

3.2. Environmental Aspects of Economic Development until 2008

Human society and its economic activities represent a potential burden for the quality of the environment. These influences can be more intensive especially at the times of strong economic growth (such as the period 2004–2007 or 2008, as the case may be). They may increase pressures on the environment on both the input side (such as material or energy inputs) and the output side (such as waste, emissions in air or water pollution). This Chapter is focused on selected indicators monitoring the environmental burden of economic growth in the period 2004–2008¹, and this perspective is complemented with expenditure on environmental protection.

- **Economic growth triggered a growth in material consumption ...**

The strong economic growth in the years 2004 to 2007 (by 5.9% per year, on average) was, unlike in the previous period, accompanied by growth of material inputs in the economy. On average, the domestic material consumption² (DMC) and the direct material input³ in the economy (DMI) increased by 2.5% and up to 3.3% per year, respectively. This trend constituted a change against the previous period of 1999–2003 when both DMI (by 0.3% per year on average) and DMC (by 1.0% per year) decreased with a 2.6% average year-on-year growth of the economy.

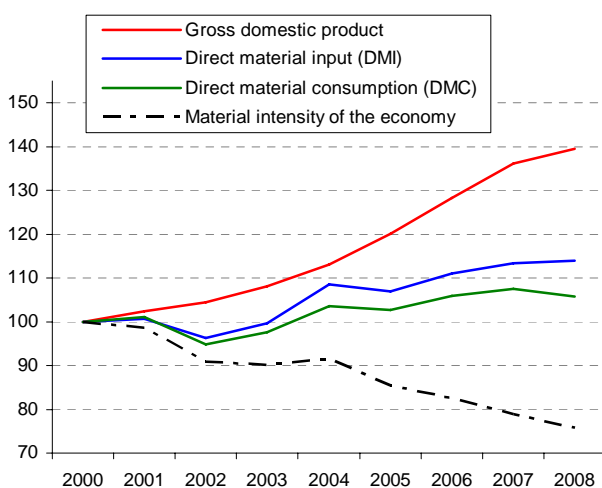
In 2008, however, the increase in DMI stopped and the material consumption even decreased again (1.6%), together with the more significant slowdown of the economic performance.

- **... but material intensity of the economy still continued decreasing**

Nevertheless, although the pressures on the environment (in the form of growing material consumption) were increasing in connection with the relatively high economic growth in the period 2004–2008, material intensity⁴ of the Czech economy decreased (by 17%) and this decrease even accelerated compared to the previous period of 1999–2003. In other words, material productivity⁵ in the Czech economy increased by 21% in that period.

This process of divergence of economic performance and environmental pressure curves is called “relative decoupling” – situation when environmental burden per unit of GDP is decreasing, but burden in absolute terms continues growing.

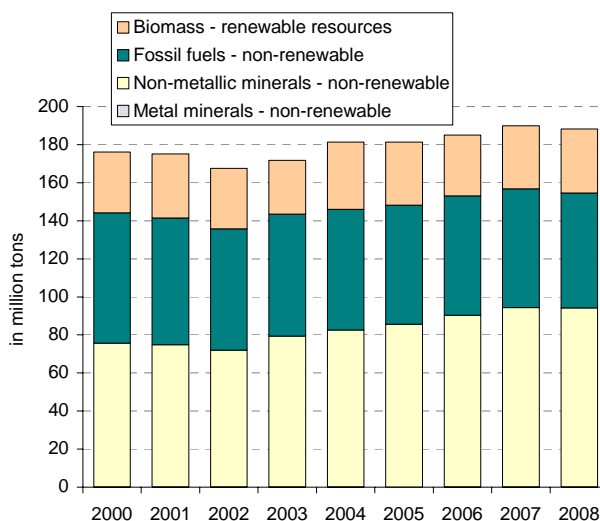
Graph No. 3.2.1 Material intensity* of the economy (year 2000=100)



* Domestic material consumption per unit of GDP (in 2000 constant prices).

