2011

REPORT ON THE ENVIRONMENT OF THE CZECH REPUBLIC

cenia

Ministry of the Environment of the Czech Republic

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Introduction

The Report on the environment of the Czech Republic (hereinafter referred to as "the Report") is to be worked out annually on the basis of the Act No. 123/1998 Coll., on the right to information on the environment, as amended, and on Resolution of the Government No. 446 of 17th August 1994 and is submitted for approval to the Government of the Czech Republic and subsequently submitted to the Chamber of Deputies and Senate of the Parliament of the Czech Republic.

It is a comprehensive evaluation document assessing the state of the environment in the Czech Republic, including the entire context. Starting with the Report on the Environment of the Czech Republic for the year 2005, CENIA, the Czech Environmental Information Agency, is responsible for drawing it up.

The Report for the year 2011 was discussed and approved by the Government on 12th December 2012 and then provided to the two chambers of Parliament of the Czech Republic for information. The report is published in electronic form at http://www.mzp.cz and http://www.cenia.cz, and it is distributed at the same time on USB flash drive, together with the Statistical Yearbook of the Environment of the Czech Republic 2011.

Contents

Methodology

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

THE USE OF INDICATORS TO DESCRIBE THE STATE OF THE ENVIRONMENT

The methodological basis of the Report is the indicators, i.e. the indicators described with precise methodology and linked with the Czech Republic´s main environmental topics and with objectives of the current National Environmental Policy of the Czech Republic. Within preparation of a updated National Environmental Policy of the Czech Republic, the set of indicators was modified so that the currently presented indicators are linked with the new policy and can report on fulfilment of its objectives annually. Environmental indicators are among the most commonly used environmental assessment instruments. Based on data, they demonstrate the state, specifics and development of the environment and can indicate new environmental problems. Assessments that use indicators are clear and user-friendly. The indicator-based assessment methodology follows methodological trends used in the EU and therefore it is in accordance with the gradual process to harmonise reporting at both national and European levels.

ENVIRONMENTAL ASSESSMENT USING A SET OF KEY INDICATORS

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

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

- ➜ relevance to current environmental problems;
- ➜ relevance to the current environmental policy, strategies and international obligations under implementation;
- ➜ availability of high-quality and reliable data over a long period of time;
- ➜ relation to sectoral concepts and to their environmental aspects;
- ➜ "cross-cutting" nature of the indicator – the indicator covers as many causal links as possible, i.e. it was selected to represent both the causes and consequences of other phenomena in the DPSIR chain;
- ➜ link to indicators defined at the international level and detailed at the EU level.

The proposed set of indicators is not static, but is constantly being adapted to the needs of the Czech Republic's current State Environmental Policy, to the EEA set, to environmental problems and to availability of the source data sets. For example, in recent years there has been a change of several chapters including the presented indicators. Because of the high financial cost of obtaining the data for the chapter Biodiversity and Ecosystem Services, the indicator "Common Bird Species" is no longer evaluated, and due to decreasing monitoring, information concerning the population burden with chemical substances is not presented in the Report. In the case of the chapter Water Management and Water Quality, detailed information relating to the presented indicators is provided at the end of the publication, in the chapter Availability of data in the Report. Due to lack of current data, the chapter Biodiversity and Ecosystem Services was deleted, however, presentation of the data continues at http://indikatory.cenia.cz. Substantiation of the absence of indicators that describe the state of biodiversity in the Czech Republic is provided in the chapter Availability of Data in the Report. Indicators contained in the set of key indicators have been developed in Czech expert institutions which deal with these issues in long terms, or they have been taken from the internationally recognised indicator sets (EEA CSI, Eurostat, OECD, etc.).

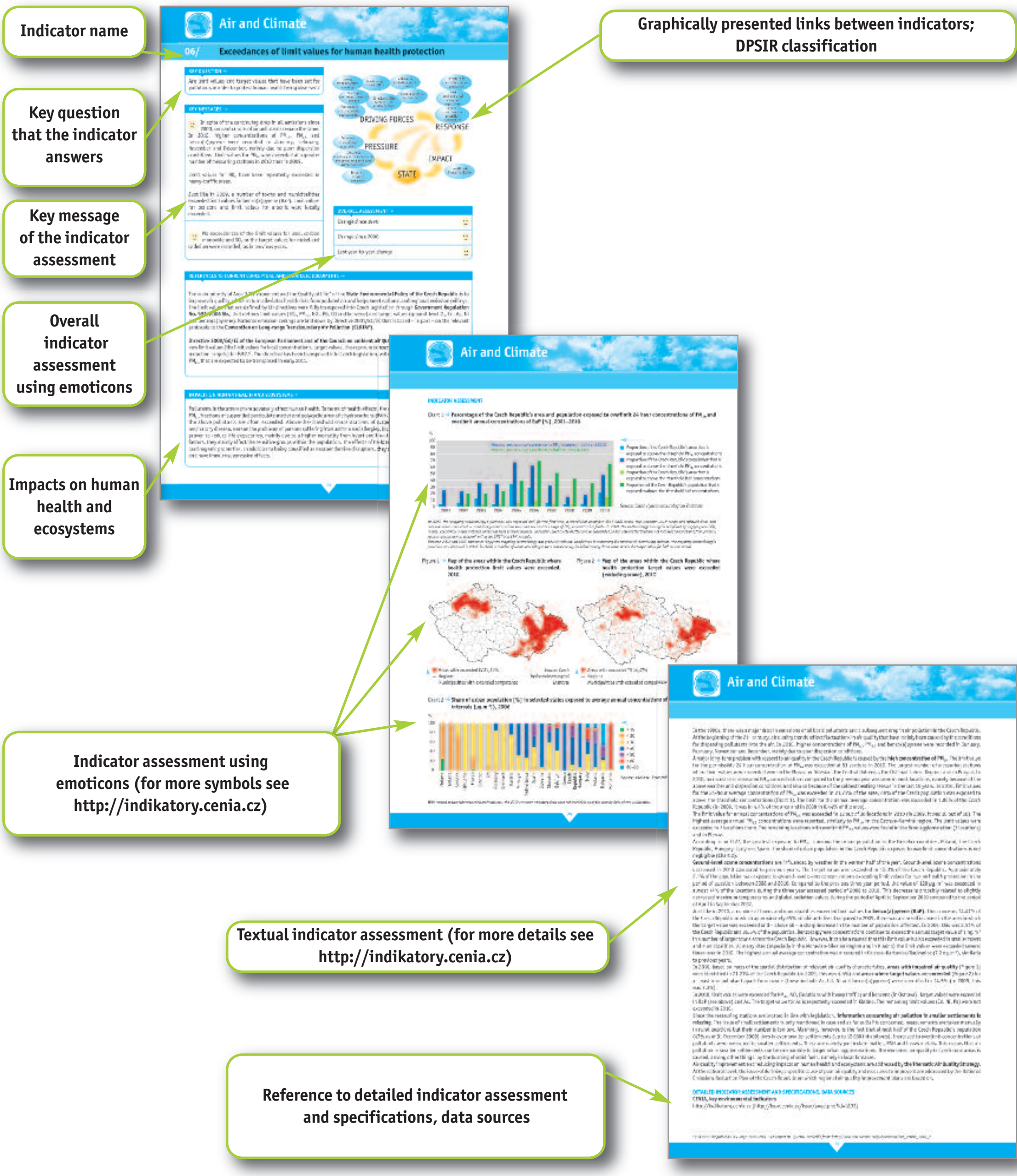
MESSAGES COMMUNICATED VIA INDICATORS

An indicator in the Report provides information across several hierarchical levels of detail. First, it provides comprehensible information – a key message, related (if currently possible) to a specific objective or another national or international commitment. General information also includes an overall assessment of the trend and impacts of the assessed phenomena on human health and ecosystems. A more detailed level of indicator assessment includes an assessment of the state and development as well as international comparison. Therefore, environmental conditions are compared with those in the other States of the EU27 where verified data are available for the respective indicators. For some indicators, international comparison beyond EU27 is included because of global importance of the topic. Each indicator is assessed according to a unified template, and presented simultaneously at http://indikatory.cenia.cz in a more detailed form than in the Report, together with methodology specifications and other metadata. The Report provides a link to the website for each indicator at the end of each chapter.

EMOTICON SYMBOL KEY

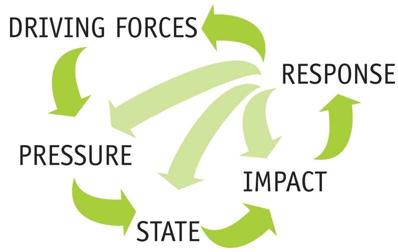
🙂	The Trend is developing positively, in accordance with the objectives set.
😐	The Trend is developing neither positively nor negatively and can be referred to as stagnate.
🙁	The Trend is developing negatively, not in accordance with the objectives set.

INDICATOR ASSESSMENT STRUCTURE



RELATED INDICATORS

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



GLOSSARY OF TERMS AND LIST OF ABBREVIATIONS

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

Key messages of the Report

In 2011, the Czech Republic's economy has been growing slightly while environmental burden was decreasing. The main environmental indicators have shown year-to-year improvement. In particular, energy and material intensity of GDP decreased. This was caused, inter alia, by a higher proportion of more technology-demanding products with a higher value added and lower emissions and energy demands, as well as by lower production costs connected with ongoing economic stagnation and household saving. In this respect, the year 2011 was characterised by decoupling of the relative development of the economy and the environmental burden which last happened in 2008.

The positive development in the state of the environment is reflected, for example, in decrease of the total amount of substances emitted into air, especially nitrogen oxides and volatile organic compounds. The main causes of the decline can be found in reduction of the energy intensity, especially in individual transport, related to modernisation of the vehicle fleet and stagnation of the transport performance. A lasting trend of reducing water withdrawals has resulted in a lower quantity of wastewater discharged into the water courses and the generally high proportion of treated waste water has led to reduction of the pollution contained in those waters. Owing to the growing interest of the population in organic products, proportion of agricultural land under organic farming, the number of organic farms and organic food producers has increased. The share of renewable resources in energy generation has also increased, which is positive not only in terms of environmental burden of these resources, which is generally small, but also in terms of the diversification of energy resources. Emphasis placed on the efficient use of resources is reflected in the growing extent of packaging waste recycling. Therefore, recycling is the most frequent way of packaging utilisation and in this respect, the Czech Republic is one of the most successful countries in EU27.

In protection of the environment, particular attention is paid to elimination of air pollution because air quality has a direct impact on the population's health. Polluted air is closely connected with the still high share of fossil fuels in energy generation in the Czech Republic, which decreases only slightly on a year-to-year basis. Emissions to air coming from the large pollution sources have been reduced to a great extent; further decreased can be expected in the context of new regulations adopted at the national and EU levels. Emissions from local household heating have a significant influence on air pollution, especially in small settlements where these emissions cause problems chiefly under adverse dispersion conditions and in inversion positions. Use of poor-quality fuels or even materials which are not directly intended for incineration in households continues. This source, which produces roughly one third of particulate matter emissions, is difficult to regulate.

Transport also takes part in the overall air pollution burden, namely due to e.g. transit transport going through large towns and other exposed settlements, increasing proportion of the road freight transport and high age of the vehicle fleet. Despite the significant decrease in the volume of particulates emitted by transport in 2009, this kind of emissions was not reduced below the level of the year 2000 so far.

Transport infrastructure, together with occupation of agricultural land due to construction, are important factors interfering the landscape's structure and function. This then results in increasing fragmentation of the landscape, higher noise pollution or disturbance of the precipitation-runoff balance. The proportion of non-fragmented areas is decreasing in the Czech Republic and therefore the pressure on habitats and the wild animal and plant species living there continues to grow.

The current burden of ecosystems as a consequence of exposure to ground-level ozone and inappropriate species composition of forest stands with dominating monocultures are the causes of bad health of the forests which are not capable of coping with the negative abiotic and biotic impacts. Although the proportion of deciduous trees used in forest regeneration is increasing and the share of acidifying substances in the air is decreasing, the health of forest stands in the Czech Republic, expressed as defoliation degree, is the worst in the EU27.

Still, however, a number of environmental problems have not been solved or reduced and for a part of them, significant positive changes cannot be expected even in the future. On the one hand, problems determined by natural circumstances and focus of the Czech Republic's economy are concerned. It is e.g. the raw-material resources (coal supplies) or energy performance of the economy (historically, the high share of industry in GDP). On the other hand, burdens are recorded in the Czech Republic which are long-term in nature, their reaction time is longer, and as a result, they become evident with years of delay. This includes e.g. anthropogenic interventions in the structure, and thus in the function of landscape – the landscape fragmentation is therefore growing, land use is changing and native species are getting lost. Old environmental burdens (contamination), the removal of which is limited in time and demands a lot of financial means, are particular problems.

It is important to perceive the state of the environment in relation to human health and ecosystem services in particular. The negative effects, which manifest in increased sickness rate or in shortened length of human life, are bound mainly to the air quality. Negative effects associated with the degradation of ecosystems consist particularly in reduced ability of nature to provide regulatory and production services.

THE MAIN POSITIVE FINDINGS OF THE REPORT:

- Interannual decrease of emissions of acidifying substances (by 0.6%), emissions of ozone precursors (by 2.7%) and emissions of primary particulate matter and secondary particulate matter precursors (by 1.2%) continues. For all the above-mentioned emission groups, NO_x have played the key role in the decrease. The positive development of the emission burden was mainly due to a decrease of transport emissions and emissions from stationary sources (mainly in the energy sector). At present, the Czech Republic fulfils the valid national emission ceilings.

- The total amount of water abstraction has decreased, mainly due to reduction of cooling water abstraction within electricity generation and distribution, and reduction of abstraction for public water supply systems and the industry, which is reflected e.g. in further reduction of drinking water consumption in households (currently, it is 88.6 l per a person and day).

- The total amount of waste water discharged into surface waters has decreased. The proportion of population connected to sewerage system sending in a waste water treatment plant has increased, as well as the number of plants with secondary and tertiary treatment, which resulted in an increase in the share of treated waste water and the consequent reduction in the amount of pollution discharged (BOD_5, COD_{Cr}, suspended solids, $N_{inorg.}$, P_{total}, most notably for the inorganic nitrogen.

- The overall quality of water in watercourses continues improving, however, in some places, environmental quality standards are still exceeded.

- Within agricultural land resources, the biggest changes in land use took place in the period 1990–2000; at that time, the proportion of the area of permanent grassland increased at the expense of arable land (by 15%). This trend continues in the following decade, too, but at a slower pace (in 2000–2011, the increase was 2.9%).

- Interannually, the area of agricultural land in organic farming has grown up to 11.4 % of the total agricultural land resources area. At the same time, the number of organic farms and producers of organic food has gone up.

- With the economy growing, consumption of primary energy sources has dropped, while the cause consists in the decrease in heat production due to the short heating season. High prices of basic raw materials, together with lower industrial production, have resulted in lower consumption in the industry.

- Generation of electricity from renewable energy sources (RES) has been growing in long terms; on the year-to-year basis it even increased by 26.2%. In 2011, RES constituted 8.5% of the electricity base in the Czech Republic, which means that the national indicative target, set at 8%, was fulfilled. In particular, ongoing development of photovoltaics, which, however, has also negative economic and environmental impacts, has contributed to this development. Solar energy sources even comprised up to 91% of the year-to-year growth of generated electricity.

- Individualisation of passenger transport stopped as a result of the households' economic situation and improving the extent and quality of public transport. The rise of rail transport within integrated systems in large cities has taken the biggest part in the year-to-year increase of railway transport performance in passenger transport (by 1.8%).

- The domestic material consumption in the Czech Republic is decreasing, which is mainly due to crisis in the building industry where there was a drop especially as a result of restrictions on investment, both in the Government and private sectors. The decline in consumption of mineral construction materials was the largest contribution to absolute decoupling of domestic material consumption and the GDP.

- The proportion of selected ways of waste utilisation in the total waste production increased in 2011, compared to the year 2003, from 62.2% to 78.2%. The proportion of selected ways of waste removal decreased in 2011 to the lowest level in long terms (12.9%).

- Between 2003 and 2011, there was a significant decline in the total waste production, namely by 15%. The proportion of municipal waste (utilised for its material composition) in the total waste production, increased by 6 percentage points in comparison with 2010. The share of municipal waste disposed by landfilling has also decreased interannually.

- There has been growth in public expenditure for protection of the environment in connection with increasing productivity of the Czech economy. Between the years 2010 and 2011, there was an increase of expenditures from territorial budgets by 3.7%. In the case of expenditure from the central sources (i.e. in particular, from the state budget and national funds), there was an increase by 29.4%.

THE MAIN NEGATIVE FINDINGS OF THE REPORT:

- Greenhouse gas emissions per capita and unit of economic performance are significantly higher in the Czech Republic compared to the average of the EU27 countries.

- In 2011, compared with 2010, the size of the area where maximum permissible concentrations of emissions of PM_{10} suspended particulates were exceeded has increased. The air pollution limit value for the 24-hour average PM_{10} concentration was exceeded in 2011 in 21,8% of the country's area; 50.8% of the Czech Republic's population were exposed to above-limit concentrations, even though lower PM_{10} concentrations were measured. The proportion of the territory where target value for benzo(a)pyrene was exceeded has also increased. The target value was exceeded on 16.8% of the territory, in particular in settlements and urban agglomerations.

- A significant interannual deterioration was recorded for air pollution with ground-level ozone. In the period 2009–2011, the target limit value was exceeded on 17.1% of the Czech Republic's territory while about 10.1% of the population were exposed to above-limit concentrations.

- The Czech Republic failed to comply with the requirements of Council Directive 91/271/EEC on municipal waste water treatment. The treatment is unsatisfactory in 43 from a total of 633 agglomerations with population equivalent over 2,000.

- Despite slowdown in the growth rate, defoliation is still very high in the Czech Republic and it is among the highest in Europe. It is the burden caused by anthropogenic soil acidification, and to reverse the development is a long-term task.

- During the period 2000–2011, the area of agricultural land resources decreased by 1.2%, particularly in the category of arable land.

- The landscape fragmentation process continues, however, its pace is lower than it was in the past. In 2010, the area of landscape not affected by fragmentation was 63.4% of the total area of the Czech Republic, which is by 2.4% less than in 2005.

- The consumption of mineral fertilizers has increased by 27.1% interannually and thus it reached the highest value since 2000, thereby getting back to the gradually increasing trend interrupted in 2009–2010. Application of plant protection products increased by 8% in 2011, compared with the previous year.

- Electricity generation is growing in the long term, while generation from steam power stations, which burn especially brown coal, predominates (61.6% of electricity).

- The Czech Republic has a significantly positive balance of foreign trade in electricity (19.5%), which, due to the structure of electricity generation, complicates further reduction of environmental burden related to energy.

- The share of road freight transport in the overall freight transport performance is growing. Alternative sources of energy are represented quite marginally in the transport sector. The number of registered vehicles increases, as well as their average age. Noise pollution from traffic remains high.

- The Czech Republic's material intensity is by 39% higher than the average of EU27 member states and by 59% than the EU15.

- In 2011, hazardous waste production increased by almost 7% compared to the previous year. The quantity of packaging waste has increased by 30% since 2003. Landfilling still remains the most common way of removing waste (97%).

01/ Meteorological conditions

KEY QUESTION →

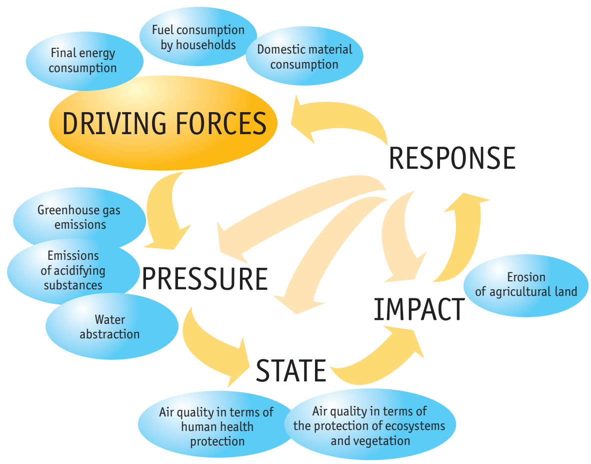
What was the development of meteorological conditions in the Czech Republic's territory in 2011?

KEY MESSAGES →

In the territory of the Czech Republic, the year 2011 showed above-average temperatures; from the perspective of annual rainfall it was average but much drier than the previous year. The average annual air temperature (8.5 °C) was by 1 °C higher than the long-term mean in 1961–1990. The annual rainfall amounted to 627 mm, which represents 93% of the long-term mean in 1961–1990. Rainfall distribution during the year was uneven; there were both very dry and very wet months.

The year 2011 was characterized by very warm early spring and by rainfall-rich July. The peak of the summer was at the end of August and November was extremely dry. The year 2011 was unique for its almost zero rainfall in November, even as regards the whole history of measurement and observation in the Czech Republic's territory.

During the months of January through March, and also in November, there were longer periods with adverse dispersion conditions. In the region of Ostrava and Karviná, the regulation signal was announced for 37 days and the warning signal for 24 days in total.



INDICATOR SIGNIFICANCE AND CONTEXT →

Weather conditions affect the environmental burdens as well as the state of the environment. Long-term development of temperature and precipitation conditions is used to detect climate change and to evaluate it.

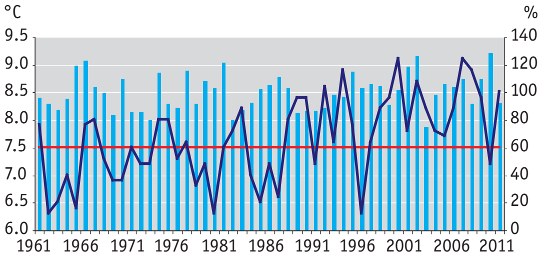
Temperature and precipitation conditions in a given year have an impact on the national economy, especially as regards the sectors of energy, agriculture, water management and forestry, and thus on the level of the environmental burdens caused by these sectors. The weather conditions directly affect the state of the environment, too. They can influence the dispersion conditions for pollutants in the atmosphere and – in turn – air quality, especially in the winter. In the summer period, high temperatures combined with intense solar radiation cause the formation of tropospheric ozone. High temperatures also increase the evaporation rate and, when combined with rainfall deficiency, they decrease soil humidity, affect drainage conditions, increase the eutrophication rate of standing water bodies and, last but not least, may also result in fires. Deepening extremity of the climate, associated with more frequent occurrence of hazardous hydrometeorological phenomena, such as floods, long-term drought or very strong wind, can cause extensive damage to the national economy.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Extreme weather conditions, whose incidence is increasing in the context of climate change in recent years, also have influence on human health and ecosystems. Very high temperatures in the summer pose a burden for the cardiovascular system and are associated with a higher mortality rate from diseases of the circulatory and respiratory systems which has been proven especially for women in the post-working age. Severe frost may also have health impacts, especially for people over 65 years and homeless people. Increases in average temperatures in the summer and extension of the length of sunlight result in enhanced formation of ground-level ozone, which, especially in the mountain areas, damages the assimilatory organs of plants and thus has a negative impact on ecosystems. Torrential rains (soil erosion), strong wind (damage to forest stands, wind erosion) and long-term drought also have negative impacts on ecosystems.

INDICATOR ASSESSMENT

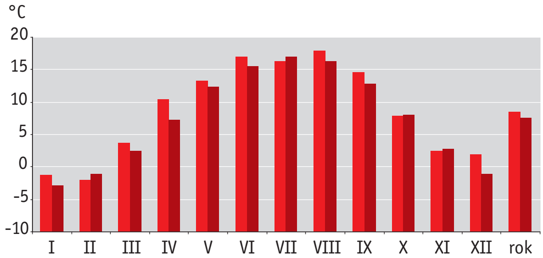
Chart 1 → **Long-term development of annual average air temperature and precipitation totals in the Czech Republic compared to the mean 1961–1990, 1961–2011 [°C, %]**



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

Source: Czech Hydrometeorological Institute

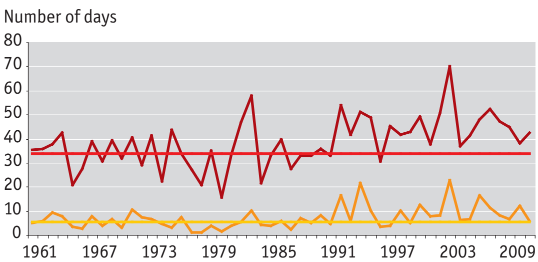
Chart 2 → **Monthly average air temperature in the Czech Republic (areal temperatures) compared with the 1961–1990 temperature mean [°C], 2011**



■ Air temperature, 2011
■ Mean value of air temperature (1961–1990)

Source: Czech Hydrometeorological Institute

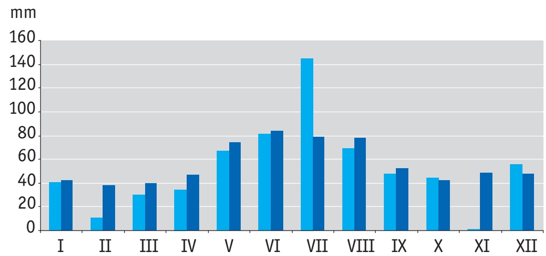
Chart 3 → **Average number of summer days and tropical days compared with the 1961–1990 mean [number of days], 1961–2011**



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

Source: Czech Hydrometeorological Institute

Chart 4 → **Monthly precipitation totals in the Czech Republic (areal averages) compared with the 1961–1990 long-term mean [mm], 2011**



■ Precipitation total, 2011
■ Mean value of the precipitation totals (1961–1990)

Source: Czech Hydrometeorological Institute

The year 2011 was very warm in the Czech Republic; the annual average temperature (8.5 °C) was by 1 °C higher than the 1961–1990 long-term mean (Chart 1). Due to this temperature, the year 2011 was the seventh hottest year since 1961, and, at the same time, the fifth hottest year since the beginning of 21st century (the hottest years at all were the years 2000 and 2007). In comparison with the previous year 2010, which was the coolest year since 2000, the year 2011 was by 1.3 °C warmer. The average monthly air temperatures were varying around the mean values of the period 1961–1990; the months of April, August and December were very warm compared to the mean.

The weather was changeable at the beginning of the year, while frost periods were alternating with times of temperatures being high above the long-term average. The average January temperature (–1.2 °C) was by 1.6 °C higher than the 1961–1990 mean and the month was normal in terms of temperature (Chart 2). The weather was cooler in February; the average temperature reached the value of –2 °C, which is by 0.9 °C less than the 1961–1990 mean. The lowest minimum air temperature –28 °C was recorded on 24th February at the meteorological station in Kořenov-Jizerka. Frosty weather at the end of January, in the course of February and in early March was connected with worsened **dispersion conditions for air pollutants**. In the Moravian-Silesian region, **the regulation signal** was in force for 37 days and **the warning signal** for 24 days of the whole year (including the November episode). The total duration of the regulation and warning signals in 2011 was slightly higher compared with 2010, not only in the Moravian-Silesian region but also in the other regions of the Czech Republic.

There was very warm weather in April; the average April temperature (10.5 °C) was by 3.2 °C higher than the 1961–1990 mean (Chart 2). As early as at the beginning of the month, the first summer day (i.e. a day with the maximum air temperature being 25 °C and more) was recorded in Prague; the maximum air temperature at the meteorological station in Prague-Karlov reached 25.6 °C on 3rd April. The maximum air temperature over 25 °C was recorded at a number of stations in the third decade of the month, too. Rapid cooling with minimum temperatures below the freezing point in the first decade of May caused extensive damage, not only for wine growers but also for orchardists and growers of other crops. On 4th May, the minimum air temperature in mountain valleys fell below –10 °C but it remained below the freezing point also in lowlands, e.g. in Pardubice it fell to –2.8 °C, in Semčice to –2.8 °C, in Kroměříž to –0.9 °C.

The warmest summer month was August, with the average monthly temperature being 18 °C (Chart 2), which is 1.6 °C more than the 1961–1990 mean; the month was therefore very warm. A heat wave with the maximum daytime temperatures above 30 °C hit the Czech Republic in the third decade of the month and it continued till early September. The highest maximum air temperatures in Bohemia and Moravia were recorded on the same day – on 26th August the maximum air temperature in Chotusice got up to 36.7 °C, in Strážnice to 36.1 °C.

Temperatures in the months of October and November were more or less normal; December was a very warm, with average monthly air temperature being 1.9 °C which is by 2.9 °C more than the 1961–1990 mean (Chart 2). The average daily temperature in the Czech Republic was oscillating above the values of the long-term monthly mean for nearly the whole month; it was lower for only 3 days. A warm end of the year has also been reflected in the low number of days with extreme temperatures. In 2011, there have been 28 **icy days** and 117 **frosty days**, which is less than in 2010.

Occurrence of **tropical days** in the Czech Republic's territory in 2011 (Chart 3) was lower in comparison with 2010 and it varied around the mean (5 days per year). Most tropical days were recorded at the end of August and at the beginning of September. By contrast, occurrence of **summer days** was slightly higher compared with the previous year (42.1 days on average for the Czech Republic), which is an above-average value in comparison with the 1961–1990 mean, as well as in all the years since 2000. The above-described occurrence of characteristic days indicates less extreme but generally warmer course of the year 2011 compared to 2010.

The annual rainfall (precipitation total) in the territory of the Czech Republic amounted to 627 mm, which represents 93% of the 1961–1990 long-term mean, and the year as a whole was evaluated as **normal in terms of precipitation**. Distribution of rainfall throughout the year, however, has been uneven; there have been both very dry and very wet months. Low rainfalls with values much below the monthly mean were recorded in February and November, and conversely, July was very moist (Chart 4).

The January rainfall (41 mm) represented 97% of the 1961–1990 long-term mean, the month was therefore normal in terms of precipitation. However, as a result of warming and abundant precipitation in the second decade of January, there were elevated river levels and different levels of flood activity were achieved in the Czech Republic. The highest flow rates were recorded in South Bohemia in the lower course of the River Lužnice and the River Skalice, in the West of the Czech Republic's territory they were in the tributaries of the River Berounka.

February was very dry; the monthly rainfall of 10 mm is only 27% of the 1961–1990 mean. As a result of dry weather, there was snow cover at the lower and middle altitudes only at the beginning of the month (before the snow melted during warm-up in the half of the first decade); there was no snow at all in the lowest altitudes in South Moravia in February. The biggest amount of snow has fallen in the Giant Mountains while the highest maximum seasonal height of the total snow cover reached 120 cm in Labská bouda, which is by almost 50 cm less than the long-term mean for this meteorological station.

The rainfall in July has been high above the mean (Chart 4); the area rainfall for the whole of the Czech Republic, which amounted to 145 mm, was 184% of the mean value. Most of the precipitation fell in North Bohemia; the highest monthly rainfalls were recorded in the stations located in the region of Liberec, namely Josefův Důl (466.7 mm), Bedřichov (461.6 mm) and Mníšek-Fojtka (422 mm). Due to the fact that in this area, damage of the 2010 floods has not been removed entirely, it is not possible to evaluate the state of the flow rates in the individual watercourses accurately. Thanks to lower flood intensity in comparison with the previous year, the property damage was not high.

In terms of precipitation, the months of September and October were oscillating around mean values. **Extremely dry weather was recorded in November**, not only in the territory of the Czech Republic but also in the whole of Central Europe. The monthly rainfall of 1 mm, which is only 2% of the long-term mean, puts this month among the driest months in the history of observations in the Czech Republic. Almost 80% of all stations which measure precipitation in the Czech Republic's territory have recorded zero rainfall or rainfall below 1 mm. According to observations at the station in Prague-Klementinum, November 2011 was the driest November since 1804, which is the entire period of continuous rainfall measurement in this station.

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

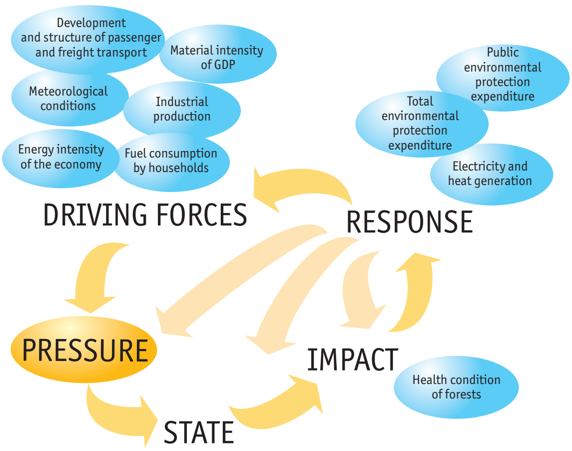
KEY QUESTION

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

KEY MESSAGES

The trend in aggregate greenhouse gas emissions in the Czech Republic is stagnant at the beginning of 21st century, with slight year-to-year fluctuations in both directions and with a close tie to the economy's performance. The Czech Republic's current commitment to the Kyoto Protocol is being met by a large margin. Greenhouse gas emissions from transport have been declining since 2007.

In the interannual comparison, the total aggregate greenhouse gas emissions rose by 3.3% in 2010, however, it was only a change associated with a significant drop in emissions in 2009 due to the economic recession. The increase in emissions occurred mainly in the energy and industry sectors. The negative trend in the area of waste continues; the emissions have been growing steadily since 1990. The decrease in emission intensity of the economy came to a standstill after 2008; specific values of the greenhouse gas emission indicators per capita and per economic performance in the Czech Republic continue to be well above average in the European context.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The Czech Republic is a signatory to the **UN Framework Convention on Climate Change** and the **Kyoto Protocol**. The Kyoto Protocol binds the Czech Republic to reduce aggregate greenhouse gas emissions in the 2008–2012 control period by 8% compared to the base year 1990. New commitments after the end of the first Kyoto Protocol control period have not been agreed upon although it has been decided to continue in the Kyoto Protocol also in the second control period for the years 2013–2017, or 2020, as the case may be.

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[1] to help to meet the EU target – i.e. to reduce the total greenhouse gas emissions in the EU by at least 20% and to achieve a 20% share of renewable energy sources in the final energy consumption by the year 2020 compared to the 1990 level. There is a commitment resulting from the climate-energy package for the Czech Republic, i.e. to reduce emissions in the sectors falling within the EU ETS by 21% by the year 2020 compared to 2005, and in the sectors outside the EU ETS not to increase the emissions by more than 9% over the same period.

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

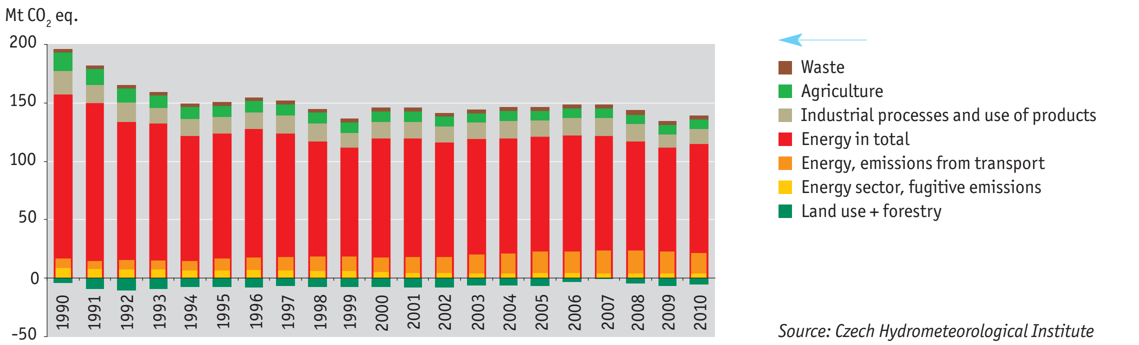
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Production of greenhouse gas emissions has minimal direct impacts on human health and ecosystems. However, given the context of greenhouse gases production and climate change, all effects caused by climate change belong to the indirect effects of their production. Also with regard to the fact that greenhouse gas emissions are usually produced along with other pollutants, it can be concluded that with the greenhouse gases increasing, the overall burden of the atmosphere, and hence the risk to human health and ecosystems arising from polluted air are growing, too.

[1] *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.*

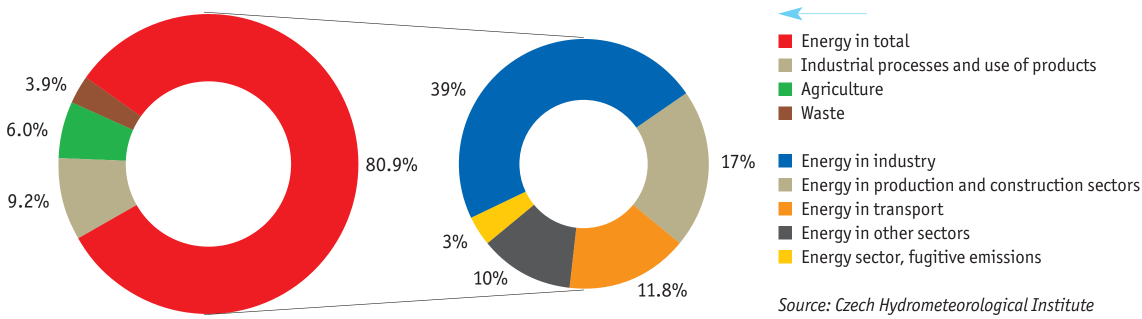
INDICATOR ASSESSMENT

Chart 1 → **Development of greenhouse gas emissions by sector in the Czech Republic [Mt CO_2 eq.], 1990–2010**



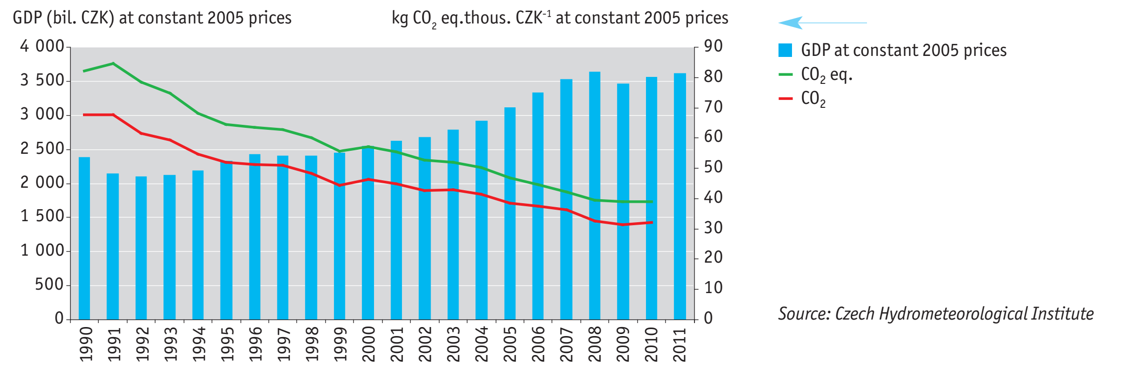
Source: Czech Hydrometeorological Institute

Chart 2 → **Structure of greenhouse gas emissions by main CRF[2] categories [%], 2010**



Source: Czech Hydrometeorological Institute

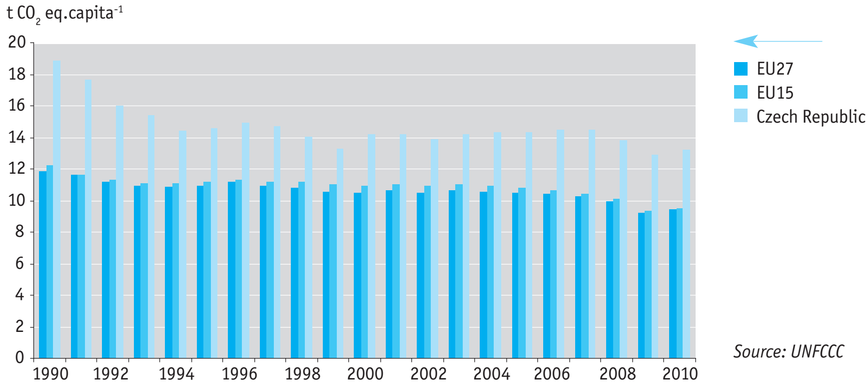
Chart 3 → **Trends in the emission intensity of the Czech economy [kg CO_2 eq.thous. CZK^{-1} at constant 2005 prices] and GDP [bil. CZK at constant 2005 prices], 1995–2010 (excluding LULUCF[3])**



Source: Czech Hydrometeorological Institute

[2] CRF – Common Reporting Format. The common structure of data reported to UNFCCC.
[3] Emissions and sinks from the LULUCF sector (Land Use, Land Use Change and Forestry Activities).

Chart 4 → **Trends in the GHG emissions in the Czech Republic and the EU [t CO_2 eq.capita^{-1}], 1990–2010 (excluding LULUCF)**



Source: UNFCCC

In 2010, **aggregated emissions of greenhouse gases** in the Czech Republic have reached a level of 139.2 Mt CO_2 eq. (excluding the LULUCF sector), which indicates an annual increase by 3.3% after a period of decline in 2007 to 2009 (Chart 1). Fluctuations in emissions in the last three years can be associated with fluctuations in the economy's performance and with its recovery in the latest reference year. The trend in emissions was stagnant in 2000–2007, and then it was declining slightly. From 1990, which is the reference year of **the Kyoto Protocol**, to 2010 the emissions decreased by almost 29%. The Czech Republic's commitment was therefore met by a large margin. Declines in emissions from the LULUCF sector amounted to 5.5 Mt CO_2 eq. in 2010, which is a value lower than that for the year 2009. Aggregated emissions including this sector amounted to 133.6 Mt CO_2 eq. (compared to the previous year this is an increase by 4.5%).

The biggest increase in emissions in 2010 in comparison with the previous year was achieved in the categories of **public electricity and heat production** (around 2.5 Mt CO_2 eq., i.e. by 4.7%) and **industrial processes** (about 0.8 Mt CO_2 eq., i.e. by 7.9%) mainly due to the increase in emissions from the production of metals (Chart 1). The increase in industrial production in 2010 was connected with interannual growth of the economy (GDP) by 2.2%. Emissions from **waste production and management** have also been rising in long terms (in 2010 it was by 2.4%), namely this is due to increased emissions from landfills. Although the amount of landfilled waste decreased interannually by approximately 6.5% in 2010, the proportion of solid municipal waste in the total landfilled waste also dropped from 77% to 68%, namely at the expense of those kinds of waste from which more methane emission arise (mainly biomass).

Conversely, **emissions from transport**, after a period of significant growth after 2007, are falling; in 2010, emissions from transport decreased in interannual comparison by 1,053 kt CO_2 eq., i.e. by 5.7% (Chart 1). In comparison with the year 2000, however, they grew by 41%, and compared to 1990, by 125%. **Emissions from agriculture** are also slightly decreasing (by 1.9% in year-to-year comparison); however, unlike transport, there is a long-term trend since 1990 when emissions from agriculture were by 50% higher than those in 2010.

In **the greenhouse gas emissions structure by the individual source categories** (Chart 2), there is a very slow decrease of the proportion of industry (the categories of combustion processes in industry and of industrial processes) and a stagnant proportion of public energy (namely around 40%). These categories, which include major stationary sources, take up approximately two thirds of the total national emissions while the rest of the emissions is produced by mobile and area sources. The share of transport increased significantly from 8.5% in 2000 to 12.5% in 2010; in recent years, however, it is stagnating due to decrease of emissions from this category, it even decreased in the year-to-year comparison by 1.2 percentage points. Emissions from agriculture amounted for 5.6% of the total emissions, and this share is declining gradually. Emissions from waste occupied 2.6% of the total emissions, and the trend has been growing.

In 2010, companies involved in **the EU emissions trading system (EU ETS)** showed CO_2 emissions in the amount of 75.6 Mt CO_2, which represents a 2.4% increase as against the previous year. In 2011, the EU ETS emissions reached 74.2 Mt CO_2, so this is a decrease by 1.9% (1.4 Mt of CO_2). The proportion of CO_2 emissions included in the emissions trading system in the total CO_2 emissions amounted to 63.1% in 2010, which indicates that the proportion in the total aggregated emissions (excluding the LULUCF sector) was 54.4%. Therefore, the influence of emissions from the emissions trading system on the total emissions dynamics is therefore essential; for this reason, it is possible to expect a decline or at least stagnation in the emissions reported in the emission inventory for the year 2011. Compared to the year 2005, which is covered by the objective of the EU climate-energy package, the EU ETS emissions decreased by 10.1% by the year 2011. Achievement of the goal of reducing emissions by 21% by 2020 should be supported by a gradual reduction of the quantities of emission allowances allocated in 2013–2020, in connection with reduction of the proportion of allowances allocated for free.

Greenhouse gas emissions per capita (without LULUCF) reached the value of 13.2 t CO_2 eq. in 2010 which is by 2.9% more than in 2009. Compared to 2000, the specific emissions per capita decreased by 6.6%; since 1990 there has been an approximately 30% reduction. The emission intensity of the economy (Chart 3), i.e. emissions production per unit of created economic performance, has been going down steadily in the Czech Republic since 2008; then the trend changes into stagnation. In interannual comparison, the 2010 emission intensity increased slightly by 0.5% to 39.1 kg CO_2 eq. per a thousand CZK of GDP, namely because the emission growth was more significant than the GDP increase.

In the European context, the values of **specific indicators of greenhouse gas emissions** are relatively much above the average of both the EU15 and EU27 countries (Chart 4). Moreover, after 2000, the difference between the values of emissions per capita in the Czech Republic and average values for the EU15 and EU27 countries is not decreasing but it is growing slightly. In 2010, the Czech Republic's emissions per capita were by 40.6% higher than those in the EU27; in 2000 it was by 34.8%. This is due to the fact that the rate of decline in aggregate greenhouse gas emissions per capita in the EU27 (by 10.4%) was greater than the decline in the emissions in the Czech Republic, which amounted to 6.6%. Among European countries, only Luxembourg, Estonia, Finland, Ireland and Cyprus have higher per capita emissions than the Czech Republic; the other countries have lower emissions.

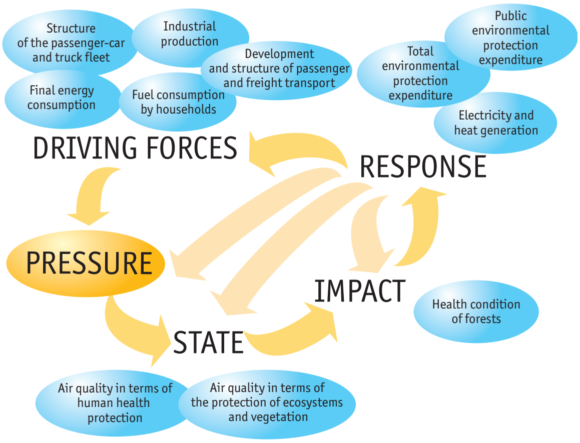
Future outlook of greenhouse gas emissions is burdened by a number of uncertainties associated in particular with development of the Czech Republic's economy, which is interconnected with developments in the EU27. Considering the fact that, in short terms, a significant growth in the Czech Republic's economy is not expected, a slight decrease of the emissions is probable. In the longer terms, decline in emissions from the transport sector is likely to continue. Emissions from the energy industry will depend on the development of the fuel-energy base, especially as regards representation of nuclear energy and RES. Concerning emissions from the industry, fluctuations related to year-to-year changes in the amount of industrial production can be expected, however, the decline in longer terms would only be possible in the event of significant changes in the sectoral composition of the industry towards productions with less energy and emission intensity. According to the recently elaborated national projections of greenhouse gas emission trends, the Czech Republic should ensure fulfilment of the obligations arising from the climate-energy package.

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 declining steadily since the 1990s. Compared to the year 2010 (14.5 kt.year^{-1}), there was a decrease in the emissions of acidifying substances by 0.6% in 2011. NO_x emissions, which have decreased by 2.2%, have contributed most to the year-to-year changes in the emissions of acidifying substances. Emission of SO_2 (36.93%) have occupied the biggest part of the total amount of acidifying substances while NO_x (35.1%) have taken almost the same proportion. The lowest share has been covered by NH_3 (28.0%).

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**. Under this programme, 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), and emission scenarios for 2015 and illustrative values of the 2020 emission scenario were formulated. The following emission ceilings for the single emissions of acidifying substances are to be met by 2010: national emission ceiling for SO_2: 265 kt per year (i.e. 8.28 kt per year weighed by the acidifying equivalent), for NO_x: 286 kt per year (i.e. 6.22 kt per year weighed by the acidifying equivalent) and for NH_3: 80 kt per year (i.e. 4.71 kt per year weighed by the acidifying equivalent)[1]. In 2011, the document the **Potential for Reduce of Pollutant Emissions in the Czech Republic by the Year 2020** was under preparation; it calculates the emission reductions in acidifying substances which the Czech Republic is able to reach by the year 2020 within the framework of revision of the **Convention on Long-Range Transboundary Air Pollution (CLRTAP)**.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

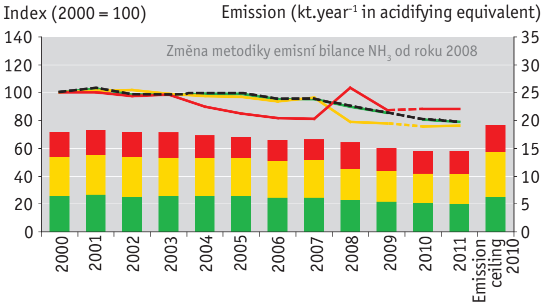
As regards human health, short-term exposure to acidifying substances may irritate the respiratory system and worsen the problems of persons suffering from asthma (bronchoconstriction) and allergies (increased sensitivity to additional allergens). Long-term exposure to high concentrations of NO_2 may increase the number of patients with respiratory problems, especially in sensitive groups of the population (people suffering from asthma, children, the elderly, etc.).

Atmospheric deposition of acidifying substances emissions increases the hydrogen ion concentration in environmental media, which results in reducing the pH of water and soil, leaching of toxic metals (Al, Cd, Pb and Cu) and disruption of the nutrients' flow. All this leads to damage to the plants' root system. The increase in acidity of the environment may lead to death of organisms, i.e. decrease of the overall biodiversity, and to ecosystem balance disruption.

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

INDICATOR ASSESSMENT

Chart 1 ➜ **Total emissions of acidifying substances in the Czech Republic, 2000–2011 and the level of national emission ceilings for 2010 [index, 2000 = 100]; [kt.year^{-1} in acidifying equivalent]**

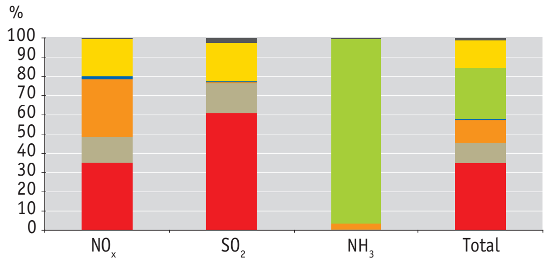


- NO_x (right axis)
- SO_2 (right axis)
- NH_3 (right axis)
- NO_x (left axis)
- SO_2 (left axis)
- NH_3 (left axis)
- Total emissions of acidifying substances (left axis)

Source: Czech Hydrometeorological Institute

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

Chart 2 ➜ **Sources of emissions of acidifying substances in the Czech Republic [%], 2010**

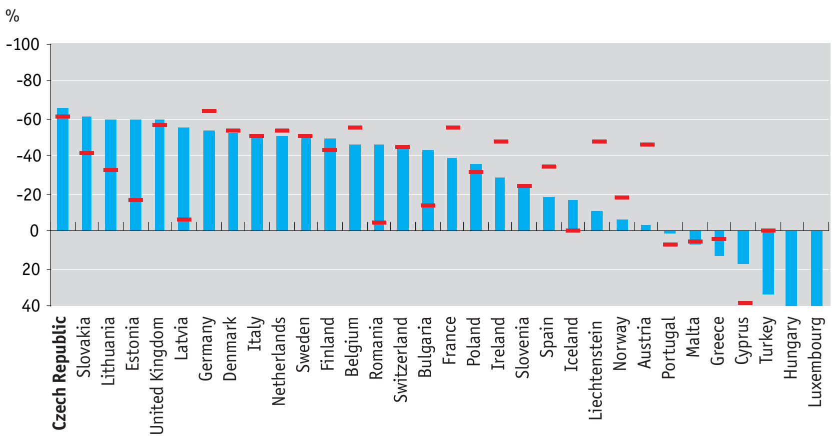


- Public energy sector
- Industrial energy sector
- Transport
- Services, households and agriculture
- Production processes without combustion
- Manure processing
- Others

Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

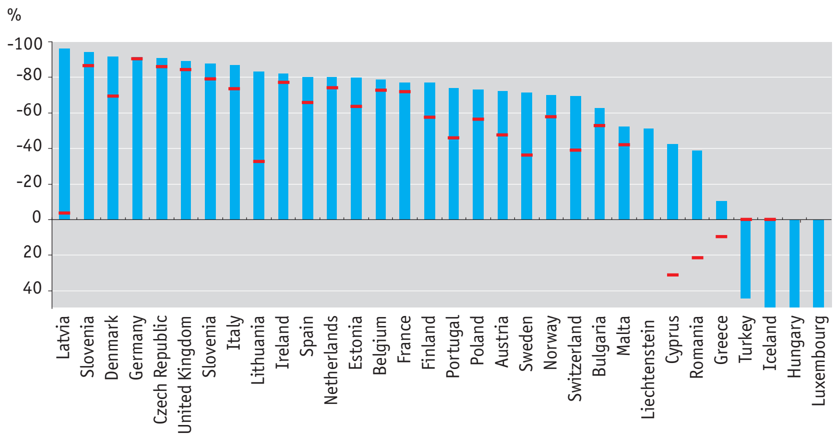
Chart 3 ➜ **International comparison of NO_x emission changes between the years 1990–2009 and deviations from the linear trend of emission reductions towards fulfilling of the national emission ceilings in 2010 [%], 2009**



- Change in emissions 1990–2009
- Deviations od emission levels from the values of national emission ceilings

Source: EEA

Chart 4 → **International comparison of SO_2 emission changes between the years 1990–2009 and deviations from the linear trend of emission reductions toward fulfilling of the national emission ceilings in 2010 [%], 2009**



Change in emissions 1990–2009

Deviations od emission levels from the values of national emission ceilings

Source: EEA

Between the years 1990 and 2011, there was a reduction of emission of acidifying substances by almost 82% (from 79.0 to 14.4 kt.year^{-1} in acidifying equivalent). The rate of decline in the emission production slowed down at the beginning of 21st century and continued decreasing only slightly (Chart 1). It is obvious from the international comparison that in these years in the Czech Republic, there was the largest reduction of nitrogen oxides emissions among all the countries included in the comparison and the fifth largest reduction of SO_2 emissions.

The decline in emissions between the years **2000–2011** amounted to almost 20% from 18.0 to 14.4 kt per year in acidifying equivalent[2]. The most significant decrease in this period occurred between the years 2008 and 2009, namely by 6.7%, which was caused by decline of the national economy as a result of the economic crisis.

Compared to the year 2010 (14.5 kt. year^{-1} in acidifying equivalent), the emissions decreased by 0.6% in 2011. This is the lowest annual decrease over the monitored period from 1990 (Chart 1). Emissions of NO_x, which declined by 2.2%, have contributed most to the year-to-year decrease. In 2011, **NO_x emissions** reached 5.1 kt in acidifying equivalent (the figure was 5.2 kt in 2010); the year-to-year decrease was caused mainly by the decline of emissions from large sources. In 2011, SO_2 emissions were stagnant at the value of 5.3 kt.year^{-1} (170.8 kt of emissions). Extra-large, large and small stationary sources have taken the greatest part in the SO_2 emissions stagnation. Emissions of NH_3 were also stagnant in 2011 and amounted to 4.0 kt.year^{-1} (68.8 kt of emissions). This stagnation is due to increases in emissions from medium-sized and mobile sources.

[2] *The proportions in the emissions of acidifying substances were as follows: SO_2 36.93%, NO_x 35.1% and NH_3 28.0%.*

The major sources of emissions of acidifying substances (Chart 2) on the basis of 2010 data[3] are as follows: the public energy sector (34.9% of total emissions, i.e. 5.1 kt.year^{-1} in the acidifying equivalent), manure processing (nearly 26.6%, i.e. 3.9 kt.year^{-1}) and the sector of services, agriculture and households (14.4%, i.e. 2.1 kt.year^{-1}). In comparison with the year 2000 and the previous reference year 2009, there was a decrease in transport emissions; in assessments they got below the sector of services, agriculture and households whose total share of emissions increased by 1.6 p.p. in an interannual comparison. In 2010, the transport's share in the total emissions was 11.7% (1.7 kt. year^{-1}), however, in 2009 it was 13%. It was particularly NO_x which contributed to this year-to-year decrease as its decline was 4.2 p.p. This change can be attributed to renewal of the vehicle fleet, and therefore to a growing share of vehicles equipped with catalytic converters.

Between 1990 and 2009, there was a significant reduction in emissions of acidifying substances in most **EEA member countries** (20 of 32). During this period, SO_2 emissions dropped by 76%, NO_x emissions by 41% and NH_3 emissions by 26%. The major sources of emissions of acidifying substances in the EEA member countries are agriculture (NH_3 emissions), road transport (NO_x) and the public energy sector (SO_2 emission), which roughly corresponds to the major emission sources in the Czech Republic (Chart 2).

