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# The Economy and the Environment

## in the Czech Republic after 1989

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# Contents

# Foreword

This publication offers a comprehensive report on the development of the Czech economy and environmental impacts from the Velvet Revolution in 1989 to the present. During the turbulent 1990s, the quality of water and air gradually improved and the rehabilitation of old contaminated sites began. This trend was possible due to the extensive social and economic changes.

Increasing production and consumption, more migration by the population, goods and services and increasing availability of idle capital resulted in new environmental pressures. Most of the measures that brought about positive effects on society and the environment were implemented in the previous decade. Today's complicated relationship between the economy, society and the environment require data and foresight when planning new measures.

CENIA, the Czech Environmental Information Agency, focuses its activities on horizontal environmental themes and their impacts on the economy and society. The data that CENIA has collected during the four years of its existence has made it possible to publish a second book covering different sectors. After the publication entitled *The Environment in the Czech Republic 1989–2004*, we focused more closely on the relationships between economic activities and their environmental impacts between1990 and 2007. The large team of authors has striven to provide unbiased information that is open to debate by any reasonable group. I would like to thank both the authors and the critics.

It is up to the readers to draw their own conclusions from the information presented in the book.

**Jiří Hradec**
Director of CENIA

Dear Readers,

The book you are reading is a sequel to *The Environment in the Czech Republic 1989–2004* by CENIA, which covered the development of the state of the environment from the 'Velvet Revolution' to the beginning of the 21st century. The purpose of the second part is to provide you with an overview of the trends and relationship between the economy and the environment over the same period, extended through 2006. Knowing this development will help us better understand the current state of the environment and its topical problems even though the data base is not quite complete and methodically homogenous.

It is needless to emphasise that both the economic and social development during this period in question were very dramatic and in many respects full of crucial turns. The structural changes of the economy, represented on the one hand by strangling traditional 'heavy' industries and on the other hand by growing less energy-intensive industries and services, the fast development of passenger and freight road transport and life style changes of the Czech population caused by generally improved societal conditions and integration into the European area were the basic factors affecting the development of the environment in the Czech Republic. Major positive changes were brought about by the Czech Republic's accession to the European Union and the related transposition and implementation of European law. This was largely because the European Community places heavy emphasis on the environmental aspects of policy.

This development was also related to the changing nature of environmental problems. While 15 years ago, people had hardly any chance to influence the catastrophic state of the environment since most pollution was caused by large industrial enterprises and raw material extraction, today, each of us can significantly affect these issues. Technological development has resulted in a decrease of certain kinds of pollution (per production unit). However, the current make-up of our GDP has a counter-effect since the material and energy demands of the population have risen.

Energy intensity has dropped by more than 50 % over this period; the largest decrease has been reported over the last 3 years, at more than 5 % per year. Regardless, the energy intensity is still much higher than the EU average. Road transportation has become one of the most important factors impacting the environment. The number of passenger cars has nearly doubled over the period in question and reached over 4 million in 2007; the volume of freight has more than tripled.

On the one hand, the trends shown above have meant lower industrial pollution (e. g. sulphur dioxide emissions have dropped to approximately one-tenth of the 1989 value) with related air and water quality improvement. On the other hand, new problems have emerged. These include: growth in ecological burdens from transportation, namely air pollution and noise; stagnant and recently even increasing greenhouse gas emissions that bring about the risk of global climate changes; modification of the landscape structure, caused by extensive residential and commercial development; and related transportation infrastructure.

This book will guide you through the sector by sector trends, offering a comprehensive view of ever more painful environmental issues. We believe that we have succeeded in what we set out to do and we look forward to your reactions.

**Various CENIA authors**

# 1

# Transformation of the Economy and Macroeconomic Development

In1989, the Czechoslovak economy was one of the centrally planned economies with a high level of monopolisation. All economic processes were controlled through a central plan. For all practical purposes, there was no real market and this situation resulted in an ever deepening economic and technological lag. Since 1989 to the present the economy transformed successfully to a relatively developed market economy. The institutional transformation required a change of the legal system to that of a democratic society.

Several forms of privatisation were used to create a functioning private sector, which presently accounts for generating approximately 90 % of the gross domestic product (GDP). Between 1990 and 2005, the GDP increased by 30 % at constant prices and, after a one-off leap at the beginning of the 1990s, inflation was successfully kept at a low level.

Following the decreases and the sluggish growth of the 1990s, macroeconomic development since 2000 has been characterised by high GDP and industrial growth rates and a strengthening currency and external stability but, on the other hand, also by a relatively high (8 %) unemployment rate and a growing public finance deficit during most of the period. These unfavourable conditions were kept under control up until 2005. The problem of public finance stability (including pension reform) remains the most pressing issue and will be for the foreseeable future.

The condition of the environment has corresponded with the economic level. Before 1989, Czechoslovakia was amongst the most devastated European countries. After a substantial improvement between 1990 and 2000, the condition of the environment has stabilised, showing both positive and negative year to year deviations. However, some indicators, especially those relating to air quality, may be indicative of the beginning of new adverse trends. Also, the high energy and material intensity of the economy, which partly results from the high proportion of industry in the national economy and the transportation boom, remains a problem.

## 1.1 The transformation and privatisation of the economy

In 1989, our country had an economic system that was fundamentally different from the system existing in developed countries. Formally, the economy was controlled through a central multiple-year plan and its directive indicators. It was a closed system and there was an ideological requirement demanding reliance on self-sufficiency. Our international relations were closely interconnected with the economies of other communist countries. This resulted in a shortage economy, in which products and raw materials were either lacking or abundant (i.e. if they were useless).

