), supporting services (soil formation, nutrient cycling) and cultural services (recreation, spiritual and other non-material values). The growing demand for ecosystem services results into the disruption of the ecosystems' ability to provide them. If the objectives of the National Forestry Programme for the period until 2013 and the National Biodiversity Strategy of the Czech Republic are met, the vitality and resistance of forests will improve and forests will be better able to withstand adverse effects and will be able to provide services important both to humans and other ecosystems.

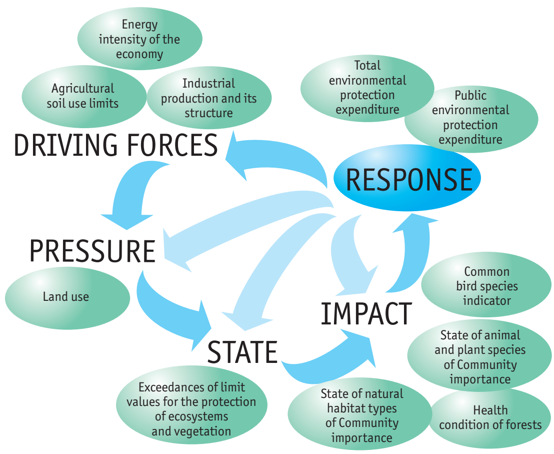
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

16/ Responsible forest management indicator

KEY QUESTION →

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



KEY MESSAGES →

In recent years, the proportion of deciduous trees in Czech Republic forests has been – very slowly but steadily – increasing.

The area of natural renewal grew by 11% compared to 2009. Total forest stock has been increasing over the long term.

While the proportion of firs in afforestation has been rising over the long term, there was a slight decline compared to 2009 (from 6.3% to 5.8% in 2010). The proportion of firs in the total area of the Czech Republic's forests has stagnated.

The amount of Czech forest area certified pursuant to the PEFC and FSC rules peaked in 2006 and recently has declined to its current level 72%.

The percentage of forest area certified by the more environmentally demanding FSC system remains very low (2% 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 „Responsible agriculture and forest management" priority of the **Strategic Framework for Sustainable Development in the Czech Republic** aims to maintain and improve biodiversity in forests while supporting nature-friendly management methods and enhancing non-production functions of forest eco-systems. The "Adaptation to climate change" priority aims at reducing the impact of the anticipated global climate change and extreme meteorological phenomena on forest ecosystems.

The objectives of the **State Environmental Policy of the Czech Republic** for forestry are as follows: promoting the continual increase in the proportion of amelioration and compacting tree species in forest renewal and afforestation, reducing damage to wetlands by logging, and reducing the drying out of these areas; conserving and utilizing the forest genetic fund; promoting the renewal of forest ecosystems in highly polluted areas; promoting the certification process within the framework of the PEFC system (Programme for the Endorsement of Forest Certification Schemes) and using sound forest management technologies.

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 and supporting the natural and nature-friendly renewal of tree species. Other partial objectives are „To maintain and improve biodiversity in forests" by supporting diverse management procedures and maintaining the pattern of stands with a high biological value within the landscape. In addition, the Programme aims „To achieve a balance between forests and game" by reducing excessive hoofed game stock in order to use more nature-friendly management forms and damage to forest stands.

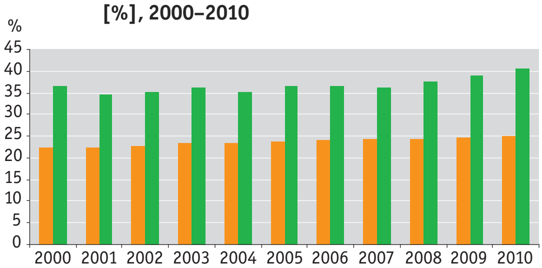
Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic** that aim to increase biodiversity in forest stands towards a natural species composition, to increase structural diversity, naturally renew the species diversity in genetically suitable stands and to enhance the non-production functions of forest ecosyste

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 ameliorative and stabilizing tree species improves the water cycle, 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

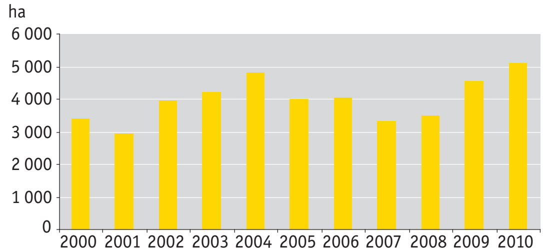
Chart 1 → **Proportion of deciduous trees in the Czech Republic's total forest area and in afforestation [%], 2000–2010**



Proportion of deciduous trees in total forest area
Proportion of deciduous trees in afforestation

Source: Forest Management Institute, Czech Statistical Office

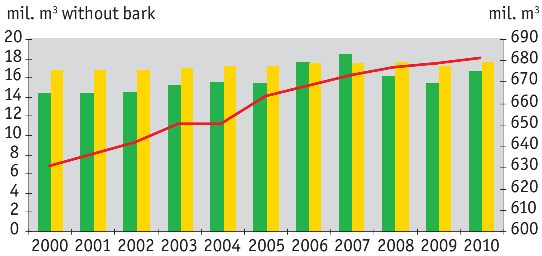
Chart 2 → **Development of natural renewal areas in the Czech Republic [ha], 2000–2010**



Natural renewal area

Source: Czech Statistical Office

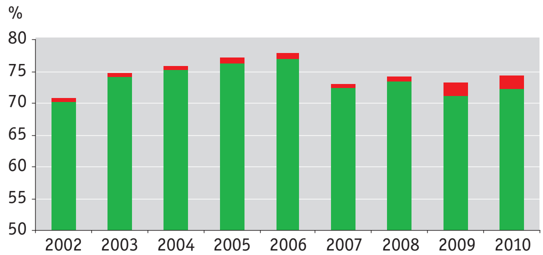
Chart 3 → **Comparison of the total average growth and wood felling [mil. m³ without bark] with total stock in the Czech Republic [mil. m³], 2000–2010**



Felling (left axis)
Growth (left axis)
Stock (right axis)

Source: Forest Management Institute, Czech Statistical Office

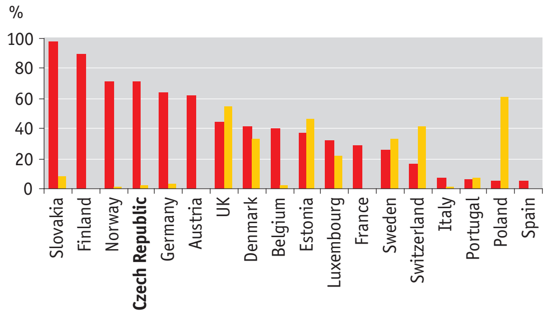
Chart 4 → **Share of forest area certified pursuant to the PEFC and FSC principles in the total forest area of the Czech Republic [%], 2002–2010**



FSC
PEFC

Source: FSC of the Czech Republic and PEFC of the Czech Republic

Chart 5 → **Proportion of PEFC and FSC certified forests in the total forest area [%], an international comparison, 2010**



PEFC
FSC

Source: PEFC of the Czech Republic and FSC of the Czech Republic

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 by 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 2010, they accounted for 25.1% of the total forest area. The **number of deciduous trees during afforestation** was long at a stable level of 35–36%, but has slightly grown over the last two years to 40.7% in 2010 (Chart 1).

An important part of a natural forest ecosystem is fir, a species important for maintaining forest stability. The **proportion of fir in the total forest area** has been stable (at about 0.9%) since 1995 and its proportion in afforestation grew from 2% in 1995 to 6.3% in 2009, but then decreased to 5.8% in 2010. 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.

The **natural renewal of forests** has almost tripled over the period in question (since 1995), which is a significant positive phenomenon from the forestry and environmental perspectives. While the proportion of natural renewal in total forest renewal kept decreasing between 2004 and 2007, it has resumed growth since 2008, reaching 19% in 2010 (an increase of 11% compared to 2009), see Chart 2.

The **total standing wood stocks** have been increasing over the long term, but the rate of increase has been slowing down in recent years. In 2010, it reached 680.6 million 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, wood felling was about 15 mil. m^3 without bark per year. Total average growth has been stable at about 17 mil. m^3 without bark during the period (since 2000).

The **forest area certified pursuant to the PEFC** (Programme for the Endorsement of Forest Certification schemes) and **FSC**[1] (Forest Stewardship Council), i.e. the area of sustainably managed forests, reached its maximum in 2006 (77.9% of the Czech Republic's total forest area). Following a decrease between 2007 and 2009, the area slightly increased in 2010 compared to 2009, reaching 74.4% (1 876 505 ha) of the Czech Republic's total forest area. 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 1.3%). The forest area certified under the FSC system, which is more stringent but also more environmentally sound, is still small (Chart 4) and it remained unchanged in comparison with 2009 (2% of the total area, 52 387 ha). Compared with other countries, the Czech Republic has an above-average forest area certified under PEFC, but is among those countries with very small forest areas certified under FSC (Chart 5).

Forest management within the objectives of the State Environmental Policy has been developing positively. As long as the objectives of the Strategic Framework for Sustainable Development in the Czech Republic and the National Forestry Programme until 2013 are accomplished, the species and age structure of forests will also improve, the vitality and resistance of forests will increase and forests will better withstand any adverse conditions. This will go hand in hand with a better species and forest diversity.

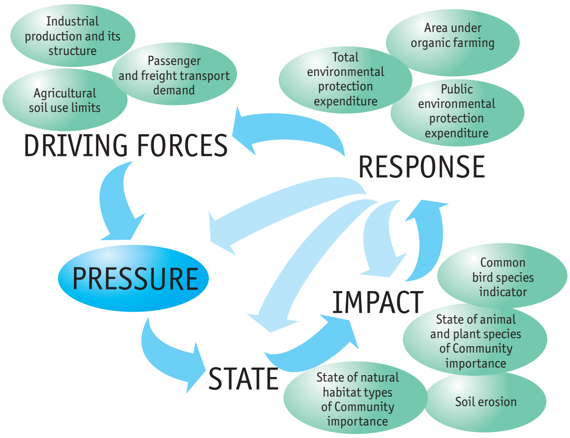
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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 aimed at sustainable forest management in the Czech Republic that strives to maintain all forest functions in favour of the environment for people. Through the certificate, the forest owner declares a commitment to manage the forest pursuant to certain criteria. PEFC is a professional, voluntary and independent association of legal entities in the Czech Republic. FSC is an international certification carried out by several authorized companies, not by certification companies accredited only in the Czech Republic. FSC does not allow for regional forest certification. From the international perspective, the systems are equal.*

17/ Land use



KEY QUESTION →

Is the Czech Republic's land use satisfactory in terms of landscape ecology?

KEY MESSAGES→

Within agricultural land resources, there is a positive growth in the proportion of permanent grasslands at the expense of arable land. The forest area has been slightly increasing.

Agricultural land resources have declined, while built-up and other areas continue to expand. The degree of landscape fragmentation has increased.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The Czech Republic's obligations 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.

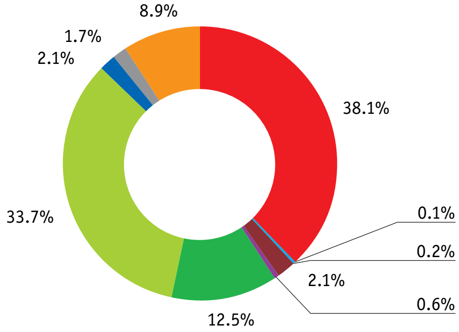
Another important strategic document is the **State Environmental Policy of the Czech Republic**. It aims for „environmentally friendly land use", i.e. it strives to minimise free-landscape disturbances, reclaim or otherwise use disturbed landscapes, remove ecological pressures, prevent landscape fragmentation and even reduce fragmentation through developing bio-corridors and ecological stability territories. With regard to economic activities that are most closely associated with land use (such as agriculture and forestry, mineral extraction, construction, transport and tourism), it is necessary to implement legislative, financial and educational measures to promote the most landscape friendly activities. 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 **State Nature Conservation and Landscape Protection Programme of the Czech Republic** aims to maintain and enhance the ecological stability of the landscape with a mosaic of interconnected biologically functional elements and policies that are able to withstand negative external influences (including climate change), maintain and enhance the natural and aesthetic value of the landscape, ensure comprehensive sustainable land use – especially through limiting landscape development, maintaining landscape permeability and limiting further fragmentation with preferential use of space within residential zones or with ties to such zones – and ensure that adequate care is provided for an optimized system of Specially Protected Areas. It shall also ensure that TSES are defined as the irreplaceable basis of natural landscape infrastructure to guarantee the conservation of biological diversity and the functioning of natural processes essential to human life.

The **Spatial Development Policy of the Czech Republic** is an instrument of land-use planning. Its priorities include – among others – protecting and developing the natural, civilization and cultural values of the territory in the public's interest, conserving the character of the unique urban structure of the territory, the settlement structure and the unique cultural landscape, creating conditions for the multipurpose use of abandoned sites and areas (i.e. brownfields of industrial, agricultural, military or other origin), economically using built-up areas (supporting the reclamation, revitalization or redevelopment of land) and protecting undeveloped areas (especially agricultural and forest land), preserving public green spaces, including minimizing their fragmentation, and ensuring that development plans that may significantly affect the landscape character are located in the least-conflicting locations and supporting subsequent necessary compensatory measures.

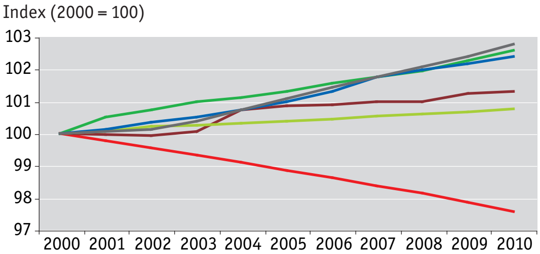
INDICATOR ASSESSMENT

Chart 1 → **Land use in the Czech Republic [%], 2010**



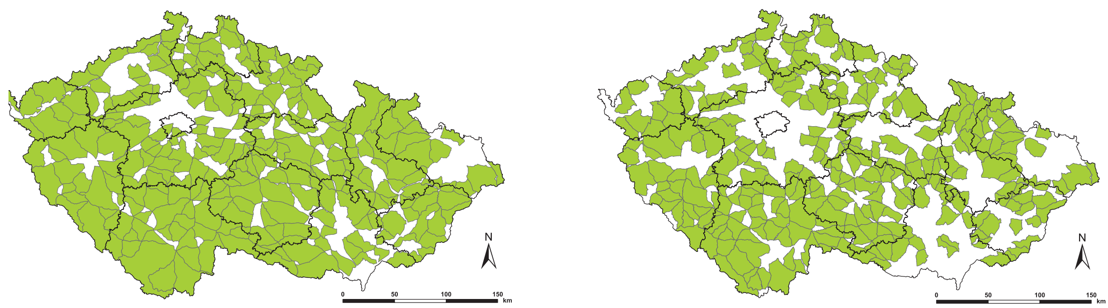
Source: Czech Office for Surveying, Mapping and Cadastre

Chart 2 → **Land use trends in the Czech Republic [index, 2000 = 100], 2000–2010**



Source: Czech Office for Surveying, Mapping and Cadastre

Figure 1 → **Landscape fragmentation due to transport in the Czech Republic, 1980 and 2005**

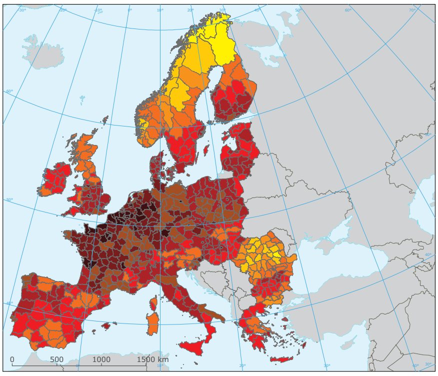


Year 1980 *Source: Evernia*
UAT polygons 1980
— Boundaries of self-governing regions

Year 2005 *Source: Evernia*
UAT polygons 2005
— Boundaries of self-governing regions

Unfragmented Areas by Traffic (UAT) is a method for determining the '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 km². The green areas are still unfragmented.

Figure 2 ➜ **Landscape fragmentation by NUTS regions, an international comparison, 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 Effective Mesh Density method is based on the number of patches / 1 000 km². A smaller size of patch (i.e. a greater number of patches / 1 000 km²) means greater landscape fragmentation. There are three categories of regions: urbanized with a population density greater than 100 inhabitants / 1 km², ex-urban and rural. Urbanized regions have a number of patches greater than 100 / 1 000 km² and are on average 40 times as fragmented as ex-urban regions.

The Czech Republic has a **high proportion of arable land** (38% of its total area, ranking 5th within the EU27) and a relatively **high proportion of forest cover** (33.7%). In 2010, agricultural land resources totalled 4 234 thousand ha (i.e. 53.7% of the total area), non-agricultural land accounted for 3 653 thousand ha. Arable land accounts for the largest proportion of agricultural land resources (71.1%), followed by permanent grassland (23.3%), while the remaining 5.7% consists of hop fields, vineyards, orchards and gardens (Chart 1).

Within agricultural land resources, there has been a gradual increase in the proportion of permanent grasslands. Year-to-year, arable land decreased by 8 768 ha (0.3%) in 2010, see Chart 2. This corresponds to a loss of about 24 ha of arable land each day. By contrast, developed and other areas displayed a year-to-year increase of 2 999 ha (0.4%) in 2010 (Chart 2). The increase since 2000 totalled 22 506 ha (2.8%). In 2010, built-up and other areas accounted for approximately 832,5 thous. ha, which represents 10.6% of the Czech Republic's total area.

Eurostat data suggest that, **in comparison with neighbouring countries**, the Czech Republic has the fastest decreasing proportion of agricultural land as measured by the country's total area. Between 2003 and 2007, the proportion fell by 2.6% in the Czech Republic. Germany and Austria experienced a much slower decrease, and in Poland the proportion of agricultural land as a function of its total area increased by 3.4%.

Land use trends in the Czech Republic are characterized by two types of changes. For remote and less attractive areas, we speak of the „**extensification**" of use, leading to a smaller area of arable land and increased areas of new permanent grasslands and forest land. On the other hand is „**intensified**" use that is typical of the main agricultural areas and urbanisation centres. This results in an increased proportion of arable land and, above all, an increase in developed and other areas. While the former process is viewed rather positively from the landscape-ecology perspective, the intensification of use in the latter case is clearly negative. The long-term trend in the Czech Republic has been one of widening disparities amongst different regions based on their natural and socio-economic characteristics, which increases the intensity of both of the above-mentioned processes. Economically attractive areas are experiencing very dynamic development while, on the other hand, remote areas that are less interesting in terms of agriculture, industry and recreation are losing both their value and population.

The dynamic development of significant economic, political and cultural centres in the Czech Republic is accompanied by population growth and, consequently, an increase in residential and commercially developed areas – not only within existing urban zones, but also in outer urban zones, especially around existing municipalities. Suburbanization also includes significant, non-compact and unaesthetic expansion of developed areas with negative environmental, economic and social implications (i.e. urban sprawl). This process is characteristic of the current trends in Prague and, to a lesser extent, in Brno and other major cities in the Czech Republic. Urban sprawl denotes the expansion of both the residential and commercial functions of a city and it typically swallows a city's existing surroundings into the municipality creating „**suburbia**" (urban residential areas adjacent to cities).

There are a wide range of natural and artificial barriers in the landscape . The landscape keeps being fragmented into ever smaller isolated units due to the combination of natural barriers and the long-term expansion and interconnection of originally separate built-up areas, the construction of linear transport structures, intensive farming and the fencing off of private land in the open landscape. As a result of the above phenomena, natural habitats of species of organisms and agricultural land resources used for building purposes and functionally-linked ecosystems are disrupted, thus reducing the permeability of the landscape. Between 1980 and 2005, the proportion of non-fragmented landscape decreased from 81% to 64% of the Czech Republic's total area (Figure 1); future prognoses assume that the proportion of non-fragmented landscape will only be 53% in 2040. By international comparison, the Czech Republic is among those countries with the highest degree of fragmentation, alongside Germany, France, Italy, Russia and Portugal (Figure 2).

The increasing proportion of developed areas significantly affects the runoff conditions in the landscape and, in turn, may influence the consequences of random natural phenomena, especially floods. While runoff from vegetated areas only represents about 5% of all stormwater, hard surfaces soak up almost no water at all. This leads to more than 90% of all stormwater that needs to run off. New development brings changes to the original terrain (new dumps, embankments etc.). At the same time, soil degradation occurs, e.g. due to worsened stormwater absorption and drainage, thereby reducing the replenishment of underground water.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

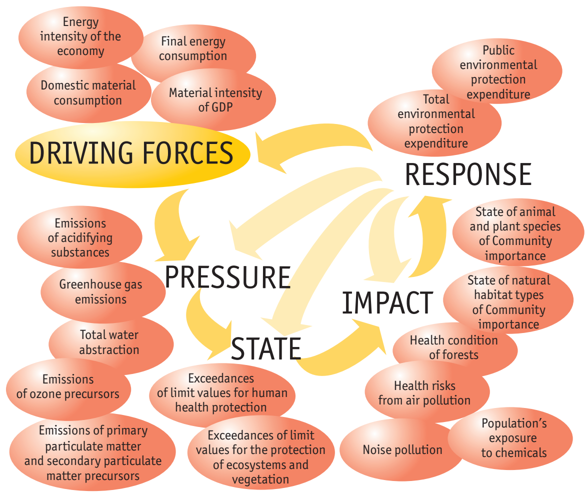
CENIA, key environmental indicators

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

18/ Industrial production and its structure

KEY QUESTION →

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



KEY MESSAGES →

Industrial production increased in 2010. As a result of restructuring, the increase is attributed to the production of products with lower energy and emission intensity and is not associated with increased negative environmental impacts.

The energy intensity of industry has been significantly declining over the long term.

Thanks to the economic recovery after the economic crisis, industrial production has grown 10.3% year-to-year. This year-to-year growth is mostly attributable to the automotive industry, engineering and the production of electrical equipment. Reflecting the delayed impacts of the economic crisis, the construction sector fell by 7.8%.

OVERALL ASSESSMENT →

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The State Environmental Policy of the Czech Republic has the following industrial objectives: to more thoroughly include environmental aspects in industrial policies; to orient industrial production on products with higher finality, a greater increase in the value of inputs and more favourable environmental effects; to support the widest possible introduction of best available techniques (BAT); to support programmes focused on the development of ecologically-minded mechanical engineering and on supporting ecological investments in air protection, the treatment and purification of waste water, the processing and disposal of waste and the introduction of "cleaner" technologies; to reduce pollution emissions into the air and water, not to pollute streams with industrial water and waste chemicals and to improve waste water treatment.

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 substances with the worst impacts on human health and the environment from circulation and to replace them with less harmful substances.

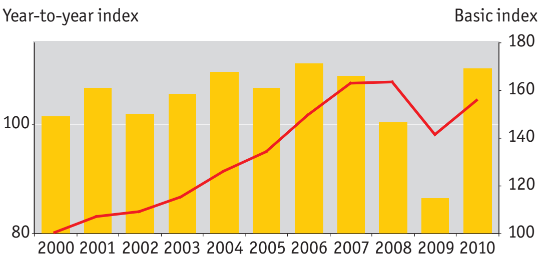
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Industry consumes significant amounts of non-renewable resources, both basic materials and energy resources. Their extraction disrupts the landscape, affects the quality, quantity and level of groundwater at the extraction sites and causes increased dust and noise pollution in the vicinity. This impacts the surrounding ecosystems and the human population, causing the death or migration of animals and plants that fail to adapt to the changes. Industrial areas suffer from increased environmental pollution, especially air pollution, i.e. both from substances that are commonly monitored and from specific substances that are associated with specialized industrial production. Poor air quality has been shown to cause increased morbidity, the incidence of allergies, asthma, respiratory and heart problems, cancer, reduced immunity etc., while noise pollution affects the nervous systems of humans and animals.

Industry is also a producer, importer and user of chemicals, mixtures and products containing chemicals, whose properties in terms of environmental and human toxicology are not always known.

INDICATOR ASSESSMENT

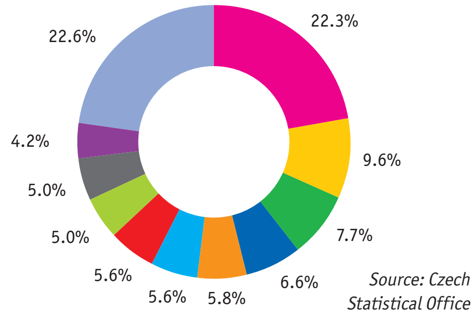
Chart 1 ➔ **Index of industrial production in the Czech Republic, 2000–2010**



- Year-to-year index of industrial production (the same period of the previous year = 100)
- Basic index of industrial production (2000 = 100) right axis

Source: Czech Statistical Office

Chart 2 ➔ **Industrial production in the Czech Republic [%], 2010**

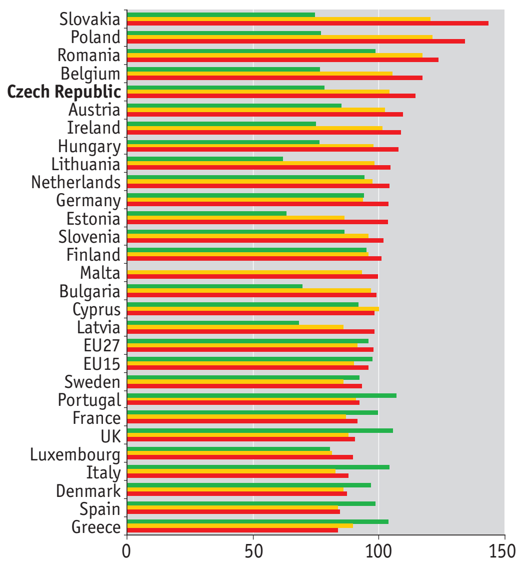


Source: Czech Statistical Office

- Manufacture of motor vehicles (except for motorcycles), trailers and semi-trailers
- Manufacture of computer, electronic and optical products
- Generation and distribution of electricity, gas, heat and conditioned air
- Manufacture of machinery and equipment, n.e.c.
- Manufacture of rubber and plastic products
- Manufacture of food products
- manufacture of basic metals, metallurgical processing; casting
- Manufacture of metal structures and fabricated metal products except from machinery and equipment
- Manufacture of electrical equipment
- Manufacture of chemicals and chemical preparations
- Other

The breakdown of industrial production by the sales of products and services. This is industrial production including mining, the production and distribution of electricity, gas, steam and conditioned air.

Chart 3 ➔ **Industrial production index [index 2005 = 100] International comparison 2000, 2009 and 2010**

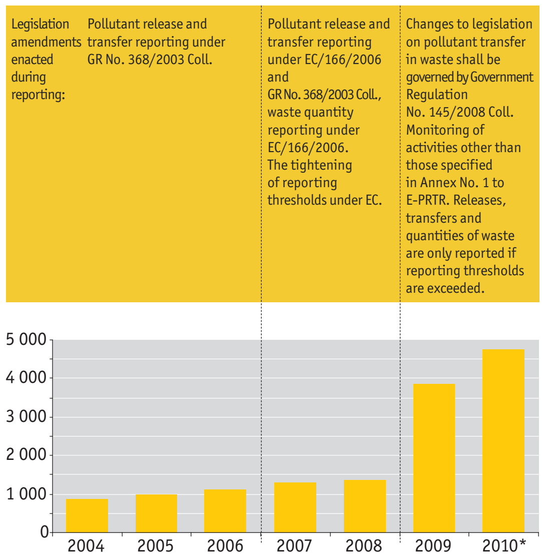


- 2000
- 2009
- 2010

Source: Eurostat

Total industrial production index (i.e. mining, processing and the energy sector, excl. water distribution). The index is recalculated according to the number of days worked.

Chart 4 ➔ **Number of facilities reporting to the Integrated Pollution Register in the Czech Republic, 2004–2010***



- Total number of facilities reporting to the IPR

Source: CENIA

** data for 2010 is only preliminary*

From 2000–2010, **industrial production in the Czech Republic** did not bring with it any increased adverse environmental impacts. Structural changes became apparent, especially through the "lightening" of production, i.e. an increase in the proportion of those sectors producing technologically more complex products with higher added value and lower energy and emission intensity (automotive, electrotechnics, computer technology). In addition, virtually all sectors underwent technologically innovative development. Therefore, the objectives – especially those of the State Environmental Policy of the Czech Republic – have been successfully fulfilled.
Despite slight fluctuations, industrial production showed an upward trend between 2000 and 2007 (Chart 1). In 2008 and 2009, the Czech Republic was affected by the global **economic crisis** and the related stagnation and **downturn in industrial production**. Starting in 2010, **economic recovery** resulted in a significant year-to-year increase in industrial production (10.3%). Above all, this reflected the rapid developments in the German economy, on which Czech industry is largely dependent. While the rise in industrial production was mainly driven by the recovery in **foreign demand**, domestic demand grew as well. The year-to-year growth is mostly attributable to medium technologically intensive manufacturing industries, especially **the automotive industry** (an increase of 24.6%) as well as the **engineering** and **manufacture of computers** (24.7%). In addition, **metallurgy** also showed rapid growth in production. By contrast, the Czech construction industry experienced the delayed impacts of the economic crisis in 2010, resulting in a year-to-year drop of 7.8%. This reflected both the austerity measures taken by the government and lower demand by households and companies.
In 2009, the economic crisis also had a significant impact on industrial emissions, with **all types of emissions declining** on a year-to-year basis. Industrial emissions can be divided into two groups – emissions from the industrial energy sector and emissions from industrial processes excluding fuel combustion. Depending on the type of production, industrial processes are specific and produce a variety of emissions that are harmful to the environment. For more information on the trends in both types of emissions of basic pollutants from the industrial sector, see indicators 3 to 5.
While the industrial energy sector showed a year-to-year decline in all types of main emissions in 2009, production process excluding combustion also experienced some increases, namely for NO_x (20.0%), and VOC (55.5%).
In terms of total industrial emissions the most significant year-to-year change was the 63.0% drop in NH_3 emissions and the 34.5% decline in PM_{10} emissions. In addition, the emissions of $PM_{2.5}$ decreased by 16.2%, CH_4 by 15.4%, CO by 13.9%, NO_x by 12.3%, SO_2 by 7.1% and VOC by 3.5%. Due to the processing methodology, emission figures for 2010 were not available at the time of finalizing this report.
The **energy intensity** in industry significantly **decreased.** While in 2000 the energy intensity in industry was 699 MJ/CZK 1 000, in 2009 it was 370 MJ/CZK 1 000 (calculated as final energy consumption in industry divided by the GVA of that sector). This trend is favourable for the environment. In 2009, energy intensity declined by 9.8% year-to-year.
By international comparison (Chart 3), all EU countries except for Greece experienced an unmistakeable industrial recovery in 2010, which followed a slump in connection with the global economic crisis. The position of industry in the Czech economy is still extraordinary. In 2010, the **Czech Republic had the greatest proportion of industry** in GDP in the EU, namely 30.5%. The EU27 average was 18.8%, mainly due to the gradual dematerialisation of the economy and the increasing imports of products of the manufacturing industry from countries outside the EU. By international comparison, proportions above 25% are only seen in five EU countries: the Czech Republic, Romania, Hungary, Ireland and Slovakia.
An important tool for increasing the awareness of pollution releases and transfers in industrial and agricultural emissions discharged into the environment is the Integrated Pollution Register (IPR). The register is maintained pursuant to Regulation of European Parliament and Council 2006/166/EC concerning the establishment of a European Pollutant Release and Transfer Register (the E-PRTR regulation), Act No. 25/2008 Coll., on the integrated pollution register and amending some acts (amended by Act No. 77/2011 Coll.)[1], and Government Regulation No. 145/2008 Coll. on the list of pollutants and threshold values and the information required for reporting to the integrated pollution register.
The total number of facilities that reported the required data in the IPR between 2004 and 2010 is shown in Chart 4. Between 2004 and 2010, the scope of reported data changed, mainly in connection with the adoption of the E-PRTR. For the reporting years 2004–2006, all operators (users of a registered substance) reported the same range of data on releases and transfers. For 2007–2008, it already mattered what activity was carried out at the facility and, at the same time, a new obligation was imposed on operators to report the quantities of waste transferred out of the facilities. Beginning with the reporting year 2009, when the Integrated Environmental Reporting System (IERS) began to be used for submitting reports to the Integrated Pollution Register, pollutant releases and transfers as well as waste quantity transfers shall be reported if they exceed threshold values specified for the given substances and waste, i.e. in facilities specified by the European Pollutant Release and Transfer Register (E-PRTR) as well as in facilities for other activities and for activities with a lower capacity than specified by the E-PRTR Directive. This is also the main reason behind the sharp increase in the number of operators that reported data for 2009 to the Integrated Pollution Register. The increased number of facilities for which reports were submitted in 2010 was probably due to operators' increased awareness of reporting through the Integrated Environmental Reporting System and due to the increased number of entities that were subject to mandatory reporting and that fulfilled their reporting obligation through the Integrated Environmental Reporting System for the first time in 2011.
Through operating the register, the Czech Republic also fulfils its obligations under the Protocol on Pollutant Release and Transfer Registers that entered into force for the Czech Republic on 10 November 2009 (108/2009 Coll. of international treaties). The protocol is the first international legally binding document on pollution release and transfer registers. Adhering to the protocol helps insure compliance with Article 5 of the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (the Aarhus Convention). In addition, it also simplifies reporting for polluters that switch to electronic reporting.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

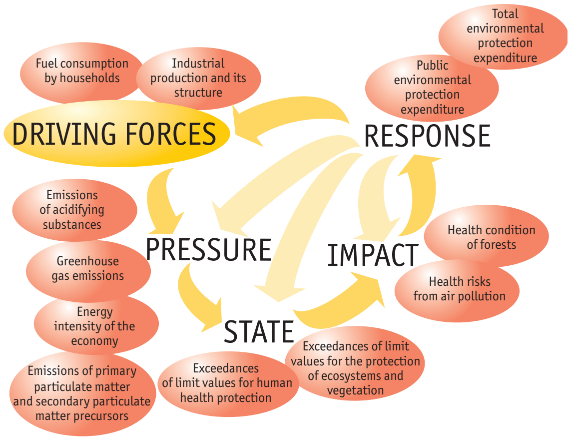
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1889)

[1] *Act No. 77/2011 Coll. details the information contained in Act No. 25/2008 Coll. relating to the operator's obligation to report transfers of waste (hazardous and other waste) in the event that it exceeds the relevant threshold values, and points out that the failure to report such transfers constitutes an administrative offence. In addition, it mentions the possibility of submitting reports via the data mailbox of the Ministry of the Environment and regulates the publication deadline for the reporting data standard.*

19/ Final energy consumption

KEY QUESTION

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



KEY MESSAGES

The decline in final energy consumption that took place over the past three years has stopped. In 2010, there was a year-to-year increase of 8.2% due to the nation's economic recovery, i.e. the current year-to-year growth in economic production.

By international comparison, the Czech Republic has an average per-capita final energy consumption. Compared to the EU average, the Czech Republic has a higher proportion of energy consumption in industry and a lower proportion of consumption in transport.

The total energy consumption in transport continues to increase – between 1999 and 2009 it increased by 91.5%.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The aim of the State Environmental Policy of the Czech Republic is to promulgate rational energy consumption and supply within sustainable development principles.

The **State Energy Policy of the Czech Republic** aims to maximize heat savings in buildings, the efficiency of energy-consuming appliances and energy distribution systems and to reduce losses in distribution.