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 the **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. Revision of the NECD directive (directive of the European Parliament and of the Council No. 2001/81/EC on national emission ceilings for certain atmospheric pollutants) is part of the Strategy's implementation. A draft of the revised directive is still under preparation, and the revision is planned till the year 2013. The revised 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

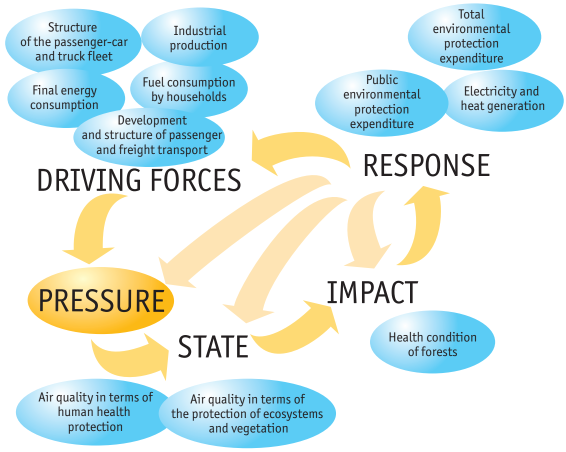
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1831)

[3] Data for year 2011 are not, due to the methodology of their reporting, available at the time of publication.

04/ Emissions of ozone precursors

KEY QUESTION

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



KEY MESSAGES

Between the years 1990–2011, the emissions of ground-level ozone precursors (VOC, NO_x, CO and CH_4) dropped by 62%. In the period 2000–2011, the decrease in emissions was 24%. Most of the decrease involved the reduction of NO_x and VOC emissions as a result of a decline in emissions from the transport sector.

In 2011, the emissions of ozone precursors reached the value 479.2 kt.year^{-1} weighted by the tropospheric ozone formation potential. Compared to the year 2010 (492.3 kt.year^{-1} in the 2010 TOFP), the emissions have decreased by approximately 2.7%, which is the least result since 2008.

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 (NO_x and VOC) resulting from anthropogenic activities. The Directive No. 2001/81/EC of European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD) has set the national emission ceilings for 2010 and it has also formulated the emission scenarios for the year 2015 as well as the illustrative values of the 2020 emission scenario. The emission ceilings were determined as follows: NO_x 286 kt.year^{-1}, 349 kt.year^{-1} in tropospheric ozone formation potential (TOFP[1]) and for VOC 220 kt. year^{-1}, in TOFP 220 kt. year^{-1}. Due to the ongoing update of the Convention on Long-Range Transboundary Air Pollution (CLRTAP), the document the **Potential for Reduce Emissions of Pollutants in the Czech Republic by the Year 2020** was under preparation in 2011. This document will calculate the reduction of ozone precursors emissions that the Czech Republic is able to achieve by 2020.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

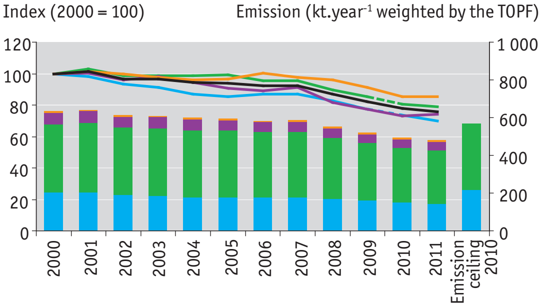
Exposure to increased ozone concentrations can cause irritation to the eyes and mucous membranes, coughing and headaches, and it reduces the organism's immunity. Health risks are caused not only by ozone but also by some of its precursors (especially NO_2).

Ground-level ozone, as a secondary pollutant resulting from chemical reactions of precursors, is a strong oxidizing agent with a negative impact on forest stands, agricultural crops and human health. Ozone damages the assimilatory parts of plants, weakens the forest stands and agricultural crops which are subsequently less resistant to other influences such as insect pests and climate conditions (wind, drought, etc.).

[1] All data on emissions presented in the charts and texts are based on emission values expressed as so-called tropospheric ozone formation potential (TOFP). The tropospheric ozone formation potential factors are as follows for the substances below: VOC = 1; NO_x = 1,22; CO = 0.11 and CH_4 = 0.014.

INDICATOR ASSESSMENT

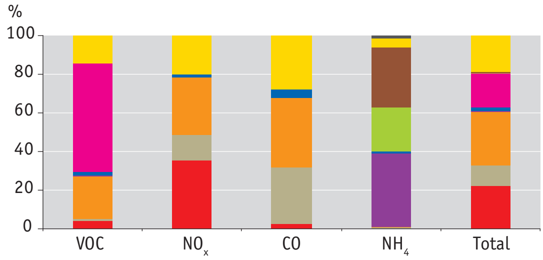
Chart 1 ➜ **Total emissions of ozone precursors in the Czech Republic, 2000–2011, and the levels of the national emission ceilings (for VOC and NO_x) for 2010 [index, 2000 = 100]; [kt. year^{-1} weighted by the TOFP]**



- VOC (left axis)
- NO_x (left axis)
- CO (left axis)
- NH_4 (levá osa)
- VOC (right axis)
- NO_x (right axis)
- CO (right axis)
- NH_4 (right axis)
- Total emission of ozone precursors (left axis)

Source: Czech Hydrometeorological Institute

Chart 2 ➜ **Sources of ozone precursors emissions in the Czech Republic [%], 2010**

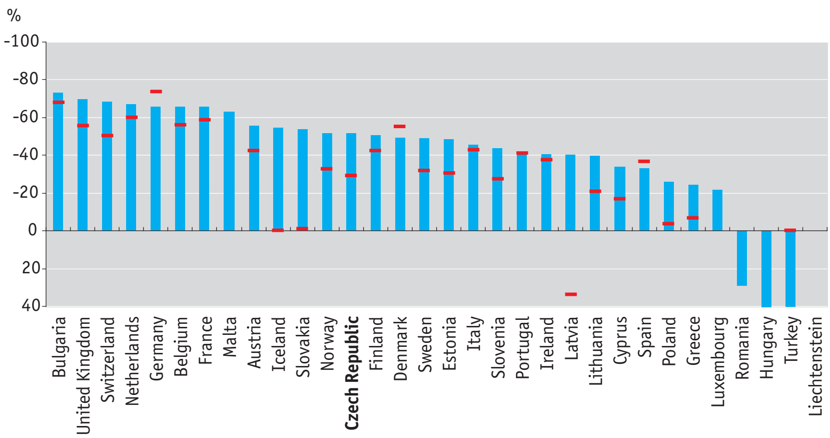


- Public energy sector
- Industrial energy sector
- Transport
- Fugitive emissions from extraction and distribution of fuels
- Production processes without combustion
- Use of solvents
- Manure processing
- Waste
- Services, households and agriculture
- Others

Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

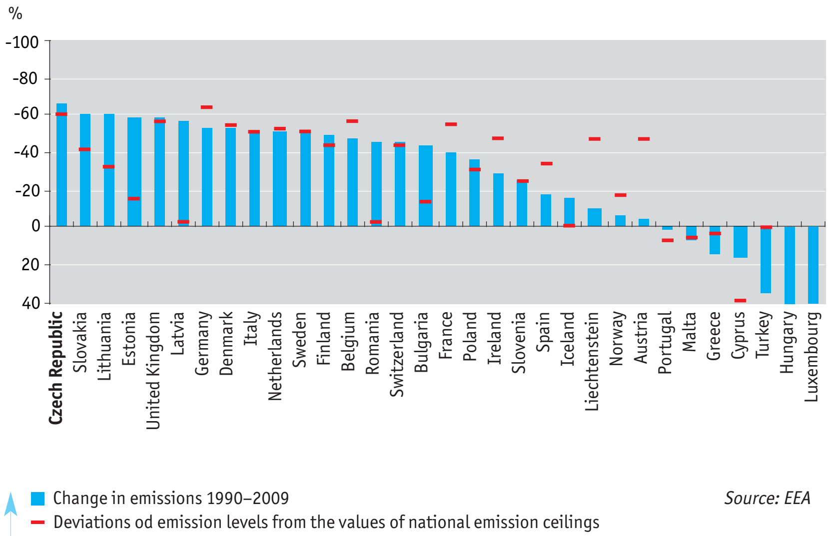
Chart 3 ➜ **International comparison of changes in VOC emissions changes between the years 1990–2009 and deviations from the linear trend of emission reduction towards fulfilling the national emission ceilings for 2010 [%], 2009**



- Change in emissions 1990–2009
- Deviations od emission levels from the values of national emission ceilings

Source: EEA

Chart 4 ➜ **International comparison of NO_x emissions changes between the years 1990–2009 and deviations from the linear trend of emission reduction towards fulfilling the national emission ceilings for 2010 [%], 2009**



Source: EEA

Between the years 1990–2011, there was **a reduction of ground-level ozone precursors emissions**[2] by 62% (from 1,365.8 to 479.2 kt.year^{-1} in TOFP). The most important decreases occurred in the 1990s and after 2000, the decline slowed down and began to stagnate. In the years 2008–2010, further and more significant decline in emissions of the ground-level ozone precursors was recorded as a result of the economic crisis. In the years 2000–2011, the emissions were reduced by 24%, i.e. from 634.2 to 479.2 kt. year^{-1} in TOFP (Chart 1).

The ozone precursors emissions have reached the value 479.2 kt. year^{-1} in TOFP **in 2011**. In comparison with the previous year 2010 (492.3 kt.year^{-1} in TOFP), there was a decrease by 2.7%, in which the emissions of VOC (interannual decrease by 4.8%) and NO_x (interannual decrease by 2.2%) took the biggest part. In the last 2 years, emissions of CH_4 are stagnating, the CO emissions are varying. The VOC emissions dropped to 143.9 kt.year^{-1} in TOFP (151.1 kt.year^{-1} in TOFP in 2010). The year-to-year decline was due to the decrease in emissions from small and mobile sources. In 2011, the NO_x emissions reached 284.2 kt.year^{-1} in TOFP (in 2010 it was 290.5 kt.year^{-1} in TOFP). The year-to-year decline was mainly due to the decrease in emissions from large sources. In the case of the CO emissions, there was a slight increase from 43.8 (2010) to 44.2 kt.year^{-1} in TOFP in 2011.

[2] Volatile organic compounds, nitrogen oxides, carbon monoxide and methane are among the so-called precursors of ground-level ozone, which is formed secondarily in the atmosphere. Adverse effects on human health and vegetation have been proved for the ground-level ozone. NO_x (59%) and VOC (31%) take the biggest parts in the ground-level ozone precursors emissions. CO accounts for 9% and CH_4 for 1%. In comparison with the year 2000, the situation has not changed significantly.

The major sources of ozone precursors emissions (Chart 2) on the basis of 2010 data[3] are as follows: the transport sector, which produces 27.5% (i.e. 137.2 $kt.year^{-1}$ in TOFP) of all ozone precursors emissions, the public energy sector (22.2%, i.e. 110.6 $kt.year^{-1}$ in TOFP), the sector of services, households and agriculture (including heating of households) which produces 18.7% (i.e. 93.1 $kt.year^{-1}$ in TOFP) and activities aimed at the use of solvents, which account for 17.6% (i.e. 87.8 $kt.year^{-1}$ in TOFP). Between the years 2000–2010, as well as in the interannual comparison, there was no significant change in the sources structure.

Since 2000, long-term reductions in NO_x emissions are related with the decline in electricity generation in power stations burning brown coal, with the drop in the solid fuels consumption (but the trend does not apply to heating of households), which is balanced by the growth of liquid fuels consumption and electricity generation in nuclear power stations, and it is also related with the growth of RES and with the reduction of emissions from transport.

Emissions of the main pollutants, i.e. ozone precursors, decreased significantly within **the countries that provide data of the European Environmental Agency (EEA)** between the years 1990–2009. During this period, there was a decrease of NO_x emissions by 41%, VOC emissions by 51%, CO emissions by 61% and CH_4 emissions by 27%. In these countries, transport is definitely the dominant source of ozone precursors emissions; it produces 34% of the total CO emissions, 45% of the total NO_x emissions and 17% of the total VOC emissions.

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 was prepared on the basis of the call of 6th Action Programme for the EU Environment of the year 2001. The Strategy proposes substantial reductions in emissions of air pollutants. In connection with ground-level ozone, it implies reduction in VOC emissions by 51% and NO_x emissions by 60% by the year 2020 compared to the year 2000 within the EU Member States. A draft of the revised NECD Directive (Directive No. 2001/81/EC of European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants) is under preparation. The revised Directive sets national emission ceilings for two ground-level ozone precursors (NO_x and VOC), as well as for other air pollutants, i.e. SO_2, NH_3 and recently also 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

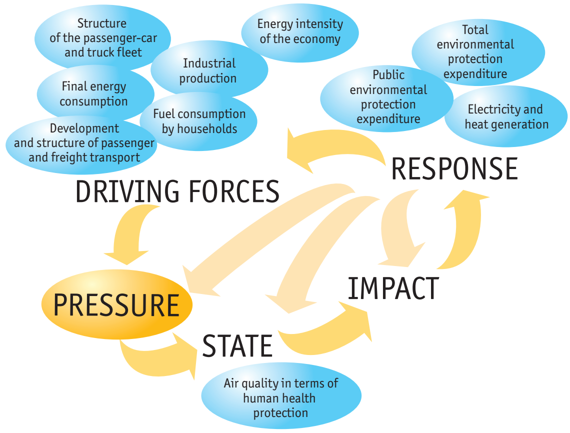
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1832)

[3] Data for year 2011 are not, due to the methodology of their reporting, available at the time of publication.

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

KEY QUESTION →

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



KEY MESSAGES →

Emissions of primary particulate matter and secondary particulate matter precursors (NO_x, SO_2, NH_3)[1] have been decreasing since 1990s. In the period 1990–2011, there was a reduction of the emissions of secondary particulate matter precursors by 79%; between the years 2000–2011, these emissions decreased by 21%. Emissions of primary particulate matter of the fraction PM_{10} dropped by 1.8% on a year to-year basis.

The comparison of the years 2010 and 2011 shows that emissions of secondary particulate matter precursors decreased by 1.2%.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **National Emission Reduction Programme of the Czech Republic** deals with the requirement to reduce emissions of primary particulate matter (emitted directly from a source) PM_{10} and secondary particulate matter precursors (SO_2, NO_x, NH_3). National emission ceilings for 2010 as well as emission scenarios for the year 2015 and illustrative values of the emission scenario for the year 2020 were laid down in the Directive of the European Parliament and of the Council No. 2001/81/EC on national emission ceilings for certain atmospheric pollutants (NECD), which is based, inter alia, on the relevant protocols to 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)[2]. In the context of the ongoing revision of the Convention on Long-range Transboundary Air Pollution (CLRTAP), the document the **Potential for Reduce Emissions of Pollutants in the Czech Republic by the Year 2020** was under preparation in 2011. It is to quantify emission reductions of primary particulate matter and secondary particulate matter precursors in the future that the Czech Republic is able to achieve by 2020.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

In terms of health, suspended particles are among the most dangerous pollutants that either are formed in or are emitted into the atmosphere.

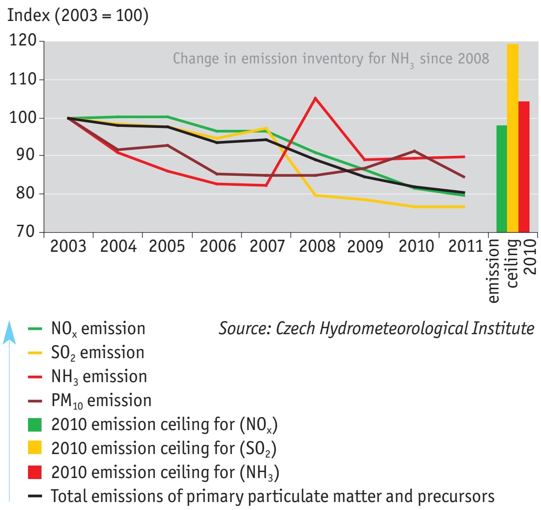
Seriousness of the pollution depends on the size, shape and chemical composition of the particles. Despite the provable negative effects of suspended particulates on human health, safe threshold concentrations have not been set for these substances. Higher concentrations of suspended particulate matter PM_x increase the risk of respiratory diseases, worsen the problems of asthmatics and allergists, they also increase infant mortality and provably shorten the length of life, mainly because of higher mortality caused by heart and vascular diseases. They particularly affect sensitive groups of population with the other factors being present, too.

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

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

INDICATOR ASSESSMENT

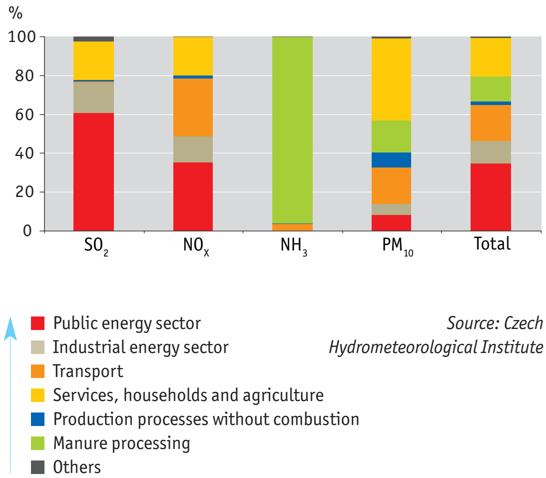
Chart 1 → **Development of emissions of primary particulate matter and secondary particulate matter precursors in the Czech Republic, 2003–2011, and the national emission ceilings (for NO_x, SO_2 and NH_3) for 2010 [index, 2003 = 100]**



Source: Czech Hydrometeorological Institute

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

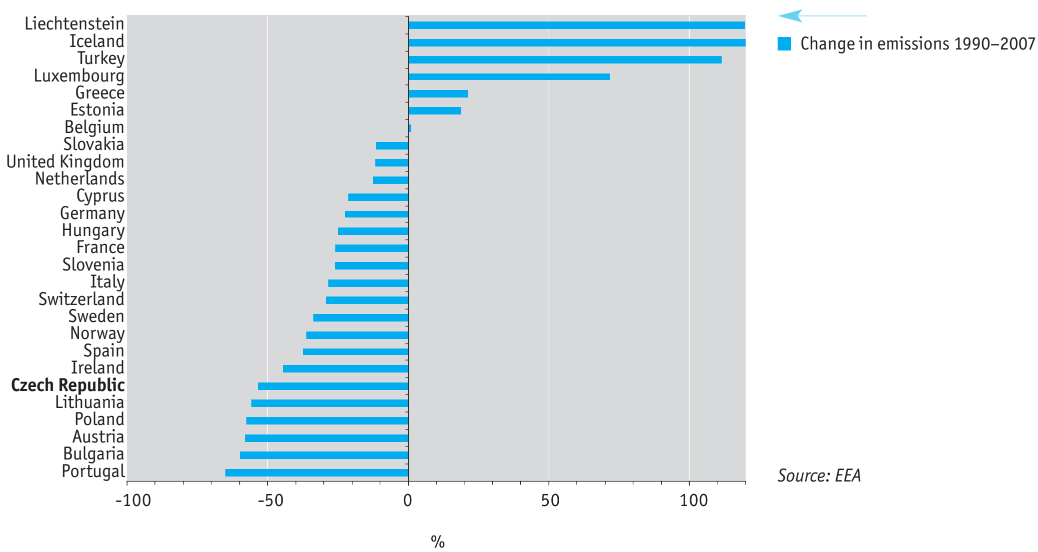
Chart 2 → **Emission sources of primary particulate matter and secondary particulate matter precursors in the Czech Republic [%], 2010**



Source: Czech Hydrometeorological Institute

Data for year 2011 are not, due to the methodology of their reporting, available at the time of publication.

Chart 3 → **International comparison of emissions of primary particulate matter and secondary particulate matter precursors [%], 2009**



Source: EEA

In the period 1990–2011, there was **a reduction of emissions of secondary particulate matter precursors**[3] (NO_x, SO_2 and NH_3) by nearly 79% (Chart 1). After a period of slight decrease in emissions after 2000, more significant year-to-year decreases of secondary particulate matter precursors were recorded in the years 2008, 2009 and 2010. Between the years 2000–2011, there was a reduction of particulate matter precursor emissions by 21% (from 431.0 to 341.2 $kt.year^{-1}$ in particulate matter formation potential). Compared to the year 2010 (345.4 $kt.year^{-1}$ in secondary particulate matter formation potential), emissions of secondary particulate matter precursors decreased by 1.2% to 341.2 $kt.year^{-1}$. This decline was largely attributable to NO_x emissions that showed an interannual decrease by 2.2% (reduced emissions from large sources). Emissions of primary particulate matter of the size fraction PM_{10} dropped by 1.8% interannually (from 37.1 $kt.year^{-1}$ in 2010 to 34.5 $kt.year^{-1}$ in 2011).

The main sources of emissions of primary particulate matter and secondary particulate matter precursors (Chart 2) on the basis of the 2010 data[4] include the public energy sector (34.8%, i.e. 133.4 $kt.year^{-1}$ in particulate matter formation potential), the sector of services, households (including heating of households) and agriculture (19.7%, i.e. 75.8 kt. $year^{-1}$ in particulate matter formation potential) and transport (18.7%, i.e. 71.6 kt. $year^{-1}$ in the particulate matter formation potential). Compared with the previous evaluated year 2009, there was a decline in emission sources of primary particulate matter and precursors of secondary particulate matter in the transport sector (20.3% in 2009). It was particularly NO_x which contributed to this year-to-year decrease as its decline was 2.5 p.p., and also PM_{10} the decline of which was 2.8 p.p.

Between the years 1990–2009, emissions of primary particulate matter and secondary particulate matter precursors decreased by 27% **in countries that provide data to EEA** (Chart 3). The largest decrease was recorded in the sectors of public and industrial energy and in the transport sector, namely by 37%, 18% and 16% respectively. This decrease is due to a combination of the use of low-sulphur fuels, natural gas instead of crude oil and coal, environment-friendly measures in extra large, large and medium-sized sources (desulphurisation, denitrification, dust removal) and last but not least, due to an increased share of vehicles equipped with catalytic converters and fulfilling of EURO emission standards in the vehicle fleet.

The Thematic Strategy on Air Pollution (hereinafter referred to as the Strategy), which was prepared on the basis of the call of 6th EU Action Programme for the Environment of the year 2001, 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 of the revised NECD Directive (Directive of the European Parliament and of the Council No. 2001/81/EC on national emission ceilings for certain atmospheric pollutants) is under preparation. The revised Directive sets national emission ceilings for all secondary particulate matters precursors (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. Revision of the NECD Directive is part of the Strategy's implementation and the revision is planned till the year 2013. 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)

[3] All figures 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.

[4] With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

06/ Air quality in terms of human health protection

KEY QUESTION

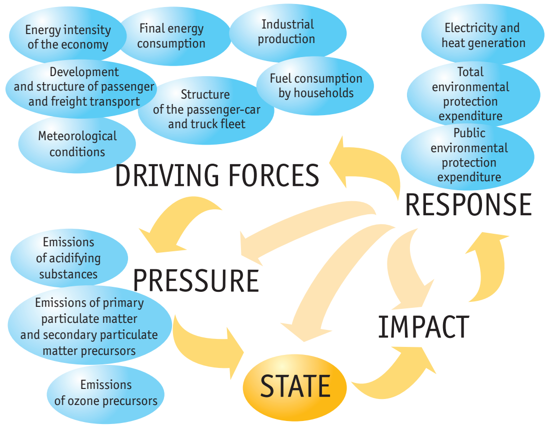
Are limit values and target concentration values that have been set for air pollutants in order to protect human health being met?

KEY MESSAGES

In spite of the continuing drop in emissions since 2000, the air quality in the territory of the Czech Republic is not getting any better. In 2011, higher concentrations of PM_{10}, $PM_{2.5}$, and benzo(a)pyrene (BaP) were measured. In 2011, the limit value for PM_{10} was exceeded at more measuring stations than in 2010. The air pollution limit for NO_2 is being exceeded repeatedly and the limit values for arsenic, nickel and benzene have been exceeded locally. In comparison with the previous two years, there has been an increase in ground-level ozone concentrations.

According to model calculations by the State Health Institute, in the period 2006–2011, there was an increase in the total mortality caused by exposure to suspended particulate matter PM_{10} within the Czech Republic and in individual lifelong risk of cancer due to exposure to As, Ni, BaP and benzene in urban localities in the Czech Republic. Data for the years 2010 and 2011 show a comparable level.

Exceeding of the air pollution limit values for lead, carbon monoxide, sulphur dioxide and cadmium were not recorded, likewise in previous years. In comparison with the year 2010, the limit value for $PM_{2.5}$ was exceeded at fewer measuring stations, and the annual average concentration went down, too.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

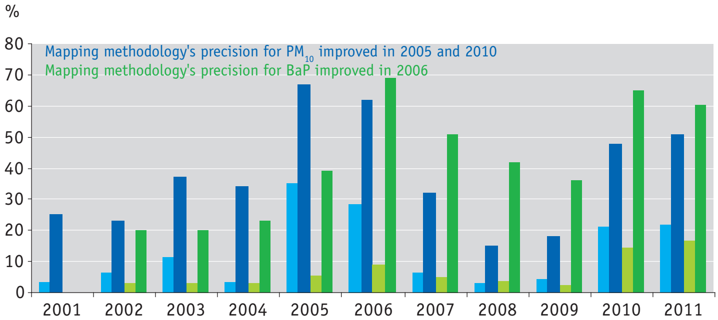
In the **Government Regulation No. 597/2006 Coll.**, the Czech national legislation fully adopted the limit values and target limit values to protect human health which were laid down by the EU directives. The **Directive No. 2008/50/EC of the European Parliament and Council on ambient air quality and cleaner air for Europe**, which sets new limit values (the air pollution limit value, target limit value, maximum exposure concentrations, national exposure reduction target) for $PM_{2.5}$, has been transposed into Czech legislation through the **Government Regulation No. 42/2011 Coll.**, amending the Government Regulation No. 597/2006 Coll., on air quality monitoring and assessment. The long-term programme to improve the Czech population's health conditions called **"Health for All in 21st Century"**, approved by a Government Resolution in 2002, imposes in its goal 10 "to reduce population exposure to health risks associated with the pollution of water, air and soil" and "to systematically monitor and evaluate air quality indicators and health indicators". Implementation of the programme shall be monitored at yearly intervals. In 2010, a declaration to improve living conditions for sensitive population groups, to reduce burden concerning non-infectious environment-related diseases and to reduce exposure to bio-accumulative substances, hormone-active agents and nano-particles was approved at **5th WHO/Europe Ministerial Conference on Health and the Environment in Parma.**

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

In long terms, the most important pollutants in relation to human health include suspended particulate matter ($PM_{2.5}$ and PM_{10}), PAHs, represented by benzo(a)pyrene (BaP), and nitrogen dioxide (NO_2), because permissible concentrations laid down for these substances by their limit values and target limit values are exceeded frequently. Above-the-threshold concentrations of suspended particles increase the risk of cardiovascular diseases, respiratory diseases, worsen the problems of persons suffering from asthma and allergies, they may even increase infant mortality (this phenomenon has not been proved in the Czech Republic). They have been proven to reduce life expectancy, mainly due to cardiovascular diseases, and they probably have influence on lung cancer. They particularly affect sensitive groups of population with the other factors being present, too. The effect of PAHs consists in their toxic, mutagenic, and carcinogenic properties and in the ability to accumulate in environmental media and living organisms. Long-term exposure to NO_2 in areas with intense traffic (transit over 10,000 vehicles a day) affects lung function, causes respiratory diseases, increases asthma problems and allergies in children's and adult population.

INDICATOR ASSESSMENT

Chart 1 ➜ **Percentage of the Czech Republic's area and population exposed to over-limit 24 hour concentrations of PM_{10} and over-limit annual concentrations of BaP [%], 2001–2011**

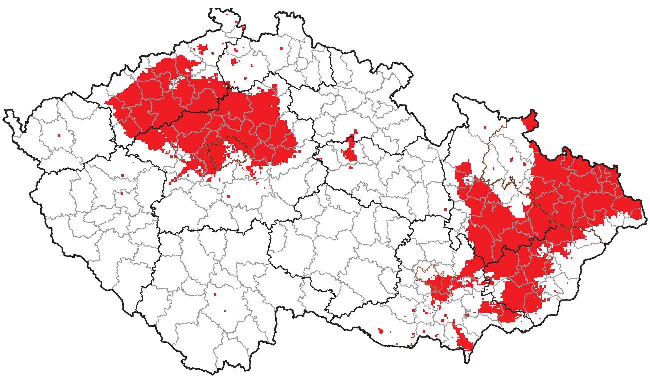


- Proportion of the Czech Republic's area exposed to over-limit PM_{10} concentrations
- Proportion of the Czech Republic's inhabitants exposed to over-limit PM_{10} concentrations
- Proportion of the Czech Republic's area exposed to over-limit BaP concentrations
- Proportion of the Czech Republic's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

Source: Czech Hydrometeorological Institute

In 2005, the mapping methodology's precision was improved and, for the first time, a model that combined the SYMOS model, the European EMEP model and altitude data with concentrations measured at rural background stations was used to construct maps of PM_{10} concentration fields. In 2009, the methodology was redefined again by applying the CAMx model. The SYMOS model includes emissions from primary sources. Secondary particulate matter and re-suspended particulate matter that are not included in emissions from primary sources are taken into account within the EMEP and CAMx models. Between 2002 and 2007, the benzo(a)pyrene mapping methodology was gradually refined. In addition to an increase of the number of monitoring stations, the mapping methodology's precision was improved in 2006. In 2006, a number of towns and villages were subsequently included among those areas where the BaP target value was exceeded.

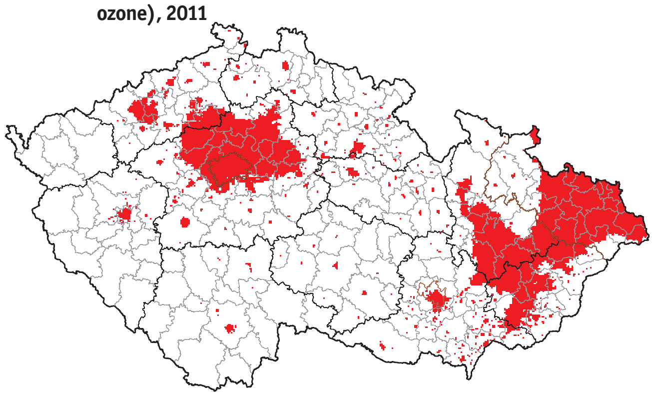
Figure 1 ➜ **Map of the areas within the Czech Republic where health protection limit values of air quality were exceeded, 2011**



- Areas with LV exceedances
- Regions
- Municipalities with extended competences

Source: Czech Hydrometeorological Institute

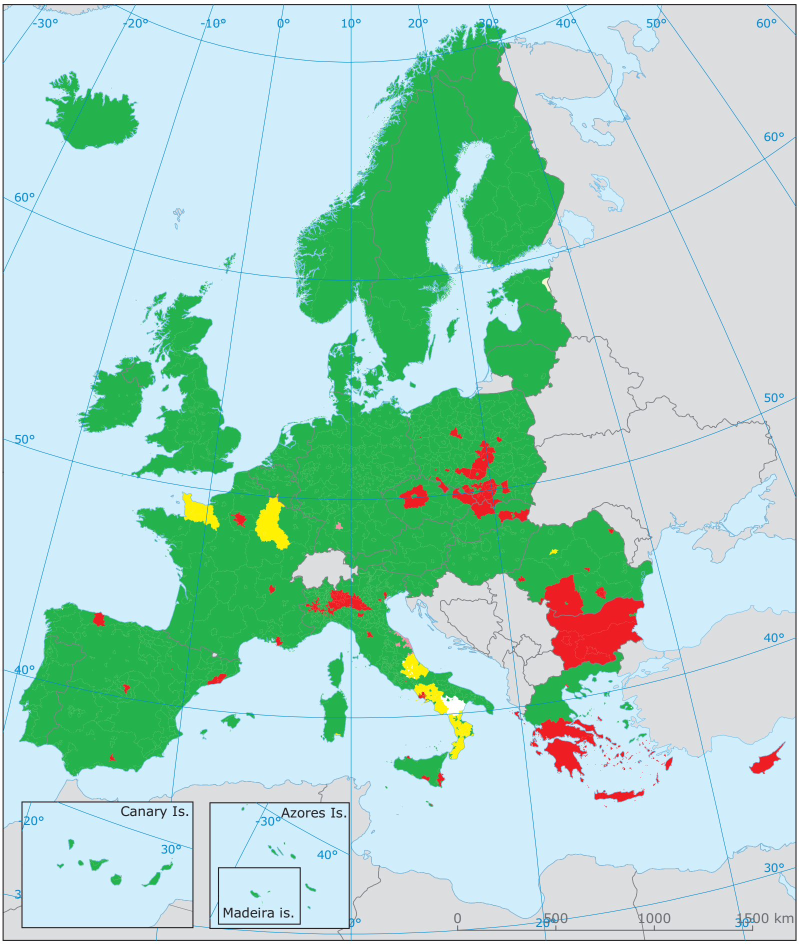
Figure 2 ➜ **Map of the areas within the Czech Republic where health protection target values of air quality were exceeded (excluding ozone), 2011**



- Areas with LV exceedances 16,9 %
- Regions
- Municipalities with extended competences

Source: Czech Hydrometeorological Institute

Figure 3 ➜ **International comparison of the proportions of population which are exposed to the average annual concentration of suspended particulate matter above emission limit [μg.m^{-3}], 2009**



- ≤ air pollution limit
- ≥ air pollution limit
- Data missing
- Area without data

Source: EEA

Table 1 ➜ **The total annual mortality increased by "premature death" [the number of premature deaths] – the span and mean for the Czech Republic, 2006–2011**

	2006	2007	2008	2009	2010	2011
PM_{10} (50% representation of the $PM_{2.5}$ fraction)	0–12,418 (4,352)	0–12,446 (2,452)	0–8,310 (2,128)	0–9,730 (2,332)	0–16,252 (2,991)	0–9,580 (2,796)
PM_{10} (75% representation of the $PM_{2.5}$ fraction)	0–18,627 (6,528)	0–18,669 (3,678)	0–12,465 (3,192)	0–14,595 (3,498)	0–24,378 (4,487)	0–16,050 (6,934)

Source: State Health Institute

The mean value is given in parenthesis.

The mean value for the Czech Republic was calculated for urban locations not exposed to extensive transport and industry. The total mortality increase was calculated from the span of values measured in the Czech Republic and from mean values for the Czech Republic, for the annual average PM_{10} values ≤ 20 μg m^{-3} (or PM_{10} ≤ 13.3 μg m^{-3} for 75% representation of the $PM_{2.5}$ fraction) evaluated as 0, and the values of total annual mortality rates were taken from the Czech Statistical Office data. The WHO recommendations were used for conversion of the PM_{10} effects; they suppose the mean representation of $PM_{2.5}$ fraction in the PM_{10} fraction to be 50% and the estimated mean value of representation of $PM_{2.5}$ fraction in the PM_{10} fraction for the Czech Republic to be 75%.

Table 2 → **Range of values of carcinogenic population risk for evaluated types of sites (As, Ni, BaP and benzene were assessed) in cities over 5,000 people (approximately 5 mil. inhabitants of the Czech Republic), 2006–2011**

Carcinogenic substances	2006		2007		2008		2009		2010		2011	
Number of additional cases according to the type of burden and site	min	max	min	max	min	max	min	max	min	max	min	max
Cities (over 5,000 to 5 mil. inhab.)	7.74	78.39	4.03	59.93	3.19	61.94	4.25	60.73	3.5	48.6	3.6	48.8
Sites without the transport burden	6.96	19.16	4.40	11.79	3.20	61.94	4.25	60.73	3.5	48.6	3.6	48.8
Sites with the transport burden	6.86	19.31	6.63	18.93	5.49	39.09	4.26	30.23	3.5	29.2	4.1	9.6
Industrial sites	16.19	78.1	15.35	76.3	11.36	61.86	12.35	60.66	11.4	48	12.9	66.7

Source: State Health Institute

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

In the 1990s, there was a major drop in emissions of all basic pollutants and a subsequent drop in air pollution in the Czech Republic. Development at the beginning of 21st century is accompanied by air quality fluctuations, which were mainly influenced by the dispersion conditions. In 2011, higher concentrations of PM_{10}, $PM_{2.5}$, and benzo(a)pyrene were measured, particularly due to poor dispersion conditions in January–March and October–November.

A serious problem in air quality in the whole territory of the Czech Republic consists in occurrence of high **concentrations of suspended particles PM_{10}**. A significantly higher number of daily exceedances of the PM_{10} limit were reached in connection with worsened dispersion conditions which were associated with occurrence of anticyclonal situations during the months of January, February, March, October and November 2011. In 2011, the air pollution limit for the 24-hour permissible concentration of PM_{10} was exceeded at 89 of 157 stations. Most stations where the limit values were exceeded are located in the Moravian-Silesian region, the region of Ústí nad Labem and in Prague. In comparison with previous years 2010 and 2009, lower PM_{10} concentrations were measured. In 2011, the air pollution limit value for the 24-hour mean PM_{10} concentration was exceeded in 21.8% of the country's area; 50.8% of the Czech Republic's population were exposed to above-limit concentrations (Chart 1). The limit for the annual mean concentration of PM_{10} was exceeded on 0.7% of the Czech Republic's territory in 2011 (in 2010 it was on 1.9% of the territory).

In the whole period considered, **the risk of exposure to suspended particulate matter PM_{10}** was biggest in the case of population living in industrially burdened areas of Ostrava and Karviná. This risk is not evenly distributed within the population, as it concerns sensitive population groups, particularly the elderly and chronically ill people. It can be estimated from these data that the overall mortality caused by exposure to suspended particulate matter PM_{10} increased by 2,796 persons in 2011. In the case of an increase of the $PM_{2.5}$ fraction within the PM_{10} fraction, the estimated total mortality would rise by approximately 7,000 persons (Table 1).

In 2011, the target air pollution limit value for the annual **concentration of suspended particulates of the $PM_{2.5}$ fraction** was exceeded in 13 sites out of 49 (in 2010 it was exceeded in 12 out of 38 stations). The highest average concentrations are recorded in the regions of Ostrava and Karviná (exceeded in 8 sites) and in and around the city of Brno (3 sites). The remaining sites where the $PM_{2.5}$ limit values were exceeded are in Třinec, Přerov and Pilsen.

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

Within European comparison, the inhabitants of Greece, Bulgaria, Romania, Poland, Italy, the Czech Republic, France and Spain were affected by exceeding concentrations of the annual air pollution limit for PM_{10} to protect human health (Fig. 3).

The **ground-level ozone** concentrations are influenced by meteorological conditions (value of sunlight, temperature and the occurrence of rainfall) during the period from April to September, when highest concentrations are usually measured. The concentration of ground-level ozone has grown in comparison with the previous years. In the period 2009–2011, the target air pollution limit value was exceeded on 17.1% of the Czech Republic's territory, where about 10.1% of the population were exposed to ozone concentrations exceeding target values for the human health protection. In the previous period evaluated (2008-2010), the target air pollution limit value was exceeded on 10.3% of the territory and 2.1% of the population were exposed to above-limit concentrations. The ground-level ozone concentrations increase is probably related to the rise of maximum temperatures in April–September 2011, in comparison with the same period in 2008.

In 2011, a number of towns and villages were classified, likewise in 2010, as the territory with exceeded target air pollution limits for **benzo(a)pyrene**. This concerns about 16.8% of the territory, where 60.2% of the population live. In an interannual comparison, the area affected has extended (in 2010, the target air pollution limit was exceeded on 14.5% of the territory), while, on the other hand, the population affected (65% of the population was affected in 2010) has decreased. BaP concentrations exceed the target annual air pollution limit (1 $ng.m^{-3}$) in most of the towns and villages monitored in the Czech Republic. Likewise in the previous year, the limit values were exceeded several times in monitoring stations of the Moravian-Silesian region, in Kladno, and newly also in Valašské Meziříčí. The highest annual average concentration is measured repeatedly in Ostrava-Bartovice/Radvanice where the value 10.1 $ng.m^{-3}$ has been reached (last year it was 7.2 $ng.m^{-3}$).

In 2006 to 2011, **the risk of new cancer diseases** in urban localities of the Czech Republic due to BaP was between 0.5 and 11 occurrences of the disease per 10,000 inhabitants under 70 years. In urban areas without a significant industrial burden, the effect of PAHs emission from traffic, combined with local heating emissions in some places, could lead to an increase in health risks by 0.5 to 5 cases per 10,000 inhabitants. The highest value of the risk is recorded in localities affected by large industrial sources, where it can theoretically represent an increase in sickness rate by up to 11 cases per 10,000 inhabitants (Table 2).

Based on the maps of the spatial distribution of relevant air quality characteristics, **areas with deteriorated air quality** were identified in 21.8% of the Czech Republic's territory in 2011 (Fig. 1). This concerns areas where the air pollution limit value for human health protection is exceeded for at least one pollutant (SO_2, CO, PM_{10}, NO_2, Pb and benzene). In 2010, areas with impaired air quality were identified on 21.2% of the Czech Republic's territory. In 2011, the air pollution limit value was exceeded for PM_{10} (see above), NO_2 (8 traffic-burdened sites) and for benzene (in Ostrava).

Based on maps of the spatial distribution of relevant air-quality characteristics, **areas where the target air pollution limit values are exceeded** (Fig. 2) for at least one substance except ozone (this concerns As, Cd, Ni and BaP) were identified on 16.9% of the Czech Republic's territory. In 2010, these areas were identified on 14.5% of the territory. In year-to-year comparison, the polluted areas have grown in the Olomouc region and in the Central Bohemian region. In 2011, the target air pollution limit values were exceeded for As (repeatedly in Kladno and Prague), Ni (in Příbram) and for the BaP. The target limit values for Cd and Pb have not been exceeded in 2011.

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 studies and, as far as BaP is concerned, in measurements taken manually in rural locations but their number is too low. However, the fact that in the Czech Republic almost half of the population live in small settlements (up to 10,000 inhabitants) is alarming. In the smaller settlements, increased to over-limit concentrations of pollutants have been measured. This concerns especially suspended particulate matter, PAHs and heavy metals. This means that air pollution in some smaller settlements can be comparable to larger urban agglomerations. The worsened air quality in Czech rural areas is caused, inter alia, by the burning of solid fuels, particularly in local household heating.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1835)

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

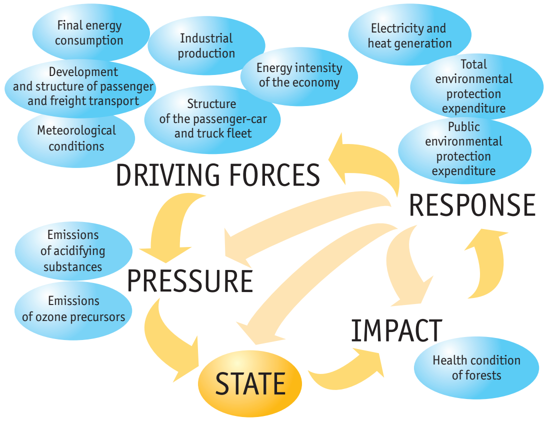
KEY QUESTION

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

KEY MESSAGES

According to the 2011 assessment, the target air pollution limit values for ground-level ozone (AOT40 exposure index, average over 5 years) in relation to the protection of vegetation was exceeded at 8 stations out of 37 (i.e. 22%); in 2009 it was exceeded at 54% of the stations. The limit values for SO_2 and NO_x for the ecosystems and vegetation protection were not exceeded in any site. As opposed to the year 2010, the decline in the value of AOT40 index for the year 2011 was recorded in a comparable number of places (19 sites) as its rise (15 sites).

During the last 10 years there has not been any significant decrease in atmospheric deposition of sulphur, nitrogen, and hydrogen ions.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

To protect ecosystems and vegetation, the target air pollution limit value for ground-level ozone – expressed as the AOT40 exposure index[1] – and SO_2 and NO_x limit values are set by the **Government Regulation No. 597/2006 Coll.**, on air quality monitoring and assessment.

On the international level, reducing the emissions of ground-level ozone precursors (NO_x, VOC) and the environmental impact of ozone is addressed by the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone** to the Convention on Long-range Transboundary Air Pollution (CLRTAP).

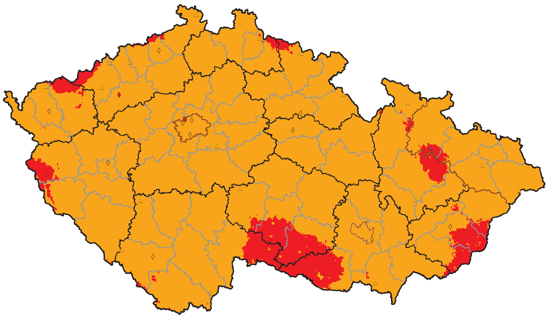
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Air pollution, together with atmospheric deposition, is one of the many factors that negatively affect the health of ecosystems and vegetation. As a result of a significant reduction in emissions of acidifying substances in Europe and in response to a decline in precipitation acidity, further acidification of terrestrial and aquatic ecosystems does not occur in most European ecosystems at present. However, there are still a lot of risk areas, particularly in Central Europe. At present, the greatest health risk for ecosystems and vegetation on the regional level is posed by ground-level ozone, which damages the green parts of plants and reduces the vegetation's resistance to external influences. Above-limit concentrations of ozone reduce the yields of agricultural crops and affect the health of forests. Any direct impact on forest growth has not been proven unequivocally.

[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 40 ppb (= 80 μg.m^{-3}) for each hour in which this threshold value was exceeded. According to the requirements of Government Regulation No. 597/2006 Coll., AOT40 is calculated for a period of three months from May to July using ozone concentrations measured 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 [μg.m^{-3}.h], 2007–2011**

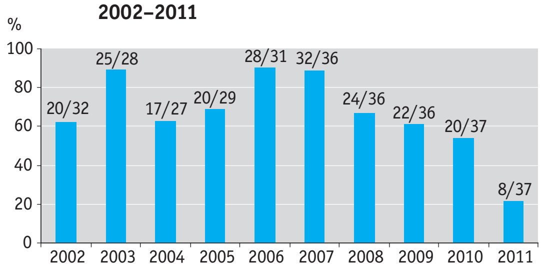


Classification of stations
◊ Suburban background
▵ Rural

AOT40
≤ 18 000 (≤ TV)
≥ 18 000 (> TV)

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 [%], 2002–2011**

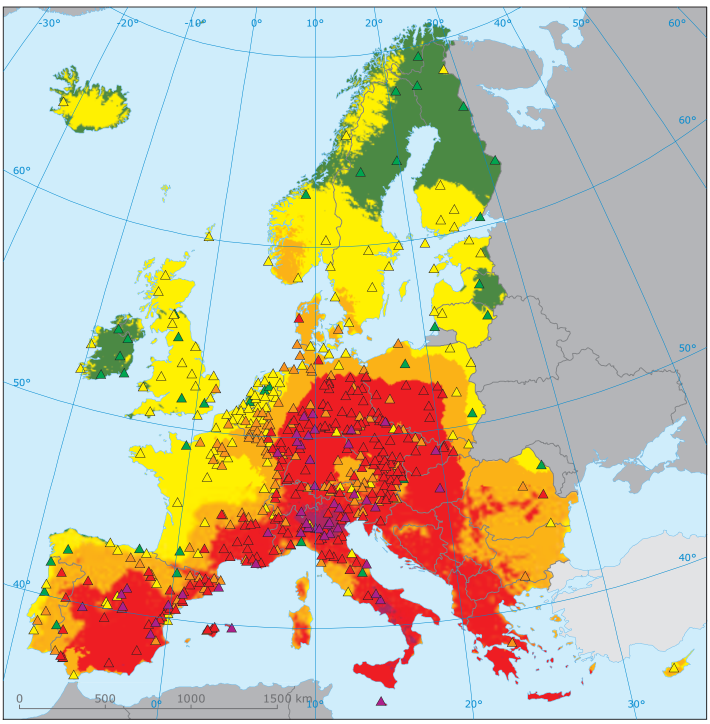


Number of stations where the target limit value was exceeded

Source: Czech Hydrometeorological Institute

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

Figure 2 ➜ **Map of the AOT40 exposure index values in Europe [μg.m^{-3}.h], 2008**



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

Source: EEA

The calculation of the AOT40 index is based on ozone concentrations measured only in stations classified as rural stations and only for the year 2008 (May-July).

Chart 2 → **Development of the total atmospheric deposition of sulphur, nitrogen, and hydrogen ions [thous. t], 2001–2011**

Source: Czech Hydrometeorological Institute

In 2011, the **ozone AOT40 target limit value** for the protection of ecosystems and vegetation (the relevant calculation was made according to the legislation) was not exceeded in most of the Czech Republic. Compared with the previous assessed period (2006–2010), the area where the limit value was exceeded has decreased significantly in all regions of the Czech Republic (Fig. 1).

Out of the total number of 37 rural and suburban stations, the target air pollution limit for the protection of vegetation for ozone, according to the 2011 assessment (average for the years 2007–2011 is concerned), was exceeded at 8 stations (22% of the total number of 37 measurement stations); in 2010 it was exceeded at 54% of the stations (Chart 1).

Interannual changes in the level of the AOT40 exposure index are affected by the sum of ozone precursor emissions, but more particularly by meteorological conditions (temperature, precipitation, solar radiation) in the period from May to July for which the indicator is calculated. As opposed to the year 2010, the decline in the value of AOT40 index for the year 2011 was recorded in a comparable number of places (19 sites) as its rise (15 sites). The highest values measured between 2007 and 2011 were reached in 2007 (if individual years are assessed) when long-term high temperature and low precipitation were measured. Within comparison of average temperatures during the months of April–September in 2006 (this year did not get into the five-year assessment) and 2011, a significant drop in average temperature in July 2011 (by 5 °C) was recorded; on the other hand, there was a slight increase in the months of April and August. In average, air temperature has grown over this period in 2011 by 0.6 °C. In contrast, the maximum 2011 temperature was, in comparison with 2006, lower in nearly three quarters of the sites and, similarly, the sums of the daily averages of global solar radiation were lower in approximately 65% of the sites that monitor the given parameter. The concentrations of precursors have shown, likewise meteorological parameters, heterogeneous trends. While the concentration of NO_2 decreased in most sites in 2011 compared with 2006, the concentrations of 60% of the 30 substances categorised as VOC that are monitored in Košetice and Libuš increased slightly in 2011.

The limit value for the winter average for **SO_2** related to the protection of ecosystems and vegetation, as well as the SO_2 and **NO_x** limit values for the protection of ecosystems and vegetation were not exceeded at any site classified as rural in 2011.

In the **international comparison**, the highest AOT40 exposure index values are found in South, Southeast and Central Europe (Fig. 2). This is caused by a combination of climate 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 2008, 38% of Europe's agricultural land was exposed to ozone concentrations exceeding the target limit. The worst year was 2006, when 70% of agricultural land was exposed to ozone concentrations exceeding the target limit value; on the other hand, the proportion of agricultural land affected in the same way was lowest in 2007 (36%).

The total atmospheric deposition (Chart 2) is the sum of wet and dry atmospheric depositions.4 In 2011, the chemical composition of atmospheric precipitation and atmospheric deposition was monitored at 50 sites in total. The total atmospheric deposition of sulphur in 2011 shows an overall level corresponding to the value 45,101 t per the area of the Czech Republic. In 2000–2006, the total deposition of sulphur was in the range between about 65,000 and 75,000 t per year, with the exception of the year 2003, the precipitation of which was significantly below the normal values. Since 2007, the value of the total sulphur deposition varies around 50,000 t of sulphur per the area of the Czech Republic. The total deposition of sulphur has its maximum in the Ore Mountains (Krušné hory), where there are also the maximum values of the throughfall sulphur deposition. In 2011, the total deposition of nitrogen was equal to 64,387 t (oxidized + reduced forms).$year^{-1}$ per km^2. The total deposition of nitrogen was highest in Orlické Mts. and Jizerské Mts. In the last decade, the value of the total nitrogen deposition was varying between 70,000 and 80,000 t per year. The total hydrogen ion deposition in 2011 is 3,542 t.$year^{-1}$ per the area of the Czech Republic. The highest values of the total atmospheric deposition of hydrogen ions are recorded in the Ore Mountains. In the last 3 years, there is a slight increase in the value of total deposition of hydrogen ions to the average value of 4,000 t.$year^{-1}$.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

08/ Water abstraction

KEY QUESTION

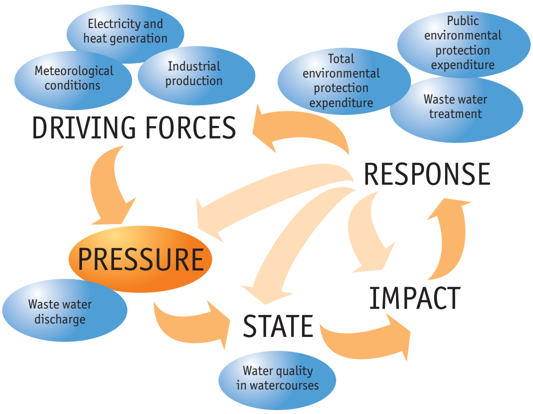
Is water in the Czech Republic being used efficiently with respect to preserving the availability of water sources for the future?

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; 93% of the Czech Republic's population are supplied with quality drinking water. The consumption of water from public water supply systems has been decreasing.

Since 2002, there is a slowdown in the decline of total water abstraction and in recent years, the stagnating trend prevails. The sectors that have experienced an increase in water abstraction since 2000 are energy, agriculture and other sectors (including construction).



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The **Directive 2000/60/EC of the European Parliament and of the Council** of 23rd October 2000 establishing a framework for Community action in the field of water policy (the Water Framework Directive) aims, inter alia, at efficient and sustainable use of water. Water abstraction should respect the requirements for water use, for the good condition and ecological limits of water bodies in order to prevent these resources and related aquatic ecosystems from being damaged by overexploitation. The Member States are to work out **River Basin Management Plans** for their respective territories; the Plans should include programmes of measures to gradually remove the most significant water management problems and to achieve a good status of both surface water and groundwater within three six-year planning periods by the year 2027.

An important strategic document, which is not directly required by the Water Framework Directive, is the **Plan of Major River Basin Districts of the Czech Republic**, which is a concept in the area of water management for the period 2007–2012, and its specific aim is to ensure a smooth supply of the population and other consumers with sanitary and high-quality water. Legislative requirements on the drinking water quality and control in the Czech Republic are based on the **Council Directive 98/83/EC** of 3rd November 1998 on the quality of water intended for human consumption.

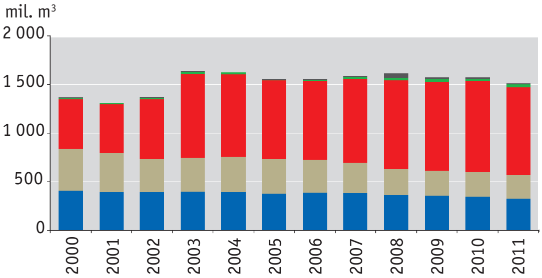
Also the **Conception of the Agrarian Policy of the Czech Republic for the Period after EU Accession (2004–2013)** and the **Conception of Water Management Policy of the Ministry of Agriculture of the Czech Republic till 2015** aim at creating the conditions for sustainable management of limited water wealth of the Czech Republic, which will allow to harmonise the requirements for all forms of using water resources with the requirements for the protection of water and aquatic ecosystems whilst taking account of measures to reduce the harmful effects of water. The mid-term strategy of state policy concerning water supply and sewerage systems before 2015 is presented in the **Development Plan for Water Supply and Sewerage Systems of the Czech Republic**.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

In 2011, 9.8 million inhabitants (93%) were supplied with drinking water from the water supply networks in the Czech Republic. It follows from long-term national monitoring of the quality of drinking water in public water supply systems that nitrates and trichloromethane (chloroform) definitely dominate over the other harmful substances in drinking water. Concentrations of the other substances determined in drinking water are often below the determination limit. There have been no significant changes in evaluated samples of drinking water distributed by the public water supply system since 2004. However, relatively numerous findings of non-compliance with the limit values for some indicators are found in samples from public and commercial wells. Concentrations of residues of human medicinal products (e.g. ibuprofen, hormonal preparations), which get through water treatment and processing plants in a small extent, also begin to be monitored in drinking water in recent years. However, previous studies have shown that the medicaments concentrations that are found in drinking water and watercourses in the Czech Republic do not pose any health risk. In the context of climate change (precipitation patterns changes), the pressure on sources of surface water and groundwater in particular will be growing in the future, especially in relation to growing water demands for agriculture.

INDICATOR ASSESSMENT

Chart 1 ➜ **Surface water abstraction by individual sectors in the Czech Republic [mil. m³], 2000–2011**

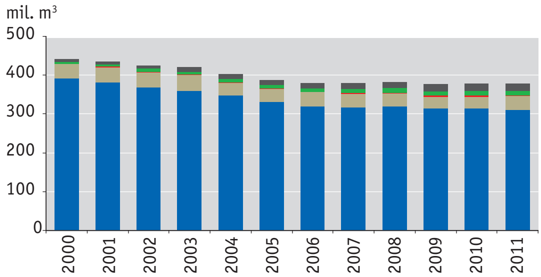


- Public water supply systems
- Industry (incl. extraction of mineral raw materials)
- Energy sector
- Agriculture, forestry and fishery
- Others (incl. construction)

Source: Czech Statistical Office

Water abstraction by users in excess of 6,000 m³ per year or 500 m³ per month is kept on record – pursuant to Section 10 of the Decree of the Ministry of Agriculture No. 431/2001 Coll.

Chart 2 ➜ **Groundwater abstraction by individual sectors in the Czech Republic [mil. m³], 2000–2011**

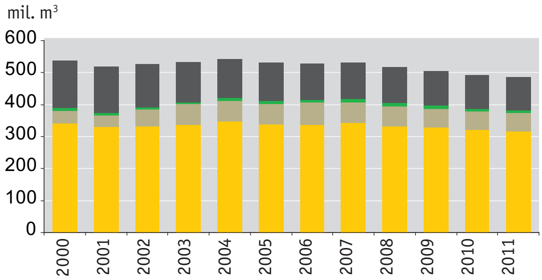


- Public water supply systems
- Industry (incl. extraction of mineral raw materials)
- Energy sector
- Agriculture, forestry and fishery
- Others (incl. construction)

Source: Czech Statistical Office

Water abstraction by users in excess of 6,000 m³ per year or 500 m³ per month is kept on record – pursuant to section 10 of the Decree of the Ministry of Agriculture No. 431/2001 Coll.