After the revolution of November 1989, the economic stagnation and lag behind the West provided an impulse that necessitated fundamental changes in the economy. In the autumn of 1990, the new Czechoslovak government, in cooperation with the national governments of the Czech and the Slovak republics, prepared a programme of radical economic reform that was intended to ensure a swift transition from a centrally planned economy to a market economy. As of 1 January 1991, 85% of all prices had been liberalised (Žídek, pp 57). Those prices that had not been liberalised, e.g. prices of electricity, gas and rent, underwent gradual liberalisation and deregulation. In 1998, the consumer price liberalisation level reached a level that was standard in EU countries.

Cumulative consumer price inflation for the 1989–2007 period amounted to 451.7%, which is still the lowest figure among all transformation economies, while Ukraine and Russia, for example, experienced hyperinflation, and Estonia and Lithuania nearly did as well. V. Klaus and V. Tomšík give the following figures for selected post-communist countries (see Table 1.1).

In addition, foreign trade was liberalised in January 1990 and switched to world prices and payments in convertible currencies. For additional information on the effects on foreign trade see chapter *Trade*.

Three devaluations of the Crown took place in 1990, from 16.5 CSK/USD to 28 CSK/USD, which allowed for the gradual implementation of the internal convertibility of the national currency in 1991 and 1992. On the negative side, the devaluations resulted in more expensive imports.

After the end of the 1950s, there were repeated efforts aimed at improving the functioning of the economy through a number of reforms, especially with respect to planning. However, these reforms met with ideological and political restrictions and failed. The only attempt at a conceptual reform occurred at the end of the 1960s. It expanded began in the economic sphere and expanded to political life, but was stopped by a Soviet-led military intervention.

In September 1990, the Federal Assembly approved the "Economic Reform Scenario" as the basic programming document. This was based on a restrictive monetary and fiscal policy, a change in ownership relationships, price liberalisation and internal convertibility. It also contained the principles of social policy.

**Cumulative inflation and GDP in transformation economies [%]**

Table 1.1

| Counrty | Period | Cumulated inflation | GDP |
|---|---|---|---|
| Ukraine | 1991–1999 | 46 000 000 | -61 |
| Estonia | 1991–1994 | 9 086 | -33 |
| Russia | 1992–1996 | 289 000 | -35 |
| Lithuania | 1992–1994 | 9 040 | -41 |
| Bulgaria | 1990–1993 | 1 702 | -27 |
| Poland | 1990–1991 | 1 066 | -18 |
| Romania | 1991–1992 | 737 | -21 |
| Hungary | 1990–1993 | 165 | -18 |
| Slovakia | 1991–1993 | 118 | -24 |
| Czech Republic | 1991–1993 | 110 | -12 |

*Source: Klaus V. and Tomšík V., Macroeconomic Facts of Czech Transformation, NC Publishing, 2007*

Cumulative inflation is the product of the values of annual inflation coefficients for the given period.

## 1.1.1 Privatisation

After 1989, the privatisation process continued on gradually in several directions. 'Small privatisation' included mainly restaurants, hotels, minor trade and, to a lesser extent, production plants. It continued until 1993 and the total auction sales amounted to approximately CZK 31 billion at the end of this period. 'Large privatisation' took place in two stages (1992, 1995–1997). It occurred through different forms of direct sales and through voucher privatisation. On the whole, the privatised property of state enterprises totalled CZK 1 780 billion at book value. Production and consumption cooperatives were also transformed to market-oriented enterprises.

A portion of the state property was returned to cities and municipalities (the historical property), with the value of such property being estimated at CZK 350 billion. Another portion of this property was returned to private entities through restitution (see Chart 1.1).

From the perspective of environmental protection, reference must be made to Section 6(a) of the Large Privatisation Act (Act No 92/1991 Sb.), which requires draft privatisation projects (submitted after 29 February 1992) to include an assessment of the enterprise's liabilities with respect to environmental protection confirmed by the Ministry of the Environment and to indicate the amount of environmental damage caused by the enterprise's activities to-date. Even though the responsibility for environmental liabilities rested with the previous owner – the state, the issue of responsibility for past environmental liabilities was to a large degree underestimated at the beginning of privatisation. It was only addressed through several resolutions of the government of the Czech Republic (in particular No 123/1993 Sb. and No 393/1994 Sb.), pursuant to which the remedying of environmental damage, although not exactly specified, that arose before privatisation, was to be paid for by the National Property Fund of the Czech Republic. The original parameters of environmental damage were specified by a Methodological Guideline developed by the Ministry of National Property Administration and Privatisation and the Ministry of the Environment, dated 18 May 1992.

The privatisation of banks was greatly delayed. State banks became state monetary institutions and later joint-stock companies; initially 100% state-owned and later majority-owned by the state (minority shares were part of voucher privatisation). After the implementation of more standard accounting procedures and banking supervision, banks turned out to be heavily burdened with a large amount of past due loans. To make the privatisation of these banks at all possible, their capital required strengthening and they needed to be stripped of bad loans. They were later offered to foreign investors under very favourable conditions. The Czech National Bank (CNB) estimates the total losses resulting from the banking sector privatisation at CZK 350–400 billion.

Generally, privatisation was most successful in enterprises that were privatised by foreign owners. Large, partly state-owned businesses also did relatively well. The businesses of minor Czech entrepreneurs were worse off. The success of enterprises privatised through the 'voucher method' is ambiguous. (Privatisation and Restitution, the Government Report on the Condition of Czech Society)

Any citizen of the Czech Republic over eighteen years of age could take part in **voucher privatisation**. A voucher book worth 1 000 investment points could be bought for 1 000 Czechoslovak/Czech crowns. Every 'investment voucher holder' could then use these points to 'buy' shares of privatised enterprises. As a side effect, 'privatisation funds' were formed, which played a significant role in the national economy.