Source: CZSO – material flow account

Graph No. 3.2.2 Domestic extraction used (in million tons)



Source: CZSO – material flow account

¹ Environmental statistics indicators are currently available until 2008, emissions until 2007.

² DMC – domestic extraction used plus imports minus exports of finished goods, raw materials extracted and biomass – measures the total quantity of materials and products consumed directly in the economy.

³ DMI – domestic extraction used plus import of finished goods, raw materials extracted and biomass – measures the input of materials used in the economy (i.e. all materials that have an economic value and are used for production and consumption).

⁴ DMC to HDP ratio in 2000 constant prices (GDP in 2000 constant prices is used in this analysis in the denominator to calculate all intensity indicators of the economy).

⁵ GDP (in 2000 constant prices) to DMC ratio – this is an inverse value of the material intensity of economy.

- Burden shifts between countries were more intensive**

Foreign trade is, in principle, a form of shifting environmental burden from one country to another. Physical imports can be seen as burden related to extraction of raw materials and production of goods, which is shifted by the importing country to the country of origin of the imports. Given the increasing importance of foreign trade for economic development in the period 2004–2008, these shifts of materials (or burden, as appropriate) were becoming more and more important. Physical exports and imports increased by 39% and 31%, respectively, during this period. It is thus possible to conclude that the speed of shifting environmental burden from the Czech Republic to other countries was slower than that of burden shifted to the Czech Republic. On the other hand, physical imports were higher than exports throughout the period so, from the point of view of material flows, the Czech Republic was basically a “burden exporter” during the entire period.
- Increase in consumption of non-renewable resources was pulled by construction activities**

The increase in domestic material consumption in the period 2004–2008 was mostly attributed to non-renewable resources, especially the strong growth of consumption of construction mineral resources (23%) caused by enhance construction activity (gross value added in construction increased by 10.8%). The share of non-renewable resources thus grew at the expense of renewable resources (biomass) and ranged around 88.6% in 2008.
- Share of fossil fuels in material consumption decreased**

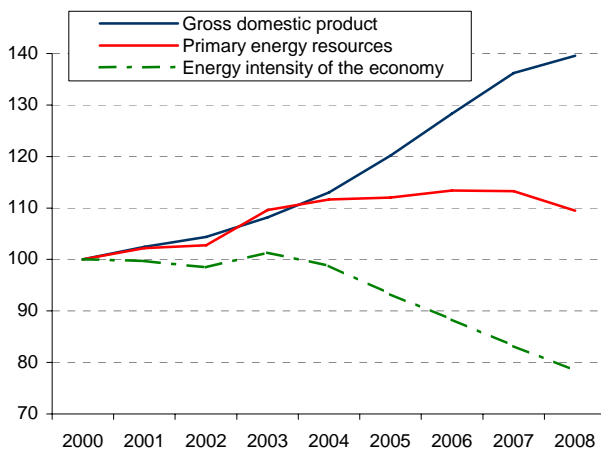
Within non-renewable resources, the long-term gradual decrease in importance of fossil fuels (by 3.4 percentage points) continued, mainly because of the increasing volume of construction mineral resources. In 2008, their share ranged around 37% of material consumption, while in 2003 it was still 41%. The reason behind this decline was primarily the stagnation (or decrease, as the case may be) of coal mining, which was not compensated even by the slight increase in consumption of oil and oil products. The contribution of fossil fuels to the growth of domestic material consumption was therefore negative throughout the monitored period (except for 2006).
- Primary energy resources stagnated**

The relative decrease of importance of fossil fuels from the point of view of material flows in the period 2004–2007 is also confirmed by the stagnating trend of primary energy resources (PER), which entered to the Czech economy during these years. The fast economic growth in the monitored period actually did not require additional need for primary energy resources, with 2008 being even marked by their decrease (by 3.3%). On contrary, these inputs were rising rather substantially in the period 1999–2003⁶ (by 1.8% per year, on average).
- Decrease in energy intensity of the Czech economy accelerated**

The economic performance and environmental pressure (in the form of PER consumption) curves were thus diverging throughout the period so that energy intensity per unit of GDP decreased markedly (by 23%). In spite of this decrease, however, the Czech economy still belongs to more energy and material intensive economies. The energy intensity per unit of GDP (in PPS) ranged at 154% of the EU-27 average in 2007 and the material intensity around 181% in 2005.