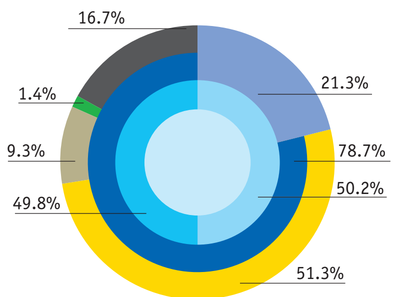
Chart 3 ➜ **Drinking water use by individual sectors in the Czech Republic [mil. m³], 2000–2011**



- Households
- Industry
- Agriculture
- Others

Source: Czech Statistical Office

Figure 1 ➜ **Drinking water use in the Czech Republic [mil. m³], 2011**

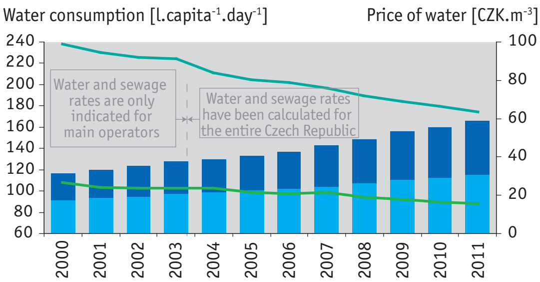


Source: Czech Statistical Office

- Total production of drinking water 617.4 mil. m³
- Groundwater 312.8 mil. m³
- Surface water 310.3 mil. m³
- Water not invoiced 131.4 mil. m³
- Total water invoiced 486.0 mil. m³
- Water invoiced for households 317.2 mil. m³
- Water invoiced for industry 57.5 mil. m³
- Water invoiced for agriculture 8.5 mil. m³
- Water invoiced for other users 102.8 mil. m³

The diagram shows the use of produced drinking water that is intended for implementation. Data on the percentage shares of non-invoiced and invoiced drinking water are determined from the total production of drinking water. The non-invoiced water includes losses in the distribution network, the actual water consumption etc. The data on abstracted groundwater and surface water are taken from the total production of drinking water.

Chart 4 → **Water consumption in the Czech Republic [l.capita^{-1}.day^{-1}] and the price of water [CZK.m^{-3}], 2000–2011**

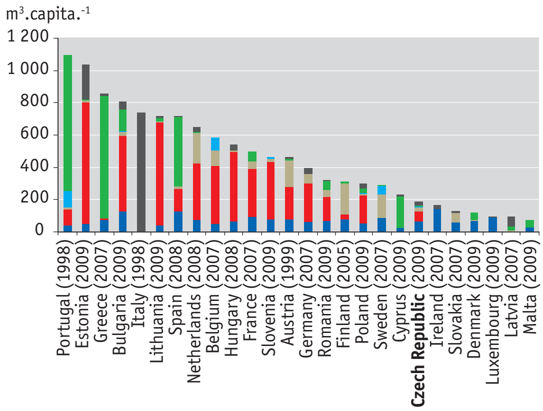


Average sewage rate (right axis)
Average water rate (right axis)
Specific consumptive use of water produced (left axis)
Water consumption in households (left axis)

Source: Czech Statistical Office

Specific consumptive use of water produced expresses the quantity of water produced per one inhabitant supplied with water from water supply systems for public use per one day. Water consumption in households (specific quantity of water invoiced for households) expresses the quantity of invoiced water for households per one inhabitant supplied with water from water supply systems for public use per one day. Until 2003 (including the year 2003), the water and sewage rates are provided for the main operators only; since 2004, the values are calculated for the whole of the Czech Republic. The water and sewage rates are provided without VAT.

Chart 5 → **International comparison of water abstraction [m^3.capita^{-1}]**



Public water supply systems
Cooling in electricity generation and distribution
Processing industry
Cooling for processing industry
Agriculture
Not specified

Source: Eurostat

The reduction of **total water abstraction** is a long-term trend. In the 1990s, the decline was related particularly to the reduction of industrial production as a result of the national economy's restructuring, and also to decreasing water intensity of the industrial technologies. In the last five years, the total volume of abstracted water has stabilized. Individual sectors account for differing proportions of water abstraction (1,892.8 mil. m^3 in 2011). There are significant differences also between abstractions from surface and groundwater sources (Chart 1, Chart 2). Of the total volume of water taken, 20.0% is collected from groundwater sources. Since 2000, groundwater abstraction has been going down, however, in the last interannual comparison, it increased slightly (by 1.4 mil. m^3, i.e. by 0.4%), namely due to increasing abstraction in the industry, agriculture and other sectors (including construction).

Most water is collected in the **energy sector** (48.2% of the total abstraction in 2011, i.e. 60.1% of surface water abstraction and 0.7% of groundwater abstraction) which took the biggest part in fluctuations of the total water abstraction in the last ten years. The reason consists in gradual putting into operation of power stations that use water for once-through cooling. Most of the water abstracted for cooling in the energy sector is returned to the watercourses with a slightly amended quality (temperature increase, lower oxygen content); a part of the water is lost by evaporation. On the other hand, water abstraction for **agriculture** is steadily low (2.1% of the total abstraction in 2011); in the case of crop farming, it usually has enough rainwater and the interannual fluctuations depend on the temperature development and the amount of precipitation during the growing season. Abstraction for the **industry sector** (including mining and quarrying) shows a long-term decline (by 39.5% since 2000), while the last interannual decrease (2010/2011) amounted to 2.1%. At present, this decrease is related rather to the introduction of new, less demanding production technologies, not only for environmental reasons but also because of efficiency. Economic development in the sectors with the highest abstraction (food, chemical and paper industries) also influences the total abstraction in the industry sector. In 2011, water abstraction in the industry sector accounted for 16.0% from surface sources and 9.2% from groundwater sources. A long-term decline in abstraction is shown also in the sector with the second largest volume of total abstraction (33.9%), i.e. **public water supply system**.

Drinking water abstraction is falling, likewise in the industry, thanks to the introduction of environment-friendly technologies to save drinking water, and also because of rising prices. The total of 48.8% of water abstraction to produce drinking water comes from groundwater sources which are of better quality and require less treatment. Nevertheless, abstraction from groundwater sources may contribute to the decline in groundwater supplies because the time for the water to get back to groundwater sources is longer than the time necessary in the case of surface sources. General risks for water supply are also connected with changes in the intensity and seasonality of rainfall and with lower infiltration in soil, which can be caused by anthropogenic interference in the landscape (soil compaction, development).

In 2011, the total of 486 mil. m^3 of drinking water were invoiced, of which 65.3% accounted for abstraction for households, the remaining part was consumed by the industry (11.8%), agriculture (1.7%) and other customers (Chart 3). In general, the **total quantity of invoiced drinking water** declined by 9.7% in the Czech Republic since 2000. In the last seven year, the quantity of invoiced drinking water has a declining trend, which is caused mainly by a reduction of supplies for households and for the category of other operators (e.g. building industry). This declining trend is also reflected in the water consumption calculated per capita (Chart 4), where the **specific consumptive use of the water produced** in 2011 (174.1 $l.capita^{-1}.day^{-1}$) accounts for 73.2% of the 2000 value (238.0 $l.capita^{-1}.day^{-1}$). Reduction of the quantity of water produced is also derived from the reduction of drinking water loss in distribution networks (at present the loss is below 20%, in 2000 it was 25%) and from reducing the water consumption in households. Since 2000, **water consumption in households** keeps decreasing steadily, in spite of the fact that the number of inhabitants supplied with drinking water from public water supply systems is growing; currently it is 9.8 million people (93% of the Czech Republic's population). Reduced water consumption in households is influenced by the water rate, which keeps growing in long terms and increased by 5.8% interannually, and by massive expansion of water-saving appliances.

In an international comparison, **water abstraction per capita** in the Czech Republic is below the European average (Chart 5). Within the EU, water abstraction per capita depends mainly on physical and geographic conditions (such as climate, relief, natural water sources) and on the technologies used to generate electricity (cooling of energy devices). Therefore, the top places are occupied by states with high abstractions in agriculture, due to irrigation in drier and warmer Mediterranean areas (Portugal, Greece, Spain, Italy), and states with high demands for water in the energy sector for the cooling purposes (Estonia, Bulgaria, Lithuania). Changes in the availability of water resources and possible threats as a result of so-called water stress are expected for the future due to the influence of climate change.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

09/ Waste water discharge

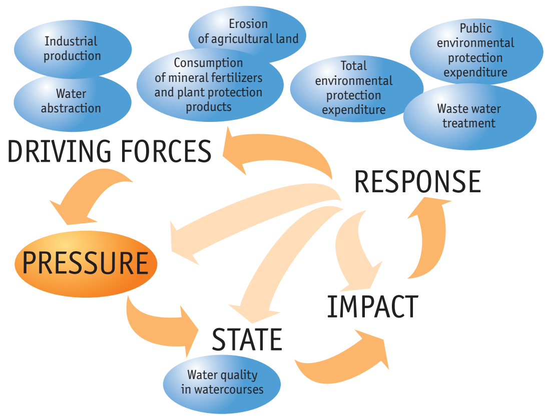
KEY QUESTION →

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

KEY MESSAGES →

Since 1993, the quantity of organic pollution and nutrients discharged from point sources has been reduced in the Czech Republic. In 2011, the value of BOD_5 accounted for 6.7% of the 1993 value, for COD_{Cr} it was 13.5% and for suspended solids it was 9.7%. A greater decrease of organic pollution was recorded mainly in 1990s, which was connected with building of municipal and industrial wastewater treatment plants. Since 2003, the quantity of discharged pollution has been falling more slowly. The decline in nutrients ($N_{inorg.}$ and P_{total}) monitored since 2003 is slower than that of organic pollution. Building, modernization and intensification of wastewater treatment plants has the main positive effect in recent years.

The total amount of discharged waste water and mining water in the Czech Republic increased slightly in the last decade (by approximately 10% against the year 2000), however, it is rather stagnating in the recent years.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Reducing the volume of waste water and the amount of pollution discharged into surface water is the principal means for improving water quality. The requirements under the **Directive 2000/60/EC of the European Parliament and of the Council** of 23rd October 2000 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, which is addressed by the **Directive 2006/11/EC of the European Parliament and of the Council** of 15th February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community. The measures (building and modernisation of waste water treatment plant) introduced in connection with implementation of the **Council Directive 91/271/EEC** of 21st May 1991 concerning urban wastewater treatment are also of great importance. The **Council Directive 91/676/EEC** of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (the Nitrate Directive) deals with water pollution related to application and storage of fertilisers in agriculture.

Other national strategic documents, mainly the **Conception of Water Management Policy of the Ministry of Agriculture of the Czech Republic till 2015** and **Development Plan for Water Supply and Sewerage Systems of the Czech Republic**, also highlight the need to reduce the entry of pollutants into water, mainly through promoting the building 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 Basin Districts of the Czech Republic** stresses the need to introduce best available techniques (BAT) into production processes and best available technologies into waste water removal. Specific objectives and programmes of measures to improve the quality of surface water and groundwater are laid down by the River Basins Management Plans. Since 2010, the adopted programmes of measures are under implementation.

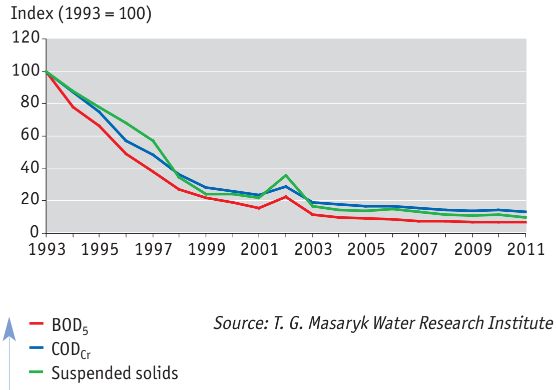
Indicators and values for the permissible pollution of waste water from point sources were newly set by **Government Regulation No. 23/2011 Coll.** which changes the Government Regulation No. 61/2003 Coll., on the indicators and values for the permissible level of surface water and waste water pollution and on the requirements for permission to discharge waste water into surface water and sewerage, and on sensitive areas, as amended by the Government Regulation No. 229/2007 Coll.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The amount and character of discharged pollution directly affects mainly the quality of the receiving surface water. Nutrients (especially phosphorus) contained in wastewater discharged from point sources, contribute, along with diffuse sources, to excessive eutrophication of watercourses and reservoirs. Polluted water can be a source of infectious diseases such as viral hepatitis A, dysentery, salmonella, etc. It may contain toxic substances which spread with water in soil and sediments and accumulate in plant and animal tissues, from which they get further into the food chain.

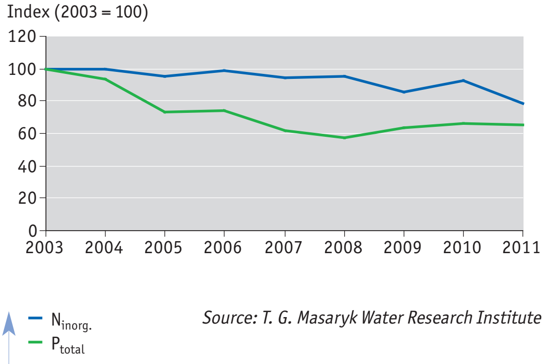
INDICATOR ASSESSMENT

Chart 1 → **Relative representation of pollution discharged from point sources – the BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 1993 = 100], 1993–2011**



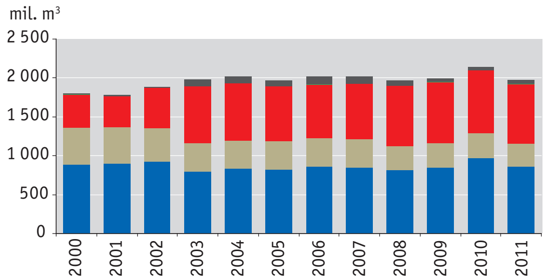
Source: T. G. Masaryk Water Research Institute

Chart 2 → **Relative representation of pollution discharged from point sources – the $N_{inorg.}$ and P_{total} in the Czech Republic [index, 2003 = 100], 2003–2011**



Source: T. G. Masaryk Water Research Institute

Chart 3 → **The quantity of waste water discharged into surface water in the Czech Republic [mil. m³], 2000–2011**

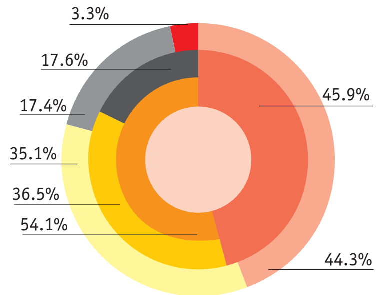


Source: T. G. Masaryk Water Research Institute based on data provided by Povodí, State Enterprise

- Public sewerage systems
- Industry (incl. extraction of mineral raw materials)
- Energy sector
- Agriculture (incl. irrigation, excl. fish farming)
- Others (incl. construction)

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

Figure 1 → **The quantity of waste water discharged into surface water in the Czech Republic [mil. m³], 2011**



Source: Czech Statistical Office

- Total water discharged into watercourses 900.9 mil. m³
- Rainwater 413.3 mil. m³
- Waste water discharged into sewerage systems 487.6 mil. m³
- Sewage water 329.1 mil. m³
- Industrial and other water 158.5 mil. m³
- Treated rainwater 398.8 mil. m³
- Treated sewage water 315.8 mil. m³
- Treated industrial and other water 156.4 mil. m³
- Untreated waste water and rainwater 29.9 mil. m³

The trend of development in the quantity of pollution discharged from point sources is evaluated through development of five basic indicators. Organic pollution is expressed in oxygen demand (BOD_5, COD_{Cr} indicators) and suspended solids; dissolved nutrients are represented by $N_{inorg.}$ and P_{total}.

Since 1993 (or 2003), a decline in **the quantity of pollution discharged from point sources** prevails for the indicators determined (Chart 1, Chart 2). Since 1993, organic pollution expressed as **BOD_5** decreased by 93.9% (to 6,789 t), as **COD_{Cr}** by 86.5% (to 42,679 t) and as **suspended solids** by 90.3% (to 11,899 t) in 2011 (Chart 1). The positive changes in the total amount of pollution that occurred in the 1990s and whose main reason was, above all, the decline in industrial production, are no longer significant during the last ten years. Currently, the development of discharged pollution is influenced, above all, by the effect of large-scale construction and modernisation of wastewater treatment plants designed to treat not only urban but also industrial waste waters. The period after 2003 showed only occasional slight annual increase of the discharged pollution, which was related, inter alia, with the occurrence of precipitation extremes (e.g. in 2010) and was subsequently reflected in the total volume of water discharged (Chart 3). This is why the last interannual change showed decline in discharged pollution, namely in the following indicators: BOD_5 by 444 t (6.1%), COD_{Cr} by 3,349 t (7.3%), suspended solids by 2,155 t (15.3%), $N_{inorg.}$ by 2,046 t (14.8%) and P_{total} by 11 t (0.9%). Discharge of **nutrients, i.e. nitrogen and phosphorus**, causes eutrophication. In the 1990s, nutrients also saw a significant reduction in the amount of pollution discharged by point sources. The long-term reduction was mainly attributable to a reduction of the amount of phosphates used in detergents and decreased use of nitrogen fertilisers but recently also by the fact that both biological nitrogen removal and biological or chemical phosphorus removal are specifically applied in waste water treatment technology within new and intensified waste water treatment plants. In 2011, the amount of pollution discharged was as follows: $N_{inorg.}$ 11,770 t and P_{total} 1,190 t, which was 78.7% and 65.7% of the 2003 value respectively.

The total amount of discharged waste water was decreasing in 1990s. At the beginning of 21st century, there was an increase in the volume of the discharged water, which was connected with the change in the limit for recorded quantity of discharged water (Chart 3). In recent years, the value varies around 2,000 mil. m^3. In 2011, the total volume of water discharged into surface waters accounted for 1,975.0 mil. m^3. The biggest shares are: discharge through public sewerage systems (43.6% and 860.5 mil. m^3) and discharge from the energy sector (38.9% and 768.9 mil. m^3). The volume of water discharged by **the energy sector** remains basically unchanged in recent years. This type of discharged water is almost exclusively composed of waste water from once-through cooling (96.8%) while usually only two of its parameters are altered – the temperature and oxygen content. On the other hand, **urban waste water** (domestic and industrial waste water, rainwater run-off) represent major point sources of pollution, especially organic pollution. Another major source of pollution is industrial waste water (14.9% and 293.4 mil. m^3), which is a source not only organic pollution but also pollution with e.g. heavy metals and specific organic compounds. The chemical, paper and food industries belong to the biggest producers of industrial waste water. **Agriculture**, which discharged only 6.9 mil. m^3 of water in 2011, is a specific polluter of surface water. Although this concerns only about 0.3% of the total volume of discharged water, agriculture still belongs to important pollution sources because a big amount of pollution gets to flowing and standing water bodies as **diffuse pollution** through rainwater run-off from agricultural land. This type of pollution is not generally recorded, but it significantly translates into the resulting quality of surface water and groundwater on the Czech Republic's territory and is a major source of pollution, in particular as regards nitrates, pesticides, and acidification. The amount of the substances that get into water is also affected, inter alia, by application and dosing of fertilizers and application of plant protection preparations used in agricultural production, as well as the conditions for soil erosion of agricultural land.

In light of building and reconstruction of waste water treatment plants within implementation of the Council Directive 91/271/EEC of 21st May 1991 concerning urban waste water treatment, which takes place especially in the last 5 years, further decrease in the pollution discharged to surface waters from point sources, in particular phosphorus, and thus the subsequent reduction of eutrophication and suppressing of algae growth affecting the BOD_5 and COD_{Cr} values can be expected **in the future**. The decline in the content of nitrate in discharged effluents may not be high because diffuse pollution is its source and therefore its quantity is influenced not only by farming on agricultural land but also by natural factors, such as rainfall affecting run-off. It can be assumed that, in this case, implementation of the Nitrate Directive, the action programme of which has been fulfilled since 2003, could have a positive influence on the development.

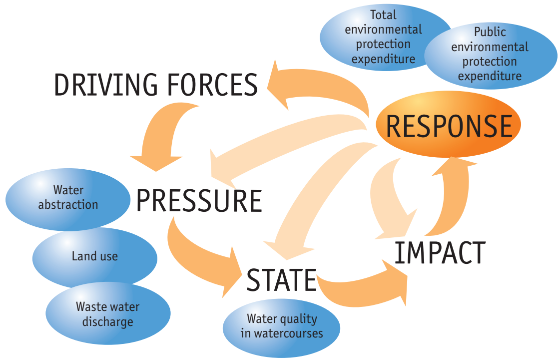
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1774)

10/ Waste water treatment

KEY QUESTION →

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



KEY MESSAGES →

In the long-term perspective, there is a constant improvement of sewerage and waste water treatment infrastructure. Since 2000, the length of the sewerage network has doubled, the number of inhabitants connected to public sewer has increased (from 75% to 83%), particularly the proportion of inhabitants connected to sewers that ends in a waste water treatment plant (from 64% to 78%). The share of treated waste water has increased slightly (from 95% to 97%), the number of waste water treatment plants (WWTPs) has almost doubled and, last but not least, the proportion of tertiary treatment has grown slightly (from 43% in 2002 to 46% in 2011).

So far, the requirements for urban waste water treatment in agglomerations above 2,000 population equivalent provided for by the Council Directive 91/271/EEC have not been met, and the unsatisfactory state in ensuring the collection and treatment of waste water concerns 43 agglomerations out of 633 (the total number).

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The treatment and discharge of municipal waste water and some waste water originating in the food processing industry is dealt with by the **Council Directive 91/271/EEC** of 21st May 1991 concerning municipal waste water treatment. The Directive aims at protecting the environment from the adverse effects of waste water discharge. In particular, it is necessary to ensure secondary treatment of municipal waste water in sensitive areas according to the Nitrate Directive, namely construction of the missing water management infrastructure (in particular waste water treatment plants and sewers), reconstruction and improvement of the waste water treatment technology in all agglomerations over 2,000 population equivalent. The Czech Republic was supposed to finish this within the transition period, i.e. by the end of 2010.

The mid-term strategy of state policy concerning water supply and sewerage systems prior to 2015 is presented in the **Development Plan for Water Supply and Sewerage Systems of the Czech Republic** that is linked to other strategic documents, while respecting the requirements of relevant EU legislation.

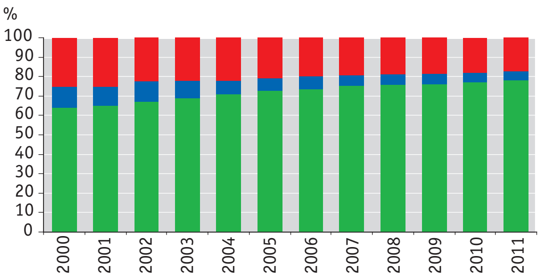
Furthermore, the desirable trend includes increasing the proportion of the population connected to public sewerage systems and increasing the proportion of the population connected to sewers ending in WWTPs. For the Development Plans for Water Supply and Sewerage Systems of the Czech Republic's Regions, the number of opinions that are issued by the Ministry of Agriculture on proposed changes to the technical solutions to drinking water supply, sewerage services and waste water treatment increases every year.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Availability of sewerage systems to the inhabitants represents not only an important part of the water management infrastructure, but it significantly affects the health of the population by providing safe collection of the sewage, which poses a health risk of infection. The treatment stage that is used for waste water collected via sewerage systems influences the quantity and nature of discharged pollutants and thus also the quality of receiving water bodies (e.g. tertiary treatment reduces the amount of discharged phosphorus and nitrogen, thus helping reduce the impact on water eutrophication). Ultimately, sufficient and properly functioning infrastructure in waste water treatment may significantly affect the use of water for drinking-water supply purposes, the quality of natural bathing water and the state of aquatic and water-related ecosystems.

INDICATOR ASSESSMENT

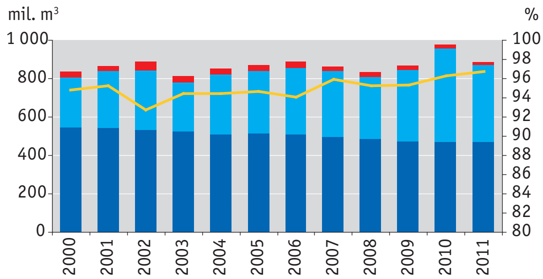
Chart 1 ➜ **Proportion of the population connected to sewerage systems and to sewerage systems ending in WWTPs in the Czech Republic [%], 2000–2011**



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

Source: Czech Statistical Office

Chart 2 ➜ **Treatment of waste water discharged into sewerage systems in the Czech Republic [mil. m³, %], 2000–2011**

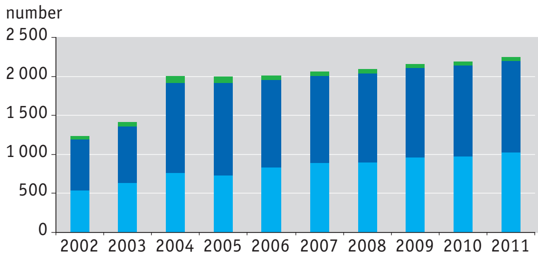


Source: Czech Statistical Office

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

For the years 2000–2003, data for the main operators' sewerage systems are concerned. Rainwater is also included in the records of treated waste water.

Chart 3 ➜ **Number of waste water treatment plants according to treatment stages in the Czech Republic, 2002–2011**

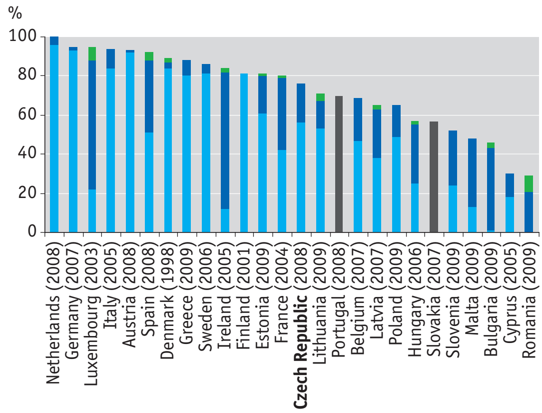


- Primary treatment
- Secondary treatment
- Tertiary treatment

Source: Czech Statistical Office

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

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



- Primary treatment
- Secondary treatment
- Tertiary treatment
- Treatment stage is not specified

Source: Eurostat

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

Since 2000, and especially in the period after the Czech Republic's joining the EU in 2004, the network of sewers and WWTPs had gone through significant development. In 2011, the sewerage networks were twice as long compared to the year 2000 and the **proportion of the Czech Republic's population connected to the sewerage** increased from 74.8% to 82.6% (Chart 1). The trend of increasing the share of the population connected to the sewerage system is not so significant in recent years since both sewers and waste water treatment plants have been constructed to a great extent in larger towns and cities and it is necessary to gradually cover smaller municipalities where fewer inhabitants are concentrated. Nonetheless, the 14% increase in the share of the population connected to sewerage ending in a WWTP between 2000 and 2011 is very positive. So far, not all the waste water discharged into sewerage systems is treated (Chart 2), however, the proportion of treated waste water (96.8%) is very satisfactory. Over the monitored period since 2000, the **proportion of waste water that is discharged into sewerage systems and treated** has stagnated at 94–96%. According to data from the Czech Statistical Office, 96.8% of the 487.6 mil. m^3 of waste water discharged into sewerage systems, excluding rainwater, was treated in 2011 (in 1990 the proportion was only 75%). In 2011, 95.9% of sewage discharged into public sewers and 98.7% of industrial and other waters were treated. The amount of treated rainwater is generally growing, with year-to-year fluctuations being influenced by precipitation totals in the years concerned.

In comparison with the year 2000, **the total number of WWTPs** for public use has doubled to 2,251 in the Czech Republic; their total capacity decreased slightly (by 3.3%) because of reconstructions of older plants but the volume of waste water discharged into sewers has decreased, too. The significant increase in the number of WWTPs after 2004 is related to implementation of the Council Directive 91/271/EEC which requires securing treatment of municipal waste water and waste water from certain industrial sectors (food industry). Due to the construction and modernization of waste water treatment plants, the number of WWTPs with nitrogen or phosphorus removal (tertiary treatment) increased by 55, the number of those with basic mechanical-biological treatment by 7 and there is one new plant with mechanical treatment. All agglomerations with population equivalent over 10,000 have ensured tertiary treatment, although not all of them comply with the Directive's requirements for the quality limits concerning discharged waste water. In 2011, altogether 52 **WWTPs with capacity exceeding 2,000 population equivalent** were reconstructed or expanded and three new ones were put into operation. At the end of 2010, the transitional period to meet the requirements of Council Directive 91/271/EEC ended, but even on 31st December, 2011, 43 out of the total number of 633 agglomerations with population equivalent over 2,000 had not ensured waste water collection and treatment in a satisfactory manner. Of this number, 35 agglomerations have not complied with the treatment limits (of which 15 agglomerations do not have any wastewater treatment plant at all), 6 agglomerations are connected to a WWTP in another agglomeration with an unsatisfactory WWTP and two agglomerations are building a connection to a satisfactory WWTP in another agglomeration. Improvement of the state and gradual meeting of the requirements in the following years can be expected.

The average efficiency of wastewater treatment plants (the amount of pollution degraded and removed) is very high in the Czech Republic; in 2011, it was as follows: 97.9% for BOD_5, 97.5% for suspended solids, 94.3% for COD_{Cr}, 82.4% for P_{total} and 72.5% for nitrogen substances. 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 complete and the amount of pollution produced in individual agglomerations has stabilized.

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

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1575)

11/ Water quality in watercourses

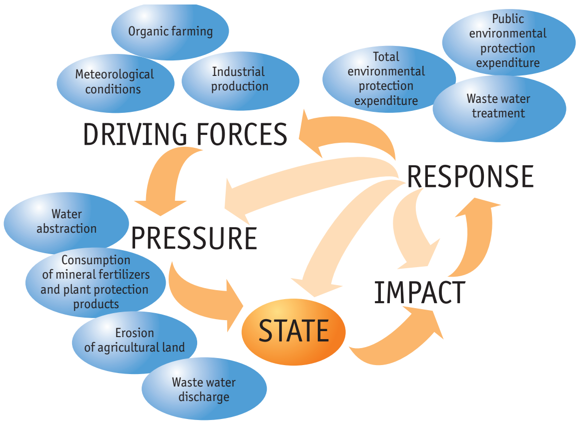
KEY QUESTION →

Is the quality of water in watercourses, which affects both aquatic organisms and the use of water, improving?

KEY MESSAGES →

Since 1993 (or 2000 respectively), average annual concentrations decreased for all of the monitored water quality indicators except chlorophyll (BOD_5, COD_{Cr}, $N\text{-}NO_3^-$, P_{total}, cadmium, adsorbable organically bound halogens – AOX and thermotolerant coliform bacteria – FC) in the Labe and Odra river basins. Most parts of important watercourses are classified in the major indicators as water quality class I to III (according to CSN 75 7221).

In the last decade, the development of water quality in the Labe and Odra basins has not shown so significant changes as it did in 1990s. There is an increase of the average concentrations of monitored indicators (BOD_5, COD_{Cr}, P_{total}, chlorophyll) in some places interannually. At present, environmental quality standards (EQS) are exceeded in 39% of the monitored profiles for AOX and in 20% of the profiles for BOD_5, COD_{Cr}, and $P_{total.}$ Nitrate nitrogen is an exception as it did not comply with the EQS in only 3% of the profiles observed.



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 the **Directive 2000/60/EC of the European Parliament and of the Council** of 23rd October 2000 establishing a framework for the Community action in the field of water policy. The Water Framework Directive focuses on the comprehensive protection of the quality and quantity of water, prevention of deterioration and on achieving at least the so-called "good status" of water and related ecosystems, as a basis for sustainable use of water and mitigation of the consequences of floods and drought. The **Council Directive 91/676/EEC** of 19th December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (the Nitrates Directive) is very important with regard to diffuse pollution. In order to achieve these objectives, surface water and groundwater administration and the determination of emission and pollution limit values and qualitative objectives are required. Specific objectives and programmes of measures to improve water quality are laid down by the **River Basins Management Plans**. Transposition of the above-mentioned Water Framework Directive into the Czech legal system is ensured mainly by the **Act No. 254/2001 Coll. (The Water Act)** which went through an extensive amendment process in 2010. Notable major changes include a new approach to water planning (the 8 river-basin districts that are currently used will be replaced with plans for 10 sub-districts) and support for revitalizing watercourses.

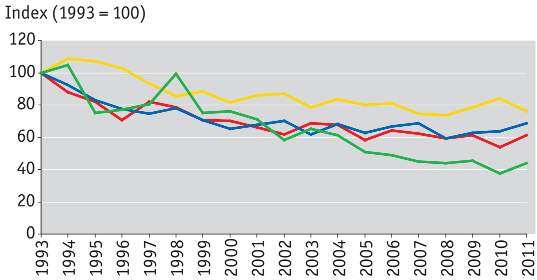
An important instrument for water protection from priority hazardous substances is the **Directive 2008/105/EC of the European Parliament and of the Council** of 16th December 2008 on environmental quality standards in the field of water policy. The standards have to be achieved by the end of 2015. Indicators reflecting the state of water in a watercourse, EQS and requirements for the use of water are provided for in the **Government Regulation No. 23/2011 Coll.**, amending the Government Regulation No. 61/2003 Coll. on indicators and values of permissible pollution of surface water and waste water, on the requirements for permits of waste water discharge into surface water and sewerage systems and on sensitive areas, as amended by the Government Regulation No. 229/2007 Coll. One of the axes of the **National Strategic Rural Development Plan in the Czech Republic in 2007–2013** also deals with protection of the quality of surface water and groundwater sources through measures related to agricultural activities.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Surface water quality has a direct influence especially on biodiversity of aquatic and water-related organisms but it also affects other adjacent ecosystems, such as river floodplains. Excessive amounts of nutrients (especially phosphorus) getting into the aquatic environment contribute to eutrophication of water (especially in reservoirs) which is problematic in the context of drinking water production and poses a direct health risk within using surface water for bathing. Certain hazardous substances contained in surface water have the ability to accumulate in the sediments and tissues of aquatic animals in long terms and thus to get into the food chains of a great number of other organisms, including humans. The main health risks associated with ingestion of and exposition to contaminated water include transmission of infectious diseases and skin rashes.

INDICATOR ASSESSMENT

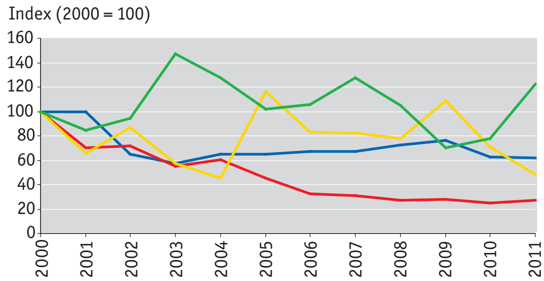
Chart 1 → **Trends in the concentrations of the pollution indicators of watercourses within the Labe and Odra river basins [index, 1993 = 100], 1993–2011**



- BOD$_5$
- COD$_{Cr}$
- N-NO$_3^-$
- P$_{total}$

Source: Czech Hydrometeorological Institute, on the basis of source monitoring data provided by Povodí, State Enterprise

Chart 2 → **Trends in the concentrations of the pollution indicators of watercourses within the Labe River basin [index, 2000 = 100], 2000–2011**

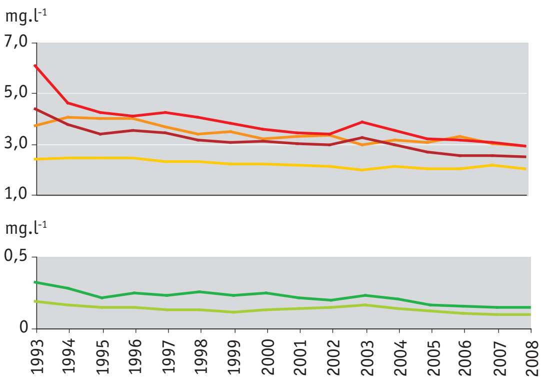


- AOX
- Cd$_r$
- FC
- Chlorophyll

Source: Czech Hydrometeorological Institute, on the basis of source monitoring data provided by Povodí, State Enterprise

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 the individual profiles within the Eurowaternet network. The water quality assessment for BOD$_5$, COD$_{Cr}$, N-NO$_3^-$ and P$_{total}$ was carried out for the Labe and Odra river basins (32 to 40 stations, according to the indicator and data availability), for AOX, Cd, FC and chlorophyll for the Labe river basin (16 to 21 stations, according to the indicator and data availability). It was not possible to perform an assessment for the whole territory of the Czech Republic because of insufficient financing of water quality monitoring. Concerning the period 2009–2011, data are not available for the Eurowaternet profiles in the river basins of the Morava, Dyje, Ohře, upper Labe and partly Odra rivers. The values for 2010 and 2011 can be influenced by a lower number of data.

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-NO$_3^-$ (Eastern Europe)
- N-NO$_3^-$ (Czech Republic)
- BSK$_5$ (Eastern Europe)
- BSK$_5$ (Czech Republic)
- Orthophosphate (Eastern Europe)
- P$_{total}$ (Czech Republic)

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 watercourses in the Czech Republic , 2010–2011**

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

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

A summary of assessments of the following indicators: BOD$_5$, COD$_{Cr}$, N-NH$_4^+$, N-NO$_3^-$, P$_{total}$ and the saprobic index of macrozoobenthos.

Satisfactory water quality in the Czech Republic's rivers is apparent from of a comparison of maps of water quality, which are drawn up in accordance with the summarising assessment of the basic indicators measured continuously according to **CSN 75 7221** since the period 1991–1992. However, it is still possible to record water quality class V in some short sections (Fig. 1). Since 2000, there has been primarily a reduction of the sections included in quality class V and an increase of the sections with unpolluted and slightly polluted water. In 2011, total of 6,396 km (11.8%) of watercourses managed by Povodí, State Enterprise were included into the quality classes IV or V. In 2010–2011, according to the maps comparison, the quality of water worsened rather than improved compared to the period 2009–2010 (in all cases, however, by one class only). The deterioration has occurred for example in the rivers Úhlava, Lužnice (below the town of Veselí nad Lužnicí) or Kyjovka. However, most of the watercourses' sections assessed are classified within water quality classes I through III. Water quality has improved e.g. in the rivers Bílina, Jizera, Malše, Jičínka, Lučina and Lužická Nisa (by two classes). The long-term poor quality of watercourses in southern Moravia (Trkmanka, Kyjovka, Litava) and of some watercourses in the Labe river basin (Vlkava, Mrlina, Pšovka) is caused by the fact that they contain less water but relatively higher pollution is discharged into them. Therefore, their dilution capacity is decreased, self-purification capacity is lowered by a significant watercourses regulation and there are many places in their catchment areas that are affected by soil erosion (run-off from agricultural land).

Within the indicator, water quality trends are only evaluated for selected profiles within the Eurowaternet network using the average annual concentrations of eight selected basic indicators of pollution (only data from the basins of the Labe and Odra rivers were available for the evaluation). Organic pollution is expressed using the BOD_5 and COD_{Cr} indicators, nutrients are represented by $N\text{-}NO_3^-$ and P_{total}, and it was assessed for the basins of the Labe and Odra rivers. Chlorophyll was selected as a biological indicator and cadmium as a heavy metal indicator, adsorbable organohalogens (AOX) represent the general indicators and thermotolerant (faecal) coliform bacteria (FC) belong to the microbiological indicators. The last four parameters were monitored only in a part of the profiles in the Labe river basin.

Development of the concentrations of the indicators monitored over the last 20 years largely reflects the development of the quantity of pollution discharged from point sources, access to waste water treatment in the Czech Republic (i.e. the proportion of treated waste water, waste water treatment stages) as well as the socio-economic and political development (restructuring of the industry, growing living standard, joining the EU). Climatic conditions of the given year (amount of water, temperature) play an important role in year-to-year fluctuations, especially in the recent years, when the quantity of pollution discharged does not change significantly. On the regional basis, concentration of industrial activities, existence of old environmental contamination or intensity of agricultural activities are of great importance.

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 exceedance of the environmental quality standards for organic pollutants and total phosphorus in the Labe and Odra river basins. In long terms, the **BOD_5** values have been reduced to 61.1% of the 1993 value and those of **COD_{Cr}** to 68.6% (Chart 1). The average concentrations of **organic pollution** in the Elbe and Odra basins in 2011 were as follows: BOD_5 2.8 $mg.l^{-1}$, COD_{Cr} 19.9 $mg.l^{-1}$, which represents a slight year-to-year increase.

In long perspective, the concentration of total **phosphorus** was reduced most, namely to 0.11 $mg.l^{-1}$ in 2011, i. e. to 43.7% of the 1993 value. The reason consists in the fact that a big part of it comes from point source pollution, which is better removed and the volume of which is generally reduced. The decline in phosphorus inputs was further supported by restrictions concerning the use of phosphates in laundry detergents beginning from 2006; in the last three years, application of phosphate fertilizers in agriculture has also been declining. Nonetheless, phosphorus remains being the major factor to cause eutrophication. Further significant reduction of phosphorus concentration in surface water is restricted by the relatively high limits for waste water discharge and by the fact that only bigger WWTPs are obliged to reduce phosphorus. A part of phosphorus comes from diffuse pollution sources and this type of pollution is very difficult to remove.

The concentration of **nitrate nitrogen**, as opposed to phosphorus, decreased only to 76.0% of the 1993 value and in recent years, it has a rather fluctuating trend (Chart 1). The concentration of nitrogen dropped from 3.0 $mg.l^{-1}$ to 2.7 $mg.l^{-1}$ on a year-to-year basis. Along with atmospheric deposition and sewage, nitrogen fertilizers are another significant source of nitrogen and, although their consumption is significantly lower in comparison with the period before 1990, there is almost a continuous growth in their consumption in the past twenty years. Along with a slight decrease of inorganic nitrogen discharged from point sources, the above-mentioned facts are the reason why the decline in watercourses pollution with this element is not as significant as it is e.g. for phosphorus. Since diffuse pollution generally covers most of the nitrate-nitrogen pollution, the interannual increase of its concentration in watercourses is partially bound to rainfall-rich years because runoff from land is higher. The long-term trend in the reduction of nitrate pollution is related, inter alia, also with the reduction of nitrogen emissions from livestock farming (pigs and poultry breeding attenuation).

After 2000, a significant positive trend (Chart 2) was recorded in the Labe river basin for cadmium (0.06 $\mu g.l^{-1}$ in 2011), which belongs to hazardous substances and whose EQS (0.3 $\mu g.l^{-1}$) has not been exceeded since 2003. While the average **AOX** concentrations in the Labe river basin has basically stagnated since 2000 (24.1 $mg.l^{-1}$ in 2011), the proportion of profiles which do not comply with the respective EQS (25 $\mu g.l^{-1}$) is the highest one (38.9%) of all the indicators monitored. The reason consists in the fact that this pollution, originating in e.g. paper and chemical industries, municipal waste water but partially also in natural resources, is difficult to degrade. Concentrations of **thermotolerant coliform bacteria** (FC) primarily reflect the level of faecal pollution. Since 2000, FC concentrations have varied considerably in the profiles monitored; climatic conditions in the respective years (temperature, precipitation) have had their influence on the concentrations. During the last two years, they were reduced to 25.3 $CFU.ml^{-1}$.

The concentration of **chlorophyll** characterizes the level of primary production in aquatic environment (or eutrophication) and the influence of climatic conditions (precipitation, temperature) is of particular importance in this context. It depends mainly on average temperatures and the course rainfall during the year (or during the growing season). For example, in 2011, high temperatures came very early and despite the below-average temperatures in June and July, the primary production increased which was also supported by the enhanced nutrient supply because of higher summer precipitation. For these reasons, the average concentration in the Labe river basin is rather fluctuating and generally, it is not reduced. The 2011 value amounted to 23.1 $\mu g.l^{-1}$.

On the basis of a comparison of average concentrations of nitrate, phosphorus and BOD_5 till 2008 measured in Eurowaternet stations in the Czech Republic and in the **states of Eastern Europe** (among which the Czech Republic is counted), it is possible to state that 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 in the watercourses, especially by their flow. The declining trend is comparable. Generally, the best quality of waters is found in Northern Europe. Concentrations in the Czech Republic are similar to average concentrations in West 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)

12/ Health condition of forests

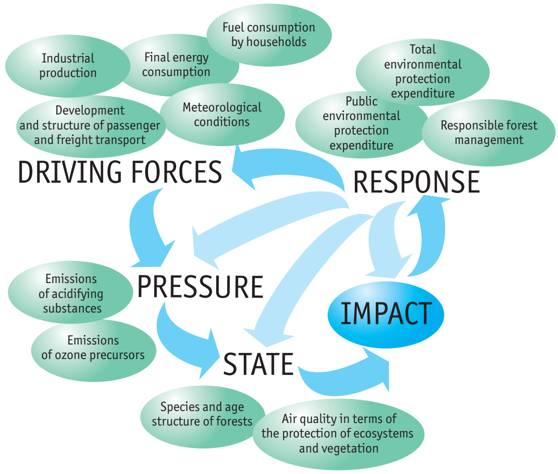
KEY QUESTION

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

KEY MESSAGES

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

Despite the slowdown in the pace of increase, the defoliation rate remains very high in the Czech Republic. Representation of older coniferous stands (over 59 years) in class 2 to 4[1] accounted for 72.8%, for younger coniferous trees (under 59 years) it was 23.2%, for older deciduous trees 41.6% and for younger deciduous trees 15.4% in 2011.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

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

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

The Forest Ecosystems section 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 and monitoring of the pollution impacts on forest and forest soil to date. In addition, it is also necessary to prepare a strategy for further abating the impacts of adverse processes on forest biodiversity.

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

From the international perspective, the **ICP Forests Programme**, which is part of the CLRTAP convention, is important. The programme focuses on assessing and monitoring the impact of air pollution on forests. Another document of international importance is the **FutMon** (Further Development and Implementation of an EU-level Forest Monitoring System) project, which is being implemented under the **LIFE+** programme and aims 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 mainly as a source of non-productive functions (in particular protecting soil against erosion, promoting the water cycle, conserving nature, air quality, controlling floods and droughts, health-related and sanitary functions, recreational and spiritual functions). The declining health of forests has impacts on not only the ecosystems and species living in them, but also on the whole society.

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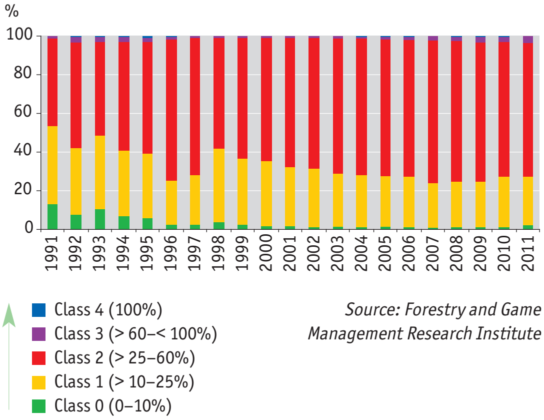
[1] *Defoliation levels are divided into five basic classes, of which the last three characterize significantly damaged trees: 0 – no defoliation (0–10%); 1 – slight defoliation (>10–25%); 2 – moderate defoliation (>25–60%); 3 – severe defoliation (>60–<100%); 4 – dead trees (100%)*

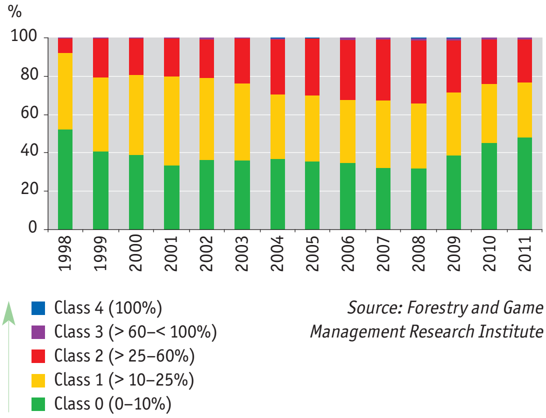
INDICATOR ASSESSMENT

Chart 1 ➜ **Trends in defoliation of older coniferous stands (over 59 years) in the Czech Republic according to classes [%], 1991–2011**



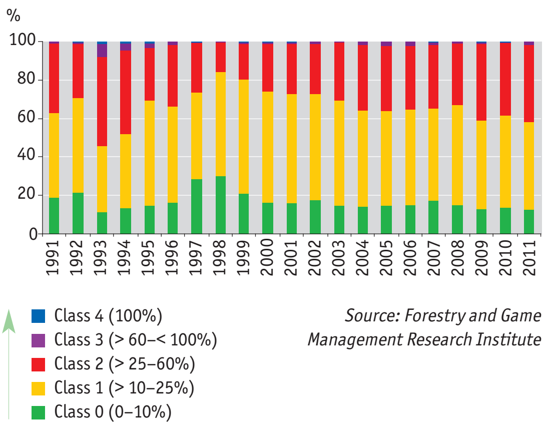
Source: Forestry and Game Management Research Institute

Chart 2 ➜ **Defoliation of younger conifers (stands up to 59 years of age) in the Czech Republic according to classes [%], 1998–2011**



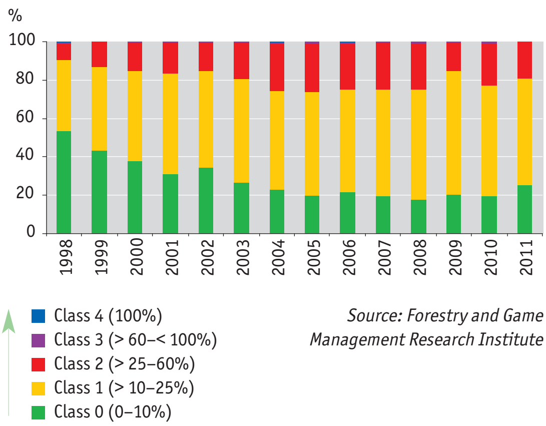
Source: Forestry and Game Management Research Institute

Chart 3 ➜ **Defoliation of older deciduous trees (stands over 59 years of age) in the Czech Republic according to classes [%], 1991–2011**



Source: Forestry and Game Management Research Institute

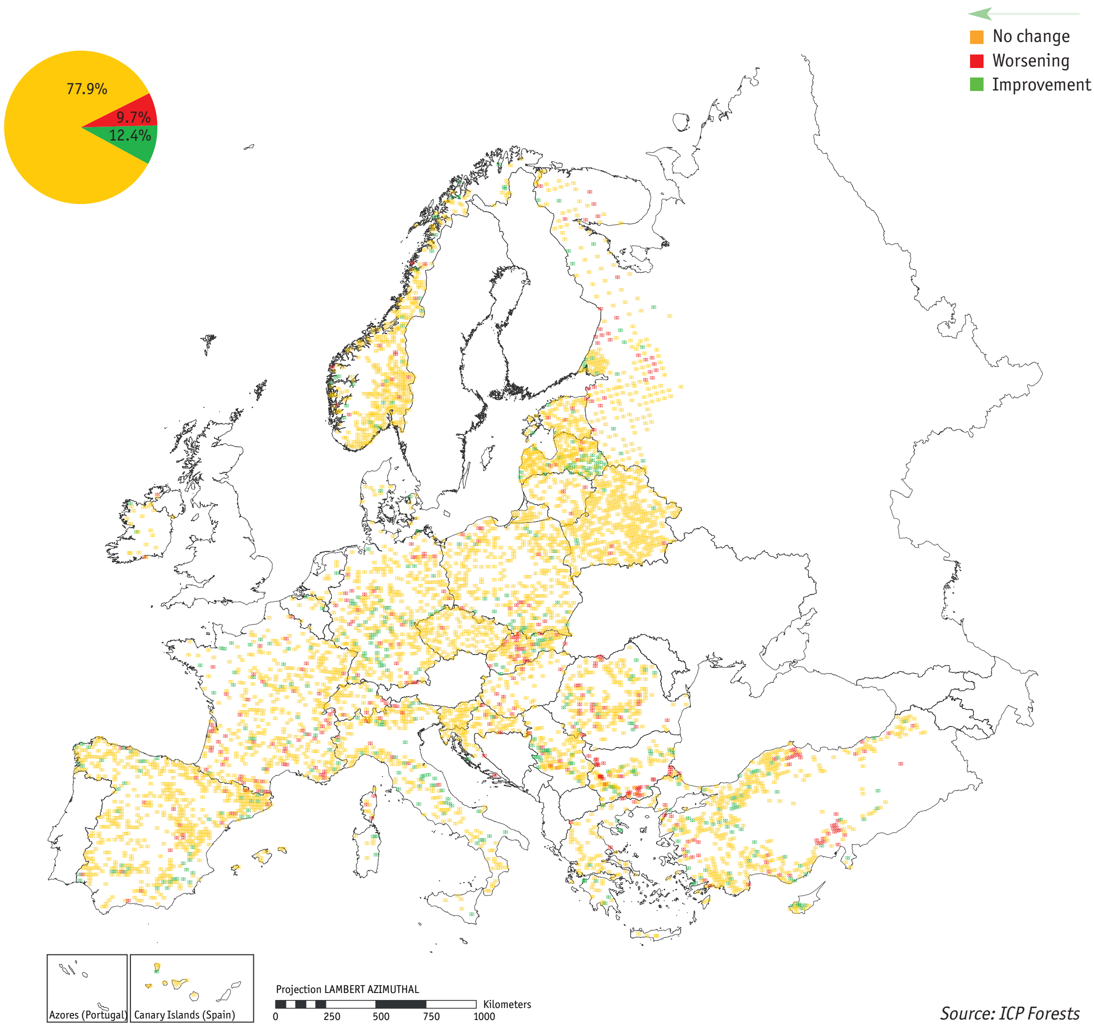
Chart 4 ➜ **Defoliation of younger deciduous trees (stands up to 59 years of age) in the Czech Republic according to classes [%], 1998–2011**



Source: Forestry and Game Management Research Institute

[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%)*

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



Source: ICP Forests

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

In **older coniferous stands (over 59 years)**, there was a significant increase in defoliation in late 1980s and in the first half of 1990s. After the average defoliation had reached its peak in 1996, with a consequent significant improvement till the year 1998, the dynamics calmed down. In the following period, i.e. late 1990s and after the year 2000, there were only slight interannual changes. There was a negative trend in terms of growing defoliation and increasing representation in classes 2 to 4 (by 10.7% for the period 2000–2009) at the expense of classes 0 and 1 (Chart 1). In the last two years, slight improvement concerning the state of defoliation was recorded; in 2010, class 1 increased by 2.6% and in 2011, class 0 grew by 0.9%. The reason for the forest stands' poor health consisted in intense pollution load of the forest ecosystems in the past decades, which continues to the present albeit with significantly lower intensity. Although the environment improved and air pollutants decreased as a result of area desulphurisation since the mid-1990s, the forest stands respond to changes with a considerable delay. There is also another important factor, i.e. the fact that the stands that had been influenced significantly by poor air quality as early as in their young growth stages get into the higher age category at present. This is why their health conditions remain unsatisfactory.

Until 2008, representation of **younger coniferous stands (under 59 years of age)** was growing especially in defoliation class 2 (by 14.1% in 2000–2008) at the expense of classes 0 and 1 (Chart 2) while after 2008, there was a decrease of representation in defoliation classes 2 to 4 (by 11.1% till 2011) and a growth in defoliation class 0 (by 16.3% till 2011). Their generally better health conditions, assessed according to defoliation compared to older stands (representation of older conifers in classes 2 to 4 in 2011 was by 49.6% higher than that of younger stands), are based on the fact that younger stands have greater vitality and ability to resist adverse environmental conditions. Another reason which must not be omitted consists in a significantly lower environmental burden than in the past.

Concerning **older deciduous stands (over 59 years of age)**, defoliation reached its peak in 1993 and in the following years, it was decreasing to get to its lowest level in 1998. In the next period, defoliation of older deciduous trees is growing slightly, with minor fluctuations. There is a negative trend consisting in growing defoliation and higher representation of stands in class 2 (by 15.4% in 2000–2011) at the expense of classes 0 and 1 (Chart 3). Concerning **younger stands of deciduous trees (under 59 years)**, defoliation was growing till 2005 (classes 2–4 have increased by 11.2% in 2000–2005), however, after 2005, the situation is improving slightly, especially in defoliation class 0, which has increased by 6.0% in 2005–2011, at the expense of class 2 which dropped by 6.3% during the same period. Despite this slightly positive trend, representation in defoliation class 0 goes on declining, which means that the number of trees that are completely healthy in terms of defoliation is going down (by 17.4% in 2000–2011). The reason for the much lower defoliation of deciduous trees in comparison with coniferous stands consists in the fact that broad-leaved (i.e. deciduous) trees are generally more resistant than conifers, because they recover all their assimilatory apparatus within one year, while in the case of conifers it is only a part of the stands (first year of age).