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

In 2008, the European Commission issued its **climate-energy package** that sets out measures to reduce greenhouse gas emissions and to increase the share of renewable energy sources in final energy consumption.

Directive 2010/31/EU on the energy performance of buildings promotes improving the energy performance of buildings.
Directive 2010/30/EU on indication by labelling and standard product information concerning the consumption of energy and other resources by energy-related products specifies how to inform end users about energy consumption during a product's use and about supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products.

Directive 2009/28/EC on the promotion of the use of energy from renewable sources establishes a common framework for the promotion of energy from renewable sources and sets mandatory national targets for the overall share of energy from renewable sources in the gross final consumption of energy and for the share of energy from renewable sources in transport. The directive establishes sustainability criteria for biofuels and bioliquids.

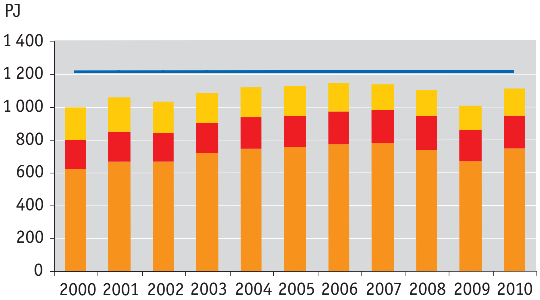
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Energy consumption affects energy production that, in turn, is closely interlinked with the emission of pollutants and greenhouse gases into the atmosphere. Due to greenhouse gas emissions, it contributes is adversely affecting climate change (increased incidences of hydrometeorological extremes – drought waves, floods and extreme temperatures), forest defoliation and damage to the landscape. Electricity and heat production is also accompanied by air pollution, which results in the increased incidence of respiratory problems and 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

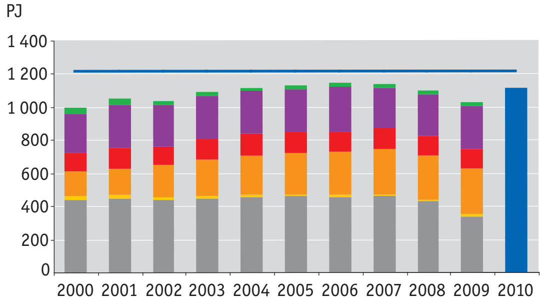
Chart 1 → **Final energy consumption trends by resource in the Czech Republic [PJ], 2000–2010**



Fuels
Electricity
Heat
SEC 2030 scenario

Source: Czech Statistical Office

Chart 2 → **Final energy consumption trends by sector in the Czech Republic [PJ], 2000–2010**

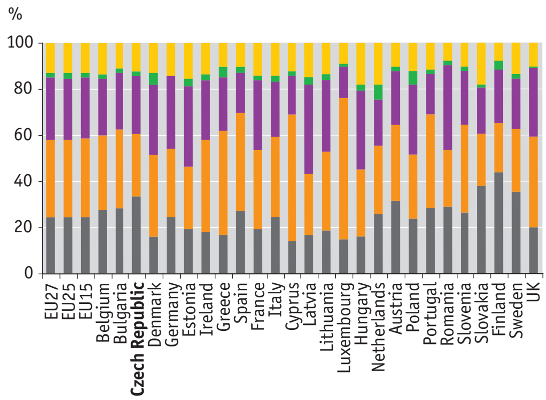


Industry
Construction
Transport
Other branches
Households
Agriculture and forestry
SEC 2030 scenario

Source: Czech Statistical Office

Due to the data processing methodology, figures for the sectoral breakdown of final energy consumption in 2010 were not available at the time of finalizing this report.

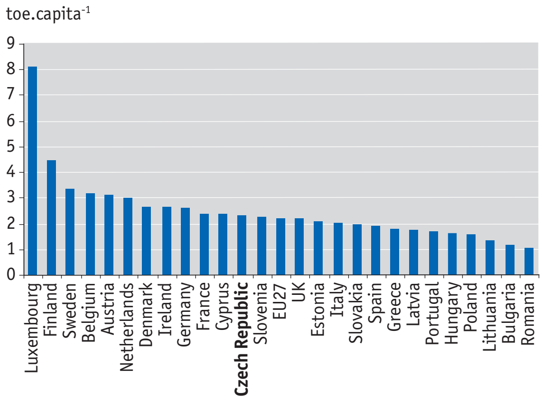
Chart 3 → **Final energy consumption by sector, an international comparison [%], 2009**



Industry
Transport
Households
Agriculture
Services

Source: Eurostat

Chart 4 → **Final energy consumption per capita, an international comparison [toe.capita^{-1}], 2009**



Source: Eurostat

toe – Ton of Oil Equivalent, a unit corresponding to the energy obtained from 1 t of oil (41.868 GJ or 11.63 MWh).

Total final energy consumption (Chart 1) has a fluctuating trend. From 2002 to 2006 it kept increasing. After a trend reversal in 2007 it kept decreasing year-to-year. While total energy started increasing again last year, this was at a time of growing industrial production and economy in general.

The highest final energy consumption (Chart 2) is reported by industry (33.2% in 2009). While final energy consumption in this sector used to fluctuate year-to-year, it has been declining every year since 2006 due to the restructuring of industrial sectors and the efforts to introduce energy-efficient technologies. The huge decline in consumption in 2009 (20.6%) was due to the economic crisis by which the sector was severely affected. 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.

The second largest consumer of energy in the Czech Republic is the **transport** sector that – unlike other sectors – shows consistent increases every year. The only exception was 2008, when a decline was caused by the incipient economic crisis that resulted in a generally lower transport volume. In 2009, transport accounted for 27.4% of total energy consumption (in 2008 it was 24.6%). Over the past 10 years (1999 to 2009) total energy consumption in the transport sector increased by 91.5%, which is connected with the increased share of transport in the emissions of greenhouse gases and air pollutants.

In 2009 **households** consumed 25.2% of energy. Energy consumption in this sector has a fluctuating trend, as it is affected by many factors including weather, the length of the heating season and temperatures during winter. Year-to-year, consumption in this sector slightly increased (by 2.9%) in 2009.

By international comparison to the EU27 countries (Chart 4), the Czech Republic has an average per-capita final energy consumption (2.32 toe per capita in the Czech Republic compared to 2.22 toe per capita in the EU27). Regarding energy consumption distribution in national economy sectors, the Czech Republic's industry accounts for a greater proportion of energy consumption compared to the EU27 and EU15 averages and, despite a strong increase in the transport sector over the past few years, energy consumption in that sector is still below the European average (Chart 3).

With the application of the measures of the State Energy Policy, the energy economy will **head towards** a higher valuation of energy inputs, increased savings and better energy management. It is expected that electricity consumption will increase, yet at a gradually diminishing rate. The share of renewable energy sources in total energy production and consumption should further increaase, so that renewable energy sources account for 13% of total production in 2020.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

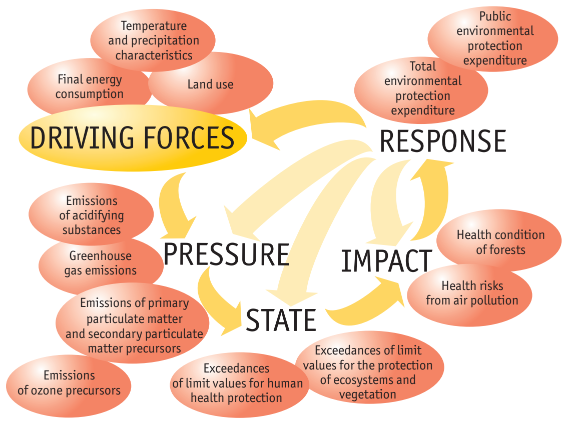
CENIA, key environmental indicators

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

20/ 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➔

Household heating significantly contributes to air pollution. In 2009, 32.5% of total PM_{10} emissions was discharged from local heating units.

The largest proportion of households is heated using natural gas and district heating. The number of households that use these heating methods is gradually increasing. In addition, the amount of heat generated from solar collectors and heat pumps is increasing each year.

Year-to-year, consumption increased for all types of fuels. Environmentally friendly sources (natural gas, biomass and solar panels) showed the largest increase.

OVERALL ASSESSMENT ➔

Change since 1990

Change since 2000

Last year-to-year change

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS ➔

One of the objectives of the **State Environmental Policy of the Czech Republic** is to reduce coal-fired local heating units that severely pollute the ground layer of the atmosphere. In addition, undisciplined burning of municipal waste produces emissions of toxic pollutants.

One of the objectives of the **State Energy Policy of the Czech Republic** is to promote heat savings in buildings and to support heat generated from renewable energy sources.

The **ecological tax reform** encourages citizens to use cleaner fuels for heating. Since January 2008, an excise tax (about 10% for coal, about 1% for electricity for heating) has been imposed on fuels that produce greater amounts of harmful emissions. The Green Investment Scheme promotes the replacement of coal-fired heating sources in households with environmentally friendlier sources. In public buildings, the replacement of coal-fired heating sources is financed by the Operational Programme Environment.

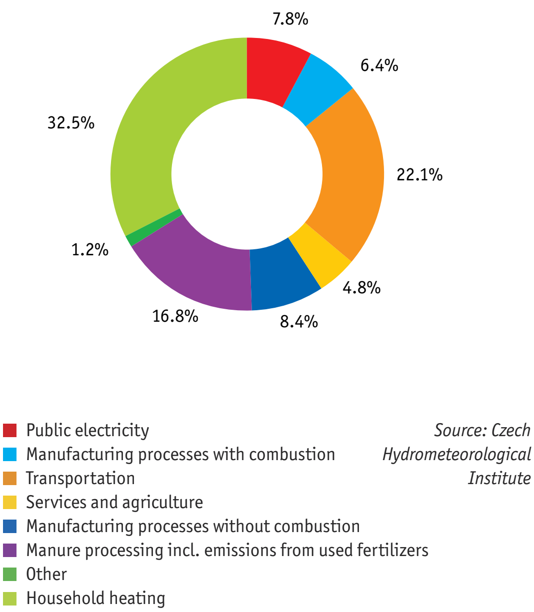
Decree No. 13/2009 Coll., on the setting of **fuel quality requirements** for stationary sources in terms of air protection The decree also applies to fuels (both solid and liquid) that are intended for combustion in small stationary sources. In particular, it sets the limit for the maximum allowable sulphur content in fuels and the requirements for their minimum calorific value.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS ➔

The household heating mix affects the air quality of the immediate environment in which we live. Local heating units significantly contribute to air pollution, as they produce more than 35% of total primary PM_{10} emissions. In addition, incomplete combustion of coal (and possibly co-combustion of plastics) produces carcinogenic polycyclic aromatic hydrocarbons that contribute to a number of health problems in the population – increased morbidity, especially an increased incidence of cardiovascular disease, cancer, respiratory problems and respiratory diseases. Particularly problematic is the immediate proximity of the emission source and the limited possibilities for regulating it.

INDICATOR ASSESSMENT

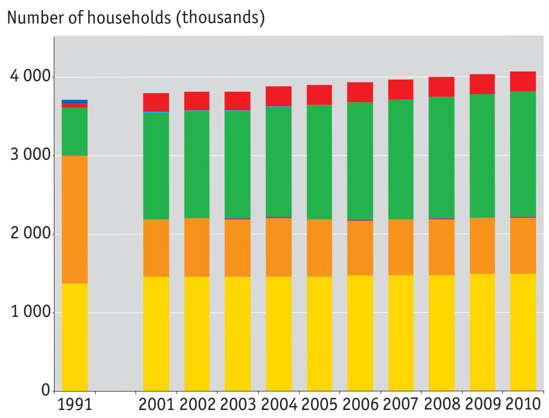
Chart 1 → **PM_{10} emissions from the different economic sectors in the Czech Republic [%], 2009**



Source: Czech Hydrometeorological Institute

Due to the processing methodology, figures for 2010 were not available at the time of finalizing this report.

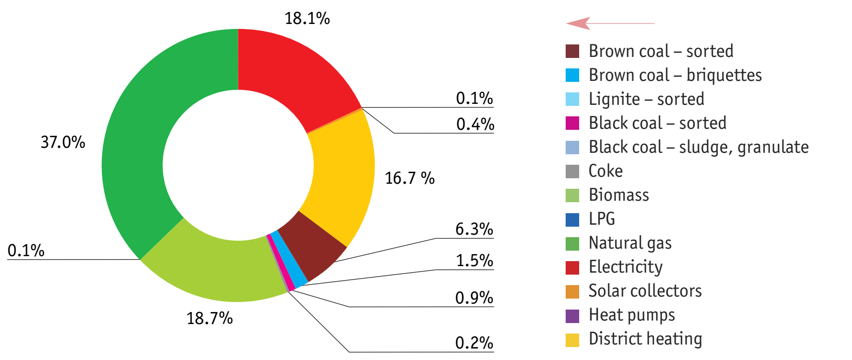
Chart 2 → **Household heating methods in the Czech Republic [thous. of households], 1991–2010***



Source: Czech Hydrometeorological Institute

** preliminary data*

Chart 3 → **Fuel and energy consumption by household (the proportion of energy contained in individual sources) in the Czech Republic [%], 2010**



Source: Ministry of Industry and Trade

In 2009, 32.5% of total **PM_{10}** emissions originated from **local heating units** (Chart 1). Compared to 2008, total PM_{10} emissions from local heating units decreased from 12.90 kt to 11.82 kt in 2009. The decrease in emissions was probably due to the winter season's milder temperatures compared to the previous year and state support that was provided for changing the manner of heating, especially the use of biomass and thermal insulation. In 2009, total PM_{10} emissions in the Czech Republic were 36.32 kt.

The **effects of local heating units** on the environment and in particular on the health of the population are considerable, especially if poor-quality fuels (or even rubbish) are used for heating. Unlike industrial facilities, local heating units operate at low combustion temperatures (incomplete combustion) and emissions are emitted at a low height above the ground. However, combustion technology also plays a major role.

In the Czech Republic, **limit values** for particulates that are valid in all EU countries are regularly exceeded – not only locally, but also in larger areas. In 2010, the limit value for the 24-hour average concentration of PM_{10} was **exceeded** in 21.2% of the Czech Republic and 48% of the Czech population was exposed to above-the-threshold concentrations.

Thanks to support for connecting households to natural gas, the **number of households** using solid fuels (especially coal) for heating significantly decreased compared to 1991 (Chart 2). Currently, natural gas and district heating (DH) are the most widely used household heat sources in the Czech Republic. Chart 2 shows "main heating"; also, it needs to be highlighted that the division of solid fuels into coal and wood is difficult to specify since these two fuels are, to a large extent, burned together and, from the user's perspective, their actual mutual proportion largely depends on their price. Households usually use multiple types of fuels for heating – the most common combinations include gas/wood and coal/wood, in rural areas. Another typical combination is gas with electricity/coal/wood.

In 2010, the **total amount of energy** that was delivered to households (100% in Chart 3) within the different sources was about 300 000 TJ, which is 10% more than in 2009. This increase is connected with the length of the heating season and temperatures during the winter season. In 2010, the heating period required 8% more heating compared to the long-term average. By contrast, 2009 was 7% less demanding that the long-term average.

Year-to-year, the **consumption** of heating **fuels** by households increased for all types of fuels. Natural gas showed the largest increase – its consumption rose by 15.9% (approximately 15 250 TJ). Heat production from solar collectors is still experiencing a boom; it increased by 45.7% year-to-year. However, the share of solar energy is still relatively small, accounting for only 0.1% of heat for household heating. Solar collectors are more often used for producing hot water and for preheating water for heating. Biomass consumption also increased significantly, namely by 11.5% (5 815 TJ).

In 2009, the **Green Savings national subsidy programme** was announced. It supports reducing energy requirements for heating in buildings, thus reducing the amount of emissions produced by local sources for household heating. From the start of the programme until 31 December 2010, the State Environmental Fund of the Czech Republic financed 13 500 applications for support totalling CZK 2 billion. While the programme is expected to continue until the end of 2012, the receipt of applications was put on hold at the end of October 2010 due to the large number of received applications and the limited resources available.

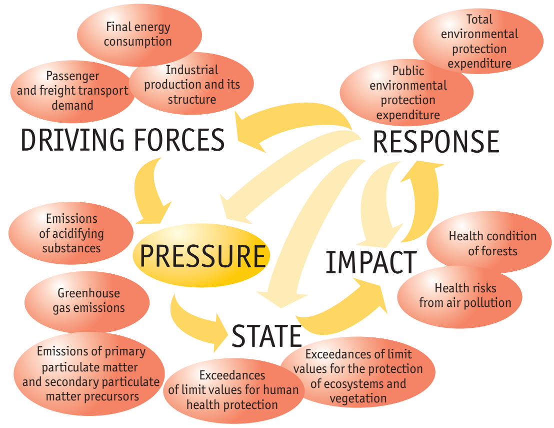
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1891)

21/ Energy intensity of the economy

KEY QUESTION

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



KEY MESSAGES

The energy intensity of Czech GDP is still high compared to the EU average.

The energy intensity of the economy showed a 2.9% year-to-year increase. However, over the long horizon since 2000, it has declined by a total of 19.0%.

The efficiency of energy use in industry is improving.

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)** include accelerating then stabilising the decrease in the energy intensity of GDP at an annual rate of 3.0–3.5% (indicative objective); accelerating then stabilising the decrease in the energy intensity of GDP at an annual rate of 1.4–2.4% (indicative objective).

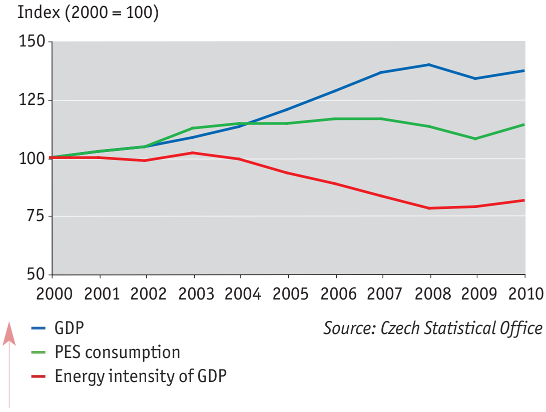
The State Environmental Policy of the Czech Republic aims to reduce energy intensity (energy consumption per GDP unit) in pursuance of the objectives of the State Energy Policy. Another goal is to reduce the energy intensity of the national economy by developing regional energy policies, performing energy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

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Higher energy intensity results in higher specific emissions of pollutants and greenhouse gases. More than 80% of total greenhouse gas emissions are produced by the energy sector. Furthermore, the energy sector accounts for 62% of SO_2, 34% of NO_x and 7% of PM_{10} emissions. In the Czech Republic, this is connected with the 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), forest defoliation and damage to the landscape. Air pollution poses a risk to human health.

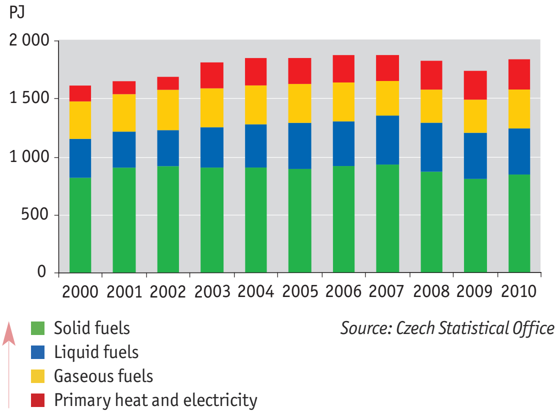
INDICATOR ASSESSMENT

Chart 1 ➜ **Energy intensity of Czech Republic's GDP [index, 2000 = 100], 2000–2010**



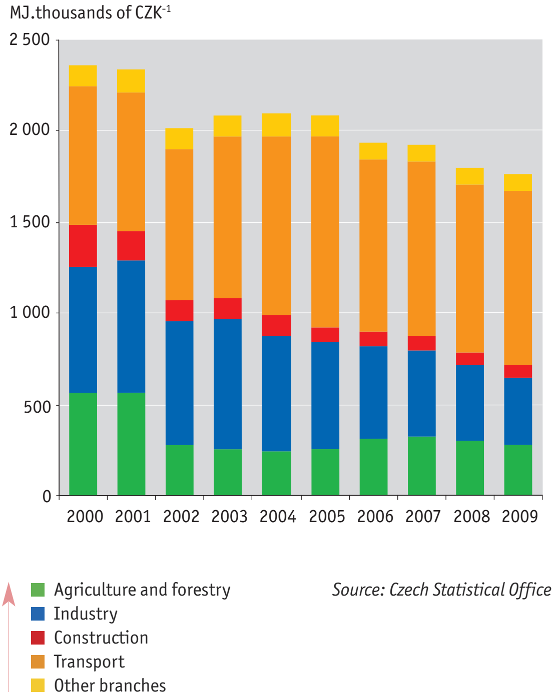
Source: Czech Statistical Office

Chart 2 ➜ **PES consumption trends in the Czech Republic [PJ], 2000–2010**



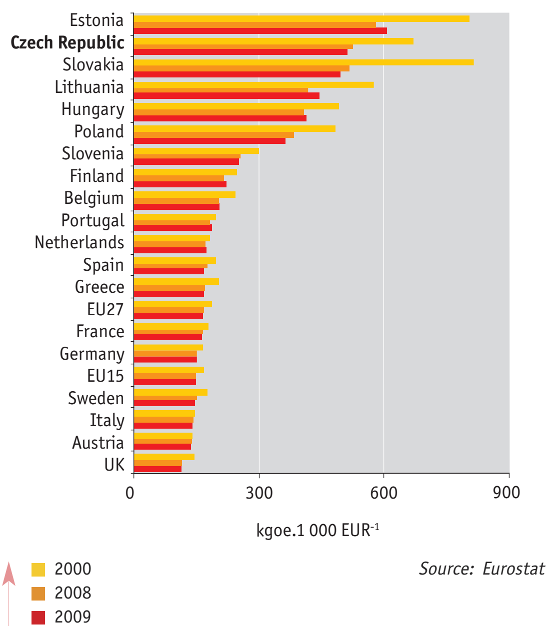
Source: Czech Statistical Office

Chart 3 ➜ **Energy intensity trends by sector, expressed as the quotient of total energy consumption in the sector and gross added value in the sector in the Czech Republic [MJ.thousands of CZK⁻¹], 2000–2009**



Source: Czech Statistical Office

Chart 4 ➜ **Energy intensity of the economy, an international comparison [kgoe.1 000 EUR⁻¹], 2000, 2008, 2009**



Source: Eurostat

Due to the processing methodology, figures for 2010 were not available at the time of finalizing this report.
The 'Other branches' category includes trade, repair of motor vehicles and consumer goods, the hotel and restaurant industry, banking and insurance, real estate, services for businesses , public administration, education, health care, public, social and personal services and households.

kgoe – Kilogram of Oil Equivalent, a unit corresponding to the energy obtained from 1 kg of oil (41.868 MJ or 11.63 kWh).

In the Chart, energy intensity is calculated as gross energy consumption per GDP at constant 2000 prices.

Following a decline in energy intensity that occurred in the mid-1990s mainly as a result of economic restructuring, there was stagnation at the time of the economic crisis around 2000. However, the situation has considerably improved since 2004 and energy intensity has been rapidly decreasing (Chart 1). This phenomenon was largely caused by economic growth, especially in industrial sectors. Until 2008, domestic energy consumption per unit of GDP steadily declined. However, both primary energy sources (PES) consumption and GDP declined in 2009 due to the financial and economic crisis, which also significantly impacted the economy's energy intensity that temporarily increased.

The **Czech economy started to grow again** in 2010. This situation affected the consumption of primary energy sources (PES) towards higher consumption (an increase of 5.3%), but GDP grew as well, by 2.3%. Both of the above figures affected the overall energy intensity of the economy, which increased by 2.9% last year, following a slight increase in the previous year that had been caused by the economic crisis. However, there remains a noticeable downward trend over the long run – the energy intensity of the Czech economy has decreased by 19.0% compared to 2000.

The consumption of primary energy sources (PES) in the Czech Republic (Chart 2) has been continuously growing on a year-to-year basis since 2000, by 0.5 – 6.6%. The trend reversed in 2007 and PES consumption started to decline. In 2009, the year-to-year decline in PES consumption was considerable (by 4.5%). In 2010, however, the consumption of primary energy sources grew by 5.3% on a year-to-year basis due to economic recovery after the economic crisis.

Year-to-year, there were no significant changes in the **breakdown of primary energy sources**. The only notable shift was a 2.6% increase in the production of primary heat and electricity (nuclear and hydroelectric power plants). Over the long term since 2000, the share of solid fuels has declined (from 50.8% to 46.0%), while the importance of liquid fuels (from 20.1% to 21.8%) and primary heat and electricity (from 8.9 % to 13.9%) has increased. This indicates an increase in the proportion of transport in total energy consumption, which correlates with the increased proportion of transport emissions in the total emissions of pollutants, especially PM and PAH. The increased proportion of primary heat and electricity in total consumption can be explained by the decreased availability of coal and the efficiency of the EU European Trading Scheme for greenhouse gas emissions that leads to greater use of emission-free sources (i.e. sources that do not produce greenhouse gases).

High energy intensity (Chart 3) is seen in the transport, industry and agriculture **sectors**. While the energy intensity of industry has been steadily declining over the long run (by 47% between 2000 and 2009, by 9.8% between 2008 and 2009), which suggests that the competitiveness of key sectors of industry is increasing by international comparison, the energy intensity of transport has been stagnating or slightly growing. Although the energy intensity of agriculture is relatively high, its long-term trend is rather positive (i.e. downward).

By international comparison, the Czech Republic has been consuming more primary energy and electricity sources – in proportion to the amount of GDP generated – than other EU countries (the value of consumed energy translates little into added value). Despite these achievements, the energy and electricity intensity of Czech GDP remains high compared to the EU average (Chart 4).

In line with EU practices, the Czech Republic has already implemented standard systemic measures conditioning the **growth in economic efficiency** (adjusting energy prices, incentive measures towards energy savings). For example, the Operational Programme Enterprise and Innovation (OPEI), Operational Programme Environment (OPE) and the Green Savings programme are some of these measures. Increasing energy efficiency is no doubt the most significant way to reduce energy demand, pollutant emissions into the environment and the growth of import energy dependence, and to increase the competitive strength of the energy sector and the economy as a whole.

With the application of the current **State Energy Policy** measures, energy management will head **towards a high valuation of energy inputs**. The energy intensity of GDP will decrease from 1.2 $MJ.CZK^{-1}$ to 0.5 $MJ.CZK^{-1}$, i.e. to 37%, by 2030. The valuation of energy consumed for GDP will increase along with savings, and energy management will improve. The combination of both factors will contribute to positive trends in the energy intensity of GDP and a fast convergence with levels found in other EU countries. For the period up to 2030, the average annual rate of decline in the energy intensity of GDP is projected at 3.22%. The average annual rate of decline in the electricity intensity of GDP is projected at 2.35%, while import energy intensity is expected to increase to 57.8% by 2030.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

22/ Structure of electricity and heat generation

KEY QUESTION →

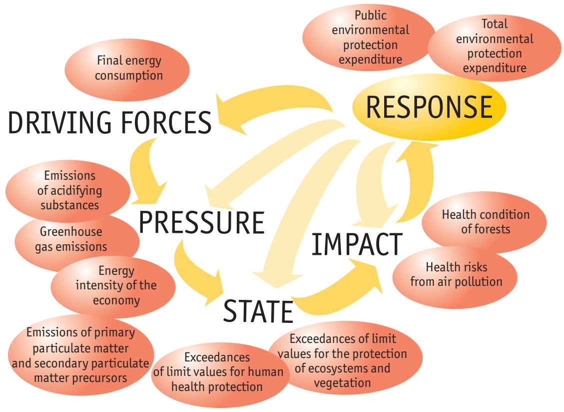
What is the mix of energy sources and what is the proportion of renewable energy sources?

KEY MESSAGES →

Electricity generation from renewable sources is increasing. The proportion of electricity generated from RES in gross electricity consumption in the Czech Republic showed a significant year-to-year increase from 6.8% in 2009 to 8.3% in 2010. However, this is still short of 8%, the indicative target for 2010.

The Czech Republic's overall energy dependence is 25.1%. Compared to other European countries, this figure is relatively low, as the average energy dependence of the EU27 is 53.9%, i.e. more than twice as high.

85 910 GWh of electricity was generated in the Czech Republic in 2010, which is 4.4% more than in 2009. Power plants, mainly brown-coal-fired, account for the largest share of generated electricity (62.4%). However, the share of gas-steam power plants that use natural gas has been increasing in recent years (Chart 2). The second largest electricity producer was nuclear power plants (32.6%).



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

In 2008, the Council of the European Union approved an **climate-energy package** that sets out measures to reduce greenhouse gas emissions by 20% by 2020 compared to 1990 and measures to increase the share of renewable energy sources in final energy consumption to 20% on average for the entire EU by 2020. Over the same period, accomplishing the EU objectives should result in a 20% increase in energy efficiency.

The **State Environmental Policy of the Czech Republic** aims for the maximum replacement of non-renewable sources with renewable sources. In the Accession Treaty that was signed in Athens in March 2003, the Czech Republic committed itself to achieving a minimum proportion of 8% of electricity from renewable sources in the Czech Republic's gross electricity consumption by 2010. In connection with the adoption of new **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 final energy consumption by 2020 was distributed among the EU member states. The Czech Republic's objective was set at a 13% proportion of energy from renewable energy sources in final energy consumption by 2020.

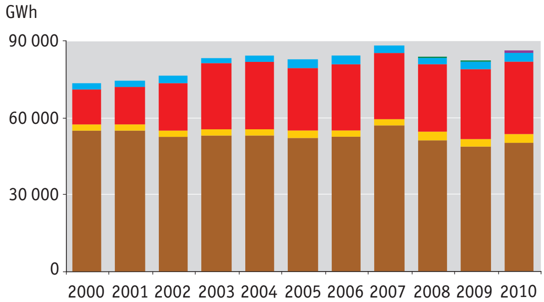
The State Energy Policy of the Czech Republic aims to prevent exceeding the threshold levels for energy import dependence (indicative targets):
– a maximum of 45% in 2010
– a maximum of 50% in 2020
– a maximum of 60% in 2030.

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), forest defoliation and general damage to the landscape. 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, surface brown coal 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

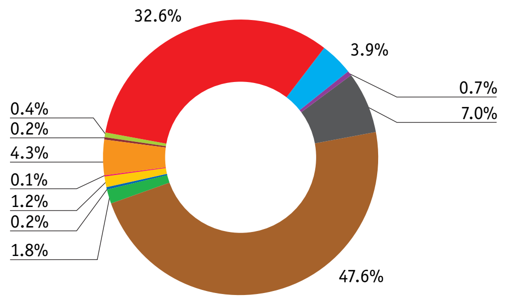
Chart 1 ➜ **Electricity generation by power plant type in the Czech Republic [GWh], 2000–2010**



- Steam
- Gas-steam and gas combustion
- Nuclear
- Hydroelectric
- Wind
- Solar
- Other

Source: Energy Regulatory Office

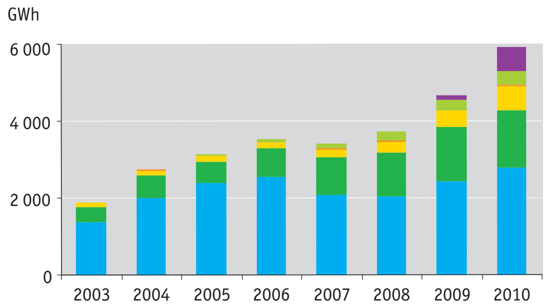
Chart 2 ➜ **Electricity generation by fuel type [%], 2010**



- Black coal
- Brown coal
- Biomass
- Oils
- Natural gas
- Landfill gas
- Other gases
- Unspecified fuel
- Wind power plants
- Nuclear power plants
- Hydroelectric power plants
- Solar power plants

Source: Energy Regulatory Office

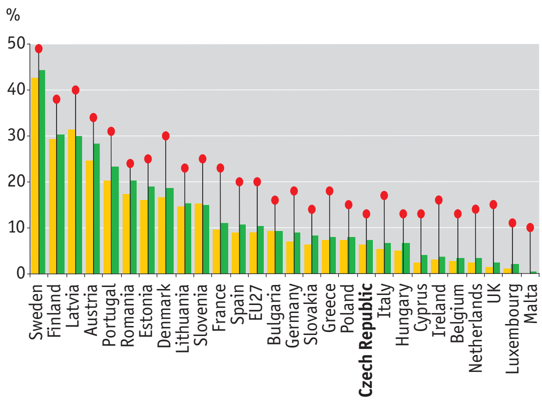
Chart 3 ➜ **Electricity generation from renewable energy sources in the Czech Republic [GWh], 2003–2010**



- Hydroelectric power plants
- Biomass
- Biogas
- Municipal solid waste (biologically degradable municipal waste)
- Wind power plants
- Photovoltaic cells

Source: Ministry of Industry and Trade

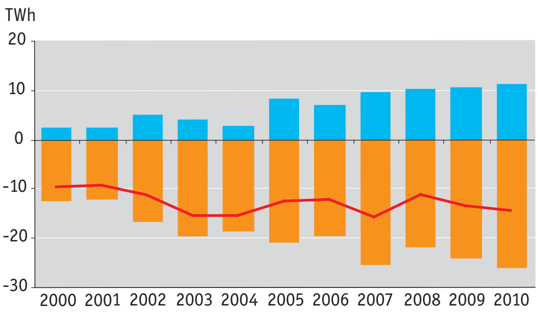
Chart 4 ➜ **Proportion of RES in gross electricity consumption [%], an international comparison, 2006, 2008**



- 2006
- 2008
- target for 2020

Source: Eurostat

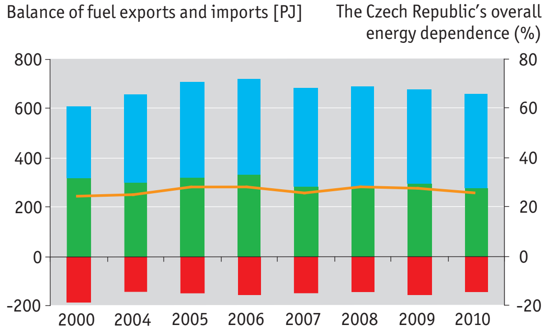
Chart 5 → **Electricity imports and exports from the Czech Republic [TWh], 2000–2010**



Imports
Exports
Export-import balance

Source: Energy Regulatory Office

Chart 6 → **Export-import balance for different fuels, the Czech Republic's overall energy dependence [PJ, %], 2000–2010**



Energy dependence (right axis)
Solid fuels (left axis)
Liquified fuels (left axis)
Gaseous fuels (left axis)

Source: Czech Statistical Office

Even though **total electricity generation** fluctuated between 2000 and 2010, there was an overall upward trend. In 2010, the amount of generated electricity increased by 16.9% compared to 2000, the year-to-year increase (2009/2010) was 4.4%. Over the long term, the share of electricity produced by steam power plants (Chart 1) has decreased and, by contrast, the importance of nuclear energy has increased. All types of power plants showed year-to year increases in production: steam (especially fossil-fuel-fired) power plants (an increase of 3.7%), nuclear (2.9%), hydroelectric (13.4%) as well as the 'other' category that includes electricity from wind and solar power plants (152.4%).

In the Czech Republic, **steam power plants** still account for the largest proportion of **electricity generation** (62.4%), i.e. mainly **brown-coal-fired** power plants (47.6%, Chart 2). In 2010, 53 580 GWh of electricity was generated by steam power plants. Nuclear power plants are second (the Dukovany and the Temelín nuclear power plants). With a total production of 27 998 GWh, they contributed 32.6% of the electricity generated in 2010.