⁶ Increase in PER in 2003 was caused, in particular, by the commissioning of the first block in the Temelín nuclear power plant (heat manufactured from fuel elements).

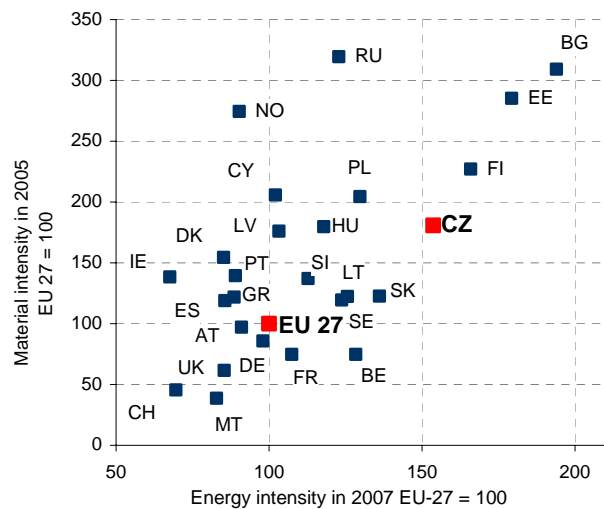
Graph No. 3.2.3 Energy intensity* of the economy (year 2000=100)



* Primary energy resources per unit of GDP (in 2000 constant prices).

Source: CZSO – energy balance

Graph No. 3.2.4 Material and energy intensity (international perspective)



Source: Eurostat, CZSO calculations

- **Waste production growth pulled by fast-growing branches**

Waste is a negative output of production processes and consumption in the society, representing a potential burden for the environment. Waste intensity of an economy is thus another indicator that characterizes the links between economic development and the related environmental pressures.

The total waste production showed a slightly increasing tendency in the last years (by 2.8% between 2005 and 2008)⁷. The largest increase was recorded in branches specialized in waste management (disposal of sewage water, solid waste and public cleaning, recycling of secondary raw materials), as well as in branches experiencing a strong boom (such as construction, manufacture of motor vehicles or manufacture of electrical machinery and devices).

- **Volume of municipal waste has increasing in the long term**

However, not only industrial waste was growing, contributing roughly 88% to the total waste production, but also municipal waste produced at the territory of municipalities increased. This waste was growing even faster (7.5%) than industrial waste (2.2%) in the period 2005–2008. With regard to its lower share, however, its contribution to the increase in the total waste production was relatively small.

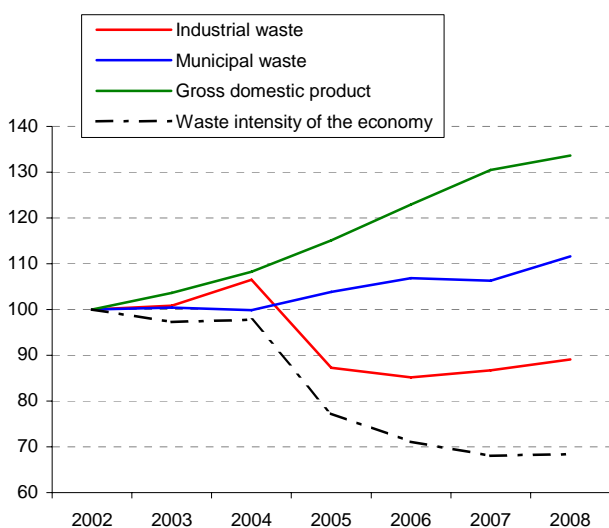
There were 305 kg of municipal waste per inhabitant in 2008, while this volume ranged around 279 kg in the years 2002–2004. This significant increase can be related not only to the increased consumption of the population during the monitored period, but also to the growth of trade business, the waste of which is also partially included in municipal waste.