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

In the international context, the state of Czech forests remains bad and belongs to the worst in Europe – despite the significant reduction in emissions in the 1990s. In 2010, 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 began to decline slightly and reached 19.2% in 2009.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

13/ Species and age structure of forests

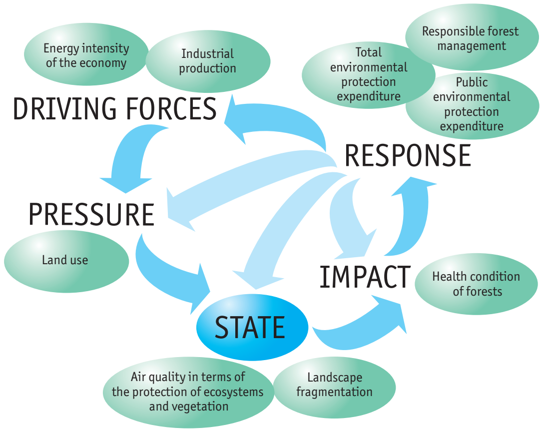
KEY QUESTION →

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

KEY MESSAGES →

The proportion of deciduous trees in the Czech Republic's forest area is rising slowly; during the period 2000–2011, it increased by only 3 p. p. to reach the value of 25.3%. Although this results in a favourable change in the species structure towards a more natural (and stable) composition of forest stands, the process is very slow.
The proportion of fir, which is an important part of the natural forest ecosystem and which contributes significantly to maintaining forest stability, has been stable since 1995 (about 0.9%) even though its share in artificial planting is 5.4%.

The current composition of the Czech Republic's forests differs significantly from the reconstructed natural structure. While the present composition is dominated by coniferous forests, deciduous forests prevail in the reconstructed natural structure and their proportion should account to 65.3% of the whole of the Czech Republic's forest area (i.e. by 40 p. p. more than the current representation).
The age structure of the Czech Republic's forests is not proportional. In recent years, the area of overmature stands (over 120 years) is growing; it increased by 1.8 p. p. for the period 2000–2011.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **EU Forest Action Plan** for the period 2007–2011 aims mainly at supporting and strengthening sustainable forest management and multifunctional roles of forests.

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

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

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

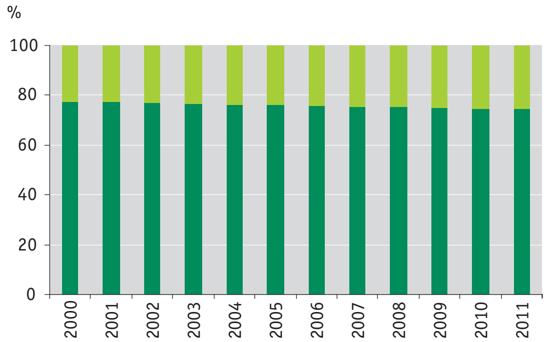
Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic**, which define the objective to increase the forest stands' biodiversity towards the natural species structure and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

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

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

INDICATOR ASSESSMENT

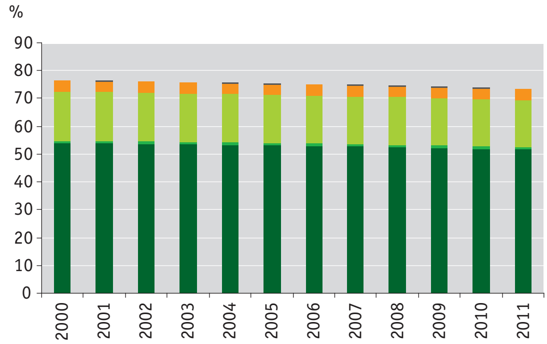
Chart 1 ➜ **Development of the proportions of coniferous and deciduous stands in the total forest area in the Czech Republic [%], 2000–2011**



Deciduous trees
Coniferous trees

Source: Forest Management Institute

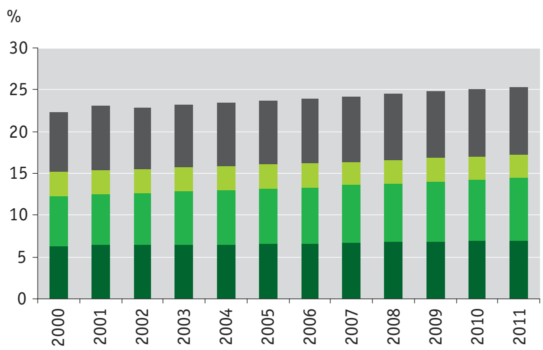
Chart 2 ➜ **Development of the species composition of coniferous stands in the Czech Republic [%], 2000–2011**



Others
Larch
Pine
Fir
Spruce

Source: Forest Management Institute

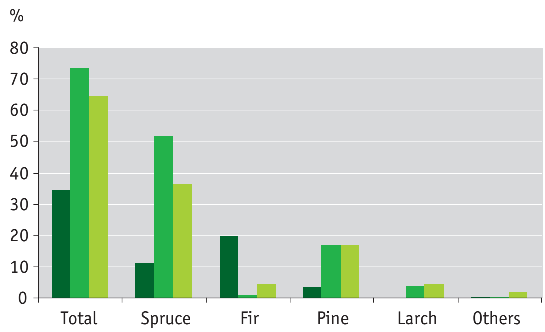
Chart 3 ➜ **Development of the species composition of deciduous stands in the Czech Republic [%], 2000–2011**



Others
Birch
Beech
Oak

Source: Forest Management Institute

Chart 4 ➜ **Reconstructed natural, present and recommended composition of coniferous forests in the Czech Republic [%], 2011**

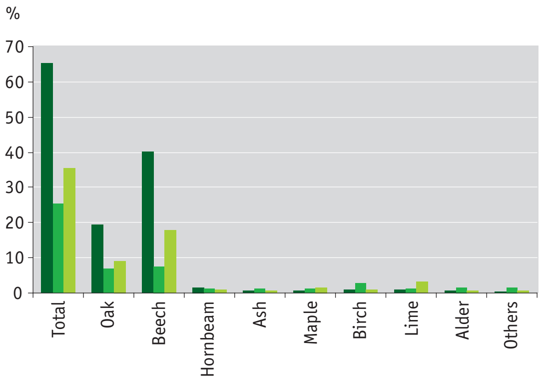


Natural
Present
Recommended

Source: Forest Management Institute

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

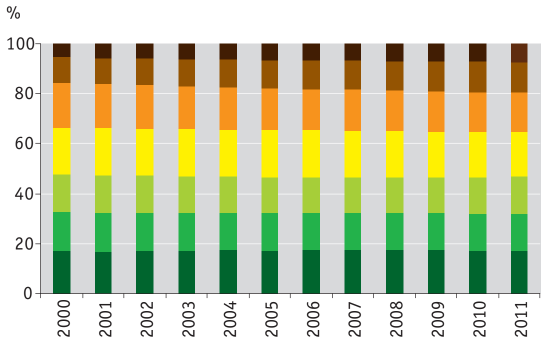
Chart 5 ➜ **Reconstructed natural, present and recommended composition of deciduous forests in the Czech Republic [%], 2011**



Source: Forest Management Institute

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

Chart 6 ➜ **Development of the age structure of forest stands in the Czech Republic [%], 2000–2011**



Source: Forest Management Institute

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

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

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

Source: European Forest Institute

The species composition of the Czech Republic's forests depends mainly on the geological structure, transition between the sub-Atlantic and continental climates as well as on diverse geomorphology. In natural conditions, oak and hornbeam forests prevail in lower altitudes; they change into beech and fir forests and in the top heights, spruce stands dominate. As a result of growing population, and therefore increased demand for wood as the main energy source, fast-growing spruce and pine monocultures were planted in large areas in the past. For this reason, forests of the Czech Republic are made up of mostly coniferous stands which, unfortunately, are not able to resist abiotic (wind, icing) and biotic (pests) disturbances.

In recent years, deciduous tree species (such as beech, oak, maple and rowan trees) have been increasingly used in forest renewal at the expense of coniferous trees (spruce and pine). This results in a favourable change in the species composition towards a more natural (and stable) structure of forest stands. The development of young forests with greater species diversity remains problematic, largely due to browsing in locations with excessive hoofed game stock. **The share of deciduous trees in the total forest area in the Czech Republic** has been growing very slowly. This is caused mainly by a relatively long rotation. In 2011, the share accounted for 25.3% of the total forest area (Chart 1). The proportion of coniferous stands in the total forest area in the Czech Republic in 2011 was 73.6%, while during the period 2000–2011 it fell by 2.9 p. p.

The Czech Republic's forests are composed of spruce (51.7%), however, its proportion in the total area of forest stands is falling steadily; it declined by 2.3 p. p. in 2000–2011. An important part of the natural forest ecosystem is fir, a species important for maintaining forest stability. **The proportion of fir in the total forest area** has been stable (about 0.9%) since 1995 and its proportion in afforestation grew from 2% in 1995 to 6.3% in 2009, but since 2010 it has decreased again to 5.5%. The very small increase in the proportion of fir in the total forest area is mainly due to extensive damage that is caused by hoofed game.

Deciduous stands are composed mainly of beech, whose share in the total forest area grew by 1.5 p. p. during the period 2000–2011 to achieve 7.5% in 2011. A slowly-growing trend has also been recorded for oak whose share increased by 0.7 p. p. over the period considered, reaching 7% of the total forest area in the Czech Republic in 2011. Beech and oak belong, together with fir, to soil-improving and strengthening species which fulfil several functions within the forest ecosystem; they e.g. improve the water regime, create more favourable microclimate in forest stands or reduce the stands' vulnerability to calamities caused by pests.

The current composition of the Czech Republic's forests differs a lot from **the reconstructed natural composition**[1] (Charts 4 and 5). While the present composition is dominated by coniferous forests, deciduous forests prevail in the natural structure and their proportion should account to 65.3% of the whole of the Czech Republic's forest area (i.e. by 40 p. p. more than the current representation). The differences between the current composition and the natural composition lie in the species structure, too. While the current composition of coniferous forests is dominated by spruce, in natural composition, fir should prevail (19.8%) and spruce should account for only 11.2% of the Czech Republic's total forest area. The difference between the natural and present compositions is significant for pine, which should occupy a smaller area (by 13.3 p. p.) of the Czech Republic's forests. The reconstructed natural composition of deciduous forests should be dominated by beech (40.2% of the Czech Republic's forest area) and oak (19.4%), which means by 32.7 p. p. and 12.4 p. p. respectively more than the two species are represented at present. Smaller differences are between the current and **the recommended compositions of the Czech Republic's forests**[2] according to which the area of deciduous forests should account for 35.6% of the Czech Republic's total forest area, i.e. by only 10.3 p. p. more than it is at present.

The age structure of forests is not proportional in the Czech Republic (Chart 6). In recent years, the area of overmature stands (over 120 years) is growing; it increased by 1.8 p. p. for the period 2000–2011.

This may be caused by the forest management methodology applied in specially protected territories and in protective forests and by postponing the renewal of economically unattractive, less accessible or low-quality stands[3]. Over-mature stands have reduced vitality and that is why there is also a higher proportion of incidental felling in them. On the other hand, this trend may have a short-term positive effect on species linked to forests of higher age and with a big amount of dead wood. The area of stands younger than 60 years is below the required size and has a decreasing trend; it dropped by 1.5 p. p. during the period 2000–2011. There is only one exception – age class one, which had a growing trend until 2009 but since that year it is falling again; during the period 2009–2011 it dropped by 1.2 p. p.

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

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

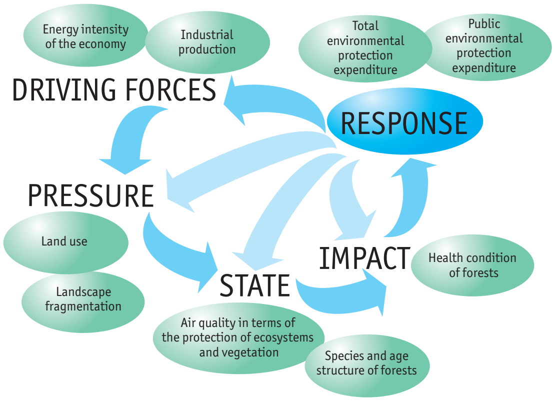
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1961)

[1] The reconstructed natural composition is close to the climax composition in the time before humans began influencing the forest.
[2] The recommended forest composition is a comprehensively optimized compromise between the natural composition and the composition that is most advantageous from the current economic perspective.
[3] Report on the State of Forests and Forestry in the Czech Republic in 2010, Ministry of Agriculture of the Czech Republic.

14/ Responsible forest management

KEY QUESTION

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



KEY MESSAGES

The proportion of deciduous trees in the Czech Republic's forest area is rising very slowly but steadily; during the period 2000–2011, it increased by 3 p. p. Total forest stock has been increasing over the long term.

The proportion of broad-leaved tree species in afforestation in the Czech Republic was growing very slightly in recent years, but it decreased in 2011 by 2.1 p. p. compared to 2010. While the proportion of fir in afforestation has been rising over the long term, there was a slight decline in the last two years (by 9.6%).
However, the proportion of fir in the Czech Republic's total forest area has stagnated.

In 2011, the area of natural renewal grew decreased by 1% compared with 2010.
The forest area certified on the basis of sustainable forest management pursuant to PEFC peaked in 2006 and recently it has declined to its current level 69.7% of the Czech Republic's total forest area.
The percentage of forest area certified by means of the more environmentally demanding FSC system remains very low (1.9% of the total forest area).

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The **EU Forest Action Plan** for the period 2007–2011 aims mainly at supporting and strengthening sustainable forest management and the multifunctional role of forests.

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

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

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

Other important documents are the **State Programme of Nature Conservation and Landscape Protection of the Czech Republic** and the **National Biodiversity Strategy of the Czech Republic**, which aim to increase species diversity in forest stands towards a natural species composition, to increase structural diversity of forests and the proportion of natural regeneration in stands suitable from genetic and species point of view and to enhance the non-production functions of forest ecosystems.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

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

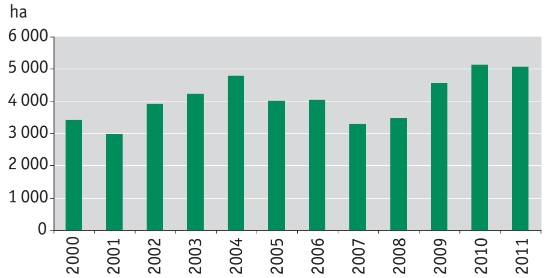
INDICATOR ASSESSMENT

Chart 1 → **Proportion of deciduous trees in the Czech Republic's total forest area and in afforestation [%], 2000–2011**

Source: Forest Management Institute, Czech Statistical Office

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

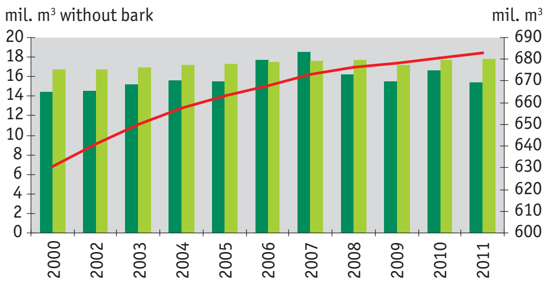
Chart 2 → **Development of natural renewal areas in the Czech Republic [ha], 2000–2011**



Source: Czech Statistical Office

- Natural renewal area

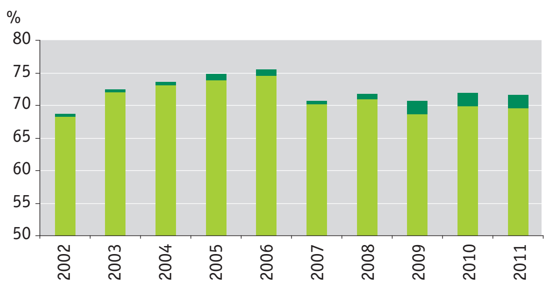
Chart 3 → **Comparison of wood felling and the total average growth [mil. m³ without bark] and the total stock in the Czech Republic [mil. m³], 2000–2011**



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

Source: Forest Management Institute, Czech Statistical Office

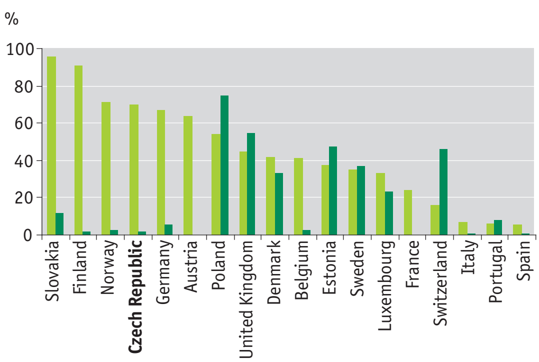
Chart 4 → **Development of the proportion of forest area certified pursuant to the PEFC and FSC principles in the Czech Republic's total forest area [%], 2002–2011**



- FSC
- PEFC

Source: FSC Czech Republic and PEFC Czech Republic

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



- PEFC
- FSC

Source: FSC Czech Republic and PEFC Czech Republic

In 2011, total of 21,700 ha were newly afforested in the Czech Republic (i.e. 0.7% of the country's total area), while afforestation with coniferous stands accounted for 61.4% and that with deciduous species for 38.6%. Thanks to responsible forest management in recent years, an increasing number of deciduous tree species (beech, oak and linden) are used in forest regeneration which contributes to a more natural and stable structure of forest stands. **The proportion of deciduous trees in afforestation** was at a stable level of 35% for long but has slightly grown over the last two years up to 40.7% in 2010. In 2011, however, there was a slight decrease (by 2.1 p. p.) to 35.6% (Chart 1). **The proportion of deciduous trees in the total forest area** has been growing steadily to reach 25.3% in 2011.

The natural forest regeneration has almost tripled over the period in question (since 1995), which is a significant positive phenomenon from the forestry and environmental perspectives. In 2004–2007, the proportion of natural regeneration decreased but since 2008 it had been growing to reach 19% of the total forest regeneration in 2010 (there was an increase by 12.4% in comparison with the year 2009), however, a slight decrease was recorded again in 2011 (namely by 1%, see Chart 2).

The total standing wood stocks have been increasing over the long term, nevertheless, the growth dynamics has been slowing down in recent years. In 2011, they reached 683 mil. m^3 (Chart 3). A main reason for the long-term growth of the total wood stocks consists in the fact that certain age groups whose areas are especially large are maturing and, at the same time, the mean age of trees is increasing. Another reason is that **wood felling** has not exceeded **the total average growth** (Chart 3) over the long term. The year 2007 was an exception; at that time, maximum wood felling values were recorded, namely due to processing of the wood mass damaged by hurricane Kyrill and the subsequent destruction caused by bark beetle (salvage felling accounted for 80.5% of the total felling). During the period in question, the amount of wood felling was about 15 mil. m^3 without bark per year and in 2011 it reached 15.4 mil. m^3. In 2011, the amount of salvage felling accounted for one fifth of the total completed felling, namely 3.8 mil. m^3, i.e. the lowest value since 2000; in this way, more favourable conditions have been created for planned forest management. The total average increment has been stable at about 17 mil. m^3 without bark during the period concerned (since 2000).

The area of forests certified in accordance with the principles of PEFC (Programme for the Endorsement of Forest Certification Schemes), **and FSC**[1](Forest Stewardship Council), i.e. forests managed in a sustainable way, reached its peak in 2006 (75.4 % of the Czech Republic's total forest area). In 2007, there was a decrease (by 4.7%), and since that year, it has been stable at about 70% of the Czech Republic's total forest area. Forest certification developed in the Czech Republic primarily after the year 2000; at that time, there were efforts focused on sustainable forest management as well as on informing consumers about the environmental qualities of wood. The reason for the decrease in issued certificates in recent years seems to be compliance with the demanding certification standards but also with financial requirements. Of the total number of issued certificates, most are PEFC (97.4%). For these certificates, a slight decrease was registered compared to last year (by 0.2%). The forest area certified under the FSC system, which is more stringent but also more environmentally sound, remains small (Chart 4), and in 2011, compared with the previous year, it dropped again by another 4.7% (because the certificate of the Žehrov Forestry Management Unit expired) to the value 1.9% of the Czech Republic's total forest area (49,000 ha).

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

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

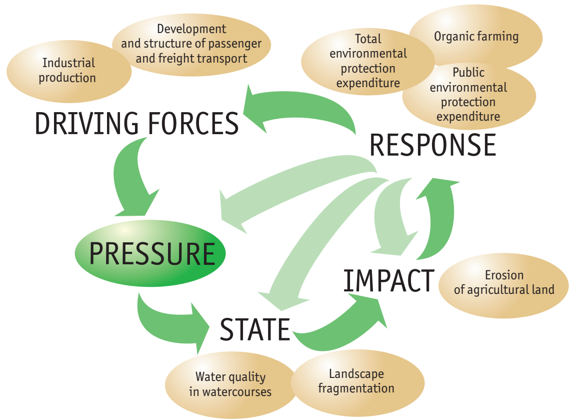
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1851)

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

15/ Land use

KEY QUESTION →

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



KEY MESSAGES →

Within agricultural land, there is a positive growth in permanent grasslands area (by 2.9% during 2000–2011) at the expense of arable land (decrease by 2.7% in 2000–2011). The forest area is increasing slightly (between the years 2000–2011 it grew by 0.9%).

There is a loss of agricultural land (for the period 2000–2011 by 1.2%), in particular arable land, as a result of enlargement of built-up and other areas (between the years 2000–2011, there was an increase by 3%).

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

The **State Environmental Policy of the Czech Republic** aims at „environmentally friendly land use", i.e. it strives to minimise free-landscape disturbances, to reclaim or otherwise use disrupted landscape, remove old environmental contamination, to prevent landscape fragmentation and even reduce fragmentation through developing bio-corridors and the territorial systems of ecological stability.

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 parts that are able to withstand negative external influences. It also aims at maintaining and enhancing the natural and aesthetic value of the landscape, ensuring sustainable use of landscape as a whole, especially through limiting the development in open landscape, maintaining landscape permeability and limiting further fragmentation with preferential use of areas within residential zones and at ensuring adequate care for the optimised system of specially protected areas. It shall also ensure that territorial systems of ecological stability are defined as the irreplaceable basis of natural landscape infrastructure which guarantees conservation of biological diversity and 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, inter alia, to protect and develop the natural, civilization and cultural values of the territory in the public interest, to preserve the character of the territory's unique town-planning structure, the settlement structures and unique cultural landscape, to create preconditions for multi-purpose use of abandoned sites and areas (i.e. brownfields of industrial, agricultural, military or other origin), to use built-up areas economically (support to development through revitalisation or reclamation of land) and to protect undeveloped areas (especially agricultural and forest land).

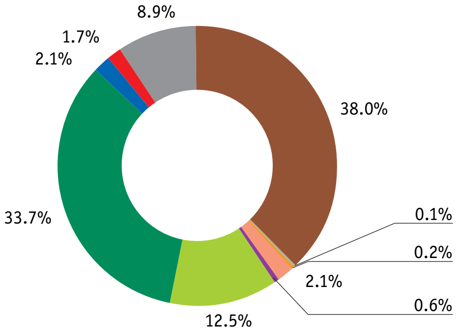
The issue of landscape and land use is also addressed by the **Strategic Framework for Sustainable Development in the Czech Republic**, namely by priority axes "Spatial development" and "Landscape, ecosystems and biodiversity".

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Changes in the landscape structure caused by land use changes, increasing rate of development and environmentally unfriendly management have a significant influence on the run-off conditions and therefore on the course and consequences of accidental natural phenomena, especially floods. New development brings changes to the surface pattern (reinforced areas, new scene dominants, dumps, embankments etc.).

INDICATOR ASSESSMENT

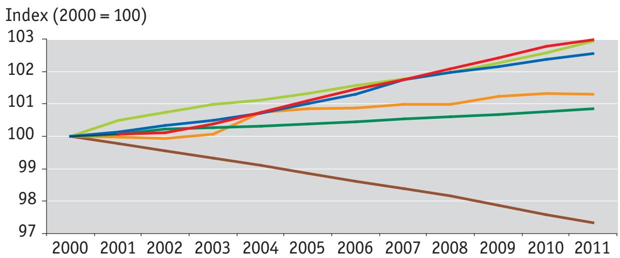
Chart 1 ➔ **Land use in the Czech Republic [%], 2011**



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

Source: Czech Office for Surveying, Mapping and Cadastre

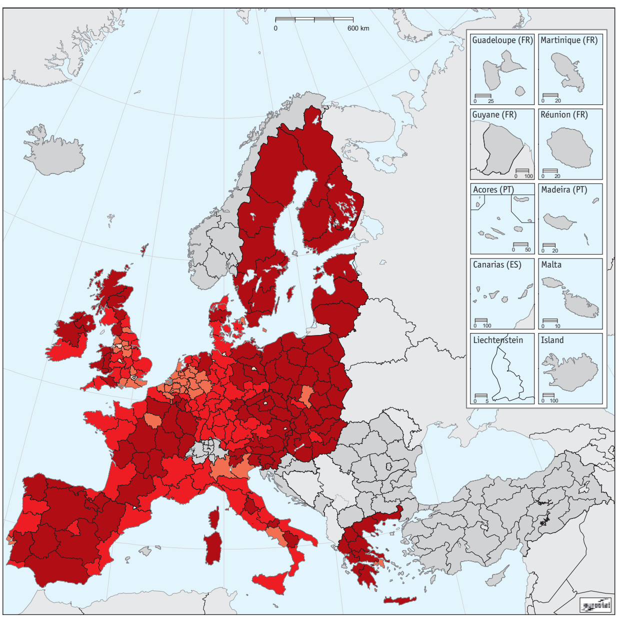
Chart 2 ➔ **Land use trends in the Czech Republic [index, 2000 = 100], 2000–2011**



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

Source: Czech Office for Surveying, Mapping and Cadastre

Figure 1 ➔ **International comparison of the proportion of built-up and other areas in the territory's total area, 2009**



% of the total area of NUTS 2 regions
- <= 5
- 5–10
- 10–25
- > 25
- Data not available

Source: Eurostat

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 terms of the land-use typology, most of the Czech Republic's territory is covered by forest-agricultural and agricultural landscape, typical for Central Europe. In 2011, according to the data of the Czech Office for Surveying, Mapping and Cadastre[1], agricultural land accounted for 4,229,000 ha (i.e. 53.6% of the total land fund area) and non-agricultural land accounted for 3,657,000 ha. Arable land accounts for the largest proportion of agricultural land resources (70.9%), followed by permanent grassland (23.4%), while the remaining 5.7% consists of hop fields, vineyards, orchards and gardens (Chart 1).

Trends in land-use changes after 2000 are characterised by gradual loss of arable land and increase in permanent grassland within agricultural land resources, and also by the gradual growth of the built-up and other developed areas (Chart 2). These changes are the result of so-called extensification of the use of less attractive and more remote regions where the area of arable land is decreasing while the areas of permanent grassland and forest land are growing. On the other hand, for the main agricultural areas and urban centres, intensified use is typical; its consequences are, in particular, the increase of the size of built-up and other developed areas, sometimes also arable land, at the expense of the other land-use categories which are more valuable from the environmental point of view. While the former process is viewed rather positively from the landscape-ecology perspective, the intensification of use is definitely negative.

In 2011, the loss of **arable land** accounted for the total of 9,056 ha (about 3% of the total area). Approximately 53% of this area of arable land has been transformed into permanent grassland (most of it being in the South Bohemian region and the region of Plzeň), another approximately 30% of it was built up, which represents an area of approximately 7.5 hectares being developed each day. The share of arable land being occupied to the benefit of built-up and other developed areas (e.g. transport infrastructure) was the biggest in the capital city of Prague (about 95% of 82 ha), followed by the South Moravian region (58.4%) and Central Bohemian region (33.3%). In 2011, by contrast, arable land resources increased by new 1,356 ha of arable land, namely through transformation of permanent grassland and other areas (mainly in the regions of Karlovy Vary, Ústí nad Labem and South Moravia). As a result of these changes, the overall balance of arable land decreased interannually by 7,700 ha, i.e. by 0.26%; since 2000, the total area of arable land decreased by 2.7%.

In 2011, **permanent grassland area** has been enlarged by 3,434 ha, i.e. by 0.3% (since 2000 by 2.9%). New permanent grassland arises on former arable land predominantly; 4,794 hectares of arable was lost at the expense of permanent grassland in 2011 (about a quarter of them being in the South Bohemian region). This value is greater than the total increase because some permanent grassland was contrarily put under plough and converted into arable land (557 km^2), or used in some other way.

In 2011, the size of **built-up and other developed areas** increased interannually by 1,656 ha (0.2%); since 2000 it has grown by 24,162 ha (3%). There is also a positive finding – the development intensity is decreasing in recent years. The area which was taken up by new development in 2011 was smallest since 2002, and in comparison with the year 2004 (when about 2,800 ha were built up), it was at the level of approximately 60% of the then state. In 2011, built-up and other developed areas accounted for approximately 834,200 ha, which represents 10.6% of the Czech Republic's total area.

In recent years, changes in land use, particularly in Prague and Brno agglomerations, are affected by **the suburbanisation process** although its intensity is lower than it was in the past. In some places, suburbanisation causes area-important but territorially incompact and unaesthetic expansion of built-up areas with negative environmental, economic and social impacts (i.e. urban sprawl) without ties to the sufficiently proportioned social and transport infrastructure. One of the adverse effects of suburbanisation is the growing intensity of individual car transport (and related negative impacts), especially on the main roads leading to centres of large cities.

In the international context, the Czech Republic is a country with above-average proportion of arable land in the country's total area and a slightly above-average forest coverage which is, however, only about a half of that in Scandinavian countries. As regards the built-up and other developed areas, the Czech Republic is below the average, particularly in comparison with Germany, the United Kingdom, France or Italy, which rank among the countries with a high proportion of built-up areas in the country's total area (Figure 1).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

[1] *Data for the Land Use Indicator are taken from the publication Summaries of the Soil Fund from the Czech Republic Real Estate Cadastre issued by the Czech Office for Surveying, Mapping and Cadastre and it always describes the state up to 31st December of the given year.*

16/ Landscape fragmentation

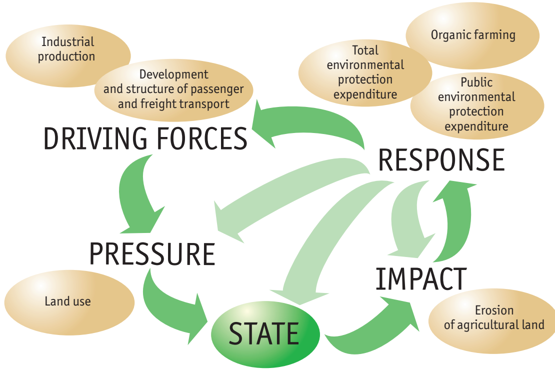
KEY QUESTION

Is there a slowdown in the landscape fragmentation process?

KEY MESSAGES

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

At present, more than 6,000 transverse barriers are recorded in the Czech Republic's watercourses which have an adverse impact on the aquatic ecosystems' biodiversity.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The Czech Republic's obligations arise from the **European Landscape Convention** which aims at ensuring the protection of individual types of European landscape.

The issue of passability of transverse barriers in watercourses is dealt with by the **Directive 2000/60/EC of the European Parliament and of the Council** of 23rd October 2000 establishing a framework for Community action in the field of water policy (the Water Framework Directive); it aims at the gradual removal of transverse barriers hampering the aquatic organisms' migration and of the burden on aquatic environments in all EU member states. Another important document is the **Council Regulation No. 1100/2007** of 18th September, 2007 establishing the measures to regenerate the stocks of European eel (Anguilla Anguilla).

The **Council Directive No. 92/43/EEC** (the Habitats Directive) dated 21st May 1992 on the conservation of natural habitats and of wild fauna and flora is also an important document.

At the national level, the fragmentation of river systems is addressed in the **Act No. 254/2001 Coll.,** on water and amendment to some acts (The Water Act) which provides for limitations to permitting a water construction, its modifications or changes in its use as well as its removal.

The **Concept of Making the Czech River Network Passable** is an important strategic tool; it has been prepared by the Ministry of Environment and its sectoral organizations and it aims at a systemic solution to renewal of the river continuum, taking into account the needs of aquatic and water-related ecosystems. The Concept defines the watercourses or their parts that are important from the migration point of view on two levels: Above-regional priority habitat corridors with international relevance and national priority sections of watercourses in terms of the territorial and species protection.

The **State Environmental Policy of the Czech Republic** deals with the issue of fragmentation in the chapter "Environmentally Friendly Land Use"; one of its aims is to prevent landscape fragmentation, to reduce it by means of habitat corridors and enhancing of the territorial system of ecological stability.

The **State Nature Conservation and Landscape Protection Programme of the Czech Republic** aims, inter alia, at ensuring the sustainable use of landscape as a whole, namely by limiting new development in the landscape, while maintaining its permeability and limiting further fragmentation, with the use of areas within settlements (or with links to them) being preferred.

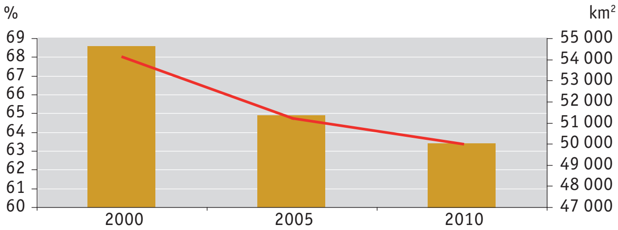
The **Spatial Development Policy of the Czech Republic** is an instrument of land-use planning. Its priorities include, inter alia, to ensure the protection of undeveloped territories (especially agricultural and forest land), to preserve public greenery including minimisation of its fragmentation. Another priority focuses on placing the development projects which may have a significant impact on landscape to sites where there is the least conflict and on subsequent support to necessary compensation measures.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Landscape fragmentation, i.e. its gradual breaking into smaller parts, is a growing problem at present, and it's primarily because its negative effects are not immediate, but they are long-term and often irreversible. Within landscape fragmentation, natural habitats of individual species of organisms are taken over and links among the functionally interconnected ecosystems are interrupted which makes migration of the organisms difficult. These negative processes have impacts on the single species populations and also on the ecosystems as wholes which provide services that are essential for the human society. Fragmentation of the river systems is another topical problem because as a result of watercourses regulation and introduction of transverse barriers, migration of aquatic and water-related organisms is restricted, which leads to the limitations of their natural distribution range, use of food resources, or availability of suitable reproduction areas.

INDICATOR ASSESSMENT

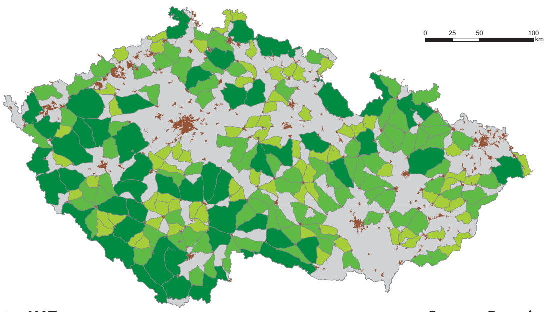
Chart 1 → **Development of the Czech Republic's area that is not fragmented by traffic, 2000, 2005 and 2010**



Source: Evernia

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

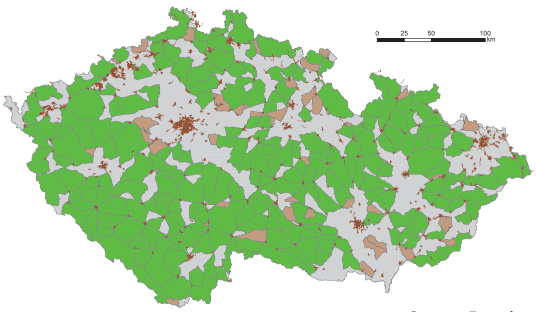
Figure 1 → **Landscape fragmentation due to transport in the Czech Republic, 2010**



Source: Evernia

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

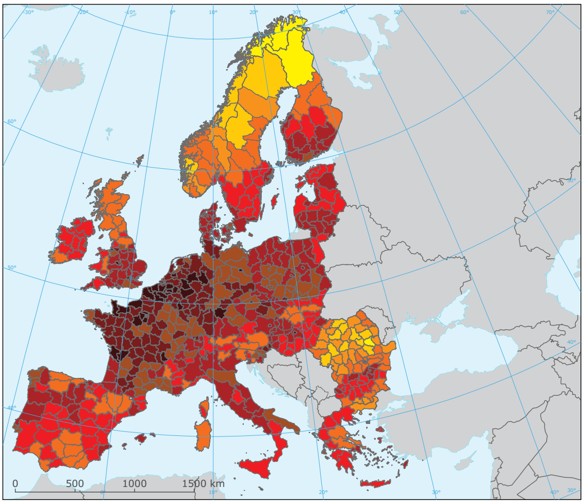
Figure 2 → **Dynamics of landscape fragmentation due to transport in the Czech Republic between the years 2005 and 2010**



Source: Evernia

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

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



- < 0.10
- 0.11–0.25
- 0.26–0.50
- 0.51–1.00
- 1.01–5.00
- 5.01–10.00
- 10.01–25.00
- 25.01–50.00
- 50.01–100.00
- > 100
- Data not available

Source: EEA

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

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

The highest level of landscape fragmentation within the Czech Republic has been recorded in Central Bohemia, South Moravia and the Moravian-Silesian region (Figure 1), which also belong to the regions with the highest decline in unfragmented areas in 2005–2010 (Figure 2). The high increase of fragmentation is caused by the territorially incompact urban sprawl and related transport infrastructure and also by the construction of motorways and express roads. In 2000–2010, a total of 4,590 ha of agricultural land and 357 ha of forest land were taken over for the construction of transport infrastructure in the Czech Republic. Most agricultural land was taken up in 2004–2006 in Central Bohemia, the City of Prague, Moravian-Silesian region and the region of Olomouc. In the Central Bohemian region, they were linked mainly with construction of the Prague ring road and in the Moravian-Silesian region with the construction of D1/D47 motorway. On the other hand, the South-Bohemian region and the region of Plzeň, where there is the least dense road network, belong to regions with the highest number of unfragmented areas.

Fragmentation of the Czech Republic's river network (training of watercourses with transverse barriers) is an important anthropogenic pressure and it has adverse impacts on biodiversity of the river ecosystems. The watercourses' regulation was most intensive in 19th and 20th centuries, in connection with industrialisation of the landscape and increased demands for the use of water resources. At present, flood prevention measures also have their influence. In the territory of the Czech Republic, more than 6,000 transverse barriers are recorded, including weir barriers higher than 1 m and water reservoirs larger than 50 ha. At important watercourses managed by the state enterprise Povodí (21.3% of all watercourses in the Czech Republic), a total of 844 weirs were recorded in 2010, of which 193 are managed by state enterprise Povodí Labe, 338 by state enterprise Povodí Vltavy, 42 by state enterprise Povodí Ohře, 189 by state enterprise Povodí Moravy and 82 by state enterprise Povodí Odry. Damming of a watercourse results in the degradation of habitats, restriction or loss of free animal migration and changes in the communities of aquatic species of organisms. In the Czech Republic, occurrence of 12 fish species which migrate between the sea and the river environments was documented on the basis of a reconstruction of historical sites but only two of them are currently recorded in the Czech Republic's territory, namely common eel (Anguilla Anguilla) and Atlantic salmon (Salmo salar).

The Concept of Making the Czech River Network Passable was compiled as a response to extensive fragmentation of the Czech Republic's river system and to the need to make the transversal barriers passable. The Concept lists several above-regional priority habitat corridors, namely the Labe international River Basin (where 11 priority sections have been determined), the Odra international River Basin with 3 priority sections and the Danube international River Basin with 2 priority sections. The first phase of making the river network passable, which will last until 2015, includes those sections of the watercourses passability of which is incorporated into programmes of measures within the watersheds' first plans. Within the Labe international River Basin, this concerns 45 transverse barriers, within the Odra international River Basin there are 9 transverse barriers and within the Danube international River Basin 10 transverse barriers.

In international comparison, the Czech Republic belongs to the states with the highest fragmentation, together with Belgium, Denmark, the Netherlands, France and Germany (Figure 3). Unlike the Scandinavian countries, which are characterized by the lowest fragmentation in Europe, these are the states with an extensive transport infrastructure and a high proportion of built-up areas.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

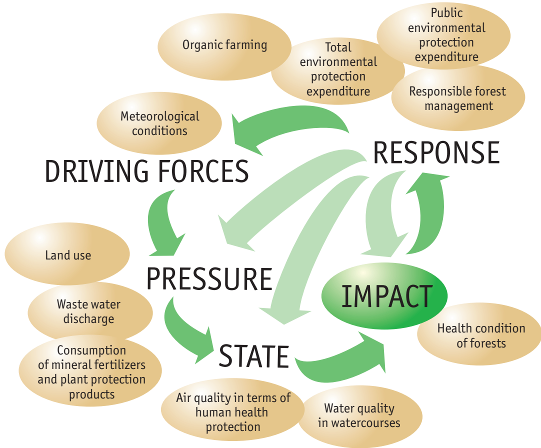
17/ Erosion of agricultural land

KEY QUESTION

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

KEY MESSAGES

In the Czech Republic's territory, 18.9% of agricultural land is under potentially strong to extreme threat of water erosion and 5.0% is at risk of wind erosion. Interannually, there have been no substantial changes in the proportion of soil at risk of water erosion while concerning wind erosion, there was a 6% decrease in the category of soil without risk. According to GAEC 2 standards concerning categories of soil prone to water erosion, 10.2% of the soil in the Czech Republic's territory is at slight risk of erosion and 0.45% of it is at high risk of erosion.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

At present, one of the priority areas of the EU's Common Agricultural Policy is the solution to the negative effects of agriculture on landscape and the environment, which also includes risk of agricultural land erosion. One of the axes of the **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013** emphasises support to environmentally friendly agricultural practices in rural landscape as well as the water and soil protection through measures aimed at the anti-erosion protection and appropriate use of agricultural land resources.

The **Conception of the Agricultural Policy after the EU Accession for the Period 2004–2013** and the **Strategic Framework for Sustainable Development in the Czech Republic** mention the risk of water and wind erosion and other ways of soil degradation (such as compacting) among the significant problems. Subsidies to agriculture also support sustainable management of agricultural land. The payment of direct support for farmers under the **Council Regulation (EC) 73/2009** and of other selected subsidies is made dependent on fulfilment of the **Statutory Management Requirements (SMR)** and **Good Agricultural and Environmental Conditions (GAEC)**[1], while GAEC 1 and GAEC 2 concern soil erosion. Emphasis is put on the protection of soil against erosion on sloping land, the soil protection against water erosion and on the effort to reduce the negative impact of the consequences of erosion (e.g. damage to roads and real estate). The GAEC and SMR standards are parts of the cross compliance system. The extension of GAEC 2, focusing on restrictions on the cultivation of wide-row crops on soils threatened with moderate erosion, is effective from 1st July 2011.

The protection of agricultural land in the Czech Republic is addressed by the Act No. 334/1992 Coll., on the protection of agricultural land resources and the Decree No. 13/1994 that regulates some details of the protection of agricultural land resources. Furthermore, the Act No. 254/2001 Coll., on waters and amendments to some acts and the Act No. 114/1992 Coll., on nature conservation and landscape protection impose the obligation on land owners to ensure that soil loss by erosion is prevented.

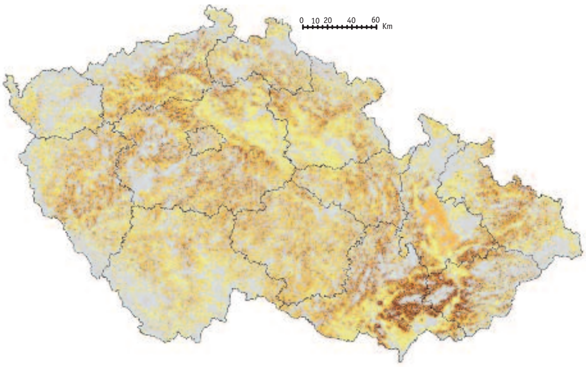
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The erosion process itself is a natural phenomenon but the problem consists in the accelerated rate of erosion of agricultural land that is caused by inappropriate farming methods, such as massive uniting of plots, monocultures, rough land management regardless of the plots' slopes and other physical geographic conditions, or also inappropriate use of land for RSE cultivation (e.g. maize). Primarily, erosion means a soil quality decrease as its most fertile parts are removed and thus the production capacity of the soil is reduced, its ecological functions are lost, the water retention and infiltration are inhibited etc. Damage caused by soil erosion, however, is reflected in the extent of water resources' pollution, water reservoirs' siltation, in damage to property (run-off of fertilizers and plant protection products, siltation of the melioration and sewerage networks, loss of seed and seedlings). It is the run-off of soil particles and of nutrients and other chemicals bound (industrial fertilizers, pesticides, various types of agricultural and industrial waste) to them which poses a risk to water resources, in particular those which are used for drinking water processing and for recreation.

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

INDICATOR ASSESSMENT

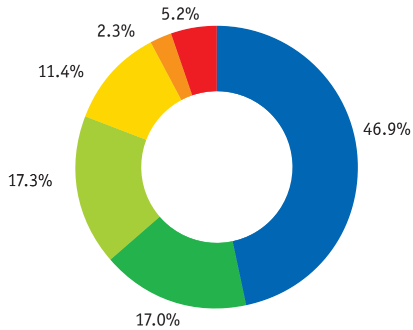
Figure 1 ➔ **Potential vulnerability of agricultural land to water erosion in the Czech Republic, 2011**



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

Source: Melioration and Soil Protection Research Institute

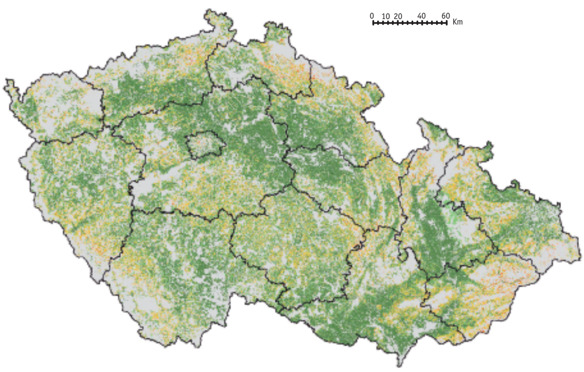
Chart 1 ➔ **Potential vulnerability of agricultural land to water erosion expressed as the long-term average soil loss (G) in the Czech Republic, 2011**



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

Source: Melioration and Soil Protection Research Institute

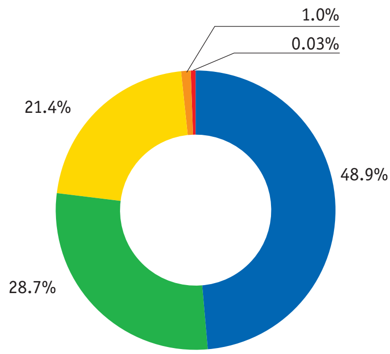
Figure 2 ➔ **Maximum admissible value of the cover and management factor (C_p) in the Czech Republic, 2011**



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

Source: Melioration and Soil Protection Research Institute

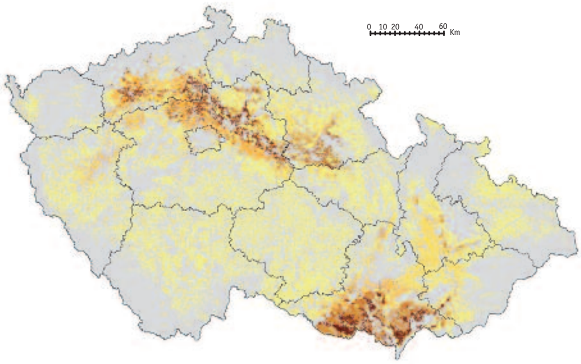
Chart 2 ➔ **Vulnerability of agricultural land to water erosion expressed as the maximum admissible value of the cover and management factor (C_p) in the Czech Republic [%], 2011**



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

Source: Melioration and Soil Protection Research Institute

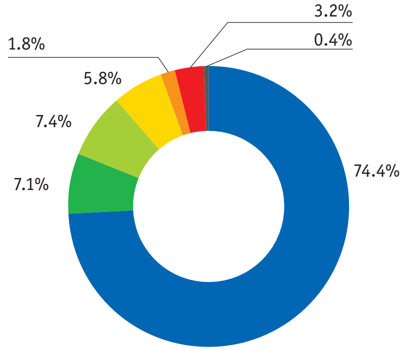
Figure 3 ➜ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2011**



- Soil without vulnerability
- Fractionally vulnerable soil
- Slightly vulnerable soil
- Vulnerable soil
- Strongly vulnerable soil
- Most vulnerable soil
- Non-agricultural and other land
- Regional borders

Source: Melioration and Soil Protection Research Institute

Chart 3 ➜ **Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2011**



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

Source: Melioration and Soil Protection Research Institute

Soil is the basic means of production in agriculture and forestry, it reacts to inappropriate management procedures very sensitively and it is subject to a number of degradation processes, such as erosion, compaction, acidification, contamination, loss of organic matter, or landslides. Degradation results in limitation on or loss of both the productive and non-productive functions of the soil. A significant risk associated with soil in the Czech Republic consists in the accelerated erosion of agricultural land that is conditioned anthropogenically. The erosion itself is a natural process and predisposition of soil to erosion depends on natural factors (climatic conditions, soil conditions, morphology of the area, vegetation conditions), which, however, may be secondarily influenced by anthropogenic factors. Therefore, human activity can be the start-up factor of the accelerated erosion also on plots that are not otherwise threatened by erosion.

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

The potential vulnerability of agricultural soil to water erosion can be quantified by means of **long-term average annual soil loss** (G)[2] (in $t.ha^{-1}.year^{-1}$). Agricultural land which is potentially extremely vulnerable to water erosion occupies 5.2% of the agricultural land resources and the G value for these soils is higher than 10.1 $t.ha^{-1}.year^{-1}$ (Chart 1). The largest area of this land is concentrated in South Moravian region (23.5%) and Central Bohemian region (14.8%). Agricultural land which is medium to very strongly vulnerable occupies 30.9% of the total agricultural land (G is equal to 2–10 $t.ha^{-1}.year^{-1}$). Very slightly and slightly vulnerable soil covers 63.9%.

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

The maximum permissible value of the cover and management factor (C_p)[3] is a tool to assess water erosion in the Czech Republic, which serves as a basis for such a framework management of land units which brings about no signs of above-limit loss of soil due to water erosion (Fig. 2, Chart 2). The framework management based on C_p is recommended for a total of 51.2% of agricultural land in the Czech Republic. Potentially the most vulnerable soil with the C_p value under 0.005, for which it is recommended to convert the land units or their parts into permanent grassland, occupy only 0.03% of the Czech Republic's agricultural land. For 1.0% of strongly threatened soils it is recommended to grow only perennial crops (e.g. clover, lucerne). The threatened land accounts for 21.4% of agricultural land resources and for them it is recommended to exclude growing of wide-row crops while narrow-row crops can only be grown using soil-conserving technologies. On slightly vulnerable soils (28.7%), wide-row crops can be cultivated using soil-conserving technologies. The C_p values have also been used to define strongly and slightly vulnerable soils for the needs of **the GAEC standards** which ensure that the management is in accordance with protection of the environment.

Determination of **the potential vulnerability of agricultural land to wind erosion**[4] is based on the BPEJ (evaluated soil-ecological units) database, i.e. primarily on the data concerning climatic regions and the major soil units. Currently, approximately 10.8% of agricultural land is at risk of wind erosion (the most threatened soil, strongly threatened soil and threatened soil) in the Czech Republic; it is by 2.1% more than in the previous year (Fig. 3, Chart 3).

Interannual changes in the overall water erosion extent are minimal and they are difficult to compare with the previous years, because the methodology to determine vulnerability of soil to water erosion has changed in order to make the data more accurate and to acquire new knowledge. Therefore, only the values since 2009 can be compared. It is rather possible to follow the changes in smaller territories, which face soil denudation as a result of single precipitation episodes. This brings about, for example, loss of crop, damage to roads, railways, buildings and buried services and water reservoirs siltation. Damage is also caused by wind erosion, which, nonetheless, threatens only a fraction of agricultural land. Along with loss of the most fertile parts of the soil profile and deterioration of its physical and chemical properties, wind erosion also damages sprouting plants and causes air pollution. In long terms, the state is getting worse which is documented by increasing costs concerning the removal of erosion-related damage and reconstruction of destroyed property owned by municipalities and other entities concerned. The increasing rate of erosion is also influenced by more frequent occurrence of extreme weather phenomena but also by inappropriate farming methods.

Determination of areas that are at risk of erosion (while taking into account other characteristics of a given area) may also help to evaluate agricultural land more adequately, to apply anti-erosion measures more efficiently and to provide subsidies for farming in less favourable conditions. The anti-erosion measures are based on slowing down the surface run-off and transforming it into groundwater run-off, on safer diverting of surface water from the watershed, on capturing the denuded soil, on water retention in landscape, on the protection of towns, villages, roads and railways against soil erosion consequences and also on reduction of the wind speed and its harmful effects. This is achieved through a set of organizational, agro-technical and technological measures.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

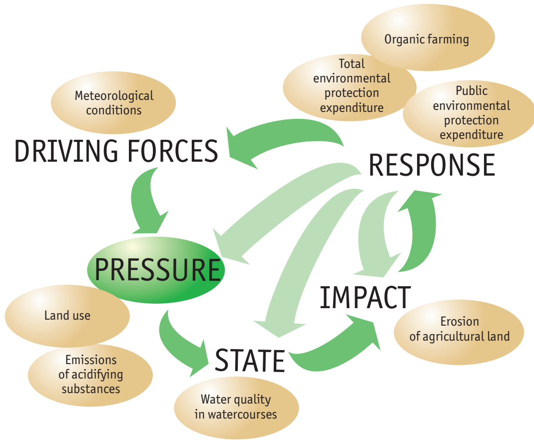
[3] C_p does not examine the potential level of risk, but it serves directly as an erosion protection tool (it means that it not only shows where the soil is threatened but also how to protect it effectively). Its value should not be exceeded in the given place, and if it is, it should be eliminated through anti-erosion measures. The maximum permissible values of the cover and management factor (C_p) are divided into 5 categories. All acreages are absolute or relative expressions of the proportion of the given category in the total acreage of agricultural land resources according to the BPEJ (evaluated soil-ecological units) database.

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

18/ Consumption of mineral fertilizers and plant protection products

KEY QUESTION

Is the amount of chemicals used in agriculture decreasing?



KEY MESSAGES

After a period of steady growth starting in 2000, the consumption of mineral fertilizers declined significantly in 2009 (by 38.5%) but in the last two years, it is rising again. For the period 2000–2011, the consumption grew by 56.1%. In 2011, it increased by 27.1% compared with 2010, and thus it reached the value 118.5 kg.ha^{-1}, which is the highest value since 2000.

The consumption of lime substances had a decreasing trend between the years 2000 and 2005, but since 2006, it has been rising again. In 2011, it increased by 46.6% compared to 2010, i.e. up to 173,000 t.

In 2000–2011, application of plant protection products has increased by 30% and, due to the weather in 2011, it increased by 8% compared to the previous year and thus it reached 5,595,000 kg of the active substance.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The **Decision No. 1600/2002/EC of the European Parliament and of the Council** of 22nd July 2002 laying down the Sixth Community Environment Action Programme states 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 the Council Directives 79/117/EEC and 91/414/EEC, the **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** of 25th November 2009 concerning statistics on pesticides. The above regulations introduce much stricter criteria for plant protection products registration and, at the same time, they regulate the use of the products and the assessment of their impacts on human and animal health and on the environment.

The **Council Directive 91/676/EEC** of 19 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (so-called Nitrate Directive) aims at reducing water pollution caused by nitrates from agricultural sources and at preventing such pollution in the future, in particular to ensure a sufficient amount of quality drinking water.

Another important document in this area is the **Regulation (EC) No. 2003/2003 of the European Parliament and of the Council** of 13 October 2003 relating to fertilizers, which concerns namely their labelling, definitions and composition.

In 2006, **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013** has been adopted which aims at increasing competitiveness in agriculture, improving the environment and landscape through supporting environmentally friendly land management methods and enhancing the quality of life in rural areas.

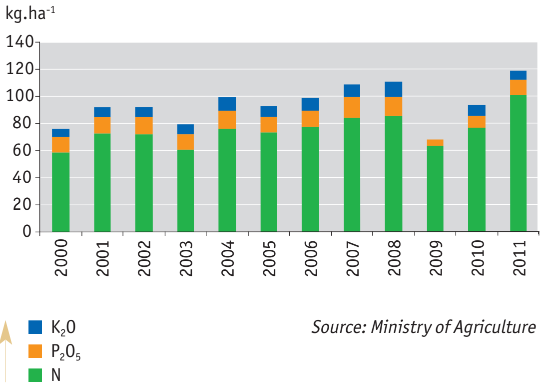
The priority area „The Environment and the Quality of Life" within the **State Environmental Policy of the Czech Republic** sets the partial objective to implement environmental aspects of agricultural management through good agricultural practice. The priority area "Sustainable Use of Natural Resources,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

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Excessive or inappropriate use of mineral fertilizers and plant protection products contributes to soil quality deterioration, causing decline in the soil micro-organisms' biodiversity and in numbers of agricultural bird species. Through the food chains, these agrochemicals are getting into food, thus threatening human health. Being washed out of the soil, they take part in the pollution of groundwater and surface water. This may result in the contamination of drinking water sources, especially by nitrates. Nitrates are important also in terms of anthropogenic eutrophication during which entire ecosystems are damaged.