Each year, the share of **electricity generated from renewable energy sources** increases (Chart 3). In 2010, 5 903 GWh of electricity was obtained from RES, which corresponds to 6.9% of the total amount of electricity generated in the Czech Republic (in 2009, the proportion was 5.7%). The proportion of electricity generated from renewable energy sources in the Czech Republic's gross electricity consumption increased from 6.8% in to 8.3% year-to-year. The **indicative target** of 8% for 2010 has thus been **met**.

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

The mix of **renewable energy sources used for generating electricity** is rather varied (Chart 3). Electricity generation in **hydroelectric plants** accounts for the highest proportion (47.4% of RES), followed by electricity generation from **biomass** (25.7%). In 2010, **photovoltaics** experienced a boom. Year-to-year, the amount of electricity generated by solar power plants increased from 89 GWh to 616 GWh, i.e. nearly sevenfold. However, this happened at the cost of disrupting socio-economic and landscape ties. Other sources remain relatively underused; they mainly include energy generation from biogas (10.2%), wind power (5.7%), and the incineration of municipal solid waste (0.6%).

The amount of heat generated from renewable sources has been increasing every year; in 2010 it increased by 9.3% on a year-to-year basis. In the Czech Republic, biomass accounts for the largest share of heat generated from renewable energy sources (87.8%), while other sources have much smaller shares (waste 5.1%, heat pumps 3.3%, biogas 3.0%, solar thermal collectors 0.7%). The principal factor in estimating heat generation from RES is the consumption of biomass by households.

In 2009, the public energy sector accounted for 63.5% of total SO_2 emissions and 34.2% of NO_x emissions. However, the amount of emissions of these substances per unit of generated energy has been steadily declining over the long term. Compared to 2000, NO_x emissions per GWh of generated electricity decreased by 24.6%, SO_2 emissions even by as much as 34.6%.

In 2010, electricity exports amounted to 26 GWh (Chart 5), i.e. 30.3% of all production. In the same year, however, 11.1 GWh of electricity was imported. The balance of exports and imports is thus 14.9 GWh, which represents 17.3% of the total amount of electricity generated in the Czech Republic (85 910 GWh).

Energy security includes everything the state must do in order to prevent threats to the steady supply of energy into the national economy. Its interruption may lead to enormous economic losses and, in the worst case scenario, a loss of life. 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. It also imports nuclear fuel for nuclear power plants, even though the Czech Republic is the only producer of uranium in the EU. However, it does not have the technology to produce nuclear fuel. More than two-thirds of oil and gas and all nuclear fuel are bought from Russia. In 2010, the Czech Republic's overall energy dependence was 27.0%. In comparison to other European countries, this figure is relatively low, since the average energy dependence of the EU27 is 53.9%, i.e. almost twice as high.

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 exports. At the end of the period (2030), energy imports will be dominated by nuclear fuel (35%) followed by natural gas (34%), liquid fuels (14.5%), and black coal and coke (9% of all imports of energy sources). The Czech Republic will be fully dependent on natural gas, 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)

23/ Passenger and freight transport demand

KEY QUESTION

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

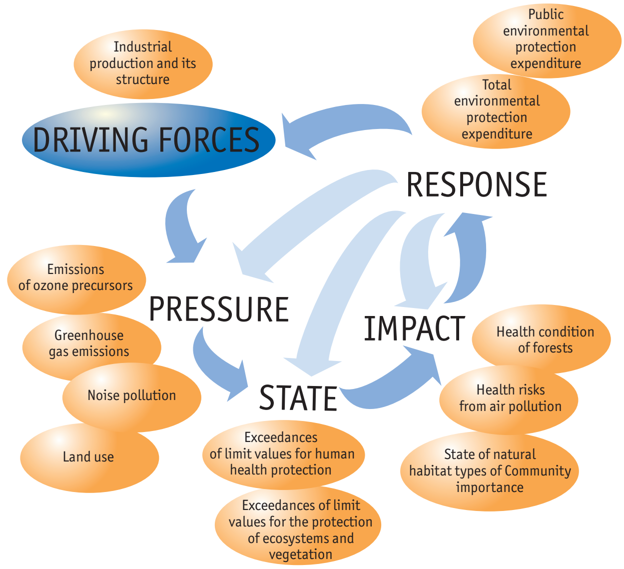
KEY MESSAGES

The long-term upward trend in passenger car and air transport demand has come to a halt in the Czech Republic. Year-to-year, passenger car transport declined by 12.9% and air transport by 4.8% in 2010. The proportion of public transport in total passenger transport thus increased by 3.3 percentage points year-to-year. By contrast, bus transport demand (excluding urban public transport) increased by 13.9% year-to-year in 2010, mainly due to an increase in the number of passengers in regular domestic transport. The proportion of public transport in total passenger transport thus increased by 3.3 percentage points year-to-year.

The emission of pollutants from motor transport decreased significantly year-to-year in the Czech Republic in 2010, including particulate matter emissions. The decrease occurred both in passenger car transport and freight road transport.

Year-to-year, reported fuel consumption dropped in 2010, namely by 9.1% for petrol and by 5.5% for diesel. However, given the trends in freight and bus transport, this may be (especially in the case of diesel consumption) the effect of refuelling abroad due to the Czech Republic's high consumption tax on fuel.

Following a drop in 2009, freight transport demand increased significantly in 2009, especially in the case of freight road transport (an increase of 15.3% over one year). The proportion of freight road transport in freight transport demand remains at ¾ of total freight transport demand.



OVERALL ASSESSMENT

Změna od roku 1990	
Změna od roku 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The transport-related priorities of the current **State Environmental Policy of the Czech Republic** for 2004–2010 include shifting the passenger and freight transport structure in favour of environmentally friendly modes, reducing the impact of road transport on the environment, reducing landscape fragmentation due to transport infrastructure, reducing the consumption of non-renewable energy sources in transport and minimizing the impacts of transport on human health and ecosystems in terms of air pollution and noise from transport.

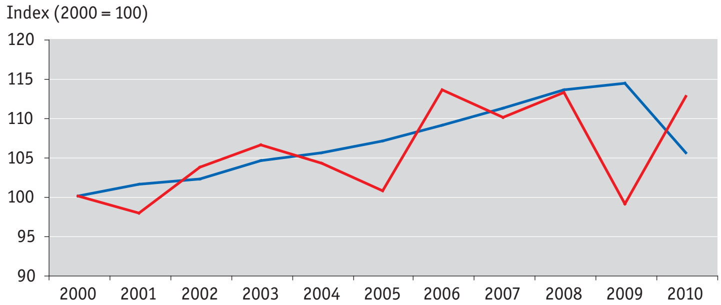
The **Transport Policy of the Czech Republic** for 2005–2013 is based on a global objective that was developed through four cross-cutting and five specific priorities that are directly related to the transport sector. The global objective of the Policy is: „...to create conditions for ensuring quality transport with focus on its economic, social and environmental impacts within the scope of sustainable development principles, and to lay realistic foundations to initiate changes in the proportions among individual transport modes". One of the cross-cutting priorities is „Limiting the environmental and public health impacts of transport in line with sustainable development principles".

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Transport, especially road transport, affects air quality and produces noise pollution that burdens the population. In terms of human health, the greatest risk is posed by exposure to fine suspended particulate matter (PM2.5), which is produced both by combustion engines (especially diesel engines) and as a result of brake and tyre wear and the stirring up of existing contaminants from road surfaces. Excessive noise disturbs sleep, affects the circulatory system, weakens immunity and may aggravate mental illness. Fine particulate matter causes respiratory diseases and – due to its chemical composition, particularly the high levels of carcinogenic substances – leads to other serious diseases. Traffic accidents also have a direct impact on human health and lives. Car transport in cities has the greatest impact – it degrades the urban environment and creates 'hot spots' with extreme air pollution and noise levels. Ecosystems and vegetation are damaged by air pollutants (ground-level ozone) that form from precursors that are produced by transport, in particular nitrogen oxides and volatile organic compounds.

INDICATOR ASSESSMENT

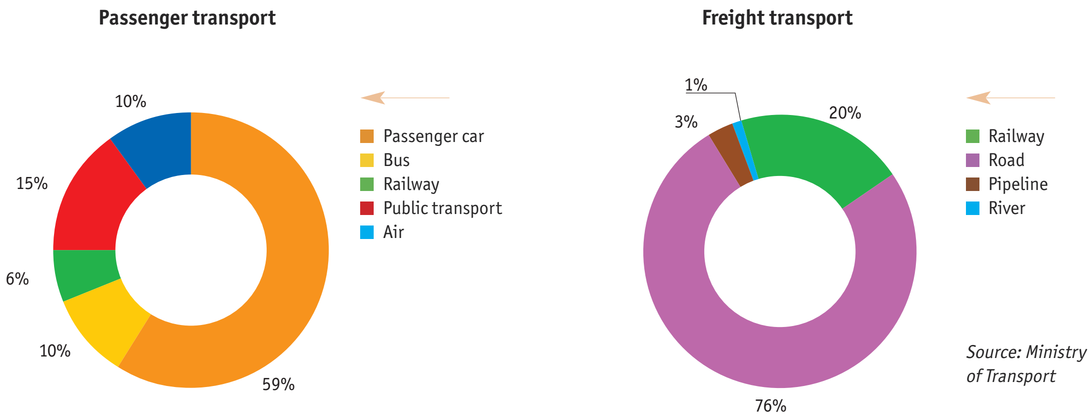
Chart 1 → **Transport demand[1] for passenger and freight transport in the Czech Republic [index, 2000 = 100], 2000–2010**



Source: Ministry of Transport

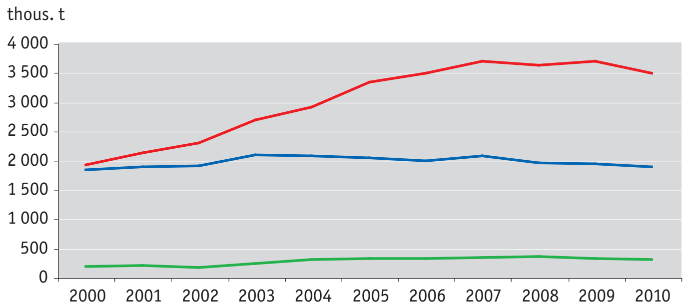
Note: In 2010 there was a change in the methodology for calculating passenger car transport demand.

Chart 2 → **Breakdown of passenger transport demand and freight transport demand in the Czech Republic, by transport mode [%], 2010**



Source: Ministry of Transport

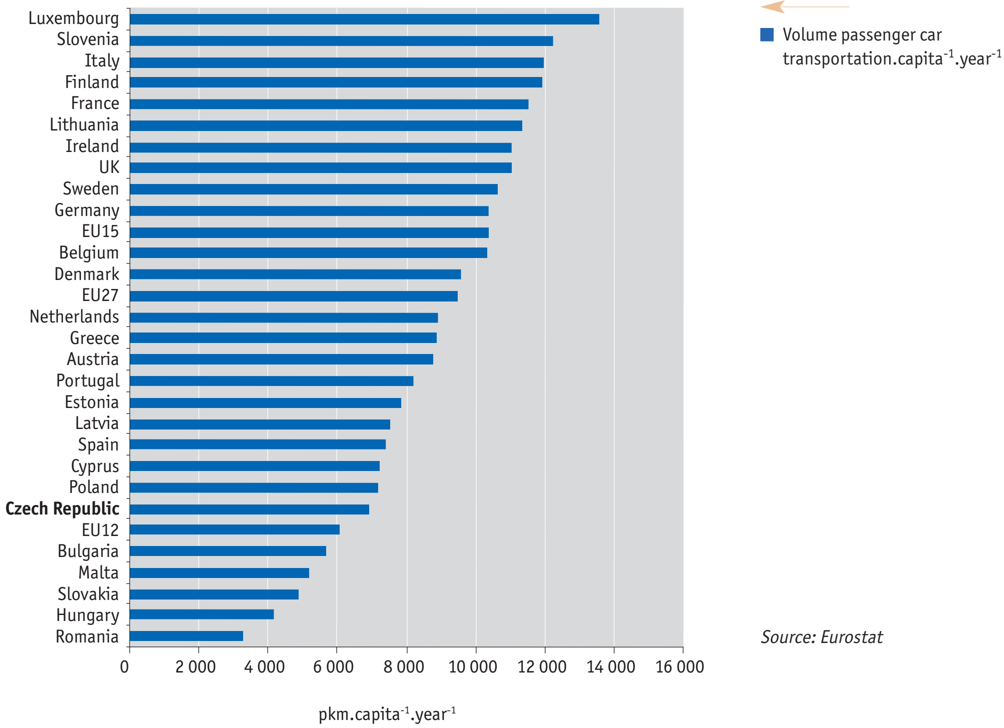
Chart 3 → **Fuel consumption in the transportation in the Czech Republic [thous. t], 2000–2010**



Source: Czech Statistical Office

[1] *Transport demand indicates the transport performance – i.e. how many persons or tonnes of goods were transported and how far. It is defined as transport performance (i.e. the distance travelled by a given vehicle regardless of the load or number of passengers) multiplied by transport volume (the number of persons or the quantity of goods that were transported). The unit of transport demand is passenger-kilometres (pkm) and tonne-kilometres (tkm).*

Chart 4 → **Volumes of passenger car transportation per capita, an international comparison [pkm.capita^{-1}.year^{-1}], 2009**



Source: Eurostat

After a period of consistent growth starting in 1993, **total passenger transport demand decreased by 7.4% year-to-year in 2010** (Chart 1). The above trend is largely attributable to a decline in reported passenger car transport demand, namely by 12.9% (approximately 9.4 billion pkm). However, this radical decline needs to be viewed in the context of the changed methodology for calculating passenger car transport demand that builds on the transport census that was carried out by the Road and Motorway Directorate in 2010. Specifically, the conversion coefficients for roads not covered by Road and Motorway Directorate monitoring have been adjusted and new findings concerning traffic flow structure have been considered. Taking account of possible inaccuracies in estimates of passenger car transport demand over the past years and the conclusions of the transport census in 2010 (both indicating stagnation in transport on most roads), these developments cannot yet be interpreted as the beginning of a downward trend in passenger car transport demand. Also, air transport demand decreased by 4.8% year-to-year, which was the first year-to-year decline since 1991. This was probably a delayed effect of the global economic crisis that significantly affected the air transport sector.

By contrast, **public road transport demand** (regular and irregular bus service, excluding urban public transport) **increased by 13.9% year-to-year in 2010**, thus increasing the proportion of buses in total passenger transport demand by 1.7 percentage points to 10% (Chart 2). This trend reflected an increase in regular domestic bus transport, where the number of passengers increased by approximately 13.5 million year-to-year in 2010, i.e. by 4.1% (traffic demand by 13.3%), and irregular transport. By contrast, international bus transport has been experiencing a decline in passenger numbers over the long term – the number of passengers has declined by 322 000 (i.e. 22.2%) since 2008 and the year-to-year decrease was 6.7% in 2010. Urban public transport demand remained virtually unchanged year-to-year. The developments in passenger transport indicate that transport 'individualization' has stopped and there has been a shift towards public transport modes. In terms land transport, the share of public transport modes (rail, bus and urban public transport) increased from 27.4% in 2009 to 30.7% in 2010, while the share of passenger car transport declined from 62.7% to 59.2%.

In 2010, total freight transport demand increased significantly by 13.8% year-to-year, exceeding the 2008 level (Chart 1). This was probably the result of industrial production growth (the automotive industry) and export growth. In terms of freight transport, rail transport demand increased by 7.7% and **road transport demand increased by as much as 15.3% over one year.** International road transport demand increased by 5.6 billion tkm (i.e. by 17.8%) and its volume grew by 9.4 million tonnes (20.9%) in 2010, thus contributing 81.5% to the overall increase in freight road transport demand. By contrast, the volume of domestic freight road transport decreased by 23.6 million tonnes (7.6%), but since the average travel distance in domestic transport increased from 41 km in 2009 to 49 km in 2010, transport demand grew by 9.4% year-to-year (however, it was 6.2% below the 2008 level). The proportion of freight road transport in total freight transport demand further increased, reaching 76% in 2010.

The somewhat unusual combination of declining passenger transport demand and growing freight transport can be interpreted as a delayed impact of the economic crisis on household consumption at a time when the Czech Republic's economy was already experiencing a boom that translated into industrial production growth.

Fuel consumption in transport in the Czech Republic displayed a downward trend (Chart 3), despite the growing freight transport demand. In 2010, petrol consumption dropped by 9.1% (184 kt), diesel consumption by 5.5% (205 kt) and kerosene by 6.3% (21 kt). While petrol consumption has been stagnating since 2000, diesel consumption has experienced considerable growth, namely by 64.3% compared to 2001. This is the result of growth in freight road transport and the increasing proportion of diesel vehicles in the passenger-car and light commercial vehicle fleet. Liquid propane gas (LPG) consumption has stagnated, while compressed natural gas (CNG) consumption has been growing - although its total consumption levels are low (7 000 tonnes in 2010). The position of alternative fuels and drives remains marginal in the Czech Republic. In 2010, consumption tax collection (a tax rate that increased by ca CZK 1 per litre as of 1 January 2010) decreased by 1.6% (CZK 500 million) for petrol, while consumption tax collection for diesel increased by 5.4% (CZK 2.5 billion).

From the European perspective, passenger car transport demand per capita is below average in the Czech Republic (Chart 4), but the specific emissions per unit of transport demand are relatively higher. The Czech Republic's per-capita passenger car transport demand, i.e. the distance that every citizen travels on average in a car every year, was 6 915 km in 2009, i.e. 33.4% lower than the EU15 and 27% lower than the EU27 average. However, passenger car transport is above average in the Czech Republic compared to the EU12 – the lowest specific demand is in Romania, Hungary and Slovakia (under 5 000 km per capita), while Poland, Latvia and Estonia show greater figures than the Czech Republic. Transport in the Czech Republic produces higher specific emissions of greenhouse gases and particulate matter per unit of transport volume compared to the average for EU member countries, i.e. it is more emission intensive. In 2009, specific greenhouse gas emissions per unit of transport demand were 136.5 g/pkm for passenger car transport and 127.3 g/tkm for freight road transport in the Czech Republic. The average for all EU member countries is 114 g/pkm for passenger transport and 111 g/tkm for freight transport. This is mainly the result of the vehicle fleet composition, with the average vehicle age being significantly higher in the Czech Republic than the EU27 average.

According to the trends in transport emissions, **air pollution from transport is gradually declining. Significant decreases in emissions have been recorded for nitrogen oxides** (7.4% year-to-year in 2010), VOC (10.7%) and **carbon monoxide** (11.8%). After a period of growth at the beginning of the 21st century and the subsequent stagnation, particulate matter emissions from transport also decreased by 8.9% year-to-year in 2010. Compared to the previous year, greenhouse gas emissions (CO_2 and N_2O) stagnated in 2010. However, the marked positive trends in emissions in 2010 need to be viewed in the context of the economic crisis, the changed method for calculating passenger car transport demand and the purchase of fuels abroad motivated by a lower consumption tax (that consumption is thus not reflected in Czech statistics). Therefore, such significant declines cannot be expected to continue in the future. In terms of the trends in particulate matter pollution, it needs to be pointed out that particulate matter emissions are produced not only by combustion engines (especially diesel engines that account for an ever increasing proportion in the passenger-car fleet) but also as a result of brake and tyre wear and from road surfaces. It is this component of particulate matter pollution – which is not covered by emission inventories that are based on combustion processes (Transport Research Centre) – that will increase significantly in the future according to model simulations (provided that transport demand increases).

It can be assumed that the future trends in the Czech Republic's transport system will depend, to a large extent, on economic development. The proportion of passenger car transport in total transport demand is not likely to further increase. As long as quality services are provided, there is growth potential in mass public transport (buses, trains and urban public transport) and especially transport in urban agglomerations. The trends in freight road transport point towards an increase in long-distance (especially international) transport, i.e. both domestic and third-country transport (transit and terminating transport). It can therefore be assumed that the use of highways and higher-class roads by freight transport will increase (or at least stagnate). The declining trend in the use of lower-class roads cannot yet be confirmed. The emission intensity of transport along with the renewal of the vehicle fleet is likely to further decline.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1894)

24/ Structure of passenger-car and truck fleet

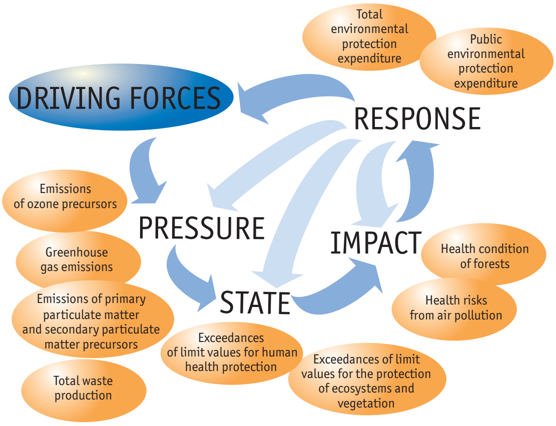
KEY QUESTION→

Has there been improvement in the parameters of the road vehicle fleet and, in turn, a reduction in environmental pressure?

KEY MESSAGES→

In 2010, the sales of new passenger cars increased by 4.7% year-to-year in the Czech Republic, while the imports of used cars from abroad dropped by 25% compared to the previous year. If this trend continues, there would be potential for an increase in the proportion of newer vehicles in the vehicle fleet and for a decrease in the overall age of the vehicle fleet. The Czech Republic's automotive industry is doing well; it has been rapidly growing since 2005 (exceeding 1 million vehicles per year), with the year-to-year production growth being 9.6% in 2010. Most cars that are manufactured in the Czech Republic are exported.

The number of registered vehicles keeps growing which, in turn, increases the burden on both the environment and the road network and exerts pressure towards road network expansion. For all categories except for vans up to 3.5 t, the age of the vehicle fleet is very high and it further increased in 2010. The average age of the passenger-car fleet is 13.7 years, while the EU27 average is approximately 8 years. 61% of the passenger cars in the register (approximately 2.7 million vehicles) are older than 10 years, 30% of the cars are older than 15 years.
The proportion of diesel passenger cars in the Czech Republic's passenger-car fleet has been growing significantly, accounting for one quarter of the total vehicle fleet (approximately 1.1 million vehicles). Based on new vehicle registrations, where diesel accounted for a 39.9% share in 2010 (31% in 2009), it is likely to continue growing. This increases the amount of particulate matter emissions that are produced by the vehicle fleet. Having only a marginal role within in the Czech Republic's vehicle fleet, alternative fuels and drives showed no significant changes.



OVERALL ASSESSMENT →

Změna od roku 1990	:-)
Změna od roku 2000	:-(
Last year-to-year change	:-(

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS→

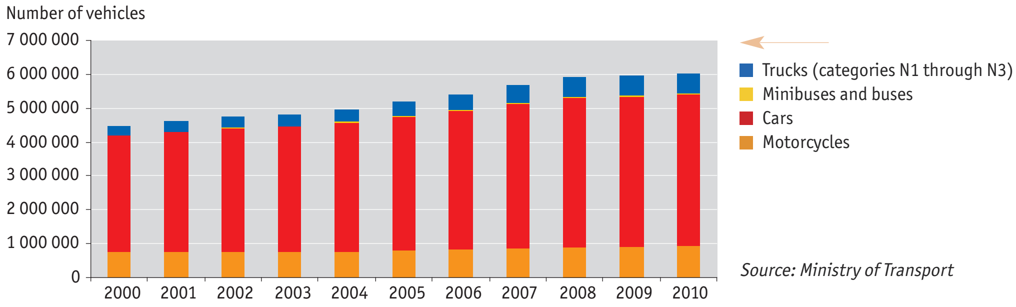
The priorities of the current **State Environmental Policy of the Czech Republic** for 2004–2010 relating to the vehicle fleet include reducing the consumption of non-renewable energy sources in the transport sector and minimizing the impacts of transport on human health and ecosystems in terms of air pollution and noise from transport. The policy aims to promote the use of alternative fuels (especially in urban public transport) including the construction of the distribution network, so that their proportion is at least 20% in 2020.
The **Transport Policy of the Czech Republic** for 2005–2013 is based on a global objective that was developed through four cross-cutting and five specific priorities that are directly related to the transport sector. The global objective of the Policy is: „...to create conditions for ensuring quality transport with focus on its economic, social and environmental impacts within the scope of sustainable development principles, and to lay realistic foundations to initiate changes in the proportions among individual transport modes". One of the cross-cutting priorities is „Limiting the environmental and public health impacts of transport in line with sustainable development principles".
At the EU level, the main legislative measure for reducing emissions from new cars are the European emission standards, or the EURO standards, which the Czech Republic as an EU member state must meet. The EURO 5 standard has been in effect since 1 September 2009 and EURO 6 is currently under preparation. Under the current agreement of the European Commission, Council and Parliament, CO2 emissions from new vehicles (and thus their energy performance) are to be gradually reduced by 25% by 2015, i.e. from the current average of 160 g/km to 120 g/km. This target should be met by 65% of vehicles by 2012, and by all produced vehicles by 2015.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The composition of the road vehicle fleet translates into the emission intensity of transport and, by extension, the negative impacts of transport on human health and ecosystems due to air pollution. In addition, older vehicles are noisier and have poorer safety standards.

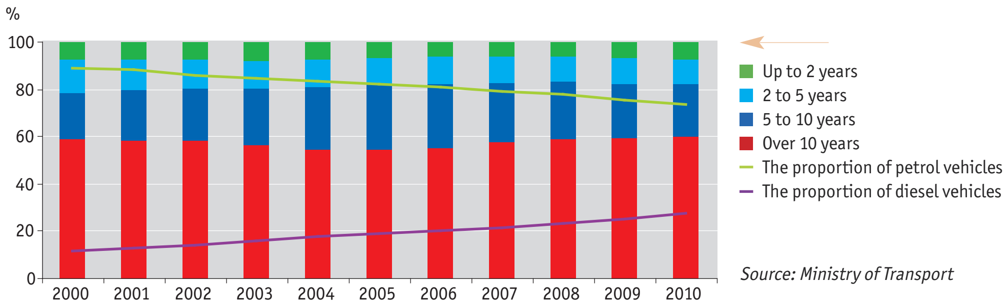
INDICATOR ASSESSMENT

Chart 1 → **Development of the number of registered motor vehicles in the Czech Republic [number of vehicles], 2000–2010**



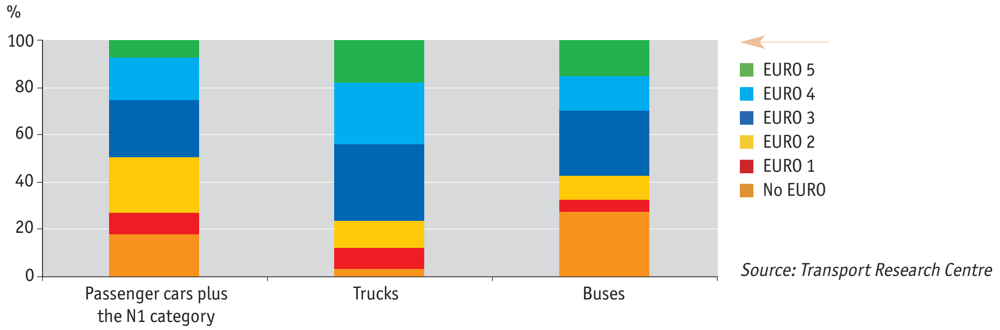
Source: Ministry of Transport

Chart 2 → **Development of the age structure of the passenger-car fleet [%] and the proportion of petrol and diesel cars in the passenger-car fleet [%], 2000–2010**



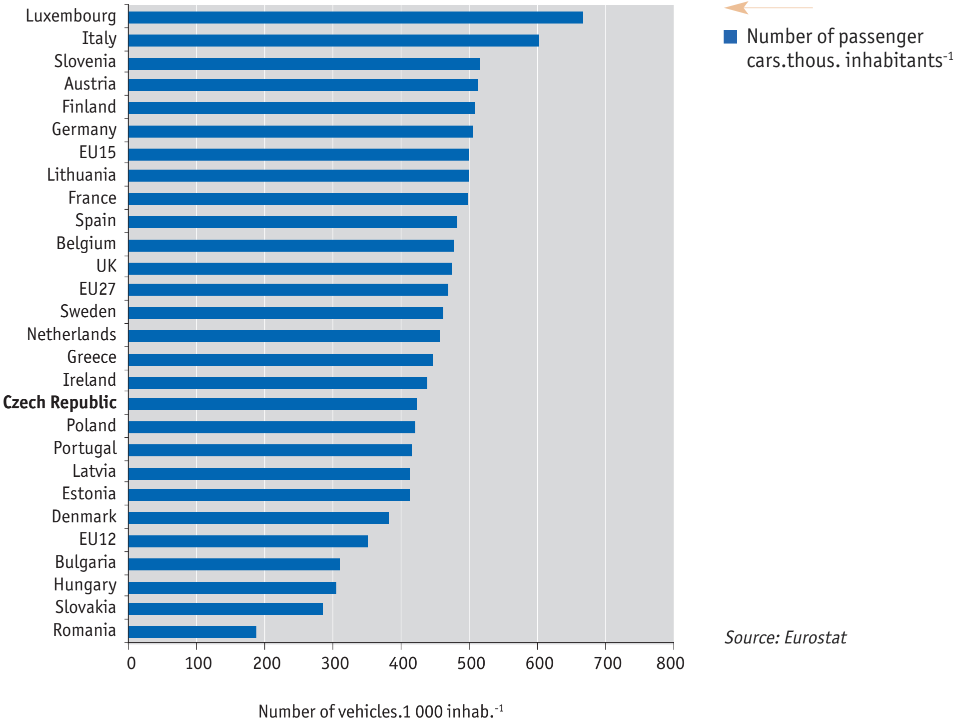
Source: Ministry of Transport

Chart 3 → **Structure of passenger cars and trucks according to the EURO emission standards in the Czech Republic [%], 2010**



Source: Transport Research Centre

Chart 4 → **Passenger car ownership rate, an international comparison [number of vehicles.1 000 inhab.$^{-1}$], 2008**



Source: Eurostat

The number of registered motor vehicles and trailers continues increasing in the Czech Republic (Chart 1). Over the long term, the age of the road vehicle fleet has been very high, increasing to 17.1 years in 2010 (16.9 years in 2009). At the end of 2010, a total of 6.28 million motor vehicles and 0.947 million trailers were registered, i.e. a total of 7.22 million vehicles of all categories. Compared to the 2009, the average age increased for all basic categories of vehicles, namely by 0.05 years (passenger cars) to 0.7 years (small vans – the N1 category). Motorcycles have the highest average age (32 years), followed by tractors (29.4 years) and minibuses (24.8 years), while small vans are the youngest (8.5 years). However, when evaluating the age characteristics of the vehicle fleet, we need to be aware of the fact that these are average ages for all registered vehicles, including very old and rarely used vehicles, rather than the actual composition of vehicles that are used on roads. Since newer vehicles are used more often than older ones (they have a higher annual usage), the structure of the actual (i.e. dynamic) vehicle fleet is younger – however, the data that are required for its detailed analysis are not available.

The number of passenger cars (the M1 category) **increased by 1.38% to 4.496 million vehicles in 2010**. Since 2000, the number of registered passenger cars has increased by approximately 1 million vehicles, i.e. by 30.7%. The number of trucks, i.e. vehicles in categories N1 through N3 excluding trailer-towing vehicles and special vehicles, has more than doubled since 2000, reaching 584 900 in 2010, but it declined by 3.6% year-to-year. After a period of stagnation between 2000 and 2004, the number of motorcycles has been growing since 2005. Having increased by 23.5% since 2000, the number of registered motorcycles increased by approximately 21 000 (2.3%) year-to-year. This is also reflected in the increasing proportion of motorcycles in the traffic flow structure on roads.

In 2010, the number of new passenger car registrations reached 169 200 vehicles, which is 4.69% (7 577 vehicles) more than the previous year. **New vehicle registrations have been increasing since 2005**, which is a positive finding. **However, the renewal of the passenger-car fleet is still insufficient.** The renewal coefficient, i.e. the proportion of initial registrations of new vehicles in the entire vehicle fleet, was 3.72%, which is far below the optimum value that ranges between 8% and 10%. In addition, the situation is also complicated by the imports of used cars from abroad, which totalled 127 000 in 2010 (a year-to-year decrease by 12%), with more than 25% of imported cars being older than 10 years. In 2010, a total of 185 400 vehicles (4.1% of the vehicle fleet) were scrapped from the register, which is 26% less than in the previous year. The above trends translated into an **increase in the average age of the passenger-car fleet, which was 13.7 years** (13.65 years in 2009). The proportion of cars older than 10 years in the entire vehicle fleet continues to increase, exceeding 60% (approximately 2.7 million vehicles), with almost 30% of the vehicles being older than 15 years (Chart 2). Prague has the lowest average vehicle-fleet age (13.11 years), the Ústecký Region has the highest (14.71 years). The oldest vehicle fleet is found in the following districts: Jeseník (15.03 years), Chomutov (15.06 years) and Děčín (15.29 years). **In 2010, motorization in the Czech Republic stood at 427 vehicles per 1 000 inhabitants** (423 in 2009). The highest motorization is in Prague (518 vehicles per 1 000 inhabitants), the lowest in the Moravian-Silesian Region (363 vehicles per 1 000 inhabitants).

The production of passenger cars has been rapidly growing in the Czech Republic since 2005. The Czech Republic is currently an 'automotive superpower' that produces more than 1 million vehicles per year, ranking fourth in the EU (after Germany, France and Spain) and in the top ten worldwide. Of the total number of vehicles produced in the Czech Republic in 2010 (1.077 million vehicles), only 65 344 vehicles were sold in the domestic market, i.e. 16.5% of the total number of vehicles produced. Compared to the previous year, production increased by 9.5%, domestic sales by 5.4% and exports by 11.1%. Since 2005, production has increased by approximately 80%, which is largely attributable to TPCA (Toyota Peugeot Citroen Automobile) and HMMC (Hyundai Motor Manufacturing Czech) launching their Czech operations in 2005 and 2008, respectively. In 2010, cars manufactured in the Czech Republic accounted for 38.6% of the market with new vehicles; the share of Škoda auto a.s. was 31.2%.

In terms of vehicle fleet composition by traction type, the proportion of diesel passenger cars in the total number of registered passenger cars has increased considerably (Chart 2).While in 2000 diesel cars accounted for about one tenth of the fleet (383 thousand vehicles), in 2009 it was about one quarter (1 102 thousand vehicles). The proportion of diesel vehicles in newly registered vehicles was 39.9% in 2010 (31.8% in 2009), which indicates a continuing upward trend in diesel vehicles. 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 (approximately 135 500 such conversions were registered in 2010). There were approximately 700 CNG passenger cars (150 new registrations), 30 electric cars (6 new registrations) and 564 solar-powered vehicles. Hybrid vehicles are not monitored separately – they are probably included in the "other" category in the register, which totalled 4 800 vehicles in 2009. Altogether, alternatively powered vehicles account for approximately 0.2% of the road vehicle fleet.

Although **the vehicle mix according to the EURO emission standards** is gradually improving, it **is still unfavourable** (Chart 3). Approximately 18% of the passenger-car and light commercial vehicle fleet (approximately 880 000 vehicles) did not comply with any emission standard in 2010 (4 percentage points less than in 2009). On the other hand, 7.3% of the vehicles complied with the most stringent EURO 5 emission standard, i.e. 3.6 percentage points more than in the previous year. The largest proportion of vehicles without any EURO emission standard was in the bus fleet (27.6%). By contrast, the situation was relatively favourable for trucks in categories N2 and N3, where only 3.4% did not met any EURO emission standard. Most of the fleet of these vehicles (approximately 75%) were compliant with EURO 3 to 5 emission standards.