**Acts that changed the ownership structure:** Act No 427/1990 Sb., on the transfer of state property to legal and natural persons, the 'Small Privatisation Act', made it possible to auction small, mainly trade facilities and Act No 92/1991 Sb., on the terms and conditions for transferring state property to other persons, the 'Large Privatisation Act'. The transformation of co-operatives was performed pursuant to Act No 42/1992 Sb., on the regulation of property relationships in co-operatives. Another factor that changed ownership relationships was 'restitution' that was carried out pursuant to Acts No 119/1990 Sb., on judicial rehabilitation, No 403/1990 Sb., on the moderation of certain property injustices, No 87/1991 Sb., on extra-judicial rehabilitation and No 229/1991 Sb., on the regulation of ownership relationships in land. State enterprises were subject to Acts No 111/1990 Sb., 92/1991 Sb. and 119/1995 Sb. These acts were amended many times.

**Gross value added** is obtained by deducting consumption from the production of goods and services. The total GVA for all sectors within the national economy plus net taxes on products equals the gross domestic product.

**Privatisation of state-owned productive assets [billions CZK]**

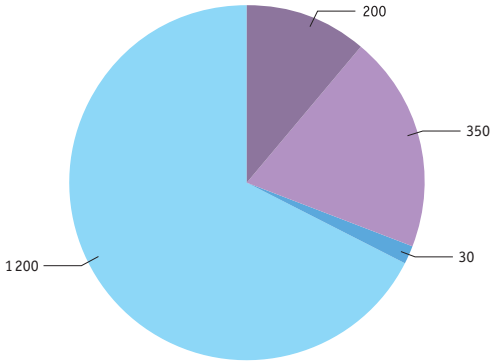



**Chart 1.1**

- Large privatisation
- Small privatisation
- Transfers to municipalities
- Restitution

*Source: Kouba, Vychodil, Roberts: Privatising without Capital, Karolinum 2005*

State-owned productive assets include manufacturing enterprises, service enterprises and agricultural land, as well as residential buildings, shops and restaurants.

**Large privatisation [billions CZK]**

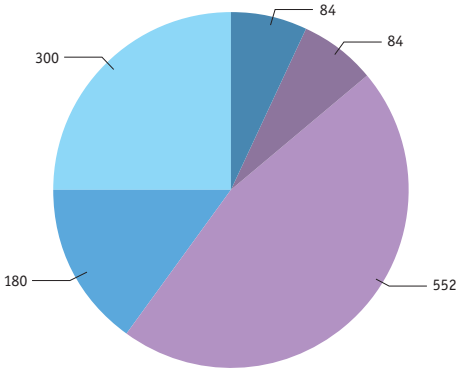



**Chart 1.2**

- Remaining state-owned enterprises
- Share companies except for those created in voucher privatisation
- Share companies created in voucher privatisation
- Enterprises privatised outside the voucher privatisation waves
- Other (e.g. liquidated etc.)

*Source: Kouba, Vychodil, Roberts: Privatising without Capital, Karolinum 2005*

**The proportion of the private sector in the production of the GDP and GVA at current prices**

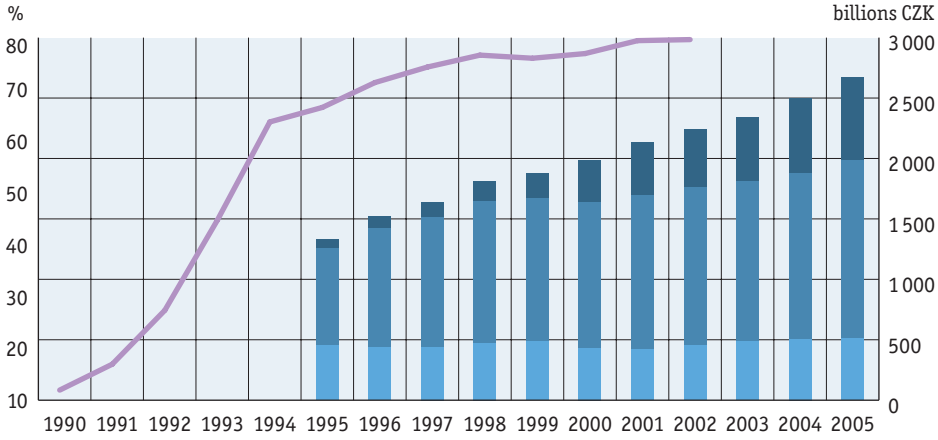



**Chart 1.3**

- GVA generated by the public sector [billions CZK, current prices]
- GVA generated by the national private sector [billions CZK, current prices]
- GVA generated by the foreign-controlled sector [billions CZK, current prices]
- The share of the non-state sphere in GDP production [%]

*Source: The HN Yearbook, 2003, Czech Statistical Office*

In view of the change in methodology, the share of the private sector in the economy after 2002 can only be monitored through its proportion in the production of gross value added (GVA). According to the Czech Statistical Office, this share has been fluctuating between 81 % and 82 %.