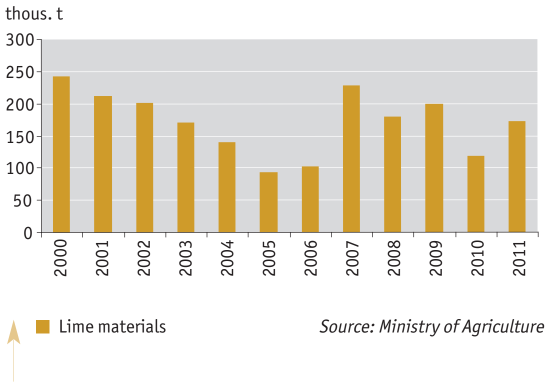
INDICATOR ASSESSMENT

Chart 1 → **Development of the consumption of mineral fertilizers in the Czech Republic [kg.ha⁻¹], 2000–2011**



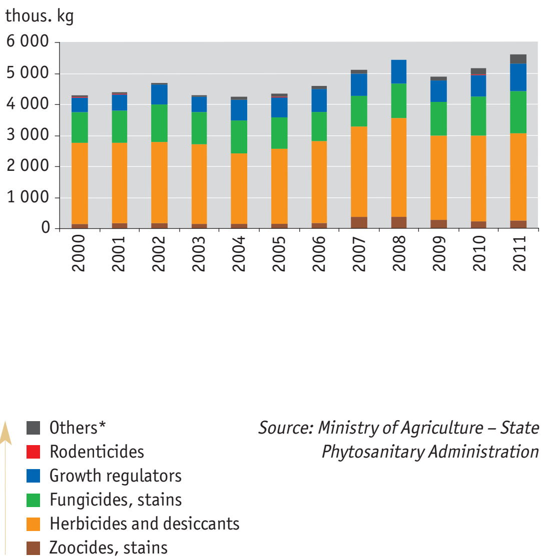
Source: Ministry of Agriculture

Chart 2 → **Development of the consumption of lime substances in the Czech Republic [thous. t], 2000–2011**



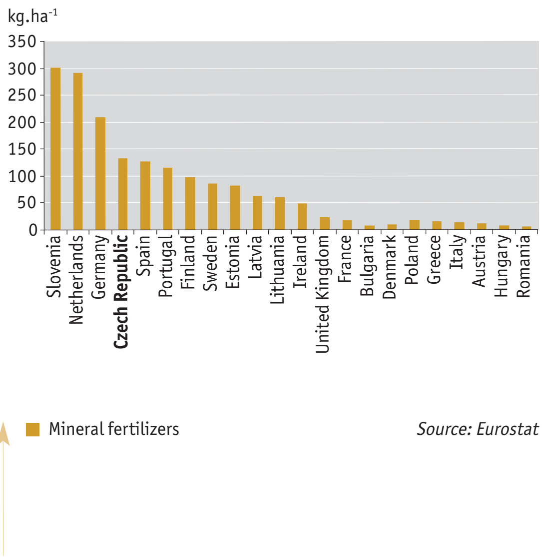
Source: Ministry of Agriculture

Chart 3 → **Development of the consumption of plant protection products in the Czech Republic [thous. kg of active substance], 2000–2011**



Source: Ministry of Agriculture – State Phytosanitary Administration

Chart 4 → **International comparison of the consumption of mineral fertilizers [kg.ha⁻¹], 2010**



Source: Eurostat

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

Consumption of mineral fertilizers, which contribute to soil and water contamination with chemicals, had dropped significantly after 1990, but since 2000 it was growing till the year 2008. In 2009, the total consumption of mineral fertilizers declined sharply by 38.5% compared to 2008. The reason for such a significant decrease consisted in high prices, in particular for phosphate and potassium fertilizers, and in low exercise prices of agricultural products[1]. In 2010, however, the consumption increased by 37% interannually, and in 2011 by another 27.1%, with the total consumption of net nutrients supplied by mineral fertilizers reaching 118.5 kg per 1 ha of agricultural land (Chart 1) which is the highest value since 2000. The main reason for the significant increase of mineral fertilizers' application lies in the fact that above-average harvest of agricultural crops was expected.

In terms of the different categories, the consumption of phosphate and potassium fertilizers is more or less constant, while the consumption of nitrogen fertilizers is growing. Within the different categories, net-nutrient consumption totalled 100.7 $kg.ha^{-1}$ for nitrogen fertilizers (as the content of N – nitrogen), 11.3 $kg.ha^{-1}$ for phosphate fertilizers (as the content of P_2O_5 – phosphorus (V) oxide) and 6.5 $kg.ha^{-1}$ for potassium fertilizers (as the content of K_2O – potassium (I) oxide). 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 of lime substances was 173,000 t in 2011; compared with the previous year, it increased by 46.6% (Chart 2). Following a steady decline in lime substances consumption starting in the mid 1990s, their consumption increased significantly in 2007–2009. This increase is probably caused by better financial conditions of the farmers and by education. Due to the decline in the use of lime substances in the past years, the share of agricultural land with increased acidity is growing; however, as application of these substances is going up gradually, decrease of the agricultural land's acidity can be expected.

The consumption of plant protection products is affected by the current occurrence of crop diseases and pests in the given year, which varies according to weather during the year, particularly air temperature and rainfall. In 2000–2011, the consumption of plant protection products increased by 30% and in 2011 only, by 8% compared with the previous year (Chart 3). This was caused by moderate to strong incidence of diseases and pests in cultivated crops due to above-average temperatures and below-average precipitation in 2011. A total of 5,595,000 kg of active substances contained in plant protection products have been applied to treat field cultures, special crops (fruit, vines, vegetables and hop) and crops in the category „other" (ornamental plants and trees, forest trees, storage of plant products etc.). Herbicides and desiccants (50.5%), fungicides and stains (24.2%) and growth regulators (15.9%) have the biggest proportion in the total consumption.

In international comparison, the Czech Republic has above-average values of mineral fertilisers' consumption (Chart 4); it belongs to the states with the highest consumption, following Slovenia, the Netherlands and Germany. On the other hand, the lowest consumption is in Romania, Hungary and Austria.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

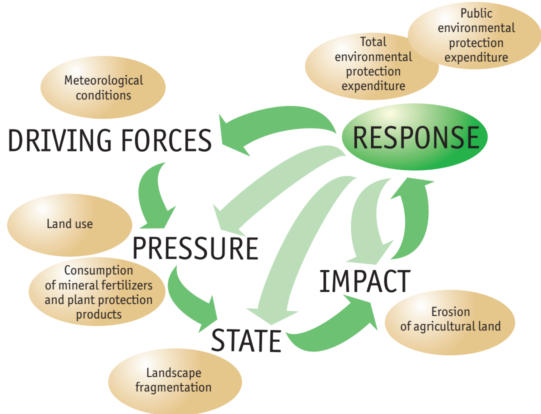
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1898)

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

19/ Organic farming

KEY QUESTION →

Is the proportion of agricultural land under organic farming increasing[1]?



KEY MESSAGES →

The proportion of agricultural land under organic farming and the number of both organic farms and organic food producers increases.

Interannually, the area of agricultural land under organic farming increased by 7.7% and in 2011, it accounted for 11.4% of the total agricultural land acreage. The number of organic farms has increased by 11% interannually and in 2011, it reached the value 3,920.

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 the **Council Regulation (EC) No. 834/2007 of 28 June 2007** on organic production and labelling of organic products and repealing the Council Regulation (EEC) 2092/91, and the **Commission Regulation (EC) No. 889/2008** of 5 September 2008 laying down detailed rules for the implementation of the Council Regulation (EC) 834/2007. The legislation also includes the **Commission Regulation (EC) No. 1235/2008** of 8 December 2008 laying down detailed rules for the implementation of the Council Regulation (EC) No. 834/2007 with regards to the arrangements for importing organic products from third countries, the **Commission Regulation (EC) No. 710/2009** of 5 August 2009 amending Regulation (EC) No. 889/2008 and laying down detailed rules for the implementation of Council Regulation (EC) No. 834/2007, as regards laying down detailed rules on organic aquaculture animal and seaweed production. Since 2007, the **Council Regulation (EC) No. 1698/2005** of 25 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) allows the Czech Republic to receive financial means to support rural development from this Fund.

In order to promote organic farming, the European Commission adopted the **European Action Plan for Organic Food and Farming** in 2004. It aims, inter alia, at improving awareness of organic farming and to encourage its public support through rural development, improving production standards and strengthening research in this area.

The **Action Plan of the Czech Republic for the Development of Organic Farming in the years 2011–2015** supports especially those areas of organic farming which are not sufficiently developed, e.g. research and education of farmers, domestic organic food market, public awareness, etc. One of the 2015 objectives is to achieve a 15% proportion of organic farming in the Czech Republic's total agricultural land area, and at least a 20% proportion of arable land to be under organic farming.

In 2006, **National Strategic Rural Development Plan of the Czech Republic for the period 2007–2013** was adopted which aims at increasing competitiveness in agriculture, improving the environment and landscape through supporting environmentally friendly land management methods and enhancing the quality of life in rural areas.

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.

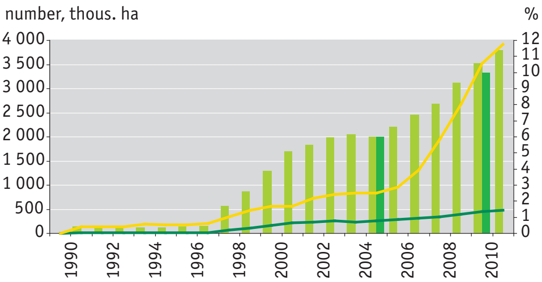
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

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. Organic farming has a positive influence on the quantity of soil micro-organisms, increasing biological diversity and ecological stability of the landscape. At the same time, it positively affects the conservation of landscape character as large units with monoculture crops are not preferred and it also contributes to sustainable rural development.

[1] *Organic farming is a form of land management which puts emphasis on elimination of using chemical inputs with adverse impacts on the environment, human health and livestock health. It is based on production of quality raw materials and food and it uses sustainable development practices.*

INDICATOR ASSESSMENT

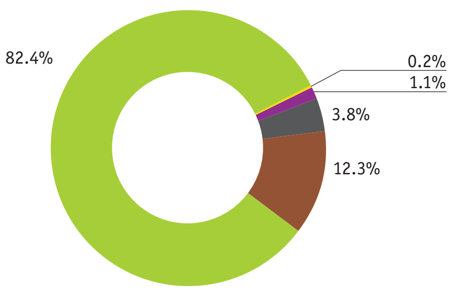
Chart 1 ➜ **Organic farming trends in the Czech Republic [number, thous. ha, %], 1990–2011**



- Proportion of the land under organic farming in ALF (right axis)
- Proportion of the land under organic farming in ALF – 2005 and 2010 targets (right axis)
- Area of agricultural land under organic farming (left axis)
- Number of organic farms (left axis)

Source: Ministry of Agriculture

Chart 2 ➜ **Structure of land resources in organic farming in the Czech Republic [%], 2011**

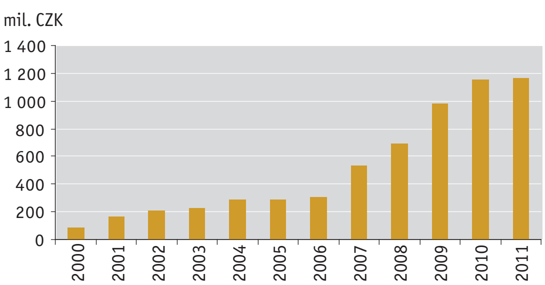


- Arable land
- Permanent grassland
- Vineyards
- Orchards
- Other areas

Source: Ministry of Agriculture

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 ➜ **Financial resources disbursed within the „Organic Farming" agro-environmental measure [mil. CZK], 2000–2011**



- Financial resources disbursed

Source: Ministry of Agriculture

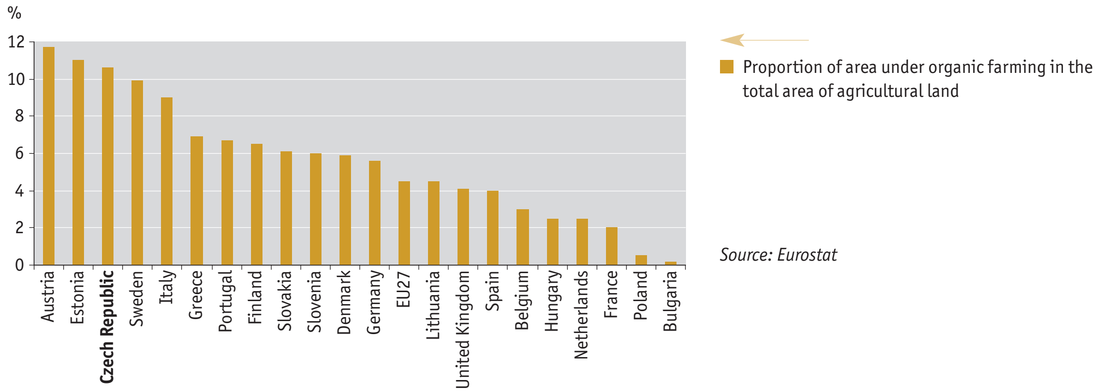
Table 1 ➜ **Amount of organic farming subsidies per unit area in the Czech Republic [CZK.ha^{-1}], 2004–2011**

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

Source: Ministry of Agriculture

[1] Horizontal rural development plan (HRDP)
[2] Rural development programme 2007–2013 (RDP)
[3] Calculation based on the actual annual EUR/CZK rate was carried out
[4] Permanent grassland management for 100% organic farmer (without concurrence with conventional agriculture /farmers with the concurrence)
[5] Management of vineyards, orchards or hop gardens /management of extensive fruit orchards

Chart 4 ➜ **Proportion of the area under organic farming in the total area of agricultural land in Europe [%], 2009**



Source: Eurostat

The importance of **organic farming** in the Czech Republic has been increasing in the long term. During the period 2000–2011, the number of organic-farming entities grew by 3,357 (almost 7 times) and between the years 2010 and 2011, there was an increase by another 403 entities (by 11.5%). By the end of 2011, there were 3,920 farmers working according to the determined organic farming principles and 646 entities were producing organic food. In 2000–2011, the area under organic farming increased by 317,000 ha (191.5%) and in 2011 by another 8%, i.e. it amounted to nearly 483,000 ha, which represents 11.4% of the total area of agricultural land (Chart 1).

The area under organic farming consists mainly of permanent grassland (82.4%) and arable land (12.3%) (Chart 2). The rest is vineyards, orchards and other areas. The areas of all the categories have grown during the year 2011. The area of arable land under organic farming is growing steadily; it increased by 7.9% to 59,000 ha, yet it only reached about 2% of the total arable land. The area of permanent grasslands under organic farming increased by 7.8% to 398,000 ha, reaching 40.2% of the total area of permanent grasslands. The area of organically managed orchards grew by 25.8% to 6,453 ha, accounting for 13.9% of the total area of orchards. The area of vineyards under organic farming increased by 20.2% and reached 965 ha, i.e. almost 5% of the total area of vineyards. The area of hop gardens under organic farming increased by 25% to 10 hectares and the area of organic ponds has reached 55 ha. Cattle breeding without commercial milk production accounts for the largest proportion of organic livestock breeding.

The significant growth of organic farming is mainly due to the resumption of **European and state subsidies** (Chart 3, Table 1). Since 2007, traditional support for organic farmers (subsidies per area that is included in the transition period or in organic farming) is paid through the Rural Development Programme 2007–2013 (RDP), where organic farming is part of the 'agro-environmental' measures under Axis II of the Rural Development Programme. Since 2007, organic farming has also been supported through a considerable point bonus in evaluating investment projects and subsequent investment measures under the Rural Development Programme that are part of Axes I and III: "Modernization of agricultural holdings", "Setting up of young farmers", "Adding value to agricultural and food products", "Promoting tourism" and "Diversification into non-agricultural activities". In addition, each year the Ministry of Agriculture of the Czech Republic financially supports the education of organic farmers and organic food producers; educational activities are mainly provided by non-governmental organisations. Greater awareness and better availability of information, along with growing consumers' interest in this kind of food, are other reasons behind the increased number of organic farmers and organic food producers.

In 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 the other European countries**, the proportion of organically farmed land is above average in the Czech Republic (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=1899)

20/ Industrial production

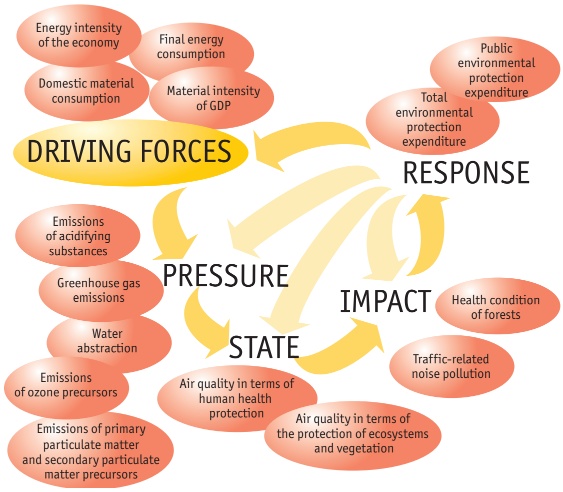
KEY QUESTION →

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

KEY MESSAGES →

The Czech Republic's industry overcame the crisis and began to return to the pre-crisis values. Interannually, industrial production increased by 6.5%, especially due to the automotive industry, mechanical engineering, manufacture of electrical devices and the manufacture of rubber and plastic products.
Revival of the industrial production has affected emissions from the industry, too. The CO emission has increased by 13.8%, NO_x emission by 5.4%, SO_2 emission by 2.3% and VOCs emission also by 2.3%. Conversely, there was a reduction of PM_{10} emission (by 8.1%) and $PM_{2.5}$ emission (by 20.8%).

The construction sector, due to the 2008 economic crisis reverberation, continued decreasing. In relation to the environment, this is rather a positive phenomenon, since there is less new development (connected with loss of land) and landscape fragmentation; excavation of construction raw materials is reduced as well as the amount of construction waste.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

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

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

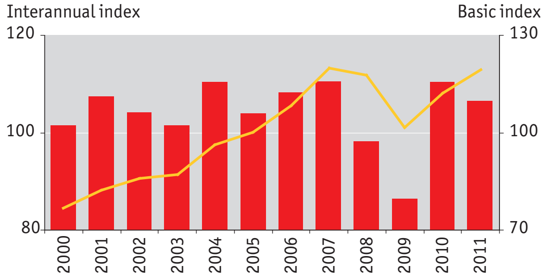
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

The industrial sector is a consumer of significant quantities of natural resources, namely both raw materials and energy resources. Extraction of raw materials disrupts the landscape character, it affects the quality, quantity and level of groundwater at extraction sites and in the vicinity of the extracted deposits there is increased dust and noise pollution, caused by not only the extraction itself but also by transport of the big amounts of material. These factors then influence the surrounding ecosystems and human population, 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 concrete industrial production. Poor air quality has been proved to cause increased morbidity, the incidence of allergies, asthma, respiratory and heart problems, cancer, reduced immunity etc., while noise pollution affects nervous systems of humans and animals.

The industry also produces, imports and processes chemical substances, their mixtures and products whose properties are not always known in relation to toxicity to the environment and to humans.

INDICATOR ASSESSMENT

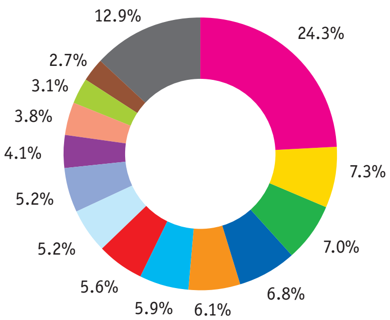
Chart 1 ➜ **Index of industrial production in the Czech Republic, 2000–2011**



- Interannual index of industrial production (the same period of the previous year = 100)
- Basic index of industrial production (the year 2005 = 100)

Source: Czech Statistical Office

Chart 2 ➜ **Structure of industrial production in the Czech Republic [%], 2011**

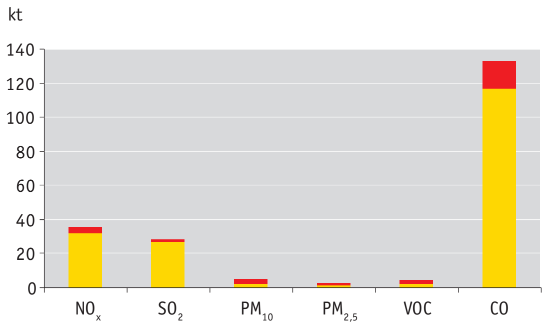


- Production of vehicles (except motorcycles), trailers and semitrailers
- Production of computers, electronic and optical appliances and devices
- Production of machines and devices
- Production and distribution of electricity, gas, heat and conditioned air
- Production of basic metals, metallurgy; foundry
- Production of rubber and plastic products
- Production of food
- Production of electrical devices
- Production of metal structures and metal-working products, except machines and devices
- Production of chemical substances and preparations
- Production of coke and refined oil products
- Production of other non-metal mineral products
- Mining and excavation
- Others

Source: Czech Statistical Office

Structure of industrial production by the sales of products and services. This is the industrial production including mining, extraction, generation/production and distribution of electricity, gas, heat and conditioned air.

Chart 3 ➜ **Emissions from industry in the Czech Republic [kt], 2010**

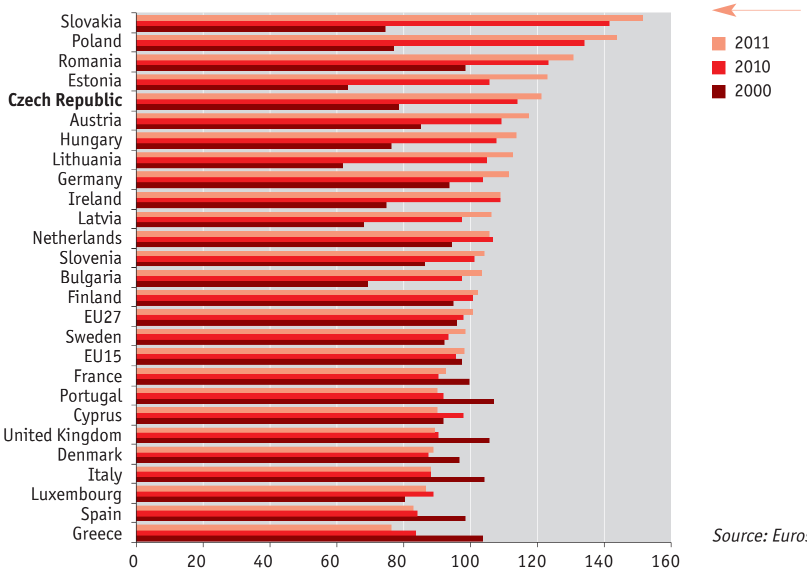


- Production processes without combustion
- Industrial energy sector

Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

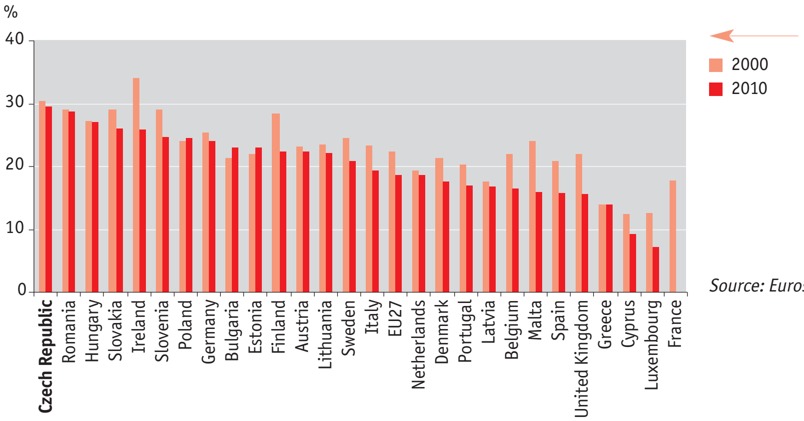
Chart 4 ➜ **International comparison of the industrial production index [index, 2005 = 100], 2000, 2010 and 2011**



Source: Eurostat

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

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



Source: Eurostat

In the Czech Republic, industry is one of **the key sources of GDP creation**. At the same time, however, it is also an important producer of many emissions of pollutants and waste products and a consumer of non-renewable resources. That is why this sector has a significant environmental impact, especially in areas where industrial enterprises emitting great quantities of pollutants are more concentrated (the Moravian-Silesian region, the region of Ústí nad Labem and Central Bohemian region).

In 2000–2011, the negative **environmental impacts** of industrial production were not increasing in the Czech Republic. The Czech economy has overcome the crisis in 2011 and slowly began to return to pre-crisis values. Interannually, industrial production increased by 6.5% (Chart 1), with the total sales for products and services reaching CZK 4,408 billion. However, the growth of the Czech economy was ensured especially by foreign trade, while domestic demand decreased. The situation was developing favourably especially in the automotive industry, mechanical engineering, electrical equipment manufacture and the production of rubber and plastic products (Chart 2).

The construction sector continued decreasing. The decline hit mainly civil engineering, which is affected by the Government's austerity measures. Another factor was the austerity measures of households, which tend to save financial means and invest less in new constructions. Declining boom in the construction of photovoltaic power stations and lower demand for their construction abroad, mainly in Germany, could have had their influence on the construction sector, too. In relation to the environment, the decline in the construction sector can be considered **a rather positive phenomenon**, since there is less new development (connected with loss of land) and landscape fragmentation; excavation of construction raw materials is reduced as well as the amount of construction waste.

Retail sales have been basically stagnating due to worse household income; only the motoring segment has ensured their interannual increase. Lower consumption has been accompanied by a change in the sales structure, in which the proportion of non-food goods increased at the expense of food.

Emissions from industry[1] (Chart 3) can be divided into two groups – emissions from the industrial energy sector and emissions from the industrial processes without combustion of fuels. Emissions from the industrial energy sector include particularly NO_x and SO_2, and also CO the vast majority of which comes from the iron and steel works in Ostrava and Třinec. The industrial processes without fuel combustion are production-type specific and they produce a variety of emissions that are harmful to the environment. In 2008–2009, the economic crisis had its impacts on emissions from the industry, that is why there was a temporary reduction in the emissions of all kinds. In 2010, revival of the industry also influenced emissions of pollutants from this sector and some of the emissions increased. Especially the production processes without combustion increased the production of all major air pollutants, except PM_{10}. In the industrial energy sector, on the other hand, there was an interannual decrease of the emissions with the exception of CO. The total emissions from the industry have grown interannually (2009–2010): the CO emission has increased by 13.8%, NO_x emission by 5.4%, SO_2 emission by 2.3% and VOCs emission also by 2.3%. Conversely, there was a reduction of PM_{10} emission (by 8.1%) and $PM_{2.5}$ emission (by 20.8%).

Since the year 2000, **the energy intensity of the industry has been decreasing** significantly. While in 2000, the energy intensity in industry was 699 MJ/CZK 1,000, in 2009 it was 371 MJ/CZK 1,000 (calculated as final energy consumption in industry divided by the GVA of that sector). This trend is positive for the environment, since higher energy consumption also means a higher burden on the environment in relation to its production. In 2010, both the industrial production and energy consumption in industry grew after the revival of the economy. However, the GVA was growing less slowly in this sector and that is why energy intensity of the industry increased to 406.2 MJ/CZK 1,000, i.e. by 2.9%.

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

Industry plays a significant role in the Czech economy; its share in creation of the Czech Republic's GDP has been between 28 to 31% in long terms. In 2010, the Czech Republic had **the greatest proportion of industry in GDP in the EU**, namely 29.5%. The EU27 average was 18.7%, mainly due to gradual dematerialisation of the economy and increasing imports of products made by the manufacturing sectors in countries outside the EU. By international comparison, proportions above 25% are only seen in five EU countries: the Czech Republic, Romania, Hungary, Ireland and Slovakia (Chart 5).

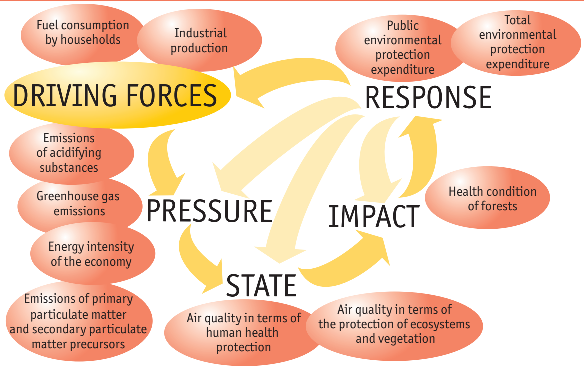
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

[1] *Data for year 2011 are not, due to the methodology of their reporting, available at the time of publication.*

21/ Final energy consumption



KEY QUESTION →

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

KEY MESSAGES →

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

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

In international comparison, the energy consumption per capita in the Czech Republic is by 6% higher than the EU27 average.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **State Energy Concept of the Czech Republic** is aimed, inter alia, at increasing the heat savings in buildings belonging to the Government, municipalities, businesses as well as private consumers; at enhancing efficiency of electrical appliances and the use of energy-efficient appliances; increasing effectiveness of the energy-distributing systems in order to achieve energy-efficient distribution networks in terms of centralization and decentralization of energy sources and reduction of distribution loss.
Adopted by the Commission, the **Action Plan for Energy Efficiency** outlines a framework of policies and measures designed to implement an estimated savings potential of over 20% of the EU's annual primary energy consumption by 2020.
The **Second Energy Efficiency Action Plan** was elaborated in accordance with the requirements of the Directive of the European Parliament and of the Council No. 2006/32/EC on energy end-use efficiency and energy services. It aims at reducing the annual average electricity consumption from the years 2002 to 2006 by 9% in the period from 2008 to 2016.
The **National Action Plan for Energy from Renewable Sources**, on the basis of the Commission Decision 2009/548/EC, sets the national target for the share of energy from renewable sources in the production of electricity, heating and cooling and also in transport by 2020.
In 2009, the European Parliament and the Council approved the **climate-energy package** that sets out measures to reduce greenhouse gas emissions and to increase the share of renewable energy sources in the final energy consumption. It includes the following Directives, inter alia:

- **Directive 2010/31/EU** on the energy performance of buildings, which promotes improving the energy performance of buildings.
- **Directive 2010/30/EU** on information concerning the energy consumption specifies how to inform end users about energy consumption during a product's use, and supplementary information concerning energy-consuming 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.

The **State Environmental Policy of the Czech Republic** requires economical energy consumption and energy supply in the sustainable development context.

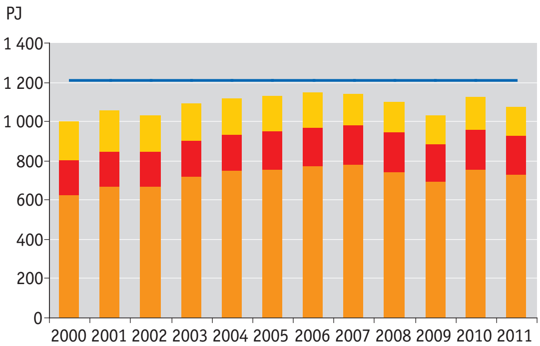
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

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

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

INDICATOR ASSESSMENT

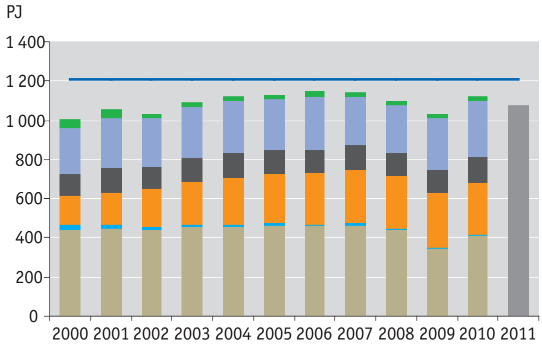
Chart 1 → **Final energy consumption trends by resource in the Czech Republic [PJ], 2000–2011**



Heat
Electricity
Fuels
The State Energy Concept scenario for the year 2030

Source: Czech Statistical Office

Chart 2 → **Final energy consumption trends by sector in the Czech Republic [PJ], 2000–2011**

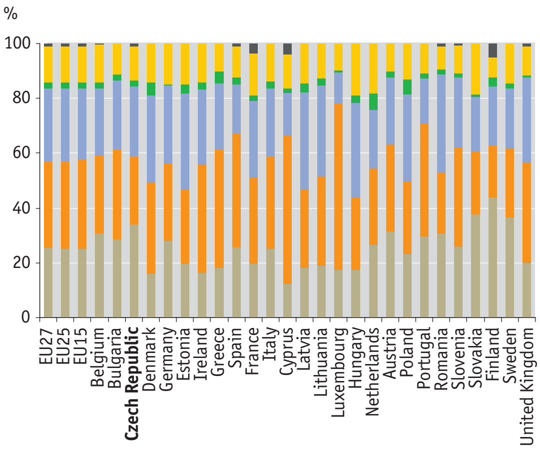


Agriculture and forestry
Households
Other sectors
Transport
Construction sector
Industry
The State Energy Concept scenario for the year 2030

Source: Czech Statistical Office

With respect to the data reporting methodology, the 2011 data concerning energy consumption by sectors were not available as of the closing date of this publication.

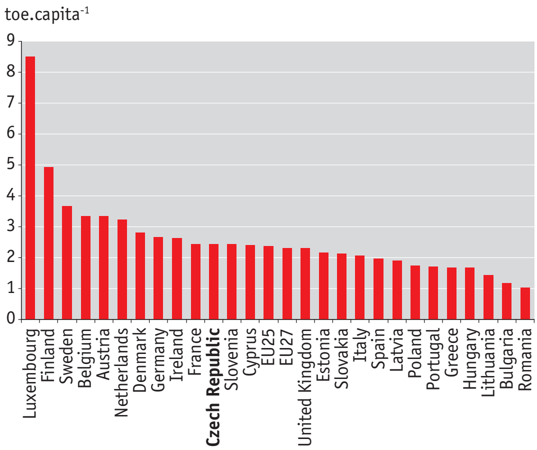
Chart 3 → **International comparison of final energy consumption by sectors [%], 2010**



Others
Services
Agriculture
Households
Transport
Industry

Source: Eurostat

Chart 4 → **International comparison of final energy consumption per capita [toe.capita^{-1}], 2010**



Final energy consumption per capita

Source: Eurostat

The final energy consumption (Chart 1) **has been fluctuating** since the year 2000. In 2002 to 2006, it kept increasing but since 2007, the consumption has been declining or fluctuating interannually. In view of the fact that the consumption is influenced by the industry to a large extent, it is obvious that there was the economic crisis in the years 2008–2009. In 2010, there was an increase in the total energy consumption, together with the growth of industrial production and the national economy as a whole, but in 2011, an interannual decline followed again, namely by 4.0%.

The highest final energy consumption (Chart 2) is recorded in **the industry sector** (36.6% in 2010). While energy consumption in this sector used to fluctuate interannually, it has been declining every year since 2006 due to restructuring of the industrial sectors and the efforts to introduce energy-efficient technologies. There was a huge interannual decline in consumption in 2009 as a result of the economic crisis, which affected this sector severely. In 2010, however, economic growth also had its impact on energy consumption and the consumption in the industry sector increased by 20.2% interannually (2009–2010). In comparison with the consumption values from the period before the economic crisis, however, a slowly declining trend continues. Within the processing industry, the most energy intensive branches are the production of metals and metallurgical processing, the production of non-metallic mineral products and the chemical and petrochemical industries.

Households are another important sector in energy consumption in the Czech Republic. In 2010, 25.7% of the total energy were consumed by households. Interannually (2009–2010), there was an increase in households consumption by 11%, which is largely caused by significantly low temperatures in the heating season, both at the beginning of 2010, and in December 2010. Heating has a major impact on energy consumption in households.

The transport sector accounted for 23.2% of the total consumption in 2010. This was the only sector in which energy consumption was growing in long terms, but in the last three years, the trend is rather varying. Interannually (2009–2010), energy consumption in the transport sector decreased by 7.6%[1].

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

Generally, the Czech Republic belongs to the countries with slightly **higher final energy consumption** per capita (2.4 toe per capita in the Czech Republic compared with 2.3 toe per capita in EU27), i.e. by 6.0% more (Chart 4).

If measures of the State Energy Concept are applied, **the energy sector will head towards** a higher appreciation of energy inputs, increased savings and better energy management. Electricity consumption is expected to increase, but at a gradually diminishing rate.

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

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1890)

[1] With respect to the data reporting methodology, the data concerning the sectoral structure in 2011 were not available as of the closing date of this publication.

22/ Fuel consumption by households

KEY QUESTION →

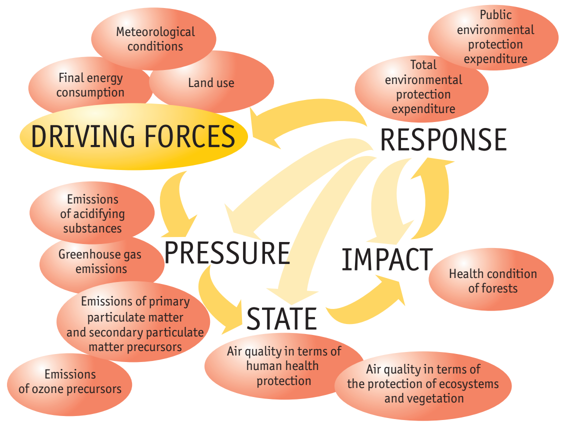
What progress has been made in reducing local heating units that have a negative impact on air quality and public health?

KEY MESSAGES →

Fuel consumption in households decreased by 9.0% interannually, in particular because of milder winter with less demands for heating.

Preliminary results of the 2011 population and housing census show that the number of households using solid fuels for heating is declining only very slightly. However, the ratio between coal and wood combustion has changed in favour of wood.

The environmental and human-health impacts of household heating are considerable, especially in the case of using low-quality fuels, or even materials which are not directly intended for incineration. In 2010, 37.3% of the total PM_{10} emissions originated from local.



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

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

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

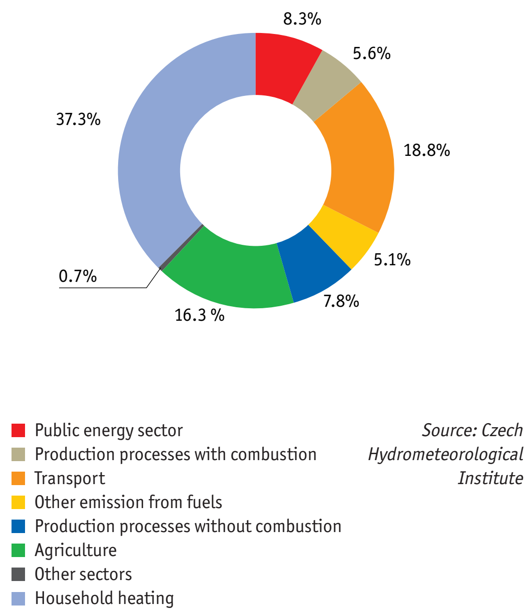
The **quality requirements for fuels** intended for stationary sources in relation to air protection are provided for in the Decree No. 13/2009 Coll. The Decree also concerns solid and liquid fuels which are intended for incineration in small stationary sources. In particular, it sets the limits for 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 air quality of the immediate environment in which people live. Compared to emissions from large incinerators, emissions from local heating units are more dangerous as they are emitted directly into the environment where the inhabitants reside. Pollutants emitted from chimneys of low buildings, most frequently family houses, cannot disperse in the air and people are forced to breathe these substances directly. Approximately one-third of the total emissions of primary particulate matter PM_{10} come from local heating sources. Incomplete combustion of coal (and possibly co-combustion of plastics) produces carcinogenic polyaromatic hydrocarbons, which contribute to a number of health problems in the population – increased morbidity, especially an increased incidence of cardiovascular disease, cancer and respiratory problems. A limited possibility to regulate these small sources is another disadvantage, too.

INDICATOR ASSESSMENT

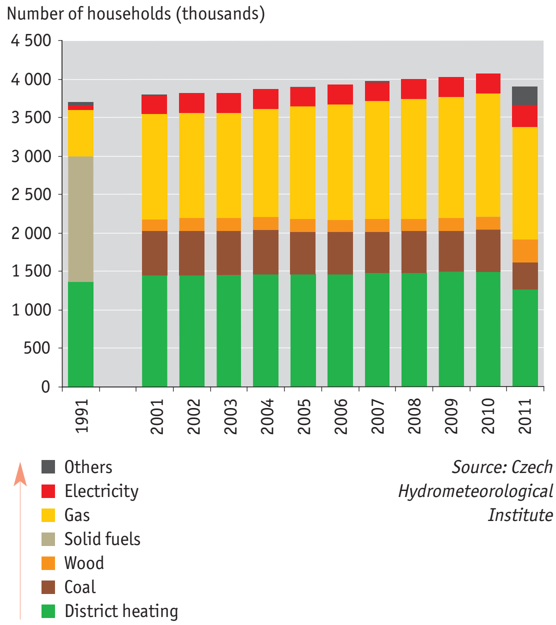
Chart 1 → **PM_{10} emissions from the different economic sectors in the Czech Republic [%], 2010**



Source: Czech Hydrometeorological Institute

With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

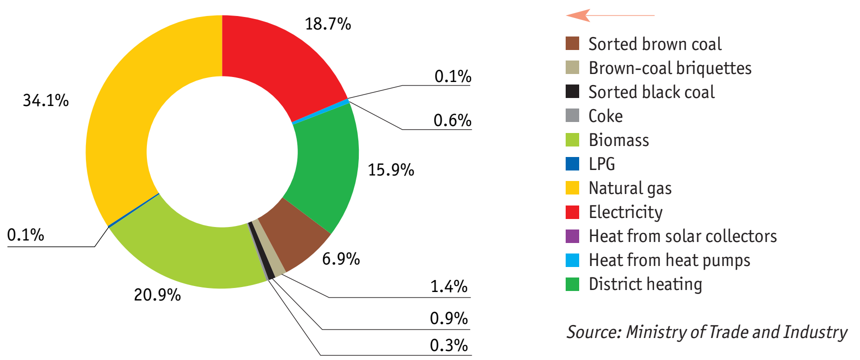
Chart 2 → **Household heating methods in the Czech Republic [thous. of households], 1991, 2001–2011**



Source: Czech Hydrometeorological Institute

For the year 2011, the item "Others" includes approximately 232,000 flats for which the data on energy used for household heating had not yet been processed after the 2011 population and housing census.

Chart 3 → **Fuel and energy consumption by households (the proportion of energy contained in individual sources) in the Czech Republic [%], 2011**



Source: Ministry of Trade and Industry

In 2010[1], 37.3% of **the total PM_{10} emission came from local heating units** (Chart 1). Compared to the year 2009, the total PM_{10} household heating emission increased from 11.82 kt to 13.82 kt in 2010. This increase was influenced by the heating season's character, because the 2010 winter was the coldest in the past 10 years. The total PM_{10} emission amounted to 37.01 kt in the Czech Republic in 2010.

The environmental and human-health **impacts of local heating units** are considerable, especially in the case of using low-quality fuels, or even materials which are not directly intended for incineration. Unlike industrial facilities, local heating units operate at low combustion temperatures and that is why the combustion is often incomplete, especially in manually regulated boilers.

Preliminary results of the 2011 population and housing census show that **the number of households using solid fuels for heating** is declining only very slightly (Chart 2). However, the ratio between coal and wood combustion has changed in favour of wood, namely in all regions. The significant jump in all the last-year values is caused by the fact that data from the 2011 population and housing census, which is carried out once every 10 years, are concerned. In the following years, only data concerning newly built flats are added but statistical sources, related to e.g. heating of already existing objects, are not available.

In the Czech Republic, natural gas (37.7%) and district heating (DH) (36.7%) are currently the most widely used **household heating sources** (Chart 2). This concerns "the main heating" in Chart 2. Nevertheless, households often use multiple types of fuel for heating – the most common combinations include gas/wood and coal/wood, in rural areas also gas with electricity/coal/wood. The proportions of wood and coal within the solid fuels often cannot be specified exactly because these two fuels are very often burnt together (co-combustion) and the users use and exchange them depending on their current prices.

In 2011, **the total amount of energy** which was delivered to households from the individual sources was approximately 273,000 TJ; this is by 9.0% less than in 2010. This decrease is related to the length of the heating season and to temperatures during the winter. Unlike the long-term average, the 2011 heating season was about 14% less intensive in terms of heating. By contrast, the year 2010 was 8% more demanding than the long-term average.

Interannually, consumption of all types of combustion fuels **decreased** in households, with the exception of biomass, for which growth of the last years is continuing. The interannual increase of biomass consumption in households accounts for 1.6%. An increase in heat generation has been recorded also for heat pumps (23.9%) and solar collectors (24.2%). However, the proportion of these two sources still remains in thousands (Chart 3). Solar collectors are more often used to produce hot water and to preheat water for heating.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

[1] With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

23/ Energy intensity of the economy

KEY QUESTION →

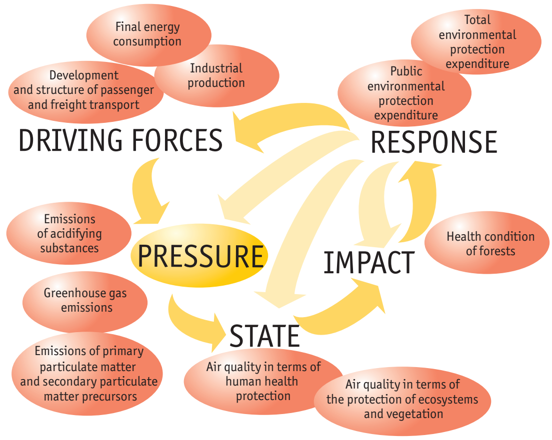
Are the efforts in reducing energy intensity of the Czech economy successful?

KEY MESSAGES →

Energy intensity of the Czech Republic's economy has been decreasing in long terms. The relative indicator is being improved due to the growth of the economy, but also due to the use of technologies with lower energy intensity, BAT, thermal insulation of buildings or savings in households.

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

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



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

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

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

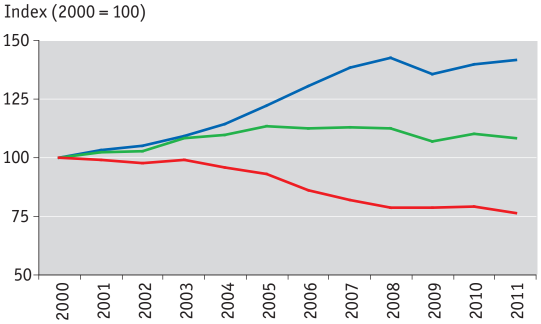
The **Climate-Energy Package**, which was approved by the EU Council and the European Parliament in 2009, contains a commitment to achieve reduction of greenhouse gas emission by at least 20% by the year 2020 in comparison with the year 1990. An increase in energy efficiency is the key element for the member states to comply with the requirements laid down in this decision. The aim consists in reducing the energy consumption by 20% by 2020.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

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

INDICATOR ASSESSMENT

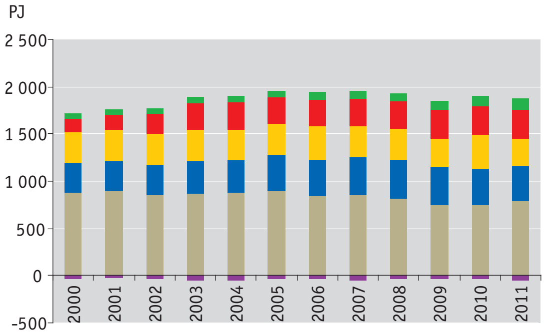
Chart 1 ➔ **Energy intensity of Czech Republic's GDP [index, 2000 = 100], 2000–2011**



- GDP
- PES consumption
- Energy intensity of GDP

Source: Czech Statistical Office, Ministry of Industry and Trade

Chart 2 ➔ **PES consumption trends in the Czech Republic [PJ], 2000–2011**

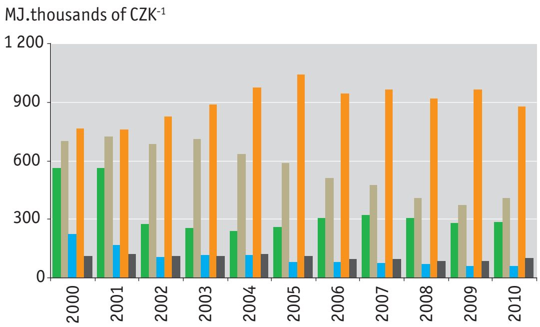


- RES without electricity
- Primary heat
- Gaseous fuels
- Liquid fuels
- Solid fuels
- Primary electricity

Source: Ministry of Industry and Trade

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

Chart 3 ➔ **Energy intensity trends by sectors, expressed as the proportion of the final energy consumption in the sector and gross value added of the sector in the Czech Republic [MJ.thousands of CZK^{-1}], 2000–2010**

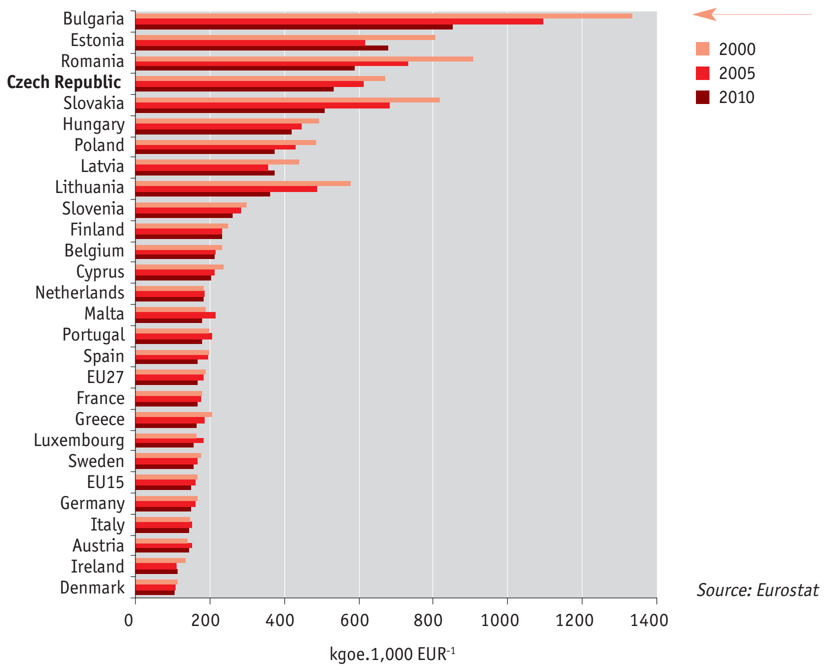


- Agriculture and forestry
- Industry
- Construction sector
- Transportation
- Other sectors

Source: Czech Statistical Office

With respect to the data reporting methodology, the 2011 data were not available as of the closing date of this publication.

Chart 4 ➜ **International comparison of energy intensity of the economy [kgoe.1,000 EUR⁻¹], 2000, 2005, 2010**



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

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

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

The energy intensity of the Czech Republic's economy **has been decreasing** in the long term. This is due to the growth of the economy (GDP), but also due to the use of technologies with lower energy intensity, BAT, thermal insulation of buildings or savings in households.

In 2008–2009, the financial and economic crisis influenced also **the energy intensity of the economy.** There was a decline in GDP and in consumption of primary energy sources, but in such proportions that the energy intensity of the economy increased temporarily. The situation changed entirely in 2011 because an absolute decoupling between GDP and PES consumption was achieved; in that year, the GDP rose but the PES consumption decreased. The economy's energy intensity has reached 505.6 GJ.CZK $1,000^{-1}$ (constant prices of base year 2005) and therefore it decreased by 3.3% interannually. In longer term, i.e. since 2000 (when this value was 661.8 GJ.CZK $1,000^{-1}$), there was a total decline in energy intensity by 23.6%.

Since 2000, **the PES consumption** has been increasing interannually by 0.7 to 5.6% in the Czech Republic (Chart 2). In 2006, this trend was interrupted and the PES consumption began to vary. In 2011, there was an interannual decrease in PES consumption by 1.7%; its value reached 1,829.5 PJ.

In **the PES structure**, declining consumption of solid fuels since the year 2000 can be seen; this decrease, however, is balanced by growing consumption of liquid fuels and electricity generation in nuclear power stations (Chart 2). The amount of energy obtained from renewable sources has also been growing. Nevertheless, the share of the solid fuels consumption is still prevailing; in 2011, it accounted for 43.3% of the total PES amount. Liquid fuels account for 20.1%, primary heat from nuclear power stations 16.9% and gaseous fuels 16.0%. Primary electricity (i.e. electricity generated in hydroelectric power stations (excluding pumped storage power stations), in wind and photovoltaic power stations plus the balance of import and export of electricity) amounts even to negative values (–2.4% in 2011) because electricity exported to foreign countries is included. Heat from renewable energy sources increases its proportion every year; in 2011 it was 6.3%, which is twice as much as in 2000 (in 2000 the proportion was 3.1%).

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

The sectors of transport, industry and agriculture account for the biggest proportion in the economy's energy intensity by sectors (Chart 3). While energy intensity of **the industry sector** was decreasing steadily in the long term (in 2000–2009 there was a 47% decline), energy intensity of **the transport sector** was growing or varying. In 2010, however, the situation for both sectors reversed: the energy intensity in transport decreased by 9.1% and that of the industry sector grew by 9.5%. Unlike the other sectors, the energy intensity of transport is high because passenger car transport, which does not create any value added for the national economy, is included here. The share of the passenger car transport is approximately 53%.

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

If measures of the State Energy Concept are applied, the energy sector will **head towards** a high valuation of energy inputs. By the year 2030, the energy intensity of GDP creation should decrease from the original value of 1.21 $MJ.CZK^{-1}$ to 0.45 $MJ.CZK^{-1}$. The valuation of energy consumed for GDP should also increase along with savings, and energy management in general should improve. The combination of both factors will contribute to positive trends in the energy intensity of GDP creation and to quick approaching to parameters typical for the other EU countries. By the year 2030, the average annual rate of decline in the energy intensity of GDP creation is expected to be 3.2%; the average annual rate of decline in the electricity intensity of GDP creation is expected to be 2.4%. The imported-energy intensity will increase to 57.8% in 2030.

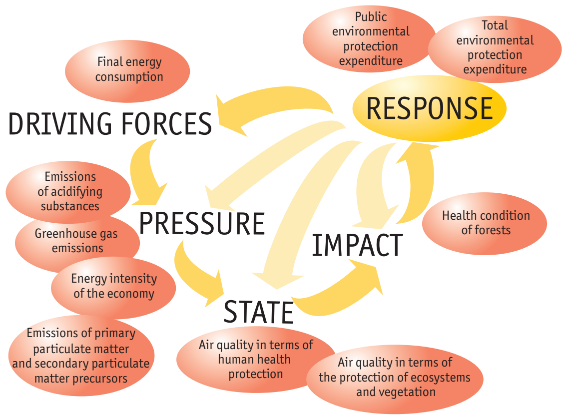
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

24/ Electricity and heat generation

KEY QUESTION

What is the structure and the amount of the energy produced?



KEY MESSAGES

Electricity generation has been growing in long terms. However, generation of electricity in steam power stations is decreasing and the importance of nuclear energy and renewable energy sources rises. Yet the steam power stations, which burn mainly brown coal, produced 61.6% of electricity and nuclear power stations 32.3%.

The total amount of produced heat decreases in long terms.

The balance of electricity exports and imports is 19.5% of the total amount of electricity generated in the Czech Republic.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

In 2009, the European Parliament and the Council approved the **climate-energy package** that sets out measures both to reduce greenhouse gas emissions and to increase the share of renewable energy sources in the final energy consumption. Over the same period, accomplishing the EU objectives should result in a 20% increase in energy efficiency.

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

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

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

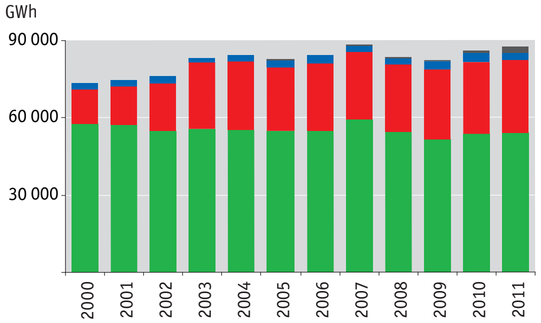
In 2011, the **Raw-Material and Energy Security Concept of the Czech Republic**, which will be in accordance with the State Energy Concept and the State Raw-Material Policy of the Czech Republic, was under preparation.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The mix and the proportions of the different energy sources are closely linked to the composition of emissions of the 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 in general. While the predominant use of domestic fossil fuels provides a certain degree of energy security and independence, surface brown coal mining disturbs the landscape character and, as a result, reduces attractiveness of the territory. Furthermore, many energy sources occupy large areas of land, affect the microclimate of the given site and interfere with the aesthetic and recreational functions of the landscape.