- **Waste intensity of the economy stagnates**

The total increase in waste production since 2005 (2.8%) thus, in spite of the fast economic growth, resulted in a decrease in the so-called waste intensity of the economy. With the economic slowdown (and further increase in waste production in 2008), however, this decrease came to a standstill and the waste intensity of the economy between 2007 and 2008 stagnated. While in 2005 there were 9.4 kg of waste per 1,000 CZK of GDP, in 2007 and 2008 the waste intensity of the economy ranged identically around 8.3 kg per 1,000 CZK of GDP.

⁷ It is problematic to evaluate waste production during the entire monitored period of 2004-2008 because between 2004 and 2005, for instance, some waste types were cancelled from the waste records, which resulted in a significant decrease in the reported production of industrial waste. For this reason, the developments in total waste volume are evaluated starting from 2005 only.

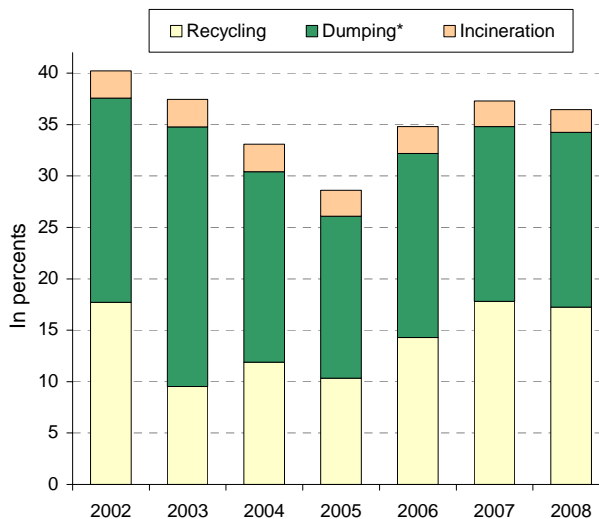
Graph No. 3.2.5 Waste intensity of the economy* (year 2002=100)



* Production of industrial and municipal waste per unit of GDP (in 2000 constant prices).

Source: CZSO

Graph No. 3.2.6 Selected waste management methods (share in total waste management in %)



* Storage and other methods of waste dumping at or below the ground level.

Source: CZSO

- **Most of municipal waste still ends up at dumping sites. However, there is more of sorted waste**

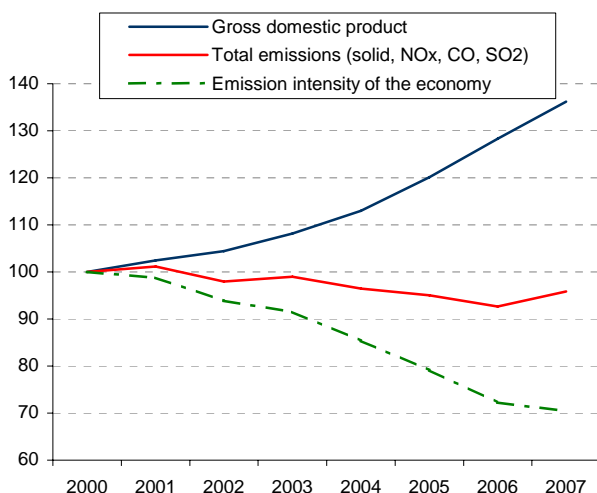
In addition to the waste production itself, however, it is also of same importance to monitor also the management of the already produced waste (re-use and disposal), as it is primarily this process that finally determines the end burden for the environment.

A positive development is seen with regard to behaviour of the population in managing their own waste – the share of sorted waste has been increasing in the long run (from 5.9% in 2002 to 14.3% in 2008), as is the use of the possibility of bulk waste collection. Against 2002, the volume of sorted waste increased 2.7 times and the bulk waste collection grew by nearly one-quarter. On the other hand, most of municipal waste still ends up at dumping sites. The share of dumped municipal waste is decreasing (from 80% in 2004 to 71% in 2008); nevertheless, the total quantity does not decrease. During the monitored period, on contrary, the volume of incinerated municipal waste decreased (by 11%) and also the share of this disposal method went down (from 14% in 2004 to 11% in 2008).