In the context of the EU27, the Czech Republic's level of passenger car ownership rate is below average (470 vehicles per 1 000 inhabitants in the EU27 compared to 423 n the Czech Republic in 2009). However, it is one of the highest among the EU12 countries (the EU12 average is 352 vehicles per 1 000 inhabitants, Chart 4). The proportion of new cars registered in 2008 (latest available data for EU27) in the total fleet size was 3.8% (167.7 thousand vehicles) in the Czech Republic. Compared with the EU27 and especially the EU15, the proportion is significantly lower (6.1% and 6.7% respectively). However, the number of new vehicles sold in the Czech Republic is greater than in the EU12 countries (2.1% of new registrations). Conversely, the proportion of the passenger-car category of over 10 years of age is one of the highest (60%), the EU27 average is 30%.

Assuming economic growth, **the sales of new vehicles can be expected to gradually increase and the age of the vehicle fleet to decline**. However, given the high proportion of older vehicles in the vehicle fleet, fleet renewal will only be very slow. In order to significantly reduce the age of the vehicle fleet, there will need to be a combination of measures to support the scrapping of vehicles from the register (e.g. subsidies for environmentally friendly liquidation) along with positive trends in both the purchasing power of households and the performance of the national economy.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

25/ Agricultural soil use limits

KEY QUESTION →

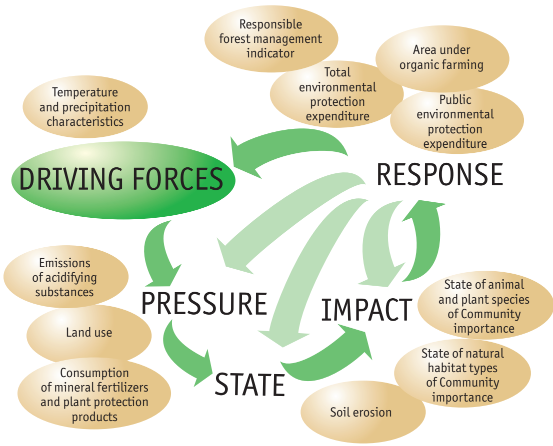
What factors threaten the quality of agricultural land?

KEY MESSAGES →

☹ In terms of the different classes of protection, the Czech Republic's agricultural land resources include both the most valuable top-quality soils and soils with poor productivity.

40% of agricultural land is at risk of degradation through compaction; the area of land that is vulnerable to acidification is also considerable.
In terms of agricultural land productivity scoring, the Czech Republic's agricultural land is mostly of rather poor quality.

The degradation of the physical and chemical properties of land adversely affects the productive and non-productive functions of land. Characteristically, the different types of land degradation condition the occurrence of other types of degradation.



OVERALL ASSESSMENT →

The soil use limits indicator includes soil quality indicators that are especially important for evaluations related to biodiversity, forests and the landscape, soil and agriculture. Given the structure of this indicator, its status remains unchanged over the long term.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

One of the partial objectives of the **State Environmental Policy of the Czech Republic** in the „Sustainable use of natural resources, material flows and waste management" priority area is to prepare and implement the national soil conservation programme.

The protection of agricultural land is addressed by **Act No. 334/1992 Coll.**, on the protection of agricultural land resources, **Decree No. 13/1994** that regulates some details of the protection of agricultural land resources, **Government Regulation No. 75/2007 Coll.**, on the conditions of the provision of payments for natural conditions disadvantages in mountain areas, in otherwise disadvantaged areas, and in Natura 2000 areas, **Government Regulation No. 79/2007 Coll.** on agro-environmental conditions, **Government Regulation No. 239/2007 Coll.**, on laying down the conditions for granting subsidies for agricultural land afforestation and **Government Decree No. 479/2009 Coll.**, on determining the consequences of violating aid conditionality.

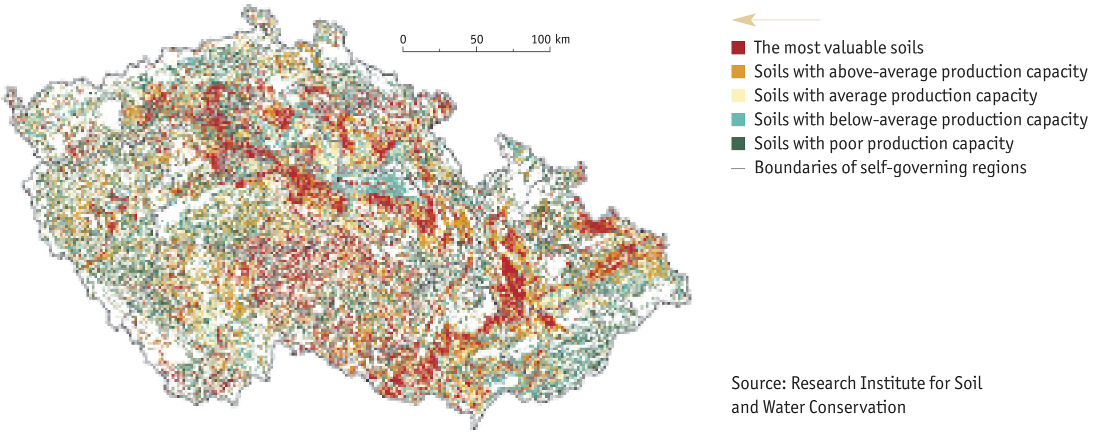
Measures to improve the quality of agricultural land resources are partly addressed by the **Good Agricultural and Environmental Conditions (GAEC) standards**, as specified by Government Regulation No. 479/2009 Coll., on determining the consequences of violating aid conditionality.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Soil degradation through compaction, which mainly results from the use of agricultural machinery, suppresses biological activity in soil through worsening the air, water and thermal properties of soil. Soil degradation through acidification results in reduced humus quality, reduced availability of nutrients to plants, increased mobility of high-risk elements and the washing away of nutrients. This, in turn, leads to reduced soil resistance and an increased risk of pathogenic organism and plant disease development, to name but a few. Via the food chain, human health may be adversely affected due to the presence of hazardous substances in the soil.

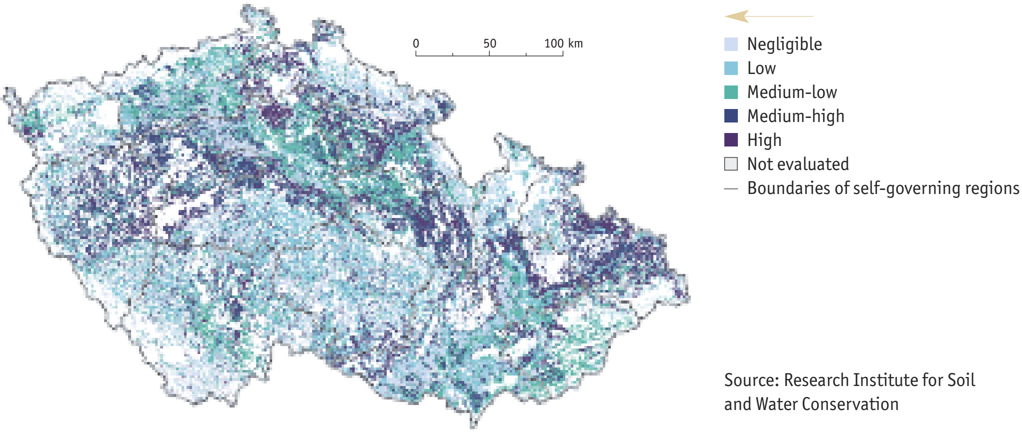
INDICATOR ASSESSMENT

Figure 1 → **Classes of protection of agricultural land resources in the Czech Republic, 2010**



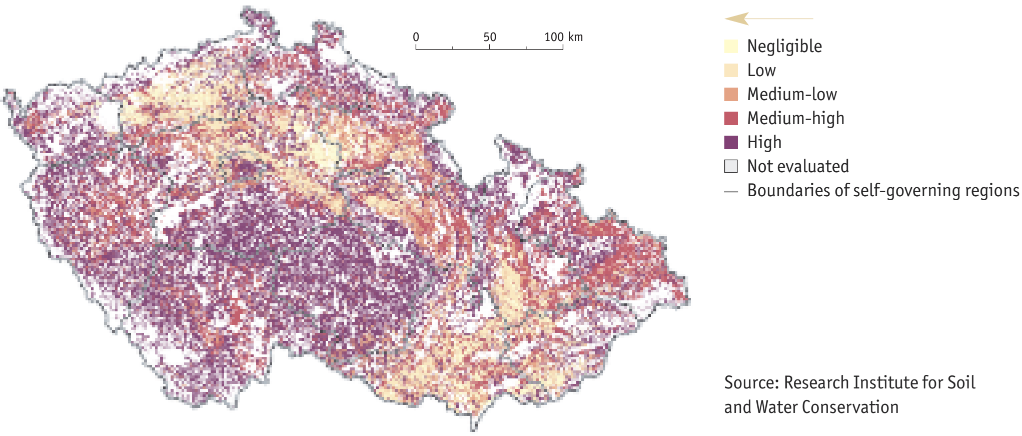
Source: Research Institute for Soil and Water Conservation

Figure 2 → **Potential vulnerability of lower layers of soil to compaction in the Czech Republic, 2010**



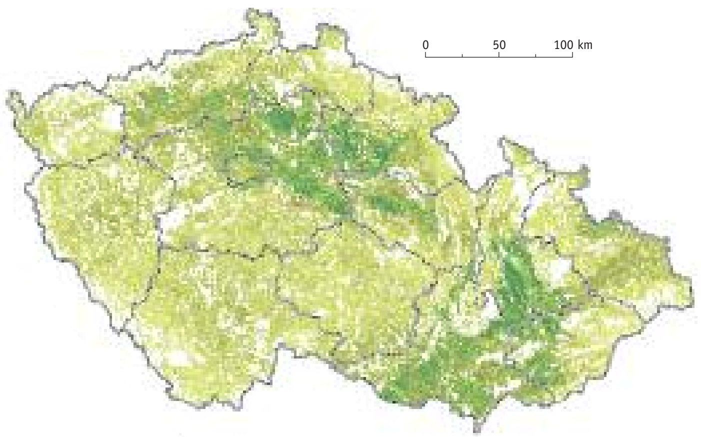
Source: Research Institute for Soil and Water Conservation

Figure 3 → **Potential soil vulnerability to acidification in the Czech Republic, 2010**



Source: Research Institute for Soil and Water Conservation

Figure 4 ➜ **Agricultural land productivity scoring in the Czech Republic, 2010**



Source: Research Institute for Soil and Water Conservation

Classes of protection of agricultural land resources

Agricultural land resources consist of plots that are cultivated for agricultural purposes and plots that have been and will again be cultivated for agricultural purposes but are currently lying fallow. The evaluation of agricultural soil quality in the Czech Republic is based on the results of the Evaluation of Czechoslovak Agricultural Land. Agricultural soils are characterized using Evaluated Soil-Ecological Units[1]. One of the practical applications of evaluation is protection classes (similar to the land tax and the official price of agricultural land). They are defined in five categories according to their productive capacity. The most highly valued soils are Class I protected agricultural land resources, while soils with a very low productive capacity are Class V protected agricultural land resources. The Czech Republic has been mapped based on this characteristic; the most highly valued soils are mainly found in the Polabí area and the areas of the Moravian depressions (Figure 1).

Potential vulnerability of the lower layers of soil to compaction

Soil compaction belongs to the most serious manifestation of soil degradation. The degradation of the physical properties of soil and the resulting compaction of subsoil and crusting on the soil surface negatively affect the production and non-production function of soil. Such degradation reduces infiltration, accelerates surface runoff and increases erosion, reduces the water retention capacity and the available water capacity of soil, reduces the effective depth of the soil profile and suppresses biological activity through worsening air, water and thermal regime of soil.

In the Czech Republic, 40% of agricultural land is at risk of degradation due to compaction, i.e. about 1.75 million ha, of which only 30% (about 0.5 million ha) is at risk of „genetic compaction" that results from the natural properties of soils, and more than 70% (approximately 1.25 million ha) is at risk of technogenic compaction that results from a number of anthropogenic causes. In terms of compaction, the condition of the Czech Republic's soils currently appears to be stagnating or steadily deteriorating. Subsoil of agricultural soils is both the most damaged and at the greatest risk, which is associated with the still spreading use of more efficient

[1] An evaluated soil-ecological unit (BPEJ) is a five-digit numeric code that is associated with agricultural parcels. It expresses the main soil and climatic conditions that affect the productive capacity of agricultural land and its economic evaluation. The legal instrument that lays down the characteristics of evaluated soil-ecological units and the procedure for managing and updating them is Ministry of Agriculture Decree No. 327/1998 Coll., as amended.

and thus heavier farm machinery, and also with the minimisation of cultivation work that is often performed under inadequate soil moisture conditions. Soils that are at risk of compaction are most commonly found in the northern and western parts of the Czech Republic (Figure 2).

Potential vulnerability of soil to acidification

Thus far, soil acidification has been a gradual process that occurs over large parts of the agricultural land resources (except for highly calcareous soils). In recent years, almost all soils in the Czech Republic have shown a slight decrease in pH, i.e. a mild acidification that is currently taking place. The process of soil acidification is a natural phenomenon especially in mountainous areas; it results from the formation of organic acids that occurs in forest soils during the decomposition of organic substances, especially litter and surface humus. However, this natural process is greatly amplified by the effects of anthropogenic activities, such as wet and dry atmospheric acid deposition, inappropriate forest management, the insufficient application of lime fertilizers, the removal of Ca and Mg from soil by crops (a large proportion of cereals with no perennial forage crops), the use of inappropriate agricultural machinery, as well as other anthropogenic activities affecting soil.

Soil degradation through acidification results in particular in reduced humus quality with a predominance of fulvic acids, the slower release of mineral nitrogen from humus, the petrification of phosphorus in soil into compounds from which phosphorus is not available to plants, the increased mobility of toxic elements, reduced resistance to the disintegration of structural units resulting in a greater vulnerability to compaction and erosion, the release of potassium into the soil solution and the subsequent risk potassium being washed away, an increased risk of pathogenic organism and plant disease development, which reduces yields. The distribution of soils that are potentially affected by acidification is shown in Figure 3, the most vulnerable soils are most commonly found in western and southern Bohemia and in the Vysočina region.

Agricultural land productivity scoring

The evaluation of agricultural land resources through a scoring method is based on integrating available information on agricultural areas. The data output stems from Government Regulation 241/2004 Coll., on the conditions for implementing assistance to less favoured areas and areas with environmental restrictions. The basic indicator includes the characteristics of evaluated soil-ecological units (BPEJ) including their ecological and economic information. The evaluation of agricultural land according to these criteria is shown in Figure 4; the highest quality soils are mainly found in the Polabí area and the areas of the Moravian depressions.

The main degradation factors affecting soils in the Czech Republic include erosion, soil compaction, acidification, contamination, loss of organic matter (mainly due to significant reduction in beef cattle breeding) and landslides. In the future, soil will also be threatened by the envisaged increase in corn cultivation for biogas stations. Complete destruction of soils is occurring due to the loss of agricultural land as a result of its transformation into land for construction and mining purposes. Characteristically, the different types of soil degradation condition the occurrence of other types of degradation – e.g. soil structure disintegration and the subsequent soil compaction are often preceded by soil acidification and loss of organic matter. The proposed Soil Framework Directive might improve the situation somewhat, as it aims to establish an EU-wide framework for protecting soils and for preserving their ecological, economic, social and cultural functions. To that end, the directive lays down measures to prevent soil degradation processes, whether they occur naturally or as a result of various human activities. In addition to preventive measures that will be included as the central element of the draft directive, it will also include cleaning up contaminated areas, reducing and eliminating risk and restoring soil functions that have been degraded due to erosion, loss of organic matter, compaction, salinisation and landslides.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

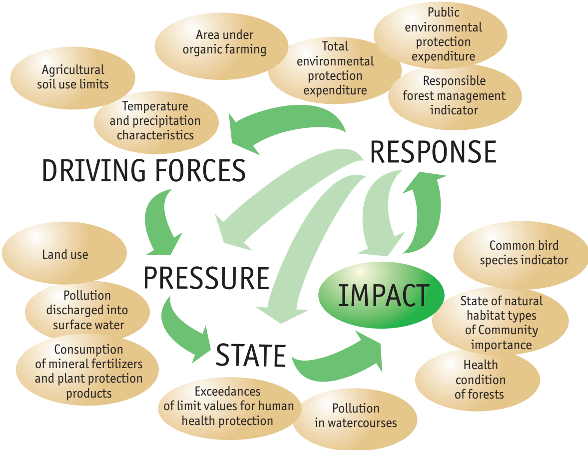
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1896)

26/ Soil erosion

KEY QUESTION

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



KEY MESSAGES

Within the Czech Republic, 50% of agricultural land is threatened by water erosion and 8.7% by wind erosion.

The vast majority of land that is at risk of erosion is not subject to any systematic protection that would reduce soil loss to permissible limits, let alone to a level that would prevent a further reduction in the thickness of the soil profile and the impacts the ongoing process of water erosion has on water quality.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The Agriculture and Forest Management sectoral policy within the **State Environmental Policy of the Czech Republic** includes a measure to expand programmes for parcels that are at risk of water and wind erosion and for greater water retention in the landscape in pursuance of a greater ecological stability of the landscape.

The protection of agricultural land is addressed by **Act No. 334/1992 Coll.**, on the protection of agricultural land resources and **Decree No. 13/1994** that regulates some details of the protection of agricultural land resources. Furthermore, **Act No. 254/2001 Coll.**, on waters and amending some acts and **Act No. 114/1992 Coll.**, on nature conservation and landscape protection impose the obligation to prevent soil loss by water erosion.

Council Regulation (EC) No. 73/2009 of 19 January 2009 establishes both common rules for direct support schemes for farmers under the common agricultural policy and certain support schemes for farmers.

The issue of erosion control measures is partly addressed by the **Good Agricultural and Environmental Conditions (GAEC) standards**, as specified by Government Regulation No. 479/2009 Coll., on determining the consequences of violating aid conditionality.

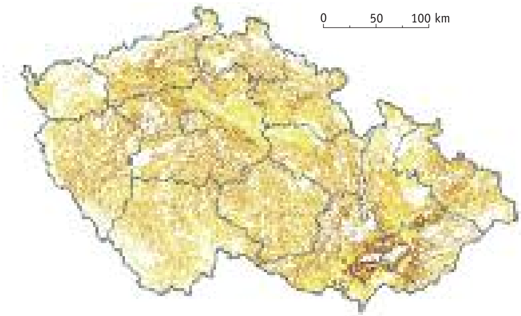
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Soil erosion poses a significant risk to the health of ecosystems and, by extension, to human health due to water pollution and the impaired landscape function in case of sudden natural phenomena (floods).

Erosion generally reduces the productive functions of affected ecosystems and disrupts the ecological stability of affected communities. Soil erosion deprives agricultural land of its most fertile component – the topsoil, deteriorates the physical and chemical properties of soil, damages crops and cultures, makes it difficult for machinery to operate on the land and causes loss of seeds and seedlings, fertilizers and plant protection products. Transported soil particles and the substances bound to them pollute water sources, reduce the flow capacity of streams, damage hydraulic structures and deteriorate the environment for aquatic organisms. Also, erosion can lead to increased mineral dust emissions.

INDICATOR ASSESSMENT

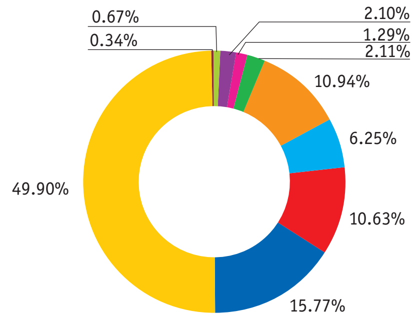
Figure 1 ➔ **Potential vulnerability of agricultural land to water erosion in the Czech Republic, 2010**



- No risk
- Vulnerable
- Low risk
- Medium risk
- High risk
- Extreme risk
- Not evaluated
- Boundaries of self-governing regions

Source: Research Institute for Soil and Water Conservation

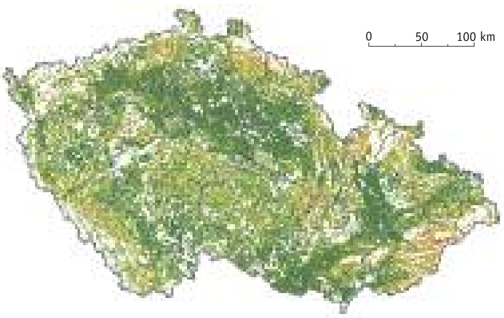
Chart 1 ➔ **Potential vulnerability of agricultural land to water erosion expressed as the long-term average soil wash-off (G) in the Czech Republic, 2010**



- 30.1 and above
- 20.1–30.0
- 12.1–20.0
- 10.1–12.0
- 8.1–10.0
- 4.1–8.0
- 3.1–4.0
- 2.1–3.0
- 1.1–2.0
- 0.1 and less

Source: Research Institute for Soil and Water Conservation

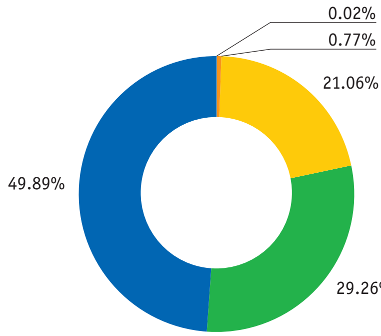
Figure 2 ➔ **Maximum admissible value of the conservation effect factor of the canopy cover (C_p) in the Czech Republic, 2010**



- Up to 0.005 (permanent grasslands)
- 0.005–0.02 (clover, alfalafa)
- 0.02–0.05 (now wide-row crops)
- 0.05-0.15 (now wide-row crops)
- 0.15-0.2 (now wide-row crops)
- 0.2–0.3 (with soil conservation technologies)
- 0.3-0.4 (with soil conservation technologies)
- 0.4-0.6 (with soil conservation technologies)
- Over 0.6 (no limitations)
- Boundaries of self-governing regions

Source: Research Institute for Soil and Water Conservation

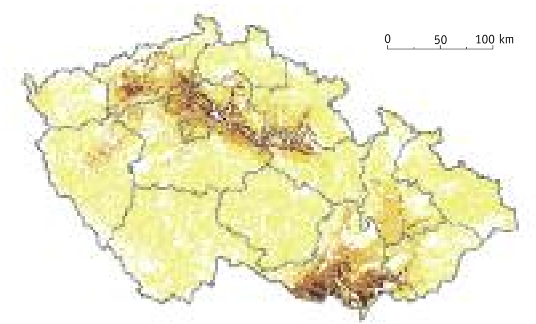
Chart 2 ➔ **Vulnerability of agricultural land to water erosion expressed as the maximum admissible value of the conservation effect factor of the canopy cover (C_p) in the Czech Republic [%], 2010**



- Extreme risk (C_p up to 0.005)
- High risk (C_p 0.005–0.02)
- Medium risk (C_p 0.02–0.2)
- Low risk (C_p 0.2–0.6)
- No risk (C_p over 0.6)

Source: Research Institute for Soil and Water Conservation

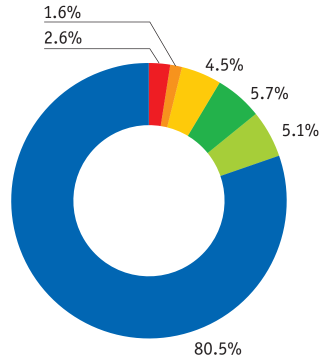
Figure 3 ➜ **Potential vulnerability of agricultural land to wind erosion, 2010**



- No risk
- Vulnerable
- Low risk
- Medium risk
- High risk
- Extreme risk
- Boundaries of self-governing regions

Source: Research Institute for Soil and Water Conservation

Chart 3 ➜ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2010**



- Extreme risk
- High risk
- Medium risk
- Low risk
- Vulnerable
- No risk

Source: Research Institute for Soil and Water Conservation

Potential vulnerability of agricultural land to water erosion

Water erosion is a serious problem in the Czech Republic, not only in terms of agriculture but also in terms of environmental protection. Determining areas that are prone to water erosion has provided a framework for establishing highly effective tools that allow for implementing erosion-control measures more effectively. Erosion-control measures are based on slowing down surface runoff and transforming it into subsurface runoff. This is achieved through a set of organizational, agro-technical and technological measures. Further, determining areas that are at risk of erosion (while taking into account other characteristics of a given area) may also help in evaluating agricultural land and providing subsidies for farming under less favourable conditions. It also makes it possible to better meet obligations arising from legal provisions and regulations. At present, about 50% of the Czech Republic's agricultural land is at risk of water erosion (Figure 2, Chart 2).

The potential vulnerability of agricultural land to water erosion is determined using the Universal Soil Loss Equation (USLE) that calculates the long-term average annual soil loss (t.ha.year^{-1}). The key identifier for assessing the degree to which an area is potentially threatened by water erosion is the maximum admissible value of the conservation effect factor of the canopy cover allowable value of the protective effect of vegetation factor (Cp)[1] (Figure 2, Chart 2). Cp does not examine the potential degree of risk, it is used directly as an erosion-control tool (i.e. it indicates both where land is at risk and how to protect it effectively). This value should not be exceeded in a given place and if it is, it should be reduced through erosion-control measures. An important indicator that helps (along with other criteria) to assess the degree of erosion risk to parcels is the maximum allowable soil loss[2], which is defined as the maximum soil loss at which it is possible to permanently and economically maintain soil fertility.

[1] *The maximum admissible value of the conservation effect factor of the canopy cover (C_P) are divided into 9 categories. The first group, which is also at the greatest risk of erosion, includes areas with a C_P of up to 0.005. To prevent this value from being exceeded, it is recommended transferring these areas into the permanent grassland category. The second group includes areas with a value of up to 0.02, for which a definitive measure is also recommended in order to reduce the risk of erosion, in this case growing perennial forage crops, for example clover and alfalfa. For other categories, no specific recommendations are provided to prevent the limit values from being exceeded. This is mainly because of the varied natural conditions, especially climatic conditions, existing in the different parcels that are placed in the same category.*

[2] *The maximum allowable soil loss is expressed as the value of erosive wash that should not be exceeded in parcels with a given depth. In parcels with shallow soil, the allowable soil loss should not exceed 1 tonne per 1 ha per year (they should be grassed); for parcels with medium-depth soil, the allowable soil loss should not exceed 4 tonnes per 1 ha per year; and in parcels with deep soils this is 10 tonnes per 1 ha per year.*

Potential vulnerability of agricultural land to wind erosion

The underlying information for determining whether agricultural land is at risk of wind erosion includes evaluated soil-ecological units (BPEJ, see the footnote on page 92), data on climatic regions and data on major soil units.

At present, approximately 8.7% of the Czech Republic's agricultural land is at risk of wind erosion (extremely vulnerable soils, highly vulnerable soils and vulnerable soils), i.e. 0.2% more than in the previous year (Figure 3, Chart 3). Wind erosion now also occurs in places where it was previously unknown or only occurred to a lesser extent without causing damage to agricultural production. Anthropogenic influences have significantly affected its distribution both in terms of area and magnitude. Given the current unsuitable farming trends, it can be assumed that the risk of wind erosion will increase in the future.

Figures related to erosion vulnerability are difficult to compare with previous years because the methodology for determining soil vulnerability to water erosion has changed due to improvements in data accuracy and some new findings – the figures can only be compared from 2009. Since most natural phenomena do not change abruptly, but rather gradually, the year-to-year changes in erosion trends are minimal. However, in the longer term the situation deteriorates. Rather than identifying changes in the rate of erosion in the entire country over one year, changes can be observed in smaller areas that struggle with mud deposits at the slightest rainfall. These events are usually associated with improper farming in parcels that are situated above municipalities and from which soil is regularly transported to the municipality where it contaminates houses, gardens, ponds etc. In addition to enormous losses of soil value (the most valuable is topsoil that is also the first to be washed off), there are also soaring costs for remedying damage that is caused by erosion and for restoring damaged property, both municipal (roads etc.) and private (various entities and individuals). These extreme situations are becoming ever more frequent. The increasing rate of erosion is also influenced by the increasing intensity and frequency of extreme weather events (especially the greater frequency of torrential rains), but also by inappropriate methods of farming agricultural land (e.g. maize growing on slopes etc.) that lead to soil degradation. Accelerated agricultural soil erosion poses a serious threat to the production and non-production functions of soils and causes multi-million damage in the inner urban zones of towns and municipalities due to surface runoff and soil wash-off, especially from agricultural land.

The negative effects of water and wind erosion are mitigated through **erosion control measures**, such as ensuring the harmless collection of surface water from river basins, reducing surface runoff and capturing soil that is being washed off, retaining water in the landscape, protecting roads and municipalities' inner urban zones from the effects of soil erosion and reducing the speed and the harmful effects of wind.

At present, the issue of erosion is partly addressed by the Good Agricultural and Environmental Conditions (GAEC) standards, namely standard no 1 (measures to protect soil on sloping land above 7°) and standard no 2 (the principles for growing certain crops on land highly vulnerable to erosion), especially in terms of the method of farming agricultural land that is rather alarming in the Czech Republic.

The proposed **Soil Framework Directive** might improve the situation somewhat, as it aims to establish an EU-wide framework for protecting soils and for preserving their ecological, economic, social and cultural functions. To that end, the directive lays down measures to prevent soil degradation processes, whether they occur naturally or as a result of various human activities. In addition to preventive measures that will be included as the central element of the draft directive, it will also include cleaning up contaminated areas, reducing and eliminating risk and restoring soil functions that have been degraded due to erosion, loss of organic matter, compaction, salinisation and landslides.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

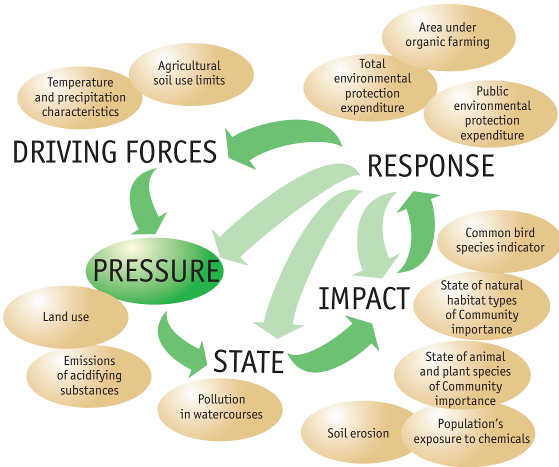
CENIA, key environmental indicators

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

27/ Consumption of mineral fertilizers and plant protection products

KEY QUESTION

Is the amount of agrochemicals used in agricultural activities decreasing?



KEY MESSAGES

After a period of steady growth starting in 2000, the consumption of mineral fertilizers declined significantly in 2009 due to unfavourable climatic conditions in the autumn of 2009 that resulted in the application being put off until the spring of 2010. For this reason, consumption increased by 37% in 2010.

In 2010, the use of plant protection products decreased by 6% compared to the previous year.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Priority area „The Environment and the Quality of Life" within the **State Environmental Policy of the Czech Republic** sets the partial objective to implement environmental aspects of agricultural management through Good Agricultural Practice. The Sustainable Use of Natural Resources, Material Flows and Waste Management priority area includes the partial objective to protect soil against contamination by hazardous substances. The Agriculture and Forest Management sectoral policy includes the measure to limit the use of hazardous pesticide and biocide products and replace them by less hazardous products.

Through Decision No. 1600/2002/EC laying down the Sixth Community Environment Action Programme, the European Parliament and the Council state that the use of plant protection products in agriculture affects human health and the environment and needs to be further reduced. Therefore, a package of three legal regulations has been prepared that includes **Regulation (EC) No. 1107/2009** of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC, **Directive 2009/128/EC** of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides, and **Regulation (EC) No. 1185/2009** of the European Parliament and of the Council concerning statistics onpesticides. The above regulations introduce much stricter criteria for plant protection products registration and, at the same time, regulate the use of the products and the assessment of their impacts on human and animal health and on the environment.

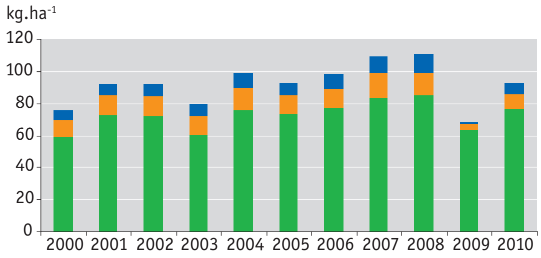
Another important document in this area is **Regulation (EC) No. 2003/2003** of the European Parliament and of the Council relating to fertilisers, namely their labelling, definitions and composition.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Both mineral fertilizers and plant protection products deteriorate soil quality and pollute groundwater and surface water. They result in the loss of biodiversity of soil microorganisms and a decline in the number of bird species. They enter into food and drinking water through the food chain.

INDICATOR ASSESSMENT

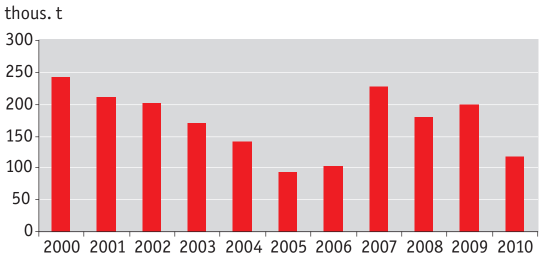
Chart 1 ➔ **Trends in consumption of mineral fertilizers in the Czech Republic [kg.ha^{-1}], 2000–2010**



K$_2$O
P$_2$O$_5$
N

Source: Ministry of Agriculture

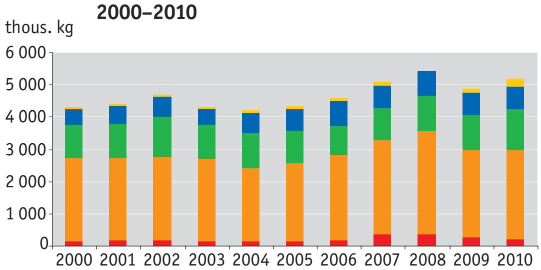
Chart 2 ➔ **Trends in consumption of lime substances in the Czech Republic [thous. t], 2000–2010**



Lime materials

Source: Ministry of Agriculture

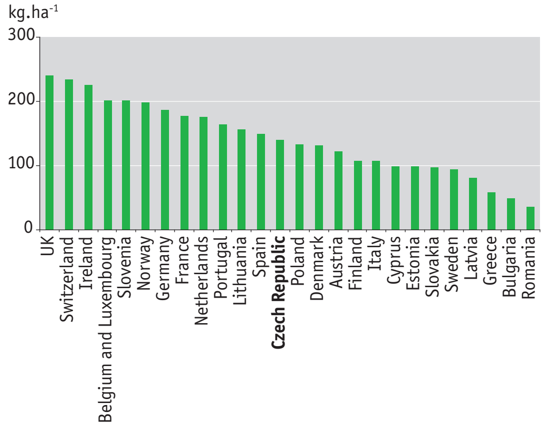
Chart 3 ➔ **Trends in consumption of plant protection products in the Czech Republic [thous. kg of active ingredient], 2000–2010**



Zoocides, mordants
Herbicides and desiccants
Fungicides, dressings
Growth regulators
Rodenticides
Other*

Source: Ministry of Agriculture

Chart 4 ➔ **Consumption of mineral fertilizers in Europe [kg.ha^{-1}], 2006**



Mineral fertilizers

Source: EFMA

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

Consumption of mineral fertilizers that contribute to chemical water and soil contamination declined sharply after 1990. From 2000, it started increasing until 2008, when it reached its maximum for the monitored period. In terms of the different categories, the consumption of phosphate and potash fertilizers was constant, while the consumption of nitrogen fertilizers increased. In 2009, the total consumption of mineral fertilizers declined sharply by 38.5% compared to 2008. However, consumption increased by 37% on a year-to-year basis in 2010, with the total consumption of net nutrients supplied by mineral fertilizers reaching 93.2 kg per 1 ha of agricultural land. In terms of the different categories, net-nutrient consumption totalled 76.7 $kg.ha^{-1}$ for nitrogen fertilizers (as the content of N_2 – nitrogen), 8.9 $kg.ha^{-1}$ for phosphate fertilizers (as the content of P_2O_5 – phosphorus oxide) and 7.5 $kg.ha^{-1}$ for potash fertilizers (as the content of K_2O – potassium oxide). The main reason for the significant increase in the use of mineral fertilizers lies in the fact that the application of fertilizers was rescheduled from the autumn of 2009 to the spring of 2010 due to adverse weather conditions. Another reason is a change in the area of covered agricultural land – up until now the consumption of mineral fertilizers and farmyard manure was calculated for 4 million hectares of agricultural land, while the new methodology only calculates 'utilized agricultural land' totalling 3.524 million hectares in 2010. Taking into account the above circumstances, the average consumption of fertilizers for 2009 and 2010 was lower than in the previous six years. The trends in the consumption of mineral fertilizers are shown in Chart 1.