INDICATOR ASSESSMENT

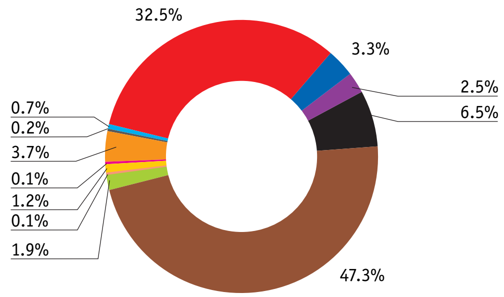
Chart 1 → **Electricity generation by the type of power stations in the Czech Republic [GWh], 2000–2011**



- Other
- Water
- Nuclear
- Steam

Source: Energy Regulatory Office

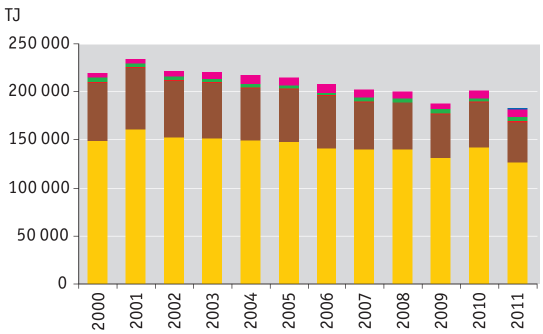
Chart 2 → **Electricity generation by fuel type in the Czech Republic [%], 2011**



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

Source: Energy Regulatory Office

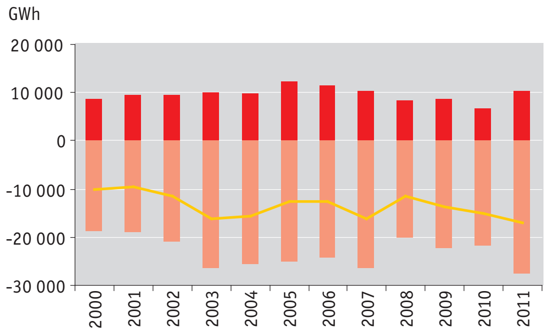
Chart 3 → **Net heat production by sources in the Czech Republic [%], 2000–2011**



- Heat pumps
- Chemical and waste heat
- Steam-gas cycle and cogeneration
- Nuclear power stations
- Heating stations
- Power stations and heating plants

Source: Czech Statistical Office

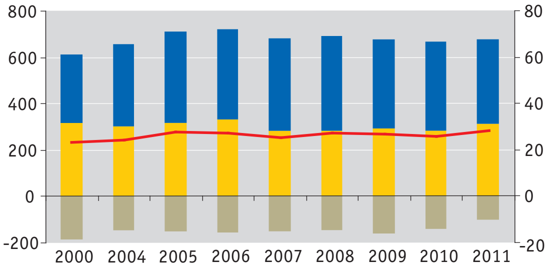
Chart 4 → **Electricity imports and exports in the Czech Republic [GWh], 2000–2011**



- Import
- Export
- Balance

Source: Czech Statistical Office

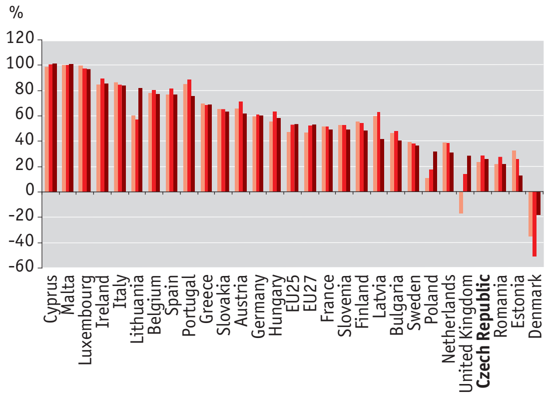
Chart 5 ➜ **Export-import balance for different fuels, the overall energy dependence of the Czech Republic [PJ, %], 2000–2011**



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

Source: Czech Statistical Office

Chart 6 ➜ **International comparison of the energy dependence [%], 2000, 2005, 2010**



2000
2005
2010

Source: Eurostat

In the period 2000–2011, the overall amounts of **generated electricity** were rather varying but the long-term trend is growing. Compared to the year 2000, more electricity was generated in 2011 (by 19.2%); the 2010/2011 interannual growth was 1.9%. Total of 87,561 GWh of electricity were generated in 2011. 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. There was an interannual increase in electricity generation in steam power stations burning mainly fossil fuels (by 0.6%), in nuclear power stations (by 1.0%) and in the category "others", which includes electricity from wind and solar power stations (by 244.0%). On the other hand, an interannual decline by 16.1% was recorded for hydroelectric power stations.

In the Czech Republic, **steam power stations** still account for the largest proportion of electricity generation (61.6%), i.e. mainly brown-coal-fired power plants (Chart 2). In 2011, 53,928 GWh of electricity were generated in steam power stations. The **nuclear power stations** (in Dukovany and Temelín) have the second biggest proportion in the Czech Republic; with a total production of 27,998 GWh, they accounted for 32.3% of the electricity generated in 2011. Renewable sources increase their proportion in electricity generation every year. In 2011, 7,403 GWh of electricity were generated in these sources, which corresponds to an 8.5% share in the total quantity of electricity generated in the Czech Republic (in 2010, this proportion was 6.9%).

In the Czech Republic, **heat production** (Chart 3) is ensured predominantly by power stations[1] and heating plants[2] (70.9%) and heating stations[3] (22.8 %). The other sources take only a minor part in heat production (in single percent). Heat from these plants (Chart 3) is intended for sale as well as for use in the given company (in both the public and in-house energy systems), however, it is not intended for electricity generation. Due to the fact that heat for industrial use is also concerned, the 2008 decrease is reflected in the total amount of produced thermal energy because industrial production declined due to the economic crisis in that year. The total amount of produced heat has been decreasing in the long term, which is a proof of the economical use of thermal energy and of the efforts to reduce heat consumption in the industrial and public sectors. In 2011, the net heat production accounted to 182,718 TJ, which is an interannual decrease by 9.4%.

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

The public and industrial energy sectors are important producers of **emission of air pollutants and greenhouse gases**. In 2010, these sectors accounted for 76.5% of the total SO_2 emissions, for 48.3% of the total NO_x emissions and for 69.7% of the total CO_2 emissions. Compared to the previous year, there was a decline in SO_2 emissions by 2.5% in this sector and in NO_x emissions by 5.1%. On the other hand, CO_2 emissions from the energy sector have been increasing, namely by 7.2%.

In 2011, 27.5 TWh of electricity, i.e. 31.4% of the total quantity produced, were exported (Chart 4). Nevertheless, 10.5 TWh of electricity were imported. **The export-import balance** is therefore 17 TWh, which is 19.5% of the total amount of electricity generated in the Czech Republic (87,561 GWh).

The energy dependence shows the extent to which the economy relies on imports to satisfy its energy needs. The Czech Republic is nearly self-sufficient only in electricity generation from coal since this raw material is mined domestically. In addition, the Czech Republic exports both coal and electricity (Charts 5 and 6). In the case of coal, this is nearly exclusively black coal, which is used in metallurgy due to its quality. The Czech Republic also imports black coal for the energy industry. The Czech Republic is dependent on crude oil and natural gas supplies. Although the Czech Republic is the only EU country which produces uranium, the nuclear fuel is imported to Czech nuclear power stations because the Czech Republic does not own the technology to produce nuclear fuel. The Czech Republic buys more than two-thirds of the crude oil/natural gas and all the nuclear fuel from Russia. The total energy dependency of the Czech Republic was 28.4% in 2011. In the period 2000–2011, this value was not changing very much; it varied between 23.5% and 28.5% (Chart 5).

In comparison with the other European countries, **the Czech Republic's energy dependence** is relatively low. The average energy dependency of EU27 countries is 53.9%, which is almost a double. The only EU country that is not dependent on imports of energy sources is Denmark (2010), which exports crude oil and natural gas from the North Sea and also supports renewable energy sources to a great extent (Chart 6).

According to **the long-term projections** presented in the State Energy Concept of the Czech Republic, the Czech Republic's imports of energy sources will increasingly exceed exports. At the end of the period concerned (2030), energy imports will be dominated by nuclear fuel (35%) followed by natural gas (34%), liquid fuels (14.5%), and black coal and coke (9% of all imports of energy sources). The Czech Republic will be fully dependent on natural gas, crude oil and nuclear fuel, and highly dependent on black coal (55%).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES
CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1893)

25/ Renewable energy sources

KEY QUESTION →

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

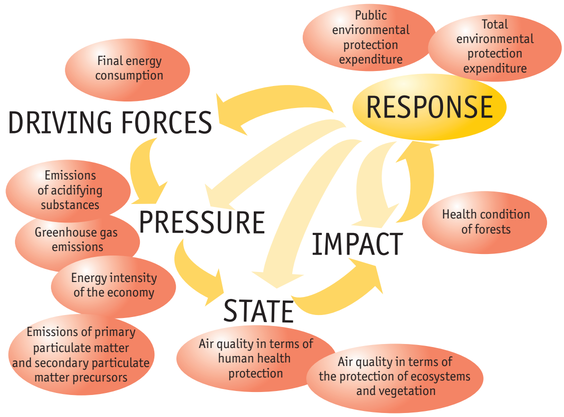
KEY MESSAGES →

Production of electricity from RES has been growing; interannually, it increased by 26.2%, in particular thanks to the continued development of photovoltaics.

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

The production of heat from RES is growing, with the consumption of fuels for household heating having the major influence.

The benefits of RES have been discussed since the production (photovoltaics) is very demanding from the financial point of view and its extent may undermine the socio-economic and landscape relations.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

In 2009, the EU Council and the European Parliament approved the so-called **climate-energy package**. It is a set of documents that specify the measures to be taken to reduce greenhouse gas emissions and the measures to increase the share of RES in the final energy consumption. Achievement of the EU objectives should also lead to an increase in energy efficiency.

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

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

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

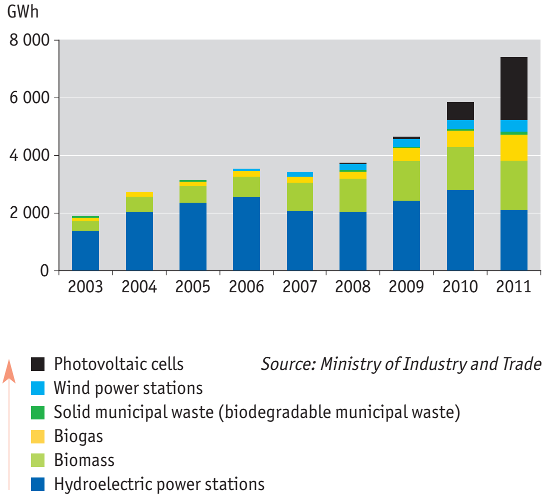
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

RES are generally seen as clean and environmentally friendly, because in their operation they do not pollute the environment to such an extent as the sources burning fossil fuels do. They are important in terms of the Czech Republic's energy self-sufficiency, they do not cause direct load on the environment and their human health impacts are minimal in comparison with other energy sources. However, there can be negative effects, too. A frequent problem of renewable sources consists in the material and energy intensity that is usually associated with their production in view of the relatively small amount of energy generated.

Another specific problem consists in taking up arable land to build photovoltaic power stations. Water resources may change the microclimate in the given site. Wind power stations disturb the landscape's aesthetic value and character and their noise is also a frequently discussed problem because it may bring up stress, sleeping and attention disorders, headaches, fatigue and negative changes in mood and behaviour. In the case of biogas, there can be difficulties with odour in the storage of raw materials intended for its production in some types of biogas stations.

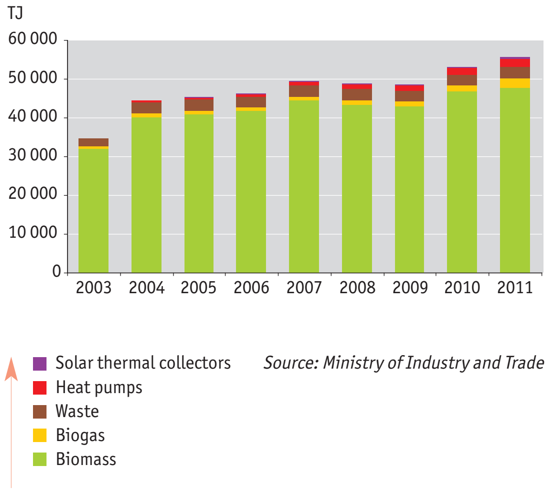
INDICATOR ASSESSMENT

Chart 1 → **Electricity generation from RES in the Czech Republic [GWh], 2003–2011**



Source: Ministry of Industry and Trade

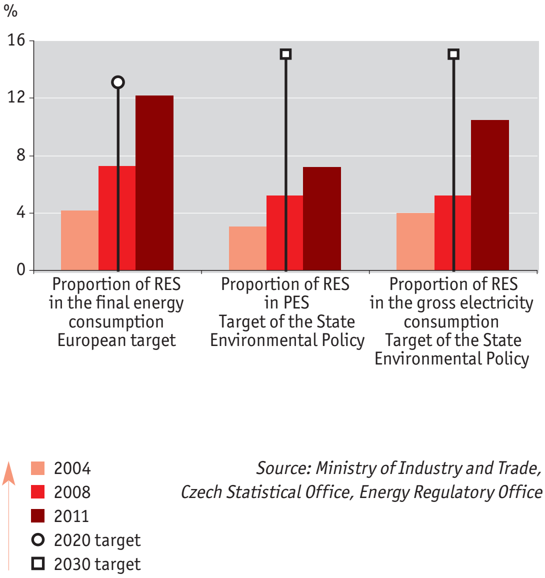
Chart 2 → **Production of heat from RES in the Czech Republic [TJ], 2003–2011**



Source: Ministry of Industry and Trade

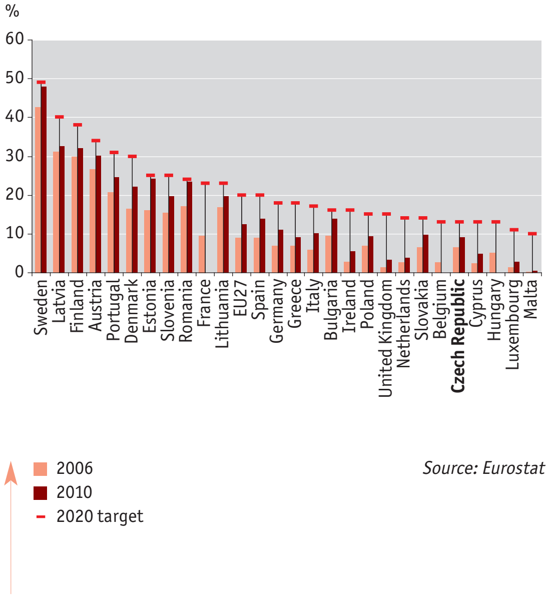
Preliminary data and estimates. Final data for year 2011 are not, due to the methodology of their reporting, available at the time of publication.

Chart 3 → **Targets for RES and the state of their implementation in the Czech Republic [%], 2004, 2008, 2011**



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

Chart 4 → **International comparison of proportions of RES in gross electricity consumption [%], 2006, 2010**



Source: Eurostat

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

In 2011, 7,403 GWh of **electricity were generated** from these sources, which corresponds to an 8.5% share in the total quantity of electricity generated in the Czech Republic (in 2010, this proportion was 6.9%). Compared to the year 2010, there has been an increase by 26.2%. This increase is mainly caused by continued development of photovoltaics, as the amount of electricity generated from this source increased interannually from 616 GWh in 2010 to 2,182 GWh in 2011, i. e. approximately three-and-a-half times more. The quantity of electricity generated from biomass (by 12.8%), by wind power stations (by 18.5%), from biogas (55.7%) and waste (by 150.5%) has also grown. The only decrease was recorded for hydro-electric power stations whose operation depends on rainfall. Electricity generation from large hydroelectric power stations was in its lowest value since 2004, as it decreased by 24.1% interannually.

The structure of electricity generation from RES is relatively diversified (Chart 1), and the ratios among the single sources begin to be balanced. Until recently, hydroelectric power stations had been the main and largest source of electricity from RES in the Czech Republic. However, electricity from photovoltaic power stations took over their primacy in 2011 (29.5% from photovoltaics as opposed to 28.6% from hydroelectric power stations). Electricity generation from biomass also increases each year; its proportion accounted for 22.7% in 2011. The other renewable sources are being used to a relatively small extent; this concerns especially energy generation from biogas (12.6%), wind power (5.4%), and municipal solid waste incineration (1.2%).

The production of heat from RES has been increasing in long terms; in 2011, there was an interannual increase by 4.8%. The largest share is covered by biomass (85.6%), for which the consumption of fuels (particularly wood) in households is the decisive factor. Interannually, the production of heat from biomass increased by 2.2%. The other sources take much smaller parts in heat production (waste 5.4%, biogas 4.3%, heat pumps 3.9%, solar thermal collectors 0.8%). A more significant interannual increase was recorded for the production of heat from biogas, namely by 47.8%, as the heat production increased from 1,610 TJ in 2010 to 2,379 TJ in 2011.

The indicative targets for the 2010 proportion of RES **have been met** within the given period, and currently the Czech Republic is heading for other objectives, namely for the years 2020 and 2030 (Chart 3). The proportion of electricity generated from renewable energy sources in the Czech Republic's gross electricity consumption increased interannually from 8.3% to 10.5% while the indicative target of the Czech Republic's State Environmental Policy for the year 2030 is 15%. In 2011, the proportion of energy from RES in the total PES consumption accounted for 7.0% and the objective set by the State Environmental Policy is to achieve a 15% share in 2030. The Directive 2009/28/EC on the promotion of RES has obliged the Czech Republic to achieve a 13% share of energy from RES in the final gross energy consumption. In 2010, the Czech Republic achieved 8.5% and in 2011, according to preliminary estimates, already 11.9%.

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

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

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

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

26/ Development and structure of passenger and freight transport

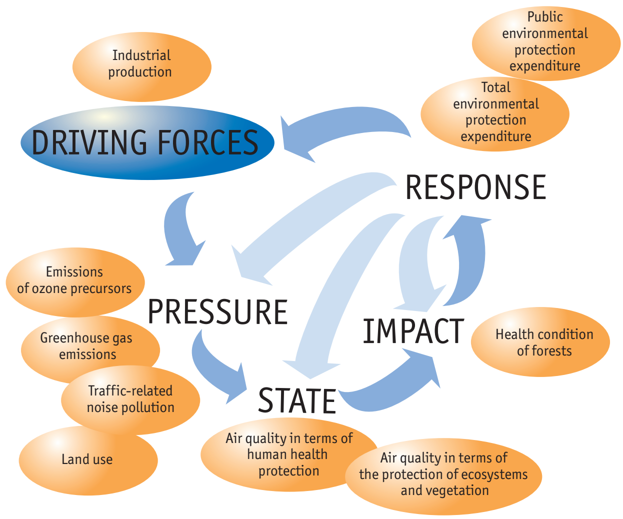
KEY QUESTION →

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

KEY MESSAGES →

In the Czech Republic, the total transport performance in passenger transport is stagnant; the proportion of public transport in the passenger transport performance is around 40% which is above-average in the European context. In 2011, the railway passenger transport performance grew by 1.8% interannually; the railways have conveyed by approximately 3 mil. passengers more than in 2010. The use of railways involved in the integrated transport systems in cities has been increasing.
Transport energy intensity has been declining, most notably for the individual car transport. Emissions of pollutants from transport, with the exception of solid pollutants, are declining significantly in the Czech Republic. In 2011, the interannual declines in emissions ranged between 6–10% for the individual substances.

Road freight transport in the Czech Republic has been increasing significantly and, at the same time, its share in the total freight transport has been growing, too. The situation in freight transport may complicate further reduction of environmental burden related to transport.
Transport is a significant source of emissions of solid pollutants, which have significant health impacts. This pollution is produced, along with combustion processes, also on the road surface and as a result of brakes and tyre wear.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Within its Priority Axis 2 (Economy and Innovation) the **Czech Republic's Strategic Framework of Sustainable Development** aims at improving transportation, making it more effective and increasing its security. According to the document, fulfilment of this objective will improve mobility of human resources, capital, and services as one of the necessary preconditions for economic development, while reducing negative impacts of transport on people and the environment. The objective should be achieved by changing the transport structure towards environmentally friendly modes of transport, and by reducing transport-related pollution.

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. One of the cross-cutting priorities is „Limiting the environmental and public health impacts of transport in line with sustainable development principles". The specific priority 4.1. (Achieving an appropriate modal split by ensuring equal conditions in the transport market) focuses on the structure of transport performance.

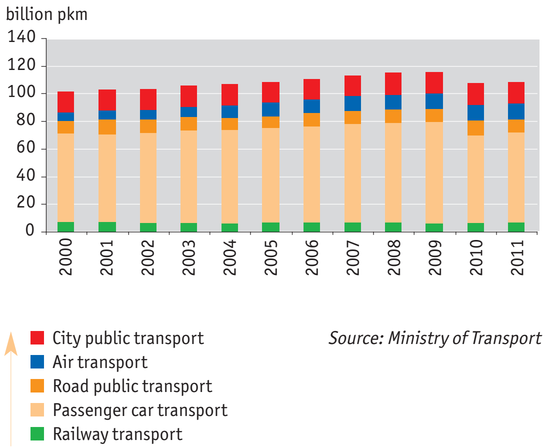
The priorities of the valid **State Environmental Policy of the Czech Republic** in the field of transport include changing the structure of passenger and freight transport in favour of environmentally friendly modes and reducing environmental impacts of road transport.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Transport, especially road transport, produces air pollution and causes noise pollution. Fundamental risks to human health arise from the fact that intensive road traffic often affects densely populated areas (towns, cities and urban agglomerations). As far as human health is concerned, the most risky pollutants are the smaller-size fractions of suspended particulate matter (PM_{10}, $PM_{2.5}$), which may cause respiratory problems and other serious diseases, due to their chemical composition, in particular the high content of carcinogenic substances. Ecosystems and vegetation are damaged especially by secondary air pollutants (ground-level ozone) that are formed from precursors produced by transport, in particular nitrogen oxides and volatile organic compounds. The road transport infrastructure causes landscape fragmentation and thus it disturbs the landscape's functions.

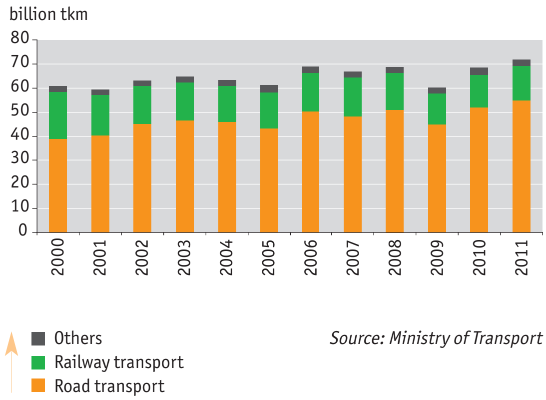
INDICATOR ASSESSMENT

Chart 1 ➜ **Development of the total transport performance in passenger transport in the Czech Republic [billion pkm], 1990–2011**



Source: Ministry of Transport

Chart 2 ➜ **Development of the freight transport performance in the Czech Republic [billion tkm], 1990–2011**

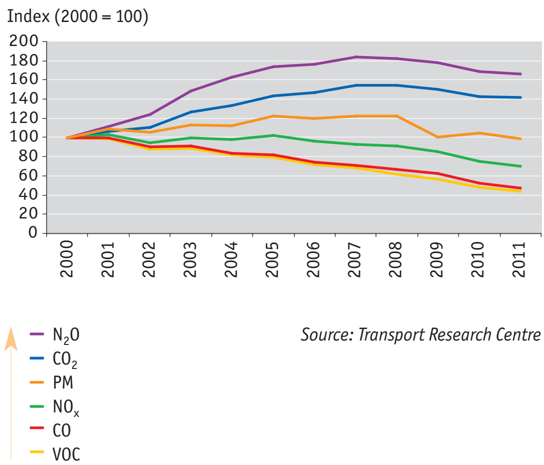


Source: Ministry of Transport

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

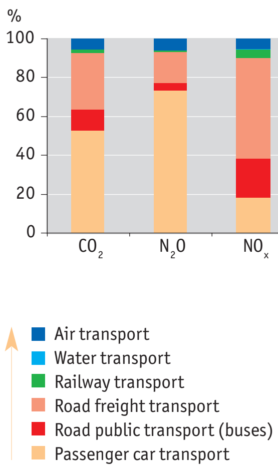
Transport performance specifies how many persons or tonnes of goods were transported and for which distance. It is defined as transport output (i.e. the distance travelled by a given vehicle regardless of the load or number of passengers) multiplied by transport volume (the number of persons or the quantity of goods that were transported). The unit of transport performance is passenger-kilometres (pkm) and tonne-kilometres (tkm).

Chart 3 ➜ **Emissions of transport-related air pollutants [index, 2000 = 100], 2000–2011**



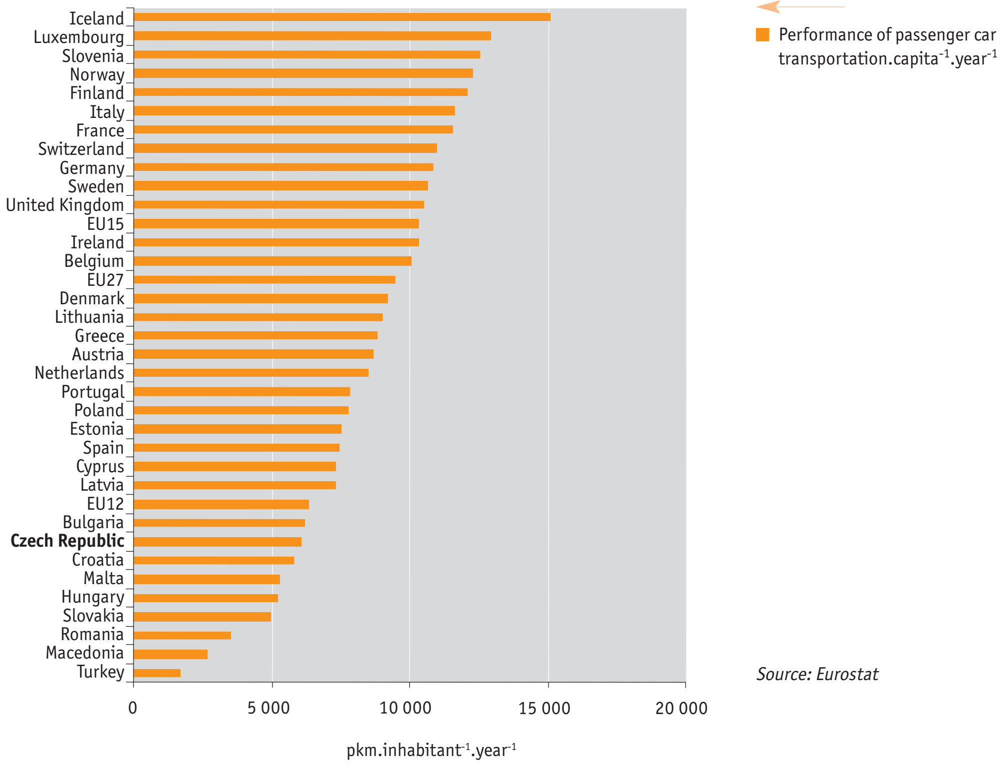
Source: Transport Research Centre

Chart 4 ➜ **Structure of emissions of greenhouse gases and transport-related pollutants by transport modes [%], 2011**



Source: Transport Research Centre

Chart 5 → **International comparison of the performance of passenger car transport per capita [pkm.inhabitant-1.year-1], 2010**



Source: Eurostat

In 2011, **the total transport performance in passenger transport** in the Czech Republic increased slightly by 1.2%, i.e. by about 1.3 billion pkm, after a significant interannual decrease in 2010 (Chart 1). What is positive is the fact that **transport individualisation**, typical for 1990s, does not go on. In general, public transport (including air transport) maintains approximately a 40% share in the total transport performance, which is above-average within the EU27 countries.

The largest proportion in passenger transport performance (approximately 60%) accounts for **passenger car transport** whose performance increased slightly by 3% to 65.5 billion pkm in 2011. In 2011, the **railway passenger transport** performance grew by 1.8%; the railway carried a total of 168 mil. passengers, which is by about 3 mil. passengers (1.9%) more than in 2010. The integrated transport systems in cities took a significant part in the growth of railway transport; in 2011, the railway transport performance increased by 3.9% and the number of passengers transported by 5.1%. **Public road transport** (both regular and irregular buses lines), however, decreased significantly compared to the year 2010. In 2011, it dropped by 10.3% and buses carried by about 7.9 mil. passengers (i.e. 2.1%) less than in the previous year. The drop concerned almost exclusively the domestic bus transport. The bus transport decrease2 can be related to cancellation of bus lines and transfer of passengers between buses and railways.

In the Czech Republic, **freight transport** has been growing for two consecutive years; in 2011, the total transport performance increased by 5.2% to around 72 billion tkm (Chart 2), which is the highest freight transport performance in this country since 1990. In 2011, the **road freight transport** performance increased by 5.8% to 54.8 billion tkm, **freight railway transport** has grown by about 0.5 billion tkm (3.1%) to 14.3 billion tkm. Increase of the proportion of road freight transport in the structure of the transport

[2] *This may be also a result of inaccuracies in the 2010 data when, according to the data reported, bus transport showed a significant increase.*

performance by modes of transport is significant and almost linear; it also continued in 2011, reaching 76.1% of the total freight transport performance. This trend is unambiguously negative from the environmental point of view, since environmental burden with emissions of pollutants and noise caused by road freight transport is the biggest burden of all modes of road transport.

Interannually, **energy consumption in transport** slightly decreased by 1% to about 247,000 TJ, mainly due to energy consumption decrease in passenger car transport by 2,400 TJ, i.e. by 1.8%. Reduction of energy demands of passenger car transport after 2008 is a very positive finding, which is linked to transport performance stagnation and gradual modernisation of the vehicle fleet. In 2011, energy consumption in the transport sector accounted for approximately 22% of the Czech Republic's energy balance.

Petrol consumption (according to sales reported in the territory of the Czech Republic) has been decreasing steadily since 2007. In 2011, it dropped by another 100,000 t (i.e. by 6.8%) to 1.8 mil. t. On the other hand, **diesel fuel consumption** slightly increased by 3.8% to 3.6 mil. t. LPG consumption is stagnant, CNG consumption is rising steadily, with the total consumption being small (8,000 t in 2011). In 2011, the consumption of bio-component in diesel fuels increased significantly, namely by 75,000 t (36%). Despite this positive development, the position of **alternative fuels and propellants** continues to be marginal in the Czech Republic. In 2011, the collection of excise tax on fuel, compared with the previous year, almost unchanged (CZK 82.2 billion, an increase by 0.3%).

The emissions from transport are declining (Chart 3 and Chart 4). A long-term and significant decrease can be seen in emissions of carbon monoxide (interannually by 9.8%, since 2000 by 53%), volatile organic compounds (VOC), whose emissions decreased by 8.9%, since 2000 by 56%, and of nitrogen oxides (decrease by 6.4%, i.e. 30%). However, **particulate matter emissions** remain problematic because they remain on the same level as in 2000 (a decrease by 1.1%), despite the interannual decrease by 5.1%. Moreover, emissions of particulate matter produced outside the transport combustion processes (i.e. re-suspension of dust on roads and wear of brakes, tyres and road surface) are expected to grow in the future. **Greenhouse gas emissions** from transport decreased in 2011, however, they are still much higher than in 2000 (CO2 by 41.4% and N2O by 66.1%), mainly due to the growth of transport performance in passenger car and road freight transport in this period. Nevertheless, development after 2008 is positive, and if the decline in energy intensity of passenger car transport continues, further reductions in the production of greenhouse gas emissions in the transport sector can be expected.

The Czech Republic's **passenger car transport performance per capita** (Chart 5) is by about 30% lower (about 6,000 pkm.inhab.$^{-1}$) than the average of EU27 countries. In the Czech Republic, the proportion of passenger car transport in the total passenger transport (except air transport) is about 65%, which is, according to the 2010 data, the lowest figure of all EU27 member states, the average of which is 82.5%. The Czech Republic has the second highest proportion (after Macedonia) of buses in the passenger transport performance[3] (18.1%), but the share of railways is below average. Switzerland has the highest proportion of railways in the passenger transport performance in Europe (17.1%).

In the further development of passenger transport it can be expected that the proportion of passenger car transport in the total transport performance will probably not increase any more. On the other hand, as long as quality services are provided, there is a growth potential in public transport (buses, trains and city public transport). Development of road freight transport will be greatly dependent on the performance of the economy, and without effective measures and significant changes in the economy, weakening of the position of road freight transport within the overall freight transport in the Czech Republic cannot be expected. This fact will probably complicate further decreasing of the transport-related environmental burden to a great extent.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

[3] Buses operated within city public transport are included, which is different from national statistics.

27/ Structure of the passenger-car and truck fleet

KEY QUESTION

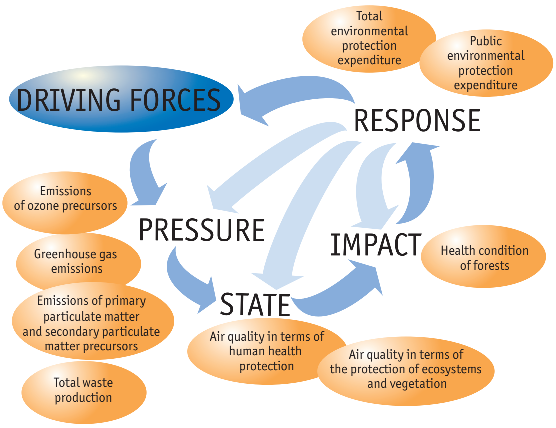
Has there been improvement in the parameters of the road vehicle fleet and, in turn, a reduction in environmental burden?

KEY MESSAGES

In the Czech Republic, sales of new passenger cars have been growing, they have exceeded the import of used cars from abroad, and gradual modernisation of the fleet can be therefore assumed. Interannually, the number of new passenger cars registered in 2011 increased by 2.4% to 173,300 vehicles, which is the highest number since 2000. The average age of the fleet was 13.8 years. The dynamic fleet, i.e. the actually operating vehicles, is much younger compared to the registered fleet; its average age is around 8.5 years.

Rather old used cars between 5–15 years of age are imported most frequently to the Czech Republic; they make up about two-thirds of the total number of imported used cars. Moreover, the proportion of imported vehicles older than 10 years is growing and, on the other hand, the proportion of newer cars below 5 years of age in the total imports is decreasing.

In the Czech Republic, the fleet of motor vehicles, with the exception of small commercial vans of category N1, are extremely old; the average age of registered cars was 13.83 years in 2011.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The priorities of the **State Environmental Policy of the Czech Republic** concerning the vehicle fleet include reducing the consumption of non-renewable energy sources in the transport field and minimising the impacts of transport on human health and ecosystems in connection with air pollution and noise from transport. The policy aims at promoting the use of alternative fuels in such a way so that their proportion in fuels consumption is at least 20% in 2020.

Within its Priority Axis 2 (Economy and Innovation), priority 2.1 (Support to the national economy's dynamics and strengthening competitiveness), the **Czech Republic's Strategic Framework of Sustainable Development** aims at "improving transportation, making it more effective and increasing its security". One of the partial objectives is to reduce the negative environmental impacts of transport, which is closely related to the fleet's age, structure and renewal.

One of the cross-cutting priorities of the **Czech Republic's Transport Policy for the years 2005–2013** is „to limit the environmental and public health impacts of transport in line with sustainable development principles". This priority also applies to the fleet of road vehicles, as the pollution produced by new vehicles per unit of transport performance has been reduced in the context of technological developments.

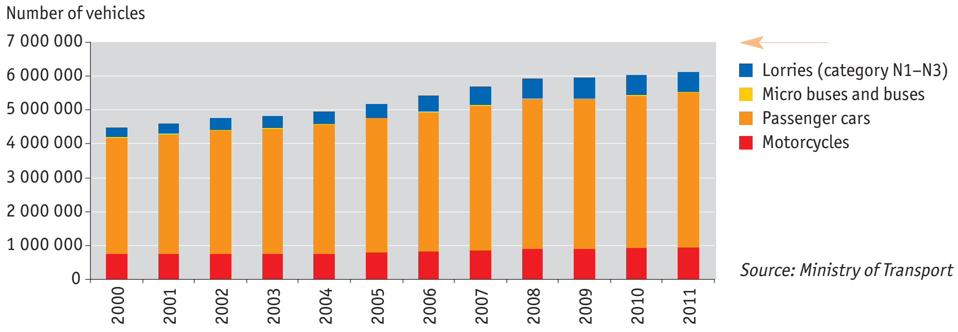
The European emission standards, or the EURO standards, which the Czech Republic as an EU member state must meet, are the main legislative measure to reduce emissions from new cars at the EU level. The EURO 5 standard has been in effect since 1st September 2009 and EURO 6 is currently under preparation.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The composition of the road vehicle fleet influences energy and 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. In terms of human-health impacts, growth of cars using diesel fuel is an adverse trend. While petrol engines produce higher emissions of greenhouse gases, diesel engines are the source of solid particulate matter.

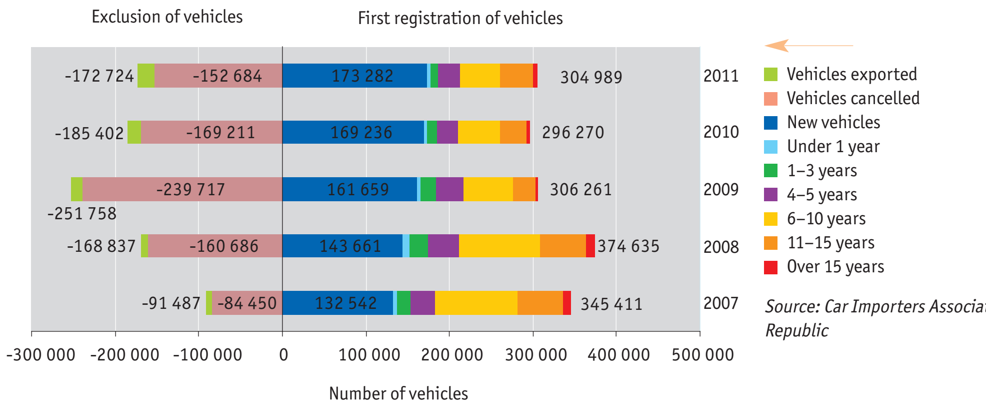
INDICATOR ASSESSMENT

Chart 1 → **Development of the number of motor vehicles registered in the Czech Republic [number of vehicles], 2000–2011**



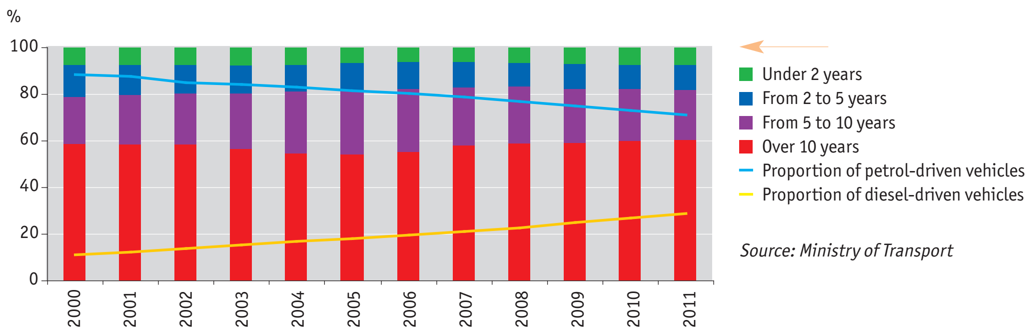
Source: Ministry of Transport

Chart 2 → **First registration of vehicles by age and excluding of vehicles from the Central Vehicle Register [number of vehicles], 2007–2011**



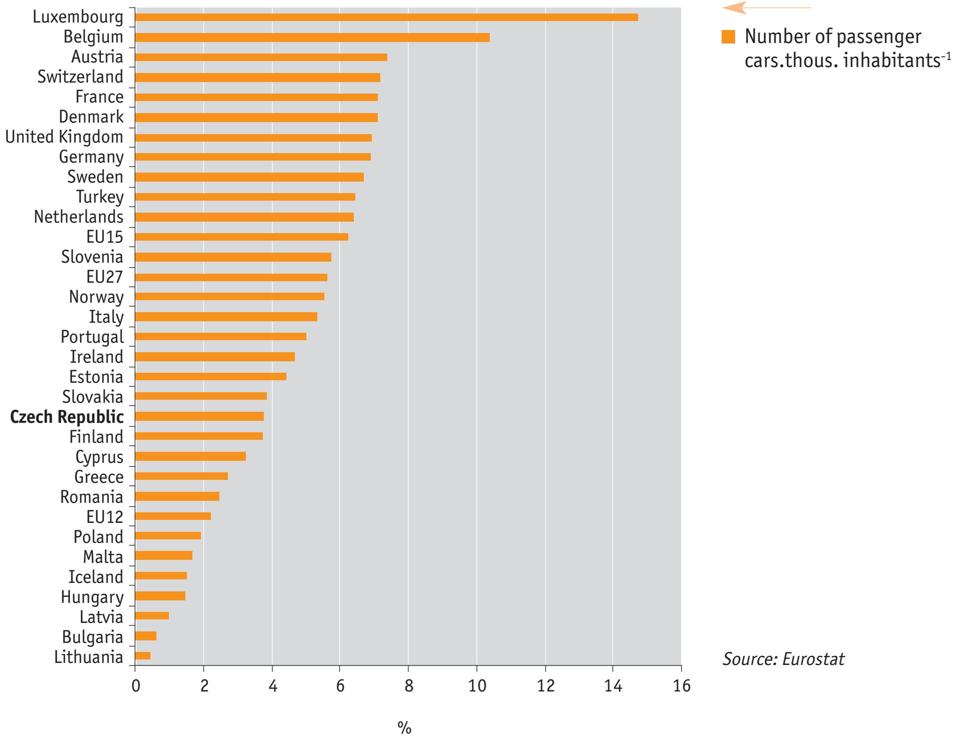
Source: Car Importers Association of the Czech Republic

Chart 3 → **Development of the age structure of the passenger-car fleet registered in the Czech Republic [%] and the proportions of petrol and diesel cars in the passenger-car fleet [%], 2000–2011**



Source: Ministry of Transport

Chart 4 ➜ **Coefficient of passenger-car fleet renewal [%], 2010**



Source: Eurostat

The coefficient is calculated as the ratio of new vehicles registered in a given year and the total size of the fleet.

The number of road vehicles registered in the Czech Republic is growing steadily and their average age is very high. According to data of the Central Vehicle Register, 6.386 mil. vehicles and 973,000 trailers, i.e. a total of 7.359 mil. road vehicles, were registered at the end of 2011, which is an interannual increase by 1.9%. **Average age of the entire fleet** was 17.3 years in the Czech Republic (at the end of 2010 it was 17.1 years); the increase in the average age was shown in all basic categories of vehicles. Motorcycles have the highest average age (32.2 years), followed by tractors (29.8 years) while small vans are the youngest (9.2 years).

In 2011, the number of registered **passenger cars** (category M1) grew by 1.93% to 4.583 mil. (increase in registrations by 86,681 vehicles). Since 2000, the number of registered passenger cars has grown by more than 1.1 mil. vehicles, i.e. roughly by one third (Chart 1). 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 585,900 in 2011, after 2008 the number has stagnated. After a period of stagnation between 2000 and 2004, the number of motorcycles has been growing since 2005. Interannually, the number of registrations of motorcycles increased by approximately 20,000 vehicles (2.2%) since 2005 by about 19%. This is also reflected in the increasing proportion of motorcycles in the traffic flow structure on roads.

Registrations of **new passenger cars** have been growing steadily since 2006 and in 2009 they exceeded the registrations of imported used cars (Chart 2). In 2011, the market with new passenger cars registered in the Czech Republic increased by 2.4% (4,046 vehicles) to 173,300 vehicles. The first registration of **imported used passenger cars** increased interannually by 3.7% (4,673 vehicles) to 131,700 vehicles after a significant decline in imports of these vehicles after 2008, when a record number of about 230,000 vehicles were imported to the Czech Republic. In 2011, 172,700 of passenger cars were excluded from the register, which is by 6.8% less than in 2010 and by 31.4% less than in 2009, when more than 250,000 vehicles were excluded from the register as a result of amendments to the Act on compulsory contractual insurance. However, the rate of **excluding vehicles from the register** is currently higher than in 2000, and it is more than tripled in comparison with the year 2005, when only 56,000 vehicles were excluded. Exports of used cars (about 20,000 vehicles in 2011) are increasing in the framework of excluding vehicles from the register. Nearly a half of the vehicles were exported within one year of the first registration.

At the end of 2011, **the average age of registered passenger cars** was 13.83 years (13.7 years in 2010), the fleet of the Czech Republic is therefore one of the oldest in Europe. Vehicles older than 10 years accounted for more than 60% of the fleet (about 2.75 mil. vehicles) and this proportion is still growing slowly after 2005 while almost 30% of the vehicles are older than 15 years (Chart 3). The highest average age of the fleet is in the region of Ústí nad Labem (14.71 years), the lowest age is in the city of Prague (13.11 years). In 2011, **the motorisation rate** in the Czech Republic was at the level of 435 vehicles per 1,000 inhabitants (427 in 2010), while the figure is highest in Prague (532 vehicles.1,000 inhab.$^{-1}$) and lowest in the Moravian-Silesian region (370 vehicles.1,000 inhab.$^{-1}$).

Along with a small renewal of the fleet through purchase of new vehicles (3.8% in 2011, the optimum value is about 8%), which, however, is a positive development, the main cause of the high and non-decreasing age of the passenger car fleet consists in used-car imports from abroad and generally little motivation of the people to purchase newer vehicles (under 10 years), which is also influenced by their purchasing power. Most of the imported vehicles are 5–15 years old (65.8% in 2011). Moreover, the proportion of imported vehicles older than 10 years has been growing (33.2% in 2011, interannual increase by approximately 5 percentage points) while the share of imported vehicles below 5 years of age is rather declining (30.5% in 2011, 32.8% in 2010).

The age of the fleet would be much more favourable, if we focus only on vehicles actually operating in traffic, on the so-called **dynamic fleet**. According to a study[1] worked out by ATEM company for the Roads and Motorways Directorate, the average age of the passenger car fleet actually operated on Czech roads is 8.5 years (at the end of 2010), which is comparable with Western Europe. Vehicles below 5 years of age account for 37.5% of all vehicles, and average representation of vehicles older than 25 years in traffic stream is 0.9% (about 10% in the Central Register of Vehicles). However, even according to this study, the fleet's age has been stagnant since 2001; there is only decrease in average age of lorries.

In terms of **the fleet's structure by drives**, the proportion of **diesel passenger cars** in the total number of registered cars is increasing significantly. While in 2000 diesel cars represented about one-tenth of the fleet (383,000 vehicles), in 2011, their proportion approached one third (1.3 mil. vehicles, i.e. 28.8 %). **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. All alternatively powered vehicles account for approximately 2% of the road vehicle fleet.

The structure of registered vehicles by **the EURO emission standards' fulfilment** is still unfavourable, although gradually improving. In 2011, about a tenth of the passenger-car fleet (10.6%) meet the strictest standard (EURO 5). On the other hand, about 16% of passenger cars and vans and 37% of all trucks did not meet any of the EURO emission standards.

Within the EU27, the motorisation rate in the Czech Republic is below average, however, among the EU12 countries, it is one of the highest (the EU12 average is 368 vehicles.1,000 inhab.-1). The proportion of new cars registered in 2010 (the latest data available for EU27) in the total fleet size (Chart 4) was 3.8% in the Czech Republic. In comparison with EU27 and especially with the EU15, this is a significantly lower proportion (5.6%, respectively 6.3%), however, within the EU12 countries (2.2% of new registrations), more new vehicles are sold in the Czech Republic. Luxembourg has the highest coefficient of renewal (14.7%) but the size of its fleet is relatively small. In Belgium, whose fleet has a size comparable to that of the Czech Republic, the coefficient of renewal is 10.4%; about three times more cars are sold here per year as opposed to the Czech Republic.

Assuming economic growth, increasing sales of new vehicles and modernisation of the fleet can be expected. The rate of the fleet's renewal will depend on imports of used cars from abroad, as far as the volume and, in particular, the age are concerned, and also on the people's motivation and possibilities to purchase new vehicles and to put the old ones out of operation.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

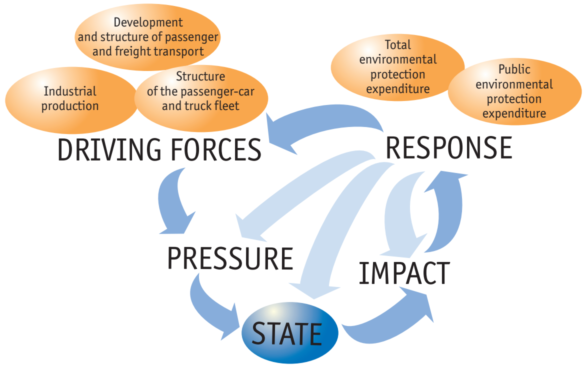
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1895)

[1] *"Determination of the current dynamic road fleet structure in the Czech Republic and its emission parameters in 2010".*

28/ Traffic-related noise pollution

KEY QUESTION →

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



KEY MESSAGES →

In the Czech Republic, 3% of the population are exposed to excessive noise which exceeds the respective health-protection limits. In urban areas, it is about 10% of the population.

The main source of noise is road transport, which covers approximately 90% of the total number of inhabitants affected by excessive noise. In some villages and smaller towns more than a half of the population living here are affected by excessive noise from road transportation.

In the Czech Republic, the characteristics and extent of noise pollution does not differ from the situation in the EU27 significantly. The proportion of the Prague population affected by excessive noise is usually lower than that in capitals of the EU12 countries; however, it is higher than that in some West European capitals.

OVERALL ASSESSMENT →

So far, it is not possible to assess the noise pollution trends on the basis of available data. The development of traffic noise will depend on the construction of new roads and their routes, and also on the development of transport performance in passenger and freight transport and on the rate of road fleet renewal. The intensity of noise pollution is being evaluated as early as during the process to assess environmental impacts of roads (EIA), i.e. before their construction begins.

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

Health-care limits for noise are laid down by Regulation No. 148/2006 Coll., on the protection of health from adverse effects of noise and vibration. In the Czech Republic, the limit values of noise indicators for the purposes of strategic noise mapping are laid down in the Decree No. 523/2006 Coll., on noise mapping.

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

According to the Directive, all EU member states were obliged to work out strategic noise maps by 30th June 2007 to document the situation in their territories – in agglomerations with more than 250,000 people, on the roads where more than 6 mil. vehicles pass per year (i.e. about 18,000 vehicles per day), for the main railway tracks where more than 60,000 trains pass every year, and also for the main airports.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

Exposure to excessive noise causes acoustic uneasiness, it interferes sleeping, has negative impacts on concentration and it may even bring about defects in both hearing and other organs. Bothering and sleep disturbance are sources of stress, which is one of the factors contributing to the emergence of civilization diseases. Long-term exposure to noise above 65 dB is associated with effects on the cardiovascular system, especially in terms of the impact on the development of coronary ischaemia and high blood pressure. Negative effects of excessive noise on the central nervous and immune system have also been described. The health impact of noise can be increased in combination with other effects, e.g. air pollution. Noise may also disrupt habitats of certain animal species, and thus it has negative impacts on ecosystems.

INDICATOR ASSESSMENT

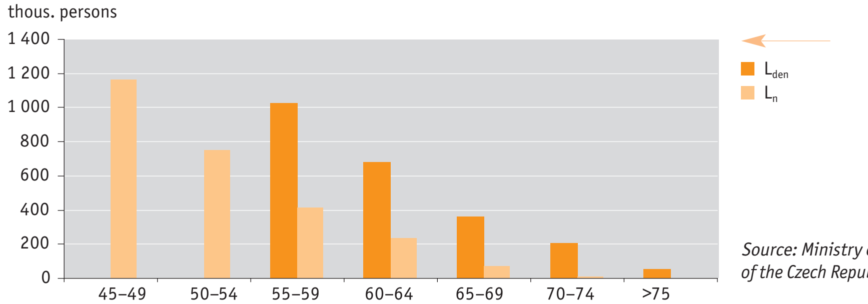
Table 1 ➔ **Limit values for noise indicators in the Czech Republic [dB], according to Decree No. 523/2006 Coll., on noise mapping**

Source of the noise	L_{den} [dB]	L_n [dB]
Road transport	70	60
Railway transport	70	65
Air transport	60	50
Integrated devices	50	40

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

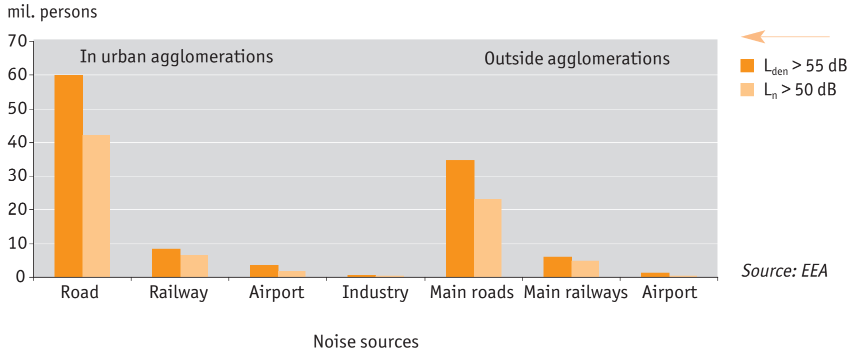
Source: Ostrava Health Institute, Ministry of Health Care of the Czech Republic

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



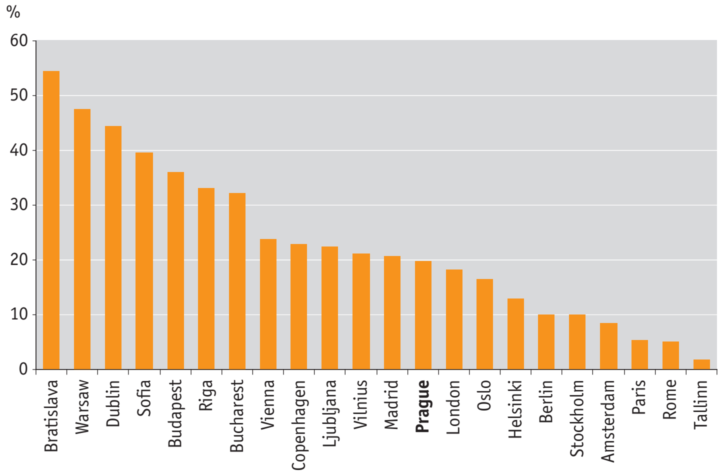
Source: Ministry of Health Care of the Czech Republic

Chart 2 ➔ **Number of EU27 citizens exposed to daily noise levels above 55 dB and night noise above 50 dB from each source category [mil. persons], 2010**



Source: EEA

Chart 3 → **Proportion of the population of European capitals affected by excessive noise exceeding 55 dB in the night hours [%], 2010**



Source: EEA

In the Czech Republic, according to the results of **the 1st phase of strategic noise mapping** (SNM), a total of 258,800 people (2.5% of the population) from the perspective of full-day noise pollution and 319,600 people (3% of the population) as regards **excessive sleep-disturbing night noise** live in areas where the noise exceeds the determined health-protection limits. The values refer to the indicators Lden (above 70 dB) and Ln (above 60 dB)1. In the Czech Republic[2], approximately 2.3 mil. people, which are 22% of the population (Chart 1), are exposed to all-day noise level exceeding 55 dB. Therefore, the proportion of the Czech population disturbed with excessive noise is comparable with the EU27 countries. However, it is necessary to emphasize that the results of noise mapping do not reveal the total level of noise pollution up to now because they do not cover the whole of the Czech Republic and all noise sources. The second phase of the strategic noise mapping (SNP), which should be finished in 2012, is expected to make the description of the noise situation in the Czech Republic more accurate.

The noise pollution to which population in **urban areas** is exposed is much higher than the average for the whole of the Czech Republic. Approximately two thirds (67% for all-day noise above 55 dB and 64% for all-day noise above 70 dB) of the total number of the Czech Republic's inhabitants exposed to excessive noise live in the three agglomerations which have been covered by noise mapping so far (Prague, Brno and Ostrava). In Prague, approximately 106,000 people are exposed to excessive noise all day and 119,000 people at night (10–13% of the population), in Brno and Ostrava it is also about 10% of the population living in these cities.

Road transport, which accounts for approximately 90% of evidenced noise pollution, is unambiguously **the main source of above-limit noise.** The remaining proportion of noise pollution is caused by railway and air transport, and only less than 0.5% comes from non-transport sources, namely so-called integrated devices, which are stationary (mostly industrial) sources of noise. The SNM has therefore showed that stationary sources do not cause significant noise in areas that have been mapped so far. However, the situation may change when noise maps are worked out for industrial and mining areas, for example the region of Ústí nad Labem.

Also **outside urban agglomerations**, where road transport contributes decisively to noise pollution, excessive noise causes environmental burden especially in those towns and villages through which the main roads with intense traffic are going. The worst situation is in the villages of Ostrovančice (Brno-outskirts district), Polom (Přerov district) and Slavnič (Havlíčkův Brod district), where traffic noise affects more than 50% of the population. This situation prevents the municipalities from developing their territory and may lead to gradual depopulation, decline in real estate prices and deepening social segregation (concentration of weaker social groups). The most people are exposed to extreme transport-related noise pollution above 70 dB at night (the limit is 60 dB for road transport) in Olomouc (1,919 inhabitants), Znojmo and Opava. In Prague, 630 inhabitants are exposed to this value of noise pollution.

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[1] *The indicator L_{den} (day-evening-night) describes all-day noise disturbance; L_n is the noise indicator of sleep disturbance. The limit values of these noise indicators according to the Decree No. 523/2006 Coll. are listed in Table 1.*
[2] *All-day exposure to this noise level can cause health defects.*

In the Czech Republic, 14,800 inhabitants (indicator L_{den}) live in areas where the limit value for noise from **railway transport** is exceeded; 600 people are exposed to above-limit noise values at night. Most of the people disturbed by noise from railway transport during the day live in Prague (12,300 people for L_{den} and 400 people for L_n). **The airport in Prague-Ruzyně** burdens 1,600 inhabitants with excessive noise levels for the whole day and 1,900 inhabitants during the night hours. The inhabitants living in the villages of Horoměřice, Jeneč and Kněževes are affected most by noise from the airport.

It is also possible to find out from the SNM results **the number of buildings affected by excessive noise**. In the Czech Republic, there are 65 hospitals and other medical buildings exposed to excessive noise at night (46 during the day) and 175 schools. Out of them, 14 hospitals and 36 schools are in Prague. In the Czech Republic, total of approximately 30,000 residential houses are affected in the daytime and 42,500 residential houses are disturbed at night.