- **Increased use of waste recycling**

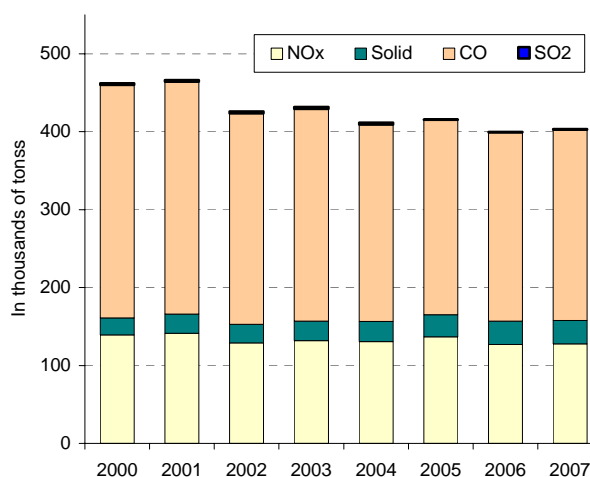
As regards management of both industrial and municipal waste together, dumping (management codes D1 – D5) was used to dispose 17% of waste in 2008 (decrease by 941 thousand tons against 2004, i.e. 16%), while 2% of waste was incinerated (codes R1 and D10). Among the waste re-use methods, recycling (codes R4 and R5) is predominant – its share in the total waste management has long been increasing (to 17% in 2008) and represents about 66% of entire re-used waste.

Graph No. 3.2.7 Emissions of main pollutants (year 2000=100)



Source: Czech Hydrometeorological Institute, CZSO calculations

Graph No. 3.2.8 Emissions from transport (REZZO 4) (in thousands of tons)



Source: Czech Hydrometeorological Institute

• **Emissions in the air declined only slightly, ...**

Compared to the dramatic fall during the 1990's (related to the structural changes in the economy and large investment projects aimed at air protection), the development of emissions of the four basic pollutants (solid emissions, NO_x, SO₂ and CO) after 2000 may appear nearly as stagnation. Nevertheless, emissions were decreasing also during that period, although very gradually and more in the long run than year-on-year⁸. In 2007, less emissions of NO_x (-1.9%), SO₂ (-1.2%) and CO (-0.2%) were released in the air against 2004. On contrary, the volume of solid emissions increased (+3.7%). The total sum between 2004 and 2007 amounted to a decrease by 6.8 thousand tons (0.6%) in spite of the year-to-year increase in 2007.

• **... but emission intensity of the economy dropped by 18%**

Thanks to the fast economic growth, the emission intensity of the economy⁹ decreased by nearly 18% in the period 2004–2007 in spite of the only very moderate decline of emission volumes. Also here the economic development and environmental burden curves were diverging, but this process – similarly to the waste intensity – slowed down towards the end of the monitored period.

The largest share in the decrease of the total volume of emissions can be attributed to NO_x emissions, which represent roughly 27% of emissions of the four basic pollutants, as well as to SO₂ emissions (their share amounts to 20%). CO emissions, ranging around 47% of the volume of this entire group of substances, contributed to this decrease until 2006 only. They increased significantly in 2007 on a year-to-year basis (by 5.6%), which finally resulted in an overall increase in emissions compared to the previous year (increase mainly for large stationary pollution sources – REZZO 1).