In 2010, the consumption of lime substances totalled 118 thousand t, displaying an 50% increase compared with the previous year. Following a steady decline in lime substance consumption starting in the mid 1990s, their consumption has increased significantly since 2007–2009 (Chart 2). This increase is probably due to the better financial circumstances of farmers and an increased awareness. Given the decline in the use of lime substances, the proportion of agricultural land with increased acidity grew over the recent years. Another reason underlying the decrease in soil pH is the deposition of acidifying substances.

Compared to other European countries, the Czech Republic has average mineral fertilizer consumption levels (Chart 4). Fertilizer consumption mostly depends on climatic conditions, the intensity of agricultural activities and the type of crop. In addition, the financial position of farmers is the limiting factor of fertilizer consumption.

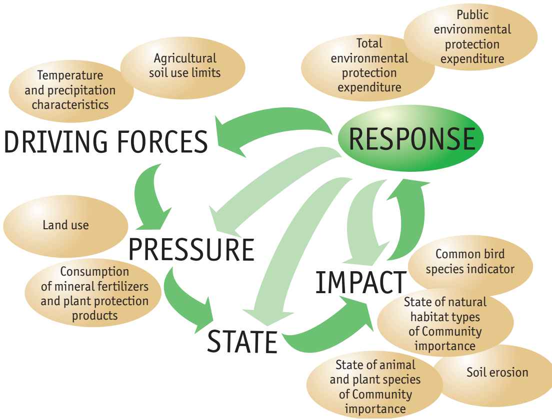
Consumption trends are shown in Chart 3. Consumption of plant protection products is influenced by the actual incidence of harmful organisms in a given year. The incidence of harmful organisms is affected by the weather conditions throughout the year, especially air temperature and precipitation. In 2010, the use of plant protection products decreased by 6% compared to the previous year. This was caused by a moderate to strong incidence of diseases and harmful organisms in cultivated crops due to above-average precipitation in 2010. In 2010, a total of 5 171 thousand kg of active ingredients contained in plant protection products was applied to treat field crops, specialty crops (fruit, vines, vegetables and hops) and within the „other" category (ornamental plants and trees, forest trees, storage of plant products etc.). The trend in consumption is shown in Chart 3. The consumption of plant protection products is expected to decrease due to the adoption of the new package of legal regulations that introduces stricter criteria for permitting plant protection products and regulates their use.

While mineral fertilizers and plant protection products increase yields in agricultural production, they are also a source of chemical soil contamination. Unused fertilizers leach from the soil and pollute groundwater and surface water and, in the case of nitrogen fertilizers, cause anthropogenic eutrophication. Intensive agricultural activity can lead to reduced biodiversity of soil microorganisms and a decline in the populations of bird species that are adversely affected by soil pollution due to nitrogen, as nitrogen accumulates in the food chain and may result in the weakening of eggshells and egg damage.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

28/ Area under 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.

In 2010, the proportion of agricultural land under organic farming in the total area of agricultural land resources reached 10.55% and the number of organic farms rose to 3 517. The target set by the State Environmental Policy of the Czech Republic was accomplished.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The rules of organic farming are mostly regulated by European legislation on organic farming: **Council Regulation (EC) No. 834/2007** on organic production and labelling of organic products and repealing Regulation (EEC) No. 2092/91 and implementing **Commission Regulation (EC) No. 889/2008** laying down detailed rules for the implementation of Council Regulation (EC) No. 834/2007. The legislation also includes **Commission Regulation (EC) No. 1235/2008** laying down detailed rules for implementation with regards to the arrangements for importing organic products from third countries, **Commission Regulation (EC) No. 710/2009** laying down detailed rules on organic aquaculture, and **Commission Regulation (EU) No. 271/2010** laying down the new organic production logo of the European Union. Since 2007, Council Regulation (EC) No. 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) allows the Czech Republic to receive funds for supporting rural development from the EAFRD.

Furthermore, national legislation also applies, namely **Act No. 242/2000 Coll., on organic farming** that primarily regulates the registration process in organic farming, the control system and the system of penalties for breaching the rules of organic farming.

The **Action Plan of the Czech Republic for the Development of Organic Farming by 2010** supports in particular those areas of organic farming that are insufficiently developed, for example research and education for farmers, the domestic market with organic farming products, public awareness etc. In addition, one of the objectives is to achieve an approximately 10% share of agricultural land under organic farming in the total area of agricultural land by 2010, which has been achieved. In order to promote organic farming, the European Commission adopted the European Action Plan for Organic Food and Farming in 2004.

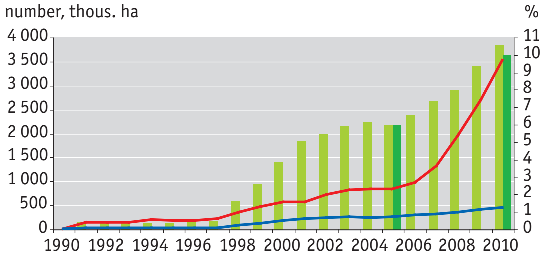
Priority area „The Environment and the Quality of Life" within the **State Environmental Policy of the Czech Republic** sets the partial objective to implement environmental aspects of agricultural management through Good Agricultural Practice. The Agriculture and Forest Management sectoral policy includes the measure to create the conditions for the development of multifunctional agriculture over the largest area possible and to promote environmentally sound farming methods in an attempt to increase the proportion of organically farmed agricultural land to at least % by and at least 10% by 2010, above all in specially protected areas and protected areas of natural accumulation of water.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Organic farming has a positive effect on the quality of soil (which is less exposed to chemicals and agricultural machinery) and, in turn, the quality of produced food. Production that uses limited amounts of chemicals also helps improve the quality of produced food. Organic farming positively affects (or helps preserve) the character of the landscape (because large units with monoculture crops are not preferred) and contributes to the sustainable development of the countryside.

INDICATOR ASSESSMENT

Chart 1 → **Organic farming trends in the Czech Republic [number, thous. ha, %], 1990–2010**

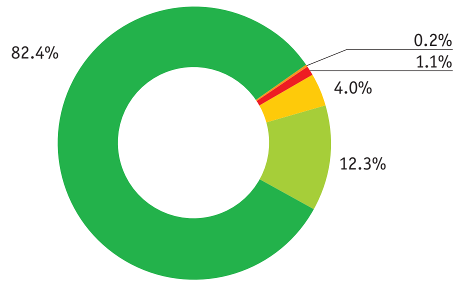


- Proportion in ALF (right axis)
- Proportion in ALF – 2005 and 2010 objectives (right axis)
- Number of organic farms (left axis)
- Area of organically farmed agricultural land (left axis)

Source: Ministry of Agriculture

ALR – agricultural land resources

Chart 2 → **Structure of land resources in organic farming in the Czech Republic [%], 2010**

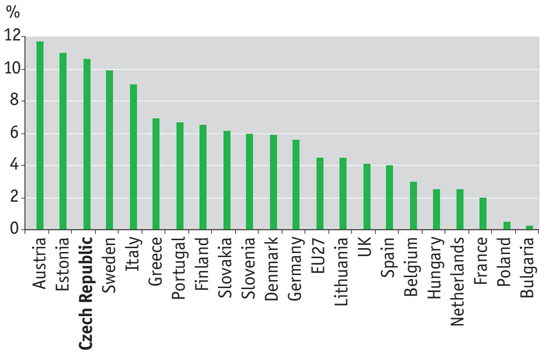


- Arable land
- Permanent grasslands
- Vineyards
- Orchards
- Other areas

Source: Ministry of Agriculture

Note: Despite the high proportion of permanent grasslands in total organically farmed agricultural land, permanent grasslands play an irreplaceable role, as they affect the quantity and the quality of groundwater and surface water, serve as a reliable erosion-control and flood-control measure and help significantly in protecting biodiversity. Expanding, restoring and maintaining grass communities in the landscape represents one of the possible solutions to agricultural overproduction and -- at the same time -- land conservation.

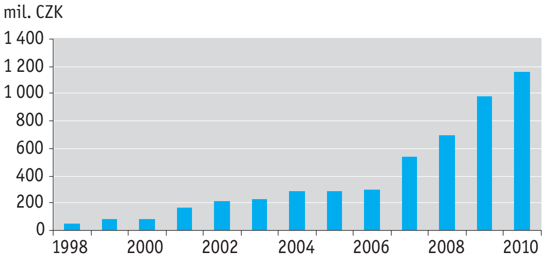
Chart 3 → **Proportion of area under organic farming in the total area of agricultural land in Europe [%], 2009**



- Proportion of area under organic farming in the total area of agricultural land

Source: Eurostat

Chart 4 → **Financial resources disbursed within the „Organic Farming" agro-environmental measure [mil. CZK], 1998–2010**



- Financial resources disbursed within the "Organic Farming" agro-environmental measure

Source: Ministry of Agriculture

Table 1 ➜ **Amount of organic farming subsidies per unit of area [CZK.ha^{-1}], 2004–2010**

Culture	2004–2006 (HRDP[1]) [CZK.ha^{-1}]	2007–2010 (PRV[2]) [CZK.ha^{-1}]	Subsidy for 2010 [CZK.ha^{-1}][3]
Arable land	3 520	4 086	3 780
Permanent grasslands	1 100	1 872	2 170/1 731[4]
Vegetables and special herbs on arable land	11 050	14 869	13 755
Permanent cultures (orchards, vineyards)	12 235	22 383	20 707/12 438[5]

Source: Ministry of Agriculture

[1] *The Horizontal Rural Development Plan (HRDP)*
[2] *The Rural Development Plan (PRV)*
[3] *The EUR/CZK conversion was made using the currently valid exchange rate on 26 July 2011.*
[4] *CZK 2 170.ha^{-1} for grassland farming for 100% organic farmers (without conventional co-farming), CZK 1 731.ha^{-1} for farmers with conventional co-farming.*
[5] *CZK 20 707.ha^{-1} for vineyard, orchard and hop garden farming, CZK 12 438.ha^{-1} for extensive orchard farming.*

Organic farming is based on the production of optimum quality food, while using sustainable development practices in order to avoid using agro-chemicals and minimize environmental damage. Over the long-term, the importance of organic farming in the Czech Republic has been growing. In 2010, there was a further increase in the number of both organic farmers and producers of organic food. By the end of 2010, there were 3 517 farmers that were farming according to set principles of organic farming and 626 entities were producing organic food. Throughout 2010, the number of organic farmers increased by almost 31% and the number of organic food producers by 26%. The area under organic farming increased by nearly 50 thousand ha (i.e. 13%) and reached 448 202 ha, representing 10.55% of the total area of agricultural land resources (Chart 1). According to projections by the Ministry of Agriculture of the Czech Republic, the objective of the State Environmental Policy of the Czech Republic (i.e. to increase the proportion of area under organic farming to at least 6% by 2005 and to at least 10% by 2010) was achieved.

In 2010, the area under organic farming increased in almost every category, with the exception of „other areas". The area of arable land under organic farming increased by 22% to 54 937 ha, yet it only reached 1.8% of total arable land. The area of permanent grasslands under organic farming increased by 12% to 369 272 ha, reaching 37% of the total area of permanent grasslands. The area of organically managed orchards grew by 39% to 5 128 ha, accounting for 11% of the total area of orchards. The area of vineyards under organic farming increased by 25% and reached 803 ha, i.e. 4.1% of the total area of vineyards. The 'hop fields' category remained unchanged at 8 ha. The area of ponds under organic farming reached 54 ha. The structure of land resources in organic farming is shown in Chart 2. Cattle breeding without commercial milk production accounts for the largest proportion of organic farming.

In 2010, the area of organically farmed agricultural land in the EU27 represented 4.5% of total agricultural land, i.e. 0.4% more than in the previous year. Compared to other European countries, the proportion of organically farmed land is above average in the Czech Republic (Chart 3).

The significant growth of organic farming is mainly due to the resumption of state subsidies. 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' measure 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". Organic farmers thus had a much greater chance of their projects being approved and financed. The amount of organic farming subsidies per unit of area and the financial resources disbursed within the "Organic farming" agro-environmental measure are shown in Table 1 and Chart 4. 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 is another reason behind the increased number of organic farmers and organic food producers.

Organic farming is positively reflected in the sustainability of soil quality, into which organic matter is supplied. Organically farmed land is not burdened by chemicals or heavy machinery, which improves the quality of produced food. Areas in which organic farming is performed have a positive effect on the landscape function and character and contribute to biodiversity conservation and sustainable rural development.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

29/ Domestic Material Consumption

KEY QUESTION →

Is the environmental pressure that is associated with material consumption decreasing in the Czech Republic?

KEY MESSAGES →

In 2009, domestic material consumption (DMC) decreased by 8.7% on a year-to-year basis in the Czech Republic[1], reaching the lowest level since 1990. The consumption of building materials and coal showed the most notable decline that is linked to the decrease in production in key economic sectors. Material flows that are associated with the electricity and gas production and distribution sectors are decreasing.

The long-term trends in material consumption are volatile and highly dependent on economic development. The majority (approximately 87%) of the Czech Republic's material basis is comprised of non-renewable resources, whose consumption poses a greater environmental burden than the consumption of renewable resources. The material flows that are associated with the sectors of metal production, construction, other mineral extraction, manufacture of machinery and equipment and manufacture of motor vehicles are increasing.

The Czech Republic imports approximately 33% of its materials from abroad – this share has increased by approximately 9 percentage points since 2000. The imports mainly include fossil fuels (oil). The Czech economy is thus one-third dependent on material imports from abroad.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Reducing both the consumption of materials and the material intensity of the economy are among the priorities of the applicable State Environmental Policy of the Czech Republic. Priority area 2 The Sustainable Use of Natural Resources, Material Flows and Waste Management, includes priority objectives 2.2 Protection of Non-renewable Natural Resources and 2.4 Reduction of the Energy and Material Intensity of Production and Increased Material and Energy Use of Waste.

In January 2010, the government approved the **Strategic Framework for Sustainable Development in the Czech Republic** that has replaced the Sustainable Development Strategy of the Czech Republic. Under priority axis 2 „The Economy and Innovation", the document sets specific objectives for the energy and material efficiency of the economy. Furthermore, the document aims to minimize the Czech Republic's dependence on foreign energy sources, especially sources from high-risk areas (priority 2.2, objective 1).

Other strategic documents such as the **Raw Material Policy in the Field of Mineral Materials and Their Resources** and the **State Energy Policy of the Czech Republic** underline the need to reduce material consumption and maintain a certain level of aw-material and material self-sufficiency. The need to reduce material consumption and the environmental impacts associated with such consumption has been highlighted by the 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.

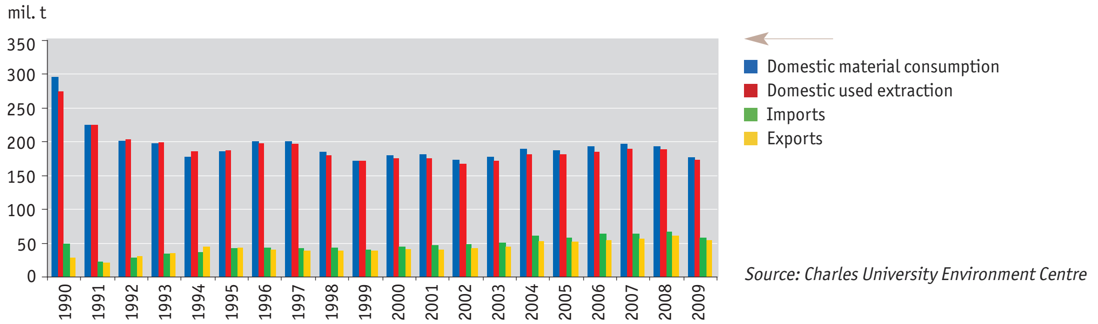
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

All materials entering the economic system are retained in the economy (e.g. in the form of fixed capital). However, once their economic life ends, all materials ultimately leave the economy as 'waste streams'. Therefore, increased material consumption goes hand in hand with increased emissions of greenhouse gases and other pollutants into the air, increased emissions into water and soil, and even increased volumes of produced waste. Raw material extraction and waste management (landfilling), i.e. activities related to material consumption, damage the landscape and disrupt ecosystem functions.

[1] *Due to the data collection and reporting procedures used by the Czech Statistical Office, data for material flow indicators for 2010 are not available at the time of finalizing this publication. These data will be published in the publication entitled „Material Flow Accounts in the Czech Republic in 2003-2010" probably in February 2012 and will be evaluated in the Report for 2011.*

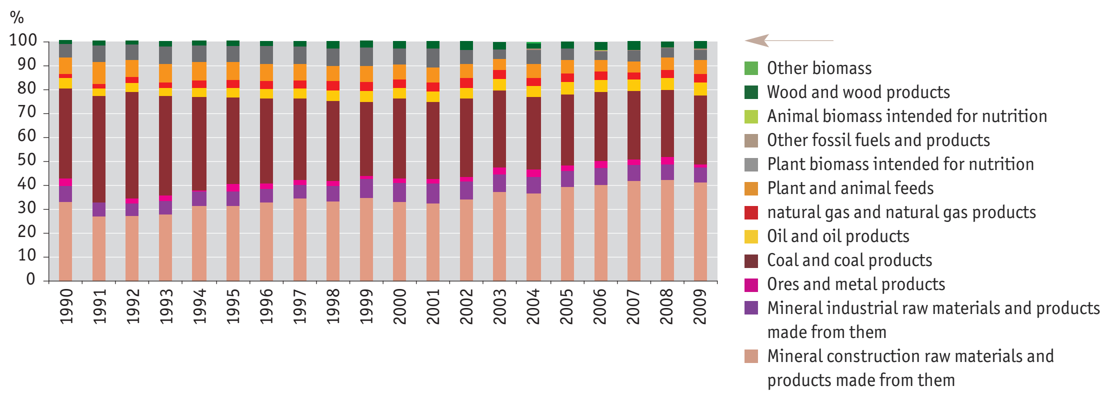
INDICATOR ASSESSMENT

Chart 1 → **Development of domestic material consumption and its components in the Czech Republic [mil. t], 1990–2009**



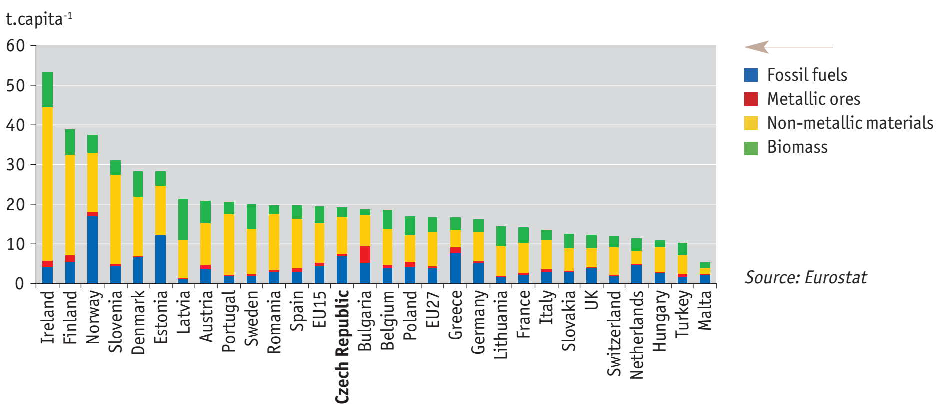
Source: Charles University Environment Centre

Chart 2 → **Material consumption structure in the Czech Republic by material groups [%], 1990–2009**



Source: Charles University Environment Centre

Chart 3 → **International comparison of domestic material consumption by material group [t.capita^{-1}], 2007**



Source: Eurostat

Following a five-year period of growth between 2003 and 2007 and a mild decline in 2008, the Czech Republic's **domestic material consumption** (DMC[2]) dropped by 8.7% to 176.5 million tonnes in 2009 (Chart 1). **The trend in the Czech Republic's material consumption has thus followed the development of the economy in the 21st century**. The decrease over the past few monitored years reflects the economic slowdown and subsequent decline in 2009 (GDP shrank by 4.1% year-to-year), especially with regard to material-intensive industries such as construction, metal production, the manufacture of machinery and equipment and the manufacture of motor vehicles. In 2009, material consumption stood at 60% of the 1990 level, which means that the environmental burden that is associated with material consumption is currently significantly lower than in the early 1990s.

Mineral construction raw materials make up the largest proportion of domestic material consumption (Chart 2). Furthermore, the proportion of this category has continued to increase since 2000 and has the greatest effect on total domestic material consumption. The absolute figures for this category indicate that it significantly contributed to both the increase in domestic material consumption between 2002 and 2007, when it increased by 39.3% from 59.1 million tonnes to 82.3 million tonnes, and to the subsequent decline of 8.3 million tonnes (10.1%), i.e. the largest absolute decline for all categories of materials. The above trends reveal noticeable fluctuations in construction that are dependent on economic development. The 'ores and ore products' category showed the largest relative decline in 2009 – after a period of significant fluctuations, it decreased by 3.1 million tonnes (i.e. by 53.1%).

The second most important category within domestic material consumption is coal and coal products, whose proportion in domestic material consumption has been slowly declining. Consumption in this category stagnated at approximately 56.8 million tonnes between 2002 and 2007. After that, coal consumption started to decline, namely by 6.7% (3.6 million tonnes) year-to-year in 2009. Due to the trends in the transport sector, the consumption of oil and oil products increased after 2000 (from 7.6 to 9.6 million tonnes, i.e. by 23%). In 2009, oil consumption stagnated and did not reflect the downward trend in the consumption of other categories of materials. The consumption of natural gas and natural gas products fluctuated over that period with no significant trend, largely due to the temperature conditions during the heating seasons. Trends in fossil fuel consumption indicate the gradual (and desirable) substitution of liquid and gaseous fuels for solid fuels. However, fossil fuel consumption has stagnated.

As regards renewable resources, it is plant and animal feed followed by plant biomass for food and wood and wood products that account for the largest proportion in domestic material consumption. The consumption of these material groups is connected with the overall proportion of the consumption of renewable resources in domestic material consumption. This proportion decreased from 15.2% in 2002 to 11.5% in 2008. Unlike non-renewable resources, the consumption of these categories of materials remained virtually unchanged in 2009 (the consumption of biomass for nutrition and wood even slightly increased by 0.5 and 0.4 million tonnes respectively, i.e. by approximately 7%) and the proportion of renewable resources in domestic material consumption thus increased to 12.9%. Nonetheless, the **proportion of renewable resources in the Czech Republic's material basis is very low** and since the consumption of renewable resources is usually associated with less environmental impact than the consumption of non-renewable resources, the trend between 2002 and 2008 should be regarded as negative.

Between 1991 and 2009, the proportion of imports in domestic material consumption (i.e. the material dependence on imports) increased significantly from 9.8% in 1991 to 33% in 2009; the increase between 2002 and 2008 was 7 percentage points. In 2009, material dependence on imports decreased by 1.4 percentage points due to a significant decline in both imports and exports (13% and 11.5%, respectively) and an overall decline in domestic material consumption. In the case of fossil fuels, the proportion of imports in their consumption increased from 14.2% in 1991 to 38.3% in 2009. Between 2002 and 2009 it increased by 8.5 percentage points, with the latest reporting year showing an increase of 2.5 percentage points. This significant increase was mainly due to the growing oil and natural gas consumption, as the vast majority of these fuels is imported.

The Czech Republic's per-capita domestic material consumption is approximately 13% higher than the EU27 average and roughly corresponds to the EU15 average (Chart 3). Per-capita domestic material consumption is much higher in many Western European and Scandinavian countries. In the Scandinavian countries, this is partly due to a very low population density, the need to maintain an extensive road network and climatic conditions. The relatively high level of domestic material consumption in the Czech Republic is due to a high per-capita consumption of fossil fuels and non-metallic materials compared to other countries. Conversely, biomass consumption in the Czech Republic is the fourth lowest after Bulgaria, Hungary and Romania. The high fossil fuel consumption can be attributed to the large proportion of solid fuels in the primary energy basis (51% in 2007) and the persistent relatively high energy intensity that results, among other things, from the substantial proportion of industry in the Czech economy.

Since material consumption largely depends on the structure of the national economy and GDP, over **the short-term horizon it can be assumed that if economic growth is resumed, domestic material consumption will increase. The longer-term trend in domestic material consumption will depend on the position of material-intensive sectors** (such as metal production, construction and the manufacture of motor vehicles) **in the Czech economy and on trends in the Czech Republic's energy basis.** Unless the position of material-intensive sectors declines (i.e. sectors with low or at least declining material-intensity such as services and the food industry become more important), material consumption and the environmental burden that is associated with such consumption are not likely to show any longer-term downward trends.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

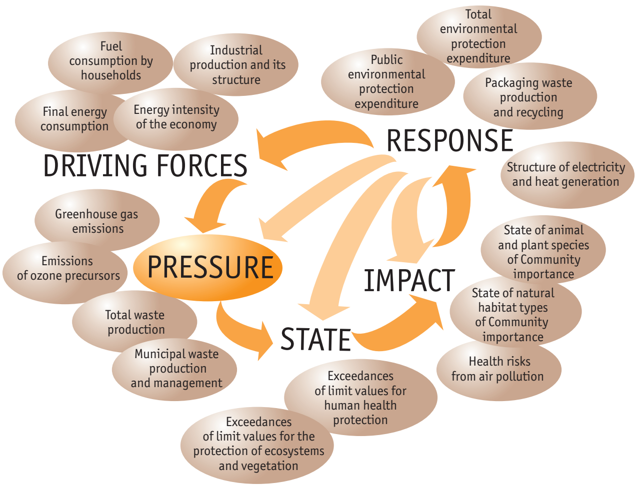
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1842)

[2] Domestic material consumption (DMC) is calculated as used domestic extraction plus imports minus exports. It measures the amount of materials that are consumed by the economy for production and consumption. The level of used domestic extraction is in proportion to the burden and the impacts that are associated with extracting raw materials and growing 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 2000. As a result, the efficiency in transforming materials into economic output is improving and the specific environmental burden declining. Between 2000 and 2009[1] material intensity decreased by 26.7%, with a year-to-year decrease of 4.8% in 2009.

Over the period under review, a decrease in material intensity occurred in most years either due to the combination of economic growth and a stagnating or growing material consumption or during economic downturn when material consumption declined even faster than economic output (the latter occurred in 2009). The combination of declining material consumption and a growing economy (i.e. absolute decoupling) has not been achieved. Therefore, if the current structure of the economy is maintained, the outlook for material consumption in the case of economic growth is not positive.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Priority area 2 'The Sustainable Use of Natural Resources, Material Flows and Waste Management' within the **State Environmental Policy of the Czech Republic** aims at (priority objective 2.4) reducing the energy and material intensity of production and increase the use of waste for material and energy recovery. While the draft State Environmental Policy of the Czech Republic for 2011–2020 addresses material consumption within the 'Conservation and sustainable use of resources' thematic area, no specific objectives for this area have been set.

Increasing material and energy efficiency and achieving the Czech Republic's independence of foreign energy sources is among the priorities of the Strategic Framework for Sustainable Development in the Czech Republic that was approved by the government in January 2010 and replaced the Sustainable Development Strategy of the Czech Republic. The strategy is to be implemented through encouraging innovation, environmentally friendly technologies and measures to promote sustainable consumption at household level. Other strategic documents such as the **Raw Material Policy** and the **State Energy Policy of the Czech Republic** underline the need to reduce material consumption and maintain a certain level of raw-material and material self-sufficiency. The need to improve efficiency in transforming materials into economic output and to reduce the environmental burden per unit of economic output has been highlighted by the **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**.

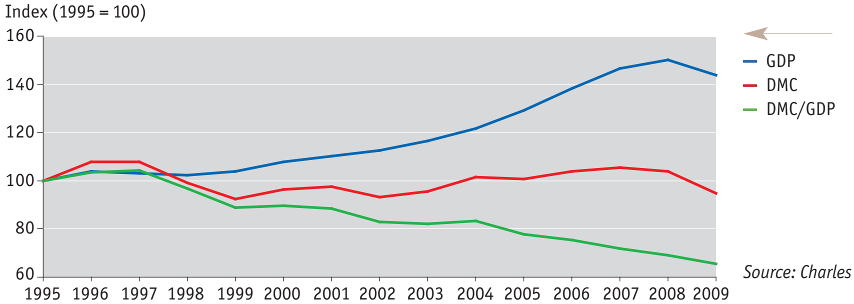
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

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

[1] *Due to the data collection and reporting procedures used by the Czech Statistical Office, data for material flow indicators for 2010 are not available at the time of finalizing this publication. These data will be published in the publication entitled „Material Flow Accounts in the Czech Republic in 2003-2010" probably in February 2012 and will be evaluated in the Report for 2011.*

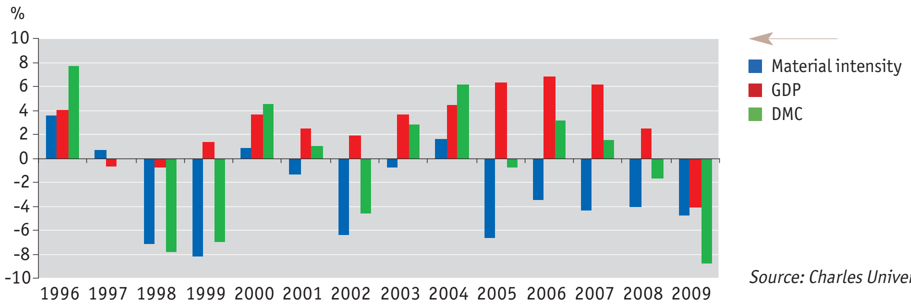
INDICATOR ASSESSMENT

Chart 1 → **Material intensity of GDP, domestic material consumption and the GDP in the Czech Republic [index, 1995 = 100], 1995–2009**



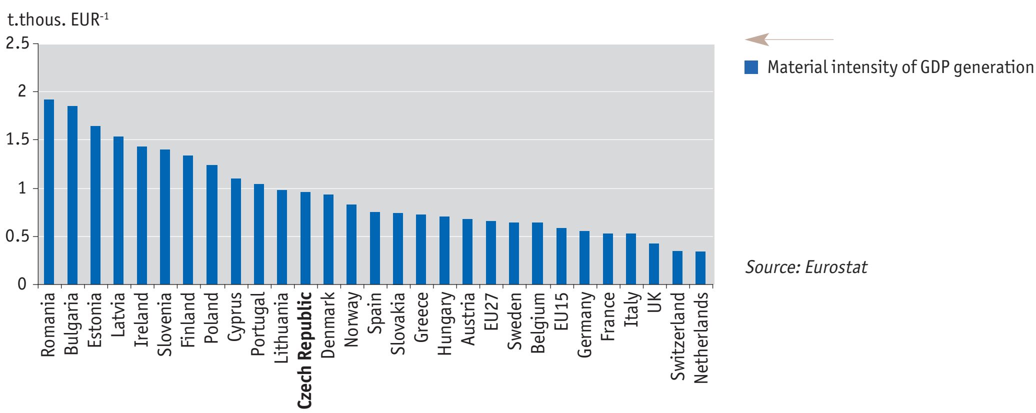
Source: Charles University Environment Centre

Chart 2 → **Year-to-year changes in material intensity, domestic material consumption and GDP [%], 1996–2009**



Source: Charles University Environment Centre

Chart 3 → **International comparison of material intensity [t.thous. EUR⁻¹], 2007**



Source: Eurostat

The material intensity of the Czech economy has been declining since 1998, most markedly in the period since 2004 (Chart 1, DMC/GDP – the green line). Between 2000 and 2009 material intensity decreased by 26.7% and in 2009, it decreased by 4.6% year-to-year while domestic material consumption decreased by 8.7%. 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. The fact that the strong economic growth between 2003 and 2007 was associated with an increase in domestic material consumption was, among other things, based on material-intensive industries such as construction, the manufacture of machinery and equipment and the manufacture of motor vehicles.

The above trend is referred to as 'decoupling', i.e. the separation of the trend in environmental impact expressed as domestic material consumption from the trend in economic output expressed as GDP (Chart 1). In the period from 1995 to 2009 as a whole (and in most years within that period), there was only relative decoupling, i.e. the economy and material consumption showed the same type of trend (upward or downward), but material consumption per unit of economic output declined. Relative decoupling resulting from economic growth (while domestic material consumption was increasing) occurred in 2001, 2003 and 2006–2007, and relative decoupling resulting from decreasing domestic material consumption (while the economy was declining) occurred in 1998 and 2009 (Chart 2). Absolute decoupling (i.e. declining material consumption combined with positive economic growth) was only recorded in 1999, 2002 and 2008. The decline in material consumption in those years indicates the subsequent decline in economic output.

The largest material flows are associated with the sectors of metal production, construction, gas and electricity production and distribution, other mineral extraction, coal and peat extraction, the manufacture of machinery and equipment and the manufacture of motor vehicles. In addition, the material flows that are induced by these sectors also grew or stagnated between 2000 and 2008 (while data is not available for 2009, this is not significant in terms of trend analysis). The only exceptions were the gradually declining material requirements in gas and electricity production and distribution, while the proportion of this sector in material consumption has also declined in the Czech Republic. This phenomenon can be partly attributed to the European greenhouse gas emission trading system, where the cost of one tonne of carbon dioxide is such a significant cost factor that it influences the choice of energy sources in electricity generation (to the detriment of brown coal power plants). Total material consumption is significantly influenced by the construction sector that is decisive for the 'mineral construction raw materials' category, thereby influencing the material flows that are associated with the 'other mineral extraction' sector. However, consumption of fossil fuels and ores is also significant from the environmental perspective – in addition to causing interference with the landscape, it results in additional environmental pressures, such as greenhouse gas and air pollutant emissions. The consumption trends in this category of materials will be shaped by material consumption trends in the sectors of gas and electricity production and distribution, metal production, manufacture of machinery and equipment and manufacture of motor vehicles, as well as by the proportion of these sectors in generating GDP.