## 1.2 The development of main macroeconomic indicators

### 1.2.1 The gross domestic product

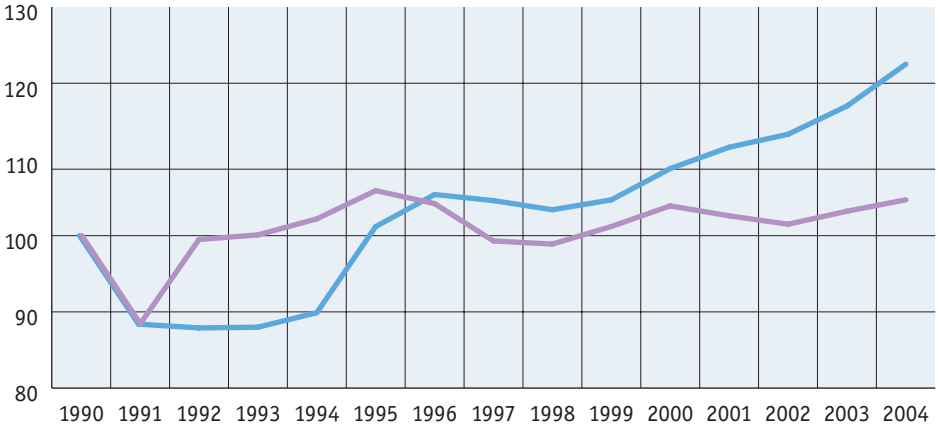
Up until 1993, the GDP kept decreasing, and this trend was only reversed in 1994. At first, the central bank and later the government responded to the growing external (the relative level of the current account of the balance of payments) and internal (the disproportionate growth of real wages) instability with a more restrictive policy. The loss of transformation dynamics was another negative factor. This caused the GDP growth rate to slow down in 1996 and, in absolute figures, even decrease between 1997 and 1998. The GDP has been growing since 1999 and, since 2005, the growth rate has sped up (3.6 % in 2003, 6.4 % in 2005 and, preliminarily, 6.5 % in 2007). Per capita GDP (see Chart 1.5) confirms this trend as well. Actual GDP is indicated at constant prices (adjusted for inflation).

In addition, the structure of GDP production based on sectors has changed considerably. While in 1990 the largest proportion of the gross domestic product was generated by industry (53.1 % including the building industry), the service sector assumed the dominant role (see Chart 1.7) in subsequent years.

The gross domestic product (GDP) is the most comprehensive indicator of the national economy's condition. It consists of the total monetary value of all goods and services produced within a certain territory over a given period of time. The time period is usually one year. Cross-border GDP comparisons often use GDP per capita calculated by purchasing power parity (PPP). To put it simply, gross national income equals gross domestic product adjusted for the balance of income received from other countries and similar payments made to other countries.

**Index of the GDP development, 1995 prices**

**Chart 1.4**



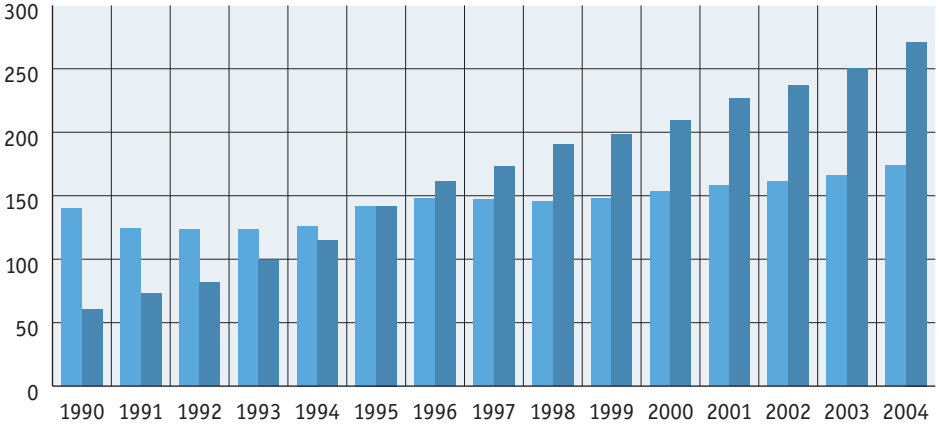

GDP (1990 = 100)
Annual GDP change (previous year = 100)

*Source: Czech Statistical Office*

The 1989/1990 GDP change is calculated according to the old methodology at 1984 prices. Data correction since 1995 is calculated according to ESA 1995 methodology – for the time being, comparison with unrevised data prior to that year is not possible. Data for 2005 are only available at 2000 prices. Therefore, they are not indicated in the chart.

**GDP per capita, 1995 prices [thousands CZK]**

**Chart 1.5**



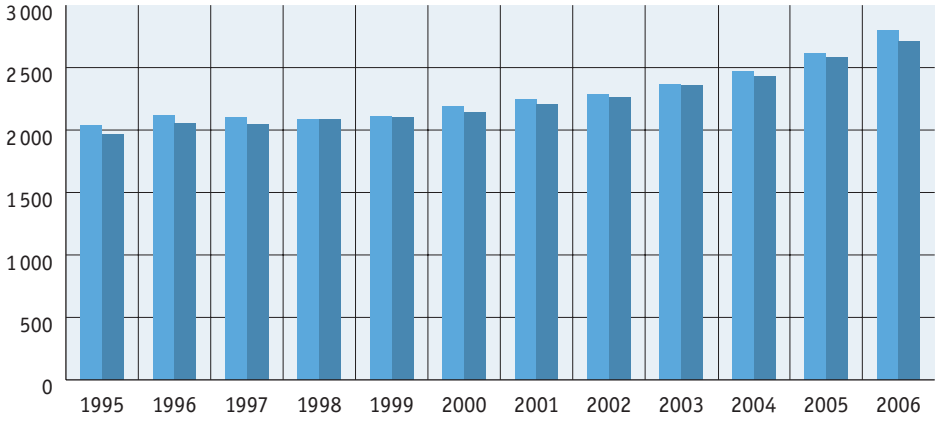

GDP per capita in CZK (1995 prices)
GDP per capita in CZK (current prices)

*Source: Czech Statistical Office*

Data correction since 1995 according to the ESA 1995 methodology – for the time being, comparison with unrevised data prior to that year is not possible.