• **Increase in solid emissions in the air driven by transport**

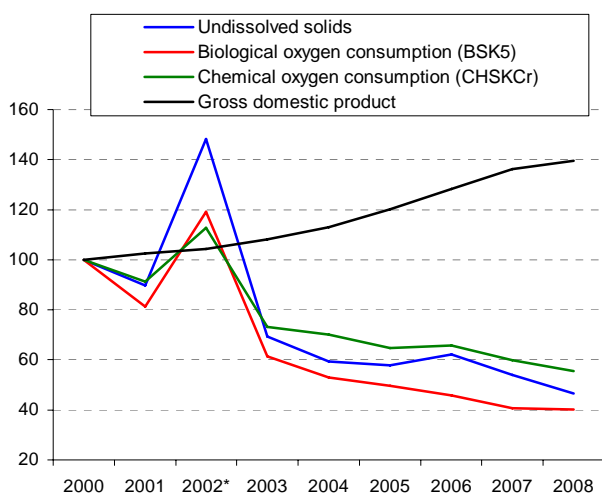
Increasing intensity of transport (REZZO 4) is very closely related to economic growth. The transport intensity contributed 37% to the sum of all four basic substances in 2007. Specifically, it contributed 50% to CO emissions, 45% to NO_x emissions and 47% to solid emissions. In the period 2004–2007, transport-generated emissions decreased in case of NO_x, CO and SO₂, which might be related to the gradual renewal of the fleet. As regards solid emissions, however, they increased by more than 14% (by 3.8 thousand tons) in the three years. The increase in these emissions is probably a consequence of the higher transport intensity during those years: transport capacity in passenger transport and in freight transport increased by 5.5% (including individual transport) and by 6.3%¹⁰, respectively.

⁸ Year-on-year fluctuations may be caused, for instance, by different climatic conditions in the respective year, which makes the evaluation of qualitative changes in the economy in relation to the so-called emission intensity considerably difficult.

⁹ Sum of solid emissions, NO_x, SO₂ and CO (in tons) per unit of GDP (in 2000 constant prices).

¹⁰ Source: Ministry of Transport of the Czech Republic, 2007 Czech Transport Yearbook (online); Ministry of Transport of the Czech Republic; Transport Research Centre, v. v. Issued in 2008 (cit. 10. 4. 2010) <http://www.sydos.cz/cs/rocenka-2007/index.html>

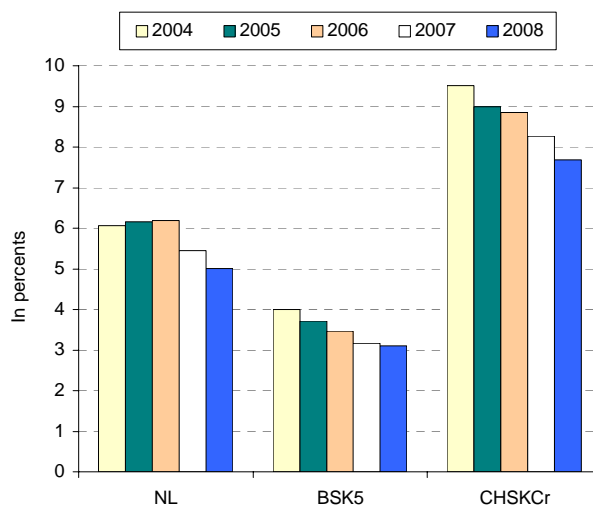
Graph No. 3.2.9 Pollution released in water streams (year 2000=100)



* Values are affected by the floods in August 2002.

Source: CZSO

Graph No. 3.2.10 Share of released water pollution in the total pollution produced (in %)



Source: CZSO

- **Decrease in water stream pollution continued in spite of the fast economic growth ...**

Water stream pollution had, unlike waste and emissions, a clearly declining tendency in the period 2004–2008. In this case, there was a full separation of the environmental burden and economic performance trends (the so-called absolute decoupling) because not only pollution per unit of GDP, but also total pollution volume released was decreasing.

The volume of undissolved solids released in water streams decreased by over 21% in the period 2004–2008, and the volume of organic pollution released decreased by 24% in indicator BSK₅¹¹ and by nearly 21% in indicator CHSK_{Cr}¹². Thus, the values dropped to less than 30%, 9% and 19% of the 1991 levels for undissolved solids, BSK₅ and CHSK_{Cr}, respectively.