The Czech Republic's material intensity is almost one-third higher than the EU15 average and is also significantly higher compared with the EU27 average (Chart 3). Higher material intensity than the Czech Republic's is found in some other new EU countries, notably Poland, Slovenia and Estonia. The only EU15 countries with a higher material intensity than the Czech Republic were Portugal, Finland and Ireland. The unfavourable position of the new EU countries results from the fact that while their direct material consumption per capita is often comparable to the EU15 countries, their GDP per capita is considerably lower.

Future trends in material intensity will depend on **the structure of the economy, the position of material-intensive sectors within the Czech economy and the development of the structure of the energy basis**. Given the increasing material flows in the sectors of metal production, the manufacture of motor vehicles and construction and their share in the Czech Republic's GDP, only a moderate decline in material intensity and continued relative decoupling can be expected. A decrease in material consumption in periods of economic growth can only occur if there are significant structural changes to the economy that would strengthen the role of sectors with low material intensity.

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

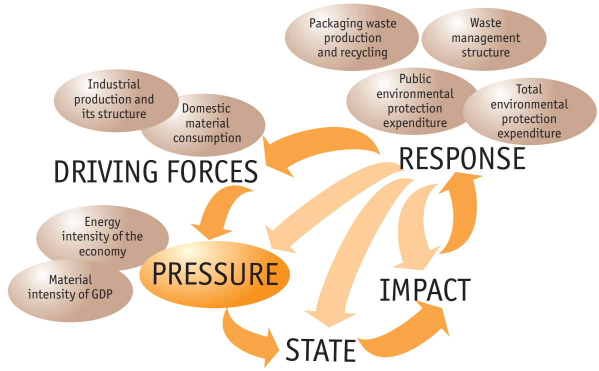
KEY QUESTION →

Is total waste production declining?

KEY MESSAGES →

Between 2003 and 2010, total waste production decreased by almost 12%. Year-to-year, total waste production decreased by 1.4%.

While waste production in the 'hazardous waste' category kept increasing between 2003 and 2009, the 2010 level of hazardous waste production was similar to 2003. There was a significant year-to-year drop of 17%.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Government Regulation No. 197/2003 Coll., on the Waste Management Plan of the Czech Republic (the Plan) and consequently the **State Environmental Policy of the Czech Republic** for 2004–2010 recommend reducing specific waste production, primarily through reducing the material intensity of production.

A useful tool is the introduction of best available techniques (BAT) both in manufacturing and in waste management. Emphasis is placed in particular on preventing and reducing the specific production of hazardous waste, reducing the hazardous properties of waste, substituting hazardous substances and materials, building facilities for hazardous waste disposal, eliminating waste polychlorinated biphenyls (PCBs) by 2010 and effectively utilising all instruments for protecting the environment in the cross-border shipment of waste that are suggested by **Regulation (EC) No. 1013/2006 of the European Parliament and of the Council** on shipments of waste. The regulation was drafted taking into account other international documents related to the cross-border transport of waste, especially the Basel Convention and the OECD Council Decision[1], laying down the rules for cross-border transport within the EU and for export to/import from third countries.

The basic legislative document is the **Waste Framework Directive** (Directive 2008/98/EC of the European Parliament and of the Council on waste), which lays down recommendations and specific requirements for waste management. The requirements of the European directive were implemented through **Act No. 185/2001 Coll., on waste** including the implementing legal regulations.

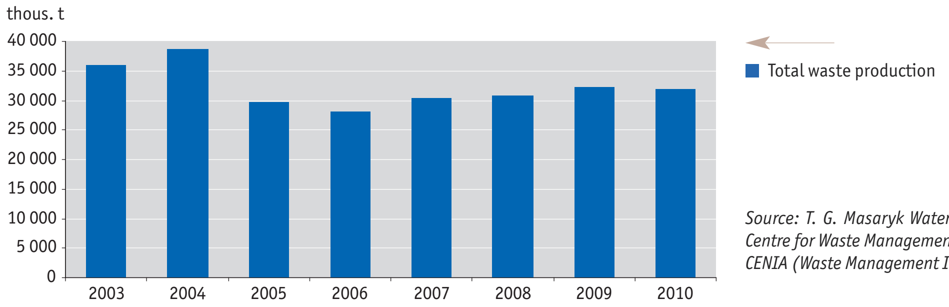
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Waste management involves many potentially dangerous situations. Releasing waste into the environment (e.g. in handling, transport or landfilling) always poses a risk to the quality of the environment and may affect the health of the residents and the quality of ecosystems. The risk is considerable especially in the case of waste with hazardous properties such as toxic, infectious and radioactive waste. The indirect impacts of waste production and management may include particulate matter emissions that are released in waste management, greenhouse gas emissions, toxic seepage into groundwater etc.

[1] *Council Decision OECD C(2001)107/FINAL*

INDICATOR ASSESSMENT

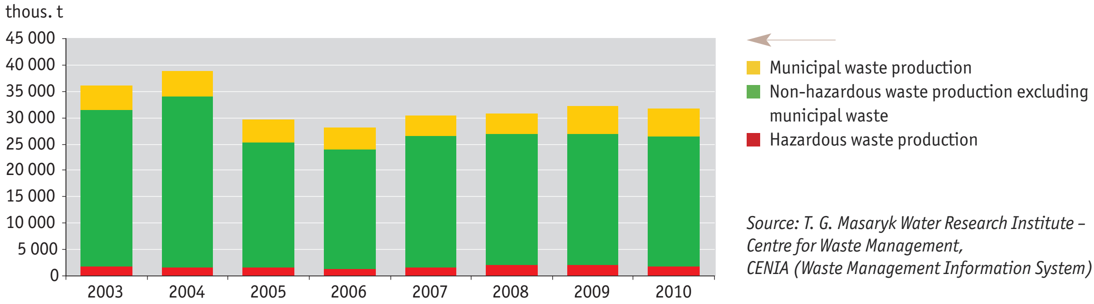
Chart 1 ➜ **Total waste production in the Czech Republic [thous. t], 2003–2010**



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

The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set".

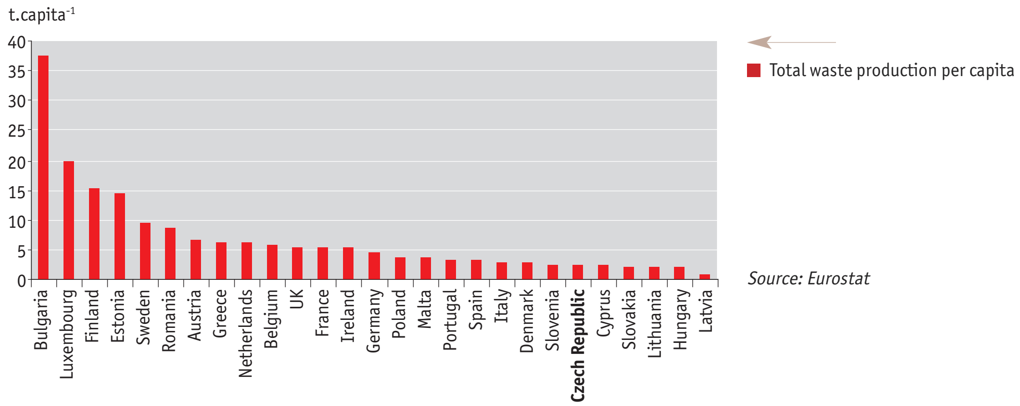
Chart 2 ➜ **Total waste production by category (hazardous, non-hazardous and municipal) in the Czech Republic [thous. t], 2003–2010**



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

The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set".

Chart 3 ➜ **Total waste production per capita, an international comparison [t.capita^{-1}], 2008**



Source: Eurostat

The underlying data are sent to Eurostat by the Czech Statistical Office; the discrepancies between data of the Czech Statistical Office and the Waste Management Information System are due to differences in data processing (different data collection and processing methodologies, different definitions of municipal waste).

Total registered waste [2] (hereinafter „total waste production") decreased by 12% between 2003 and 2010 (Chart 1). Over the monitored period, the lowest level was achieved in 2006 (a total of 28 million tonnes of waste was produced) and, by contrast, the highest amount of waste was produced in 2004 (38.7 million tonnes). In 2010, total waste production decreased by 1.4% year to year. The decrease in total waste production between 2003 and 2010 is largely attributable to structural changes in industrial production: the development of industrial and waste processing technologies that increase production efficiency and, last but not least, the economic impact of the rising prices of primary raw materials. After transposing the waste directive, a portion of waste may be labelled as by-products that are not regulated by the Act on Waste (e.g. fly ash from incinerators).

Over the monitored period, **waste production trends in the 'other waste' category** including municipal waste correspond to the trends in total waste production, reaching a minimum in 2006 and a maximum in 2004 (Chart 2). Between 2006 and 2009, waste production in the 'other waste' category increased, while the last year-to-year change was a slight decline (of 0.3%) compared to 2009.

While **waste production in the 'hazardous waste' category** grew between 2003 and 2009, production dropped significantly in 2010, when the amount of produced hazardous waste was similar to the 2003 level (Chart 2). Year-to-year, hazardous waste production decreased by 17.5%. As the total production of waste in the 'hazardous' category grew between 2003 and 2009, the proportion of hazardous waste in total waste production also grew. It increased from 4.9% in 2003 to 5.6% in 2010, but the most significant increase in the proportion of hazardous waste in total waste production occurred mainly in 2007 and 2008.

By comparison to per-capita waste production in other EU27 member states (Chart 3), the Czech Republic has the sixth lowest total per-capita production, namely 2.4 tonnes in 2008. The largest amount of waste per capita was produced in Bulgaria (37 tonnes) in 2008. By contrast, Latvia had the lowest per-capita waste production (0.7 tonnes). In the EU27, an average of 5.2 tonnes of waste was produced in 2008, which represented a decrease of 28% compared to 2006.

Since waste production in the Czech Republic is lower compared to the EU27, waste production cannot be expected to significantly decline in the future, even if materials that are currently considered waste are reused.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

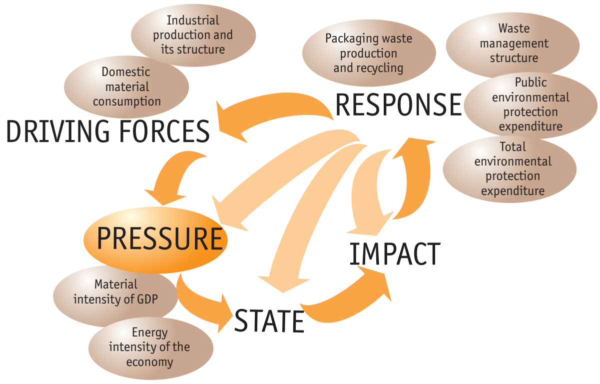
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1844)

[2] The reason why the registered disposal volume is greater than the registered production volume lies in the exclusion of below-the-threshold producers from total waste production. (Below-the-threshold waste producers are producers that did not exceed the reporting limits set by section 39 of Act No. 185/2001 Coll., on waste, and thus have no reporting obligation and are not included in total registered production. However, their waste is included in registered disposal, because final waste disposal facilities are always obligated 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 Act on Waste must include recalculating the total amount of produced waste to include waste from below-the-threshold producers.

32/ Municipal waste production and management

KEY QUESTION →

Is the proportion of landfilled municipal waste decreasing?



KEY MESSAGES →

The proportion of municipal waste that is used for material recovery in total waste production increased from 10.9% in 2003 to 24.3% in 2010. This trend also continued between 2009 and 2010, with the proportion of municipal waste that is used for material recovery increasing from 22.7% to 24.3%.

While the amount of produced municipal waste increased by 1% year-to-year, the amount of mixed municipal waste decreased by 4%.

In 2010, 59.5% of all municipal waste was landfilled. Landfilling thus remains the most common method of municipal waste disposal, even though the proportion of municipal waste disposed of through landfilling is gradually declining.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The most significant strategic materials include **Government Regulation No. 197/2003 Coll., on the Waste Management Plan of the Czech Republic** (the Plan) that provides the basis for the **State Environmental Policy of the Czech Republic** for 2004–2010. The Plan defines several key strategic objectives that include reducing specific waste production independently of the level of economic growth; achieving the maximum utilization of waste as a substitute for primary natural resources; and minimizing the adverse effects on human health and the environment in waste management.

Municipal waste management is addressed in greater detail in the above documents. The sub-objectives set by the Plan include increasing the proportion of municipal waste that is used for material recovery to 50% by 2010 compared to 2000 and (in pursuance of Council Directive 1999/31/EC on the landfill of waste) reducing the proportion of landfilled biodegradable municipal waste (BMW) so that the proportion of the weight of this component in the total amount of BMW that was produced in 1995 is no more than 75% by 2010, 50% by 2013 and eventually 35% by 2020. The landfilling of BMW is also addressed by one of the sub-objectives and measures of the State Environmental Policy of the Czech Republic for 2004–2010. In addition, using the resources of the State Environmental Fund to build facilities for the processing of BMW is recommended as a measure to reduce the maximum amount of BMW that is landfilled.

Waste management is addressed in very specific terms by Act No. 185/2001 Coll., on waste (as amended) that was adopted in response to new **Directive 2008/98/EC of the European Parliament and of the Council.**

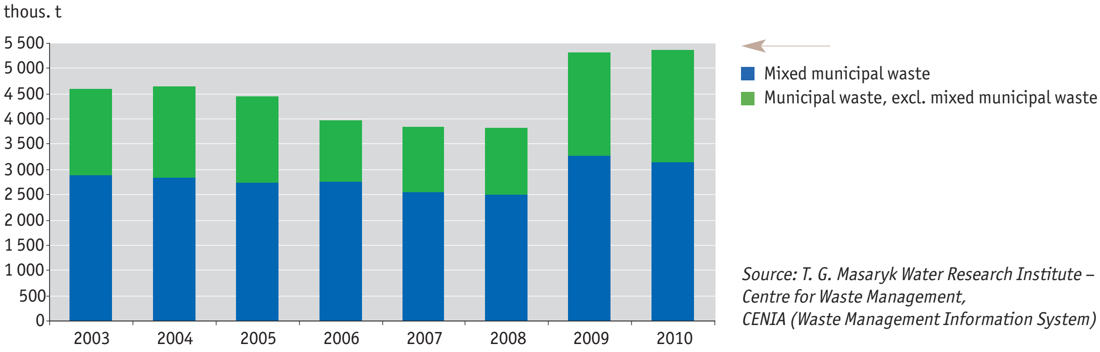
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Society most commonly comes into contact with municipal waste, which is why emphasis is placed on proper municipal waste management. Given its diversity and often also hazardous properties, this type of waste may pose a risk to human health. Significant issues include the potential biogenic contamination of recycling areas, the handling of BMW, compost etc. Illegal landfills (and landfills in general) have a negative impact, especially on the landscape.

In the case of controlled landfilling, the negative effects mainly include the wind transport of material. Landfills are a source of methane, a powerful greenhouse gas that is generated through the anaerobic decomposition of organic carbon. Waste incineration is a source of air pollution and a source of CO_2 originating from fossil carbon.

INDICATOR ASSESSMENT

Chart 1 ➜ **Total municipal waste production in the Czech Republic [thous. t], 2003–2010[1]**



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

The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set".

Table 1 ➜ **Municipal waste management mix relative to total municipal waste production in the Czech Republic [%], 2003–2010[1, 2]**

Management method [%]	2003	2004	2005	2006	2007	2008	2009	2010
Data provided by	T. G. Masaryk Water Research Institute	T. G. Masaryk Water Research Institute	T. G. Masaryk Water Research Institute	T. G. Masaryk Water Research Institute	CENIA	CENIA	CENIA	CENIA
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
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
Proportion of municipal waste disposed in landfills (D1, D5, D12)	63.3	64.4	69.3	81.0	86.2	89.9	64.0	59.5
Proportion of municipal waste disposed in incinerators (D10)	4.80	0.05	0.04	0.05	0.07	0.05	0.04	0.04

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

The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set".

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

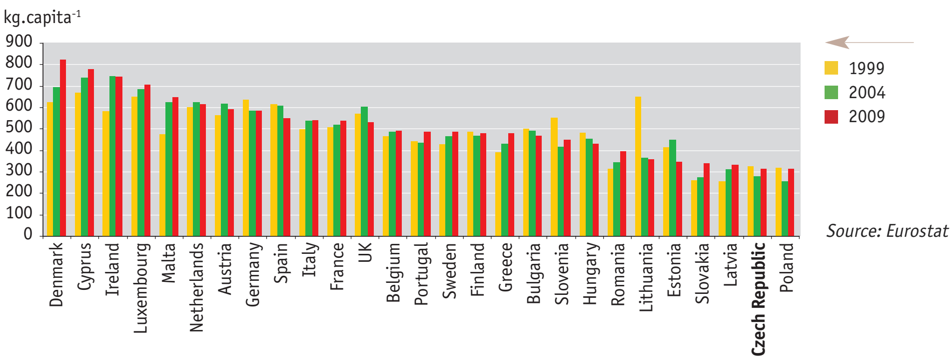
[2] *Waste disposal codes D3 and D4 are not included in the table because these categories contain zero values.*

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	Depositing 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

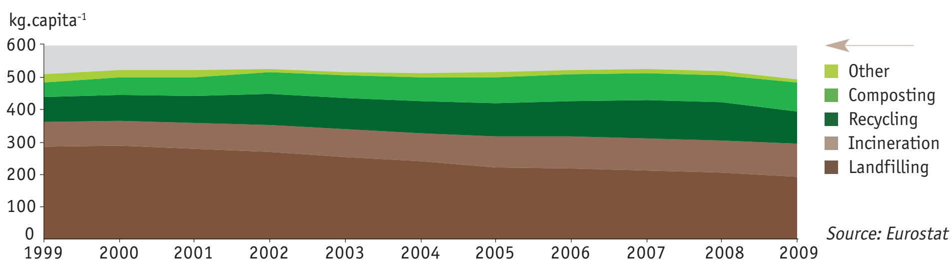
Source: Decree No. 383/2001 Coll., on waste management details

Chart 2 ➜ **International comparison of municipal waste production [kg.capita^{-1}], 1999, 2004, 2009**



The underlying data are sent to Eurostat by the Czech Statistical Office; the discrepancies between data of the Czech Statistical Office and the Waste Management Information System are due to differences in data processing (different data collection and processing methodologies, different definitions of municipal waste).

Chart 3 ➜ **Municipal waste management methods in EU27 [kg.capita^{-1}], 1999–2009**



In the period between 2004 and 2008, **total municipal waste production** followed a downward trend. The decline over that period totalled approximately 840 thousands of tonnes of waste. Following a reversal of the trend in 2008, municipal waste production has been increasing. In 2010, it reached 5.36 million tonnes (Chart 1). Overall, municipal waste production has increased by 16% since 2003. In 2010, about 510 kg of mixed municipal waste per capita was produced in the Czech Republic.

Over the monitored period, **the total production of mixed municipal waste** (i.e. residual or unsorted waste originating mostly from households and small businesses that typically produce waste in non-manufacturing activity) followed the same trend as total municipal waste production. In 2010, the proportion of mixed municipal waste in total municipal waste production was 59%, which is the lowest value for the entire monitored period (the average value being around 62%). In 2010, about 300 kg of mixed municipal waste per capita was produced in the Czech Republic.

The different methods of waste management (treatment) 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 Calculating the „Waste Management Indicator Set" methodology, which defines the procedure for calculating the various indicators in waste management, the methods of municipal waste management can be divided in particular 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). In 2003, a total of 63.3% of municipal waste was disposed in landfills. Until 2008, the proportion of municipal waste disposed of in landfills gradually increased to 89.9%. Since 2009, there has been a positive downward trend in the proportion of municipal waste disposed of in landfills, reaching 59.5% in 2010. In terms of other municipal waste management methods, the use for material recovery is important – its proportion has been gradually increasing since 2003. At present, 24.3% of municipal waste is used for material recovery. Approximately 9% of municipal waste is used for energy recovery, while 0.04% of municipal waste was disposed of in incinerators in 2010.

In each member state, the issue of municipal waste is dealt with differently and even the definitions of municipal waste are different. **By international comparison** with other EU countries, the Czech Republic is doing very well and has one of the lowest levels of municipal waste production in the EU27 (Chart 2). Apart from the above-mentioned differences in definitions, lower municipal waste production is closely related to the population's purchasing power, consumer behaviour and the frequency of consumer goods replacement. The declining production of mixed municipal waste is caused by a consistently growing level of the sorting of separable municipal waste components (plastics, paper, glass etc.). When comparing municipal waste management in the Czech Republic and the EU27, the biggest difference is in the proportion related to municipal waste disposal in incinerators or through the use for energy recovery (this category is assessed jointly in the EU). However, similarly to the Czech Republic, the most common municipal waste management method is landfilling (Chart 3).

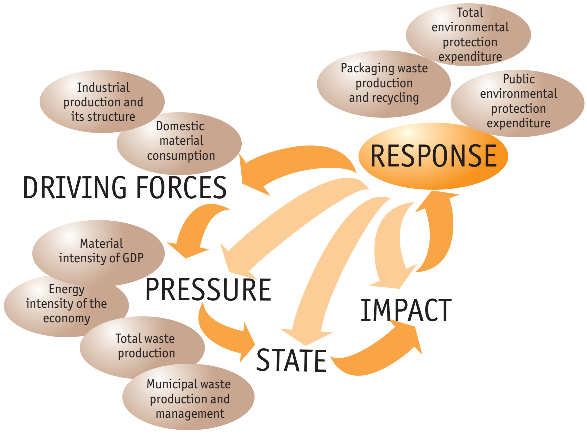
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=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 utilization methods in total waste production increased from 62.2% in 2003 to 73.5% in 2010.

The proportion of selected waste disposal methods in total waste production has been declining over the long term.

In 2010, depositing into or onto land (landfilling) was still the most common method of waste disposal, accounting for 95% of the total waste disposal.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

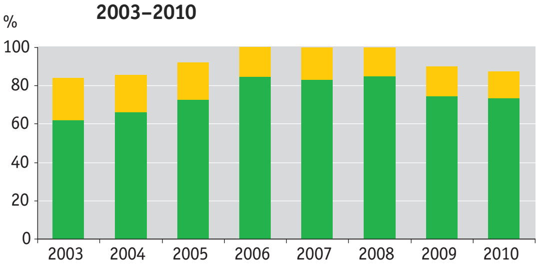
Similarly to the EU, it is recommended to follow the waste management hierarchy in the Czech Republic, meaning that waste prevention and waste utilization are preferred to waste disposal. The hierarchy is also reflected in the S**tate Environmental Policy of the Czech Republic** for 2004–2010, which is based on **Government Regulation No. 197/2003 Coll., on the Waste Management Plan of the Czech Republic** (the Plan). Among other strategic objectives, this document also sets out the requirement to maximize the utilization of waste as a substitute for primary natural resources. This is achieved primarily through measures that aim to initiate and support changes in production procedures towards low-waste and zero-waste technologies and, should waste be produced, a higher level of recovery thereof. Assuming that this is technically and economically feasible, it is recommended that harmful materials and components should be replaced with less harmful materials and components. Key emphasis is placed on minimizing the volume and weight of products while retaining their functional properties.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Compliance or non-compliance with the waste management hierarchy is also important with respect to ecosystems and ecosystem services. The use of primary raw materials can be prevented if the full potential of waste as a valuable raw material is realized (e.g. the use of waste for energy recovery, recycling etc.).

INDICATOR ASSESSMENT

Chart 1 ➜ Proportions of waste management methods in total waste production in the Czech Republic [%], 2003–2010

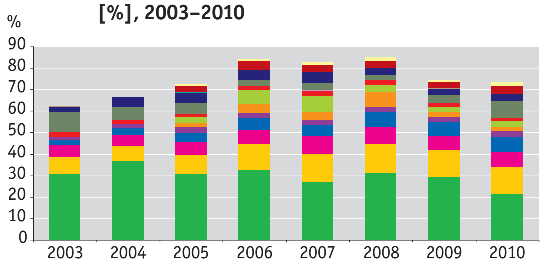


Source: T. G. Masaryk Water Research Institute – Centre for Waste Management, CENIA (Waste Management Information System)

- Disposal as a proportion of total waste production (D1, D5, D12, D3, D4, D10)
- Utilization as a proportion of total waste production (R1–R12, N1, N2, N8, N10, N11, N12, N13, N15)

The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set". A detailed description of the management codes is given in Table 2 on page 115.

Chart 2 ➜ Proportions of selected waste utilization methods in total waste production in the Czech Republic [%], 2003–2010

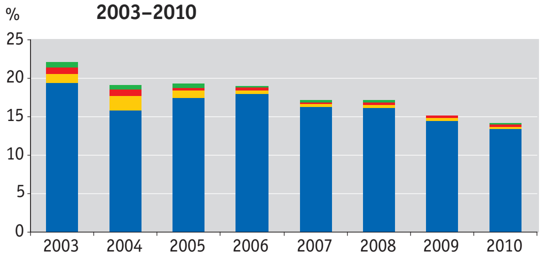


Source: T. G. Masaryk Water Research Institute – Centre for Waste Management, CENIA (Waste Management Information System)

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

The chart shows selected waste utilization methods (codes according to Decree No. 383/2001 Coll., on waste management details, as amended – R1–R12, N1, N2, N8, N10–N13, N15). The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set". A detailed description of the management codes is given in Table 2 on page 115.

Chart 3 ➜ Proportions of selected waste disposal methods in total waste production in the Czech Republic [%], 2003–2010

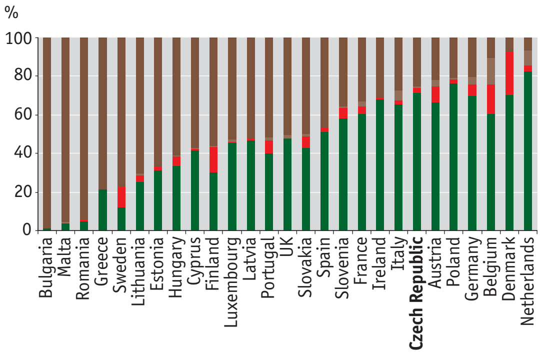


- D1
- D3
- D4
- D5
- D10
- D12

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

The chart shows selected waste disposal methods (codes according to Decree No. 383/2001 Coll., on waste management details, as amended – D1, D3, D4, D5, D10 and D12). The data were determined according to the methodology applicable for a given year – according to the Mathematical Expression of Calculating the „Waste Management Indicator Set". A detailed description of the management codes is given in Table 2 on page 115.

Chart 4 ➜ Waste management mix in the EU [%], 2008



- Recycling
- Energy recovery
- Incineration
- Landfilling

Source: Eurostat

The underlying data are sent to Eurostat by the Czech Statistical Office; the discrepancies between data of the Czech Statistical Office and the Waste Management Information System are due to differences in data processing (different data collection and processing methodologies, different definitions of municipal waste).

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. In terms of the Mathematical Expression of Calculating the "Waste Management Indicator Set", waste management can be divided into waste utilization (recovery, recycling, waste pre-processing etc.) and waste disposal (landfilling, incineration on land etc.). The different municipal waste management codes are described in detail in Table 2 on page 115.

Over the monitored period, the proportion of **waste utilization** has gradually increased, while waste disposal has declined. 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. However, the proportion of waste disposal slightly declined in 2010, which may be due to the effects of the financial crisis in industry and, at the same time, the reclassification of a portion of produced waste that is suitable for utilization as by-products (Chart 1).

Between 2003 and 2008, the proportion of selected waste utilization methods increased from 62.2% to 85.3% (Chart 2), but the upward trend reversed in 2009 and the proportion dropped to 73.5% in 2010. In terms of the structure of selected waste utilization methods, the most common is Use of waste for reclamation and landscaping (30%) and recycling or recovery of other inorganic materials (17%).

Between 2003 and 2010, the proportion of waste disposal in total waste production steadily declined (from 22.1% to 14.1%). Within the selected disposal methods, depositing into or onto land (landfilling) remains the most common method, accounting for 95% (Chart 3). Another method that is dominant among the selected disposal methods is surface impoundment.

In most EU countries, **waste disposal** (especially landfilling) is the most common waste management method. The states that landfilled more than 90% of waste included Romania, Bulgaria and Greece, while countries like Denmark, Belgium or the Netherlands landfilled up to 10% of waste in 2008. Waste recovery through recycling is of increasing importance in most EU member states (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=1847)

34/ Packaging waste production and recycling

KEY QUESTION

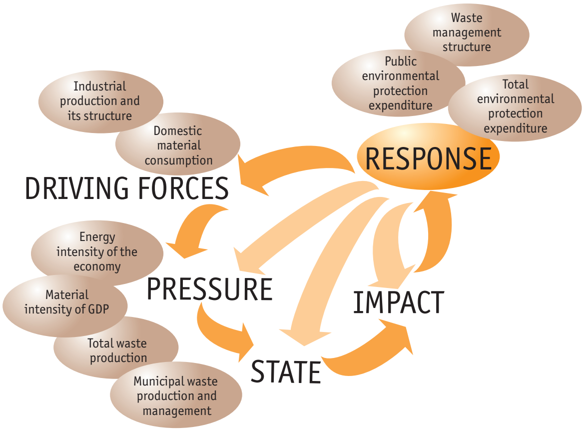
Is the amount of produced packaging waste decreasing and the proportion of packaging waste utilization increasing?

KEY MESSAGES

In 2010, 70% of the total amount of produced packaging waste was recycled and 7.9% was used for energy recovery.

The utilization of registered packaging waste has been steadily increasing since 2003. In 2010, 72.8% of produced packaging waste was utilized within the system of the authorized packaging company, EKO-KOM.

In 2010, the amount of produced packaging increased by 28% compared to 2003. Compared to 2009, produced packaging waste increased by 3%.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Similarly to other types of waste, packaging waste is regulated by two basic strategic documents, namely **Government Regulation No. 197/2003 Coll., on the Waste Management Plan of the Czech Republic** (the Plan) and the **State Environmental Policy of the Czech Republic** for 2004–2010. Under priority area 2 "The Sustainable Use of Natural Resources, Material Flows and Waste Management", the State Environmental Policy of the Czech Republic recommends improving the management of products, packaging and packaging waste. This objective can be achieved primarily through reducing specific waste production independently on the level of economic growth; achieving the maximum utilization of waste as a substitute for primary natural resources; and minimizing the adverse effects on human health and the environment in waste management.

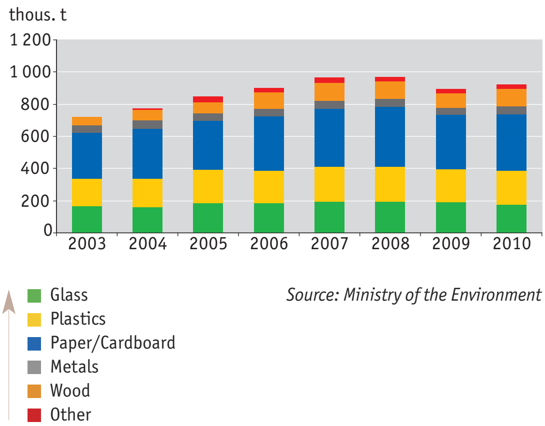
The main legislative document concerning packaging waste management at the EU level is **European Parliament and Council Directive 94/62/EC on packaging and packaging waste.** The obligations following from this European directive have been implemented through **Act No. 477/2001 Coll., on packaging**, as amended.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The recycling of packaging waste reduces the pressures on ecosystems, because the sorted waste components can be reused as new material without the need to extract mainly non-renewable primary raw materials, including all the accompanying phenomena.

INDICATOR ASSESSMENT

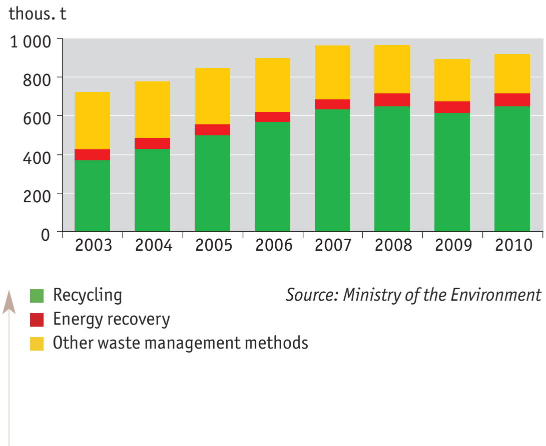
Chart 1 ➔ **Packaging waste and packaging waste composition mix produced in the Czech Republic [thous. t], 2003–2010**



Source: Ministry of the Environment

Produced packaging waste corresponds to the quantity of disposable packaging that is put on the market and the quantity of waste resulting from reusable packaging.

Chart 2 ➔ **Utilization of packaging waste in the Czech Republic [thous. t], 2003–2010**



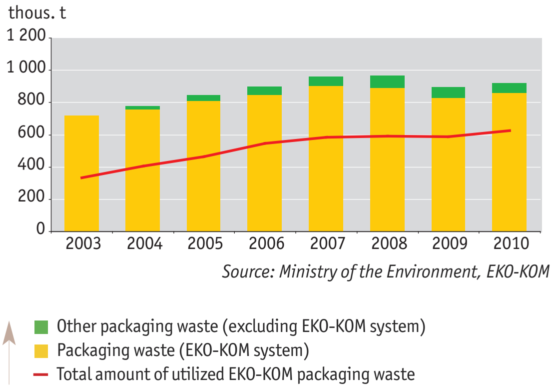
Source: Ministry of the Environment

Table 1 ➔ **Number of entities that are obligated to utilize packaging waste or to provide take-back and that participate in the EKO-KOM system, and the number of municipalities that participate in the EKO-KOM system, 2003–2010**

Year	Number of clients participating in the EKO-KOM system in the EKO-KOM system	Number of municipalities participating
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

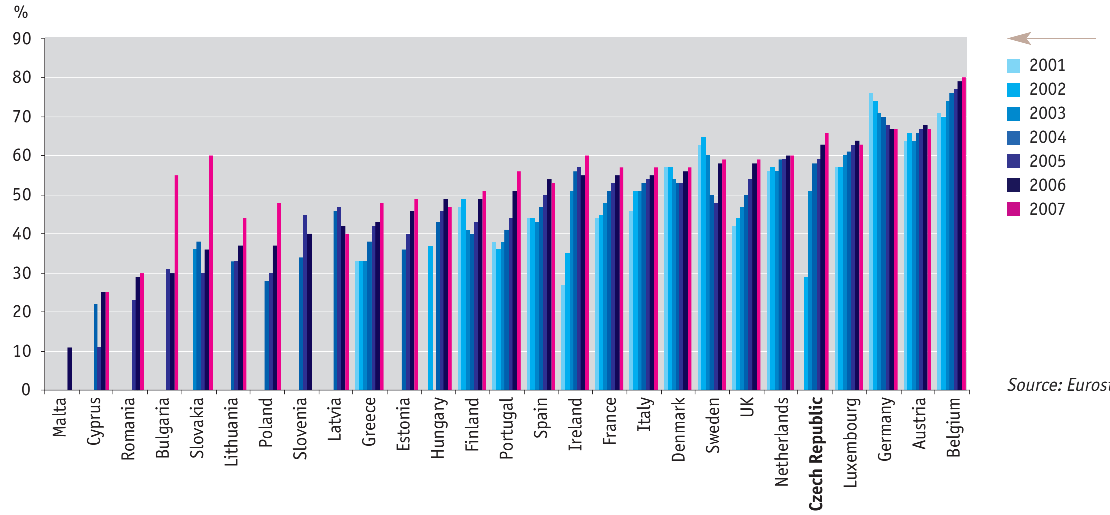
Source: Ministry of the Environment, EKO-KOM

Chart 3 ➔ **Utilization of packaging waste in proportion to the total amount of produced packaging waste in the Czech Republic within the EKO-KOM system [thous. t], 2003–2010**



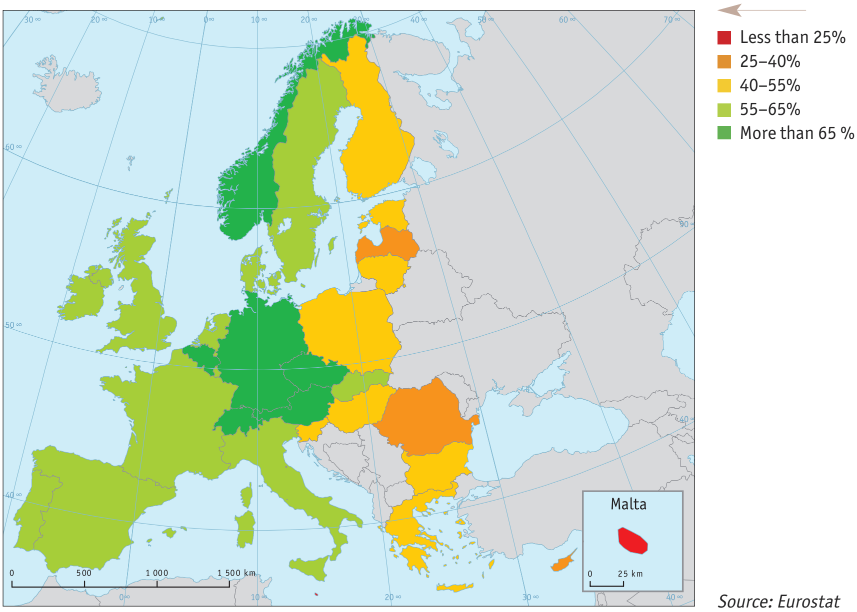
Source: Ministry of the Environment, EKO-KOM

Chart 4 ➜ **International comparison of the packaging waste recycling rate [%], 2001–2007**



Source: Eurostat

Figure 1 ➜ **Packaging waste recycling rate in EU countries, 2007**



Source: Eurostat

The amount of packaging waste produced in 2010 was 28% higher compared to 2003 (Chart 1). Compared to the previous year, produced packaging waste slightly increased by 3%. It can be assumed that one of the main reasons underlying the above year-to-year change is the economic recovery and, by extension, increased consumption and packaging waste production.