**GDP and GNI from 1995 to 2006, 2000 prices [billions CZK]**

**Chart 1.6**



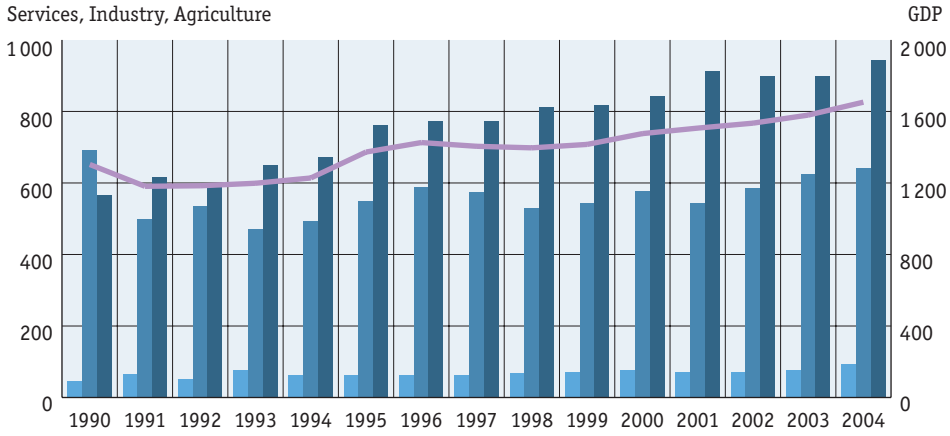

The gross domestic product
The gross national income

*Source: Czech Statistical Office*

In simple terms, gross national income equals GDP less primary income payable to non-residents plus primary income receivables from non-resident units.

**GDP structure by sector between 1990 and 2004 , 1995 constant prices [billions CZK]**

**Chart 1.7**

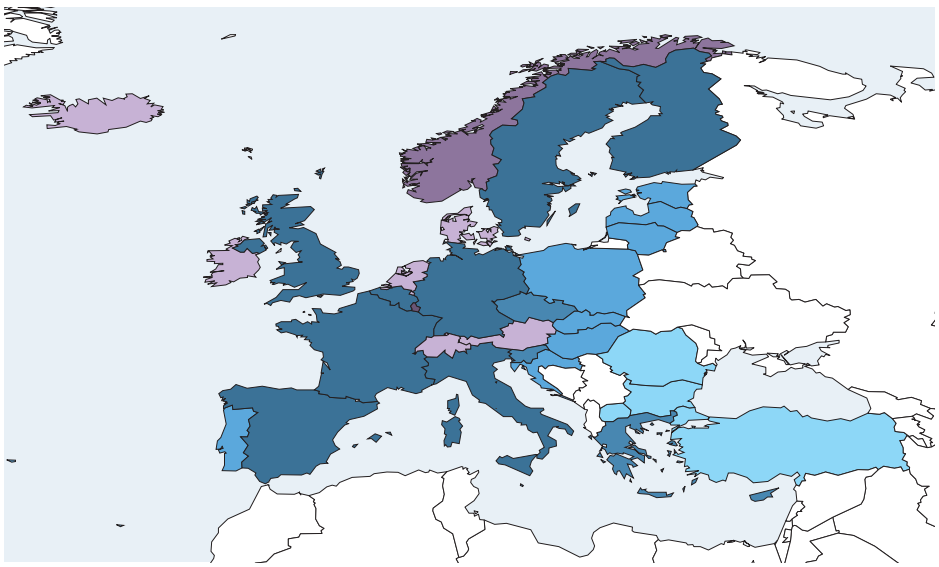



Agriculture
Industry
Services
GDP

*Source: Czech Statistical Office*

**GDP per capita, converted at current purchasing power parity, EU27 = 100, 2006**

**Figure 1.1**



N/A
0–50
51–75
76–100
101–125
126–150
151–175
176–200
200 and more

*Source: Czech Statistical Office*

GDP per capita in USD measured by purchasing power parity has been growing steadily since 1998. This indicator increased from 11 430 USD in 1993 to about 24 200 USD in 2007. By international comparison with developed countries, the Czech Republic's relative position remained more or less unchanged from the monitored period. Of the EU15, only Portugal was surpassed by 2006.

**Purchasing power parity** is the exchange rate between two currencies that represents the ability to purchase the same basket of goods in both countries. It is determined at three-year intervals (the latest is from 2005). Between periods, interpolation and extrapolation methods that are based on real exchange rates are used.

## 1.2.2 Inflation

Inflation is a change in the general price level during a monitored period (for a year or a month). When inflation is high, the amount of goods and services that households with a fixed or slowly growing income can buy decreases over time.

Price liberalisation in early 1991 led to a significant increase in the price level (57 % in 1991). After 1994, annual inflation rates fluctuated around 10 % without any major price jumps. Since 1999, the annual inflation rate has decreased to a level that is comparable with developed countries. Since that same year, the growth rate of the consumer price index has also decreased, and since 2002 it has not exceeded 3% (in 2005 in reached 2.5 %). However, since the end of 2007, inflation has started to rise sharply (7.5 % in February 2008).

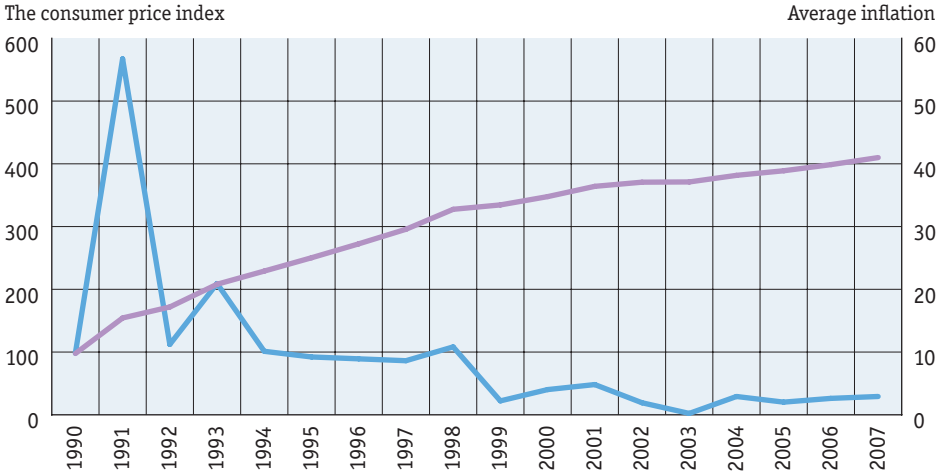
In comparison with 1990, the 2007 price level reached a more than fourfold level (412 %). Among other things, this affects the relative weight of charges for polluting the environment that are specified as absolute amounts. Even though producer price indexes grew significantly (1.5–3.5 times) during the monitored period, they did not reach any levels similar to the consumer price indexes that increased approximately 4.1 times over the same period.