- **... not only thanks to the pollution-eliminating improvements in the infrastructure, but also thanks to pollution prevention**

The reason behind the continued decrease was, for a large part, related to the infrastructure investments aimed at elimination of the pollution produced (public sewage system, sewage treatment plants¹³ and facilities in businesses, which are not connected to the public sewage system). In 2008, 5% of undissolved pollutants that were produced in the Czech Republic in that year were discharged into water streams. This share has decreased by 1.1 percentage points since 2004 (i.e. nearly by 12 percentage points since 1991). A similar decline was also recorded for organic pollution measured by biological and chemical oxygen consumption where the share of released and produced pollution ranged around 3.1% and 7.7%, respectively.

During the period 2000–2008, not only the volume of the pollutants released, but also the volume produced was decreasing. This may lead to a conclusion that not only expansion of capacities and improvement of efficiency of facilities eliminating the already produced pollution, but also the introduction of technologies that prevent the production of pollution itself contributed to reducing the environmental pressures.

- **Increase in water draw-off driven by energy¹⁴**

Water pollution (as an output of economic processes), however, is not the only existing environmental pressure related to water and water streams. Water is also a resource that is drawn off from surface and underground waters (and consumed or returned to the system). The largest share in the surface water draw-off is attributed to the energy sector – mainly to cool down circulating steam (57% in 2008); 22% is

¹¹ BSK₅ is the biochemical consumption of oxygen needed for the organisms for pollution decomposition in 5 days.

¹² CHSK_{Cr} is chemical oxygen consumption determined by dichromate.

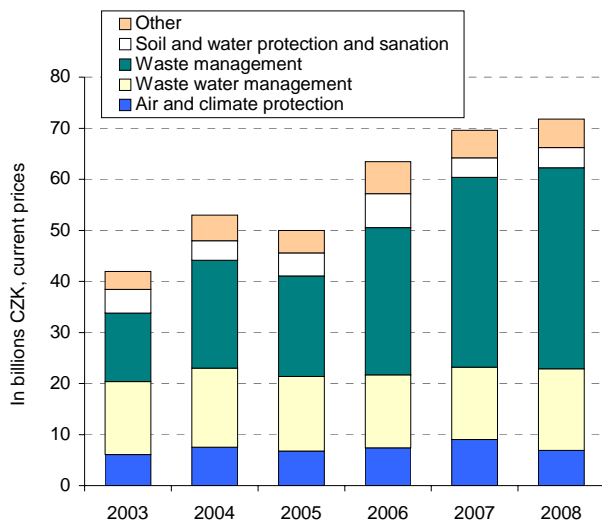
¹³ For instance, the share of population connected to a sewage treatment plant increased by 4.7 percentage points to nearly 76% in the monitored period.

¹⁴ Source: Ministry of Agriculture of the Czech Republic. Report on State of Water Management in the Czech Republic, state as at 31 December 2008. Ministry of Agriculture of the Czech Republic, Prague, 2009, ISBN 978-80-7084-850-0, and Ministry of Agriculture of the Czech Republic. Report on State of Water Management in the Czech Republic, state as at 31 December 2005. Ministry of Agriculture of the Czech Republic, Prague, 2006, ISBN 80-7084-543-0.

drawn-off by water lines for public purposes¹⁵ and 17% by industry. The share of agriculture (including irrigation) ranged around 1.3% in 2008.