The proportions of the different packaging waste types are relatively constant. Over the 2003–2010 period, paper and cardboard waste and plastic waste accounted for the largest proportion of packaging waste. The largest year-to-year changes in the packaging waste structure occurred in the following categories: glass (a decrease of 6%) and wood (an increase of 23%).

The predominant method of waste utilization is **recycling.** A total of 923 thousands of tonnes of packaging waste was produced in 2010, of which 70% was recycled and 8% was used for energy recovery (Chart 2). In the same year, paper/cardboard packaging totalled 353 thousands of tonnes and was 94% recycled, while plastic packaging totalled 209 thousands of tonnes, of which 23% was used for energy recovery, thus accounting for the largest proportion of packaging waste used for energy recovery.

Entities that place packaging or packaged products on the market or into circulation are obligated under **Act No. 477/2001 Coll.**, on packaging to use packaging waste. This obligation can be met by the relevant entities either on their own, or collectively through EKO-KOM.

Between 2003 and 2005 the number of entities participating in the EKO-KOM system increased each year; from 2006 to 2010 the number of participating entities fluctuated, because some companies went out of business or merged. In 2010, the number of the authorized packaging company's clients totalled 20 591. Also, the number of municipalities participating in the EKO-KOM system has been increasing every year since 2003. In 2010, there were a total of 5 904 participating municipalities (Table 1) which corresponds to 98% of the entire population. A total of 861 thousands of tonnes of produced packaging waste was registered within the EKO-KOM system in 2010, which accounts for 93.3% of the total amount of produced packaging waste. The use of packaging waste has been growing since 2003. Within the EKO-KOM system, 72.8% of produced packaging waste was utilized in 2010 (Chart 3).

From the European-wide perspective, the obligations following from Directive 2004/12/EC are being successfully met. In 2007, the recycling rate was approximately 59% in the EU27, with a total of 14% of packaging waste being used for energy recovery. In 2007, 18 member states managed to meet the obligations set by the Packaging Directive. **By international comparison** (Chart 4), Belgium showed the highest packaging waste recycling rate in 2007, namely 80%. Other countries with high recycling rates include Austria (67%), Germany (67%) and the Czech Republic (66%).

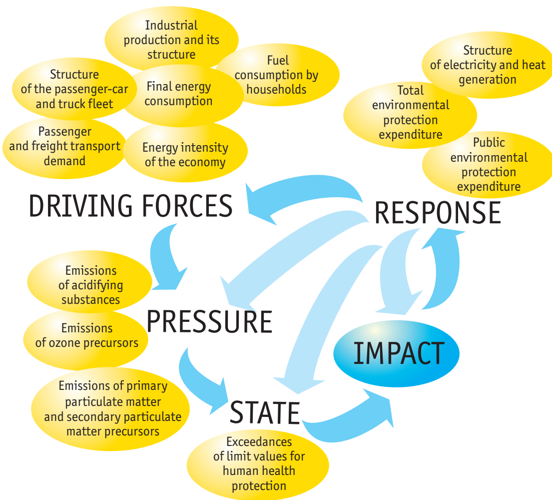
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

35/ Health risks from air pollution

KEY QUESTION

What progress has been made in mitigating health risks arising from air pollution?



KEY MESSAGES

In the long-term horizon, particulate matter ($PM_{2.5}$ and PM_{10}), polycyclic aromatic hydrocarbons (PAHs, represented by benzo(a)pyrene – BaP) and nitrogen dioxide (NO_2) are the most important air pollutants.

According to model calculations of the National Institute of Public Health, both overall mortality caused by exposure to PM_{10} throughout the Czech Republic and the individual lifetime risk of cancer due to exposure to As, Ni, BaP and benzene in Czech urban areas increased between 2006 and 2010.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

One of the priorities of Area 3 "The Environment and the Quality of Life" of the **State Environmental Policy of the Czech Republic** for 2004–2010 is to improve air quality and, by extension, to reduce health risks from polluted air.

Objective 10 of the long-term programme for improving public health in the Czech Republic – **Health for All in the 21st Century (HEALTH21)**, which was approved through a government resolution in 2002, calls for „...reducing public exposure to health risks that are associated with water, air and soil pollution...," and „...systematically monitoring and evaluating air quality and health indicators". Compliance with the programme is monitored at yearly intervals.

In 2008, the revised **Integrated Programme to reduce emissions and improve air quality in the Czech Republic** was prepared.

The **Sixth Environment Action Programme of the EU** called for the preparation of a strategy on air pollution in Europe in order to achieve such air quality that does not result in any significant adverse impacts and risks to human health and the environment. The strategy within the Clean Air for Europe programme (CAFE) was prepared and implemented through Directive 2008/50/EC that specifies air management and monitoring.

The basis for the EU strategy entitled "**Together for Health: A Strategic Approach for the EU 2008–2013**" was adopted in 2007.

In 2010, at the Fifth Ministerial Conference on Environment and Health in Parma, WHO/Europe adopted a declaration aiming to improve the living conditions of the sensitive population, reduce non-infectious diseases that are related to the environment, and reduce exposure to bioaccumulative substances, endogenous disruptors and nanoparticles.

INDICATOR ASSESSMENT

Chart 1 → **Spans of annual averages of PM_{10} [$\mu g.m^{-3}$] in the different types of urban sites in the Czech Republic, 2006–2010**

Source: National Institute of Public Health

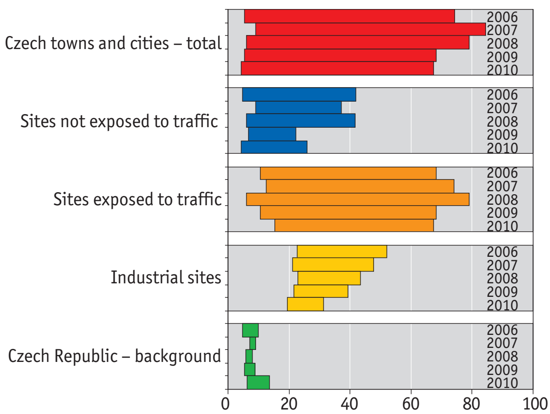
Chart 2 → **Spans of annual averages of $PM_{2.5}$ [$\mu g.m^{-3}$] in the different types of urban sites in the Czech Republic, 2006–2010**

Source: National Institute of Public Health

Chart 3 → **Spans of estimated health risks (ILCR[1]) for BaP in the different types of urban sites in the Czech Republic, 2006–2010**

Source: National Institute of Public Health

Chart 4 → **Spans of annual averages of NO_2 [$\mu g.m^{-3}$] in the different types of urban sites in the Czech Republic, 2006–2010**



Source: National Institute of Public Health

[1] *ILCR (Individual Lifetime Cancer Risk) expresses risk level as the probability that an individual belonging to the exposed population will develop cancer over a lifetime.*

Table 1 → **Increase in total annual mortality due to "premature deaths" [premature deaths] – the spans and (mean values) for the Czech Republic, 2006–2010**

	2006	2007	2008	2009	2010
PM_{10} (50% of $PM_{2,5}$)	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)
PM_{10} (75% of $PM_{2,5}$)	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)

Source: National Institute of Public Health

The increase in total mortality was calculated from the span of the values measured in the Czech Republic and the mean values for the Czech Republic; annual averages for $PM_{10} \leq 20$ µg.m^{-3} were evaluated as 0; total annual mortality figures were borrowed from the Czech Statistical Office.

When calculating the effects of PM_{10}, WHO recommendations were used, assuming a mean proportion of $PM_{2.5}$ in PM_{10} at 50% and an estimated mean proportion of $PM_{2.5}$ in PM_{10} at 75% in the Czech Republic.

Table 2 → **Spans of the cancer risk to the population for evaluated types of sites (evaluated substances: As, Ni, BaP and benzene) in towns with a population of over 5 000 (ca 5 million inhabitants in the Czech Republic), 2006–2010**

Carcinogenic substances	2006		2007		2008		2009		2010	
Number of additional cases according to type of exposure and site	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
municipalities (over 5 000 – 5 mil. inhabitants)	7.74	78.39	4.03	59.93	3.19	61.94	4.25	60.73	3.5	48.6
sites not exposed to traffic	6.96	19.16	4.40	11.79	3.20	11.96	4.49	10.32	4.4	12.8
sites exposed to traffic	6.86	19.31	6.63	18.93	5.49	39.09	4.26	30.23	3.5	29.2
industrial sites	16.19	78.10	15.35	76.30	11.36	61.86	12.35	60.66	11.4	48.0

Source: National Institute of Public Health

For the purposes of health risk assessment, the data were processed in the form of span intervals for the Czech Republic, for all urban stations (a total of approximately 5 million inhabitants) and for selected types of urban sites (residential not exposed to traffic and urban exposed to traffic). Due to lack of data, the above procedure cannot be used for a more detailed evaluation of exposure for residents of small municipalities (< 5 000 residents – approximately 5 million inhabitants).

Exposure to PM_x corresponds to the level of pollution and the behavioural patterns in the population that are characteristic of the respective age group. The severity depends on the size, shape and chemical composition of the particles. Despite the proven adverse effects of suspended particulate matter on human health, no threshold concentrations have been set.

The effects of short-term elevated daily concentrations of PM_{10} include increased overall morbidity and mortality (especially from cardiovascular disease), increased hospitalizations for respiratory diseases, increased infant mortality, increased incidence of cough and breathing difficulty (especially in asthmatics).

The effects of long-term elevated concentrations include reduced lung function in children and adults, increased morbidity from respiratory diseases, the occurrence of the symptoms of chronic bronchitis and reduced life expectancy mainly due to a higher mortality from cardiovascular disease and probably also from lung cancer. Increased mortality affects in particular elderly and sick persons, in whom it reduces life expectancy. These effects of PM_{10} are reported for annual average concentrations greater than 20 µg.m^{-3}. In the case of chronic exposure to suspended particulate matter $PM_{2.5}$, reduced life expectancy already occurs at an annual average concentration of 10 µg.m^{-3} (Charts 1 and 2).

Over the monitored period, **risks from exposure to PM_{10}** accounted for 1.7% to 13.2% of premature deaths in the population, most of all in the Ostrava-Karviná region that is heavily burdened with industry. The risk is not evenly distributed in the population – it affects sensitive population groups, especially chronically sick and elderly persons. Since the number of deaths in the Czech Republic has been more or less stable at 100 000 per year, the above data indicate that the increase in total mortality due to exposure to PM_{10} averaged from 2 000 to more than 4 000 persons per year for the entire Czech Republic. Given the joint and complex effects of atmospheric substances on the human body, the above effects also include the action of carbon dioxide (Table 1).

Exposure to polycyclic aromatic hydrocarbons (PAHs) corresponds to the potential for accumulation in the environmental components and in living organisms and the effects on the human body (toxic, mutagenic and carcinogenic effects). PAHs are classified as indirectly acting genotoxic compounds. Carcinogenic PAHs are represented by **benzo(a)pyrene** that represents the carcinogenicity of other substances in the monitored PAH mix (Chart 3).

Between 2006 and 2010 **the total increase in individual lifetime risk of cancer** in Czech urban sites for BaP ranged from 1.2×10^{-4} to 1×10^{-3}, i.e. 1 to 10 cases of disease per 10 000 inhabitants over a period of 70 years. Using the figures that were calculated for the different types of urban sites, it can be very roughly estimated that the effects of PAH emissions from transport (in some sites combined with emissions from domestic heating) may have increased health risks by 1.3×10^{-4} to 5.2×10^{-4} (1 to 5 cases per 10 000 inhabitants) in urban agglomerations. In sites that are affected by large industrial sources, the level of individual risk was higher than in other urban sites and theoretically represented an increase of 6 to 10 cases per 10 000 inhabitants (Table 2).

Over the long term, exposure to nitrogen dioxide mostly affects the residents of large urban agglomerations/sites that are exposed to traffic. In heavily trafficked areas (more than 10 000 vehicles per day) exposure can be expected to affect lung function, respiratory disease and produce an increased incidence of asthma and allergies in both children and adults. In urban locations that are not directly affected by traffic, nitrogen dioxide does not pose any health risks (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=1900)

36/ Population's exposure to chemicals

KEY QUESTION

Is the population's exposure to selected chemicals decreasing?

KEY MESSAGES

Since 2000, blood lead concentrations in the Czech Republic's adult and child populations have shown a downward trend. One of the key reasons is the ban on the use of leaded petrol. Blood mercury level in the Czech Republic's adult and child populations do not exceed values that are associated with adverse health effects. A significant long-term downward trend in the concentrations of DDT and other organochlorine pesticides (that were used from the 1950s to 1970s) has been evidenced in the breast milk of Czech mothers.

Since no safe blood lead level can be set for the paediatric population, the next necessary precautionary step is to gradually reduce environmental lead concentrations.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Priority area 3 „The Environment and the Quality of Life" within the **State Environmental Policy of the Czech Republic** aims to minimize the exposure of the human population to toxic metals and organic pollutants. Priority axis 1 „Society, People and Health" **of the Strategic Framework for Sustainable Development in the Czech Republic** makes „Reducing the health risks associated with negative environmental factors and food safety" one of its objectives.

Health 21, a key programme for protecting and promoting public health that was adopted by the government in , obligates individual ministries to take measures to promote one of its objectives, namely to reduce public exposure to health risks that are associated with water, air and soil pollution by microbial, chemical and other substances.

The **Strategic Approach to International Chemical Management** constitutes a political framework for the safe management of chemicals throughout their life cycle so that by 2020, chemicals will be produced and used in ways that lead to the minimization of significant adverse effects on human health and the environment.

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty aimed at protecting human health and the environment from the harmful impacts of persistent organic pollutants. At the national level, the implementation of the Stockholm Convention takes place according to the National Implementation Plan that was acknowledged by the Government on 7 December 2005 through Resolution No. 1572.

The Protocol on Heavy Metals to the Convention on Long Range Transboundary Air Pollution State (CLRTAP) obligates the contracting parties to apply measures to reduce air emissions of heavy metals, especially cadmium, lead and mercury.

Reducing pollution by persistent organic pollutants is addressed by the Protocol on Persistent Organic Pollutants to CLRTAP. Within the EU Seventh Framework Programme, the **European Environment and Health Action Plan** that is being implemented for the 2004–2010 period supports scientific and professional programmes. The efforts to restrict the movement of persistent pollutants in the environment are also linked to the implementation of the EU's new chemicals policy called REACH[1], which represents a new system of chemical management that ensures that – no later than 2020 – only chemicals with known properties will be used and only in a way that does not damage the environment or human health.

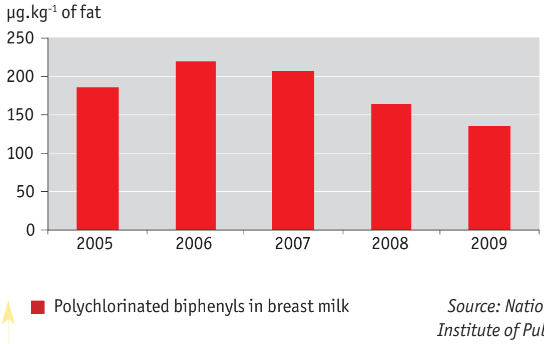
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Polychlorinated organic compounds (POPs) accumulate in the fatty tissues of animals and enter the human organism through food chains. They cause reproductive disorders, affect the hormonal and immune functions and increase the risk of cancer. Increased exposure to lead poses a health risk especially to developing foetuses and young children, in whom the presence of lead in blood is associated with toxic effects on the developing brain and nervous system. Mercury accumulates in living organisms and damages the nervous system.

[1] Regulation (EC) No. 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No. 793/93 and Commission Regulation (EC) No. 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC („REACH").

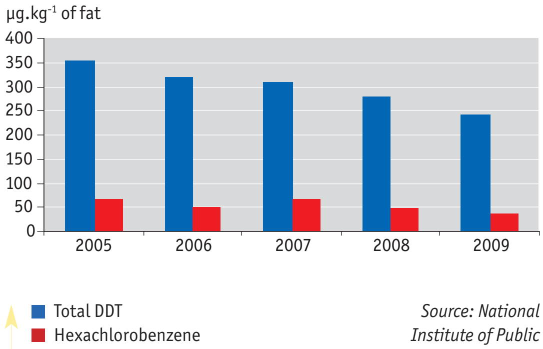
INDICATOR ASSESSMENT

Chart 1 → **Polychlorinated biphenyls in breast milk in the Czech Republic, the median concentration of PCB congener 153 [μg.kg^{-1} of fat], 2005–2009**



Source: National Institute of Public Health

Chart 2 → **Chlorinated organic compounds in breast milk in the Czech Republic, median concentration [μg.kg^{-1} of fat], 2005–2009**



Source: National Institute of Public Health

Blood lead level

Lead is one of the best-known toxic heavy metals. At higher exposures, the health effects of lead include anaemia and adverse effects on the nervous system, kidney function and immunity. Blood lead levels are a reliable indicator of both current and recent exposure to environmental lead.

Blood lead levels in the adult population have gradually declined over the years. In 2010, monitoring was not carried out. In 2009, mean (median) blood levels of 23 μg.l^{-1} were found in men and of 14 μg.l^{-1} in women, both of which are significantly lower compared to the levels that had been recorded at the beginning of the monitoring in 1996. The medically significant degree I limit value, i.e. 100 μg.l^{-1} for blood lead level in women of childbearing age (18–35 years) and 150 μg.l^{-1} for the remaining adult population, was only rarely exceeded. The medically significant limits for lead are currently being reviewed.

In the latest monitoring year (2008), the mean value (median) of recorded individual blood lead level values in the child population in individual monitoring cities ranged from 16 to 29 μg.l^{-1}. The descending trend of blood lead values in children, monitored since 2001, continued. To a certain degree, blood lead level data corresponded to the trend in the lead concentrations in urban air that were measured within the Environmental Health Monitoring System in the Czech Republic. Within the monitoring, the originally set maximum permissible level of 100 μg.l^{-1} was not exceeded in any of the monitored children. The above trends are consistent with the relevant environmental protection measures – the sale of fuels containing lead has been banned in the Czech Republic since 1 January 2001. Also, lead concentrations in the different environmental components decline as well.

Blood mercury level

Mercury is a toxic heavy metal. It is widely present in the environment and it accumulates in living organisms and is subsequently transferred through the food chain. One of the most serious negative effects on organisms is damage to the nervous system. Of the possible sources of mercury exposure, the intake of toxic methylmercury from the consumption of fish and fish products is currently considered the most significant; the inhalation of vapours and the swallowing of small particles of mercury from amalgam dental fillings are less significant in terms of health.

Detected blood mercury levels do not indicate an increased exposure of the Czech population to this element, the levels show a slight decline compared to previous years. In 2010, monitoring was not carried out. The degree I limit value for blood mercury level in adults of 5 μg.l^{-1} that is significant with respect to health was exceeded in 0.7% of all persons (cases) in 2009. The result is similar to the previous monitoring year (2007).Women generally show higher mercury levels. Risk groups include in particular pregnant women and women of childbearing age (there is a risk of neurotoxicity to the foetus). In 2009, the limit value of 3.4 μg.l^{-1} that had been set for women of childbearing age was exceeded in 3 out of 159 women up to 40 years of age, i.e. it decreased by 0.5% compared with the previous monitoring year (2007). The insignificant increase in mercury level that had been observed in several previous years (until 2007) was related to dietary exposure (i.e. a rise in seafood consumption).

Lead and mercury concentrations in the biological material of Czech adult and child populations are consistent with the typical values observed **in other European countries**.

PCB and OCP levels in breast milk

Polychlorinated biphenyls (PCBs) and DDT-, HCB- and HCH-type organochlorine pesticides (OCPs) are persistent organic pollutants (POPs). While the production of **PCBs** began in the 1920s, their industrial use spread mainly in the 1950s. Due to the wide commercial use of these substances and their persistence, their concentration in the environment has increased, which is especially significant in the food chain. Producing PCBs was banned in the second half of the 1970s (in the Czech Republic in 1984) and their use became regulated. The use of PCBs has also been regulated and PCB levels in the environment have been gradually declining. The main exposure route to most POPs is dietary exposure, especially via food of animal origin with a higher fat content – animal fat, dairy products, meat and fish. Most POPs cross the placenta and may adversely affect foetal development.

Generally, exposure is monitored using indicator congeners, one of which – PCB 153 (the one that makes up the largest proportion in the mix of monitored PCB congeners) – is a relevant indicator of exposure for the entire group. The results of the monitoring of PCB levels in breast milk confirm the predominance of highly chlorinated PCB congeners 138, 153 and 180. In the areas that have been monitored since 2005, the level of the PCB 153 indicator congener follows a downward trend, including the Uherské Hradiště area, where elevated values were measured in recent years due to old environmental burden. In 2010, monitoring was not carried out (Chart 1).

Since the 1970s, DDT-, HCB- and HCH-type **organochlorine pesticides** have not been used in the Czech Republic. In the 1990s, the level of OCPs (that were used in the 1950s to 1970s) in breast milk continually declined. After the turn of the millennium, the concentrations of total DDT fluctuated between 250 and 400 $\mu g.kg^{-1}$ of fat; since 2005 they have been declining. In 2010, monitoring was not carried out. The decline in HCB levels has been continual (Chart 2).

The main exposure pathway of a large portion of POPs is food and products of daily consumption. In terms of health risks, the 'dioxin effect' is often reported, i.e. various disorders both during intrauterine development and after birth – disorders of the reproductive, endocrine, nervous and immune systems, various metabolic disorders, as well as carcinogenicity.

POPs, including polycyclic aromatic hydrocarbons, may act as endocrine disruptors. Substances with suspected estrogenic effects include PCBs and DDT and its derivatives. Their toxicity can manifest as hyperestrogenism, i.e. the physiological effects of excessive estrogen hormones. Estrogenic substances may cross the placenta or may be passed on to newborn babies through breast milk. Possible health effects to the population that are being considered in connection with environmental estrogens include cancer and problems with reproduction.

Repeated studies coordinated by the World Health Organization that have been monitoring the levels of selected POPs in breast milk in a number of European countries have shown that there are **significant differences between countries**. The level of dioxins in breast milk in a sample of Czech women was among the lower ones. By contrast, the detected PCB level was (along with Slovakia) high compared to other countries, which can to some extent be explained by a delay of about 10 years in banning PCB production and use compared to Western countries.

The European Environment and Health Action Plan considers biological monitoring a significant part of preventive activities. The EU seeks to harmonize biological monitoring procedures in EU countries so that the outcomes are comparable, representative and focused on current issues. The implementation of the EU chemicals policy (REACH) ensures that – no later than 2020 – only chemicals with known properties will be used and only in a way that does not damage the environment or human health. The monitoring of the impacts of substances that were used in the past on human health shows that it is still necessary to pay increased attention to chemicals and that those posing the greatest risk need to be excluded from use.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1901)

37/ Noise pollution

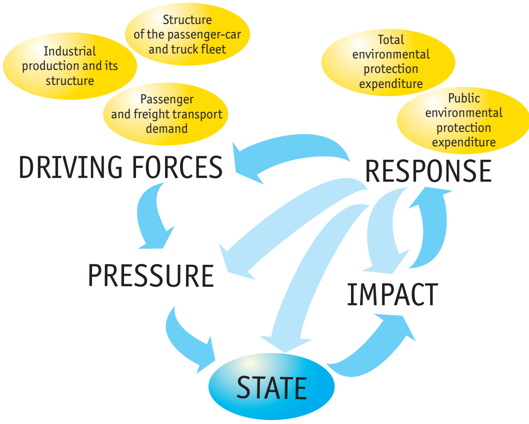
KEY QUESTION

What is the state and development of the noise exposure of the Czech population?

KEY MESSAGES

Noise pollution is a significant environmental factor that adversely affects human health. In the Czech Republic, the main source of noise is road transport, which causes excessive noise not only in residential buildings, but also in schools and medical facilities.
In Prague, Brno and Ostrava, approximately 10% of the population is exposed to noise levels that exceed the limit values. In some municipalities that are close to busy roads, more than one quarter of all residents are exposed to excessive traffic-related noise, i.e. noise may be adversely affecting the economic and social situation of these municipalities and hampering their further development.

In the Czech Republic, the exposure of the population to noise from rail transport is negligible compared to road transport and may only play a significant role locally. Air transport only affects the population living around airports.



OVERALL ASSESSMENT

The relevant data that are required for assessing noise pollution trends are not available in the Czech Republic. However, it can be assumed from data on transport trends that the population's total exposure to noise from road transport kept increasing until 2005, and has been stagnating ever since. At the same time, noise pollution near newly constructed roads (e.g. the Prague Ring Road) increases, while noise pollution near roads that are parallel to such new roads declines. The level of noise pollution is already evaluated as part of the environmental impact assessment (EIA) for roads, i.e. before their construction begins.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Priority area 3 „The Environment and the Quality of Life" within the current **State Environmental Policy of the Czech Republic** sets priority objective 3.3 entitled „Protection of the Environment and Humans against Noise". The partial objectives and measures include protecting quiet areas in the landscape and reducing the burden on the population in settlements from exposure to transport noise and noise from industrial activities.
Sanitary noise limits are laid down by Government Regulation No. 148/2006 Coll., on health protection from the adverse effects of noise and vibrations. Limit values for noise indicators for the purposes of strategic noise mapping in the Czech Republic are defined by Decree No. 523/2006 Coll., on noise mapping. In 2010, an amendment to Government Regulation No. 148/2006 Coll., on health protection from the adverse effects of noise and vibrations was being prepared.
At the European level, the issue of noise exposure is regulated by **Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise (END)** that was adopted in 2012. The END Directive was implemented into Czech legislation through an amendment to Act No. 258/2000 Coll., on public health protection, and Decree No. 523/2006 Coll., on noise mapping. The directive aims to determine the exposure to environmental noise through noise mapping and by assessment methods common to the member states. Furthermore, the directive also regulates the public disclosure of information about noise and its effects and the adoption of action plans by the member states, based upon noise-mapping results, with a view to preventing and reducing environmental noise. It is expected that an amended END Directive (2002/49/EC) will be adopted in 2011, reflecting the experience to date with preparing maps and action plans. An important part of the amendment is supposed to be the inclusion of approaches for evaluating the health risks of noise exposure. These are both 'subjective criteria' – noise annoyance and sleep disturbance, and 'objective criteria', i.e. the population attributable risk of some diseases, especially cardiovascular disease.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Exposure to excessive noise causes acoustic discomfort, disturbs sleep, impairs concentration and may have both auditory and extra-auditory effects on organs. Annoyance along with sleep disturbance is also a source of stress, which is one of the factors that co-act in the development of 'civilization' diseases. Effects on the cardiovascular system are associated with long-term noise exposure greater than 65 dB, especially in terms of co-acting in the development of ischemic heart disease and hypertension. Negative effects of excessive noise on the central nervous and immune systems have also been described. In addition, the health impact of noise may increase when combined with other factors, such as air pollution. Since noise may also disrupt the biotopes of certain species, it adversely affects ecosystems.

INDICATOR ASSESSMENT

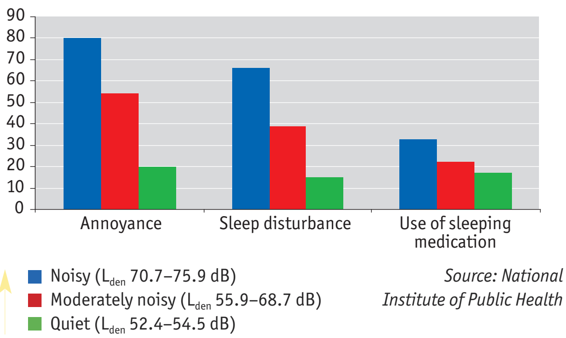
Table 1 → **Limit values for noise indicators in the Czech Republic [dB] pursuant to Decree No. 523/2006 Coll., on noise mapping**

Source of noise	L_{den} [dB]	L_n [dB]
Road transport	70	60
Rail transport	70	65
Air transport	60	50
Integrated facilities	50	40

L_{den} – The limit value for day-evening-night (L_{den}) characterizes the overall annoyance over an entire day.
L_n – The limit value for night hours (23:00–07:00, L_n) that characterizes sleep disturbances.

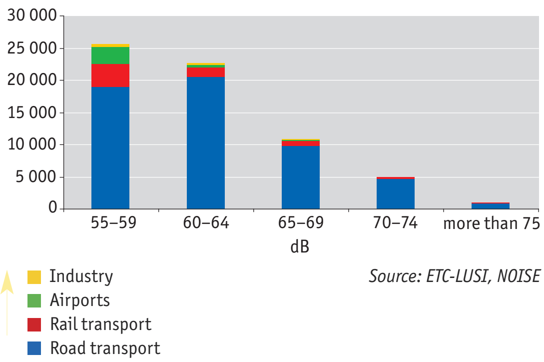
Source: National Institute of Public Health Ostrava, Ministry of Health

Chart 1 → **Proportion of the population in the Czech Republic living in the respective noise-level categories of sites, who experience annoyance, sleep disturbance and who take sleeping medication [% of respondents], 2007**



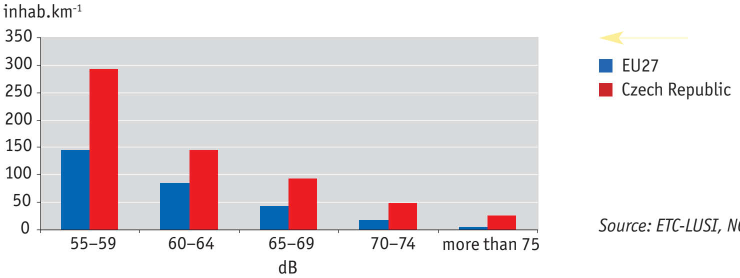
Source: National Institute of Public Health

Chart 2 → **Number of EU27 inhabitants living in agglomerations with a population greater than 250 thous., who are affected by noise within the given categories of noise pollution (according to the L_{den}[1] indicator) from the given sources [thous. inhabitants], 2010**



Source: ETC-LUSI, NOISE

Chart 3 → **Number of inhabitants per 1 km of main roads living outside urban agglomerations in areas with excessive noise from road transport in the given noise pollution categories [inhabitant.km^{-1}], 2010**



Source: ETC-LUSI, NOISE

Noise is one of the key environmental factors that affect human health and quality of life. **In the Czech Republic, noise pollution is mainly caused by road transport.** However, there are also other significant noise sources in some sites, such as air and rail transport, construction activities, industry etc. The present assessment is based on the currently available data from the Strategic Noise Mapping that was carried out according to the European END Directive for agglomeration with more than 250 000 inhabitants (Prague, Brno and Ostrava) and for roads with traffic volumes greater than 6 million vehicles per year (approximately 20 000 vehicles per day) and for major airports and rail lines. Therefore, it does not cover noise pollution comprehensively – this goal will be achieved by the subsequent phases of noise mapping.

[1] Noise is evaluated using the following indicators: L_{den} (day-evening-night) that indicates the 24-hour noise exposure, and L_n (night) that indicates night-time noise exposure, which has stricter limits.

In Prague, 119 500 residents are exposed to above-the-threshold noise levels (i.e. 12.9%), in Ostrava 10.8% and in Brno 10.3 %. These figures refer to a L_n greater than 60 dB, i.e. the more stringent (night-time) noise limit. Approximately 10% fewer residents are exposed to the 24-hour noise limit (L_{den} greater than 70 dB) that indicates 24-hour exposure with a greater risk of health effects. The largest number of residents that are exposed to extreme noise pollution from transport (in excess of 70 dB at night, the limit is 60 dB for road traffic) is found in Olomouc (1 919 residents), Znojmo and Opava, while the number of Prague residents that are exposed to this level of noise pollution is 630. In Prague there are a total of 36 schools that are exposed to noise levels that exceed the limit values for 24-hour exposure, Brno has 7 such schools and Ostrava 18. Prague has 14 medical facilities that are exposed to excessive noise pollution, Brno has 8 and Ostrava 1. A total of 1 600 residents (24-hour exposure) or 1 900 residents (night-time exposure) are exposed to noise pollution exceeding the L_{den} (60 dB) and L_n (50 dB) limit values that is produced by the Prague Ruzyně Airport. Most of the affected residents live in Horoměřice (1 452), Jeneč (325) and Kněževes (66).

Noise limits are often exceeded in municipalities that are located near busy roads, which may significantly affect the quality of life of local residents. Te worst-affected municipalities are Ostrovančice (the Brno-venkov district), Polom (the Přerov district) and Slavníč (the Havlíčkův Brod district), where more than 50% of the population is exposed to traffic-related noise. This situation prevents the affected municipalities from developing their territory and may lead to gradual depopulation, a decline in property prices and deepening social segregation (the concentration of the weaker social classes).

Within a **survey entitled "Noise and Health" that was organized by the National Institute of Public Health in 2007**, the subjective perception of noise by the residents of noisy sites (A daily average greater than 70 dB), moderately noisy sites (between 69 and 55 dB) and quiet sites (below 55 dB) was evaluated on a sample of approximately 5 000 respondents. In noisy sites, 80% of the residents indicated noise annoyance and 66% sleep disturbance (Chart 1). The most commonly indicated noise source was passenger car transport (59% of all respondents), followed by freight road and motorcycle transport. Noise inside buildings (technical equipment such as lifts, noise from neighbours etc.) was only indicated as significant in quiet sites (2nd place after road transport). The survey also revealed a distinct correlation between the use of sleep medication and the noise pollution in the given site.