The nature and extent of noise pollution in the Czech Republic are comparable to those in the EU27 countries. In the EU27 countries, about 115 mil. people are exposed to daily noise levels above 55 dB (23% of the population), of which 95 mil. inhabitants are disturbed by noise related to road transport (Chart 2). Roughly 63% of the population exposed to excessive noise live in urban agglomerations. The situation regarding the night noise pollution (above 50 dB) is somewhat better — it concerns about 80 mil. people, i.e. 16 %. France and the United Kingdom have the highest numbers of persons affected by noise from main roads outside urban agglomerations; more than 10 mil. people disturbed by all-day noise above 55 dB live in these two countries. For a comparison – in the Czech Republic this concerns 755,000 people. In France, there is also a very high number of inhabitants exposed to extreme transport-related noise pollution over 75 dB, which is 1.79 mil. people (2.8% of the population); in the Czech Republic this is only about 32,000 inhabitants (0.3%). In comparison with other European capitals, the situation regarding noise pollution in Prague is satisfactory (Chart 3). Significantly larger proportions of the population affected by excessive night noise live in Bratislava, Budapest and Warsaw. However, there is another interesting fact – the noise pollution in Paris, Amsterdam and Rome is much lower than that in Prague, probably because the transit road transport does not go through the centres of these cities.

According to **the World Health Organization's study**[3], aimed at the health impacts of noise exposure, in some West European countries, excessive noise causes the loss of 1.5 mil. years of healthy life per year (the figure includes the years lost due to premature deaths and the years of illness which limit the people significantly). Along with problems concerning air pollution, which causes a loss of up to 4.5 mil. years, noise is the second most serious environmental factor which has negative impacts on human health.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1902)

[3] *WHO, Burden of disease from environmental noise, 2011, available at: http://www.euro.who.int/en/what-we-publish/abstracts/burden-of-disease-from-environmental-noise.-quantification-of-healthy-life-years-lost-in-europe.*

29/ Domestic material consumption

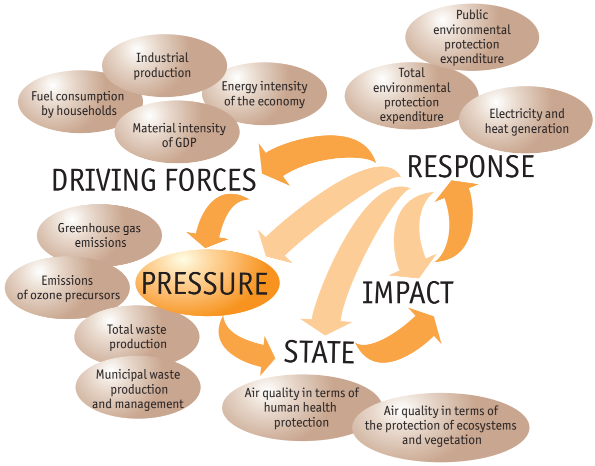
KEY QUESTION

Is the environmental burden associated with material consumption decreasing in the Czech Republic?

KEY MESSAGES

In 2010, the domestic material consumption[1] decreased by 5% in the Czech Republic, so the decreasing trend in material consumption which began in 2008 continued. The consumption of construction minerals resources showed the most notable decline (by 12.5%); these minerals also account for the largest proportion in the Czech Republic's material consumption. Coal consumption has been falling steadily, the consumption of crude oil and petroleum products decreased interannually, too.

In 2010, the consumption of ores and industrial minerals resources increased in response to growing industrial production. Material dependence on foreign countries has been growing; in 2010, imports covered 40.1% of the domestic material consumption, which is the highest proportion since 1990. The majority (approximately 88%) of the Czech Republic's material base is comprised of non-renewable resources, whose consumption poses a greater environmental burden than the consumption of renewable resources.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The **Strategic Framework for Sustainable Development of the Czech Republic**, which is valid since January 2010, is the fundamental document that sets out the goals and strategies in the field of material consumption and material intensity of the economy. Within priority axis 2 "Economy and innovation", the document sets the objectives concerning achievement of maximum independence of the Czech Republic on the import of energy and material resources and the promotion of sustainable material management.

Efficient use of resources is one of the main topics of the **EU Strategy of Competitiveness – Europe 2020,** the **National Reform Programme**, which was approved by the Czech Government in 2010, and other national strategic documents, such as the **State Energy Policy of the Czech Republic** and the **Raw Materials Policy of the Czech Republic**.

Reducing both the consumption of materials and the material intensity of the economy are also among the priorities of the **State Environmental Policy of the Czech Republic**.

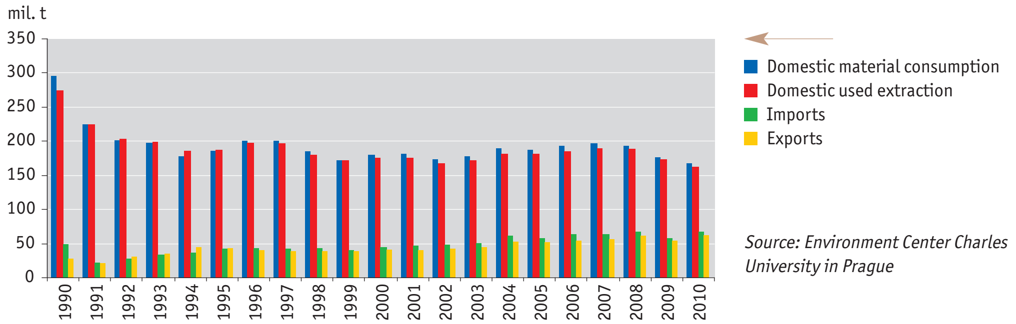
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

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. Fuels account for almost one third of the material consumption; their use is then connected with emissions of greenhouse gases and air pollutants. Material consumption increases emissions into water and soil, and the amount of waste generated. Raw material extraction and processing, production of products and waste management (landfilling), i.e. activities related to material consumption, damage the landscape, disrupt ecosystem functions and have a number of negative health impacts.

[1] *The 2011 data are not, due to the methodology of their reporting, available at the time of publication. These data will be published in the publication "Material Flow Accounts in the Czech Republic in 2004–2011" probably in February 2013, and will be evaluated in the 2012 Report.*

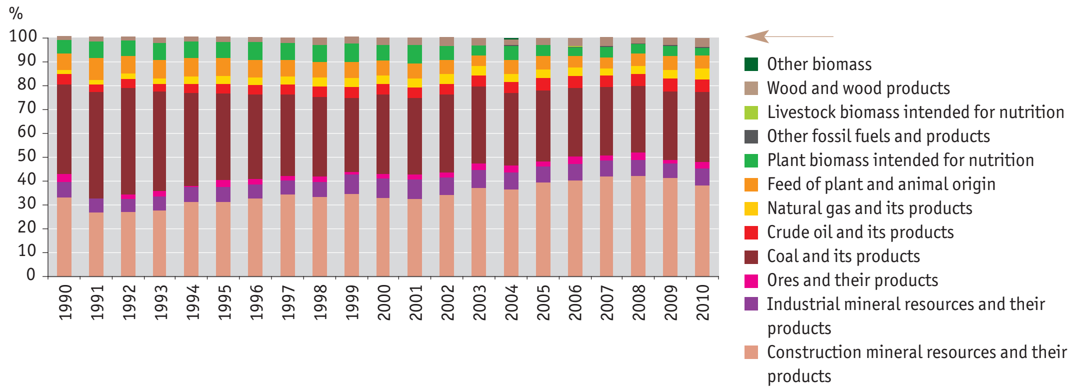
INDICATOR ASSESSMENT

Chart 1 → **Development of domestic material consumption and its components in the Czech Republic [mil. t], 1990–2010**



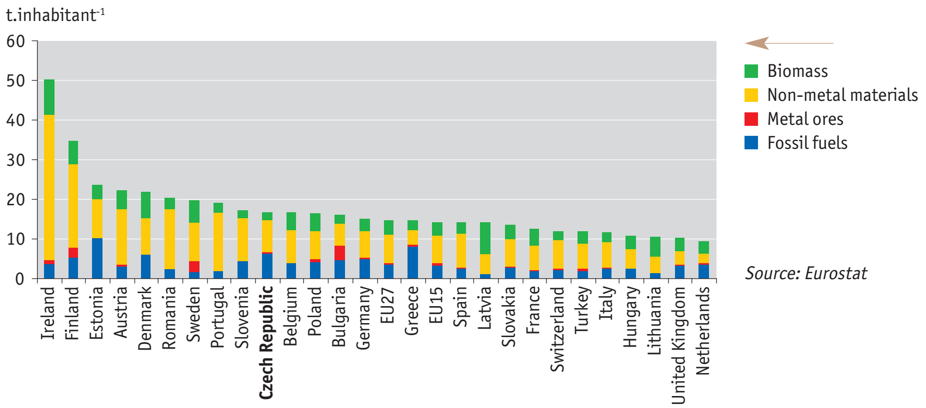
Source: Environment Center Charles University in Prague

Chart 2 → **Development of the DMC structure in the Czech Republic by material groups [%], 1990–2010**



Source: Environment Center Charles University in Prague

Chart 3 → **International comparison of domestic material consumption by groups of materials [t.inhabitant-1], 2009**



Source: Eurostat

In 2010, **the Czech domestic material consumption (DMC)**[2] showed a considerable interannual decrease by 5% to 167.7 mil. t in the second consecutive year, following a five-year period of growth between 2003 and 2007 and a mild decline in 2008 (Chart 1). In the Czech Republic, consumption of materials followed the economy's development in 21st century. In 2010, however, despite a slight recovery of the economy, there was a decline in the DMC, which is a positive finding that indicates absolute separation of the environmental burden curve associated with consumption of materials and that of economic growth (so-called absolute decoupling). In 2010, material consumption stood at 57% of the 1990 level, which means that the environmental burden associated with material consumption is currently much lower than it was in the early 1990s. However, because the DMC, due to the calculation method, does not take into consideration the creation and consumption of stocks in the single material categories, there may be a certain time lag between the DMC development and development of the pollution connected with the materials' consumption (e.g. coal combustion in power stations).

In 2010, the DMC development in the Czech Republic was most affected by interannual decrease in consumption of **construction mineral raw materials** by 8.9 mil. t , i.e. by 12.5%. Although in 2010, the construction performance increased by about 3%, in 2011, according to the CSO estimates, it decreased by more than 7%, which was reflected in a decreasing demand for extraction and production of construction materials as early as in 2010. Since 1998, the construction mineral resources account for the largest proportion in the total material consumption in the Czech Republic (about 38% in 2010, Chart 2) and that is why their consumption has the greatest influence on the total DMC. The absolute figures for this category indicate that it contributed significantly to the increase in domestic material consumption between 2002 and 2007, when it increased by 39.3% (from 59.1 mil. t to 82.3 mil. t), mainly as a result of building of transport infrastructure.

On the other hand, in 2010, the greatest increase was recorded in the consumption of **industrial mineral resources**, namely by 1.7 mil. t (16%), and **ores and related products** (by 1.6 mil. t, i.e. 55.6%), thus groups of materials that are used mainly in the processing industry. The development can be linked with the growth of industrial production in 2010, after a significant decline in 2009.

Consumption of **fossil fuels** accounted for approximately 40% of the Czech Republic's total material consumption in 2010. The consumption of **coal and coal products** has a downward trend since 1990; in 2010 it decreased interannually by approximately 1 mil. t, i.e. by 2% to 49.7 mil. t. Nevertheless, in view of a more significant decline in the total DMC, the proportion of coal in the material base grew in the second consecutive year; in 2010 it increased by 0.9 p. p. to 29.6%. In the years 2002–2008, the consumption of **crude oil and petroleum products** was gradually growing to reach the value of 9.7 mil. t; then it showed a slight interannual decrease and in 2010, it dropped significantly by 8.5% to 8.8 mil. t. The decline in oil consumption is probably caused by a decrease of fuel consumption in transport (petrol dropped by 9.1%). The reason consists in stagnation of the transport performance and in the trans-boundary transport of fuel due to the different rates of excise duty. **Natural gas consumption** does not have a significant trend at the beginning of 21st century and it is influenced mainly by temperatures during the heating seasons. That is why the increase in natural gas consumption to 7.6 mil. t in 2010 (by 17.5%), which is the highest value in the period 1990–2010, can be attributed to one of the coldest heating seasons in recent years. The overall trend in the consumption of fossil fuels indicates the gradual and environmentally more favourable substitution of solid fuels for liquid and gaseous fuels.

As regards **renewable resources**, it is plant and animal feed (5.5%) followed by wood and wood products (3.7%) and plant biomass intended for nutrition (3%) that account for the largest proportions in domestic material consumption. While the consumption of plant biomass showed a significant interannual decrease by 2.8 mil. t (by 35.5%) in 2010 and its trend has been declining with relatively significant fluctuations since 2000, the consumption of wood has risen by 0.8 mil. t, i.e. by 16.2%, which is probably also connected with the cold heating season and consumption of wood for heating. In long terms, the proportion of renewable resources in the Czech Republic's material base has been very low and, given the fact that the consumption of renewable energy resources is usually associated with less environmental impacts than the consumption of non-renewable resources, the development in 2002–2010 can therefore be considered as negative in these terms.

The proportion of imports in the DMC, i.e. **material dependence on foreign countries,** grew from 24.8% in 2000 to 40.1% in 2010. In 2010, there was a very significant interannual increase of the material dependence by 7.1 p.p. (by 21.6%), namely due to the growth of imports by 9 mil. t to 67.2 mil. t, which is the highest level since 1990, while the total DMC decreased. The largest proportions of this growth were covered by an increase in imports of iron ore by 2.7 mil. t (27.3%) to 12.4 mil. t, natural gas by 2 mil. t (27.8%) to 9.3 mil. t and biomass by 1.1 mil. t (11.5%), within which wood (by 437,000 t) and vegetables (by 131,000 t) accounted for the greatest parts. In the case of fossil fuels, the proportion of imports in their consumption increased from 14.2% in 1991 to 38.3% in 2009 while in 2010 there was another growth by 5 p. p. to 43.2%. This significant increase was mainly due to the growing oil and natural gas consumption, as the vast majority of these fuels is imported.

[2] DMC is calculated as the domestic used extraction minus exports plus imports. It measures the quantity of materials consumed by the given economy for production and consumption. The value of the domestic used extraction corresponds to the burden and impacts related to extraction of raw materials and production of biomass.

The Czech Republic's **per-capita domestic material consumption** is by 14.5% higher than the average of EU27 and by 18.3% higher than the average of EU15 (according to the 2009 data, Chart 3). In some European countries, however, the DMC per person is significantly higher than that in the Czech Republic. In Ireland, Finland, Romania, Austria and Portugal, the high per-capita DMC value is caused by a high consumption (i.e. extraction) of non-metal materials, and in Estonia by extraction of fossil fuels. The relatively high specific value of domestic material consumption in the Czech Republic is due to a high per-capita consumption of fossil fuels and non-metal materials within the countries compared. By contrast, biomass consumption in the Czech Republic is the third lowest one after Slovenia and Bulgaria. In the Czech Republic, the high consumption of fossil fuels can be attributed to the high proportion of solid fuels in the primary energy base and to relatively high energy intensity that results, among other things, from a substantial proportion of industry in the Czech economy.

Given the fact that the consumption of materials depends substantially on the structure of the national economy and development of the GDP indicator, the DMC can be expected to increase in short term, provided that economic growth recovers. The long-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 base. Unless the position of materially intensive sectors declines at the expense of sectors with low or at least declining material intensity (such as services), material consumption and the environmental burden that is associated with such consumption are not likely to show any long-term decline in the future.

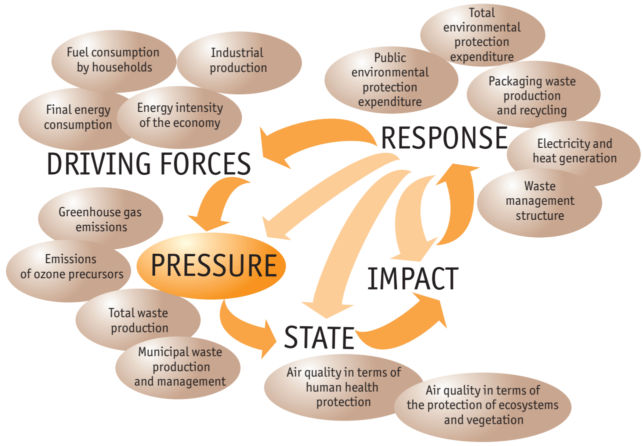
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1842)

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 primary materials into economic output is improving. Between the years 2000–2010[1], the material intensity decreased by 33.3%. In 2010, the material intensity dropped interannually by 7.5%, while GDP grew by 2.7%, accompanied by a decrease in domestic material consumption by 5%. Therefore, in this year, there was an absolute separation of the curves of environmental burden associated with material consumption and of economic growth (so-called absolute decoupling).

Over the period concerned, a decrease in material intensity occurred in most years either due to the combination of economic growth and a stagnating/growing material consumption, or during economic downturn when material consumption declined more quickly than the economic performance (the latter occurred in 2009). Therefore, if the current structure of the economy is maintained, the outlook for material consumption in the case of economic growth is not unequivocal.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Increasing material and energy efficiency and achieving the Czech Republic's independence on foreign energy sources is among the priorities of the **Strategic Framework for Sustainable Development of the Czech Republic** that the Government approved in January 2010. This priority is also included in the **Strategy of Energy Security**, which the Government has taken note of in 2011.

The need to improve efficiency in transforming materials into economic output and to reduce the environmental burden per unit of economic performance has been highlighted by the **EU Sustainable Development Strategy,** the **EU Thematic Strategy on the Sustainable Use of Natural Resources** and the **OECD Council Recommendation on Material Flows and Resource Productivity.**

The priority area 2 "The Sustainable Use of Natural Resources, Material Flows and Waste Management" within the currently valid **State Environmental Policy of the Czech Republic** aims at (priority objective 2.4) reducing the energy and material intensity of production and increasing the use of waste for material and energy recovery.

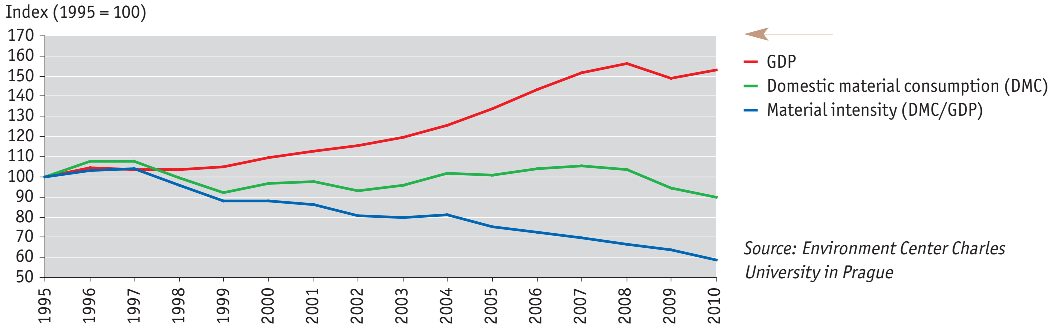
IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

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

[1] *The 2011 data are not, due to the methodology of their reporting, available at the time of publication. These data will be published in the publication "Material Flow Accounts in the Czech Republic in 2004–2011" probably in February 2013, and will be evaluated in the 2012 Report.*

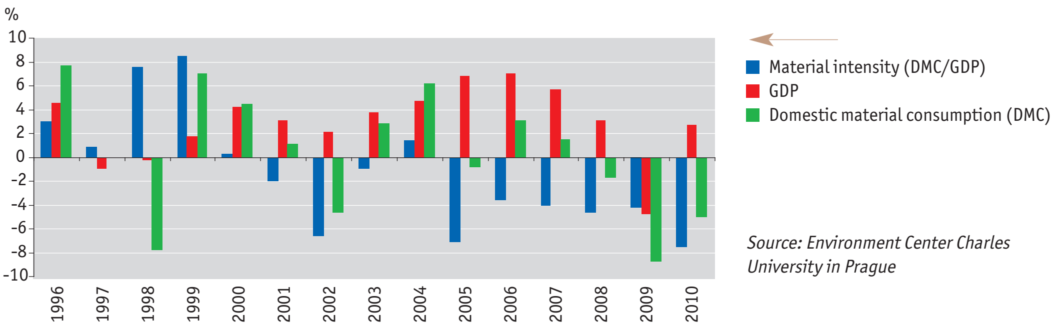
INDICATOR ASSESSMENT

Chart 1 ➜ **Material intensity, domestic material consumption and GDP in the Czech Republic [index, 1995 = 100], 1995–2010**



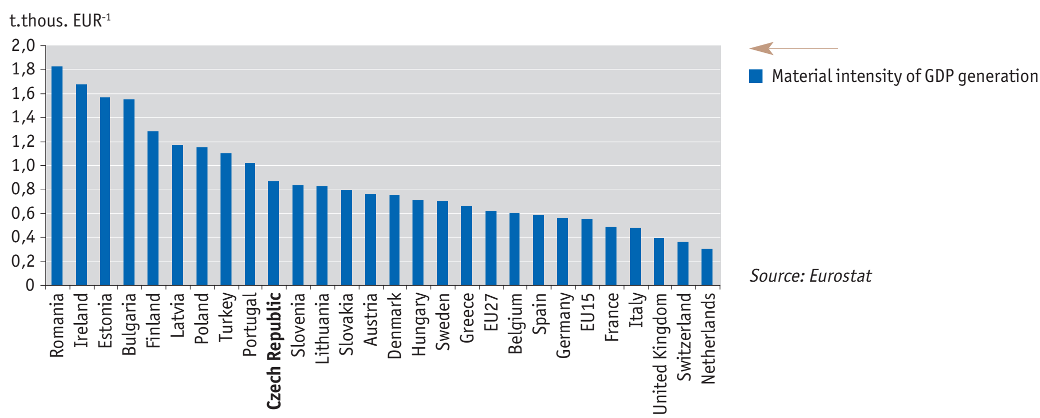
Source: Environment Center Charles University in Prague

Chart 2 ➜ **Interannual changes in material intensity, DMC and GDP [%], 1996–2010**



Source: Environment Center Charles University in Prague

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



Source: Eurostat

GDP conversion is based on purchasing power parity (PPP).

The material intensity of the Czech Republic's economy[2] has been declining since 1998, most notably in the period since 2005 (Chart 1, line DMC/GDP). Between the years 2000 and 2010, material intensity decreased by 33.3% and in 2010, it decreased by 7.5% interannually while domestic material consumption dropped by 5%. So there was **an absolute decoupling** in the latest reference year, in which environmental burden was declining while economic performance was growing. Decreasing material intensity is a positive trend that indicates an increased efficiency of transforming input material flows into economic output and also a decreased environmental burden per unit of GDP. The fact that the strong economic growth between 2003 and 2007 was associated with a DMC increase was, among other things, caused by material-intensive industries such as construction, the manufacture of machinery, metal-working products 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 burden expressed as DMC from the trend in economic performance expressed as GDP (Chart 1 and Chart 2). There was **a relative decoupling** (when the trends in material consumption and in the economy have the same direction) as a result of economic growth (with DMC growing) in the years 2001, 2003, 2006 and 2007, and as a result of DMC decline (with the economy declining) in 1998 and 2009. **The absolute decoupling**, i.e. declining material consumption combined with positive economic growth was showed in 1999, 2002, 2005, 2008, and newly also in 2010.

In 2009, **the Czech Republic's material intensity** was by more than a third (39%) higher than that of the EU27 average and by more than 50% higher than material intensity of the EU15 average (Chart 3). The above-average material intensity of the Czech Republic is connected with a higher per-capita DMC resulting from the national economy's structure and, in comparison with the West European countries, with lower economic performance. A material intensity higher than that of the Czech Republic is primarily in new EU countries, especially Romania, Bulgaria, Estonia and Poland. Among the EU15 countries, only Portugal, Finland and Ireland have a higher material intensity than the Czech Republic.

Future trends in material intensity will depend on the economy's structure, the position of material-intensive sectors within the Czech economy and on the development of the energy base structure. With regard to the high proportion of sectors with high demands for materials and energy (manufacture of metal products, machinery and equipment, manufacture of motor vehicles and construction) in creation of the Czech Republic's GDP, only a gradual decline of material intensity and continuing of the relative decoupling can be expected. Further decrease in material consumption even in periods of economic growth can only occur if there are significant structural changes in the economy that would strengthen the role of sectors with low material intensity (especially services) or the use of entirely new materials.

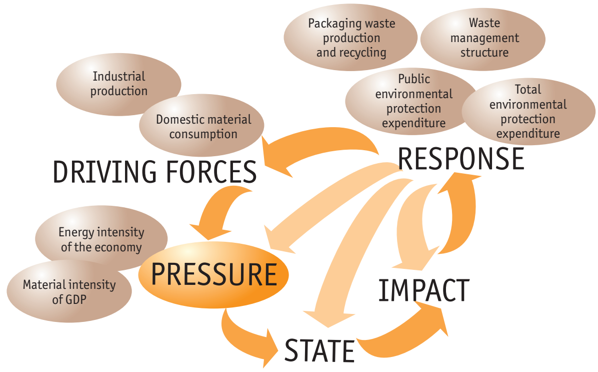
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

[2] Material intensity development in the single years is determined by the developments of its components – the indicators of DMC and GDP. Detailed information on the DMC development is provided in chapter 29 (Domestic material consumption).

31/ Total waste production



KEY QUESTION

Is the total waste production declining?

KEY MESSAGES

The total waste production between 2003 and 2011 decreased by 15.0%, interannually there was a decrease by 3.6%.

Waste production in the category of hazardous waste was growing between 2003 and 2009, in 2010, however, hazardous waste production approached the state in 2003, when there was an interannual decline by 17.5%. Unfortunately, in 2011, hazardous waste production increased again compared with the year 2010, namely by 3.2%.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

The most important strategic document concerning the area of waste management is the **Government Regulation No. 197/2003 Coll., on the Waste Management Plan of the Czech Republic** (here-in-after referred to as the Plan). In its binding part, the Plan provides for the basic measures and principles the implementation of which is one of the steps to reduce waste production in the Czech Republic. Currently, emphasis is placed on efficient use of resources, and therefore the Plan introduces a number of measures aimed at reducing the production of waste, regardless of the level of economic growth, in particular through the maximum utilisation of waste as a substitute for primary natural resources. The plan recommends promoting by all means the changes in production processes towards low-waste to wasteless technologies, which is also related to support to introduction of BATs, both in the field of production and in the area of waste management. In particular, emphasis is put on the prevention or reduction of specific hazardous waste production, reducing the hazardous properties of the waste, on substitution of hazardous substances and materials, and building technical capacities for hazardous waste management.

The measures introduced through recommendations of the **State Environmental Policy of the Czech Republic** are also in accordance with the Plan. In the priority area 2 (Sustainable use of natural resources, material flows and waste management), great attention is paid to elimination of waste production and to recommendations for effective natural resources management.

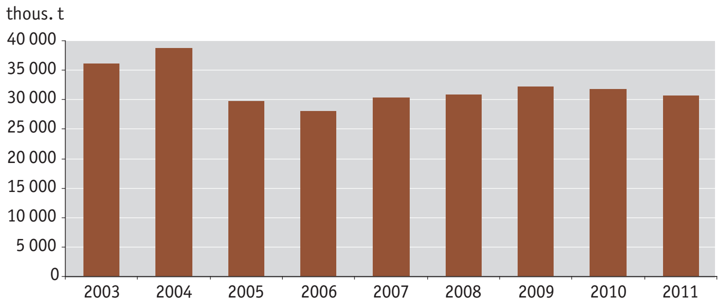
The basic EU document in waste management is the Directive 2008/98/EC of the European Parliament and of the Council No. of 19 November 2008 on waste and repealing certain Directives (Waste Framework Directive), which provides for specific requirements for waste management. The requirements of the European Directive were implemented through an amendment to the **Act No. 185/2001 Coll., on waste**, including the implementing regulations, as early as in 2010. In 2011, there was a gradual implementation of the issues concerning the differences between non-waste and waste, and by-products from manufacture.

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

Waste production accompanies almost every human activity, and in many cases, it may concern waste which, because of its composition and possible reactions, is hazardous both for human health and preservation of undisturbed ecosystems. For this reason, emphasis is put on minimising the production of waste and the introduction of new production technologies which eliminate the use of substances dangerous to human health.

INDICATOR ASSESSMENT

Chart 1 ➜ **Total waste production in the Czech Republic [thous. t], 2003–2011**

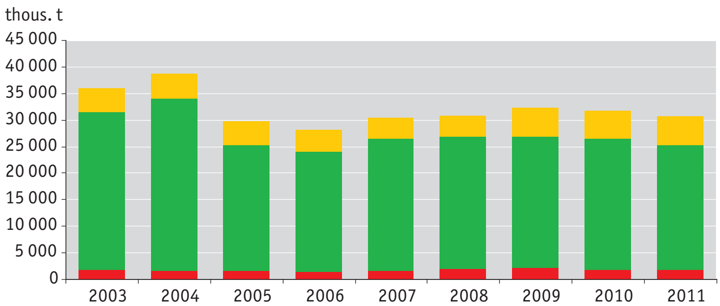


Total waste production

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 – on the basis of the Mathematical Expression of Calculation of " Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2011.

Chart 2 ➜ **Total waste production by category (hazardous, non-hazardous and municipal) in the Czech Republic [thous. t], 2003–2011**

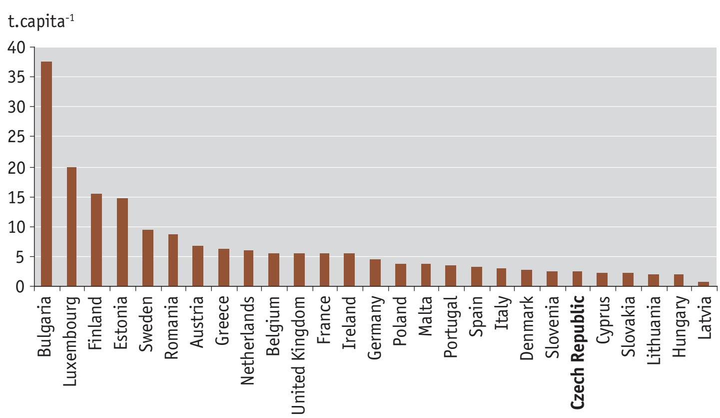


- Municipal waste production
- Non-hazardous waste production excluding municipal waste
- Hazardous waste production

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 – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2011.

Chart 3 ➜ **International comparison of total waste production per capita [$t.capita^{-1}$], 2008**



Total waste production per capita

Source: Eurostat

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data processing (different data collection methodology and different definition of municipal waste).

In comparison with the year 2003, in 2011, there was a decrease in the **total registered waste production**[1] ("total waste production") by 15.0%; in comparison with the previous year, there was a slight decrease in the total waste generation (by 3.6%). The significant decrease since 2003 (Chart 1) is caused primarily by changes in the structure of industrial production: the development of industrial technologies and waste treatment technologies that increase production efficiency. The economic influence consisting in the growth of prices of primary raw materials is not negligible either. On the basis of standardisation, certain wastes can be referred to as by-products which are not subject to the Waste Act (e.g. fly ash from incineration plants). Since 2007, the value of the total waste production oscillates slightly above 30 mil. t. The oscillation is caused primarily by fluctuations in the economic situation; this is reflected, inter alia, also in decline or increase in construction activity which is one of the areas that produce large quantities of waste.

The same trend, i.e. a significant drop in waste production since 2003, is observed in the **production of waste in the category "other waste"**; in this category, the lowest value was achieved in 2006 (Chart 2). Interannually, there was a decrease in production of other waste by 4.0%.

In terms of protection of the environment, there is a very negative trend in the area of **hazardous waste production**. It can be concluded that, with the exception of a deviation in 2010, hazardous waste production was increasing in 2006 to 2011. Compared to 2010, when there was an interannual decline by 17.5%, the production in the category of hazardous waste grew by 3.2% in 2011. The increase was both absolute and relative, because the proportion of hazardous waste in the total waste production increased interannually from 5.6 to 6.0%. The increase in hazardous waste production can be explained by a slight economic recovery, and thus by increased industrial activities generating hazardous waste (e.g. chemical industry).

In terms of international comparison of waste production per capita (Chart 3), the Czech Republic was in the sixth lowest place in 2008, with the value being 2.4 t. Bulgaria reached the highest value in 2008; its waste production was 37 $t.capita^{-1}$. On the other hand, the lowest per-capita waste production was in Latvia – 0.7 t. In the EU27, an average of 5.2 tonnes of waste was produced in 2008, which represented a decrease of 28% compared to 2006.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

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

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

32/ Municipal waste production and management

KEY QUESTION

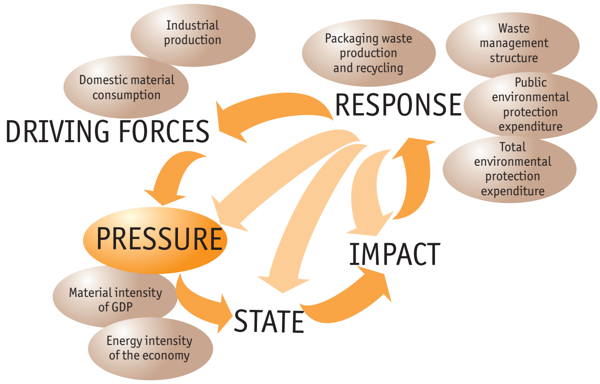
Is the proportion of landfilled municipal waste decreasing?

KEY MESSAGES

The proportion of municipal waste that is used for material recovery in the total waste production was increasing steadily between the years 2003 and 2011. This trend also continued between 2010 and 2011, with the proportion of municipal waste that is used for material recovery increasing from 24.3% to 30.8%. There is a positive trend also in case of mixed municipal waste; its generation decreased interannually by 2.4%.

In 2011, compared to the year 2010, the proportion of landfilled municipal waste decreased by more than 4 p. p. Despite this decline, however, landfilling continues to be the most frequent municipal waste disposal method.

Since 2003, there has been an increase in municipal waste production. In 2011, municipal waste production was oscillating around a level similar to that of the previous year.



OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Municipal waste belongs to those types of waste which are given considerable attention, both in the **Government Regulation No. 197/2003 Coll., on the Waste Management Plan of the Czech Republic** (the Plan) and in the **State Environmental Policy of the Czech Republic**.

Within several measures, these two documents focus on reducing the overall waste production as well as on municipal waste production. Great emphasis is also placed on building the infrastructure for sorted municipal waste collection system.

Municipal waste disposal and management is also a big issue and that is why this area is described in more detail in the Plan: 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 of 26 April on the landfill of waste) reducing the maximum amount of landfilled biodegradable municipal waste (BMW) so that the proportion of this component in the total amount of BMW produced in 1995 is no more than 75% by 2010, 50% by 2013 and eventually 35% by 2020. Landfilling of BMW is also addressed by one of the sub-objectives and measures of the State Environmental Policy of the Czech Republic. In addition, using the resources of the State Environmental Fund to build facilities for BMW processing is recommended as a measure to reduce the maximum landfilled amount of biodegradable municipal waste.

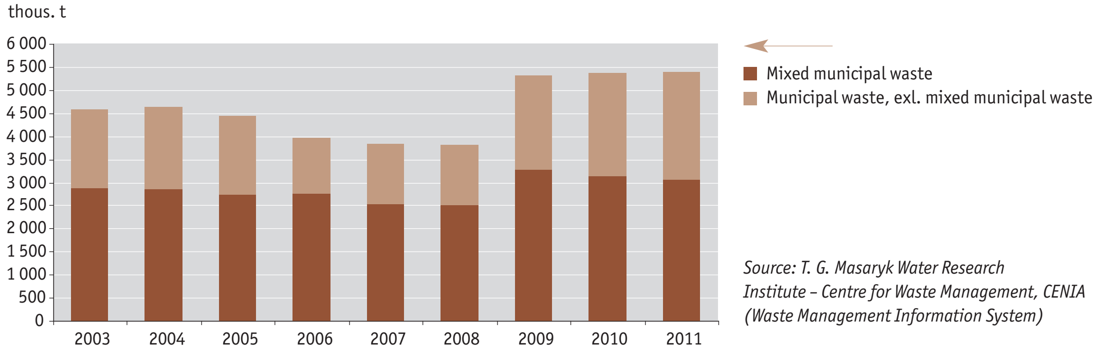
The **Effective Raw Materials Strategy for Europe** is an important document from the international point of view. In this document, emphasis is mainly put on compliance with the waste management hierarchy, which is defined in the Waste Framework Directive, especially on increasing the rate of waste recycling and reuse. Attention is also directed at elimination of landfills, specifically at reduction of the amount of biodegradable municipal waste deposited in landfills.

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 significant negative impacts, especially on landscape character as well as on groundwater and surface water quality. Landfills are a source of methane, a powerful greenhouse gas that is generated through the anaerobic decomposition of organic carbon. Waste incineration outside facilities intended for it is a dangerous 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], 2003–2011[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 – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2011.

Table 1 ➜ **Municipal waste management mix relative to the total municipal waste production in the Czech Republic [%], 2003–2011[1, 2]**

Management method [%]	2003	2004	2005	2006	2007	2008	2009	2010	2011
Data provided by	WRI	WRI	WRI	WRI	CENIA	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	10.8
Proportion of municipal waste used for material recovery (R2–R12, N1, N2, N8, N10, N11, N12, N13, N15)	10.9	11.8	15.5	20.0	21.1	24.2	22.7	24.3	30.8
Proportion of landfilled municipal waste (D1, D5, D12)	63.3	64.4	69.3	81.0	86.2	89.9	64.0	59.5	55.4
Proportion of municipal waste disposed in incinerators (D10)	4.80	0.05	0.04	0.05	0.07	0.05	0.04	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 – on the basis of the Mathematical Expression of Calculation of " Waste Management Indicator Set". The 2010 methodology was used to determine the data for the year 2011.

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

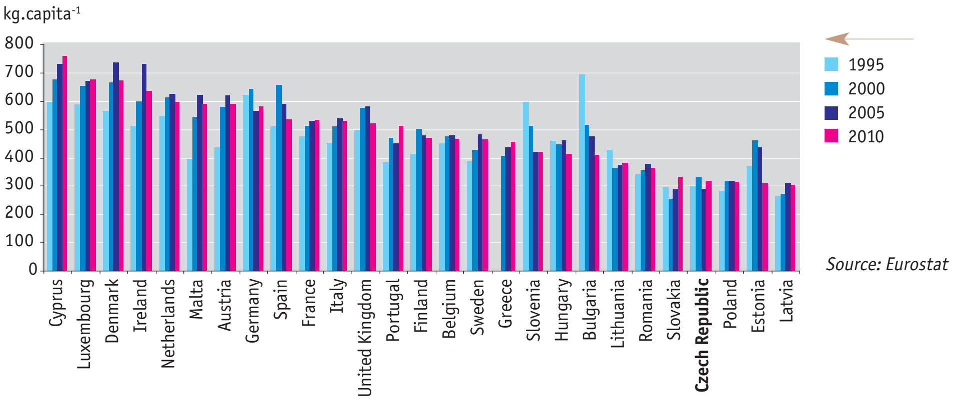
[2] Waste disposal codes D3 and D4 are not included in the table because these categories contain zero values.

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

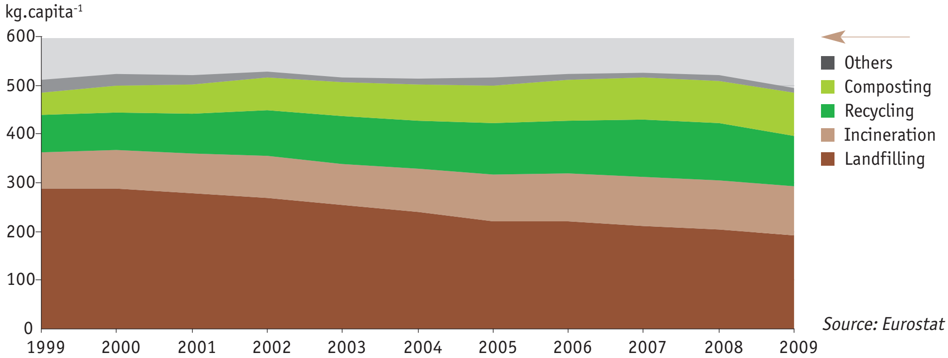
Chart 2 ➜ **International comparison of municipal waste production [kg.capita^{-1}], 1995, 2000, 2005, 2010**



Source: Eurostat

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data processing (different data collection methodology and different definition of municipal waste).

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



The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data processing (different data collection methodology and different definition of municipal waste).

Development of the **total municipal waste production** can be divided into two periods with different trends. In 2004–2008, there has been a gradual reduction of the total municipal waste production, namely by 18.0% within the whole period. Since 2009, there has been a slight increase of the total municipal waste production, however, in the last interannual comparison, the municipal waste production stagnated (increase by 0.5%). In connection with development of the total municipal waste production, there is a significant change in the trend of municipal waste production per capita in the Czech Republic. Since 2008, more than 500 kg of municipal waste were generated per one inhabitant and year; specifically, the value reached 513.4 kg in 2011.

The category of **mixed municipal waste** consists mainly of residual (unsorted) waste originating mostly from households and small businesses which generate waste within non-productive activities predominantly. Between the years 2003 and 2011, the development in this category was almost identical to that in the category of total municipal waste production. The reduction of the proportion of mixed municipal waste in the total municipal waste production is particularly positive. Between the years 2003 and 2011, there was a reduction by more than 5.5 p. p. to 56.9%. The reason consists primarily in the growing proportion of sorted waste. In 2011, 292.3 kg of mixed municipal waste per capita were produced in the Czech Republic.

The different methods of waste management are identified using codes that are defined by Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste management details, as amended (Table 2). According to the Mathematical Expression of Calculation of „Waste Management Indicator Set", which defines the procedure to calculate the various indicators in waste management, the municipal waste management methods can be divided into:

- the use of municipal waste for material (recovery, recycling, waste pre-processing and others),
- the use of municipal waste for energy (using waste in a manner similar to fuels and in other ways to generate energy),
- the disposal of municipal waste in landfills (landfilling),
- the disposal of municipal waste in incinerators (incineration on land).

The different municipal waste management codes are described in detail in Table 2.

Landfilling remains one of the most common **methods of municipal waste management** (Table 1), however, in terms of an interannual comparison, there is a positive trend in this area because the proportion of landfilled waste decreased by 4.1 p. p. In 2003, 63.3% of municipal waste was disposed in landfills. In 2011, this figure amounted to 55.4%. The use for material recovery, the proportion of which has been growing since 2003, also belongs to significantly represented municipal waste management methods. In 2011, 30.8% of municipal waste was used for material recovery, 10.8% were used for energy recovery and 0.04% of it was incinerated.

The issues of municipal waste are dealt with differently in the single member states and the very definitions of municipal waste differ, too. By international comparison with the other EU countries, the Czech Republic has one of the lowest levels of municipal waste production in the EU27 (Chart 2). Apart from the above-mentioned differences in definitions, 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 sorting the separable municipal waste components (plastics, paper, glass etc.). A comparison of municipal waste management in the Czech Republic and in the EU27 shows that 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, landfilling is the most common municipal waste management method (Chart 3).

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

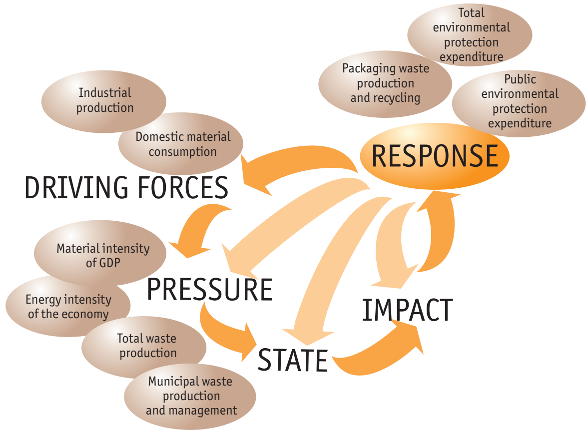
CENIA, key environmental indicators

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 utilisation methods in the total waste production increased in 2011, compared to the year 2003, from 62.2 % to 78.2 %.

The proportion of selected waste disposal methods in the total waste production has been decreasing in long terms; in 2011, it was on the lowest level in the long term, namely 12.9%.

In 2011, depositing into or onto land (landfilling) was still the most common waste disposal method, accounting for 97% of the selected waste disposal methods.

OVERALL ASSESSMENT

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

Likewise in the other EU member states, in the Czech Republic waste management is governed by the Waste Framework Directive, which, inter alia, defines the waste management hierarchy where waste prevention is in the first place, followed by reuse, material and energy recovery. Waste disposal is in the last place of the hierarchy.

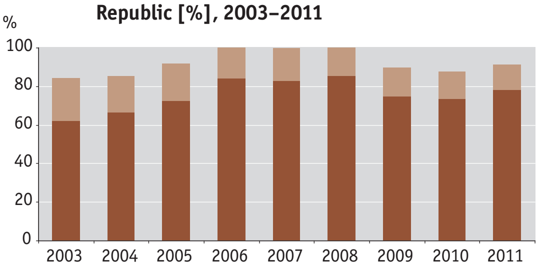
The national strategic documents regulating the area of waste management, i.e. the **Government Regulation No. 197/2003 Coll., on Waste Management Plan of the Czech Republic**, the **State Environmental Policy of the Czech Republic** as well as the **Strategic Framework for Sustainable Development of the Czech Republic** also put emphasis on preferring waste utilisation to waste disposal. In these documents, it is recommended to create an integrated and adequate network of waste management facilities, while emphasis is placed on not supporting the building of new landfills. In its priority axis 2, which focuses on economy and innovation, the Strategic Framework for Sustainable Development of the Czech Republic sets the objective of supporting sustainable material management. It specifically mentions achievement of a sustainable relationship between economic effectiveness of material consumption and environmental impacts of material flows. Specifically, this objective can be achieved through support for increasing the proportion of environmentally-friendly technologies (e.g. BAT and low-waste technologies). Other tools consist in a greater support for research, development and innovation in the field of environmentally sound and knowledge technologies with a high value added and lower demands on material consumption, and in application of a system focused on waste minimisation, separation and subsequent material recovery of the remaining waste (reduction of primary resources consumption through promoting products from recycled materials).

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

The waste management hierarchy completely corresponds to the current trend in which emphasis is placed on efficient use of resources. With the waste management hierarchy being complied with, it is possible to achieve not only a reduction of the impacts on ecosystems but also to mitigate the effects of the current economic recession, namely through the use of wastes as secondary raw materials.

INDICATOR ASSESSMENT

Chart 1 ➔ **Proportions of selected waste management methods in the total waste production in the Czech Republic [%], 2003–2011**

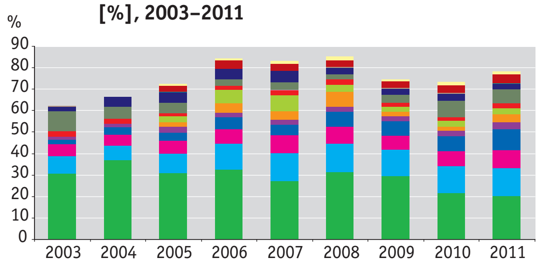


Source: T. G. Masaryk Water Research Institute – Centre for Waste Management, CENIA (Waste Management Information System)

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

The data were determined according to the methodology applicable for a given year – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The waste management codes are described in detail in Table 2 on page 127. The 2010 methodology was used to determine the data for the year 2011.
The reason why the registered disposal volume is greater than the registered production volume lies in the exclusion of below-the-threshold producers from the total waste production. (Below-the-threshold producers are producers that did not exceed the reporting limits set by section 39 of the Act No. 185/2001 Coll., on waste, and thus have no reporting obligation and are not included in the total registered production. However, their waste is included in registered disposal, because final waste disposal facilities are always obliged to report waste.) Due to the growing difference between registered and actual waste production, starting from 2009, the processing of final data that are collected under the Waste Act must include recalculation of the total amount of produced waste to include waste from the below-the-threshold producers.

Chart 2 ➔ **Proportion of selected waste utilisation methods in the total waste production in the Czech Republic [%], 2003–2011**

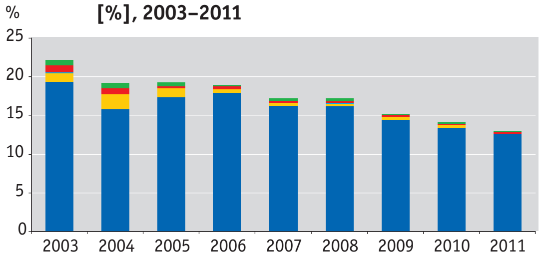


Source: T. G. Masaryk Water Research Institute – Centre for Waste Management, CENIA (Waste Management Information System)

- 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 utilisation methods (codes according to the Decree No. 383/2001 Coll., on waste management details, as amended – R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, N1, N2, N8, N10, N11, N12, N13, N15).
The data were determined according to the methodology applicable for a given year – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The waste management codes are described in detail in Table 2 on page 127. The 2010 methodology was used to determine the data for the year 2011.

Chart 3 ➔ **Proportion of selected waste disposal methods in the total waste production in the Czech Republic [%], 2003–2011**

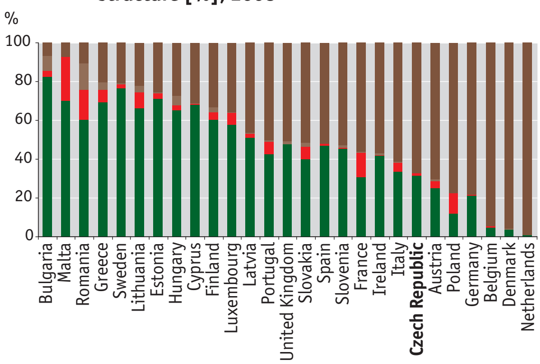


- D12
- D10
- D5
- D4
- D3
- D1

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

The chart shows only the most frequently represented waste disposal methods (codes according to the Decree No. 383/2001 Coll., on waste management details, as amended – D12, D10, D5, D4, D1 and D3).
The data were determined according to the methodology applicable for a given year – on the basis of the Mathematical Expression of Calculation of "Waste Management Indicator Set". The waste management codes are described in detail in Table 2 on page 127. The 2010 methodology was used to determine the data for the year 2011.

Chart 4 ➔ **International comparison of waste management structure [%], 2008**



- Recycling
- Energy recovery
- Incineration
- Landfilling

Source: Eurostat

The Czech Statistical Office sends the data to Eurostat; possible data deviations between Czech Statistical Office and the Waste Management Information System are caused by different data processing (different data collection methodology and different definition of municipal waste).

The different **waste management methods** are identified using codes that are defined by the Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste management details, as amended. In terms of the Mathematical Expression of Calculation of "Waste Management Indicator Set", the waste management structure can be divided into waste utilisation (recovery, recycling, waste pre-treatment etc.) and waste disposal (landfilling, incineration on dry land etc.). The different waste management codes are described in detail in Table 2 on page 127.

Since 2003, there has been a positive trend as the ratio of **waste utilisation** to waste disposal has been growing gradually. This was mainly caused by new technologies with improved efficiency both in the manufacturing sector (minimizing waste production) and in waste management itself. The proportion of waste disposal has been declining slightly since 2009, which may be due to the effects of the financial crisis in industry and, at the same time, the transfer of a part of produced waste that is suitable for utilisation to the category of by-products (Chart 1).

There was a positive trend in waste utilisation; in the years 2003–2008, the proportion of selected waste utilisation methods grew from 62.2% to 85.3% (Chart 2). In 2009, however, the growth rate dropped, probably due to economic stagnation, to 74.7%, and since that year there has been a gradual increase to 78.2% in 2011. In terms of the structure of selected waste utilisation methods, there were no significant changes in recent years. Use of waste for reclamation and landscaping (20.1%) and recycling or recovery of other inorganic materials (13.2%) continue being the most frequent waste utilisation methods.

Between 2003 and 2011, the proportion of **waste disposal** in the total waste production was declining steadily (from 22.1% to 12.9%). Therefore, the lowest value within the period concerned was achieved in 2011. Within the selected disposal methods, depositing into or onto land (landfilling) remains the most frequently used waste disposal method, accounting for 97% in 2011 (Chart 3). Incineration on dry land is another method that is dominant among the selected disposal methods.

In most EU countries, waste disposal (especially landfilling) is the most common waste management method. The states that landfilled more than 90% of their waste include Romania, Bulgaria and Greece, while countries like Denmark, Belgium or the Netherlands deposited only up to 10% of their waste in landfills 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 →

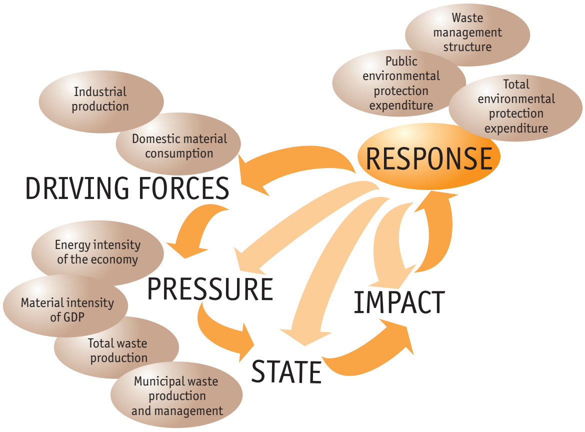
Is the amount of produced packaging waste decreasing and the proportion of packaging waste utilisation increasing?

KEY MESSAGES →

In 2011, 69.7% of the total amount of produced packaging waste was recycled and 5.1% were used for energy recovery.

The utilisation of registered packaging waste has been increasing steadily since 2003. In 2011, 72.4% of the waste were utilised within the system of EKO-COM authorised packaging company.

Compared to the year 2003, the amount of produced packaging increased by 31.3% in 2011. In comparison with the year 2010, there was a slight increase of produced packaging waste, namely by 2.5%.



OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

The **Government Regulation No. 197/2003 Coll., on Waste Management Plan of the Czech Republic** is the main strategic document governing the management of packaging waste. Generally, it puts emphasis on reducing the waste production; in terms of packaging, it mentions especially the need to establish the conditions to promote returnable and reusable containers.

Packaging is also dealt with in the second priority area of **State Environmental Policy of the Czech Republic**, which is aimed at the use of natural resources, material flows and waste management; it recommends improvement of the management of products, packaging and related waste. This objective can be achieved primarily through reducing specific waste production independently on the level of economic growth and achieving the maximum utilisation of waste as a substitute for primary natural resources.

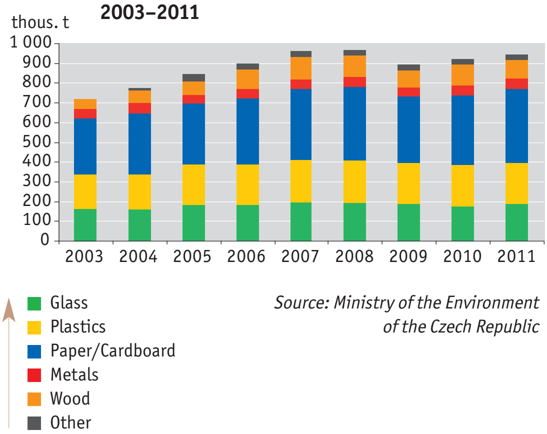
The main legislative document concerning packaging waste management at the EU level is the **European Parliament and Council Directive 94/62/EC on packaging and packaging waste** which has been amended by Directive 2004/12/EC and Directive 2005/20/EC. The obligations following from these European directives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

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS →

At present, emphasis is put on efficient use of resources, and it is the preferred use of packaging waste as a substitute for a primary source which is one of the effective methods to prevent the increasing pressure on ecosystems. Packaging waste is a part of municipal waste but also industrial waste which can be sorted effectively to get the single components that can be used subsequently as a secondary raw material.