Similarly to the GDP, the 2004/2003 consumer price index was also the lowest compared to other Visegrad countries (the Czech Republic, Slovakia, Hungary, and Poland) and even surpassed some developed European countries. However, the Czech Republic still lags behind both the EU and the OECD averages.

**The consumer price index (CPI)** is a number that is based on the price of a basket of goods and services paid by the population. Each product and service in the basket is assigned a weight. CPI measures how the prices of goods and services consumed by households over a given time period change (therefore, it is also referred to as the cost of living index).

**The inflation rates and the consumer price index**

**Chart 1.8**

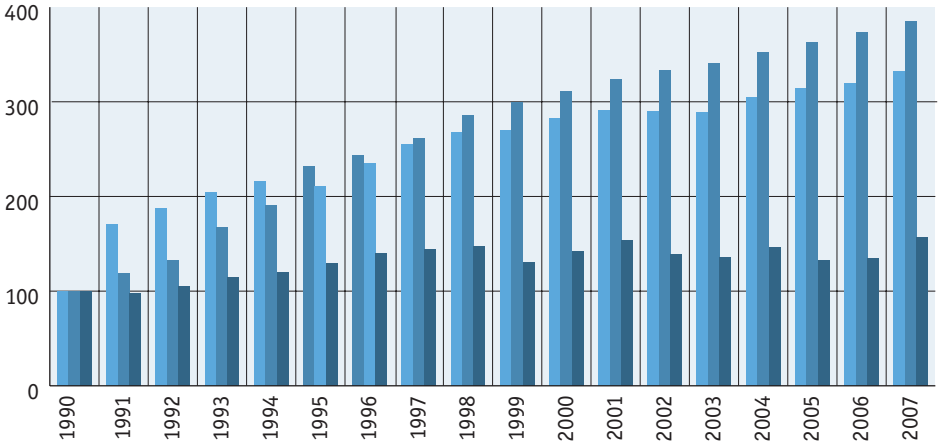



Average inflation [%]
The consumer price index, 1990 = 100

*Source: Ministry of Finance, Czech Statistical Office*

**Producer price indexes (1990 = 100)**

**Chart 1.9**

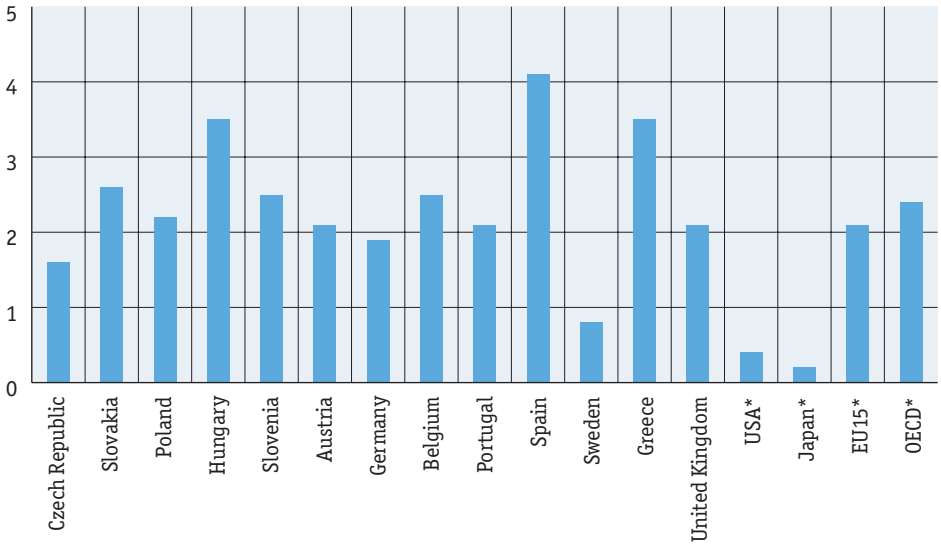



Industrial producer price index
Construction work price index
Agricultural producer price index

*Source: Ministry of Finance, Czech Statistical Office*

**International consumer price index comparison (index 2005/2004)**

**Chart 1.10**




*Source: OECD*

For European countries, the harmonised index of consumer prices (HICP) is calculated.