According to a study by the World Health Organization[2] (WHO) dealing with the health effects of noise exposure, **1.5 million healthy life years are lost due to excessive noise in Western European countries every year** (the figure includes years lost due to premature death and years of disability that poses a significant limitation to individuals). It is thus the second most significant environmental factor adversely affecting human health, second only to problems that are associated with air pollution, which causes up to 4.5 million lost years. About 60 000 years are lost from ischemic heart disease, 900 000 from problems associated with sleep disturbance, 45 000 years from cognitive (auditory) impairment in children and 650 000 from annoyance and the consequent stress. According to the study, at least one million healthy life years are lost every year from traffic-related noise.

Based on currently available data from the **NOISE**[3] **information system** (Noise Observation and Information System for Europe, http://noise.eionet.europa.eu), approximately 55 million people living in agglomerations with a population greater than 250 000 and an additional 23.3 million people living outside such agglomerations (i.e. nearly 80 million people in total) are exposed to excessive noise from road transport during daytime and evening hours (L_{den} greater than 55 dB) in the EU27 countries (for which data are available). This represents approximately 16% of the population of the EU27 (Chart 2). A total of 6.1 million people are exposed to noise from rail transport, 3.2 million people are exposed to noise in the vicinity of airports and approximately 820 000 people are exposed to industrial noise. At night, the number of people that are exposed to excessive noise is only slightly lower.

In the EU27, an average 296 inhabitants per 1 kilometre live in the vicinity of busy roads with traffic volumes greater than 6 million vehicles per year where the L_{den} indicator exceeds 50 dB (outside major agglomerations with a population greater than 250 000). However, **in the Czech Republic this is 607 inhabitants per 1 km**, which reflects the greater population density in the Czech Republic and the fact that residential houses are often located near roads (Chart 3). In all categories of 24-hour (and night-time) noise pollution, the exposure of the Czech population to noise from road traffic (expressed per 1 kilometre of road) is above average in the European context. A situation similar to the Czech Republic's is found for example in the United Kingdom and Italy, while the situation in Germany and France is considerably better (fewer than 200 affected people per 1 km).

In the Czech Republic, **the second phase of strategic noise mapping** will take place in the period until 30 June 2012. It will cover 7 agglomerations with more than 100 000 inhabitants and a total area of 2 000 km^2 (round I: 3 agglomerations, ca 950 km^2), ca 4 000 km of major roads with more than 3 million vehicles per year (round I: ca 1 243 km), and 2 000 km of rail lines with more than 30 000 trains per year. Strategic noise maps for the second phase should be completed in 2012.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1902)

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[2] *WHO, Burden of disease from environmental noise, 2011*
Available from:http://www.euro.who.int/en/what-we-publish/abstracts/burden-of-disease-from-environmental-noise.-quantification-of-healthy-life-years-lost-in-europe.

[3] *The information system is administered by the European Environment Agency, i.e. the European Topic Centre for Land Use and Spatial Information (ETC-LUSI). It is designed to provide noise monitoring and evaluation pursuant to the END Directive.*

38/ Total environmental protection expenditure

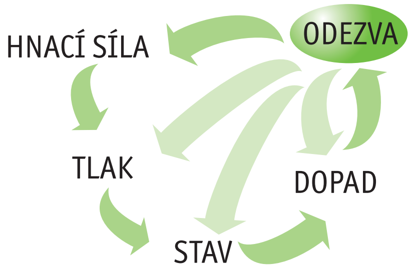
KEY QUESTION →

What amount of financial resources in the form of investment expenditure and non-investment expenditure do we spend on maintaining and improving the environment?

KEY MESSAGES →

☺ Total environmental protection expenditure (i.e. the sum of investment expenditure for environmental protection and non-investment expenditure for environmental protection) has been monitored for the 2003–2010 period. It can be concluded that while there had been consistent, significant growth in total expenditure until 2008, the trend came to a halt in 2008 due to a decrease in non-investment costs. While the last year-to-year comparison (2009 and 2010) showed an increase in non-investment costs, investment expenditure slightly declined. It can thus be summarized that, in terms of total financial resources expended, total environmental protection expenditure increased.

In 2010, total environmental protection expenditure amounted to CZK 76.1 billion, in 2009 almost CZK 72.3 billion, i.e. there was a year-to-year increase of CZK 3.8 billion. In current prices, the proportion in GDP was close to 2.1% in 2010. However, given the difference in GDP between 2009 and 2010, the proportion showed no significant change year-to-year. The above developments allow us to conclude that, in terms of financing, environmental protection has steadily maintained its importance. The largest increase occurred in non-investment costs, namely in waste management (an increase of CZK 2.7 billion). By contrast, investment expenditure reported the most significant decrease in the protection and remediation of soil, groundwater and surface water (a decrease of CZK 1.1 billion).



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 INVESTMENT EXPENDITURE →	
Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☹

OVERALL ASSESSMENT NON-INVESTMENT EXPENDITURE →	
Change since 1990	N/A
Change since 2003	☺
Last year-to-year change	☺

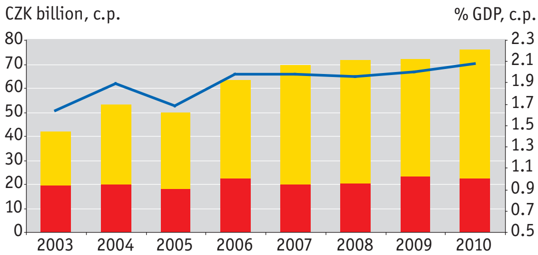
REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **State Environmental Policy of the Czech Republic** indicates that, with regard to total environmental protection expenditure, it is primarily necessary to ensure that there is a well-functioning public-private partnership in financing environmental protection projects. These projects must meet the criterion of economic efficiency, i.e. they must strive to optimize costs while maximizing the benefits achieved. Total expenditure should be directed towards projects addressing, above all, investments in technologies that use thermal energy from renewable resources, environmental engineering, air protection and waste water treatment, as well as the introduction of 'cleaner' technologies in industry.

Additional commitments follow from the **Strategic Framework for Sustainable Development of the Czech Republic** where the emphasis is primarily on innovation and, by extension, the Czech Republic's competitiveness. The Strategic Framework stipulates (as does the State Environmental Policy of the Czech Republic) that total environmental protection expenditure must be directed towards projects that will keep the Czech Republic competitive with other countries within the global market economy – it is therefore necessary to reduce the material and energy intensity of the Czech economy and to support projects that will help achieve that objective (e.g. investment in modern technology, as mentioned above).

INDICATOR ASSESSMENT

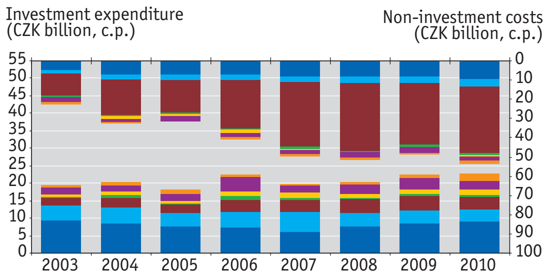
Chart 1 → **Total environmental protection expenditure in the Czech Republic [CZK billion, % of GDP, current prices], 2003–2010**



Source: Czech Statistical Office

- Investment expenditure (CZK billion, c.p.)
- Non-investment costs (CZK billion, c.p.)
- Proportion of total environmental expenditure in GDP (%)

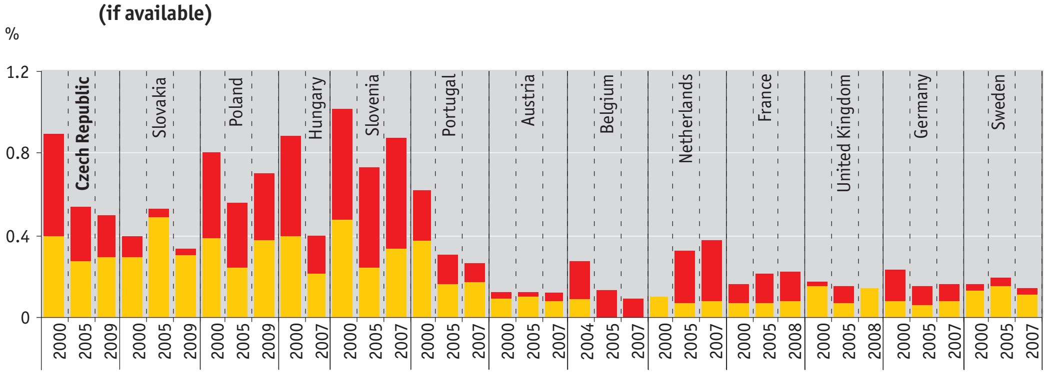
Chart 2 → **Investments and non-investment expenditure for environmental protection in the Czech Republic according to programming orientation [CZK billion, current prices], 2003–2010**



Source: Czech Statistical Office

- Waste water management
- Air and climate protection
- Waste management
- Landscape and biodiversity conservation
- Reduction of noise and vibrations; radiation protection
- Protection and reclamation of soil, underground and surface water
- R&D; other environmental expenditure

Chart 3 → **Proportion of investment expenditure on environmental protection by the business and the public sectors in GDP, an international comparison [% of GDP], 2000, 2005 and the last available year, i.e. the closest years available (if available)**



- Public sector
- Business sector

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 for environmental protection that are expended by all economic entities with the Czech economy (i.e. both private individuals and the public sector). Investment expenditure include all expenditure for tangible fixed assets, i.e. expenditure that relates to environmental protection activities whose main objective is to reduce the negative effects resulting from entrepreneurial activity. Non-investment costs are current or operating expenditure, especially payroll costs, payments for material consumption, energy, repairs and maintenance etc. The statistical collection of source data is carried out by the Czech Statistical Office. Data on investment expenditure for environmental protection have been collected since 1986; data on non-investment costs have been statistically monitored since 2003.

In 2010, total environmental protection expenditure amounted to more than CZK 76 billion, which indicates an increase in expended financial resources of CZK 3.8 billion compared to the previous year. This is largely due to a noticeable increase of CZK 4.7 billion in non-investment costs compared to 2009 (these costs thus totalled CZK 53.4 billion). By contrast, investment expenditure showed a slight decline of CZK 0.8 billion compared to 2009. Taking account of the trends in the Czech economy, the proportion of total environmental protection expenditure in nominal GDP has been stable in the Czech Republic over the past five years – i.e. at approximately 2% of GDP (at current prices). In 2010, the proportion was exactly 2.1% of GDP (Chart 1).

Investment in environmental protection
Based on data that have been monitored by the Czech Statistical Office since 1986, it can be concluded that in the 1990s the largest amounts of financial resources were spent on air protection (until 2000). This was mainly due to the typical post-communist development that was associated with impaired air quality in border and industrial regions. The priorities changed in 2000, with most financial resources being re-oriented towards investment in waste water and waste management.

In 2010, investments in environmental protection totalled CZK 22.6 billion, i.e. an annual decline of CZK 0.8 billion. To sum up, most investment goes to end-of-pipe equipment, where an integrated approach to environmental protection is applied based on the principle of introducing and using best available techniques. In the future, investment costs are expected to slightly decline year-to-year as a result of the gradual modernization of polluters' production and operating facilities. However, this trend has not been reported over the past five years.

Within the programming orientation, most funding was invested in waste water management (CZK 9.0 billion), waste management (CZK 3.7 billion) and air quality and climate protection (CZK 3.6 billion) in 2010, similarly to preceding years. Compared to 2009, the largest increase in investments was recorded in research and development and other environmental protection activities (an increase of CZK 1.1 billion), while the most significant decrease occurred in the protection and remediation of soil, groundwater and surface water (a decrease of CZK 1.1 billion), see Chart 2.

In terms of the economic sectors of the investing entities (CZ-NACE), the largest proportion in total investment took place in the following sectors: public administration, defence and compulsory social security (35.3% of total investment) and water supply and activities relating to waste water, waste and remediation (19.3% of total investment). Additional sectors that account for significant proportions in total investment include transport and storage (7.8% of total investment) and electricity, gas, heat and conditioned air production and distribution (8.3% of total investment).

Recent years have shown a positive trend, where investment in environmental protection by the business sector steadily increased, while investment by the public sector declined. Based on economic principles, this is the application of the „polluter pays" principle, where it the main responsibility for protecting the environment needs to be transferred onto private entities, thus reducing public sector involvement. In 2010, businesses invested more than CZK 11.9 billion and the public sector (both central and regional) approximately CZK 10.8 billion.

Non-investment costs for environmental protection
Non-investment costs for environmental protection have been monitored by the Czech Statistical Office since 2003. In 2010, they totalled CZK 2010 billion, experiencing a rather notable year-to-year increase of CZK 4.7 billion compared to 2009). Non-investment costs constitute a significant portion of total environmental protection expenditure (more than 60% in the 2003–2010 period). The largest amount of non-investment costs was spent on material and energy consumption and payroll.

In terms of **programming orientation**, most resources were invested in waste management (CZK 34.8 billion) and waste water management (CZK 9.6 billion) in 2010, similarly to preceding years, see Chart 2. Especially the area of waste management showed a very significant increase in non-investment costs incurred, namely an increase of CZK 2.7 billion year-to-year. This was mainly due to the announcement of a new call under the Operational Programme Environment's priority axis 4: The Improvement of Waste

Management and the Rehabilitation of Old Ecological Burdens in 2010, when a one-off increase in costs for preparing and administering applications can be expected in both the business and public sectors.

In terms of the economic sectors of the investing entities (CZ-NACE), the largest proportion of non-investment costs for environmental protection took place – as in the case of investments – in the area of water supply and activities relating to waste water, waste and remediation (50.3% of total non-investment costs) and public administration, defence and compulsory social security (15.9%), followed by mining and extraction (6.4%) and production of coke and refined petroleum products (4.2% of total non-investment costs).

An international comparison

In an international comparisons with other EU countries, the Czech Republic, along with other post-communist countries, spent considerably more on environmental protection than Western European countries (until 2007), see Chart 3. Logically, this trend is attributable mainly to the increased environment burden that had resulted from long neglected environmental problems associated with intensive industrial production and mining.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1903)

39/ Public environmental protection expenditure

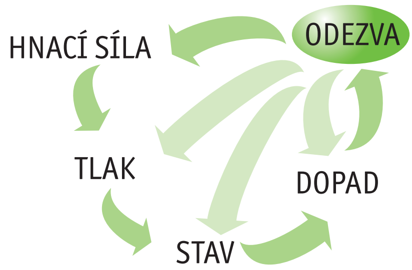
KEY QUESTION →

What is the mix and the volume of expended financial resources from central sources and local budgets within public support for environmental protection?

KEY MESSAGES →

Despite some fluctuations in the amount of public environmental protection expenditure (i.e. expenditure from central sources and local budgets) over the monitored period since 2000, we can conclude that public expenditure has been following an upward trend, especially after the Czech Republic's accession to the EU in 2004. Also significant is the share of expenditure from local budgets. Environmental protection expenditure from local budgets is greater than environmental protection expenditure from central sources, i.e. from the state budget, the now-defunct National Property Fund (whose remaining competences and resources have been assumed by the Ministry of Finance), and state environmental protection funds. In 2010, expenditure from Czech central sources totalled CZK 26.48 billion (0.72% of GDP at current prices) and expenditure from local budgets totalled CZK 35.7 billion (0.91% of GDP at current prices). Over the long term, the most supported area has been water protection.

In a year-to-year comparison, expended financial resources increased for both components of public environmental protection expenditure. Expenditure from central sources increased by CZK 2.5 billion and expenditure from local budgets increased by CZK 4 billion. Notable positive developments include the improving quality of life of the population and the improved availability and quality of sewerage systems, waste water treatment plants and waste management systems in municipalities, since expenditure from local budgets constitutes the largest portion of non-investment expenditure in these areas.



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	🙂

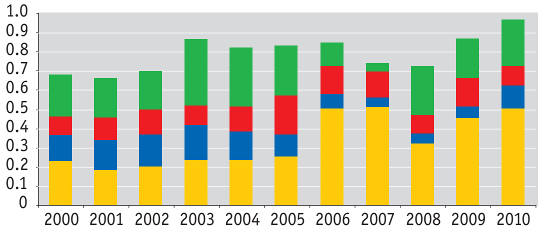
REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **State Environmental Policy of the Czech Republic** stresses that while expending resources on environmental protection, economic effectiveness needs to be retained, i.e. effort must be made to optimize the costs that are associated with implementing a given policy. In addition, it is also necessary to ensure that any support from public sources is provided to measures with a positive (or at least a zero negative) environmental impact. As to the specific structure of public environmental protection expenditure, the State Environmental Policy of the Czech Republic aims to increase expenditure from the state budget and ensure that foreign sources (especially EU funds) are used effectively. This is also connected with the long term trend in Czech environmental policy, namely to orient the subsidy policy from both the state budget and the State Environmental Fund in particular towards fulfilling the obligations under European law and the priority objectives of the State Environmental Policy of the Czech Republic.

Approved in 2010, the **Strategic Framework for Sustainable Development in the Czech Republic**, priority axis 2: Economy and innovation states that both total environmental protection expenditure and public environmental protection expenditure must be directed towards activities that will ensure continued economic growth, i.e. that will mitigate the impacts of global recession, with a particular focus on small and medium-sized enterprises. Environmental protection expenditure is therefore channelled into the following three priorities: 1) supporting the dynamics of the national economy and improving competitiveness (in industry and business, agriculture, services); 2) ensuring national energy security and improving the energy and raw-material intensity of the economy; and 3) promoting human resource development, supporting education, research and development. Among other things, the Strategic Framework for Sustainable Development mentions the need to increase public expenditure and improve the efficiency of the cooperation between the public and private sectors in R&D, because – in terms of economic efficiency – this is one of the key factors of rapid innovation in the production industries.

INDICATOR ASSESSMENT

Chart 1 ➔ **Proportion of public environmental protection expenditure in GDP in the Czech Republic by source type [% GDP, current prices], 2000–2010**

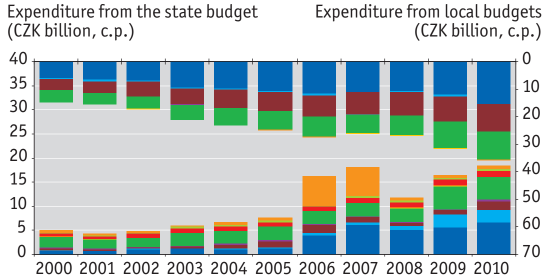


- Proportion of environmental protection expenditure by local budgets in GDP
- Proportion of environmental protection expenditure by the National Property Fund in GDP
- Proportion of environmental protection expenditure by state funds in GDP
- Proportion of environmental protection expenditure by the state budget in GDP

Source: Ministry of Finance

The National Property Fund was abolished as of 1 January 2006. Both its competences and its resources spent on the rehabilitation of old contaminated sites are now administered by the Ministry of Finance of the Czech Republic. The marked increase in state budget expenditure between 2005 and 2006 resulted from the involvement of funding by European funds. A portion of public environmental expenditure by local budgets is a duplication of expenditure from central sources.

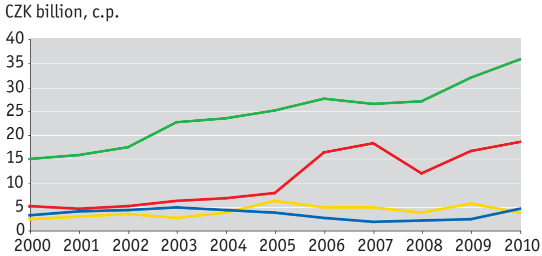
Chart 2 ➔ **Public environmental protection expenditure from the state budget and local budgets in the Czech Republic by programming orientation [CZK billion, current prices], 2000–2010**



- Water protection
- Air protection
- Waste management
- Soil and groundwater protection
- Landscape and biodiversity conservation
- Reduction of the impact of physical factors
- Administration in environmental protection
- Environmental research
- Other activities in ecology

Source: Ministry of Finance

Chart 3 ➔ **Public environmental protection expenditure in the Czech Republic by source type [CZK billion, current prices], 2000–2010**

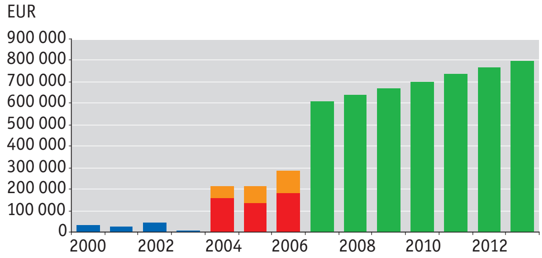


- Total environmental protection expenditure by local budgets
- Total environmental protection expenditure by the state budget
- Total environmental protection expenditure by the National Property Fund
- Total environmental protection expenditure by state funds

Source: Ministry of Finance

The National Property Fund was abolished as of 1 January 2006. Both its competences and its resources spent on the rehabilitation of old contaminated sites are now administered by the Ministry of Finance of the Czech Republic. The marked increase in state budget expenditure between 2005 and 2006 resulted from the involvement of funding by European funds. A portion of public environmental expenditure by local budgets is a duplication of expenditure from central sources.

Chart 4 ➔ **Estimated allocation of financial resources from EU funds for projects in the area of the environment in the Czech Republic [EUR], 2000–2013**



- ISPA (2000–2003)
- CF (2004–2006)
- OPI (2004–2006)
- OPE (2007–2013)

Source: Ministry of Environment

Public environmental protection expenditure is comprised of environmental protection expenditure from central sources and local budgets and it quantifies the implementation of the need to protect the environment at both the central and regional levels. However, given the methodology of data collection (data are collected by the Ministry of Finance), public environmental protection expenditure is not the simple sum of central and local budgets, because a portion of public expenditure from local budgets is the duplication of expenditure from central sources. Total public expenditure includes both capital and current environmental protection expenditure.

In order to allow for an international comparison, public environmental protection expenditure is assessed above all in relation to the overall performance of the Czech economy expressed as the absolute level of GDP at current prices. The proportion of public expenditure in GDP at current prices kept slightly increasing between 2000 and 2010, i.e. both for expenditure from central sources and from local budgets. This trend can be viewed as positive, especially in the context of the crisis that hit the Czech Republic in 2008 and whose consequences could also be observed in 2009 and 2010 – public support for environmental protection has retained its importance. In 2010, the proportion of expenditure from central sources in GDP at current prices was 0.72% (i.e. +9.3% compared to 2009), and the proportion of expenditure from local budgets in GDP at current prices was nearly 1% (i.e. +11.4% compared to 2009), see Chart 1.

Public expenditure from central sources

Financial resources (subsidies and repayable financial assistance) coming from the **state budget** are the most significant central source. Within the **monitoring of environmental protection expenditure from state funds**, additional important central sources include the financing of environmental protection through the **State Environmental Fund of the Czech Republic** and the now-defunct National Property Fund, whose remaining competences and resources are now administered by the Ministry of Finance. These are financial resources that are used by the Ministry of Finance 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 to remediate damage that had been caused by the presence of Soviet troops in the Czech Republic.

In a long-term comparison of data since 2000, when **state budget expenditure** totalled CZK 5.4 billion, there was an unprecedented increase in the period until 2010, when the final financial amount totalled almost CZK 18.5 billion – the amount of expended financial resources thus increased nearly 3.5-fold. Much of this expenditure are resources from the EU pre-accession funds and, since 2004, resources from the EU Structural Funds, which are primarily intended to bring the condition of Czech environment to al level corresponding to other developed EU countries. A significant increase in expenditure from the state budget was recorded in 2006 and 2007, when financial resources from EU funds became involved in financing environmental protection in the Czech Republic. In 2008, these resources were transferred directly to the newly prepared environmental protection programmes, which resulted in a significant year-to-year decline in such expenditure. Environmental protection expenditure has resumed growth since 2009 due to the amount of resources spent on co-financing environmental protection projects. In 2010, environmental protection expenditure from the state budget totalled CZK 18.5 billion, i.e. a further increase of CZK 2 billion compared to 2009.

The largest year-to-year increase in the amount of financial resources expended from the state budget occurred especially in waste management – i.e. from CZK 0.84 billion in 2009 to CZK 1.73 billion in 2010 (+104%) and in water protection – i.e. from CZK 5.58 billion in 2009 to CZK 6.64 billion in 2010 (+19%). Over the long-term, the most supported areas include water protection and waste management (as mentioned above), as well as biodiversity protection and landscape conservation and, in the past two years, also air protection, which was the highest priority during the entire 1990s (Chart 2).

Within the monitoring of environmental protection expenditure from state funds, the largest extra-budgetary central source of environmental protection financing is the **State Environmental Fund of the Czech Republic**. Its main sources of income include environmental pollution fees and, in recent years, also revenues from the sale of greenhouse gas emission units (AAU) abroad. In 2010, the State Environmental Fund of the Czech Republic contributed a total of CZK 4.44 billion to environmental protection, which represents a significant change compared to the slightly downward trend in expenditure over the past 5 years. Compared to 2009, the figure increased by CZK 2.37 billion (+114%). This is mainly due to an increase in expenditure from the Green Investment Scheme programme (a total of CZK 2 billion in 2010) and from the Operational Programme Environment – the largest increase occurred in priority axis 3 – Sustainable use of energy sources, and priority axis 6 – Improvement of state of nature and landscape.

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. There is a difference in the reporting of expenditure from the state budget (EU funds) and the State Environmental Fund of the Czech Republic: while the state budget reports resources for which a contract has been signed (any type of commitment), the State Environmental Fund reports resources that have actually been expended. Support from the State Environmental Fund of the Czech Republic is mainly used in the form of loans, subsidies and partial payments of interest, and it is directed to the areas of water protection, biodiversity protection and landscape conservation, air protection, and waste management (i.e. the priority areas of environmental protection in the Czech Republic).

In 2010, a total of CZK 3.57 billion was expended from the resources of the National Property Fund that are administered by the Ministry of Finance and that are used to remediate old environmental damage, the amount of resources thus declined compared to 2009 when it reached CZK 5.39 billion (-33.8%), see Chart 3. These are financial resources that are used by the Ministry of Finance 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 to remediate damage that had been caused by the presence of Soviet troops in the Czech Republic.

In 2010, environmental protection expenditure from central sources totalled CZK 26.48 billion, i.e. there was a further year-to-year increase of CZK 2.5 billion (+10.5%). This trend can be expected to continue in the coming years, because expenditure within operational programmes from the European funds is reported as expenditure from central sources. The envisaged expenditure from the Operational Programme Environment alone totals EUR 5.4 billion for 2007–2013.

Public expenditure from local budgets

Financial resources from local budgets of municipalities and self-governing regions constitute the other type of public expenditure. Over the long term, this expenditure has been following a steady upward trend, reaching an amount of CZK 35.7 billion in 2010, i.e. a year-to-year increase of CZK 4 billion (+12% compared to 2009). In a long-term comparison between 2000 and 2010, this expenditure significantly increased, namely 2.5-fold over that period. Local budgets are thus the most significant public source of funding for environmental protection in the Czech Republic (Chart 3). At the municipality and self-governing region levels, expenditures are implemented continually based on the competence of municipalities and self-governing regions – however, they partly consist of subsidies from central sources. As in the case of expenditure from central sources, the largest year-to-year increase in expenditure from local budgets occurred in areas whose support has been prioritized in the long term, namely in water protection (+CZK 3.3 billion, i.e. +27% compared to the previous year) to a total of CZK 15.4 billion, and in biodiversity protection and landscape conservation (+CZK 0.42 billion, i.e. +4% compared to the previous year) to a total of CZK 10.1 billion (Chart 2).

Financing by EU and foreign sources

When the Czech Republic joined the EU in 2004, environmental protection expenditure increased significantly – not only due to direct support by the EU, but also as a result of the improved possibilities for drawing money from other foreign sources. The main sources for financing environmental protection are the **Operational Programme Infrastructure** (OPI, 2004–2006), the **Cohesion Fund** (2004–2010), the **Norwegian and the EEA Financial Mechanisms** (2004–2009), the **Swiss-Czech Cooperation Programme** (2007–2011) and the **Operational Programme Environment** (2007–2013) that is the largest in terms of subsidies and that is thematically linked to the OPI (Chart 4). Between 2004 and 2013, the largest portion of environmental protection funding has been provided by the Operational Programme Infrastructure (more than EUR 4 billion between 2004 and 2006) and the Operational Programme Environment (EUR 4.9 billion between 2004 and 2013).

In all developed countries with a functioning market economy, the long-term trend is to increase the involvement of private entities while reducing the role of central government decision making. These are the envisaged future trends in environmental protection expenditure.

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 the Eurozone economy. It has particularly strong ties to the German economy. The trends in global megatrends, trading in commodity exchanges and decisions of transnational business entities can affect the condition of the Czech Republic's environment beyond the capabilities of national regulation.

Megatrends are the main social, economic and environmental forces that affect the development of the society. Knowing the likely vectors of future developments helps improve our understanding of the condition of the environment in the Czech Republic.

Socio-economic megatrends:

1. For most OECD countries, the **aging** of the European and American population is at the top of the political agenda due to changes in the structure of the labour market, declining competitiveness and re-distribution of public resources. 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. While 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 condition of the environment.
3. **Technological development** brings solutions to existing problems and entirely new problems, to which no solutions are available. New sources of energy, nanotechnology, genetic modification, virtualization, brand new compounds and manufacturing processes are examples of areas whose impacts 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%, a 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 sit well with 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 need anywhere in the world results in consumerism that was inconceivable some fifty years ago. On the other hand, ongoing digitization will speed up the shift towards a knowledge economy. Commercialization limits personal decision making, 'relativises' moral values and, by extension, reduces one'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 produce result in increased pressure on the ability to regulate real problems.
9. The **interconnection** between social, economic and technological networks provides a starting point for ever faster economic and social changes. At the same time, dependence on critical infrastructures increases, as does the cost for their security.
10. **Urbanization** allows for creating nodes in networks and is massively taking place above all in developing countries. It tends to be associated with commercialization and the increasingly poor evaluation of work in primary industry.

Environmental megatrends:

1. **Global environmental pollution increases**. Both the amount and the 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 little understood.
2. **Declining resilience of ecosystems and loss of ecosystem services**. Provisioning, cultural, regulating, supporting and other services constitute quantifiable natural capital that is exploited in order to sustain humanity. Striking 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 effects of these trends are being intensively studied.
4. The growing **risk of pandemics and the spread of non-native diseases** and pests is the result of the global movement of goods and services, the climate trends and the reduced resilience of ecosystems. New human, animal and plant diseases can extremely quickly spread all over the world. Fear of pandemics has a major impact on global markets.
5. **Environmental debt** represents the accumulated environmental pressures that have not been included in prices in the real economy. The unrealistic financial evaluation of the real economy is what led to the financial crisis. The result was 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 the destruction of the value of economic and natural capital and investment, and the increasing risk of 'inflation' of values.

List of abbreviations

ALR	agricultural land resources
AOT40	accumulated ozone exposure over a threshold of 40 parts per billion
AOX	adsorbable organohalogens
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	CENIA, Czech Environmental Information Agency
CF	Cohesion Fund
CLC	CORINE Land Cover
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CNG	compressed natural gas
COD_{Cr}	chemical oxygen demand by chromium
Coll.	Czech collection of laws
c.p.	current prices
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
E-PRTR	European Pollutant Release and Transfer Register
EU	European Union
EU ETS	European Union Emission Trading System
EUR	Euro
Eurostat	Statistical Office of the European Union
FCOLI	thermo-tolerant (faecal) coliform bacteria
FSC	Forest Stewardship Council
GAEC	Good Agricultural and Environmental Conditions standards
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
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
SCI	Sites of Community Importance
SEBI	Streamlining European Biodiversity Indicators
SEP	State Energy Policy
SPA	Special Protection Areas
TSES	Territorial System of Ecological Stability
TV	target value
UAT	Unfragmented Areas by Traffic
UN	United Nations
UNFCC	United Nations Framework Convention on Climate Change
USLE	Universal Soil Loss Equation
VAT	value added tax
VOC	volatile organic compounds
WHO	World Health Organization
WMIS	Waste Management Information System
WMO	World Meteorological Organization
WWTP	waste water treatment plant

Glossary of terms

Acidification. The process whereby the substance's pH decreases, resulting in increased acidity. It primarily affects air and secondarily affects water and soil. Acidification is caused by the emission of acidifying substances (i.e. sulphur oxides, nitrogen oxides and ammonia) into the air.

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 absorbable 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 fatty tissues.

BAT. Special Protection Areas. BAT means the most effective and advanced stage in the development of technologies, practices and methods of operation which indicate the practical suitability of particular techniques designed to prevent, or when not possible, to reduce emissions and their impact on the environment.

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 non-material 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.

Exacerbation. The worsening of a previously stable asthmatic condition that typically is associated with breathlessness, coughing, wheezing, chest tightness, or any combination of these symptoms.

Greenhouse gases. Gases that are naturally present in the atmosphere or produced by humans; they have the ability to absorb long-wave radiation that is emitted by the Earth's surface, thus influencing the climate's energy balance. The action of greenhouse gases results, in part, in an increased daily average temperature near the Earth's surface. The most important greenhouse gas is water vapour, which accounts for 60–70% of the total greenhouse effect in mid-latitudes (excluding the effect of clouds). The most important greenhouse gas that is affected by humans is carbon dioxide.

Hazardous waste. Waste exhibiting one or more hazardous characteristics that are listed in Annex 2 to Act No. 185/2001 Coll., such as explosiveness, flammability, irritability, toxicity, and others.

Investment in environmental protection (= investment expenditure). Investment expenditure on environmental protection includes all expenditures for acquiring tangible fixed assets that are spent by reporting units in order to acquire fixed assets (through purchasing or through their own activities), along with the total value of tangible fixed assets that are acquired free of charge, transferred under applicable legislation, or reassigned from private use to business use.

Lime fertilizers. Calcium for the production of lime fertilizers is obtained from lime and magnesian-lime rocks that naturally formed from calcium that had been released from magnetic minerals. Another source of calcium fertilizers is waste materials from industry – lime sludge, cement dust, phenol lime etc., and natural lime fertilizers of local importance. Lime is used as fertilizer either directly (possibly after mechanical processing), as a fertilizer produced through a chemical process (calcining, burnt-lime slaking 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. Waste that remains after the separation of usable components and hazardous components from municipal waste; 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.

Natura 2000. A system of protected areas that are formed in all EU member states based on common principles. The system aims to protect animal and plant species and habitat types that are – from the European perspective – the most valuable, endangered, rare or limited in their prevalence to a particular region (endemic).

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.

Outer urban zone. The outer area of a municipality, usually outside its administrative boundaries, that forms a transition zone between the municipality (or the ‘inner urban zone’) and open landscape.

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.

Pentad. The five-day period that is used in the detailed analysis of meteorological data, most commonly for precipitation. The first pentad occurs from 1 to 5 January, the last one from 27 to 31 December; there are 73 pentads in a year, some of which are part of two consecutive months.

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.

Prevalence. The number of people within the monitored population that suffer from a given disease. It is usually indicated as a percentage as of a certain date.

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.

SCI. Sites of Community importance are protected areas that have been identified in order to ensure the protection of habitats of Community importance and species of Community importance. They are created pursuant to Directive 92/43/EEC and, along with Special Protection Areas, constitute the Natura 2000 network.

SPA. Special Protection Areas are protected areas that have been indentified in order to ensure bird conservation. They are created pursuant to Directive 2009/147/ES and, along with Sites of Community importance, constitute the Natura 2000 network.

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.).