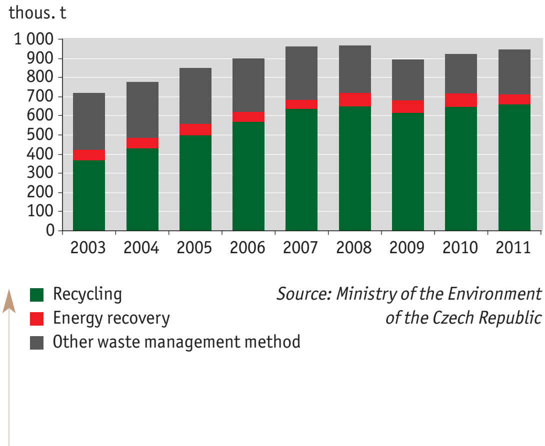
INDICATOR ASSESSMENT

Chart 1 ➜ **Packaging waste and packaging waste composition mix produced in the Czech Republic [thous. t], 2003–2011**



Source: Ministry of the Environment of the Czech Republic

Chart 2 ➜ **Utilisation of packaging waste in the Czech Republic [thous. t], 2003–2011**



Source: Ministry of the Environment of the Czech Republic

Table 1 ➜ **Number of entities involved in the EKO-KOM system that are obligated to utilise packaging waste or to provide take-back, and the number of municipalities involved in the EKO-KOM system, 2003–2011**

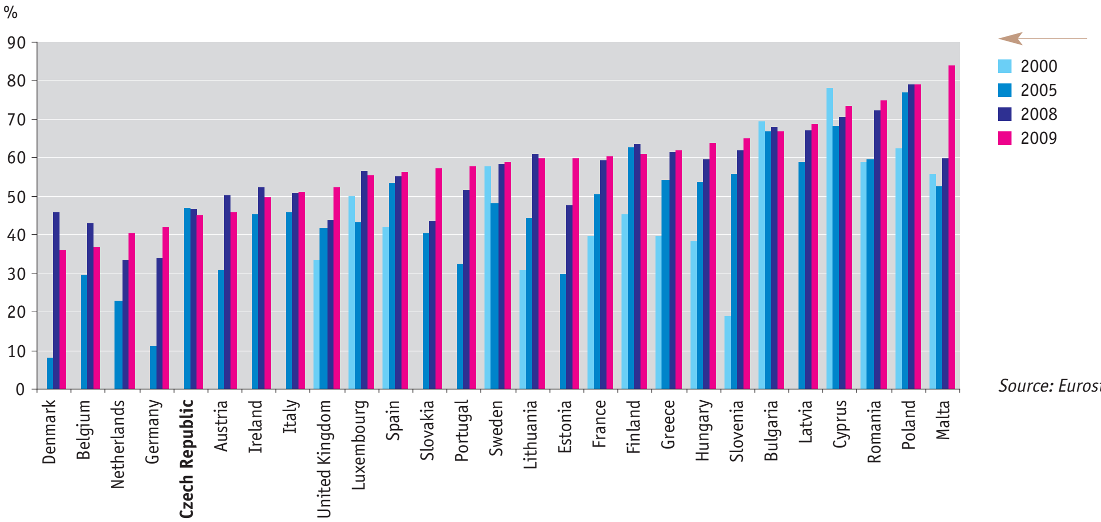
Year	Number of clients involved in the EKO-KOM system	Number of municipalities involved in the EKO-KOM system
2003	20,754	4,358
2004	21,164	4,932
2005	21,502	5,337
2006	20,946	5,481
2007	20,798	5,668
2008	20,822	5,791
2009	20,573	5,861
2010	20,591	5,904
2011	20,482	5,993

Source: Ministry of the Environment of the Czech Republic, EKO-KOM

Chart 3 ➜ **Utilisation of packaging waste in proportion to the total amount of produced packaging waste in the Czech Republic within the EKO-KOM system [thous. t], 2003–2011**

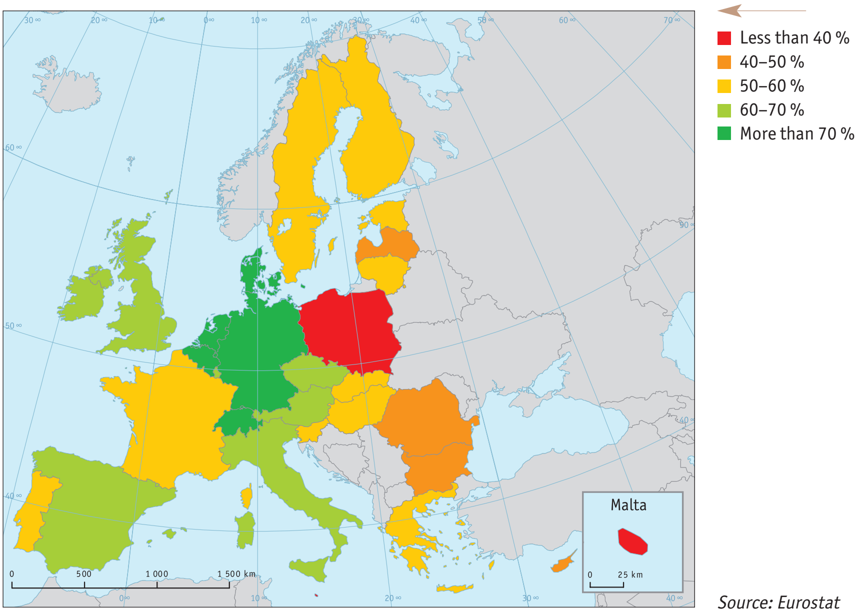
Source: Ministry of the Environment of the Czech Republic, EKO-KOM

Chart 4 ➜ **International comparison of the packaging waste recycling rate [%], 2000–2009**



Source: Eurostat

Figure 1 ➜ **Packaging waste recycling rate in the EU countries, 2009**



Source: Eurostat

In 2011, more than 945 thous. t of **packaging waste** were produced, which was an interannual increase in packaging waste production by 2.4%. For this category of waste, there is a long-term increasing trend; between 2003 and 2011, the quantity of produced packaging waste grew by 31.3% (Chart 1). In 2003–2007, the interannual growing trend was about 8% while since 2008, the trend has been slowing down. The year 2009 was an exception because there was an interannual decrease of packaging waste production in that year. Since 2009, however, probably in connection with a slight recovery of the economy, the packaging waste production has been growing by 2–3% per year.

Paper or cardboard packaging, followed by plastics and glass belong to the most frequently represented categories of packaging waste. In terms of time development, there are no significant changes in representation; the proportions of the single categories vary in interannual comparisons by not more than 5%. The most dynamic interannual change occurred in the category of wood; there was a decrease by 10%. On the other hand, the category of glass increased by 6.1%, and there was similar development in the category of paper/cardboard (an increase by 6.0%).

From an environmental and economic point of view, the fact that there has been a significant increase in **recycling of packaging waste** (an increase by 78%) since 2003 is very positive. In long terms, recycling is the most frequently represented packaging utilisation method (Chart 2); it accounted for 70% of all packaging waste produced in 2011. Compared with the past, there was a decline in the category of energy recovery; interannually it decreased by 28.8% and reached the lowest value since 2008.

The issues of packaging waste are dealt with in the Act No. 477/2001 Coll., on packaging, which requires that all entities that market or put into circulation packaging or packaged products have the obligation, inter alia, to utilise their packaging waste. This obligation can be met by the relevant entities either on their own, or collectively through EKO-KOM. Within comparison of the numbers of entities that meet their obligations resulting from the Act on packaging through the authorized packaging company, there were no significant changes in 2003–2011 (Table 1), however, when we look at the individual years in this period, we can see a more pronounced dynamics associated with the gradual involvement in or abandonment of the collective system. The situation is usually caused by termination of business activities or by a merger of several companies. In 2011, the number of clients involved in the system of the authorized packaging company EKO-COM therefore reached 20,482. There have been more distinctive (both total and interannual) changes in the category of "the number of municipalities involved in the EKO-KOM system"; this category grew by 38% between the years 2003 and 2011. Currently, 5,993 municipalities, in which 98% of the population live, are involved in the collective system. In 2011, 89 more municipalities were involved in the system of packaging waste collection and utilisation compared to the year 2010. At present, there are still 250 municipalities in the Czech Republic which solve the problems related to packaging waste outside of the authorised company EKO-KOM. In 2011, 72% of all packaging waste (Chart 3) which is covered by the authorised packaging company was therefore utilised, which is nearly 68% of all packaging waste produced in the Czech Republic.

At the EU level, the issues of packaging and packaging waste are regulated through the Directives 94/62/EC, 2004/12/EC and 2005/20/EC. According to these Directives, the member states are under an obligation to achieve packaging waste recycling of at least 55% of the packaging weight. The deadlines for these obligations to be fulfilled were set with regard to the year in which the member states joined the EU. From the perspective of EU15 countries, this undertaking was met by all the countries except Greece, where the recycling rate was slightly below the target value (52.3%) in 2009. For the new member states of the EU27, the deadline to meet this obligation was postponed to the years 2012–2015.

In 2009, the lowest recycling rates (Fig. 1, Chart 4) were in Malta (36%), Poland (37%) and Romania (40%). On the other hand, Denmark (84%), Belgium (79%) and the Netherlands (75%) were in the first places in 2009. From the international point of view, the Czech Republic is in the leading positions in long terms; in 2009 it was in the fifth place (69%) and it belongs to the most successful countries in the EU27.

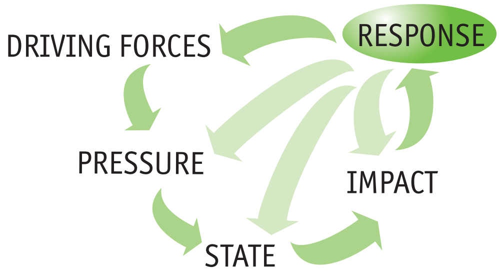
DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

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

35/ Total environmental protection expenditure

KEY QUESTION

What amount of financial resources in the form of investment expenditure and non-investment costs do we spend on maintaining and improving the environment?



KEY MESSAGES

☺ Due to the data collection methodology, the total expenditure for environmental protection is evaluated in 2003–2011. In this period, there has been a relatively stable trend of growing amount of financial means being spent on environmental protection. There was a slight deviation in 2008, when the non-investment costs decreased. The last interannual comparison (2010–2011) shows an approximately 10% increase in the total environmental protection expenditure.

In 2011, the total expenditure on environmental protection amounted to CZK 83.8 billion, which represents an increase by CZK 7.7 billion in comparison with the year 2010. The proportion of the total expenditure in GDP was 2.2%, which is a 6% increase compared to the 2010. In terms of the programmes and focus of the total expenditure, the biggest part of the funds went to waste management (a total of CZK 42.5 billion), followed by waste water management with a total amount of CZK 20.1 billion and the area of air and climate protection, with the total amount of CZK 8.2 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 OF THE TREND IN INVESTMENT EXPENDITURE	
Change since 1990	☺
Change since 2000	☺
Last year-to-year change	☺

OVERALL ASSESSMENT OF THE TREND IN NON-INVESTMENT COSTS	
Change since 1990	N/A
Change since 2000	☺
Last year-to-year change	☺

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS

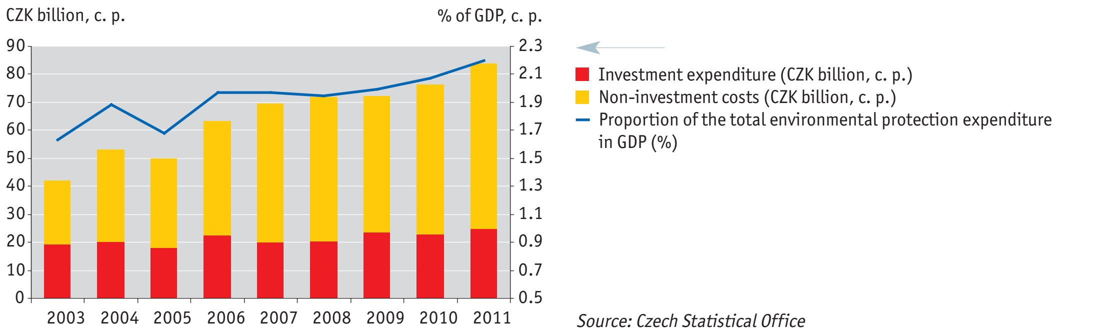
References arising from the Czech Republic's membership in the EU assume a combination of such normative, economic, institutional, organizational, information, voluntary and other instruments which will enable to achieve the desired results with the lowest requirements for financial, human, technical and other resources. It clearly follows from this objective that projects aimed at protection of the environment must comply with the economic efficiency criterion, i.e. they must strive to optimise the costs while maximizing the benefits achieved. Therefore, manufacturers should actively reduce their environmental impacts thanks to technological innovation, introduction of BAT, recycling and energy savings, and thus achieve an effective amount of investment and non-investment expenditures.

It follows from the **National Strategic Reference Framework of the Czech Republic** for the years 2007–2013 that the Czech Republic belongs to a group of the EU countries with lower economic performance (measured as GDP per person in purchasing power parity[1]) which is increasing gradually. Nonetheless, the Czech Republic is a highly opened economy and it is characterized by significant orientation of its foreign trade towards the EU member states. The goods and services traded within the EU are therefore subject to high environmental standards, which can be achieved mainly through investment in environmental protection projects, i.e. through increasing investment spending. Similar statements concerning total expenditure for environmental protection are also in the **Strategic Framework of Sustainable Development of the Czech Republic** which puts emphasis mainly on the area of innovation and related competitiveness of the Czech Republic.

[1] The purchasing power parity of the national currency is the internationally comparable purchasing power of the population. The basis for the parity calculation consists in a comparison of the prices in national currencies for a sufficient number of identical products and services in the national markets. This is usually carried out using the consumer basket method, expressing the common household costs. In this way, price differences between compared regions are eliminated.

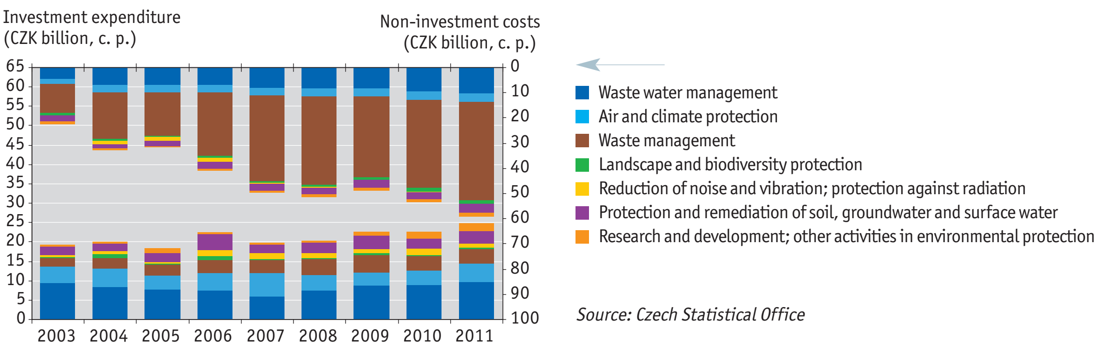
INDICATOR ASSESSMENT

Chart 1 → **Total environmental protection expenditure in the Czech Republic [CZK billion, % of GDP, current prices], 2003–2011**



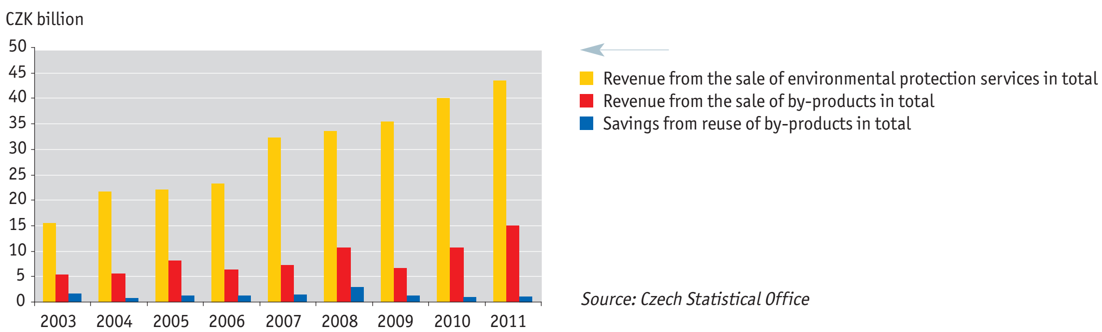
Source: Czech Statistical Office

Chart 2 → **Investments and non-investment costs for environmental protection in the Czech Republic according to programming orientation [CZK billion, current prices], 2003–2011**



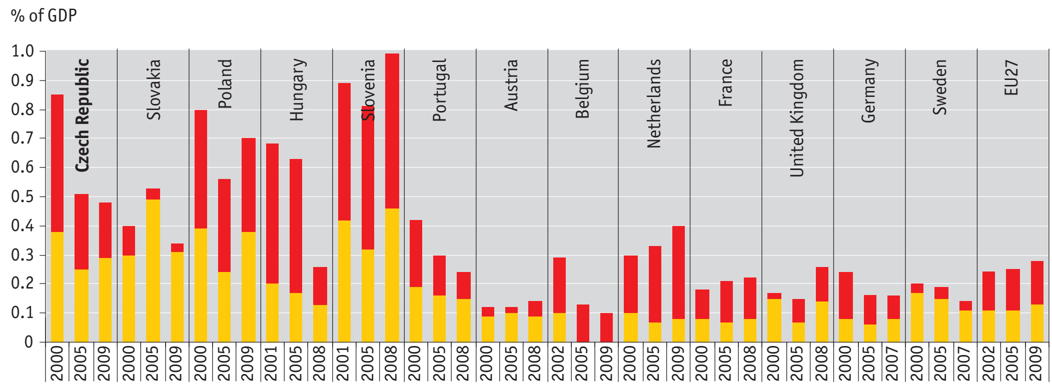
Source: Czech Statistical Office

Chart 3 → **Economic benefits of environmental protection activities in the Czech Republic [CZK billion], 2003–2011**



Source: Czech Statistical Office

Chart 4 → **International comparison of proportions of investment expenditure on environmental protection by the business and the public sectors in GDP [% of GDP], 2000, 2005 and the last available year or the closest years available**



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 of environmental protection that are expended by the monitored economic entities with the Czech economy (i.e. both private individuals and the public sector). Investment expenditure includes all expenditure for tangible fixed assets, i.e. expenditure that relates to environmental protection activities the main objective of which is to reduce the negative effects resulting from the business activity. Non-investment costs are current or operating expenditure, especially payroll costs, payments for material consumption, energy, repairs, maintenance etc. The statistical collection of source data is carried out by the Czech Statistical Office. The data on investment expenditure for environmental protection have been collected since 1986; the data on non-investment costs have been monitored statistically since 2003.

In 2011, the total expenditure on environmental protection amounted to CZK 83.8 billion, which compared with the previous year 2010, represents a kind of traditional increase in spent financial means, namely by CZK 7.7 billion. The growth was divided proportionally between investment expenditure (interannual increase by CZK 2.2 billion to the final amount of CZK 24.8 billion), and the non-investment costs (interannual increase by CZK 5.6 billion to the final amount of CZK 59 billion). Likewise in previous years, the 2011 total environmental protection expenditure is also dominated by non-investment costs, which amounted to 2.4fold of the investment expenditure. In the last five years, there has been a balanced trend also in the proportion of the total expenditure in GDP (current prices) as there is a constant, slight increase with regard to the Czech economy's performance. This proportion amounted to 2.2% in 2011 (Chart 1).

Investment in environmental protection

A long-term comparison of data from the years 2000–2011 shows that the areas of waste water management and waste management are commonly the main priorities. The year 2011 was no exception and these two areas dominated in the amounts of financial means invested into projects to reduce the negative impacts of activities in these areas. In the last few years, air and climate protection, which was the main priority in 1990s, has been gaining importance again.

As regards development of investments in 2011, there has been a slight increase again in the amount of expenditure to the total of CZK 24.8 billion compared to the year 2010. Concerning environmental innovation, most of the investment goes to end-of-pipe equipment where an integrated approach to environmental protection based on the introduction and use of BATs is applied. In the future, investment costs are expected to slightly decline interannually as a result of gradual modernization of the polluters' production and operating facilities. However, this trend has not been reported over the past five years.

Concerning the single programmes, most of the 2011 funds were invested in waste water management (CZK 9.6 billion), air and climate protection (CZK 4.8 billion) and waste management (CZK 3.6 billion). As opposed to the year 2010, investments in air and climate protection increased most of all (by CZK 1.3 billion). On the other hand, there was the most significant decrease in landscape and biodiversity protection, however, this decline was negligible in a relative comparison with developments in other years (by 0.03 billion), see Chart 2.

In terms of economic sectors of the investing entities (CZ-NACE), the largest proportions in the total investment were recorded in the following sectors: public administration, defence and compulsory social security (38.2% of the total investment) and water supply and activities relating to waste water, waste and remediation (19.4% of the total investment). The transport and storage sector (8.7% of the total investment) and the production and distribution of electricity, gas, heat and conditioned air (7.8% of the total investment) also amount to a significant percentage of the total investment.

Recent years have shown a positive trend, as investment in environmental protection by the business sector has been increasing steadily while investment by the public sector has been declining. Based on economic principles, this is application of the polluter-pays-principle as the main responsibility for protecting the environment needs to be transferred onto private entities, thus reducing the public sector's involvement. In 2011, businesses invested approximately CZK 14.3 billion and the public sector (both central and regional) approximately CZK 10.5 billion.

This is also connected with the relative interannual increase of economic benefits of the activities to protect the environment. Based on the principle of economic efficiency related to investing in environmental protection projects, a positive causal link between the crucial role of the private sector and the amount of such benefits can be assumed. The economic benefits are divided into the revenue from the sale of environmental protection services (in 2011 dominated by the waste management sector with the amount of CZK 33.8 billion), revenue from the sale of by-products (again dominated by waste management with the amount of CZK 14.3 billion) and savings related to by-products reuse (again dominated by waste management with the amount of CZK 1 billion). Waste management therefore represents the most profitable area of environmental protection, see Chart 3.

Non-investment costs of environmental protection

Non-investment costs of environmental protection have been monitored by the Czech Statistical Office since 2003. In 2011, they reached the value of CZK 59 billion. Compared with the year 2010, these costs showed another significant increase in 2011 (similarly to the previous years), namely by CZK 5.6 billion. Non-investment costs constitute a substantial proportion of the total environmental protection expenditure (more than 60% in 2003–2011). The biggest amount of non-investment costs was spent on material and energy consumption and wages.

Concerning the single programmes, in 2011 – as well as in previous years – most of the funds were spent on waste management (CZK 38.8 billion, which in sum with the investment expenditure accounts for the biggest part of the total environmental protection expenditure) and on waste water management (CZK 10.5 billion), Chart 2. Especially the area of waste management showed a very significant increase in non-investment costs, namely by CZK 4 billion in an interannual comparison with the year 2010. In the other areas of environmental protection, no significant decline or increase of non-investment costs has been recorded.

In terms of economic sectors of the investing entities (CZ-NACE) in 2011, the biggest proportion of non-investment costs for environmental protection was incurred in the sector of water supply and activities related to waste water, waste and remediation (53.3% of the total non-investment costs) and in the sector of public administration, defence and compulsory social security (almost 15% of the total non-investment costs). These two sectors were followed by the mining and quarrying sector (almost 6%).

An international comparison

In an international comparisons with other EU countries, the Czech Republic, along with other post-communist countries, spent considerably more financial means on environmental protection than the West European countries (until 2007), see Chart 4. Logically, this trend is attributable mainly to the increased environmental burden that had resulted from long and neglected environmental problems associated with intensive industrial production and mining.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

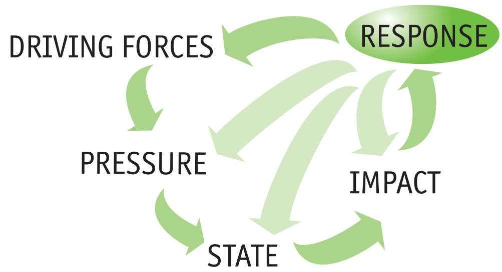
CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1903)

36/ Public environmental protection expenditure

KEY QUESTION →

What is the structure and volume of financial means expended from central sources and local budgets within public support for environmental protection?



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).

KEY MESSAGES →

For the period 2009–2011, it is possible to conclude that the public expenditure on environmental protection has been increasing with regard to productivity growth of the Czech economy (expressed as GDP in current prices) and the trend in public financing of environmental protection is not changing. In long terms, it is especially the local budgets which take over the main role in financing the environmental protection projects; in 2010 and 2011, there was an increase in expenditure from local budgets by CZK 1.3 billion, i.e. by 3.7% to the total of CZK 37 billion (0.97% of GDP in current prices). In case of expenditure from central sources (i.e. particularly from the state budget and state funds), the increase amounted to CZK 7.8 billion, i.e. by 29.4% to the total of CZK 34.3 billion (0.9% of GDP in current prices).

Since 2005, water protection has been the most supported environmental medium (in 2011 it concerned CZK 8.2 billion from the central sources and CZK 17.8 billion from the local budgets), followed by biodiversity and landscape protection (in 2011 it concerned CZK 4.3 billion from the central sources and CZK 9.8 billion from the local budgets). This fact has positive impacts, especially in a growing quality of the citizens' lives related to better equipment of municipalities with sewerage and waste water treatment plants but also to increasing sustainability of ecosystems.

OVERALL ASSESSMENT →

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

REFERENCES TO CURRENT CONCEPTUAL AND STRATEGIC DOCUMENTS →

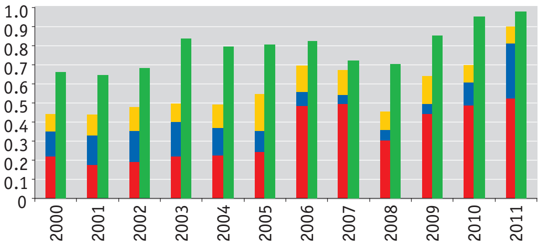
The Czech Republic's membership in the EU demands respect for certain fundamental principles which set out the main priorities in environmental protection from the economic point of view. They concern primarily the polluter-pays-principle and the precautionary principle. In the area of the Czech Republic's trade policy measures, the European Commission's principles concerning state support in the field of the environment should be applied. The principles extend the possibilities of using the support's potential for environmental purposes, with the impact on competitiveness within the single EU market being minimised. In addition, it is also necessary to ensure that all public support is provided to implementation of measures with a positive (or at least a zero negative) environmental impact.

The **National Strategic Reference Framework of the Czech Republic** for the years 2007–2013 focuses on five priorities: the society, humans and health; economy and innovation; territorial development; landscape, ecosystems and biodiversity; and the stable and secure society. The priority axis No. 2 ("Economy and innovation") provides that expenditure from the central sources and local budgets, i.e. public spending on environmental protection, must be directed to activities which ensure adequate competitiveness of Czech products and services in international trade and will promote economic growth of the Czech Republic. The principles of expending funds from the Czech Republic's public sources on environmental protection are also mentioned in the **Strategic Framework of Sustainable Development of the Czech Republi**c (2010), which, in its requirements for financing of environmental protection, is in accordance with the National Strategic Reference Framework of the Czech Republic. The Strategic Framework of Sustainable Development of the Czech Republic also states that it is essential to increase public expenditure on and enhance the efficiency of the cooperation between the public and private sectors in research and development, which is one of the main factors of innovation in the production sectors.

INDICATOR ASSESSMENT

Chart 1 → **Proportion of the public environmental protection expenditure in GDP in the Czech Republic by source type [% of GDP, current prices], 2000–2011**

% of GDP, c. p.



Source: Ministry of Finance of the Czech Republic, Czech Statistical Office

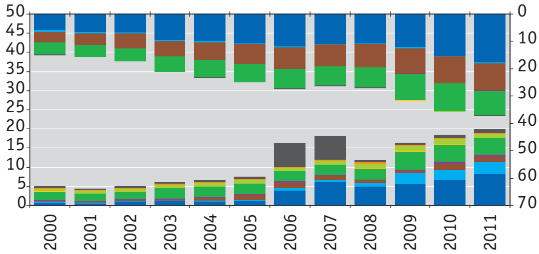
- Proportion of the state budget expenditure on environmental protection in the GDP
- Proportion of the state environmental protection funds' expenditure in the GDP
- Proportion of the National Property Fund's expenditure on environmental protection in the GDP
- Proportion of the local budgets' expenditure on environmental protection in the GDP

The National Property Fund was dissolved as of 1 January 2006. Both its competencies and the financial means spent on the removal of old contaminated sites originated prior to privatisation are now administered by the Ministry of Finance of the Czech Republic. The marked increase in the state budget expenditure between 2005 and 2006 resulted from the involvement of funding from the European funds. A part of public environmental expenditure by the local budgets may be a duplication of expenditure from the central sources.

Chart 2 → **Public environmental protection expenditure from the state budget and local budgets in the Czech Republic by programming orientation [CZK billion, current prices], 2000–2011**

State budget expenditure (CZK billion, c. p.)

Local budgets expenditure (CZK billion, c. p.)

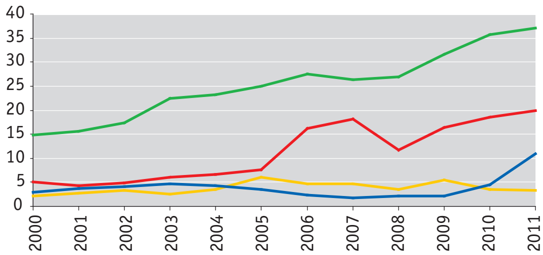


- Water protection
- Air protection
- Waste management
- Soil and groundwater protection
- Biodiversity and landscape protection
- Reduction of physical factors' impacts
- Administration in environmental protection
- Environmental research
- Other activities in ecology

Source: Ministry of Finance of the Czech Republic

Chart 3 → **Public environmental protection expenditure in the Czech Republic by source type [CZK billion, current prices], 2000–2011**

CZK billion, c. p.



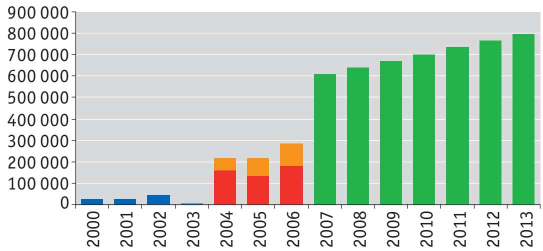
- Environmental protection expenditure from local budgets
- Environmental protection expenditure from the state budget
- National Property Fund's expenditure on environmental protection
- The state environmental protection funds' expenditure

Source: Ministry of Finance of the Czech Republic

The National Property Fund was dissolved as of 1 January 2006. Both its competencies and the financial means spent on the removal of old contaminated sites originated prior to privatisation are now administered by the Ministry of Finance of the Czech Republic. The marked increase in the state budget expenditure between 2005 and 2006 resulted from the involvement of funding from the European funds. A part of public environmental expenditure by the local budgets may be a duplication of expenditure from the central sources.

Chart 4 → **Estimated allocation of financial means from the EU funds for environmental projects in the Czech Republic [EUR], 2000–2013**

EUR



- ISPA (2000–2003)
- Cohesion Fund (2004–2006)
- Operational Programme – Infrastructure (2004–2006)
- Operational Programme – the Environment (2007–2013)

Source: Ministry of the Environment of the Czech Republic

Table 1 ➜ **Income from selected environmental fees, payments and taxes in the Czech Republic [million CZK], 2005–2011, or between the year in which the respective fee was introduced and 2011**

Income [CZK million]	2005	2006	2007	2008	2009	2010	2011
Air pollution fees – operators of small stationary sources	13.1	9.3	10.3	10.3	10.9	9.1	8.7
Air pollution fees – operators of medium-sized stationary sources	27.7	26.4	32.8	32.5	34.2	21.0	23.0
Air pollution fees – operators of particularly large and large stationary sources	454.2	468.2	474.4	507.9	392.7	377.0	340.5
Fees for deposition of waste	1 401.9	1 312.7	1 712.6	1 718.3	1 927.0	1 990.0	1 758.7
Fee for operation of a system of collection, transport, sorting, utilisation and disposal of municipal waste	3 776.6	3 850.0	4 015.1	4 058.1	4 074.5	4 054.8	3 453.3
Fees for waste water discharge into surface water, minus the deferrals	370.3	307.7	355.2	240.7	188.3	197.6	221.3
Fee for permitted waste water discharge into groundwater	0.3	1.0	0.4	0.6	2.4	2.4	2.0
Fee for extracted amount of groundwater	828.2	768.2	711.2	764.0	783.8	736.5	358.1
Charges for exclusion of land from the agricultural land resources	413.3	422.2	400.7	391.1	400.8	301.7	293.0
Fees for exclusion of plots intended for the fulfilment of the forest's functions	81.6	81.2	67.2	76.8	60.9	64.7	72.3
Tax on natural gas and some other gases	-	-	-	1 002.8	1 285.9	1 338.7	1 386.9
Solid fuels tax	-	-	-	431.6	508.5	494.5	477.1
Electricity tax	-	-	-	1 019.1	1 386.9	1 417.8	1 322.7

Source: Ministry of Finance of the Czech Republic, Ministry of the Environment of the Czech Republic, State Environmental Fund of the Czech Republic

Public environmental protection expenditure is comprised of **environmental protection expenditure from central sources and local budgets**. However, given the data collection methodology (the data are collected by the Ministry of Finance of the Czech Republic), the public environmental protection expenditure is not a simple sum of the central and local budgets, because a part of the public expenditure from the local budgets is a duplication of expenditure from the central sources. The total public expenditure includes both capital and current environmental protection expenditure. Financing of environmental protection projects through expenditure originating from central sources and local budgets supports, inter alia, the territory's competitiveness and increases its tourist attractiveness, contributing thereby positively to creation of the GDP of the region and also that of the Czech Republic.

Given the varied performance of different economies in the World, which is usually measured as the ratio of the domestic product per one inhabitant (most often as GDP/inhab.), it is appropriate to evaluate the evolution of public environmental protection expenditure in relation to the GDP (in current prices). What is quite interesting is evaluation of the trend since 2009 (when the Czech Republic was hit by the economic crisis) because no impact on the amount of public environmental protection expenditure has been recorded – especially in relation to expenditures from the EU funds. The 2010/2011 interannual comparison shows that there was an increase in the proportion of expenditure from the central sources to GDP (current prices) by 28.2% and an increase in the proportion of expenditure from the local budgets by 2.7%. In 2011, the proportion of expenditure from the central sources to GDP (current prices) amounted to 0.9% and that from the local budgets to 1%, see Chart 1.

Public expenditure from central sources

Financial means (subsidies or returnable financial aid) coming from **the state budget** are the most significant central source. Within environmental protection expenditure from public funds, additional important central sources include environmental protection financing through **the State Environmental Fund of the Czech Republic** and the now-defunct National Property Fund, the remaining competences and resources of which are now administered by the Ministry of Finance of the Czech Republic. These are financial resources that are used by the Ministry of Finance of the Czech Republic to finance the remediation of old environmental damage that had been caused prior to privatization and – to a lesser extent – by the Ministry of the Environment of the Czech Republic to remediate damage that had been caused by the presence of Soviet troops in the Czech Republic.

When evaluating long-term trends in public expenditure from the central sources, we can observe a growth in expended financial means which is more than tripled – i.e. these expenditures increased from the amount of CZK 10.1 billion in 2000 to the final sum of CZK 34.3 billion (i.e. by 240%). Expenditure from **the state budget**, namely almost CZK 20 billion in 2011 (i.e. by 8% compared to the year 2010) amounts to the largest proportion of this amount. A great part of this expenditure had been increased thanks to financial means arising from the EU pre-accession funds, which ceased to be used in 2004, and after the Czech Republic joined the EU, thanks to financial means from the EU structural funds, which are used especially to balance the state of the environment in the Czech Republic with that in the other developed EU countries. A significant increase in expenditure from the state budget can be observed in 2006 and 2007, when financial means from the European funds were included in financing of environmental protection in the Czech Republic. Given to the method of financing the individual projects in environmental protection, these funds are considered to be the means of the state budget, from which the projects are pre-financed.

Over the long term, water protection is the most supported environmental medium and this where most of the funds from the state budget were directed in 2011. This concerned CZK 8.2 billion and there was again an increase by CZK 1.6 billion (+23.5%) compared with the year 2010. The area of biodiversity and landscape followed; the state budget investment in this area amounted to CZK 4.3 billion. However, there was a decrease by CZK 240 million in comparison with the year 2010 (–5.3%). In the last three years, air protection, which was a priority during the whole 1990s, is gaining importance again (Chart 2).

Concerning environmental protection expenditures from state funds, **the State Environmental Fund of the Czech Republic** (and also the State Agricultural Intervention Fund or the State Transport Infrastructure Fund etc.) is the largest extra-budgetary central source of environmental protection financing. Its revenues consist mainly of the fees for environmental pollution and in recent years, also of the proceeds from the sale of greenhouse gas emission units (AAU)[1] intended for sale of the greenhouse gas emissions abroad within the mechanism that is based on the Kyoto Protocol. The 2010/2011 interannual comparison shows that there was a significant increase in the amount of expended financial means – from CZK 4.4 billion in 2010 to CZK 10.9 billion in 2011 (+145%), although reduction of expenditure from the state funds is expected in long terms. This increase was caused by payments based on applications for subsidies under the Green Savings programme. Financial means for this programme came from the sale of AAUs.

The State Environmental Fund of the Czech Republic uses its own resources to co-finance expenditure from the European funds in an amount of 4% of the total allocated subsidy but it also administers collection of fees related to environmental protection. The purpose of the fees is to return them directly to environmental protection, which is different from environmental taxes. The main income of the State Environmental Fund of the Czech Republic comes from collecting fees in the area of waste management. Specifically, this concerns the fee for deposition of waste (CZK 1,8 billion in 2011) and the fee for operation of a system of collection, transport, sorting, utilisation and disposal of municipal waste (CZK 3,5 billion in 2011). Fees from water management are another important financial source for the State Environmental Fund. In 2011, this concerned especially the income from the fee for abstracted quantity of groundwater (CZK 358.1 million), Table 1. The fees are the source for providing financial aid within the State Environmental Fund's competences. This support is then used primarily in a form of loans, subsidies and payment for a part of interests from loans, and it goes to water protection, biodiversity and landscape protection, air protection and waste management (i.e. to the priority areas of environmental protection in the Czech Republic).

In 2011, CZK 3.4 billion from the financial means of **the National Property Fund** were spent; these funds are administered by the Ministry of Finance of the Czech Republic and directed to removal of old environmental contamination. Interannually, the amount of these financial means decreased compared to the year 2010 (Chart 3) when it reached CZK 3.6 billion (–5.1%). These are financial means that are used by the Ministry of Finance of the Czech Republic to cover remediation of old environmental contamination that had arisen before privatization, and to a lesser extent, by the Ministry of the Environment of the Czech Republic to cover removal of damage caused by presence of Soviet troops in the territory of the Czech Republic.

Public expenditure from local budgets

Financial resources originating from **local budgets of municipalities and self-governing regions** constitute the second part of public expenditure. These budgets are expected to take a major position in financing of environmental protection projects in the future, especially as a result of decentralisation of decision-making processes. In 2011, expenditures of the local budgets amounted to CZK 37 billion (+ CZK 1.3 billion, i.e. +3.7% compared to the year 2010). In a long-term comparison between 2000 and 2011, local budgets' expenditures have been growing significantly; their volume has increased almost 2.5fold over this period. Local and local budgets are thus the most significant public source of funding for environmental protection in the Czech Republic (Chart 3). At the levels of municipalities and self-governing regions, the expenditures are implemented continually based on competences of the given municipalities and self-governing regions. However, in a great part they consist of subsidies from central sources.

As regards protection of the single environmental media and its financing from the local budgets of municipalities and regions, water protection is the main priority; a total of CZK 17.8 billion (+ CZK 2.4 billion, i.e. +15.9% compared to the year 2010) were spent in 2011. Waste management was the second greatest item in financing (Chart 2, a total of CZK 9.8 billion), followed by biodiversity and landscape protection (a total of CZK 8.8 billion).

[1] The Assigned Amount Unit (AAU) is a unit defined under the Kyoto Protocol, which represents a tradable right of a country to discharge into the atmosphere one tonne of greenhouse gas emissions in the period 2008–2012. A country which reduced its emissions more than it had undertaken within the Kyoto Protocol may sell the surplus to the other countries. The assigned amount units are actually "the emissions budget" of each industrially developed country that the country received on the basis of its emission targets under the Kyoto Protocol.

Financing by EU and foreign sources

In addition to national funding programmes in environmental protection, managed primarily by the State Environmental Fund of the Czech Republic, public expenditures on environmental protection are strengthened since 2004 thanks to the direct support from the EU and a possibility to co-finance projects from other foreign sources as well. The main sources to finance environmental protection are **the Operational Programme Infrastructure** (OPI, 2004–2006), **the Cohesion Fund** (2004–2010), and at present especially **the Norwegian and the EEA Financial Mechanisms** (2004–2009), **the Swiss-Czech Cooperation Programme** (2007–2011) and **the Operational Programme – the Environment** (2007–2013) which is the largest source in terms of subsidies and is linked thematically to the OPI (Chart 4). In 2004–2013, the strongest financial sources in environmental protection are the Operational Programme Infrastructure (OPI), with more than EUR 4 billion in 2004–2006, and the Operational Programme – Environment (OPE) with EUR 4.9 billion in 2007–2013.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators

http://indikatory.cenia.cz (http://issar.cenia.cz/issar/page.php?id=1904)

Global and European context of driving forces affecting the state of the environment

The Czech Republic is a small, open, export-oriented economy that is dependent on the situation of the global economy and Eurozone economy. It has particularly strong ties to the German economy. Development of global megatrends, trading in the World's commodity exchanges or decisions of transnational business entities can affect the state of the Czech Republic's environment beyond capabilities of the national regulation.

The megatrends are the main social, economic and environmental forces that affect development of the society. Knowing the likely vectors of future developments may help to improve our understanding of the state of the environment in the Czech Republic.

Socio-economic megatrends:

1. For most OECD countries, **aging of the European and American population** is at the top of the political agenda due to changes in the labour market structure, declining competitiveness and re-distribution of public funding. Given the envisaged future massive dematerialization of the economy, the job structure will come under great pressure and jobs may be transferred to countries outside the OECD. The exposure of the aging population to the effects of pollutants is longer, which is why the threshold-values for the risks posed by substances are being reviewed.

2. **Globalization** and the worldwide movement of people, goods, services and knowledge reduce the extent to which national development can be controlled. Although globalization may be at its peak and future trends may lead to regionalization, transnational corporations may – through their decisions – move production both into and out of the Czech Republic, thereby changing the employment structure, the need for transport services and, consequently, the state of the environment.

3. **Technological development** provides solutions to existing problems but it also brings about entirely new problems to which no solutions are available. New energy sources, nanotechnology, genetic modification, virtualisation, new compounds and manufacturing processes are examples of areas the impacts of which may fundamentally transform the topics that are discussed in this Report.

4. Prosperity and economic growth result in a new **imbalance** between the slow-growing Euro-American society and the breakneck growth that is experienced especially in Brazil, Russia, India, China and South Africa (BRICS). BRICS countries are characterized by economic growth of around 10%, young population, emerging middle class and an aggressive approach to gaining access to natural resources, at the expense of OECD countries. There will be changes to business models, product trends, capital movements, but there will also be increase in waste, which may not suit the Czech Republic.

5. **Individualization** comes hand in hand with pressure on the mode of transport (passenger car transport), housing (suburbanization), but also reduced interest in public affairs and environmental protection.

6. **Commercialization** is closely tied to the other megatrends. The speed of the market response to any demand anywhere in the world results in consumerism that was inconceivable some fifty years ago. On the other hand, ongoing digitisation will speed up the shift towards a knowledge economy. Commercialization limits personal decision-making, 'relativises' moral values and, consequently, reduces the people's interest in their surroundings including the environment.

7. **Interest in health and the environment**, as opposed to commercialization, represents a global trend that is typical of the middle and upper classes within the society. Sports, spas, organic products and interest in the origin of goods and the impacts of consumption are trends that, if well regulated, may benefit the environment. Through promoting product labelling (e.g. the Forest Stewardship Council at the international level, the Flower at the European level, and the Environmentally Friendly Product and Environmentally Friendly Service at the national level) and certification systems for companies (the Eco-Management and Audit Scheme, Corporate Social Responsibility), many countries intend to promote more efficient protection of ecosystem services. The codes of many corporations now include sustainability and socially and environmentally responsible behaviour.

8. The speeding up of product marketing, innovation cycles, **intensive research**, improved marketing surveys, continuous optimization and modification result in an increased pressure on the ability to regulate real problems.

9. The interconnectedness between social, economic and technological networks provides a **basis for accelerated economic and social changes**. At the same time, dependence on critical infrastructures is growing, as is the cost of their security.

10. **Urbanization** allows for creating nodes in networks and is massively taking place especially in developing countries. It tends to be associated with commercialization and the increasingly poor evaluation of work in the primary industry.

Environmental megatrends:

1. **Global environmental pollution increases**. Both the amount and diversity of pollutants increase. Suspended particulate matter, sulphur oxides, nitrogen oxides, ground-level ozone and greenhouse gases, which are currently receiving considerable attention, are merely the tip of the iceberg. The main mass of that iceberg comprises substances such as endocrine disruptors, persistent organic compounds and nanoparticles, whose independent or joint action within the environment is understood to only a very small extent.

2. Declining resilience of ecosystems and **loss of ecosystem services**. Provisioning, cultural, regulating, supporting and other services constitute a quantifiable natural capital that is exploited in order to sustain humanity. Finding a balance between the exploitation of ecosystem services by the society and their sustainability for future generations has been the leitmotif of environmental protection.

3. **Climate trends** affect the availability of ecosystem services, including water supply, conditions for business (primarily in agriculture) and ocean acidification. The possible impacts of these trends are being studied intensively.

4. The growing **risk of pandemics** and the spread of non-native diseases and pests are caused by the global movement of goods and services, the climate trends and the reduced resilience of ecosystems. New human, animal and plant diseases can spread all over the world extremely quickly. Fear of pandemics has a major impact on global markets.

5. **Environmental debt** represents the accumulated environmental burdens that have not been included in prices in the real economy. The unrealistic financial evaluation of the real economy is what has led to the financial crisis. The situation resulted in a crisis of confidence in the real economy, leading to a crisis of governance, during which economies were experiencing reduced confidence in regulation. The characteristic effects of that crisis include destruction of the value of economic and natural capitals and investment, and the increasing risk of inflation of values.

Availability of data in the Report

With respect to the Report's preparation schedule, some data are not available as of its closing date. Subsequent updating of the data will take place within settlement of the inter- and intra-sectoral comments or, if need be, in the time period before the Report is submitted to the Government of the Czech Republic for approval. If some data are available in a final form after this date, they will be updated in the electronic version only, i.e. on the website of CENIA, in the framework of the Information System of Statistics and Reporting (ISSaR)[1].

Indicators evaluating the state of biodiversity and ecosystem services in the Czech Republic

The chapter **Biodiversity and Ecosystem Services** is not included in the Report because of a lack of updated data. In the past, three indicators were presented in the Report – State of animal and plant species of Community importance between 2000 and 2006, State of natural habitat types of Community importance between 2000 and 2006 and Common bird species indicator. The indicators State of animal and plant species of Community importance between 2000 and 2006 and State of natural habitat types of Community importance between 2000 and 2006 were removed due to repetition of the evaluation lasting several years because only data concerning the state in these areas in 2000–2006 are available. The Common bird species indicator was excluded by CENIA for financial reasons.

Discussion with specialists in biodiversity evaluation came to a conclusion that in the Czech Republic, there is no other indicator that would cover development in this field using a longer time period. In 2010, the Ministry of Environment, in co-operation with Agency for Nature Conservation and Landscape Protection of the Czech Republic, issued the Report on Fulfilling the 2010 Target in Biodiversity Protection in the Czech Republic, which deals with evaluation of the key area of the Convention on Biological Diversity, i.e. "the state and trends of biodiversity components". Altogether 21 indicators are presented in the Report. Along with the indicators "State of animal and plant species of Community importance" and "State of natural habitat types of Community importance", which were evaluated in the CENIA documents, the Report also covers e.g. the numbers and distribution of selected species (butterflies and birds), the Red List Index (RLI) or the size of specially protected areas established at the national level. Unfortunately, none of these indicators which are commonly used within the EU to evaluate biodiversity (SEBI) is suitable for the Report on the Environment, primarily due to irregular monitoring or minimum changes reported in their trends (e.g. specially protected areas).

As far as nature and landscape and related biodiversity are concerned, most of the changes are slow and long-term, and necessary data collection demands specialised professionals, a lot of time and funding because greater data sets are usually necessary to describe the changes, and the data collection cannot be provided, with some exceptions, by automated technical devices. That is why the one-year period for which the Report is worked out does not correspond to evaluation possibilities in this area in most cases, and therefore the data used in the Report are always updated depending on the evaluation deadlines of the single types of monitoring.

The given indicators evaluating the state of biodiversity continue being presented at http://indikatory.cenia.cz where there are the data from monitoring of the animal and plants species of European importance and monitoring of the state of habitats of European importance which are evaluated in a six-year period based on the reporting obligation provided for in the Directive 92/43/EEC. The next evaluation deadline (i.e. the date by which the reporting must be submitted) is in June 2013 and that is why the 2011 Report contains data identical to those from the previous years (updating will be carried out in the 2013 Report).

In terms of international comparison, all EU member states use the same indicators to evaluate the state and development of biodiversity (the state of animal and plant species of Community importance and the state of natural habitat types of Community importance, which are presented in CENIA documents) and hence they can be compared among the single states. The member states also present additional information but only depending on the scheduled monitoring and financial flows directed to this area. The new State Environmental Policy, which is under preparation at present, extended the requirements for monitoring, especially as far as biodiversity development evaluation is concerned. For this reason, extension of the indicator set can only be expected after several years of this new document's effect.

Data on water quality in the Czech Republic

In 2009–2011, financing of the **surface water monitoring**, in which both the Ministry of Environment and the Ministry of Agriculture were to participate, was not resolved. In this time period, data concerning BOD_5, COD_{Cr}, $N\text{-}NO_3^-$ and P_{total} in monitored Eurowaternet profiles were available only for the basins of the river Vltava, the mid- and lower Elbe and the Odra. As far as the rivers Ohře, Morava and Dyje are concerned, only data for their outlet sections were provided. The 2011 values of AOX, Cd, FC and chlorophyll for the basin of the river Odra are missing entirely. For these reasons, evaluation of water quality in watercourses could not be elaborated for the whole territory of the Czech Republic but only for its part. The overall state (and trends) of the watercourses quality in Czech Republic may therefore differ from the evaluation provided. Locations and numbers of the profiles included in evaluation in this Report will be published on CENIA website as a part of the key environmental indicators.[2]

Data on soil quality in the Czech Republic

In the past, the indicator "Agricultural land use limits" was also presented in the Reports. It focused on evaluation of data concerning potential vulnerability of lower soil strata by compacting, potential vulnerability of soil by acidification and point yield evaluation of agricultural land. However, data for this indicator are updated annually for small territories only (in km^2) and that is why the given indicator will be evaluated in the Report for an interval longer than one year. Nonetheless, the indicator will continue being presented at the Information System of Statistics and Reporting (ISSaR).

[1] *http://indikatory.cenia.cz*
[2] *http://issar.cenia.cz/issar/page.php?id=1579*

List of abbreviations

ALR	agricultural land resources
AOT40	accumulated ozone exposure over a threshold of 40 parts per billion
AOX	adsorbable organically bound halogens
BaP	benzo(a)pyrene
BAT	Best Available Techniques
BMW	biodegradable municipal waste
BPEJ	evaluated soil-ecological unit
BOD_5	biochemical oxygen demand over five days
CEHAPE	Children's Environment and Health Action Plan for Europe
CENIA	CENIA, Czech Environmental Information Agency
CF	Cohesion Fund
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CNG	compressed natural gas
COD_{Cr}	chemical oxygen demand by dichromate
Coll.	Czech collection of laws
c. p.	current prices
CRF	Common Reporting Format
CSN	Czech state standard
CZK	Czech crown
DDT	dichlorodiphenyltrichloroethane
DG JRC	Directorate General Joint Research Centre
DH	district heating
DMC	domestic material consumption
EAFRD	European Agricultural Fund for Rural Development
EC	European Communities
EEA	European Environment Agency
EEC	European Economic Community
EFMA	European Fertilizer Manufacturers Association
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
END	Environmental Noise Directive
EQS	environmental quality standards
EU	European Union
EU ETS	European Union Emission Trading System
EUR	Euro
Eurostat	Statistical Office of the European Union
FC	thermo-tolerant (faecal) coliform bacteria
FSC	Forest Stewardship Council
GAEC	Good Agricultural and Environmental Conditions
GDP	Gross Domestic Product
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane
HRDP	Horizontal Rural Development Plan
ICP Forests	International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
IPPC	Integrated Pollution Prevention and Control
IPR	Integrated Pollution Register
ISPA	financial assistance instrument for supporting investment projects
ISSaR	Information System for Statistics and Reporting
IUCN	International Union for the Conservation of Nature
LPG	liquefied petroleum gas
LV	limit value
LULUCF	Land Use, Land Use Change and Forestry
MT	margin of tolerance
NECD	National Emission Ceiling Directive
NIS	National Inventory System
N/A	data not available
OCPs	organochlorine pesticides
OECD	Organisation for Economic Co-operation and Development
OPE	Operational Programme Environment

OPI	Operational Programme Infrastructure
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
p. e.	population equivalent
p. p.	percentage point
PEFC	Programme for the Endorsement of Forest Certification Schemes
PES	primary energy sources
PM	particulate matter
POPs	persistent organic pollutants
RDP	Rural Development Programme
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RES	renewable energy sources
SEBI	Streamlining European Biodiversity Indicators
SEP	State Energy Policy
SAIF	State Agricultural Intervention Fund
SFTI	State Fund for Transport Infrastructure
SMR	Statutory Management Requirements
TSES	Territorial System of Ecological Stability
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
WRI	T. G. Masaryk Water Research Institute

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 adsorbable organically bound halogens. The summary indicator AOX is expressed as chlorides, expressed as the equivalent weight of chlorine, bromine and iodine contained in organic compounds (e.g. trichloromethane, chlorobenzene, chlorophenols etc.) that, under certain conditions, adsorb onto activated carbon. The main source of these substances is the chemical industry. While generally poorly degradable and water-soluble, these compounds are soluble in fats and oils, and thus easily accumulate in adipose tissues.

BAT. Best Available Techniques. In accordance with Act No. 76/2002 Coll., on integrated prevention, the best available techniques are the most efficient and advanced stages of development of the applied technologies and activities as well as their means of operation, which show practical suitability of certain techniques designed to prevent, and if it not possible, to reduce emissions and their environmental impacts. The techniques mean both the technology used and the way in which the respective device is designed, built, operated, maintained and put out of operation. The available techniques mean techniques that have been developed on a scale which allows their introduction in the relevant branch of the economic sector, under economically and technically acceptable conditions taking into consideration the costs and benefits, if they are available to the operator of an installation under reasonable conditions, no matter if they are used or produced in the Czech Republic or not. The best technique means a technique that is most efficient in attaining a high level of protection of the environment. Within identification of the best available technique, standpoints listed in Annex 3 to this Act must be taken into account.

Biomass. As a general concept, biomass includes all organic material that is involved in the energy and element cycles within the biosphere. This especially includes plant and animal substances. For the purposes of the energy sector, biomass includes plant material that can be utilised for energy (e.g. wood, straw etc.) and biological waste. The energy that is accumulated in biomass originates from the sun, similar to fossil fuels.

BMW. Biodegradable municipal waste is the biologically degradable component of municipal waste that undergoes anaerobic or aerobic decomposition, such as food and garden waste, as well as paper and cardboard.

BOD_5. This represents the five-day biochemical oxygen demand. BOD_5 is the amount of oxygen that is consumed by microorganisms during the biochemical oxidation of organic substances over five days under aerobic conditions at 20 °C. This is therefore an indirect indicator of the amount of biodegradable organic pollution in water.

BPEJ. The evaluated soil-ecological unit (BPEJ) is a five-digit numeric code associated with agricultural land. It expresses the main soil and climatic conditions that affect the productive capacity of agricultural land and its economic value.

Climatic conditions (climate). This is the long-term weather trend that is determined by the energy balance, atmospheric circulation, the character of the active surface, and human activities. Climate is an important component of the natural conditions of any specific location. It affects the character of the landscape and whether it can be used for anthropogenic activities. It is geographically contingent and reflects the latitude, altitude and the degree of ocean influence.

CO_2 eq. This carbon dioxide emission equivalent measures aggregating greenhouse gas emissions. It expresses a unit of any greenhouse gas recalculated to CO_2 radiation efficiency that is taken as 1; other gases have higher coefficients.

COD_{Cr}. Chemical oxygen demand determined by the dichromate method. COD_{Cr} is the amount of oxygen that is consumed for oxidizing organic substances in water through an oxidizing agent – potassium dichromate under standard conditions (two hours of boiling in a 50% acid with a catalyst). It is therefore an indirect indicator of the amount of all organic pollution in water.

DDT. Dichlorodiphenyltrichloroethane is a chlorinated pesticide. The production and use of DDT is now banned in most countries all over the world, in particular due to bioaccumulation, toxicity, carcinogenic effects and contribution to reduced fertility.

Decoupling. The separation of the economic growth curve from the environmental pressure curve. Decoupling reduces the specific environmental pressure per unit of economic output. It can be either absolute (economic output increases while pressure decreases) or relative (economic output increases while pressure also increases, yet at a slower rate).

Dependence on foreign countries for materials. It expresses the proportion of imports in domestic material consumption. It is usually evaluated for certain groups of materials (e.g. oil) for which it indicates whether and to what degree the country's economy is dependent on the imports of that material.

DH. District heating. In a DH system, heat is generated at a single centralised source and subsequently distributed via grids to multiple buildings. DH is also known as teleheating.

Domestic material consumption. This term covers all materials entering the economy. It is calculated as the sum of all direct material input (domestic extraction, including extraction-related indirect material flows) and imports less exports.

Ecosystem services. Ecosystem services are the benefits that people obtain from ecosystems. They are further divided into provisioning services (food, wood, medicines, and energy), regulating services (regulation of floods, drought and diseases, land degradation), supporting services (soil formation and nutrient cycling) and cultural services (recreational, spiritual and other 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 carbonate rocks and magnesium carbonate rocks that naturally formed from calcium that had been released from minerals. Another source of lime fertilizers is waste materials from industry – carbonation sludge, cement dust, phenol lime etc., and natural lime fertilizers of local importance. Lime material is used as fertilizer either directly (possibly after mechanical processing) or as a fertilizer produced through a chemical process (burnt lime, slaked lime etc.).

Local concentration of pollution. A pollutant that is present in the air and comes into contact and affects the recipient (humans, plants, animals, materials). It results from the physical and chemical transformation of emissions.

LULUCF. The category that covers the emission and removal of greenhouse gases resulting from land use and forestry activities. This category is usually negative for countries with high forest cover and low levels of logging, and positive for countries with low forest cover or where there are rapid changes in the landscape towards the cultural landscape.

Material intensity of GDP. The amount of materials that a given economy needs to produce a unit of economic output. High material intensity indicates that the economy causes high potential pressure on the environment and vice versa. The pressure results not only from the extraction of materials, but also from waste flows, e.g. emissions and waste.

Meteorological conditions. The weather trend over several days, months, or even longer periods selected with regard to the influence on certain economic activities (e.g. the energy sector) and the state of environment (air quality). The term should not be confused with climatic conditions (climate).

Mineral fertilizers (inorganic, industrial, chemical fertilizers). Fertilizers containing specific inorganic nutrients that are obtained through extraction and/or physical and/or chemical industrial processes.

Mixed municipal waste. 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.

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 amunicipality, 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.

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.).