* 2004/2003

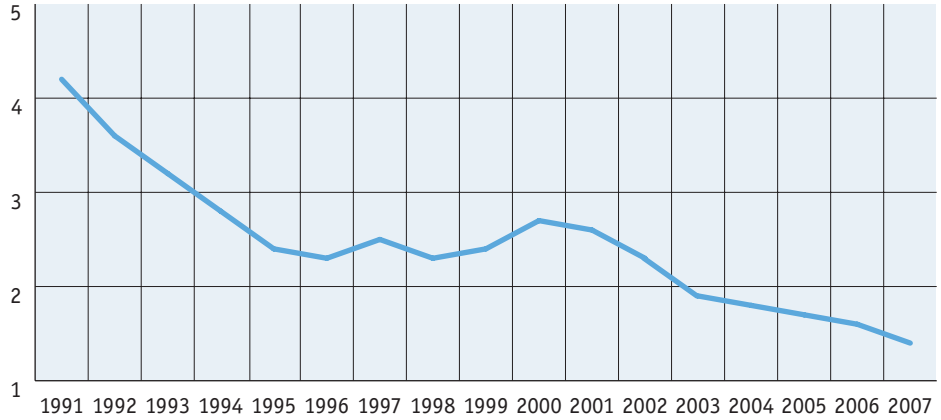
## 1.2.3 The exchange rate

The transition of the crown to full convertibility was one of the objectives of and, at the same time, prerequisites to successful economic transformation. The path led from the single internal exchange rate (1990) to internal convertibility (1991), i.e. the crown could only be traded domestically. Exchange rate fixation onto a currency basket was switched for a fluctuation band in 1992. Since 1995, the crown has been fully convertible, i.e. tradable both domestically and abroad. Since 1997, the crown has been in the free exchange rate regime of a fully convertible currency. Since EU accession on 1 May 2004, preparations for the introduction of the euro as the national currency have been in motion.

**The Exchange Rate Deviation Index (ERDI)** is the ratio between the crown's exchange rate and purchasing power parity (PPP). The poorer the economy (the larger the gap between its price level and the international price level), and the lower the demand for its currency, the higher the ERDI.

**Exchange Rate Deviation Index**

**Chart 1.11**




*Source: OECD, Czech National Bank*

The chart, which indicates the ratio of the crown's purchasing power parity to the market exchange rate of the American dollar, clearly shows that despite slight wavering in the second half of the 1990s, our currency has developed positively and this also confirms the Czech economy's place among developed countries.

## 1.2.4 Unemployment

Transformation changes were also reflected in the advent of and increase in unemployment. Unemployment can be monitored from the regional or structural perspective. There are significant differences in unemployment rates within individual regions – there is Prague and its surroundings with very low unemployment on the one hand and the Moravian Silesia and the Ustí nad Labem Regions with high unemployment on the other. With respect to structure, unemployment was most significantly influenced by the decline of lignite and coal mining and the restructuring of heavy industry. In addition, long term unemployment appeared. This mainly includes people with disabilities, the youth, the elderly, ethnic minorities, the unqualified and women with multiple small children (cf. Spěváček, pp 252).

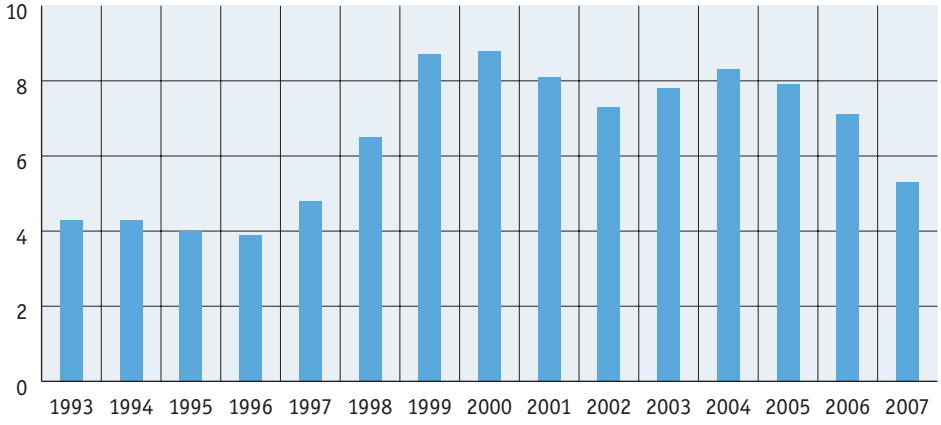
In the first half of the 1990s, the unfinished transformation of the economy kept unemployment at an artificially low level. Enterprises were not exposed to market conditions, due to, among other things, readily available bank loans. This enabled a large number of inefficient enterprises and production facilities to survive. After 1996, unemployment figures started to grow rapidly and the number of applicants per one available job grew even faster. In 2003 and 2004, the registered unemployment rate remained at approximately 10%. Unemployment did not start decreasing until 2004 and economic growth only began to create new jobs after 2005, although on a small scale.

In comparison with other European countries, unemployment rate presently fluctuates around the EU average, which can be viewed as one of the successes of the economic transformation.

The Ministry of Labour and Social Affairs uses the statistics from labour offices and includes such persons in the unemployment figures who are registered with the employment offices as currently unemployed. The registered unemployment rate is the proportion of the registered unemployed in the total labour force. The general unemployment rate is the proportion of all unemployed in the total labour force. This indicator is determined through sample surveys according to the Eurostat methodology. Since this indicator was not used until 1998, a chart showing the development of the general unemployment rate has not been included. According to quarterly surveys of the number of the unemployed that are conducted by the Czech Statistical Office, unemployment figures are usually 200 000–300 000 people higher than their registered numbers.