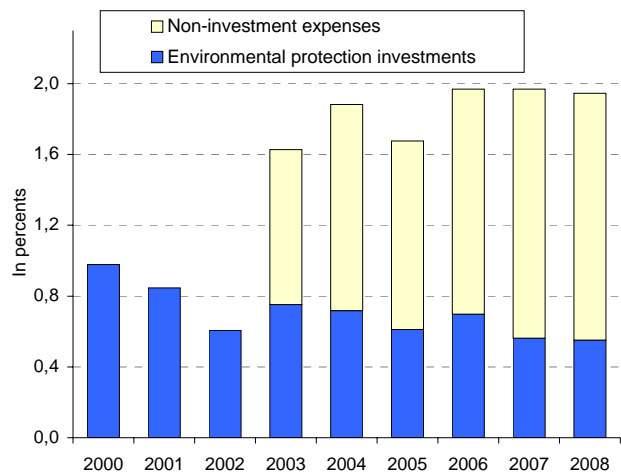
In total, surface water draw-off thus increased by 3.5% between 2005 and 2008. The energy sector needs are determinant for the development of the total volume of surface water draw-off. In the monitored period (2004-2008), these needs started growing only after 2005 and increased by nearly 14% by 2008 (gross value added in the energy sector increased by 20% in the same period of time). Consumption in agriculture¹⁶ increased as well (by 97%, while the gross value added dropped by nearly 22%) during that period, but the influence of this increase was negligible given the low share in the total surface water draw-off. An opposite development was taking place in industry and in water lines for public purposes. In both these categories, the long-term decrease in water draw-off continued (by 25.8% and 4.3%, respectively). The water-supply intensity of industry thus decreased in relative terms (i.e. compared to 30% growth of gross value added¹⁷) as well as in absolute terms (decrease by 92 million m³, i.e. 6% of surface water draw-off in 2005) at the times of economic growth.

Graph No. 3.2.11 Environmental protection expenditure (in billion CZK, current prices)



Source: CZSO

Graph No. 3.2.12 Investments and non-investment expenses* for environmental protection as a share in GDP (in %)



* Non-investment expenses have been established since 2003 only.

Source: CZSO

• **Environmental protection expenditure increased thanks to non-investment expenses**

Environmental protection expenditure (sum of investment and non-investment expenditure) is an indicator expressing the society's efforts to eliminate or prevent burden. Economic growth (growth of disposable sources) can thus be expected to bring an opportunity for the environment rather than a risk.

On average, the value of environmental protection investments ranged around 20 billion CZK per year (2004 to 2008). However, their importance in the total value of expenditure decreased by 10 percentage points to 28% between 2004 and 2008. On contrary, non-investment expenditure increased by 128% to 51 billion CZK in this period. This increase was mainly related to the need for current operating expenses linked to investment projects in environmental protection implemented in the previous years.

• **Expenditure growth has kept pace with the economic growth**

Environmental protection expenditure in current prices thus increased by over 71% during the monitored period, while gross domestic product in current prices, which is usually taken as the basis to calculate the share of environmental protection expenditure, increased by 43%. This implies that the share of environmental

¹⁵ In 2008, nearly 362 million m³ of water (22% of total draw-off) were taken by water lines for public purposes from surface waters and 320 million m³ from underground water, which represents 84% of draw-off from these resources.

¹⁶ Agriculture including irrigation, but excluding fish farming.

¹⁷ In the water management statistics, industry is defined as BCEA 10 to 45 excluding energy and water lines (i.e. excluding BCEA 401, 403 and 41). Here, the gross value added in the industry is indicated for BCEA 10 to 45, excluding the entire Section E (i.e. BCEA 40 and 41).

protection expenditure to GDP was gradually increasing, and remained at a relatively stable level around 1.9% during the years of fast economic growth.

- ***Growth of waste management expenditure was dominating*** Contrary to 1990's when attention was focused mainly on air and climate protection investments, expenditure related to waste and waste water management has been becoming increasingly important in the past years. In 2008, nearly 55% of all expenditure was intended for waste management, of which 89% consisted in non-investment expenses. The growth of these expenses (212%) also contributed the most to the growth of total environmental protection expenditure in the period 2004–2008. Waste water management expenditure represented the second largest share in total expenditure in 2008 (22%). Although the investments in this field decreased substantially in the monitored period (by 21%), this decrease was more than compensated by the increase in non-investment expenses so that total expenditure on waste water management eventually increased by 12%. The previously dominant area of environmental protection expenditure, i.e. investments in air and climate protection, declined by 8% in the monitored period. However, the entire decline was compensated by increased non-investment expenses in this area (59%) so that the air and climate protection expenditure finally increased by 13%. Nevertheless, the share of this expenditure in total expenditure decreased by 4.9 percentage points to 9.6%.