**The registered unemployment rate [%]**

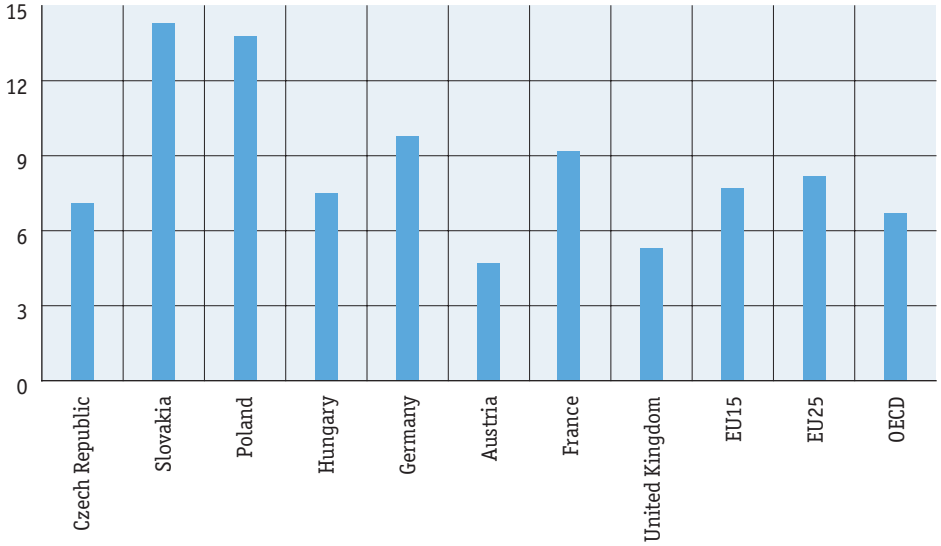
**Chart 1.12**




*Source: Ministry of Labour and Social Affairs, Czech Statistical Office*

**International comparison of general unemployment rates, 2006 [%]**

**Chart 1.13**




*Source: Eurostat*

## 1.2.5 External debt

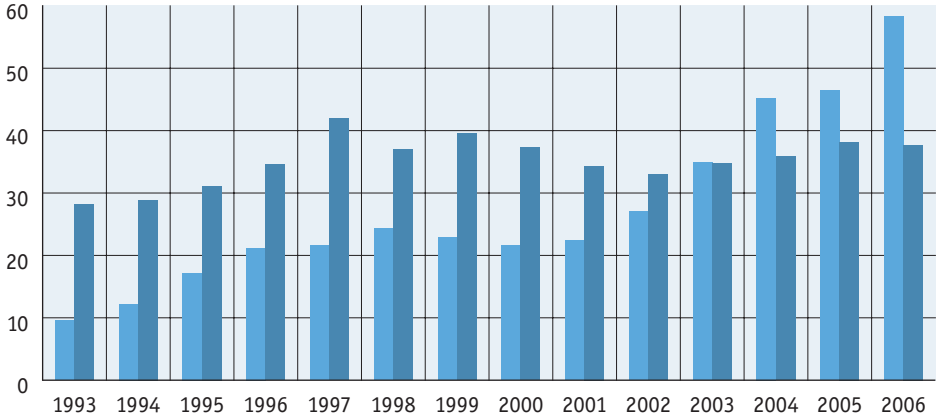
The level of external debt is another significant macroeconomic indicator. Chart 1.12 illustrates the growing trend in the Czech Republic's external debt levels. After a moderate decline between 1998 and 2001, the debt in dollar equivalent rose sharply to reach USD 58.3 billion in 2006. The World Bank and the International Monetary Fund put the critical level of external debt at 150% of exports, which means about USD 143 billion for the Czech Republic. It is obvious that we are far below this limit. In view of the strengthening crown and growing GDP, its ratio to the GDP has even decreased. The highest proportion of the GDP was achieved in 1997 (41.9%, Chart 1.14). However, the foreign debt level still remains below the level common in Western European countries (Chart 1.15).

The comparison of this indicator is in line with the current trend – compared to the Visegrad countries, the external debt to GDP ratio is considerably lower, while compared to some developed countries such as Austria (a neighbouring, small and developed country) and Belgium (a country with an historically similar economic structure), it remains very low.

**External debt** is the sum of the liabilities, both in CZK and in foreign currencies, owed by the banking system (incl. the CNB), enterprises and the government to non-residents. The correction of GDP figures up to 1995 was performed according to the ESA 95 methodology and, for the time being, comparison with unrevised figures and any data derived from them before that year is not possible.

**External debt of the Czech Republic**

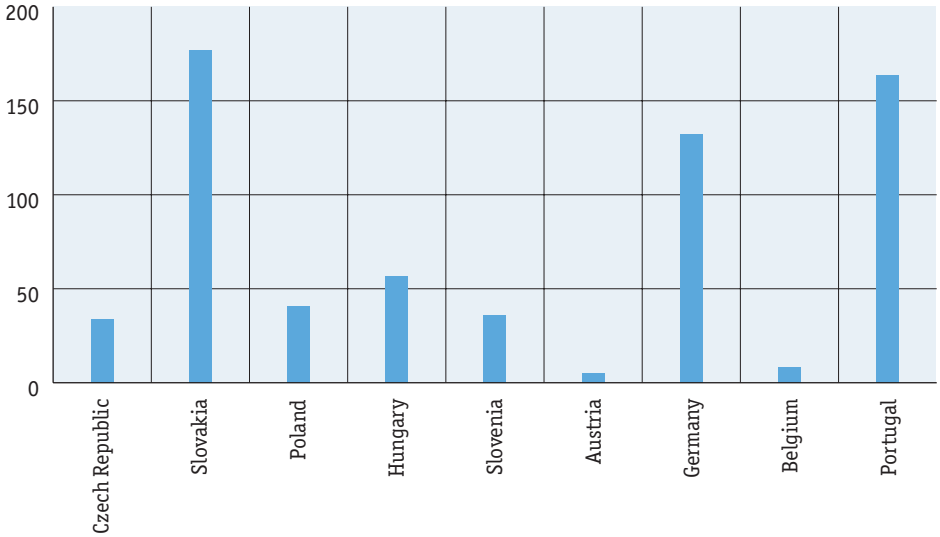
**Chart 1.14**




*Source: Ministry of Finance*

**International comparison of external debt, 2006 [GDP percentage]**

**Chart 1.15**




*Source: CIA World Factbook and The IMF, calculations by CENIA*

## 1.3 Macroeconomics and the environment

### 1.3.1 Investments in environmental protection

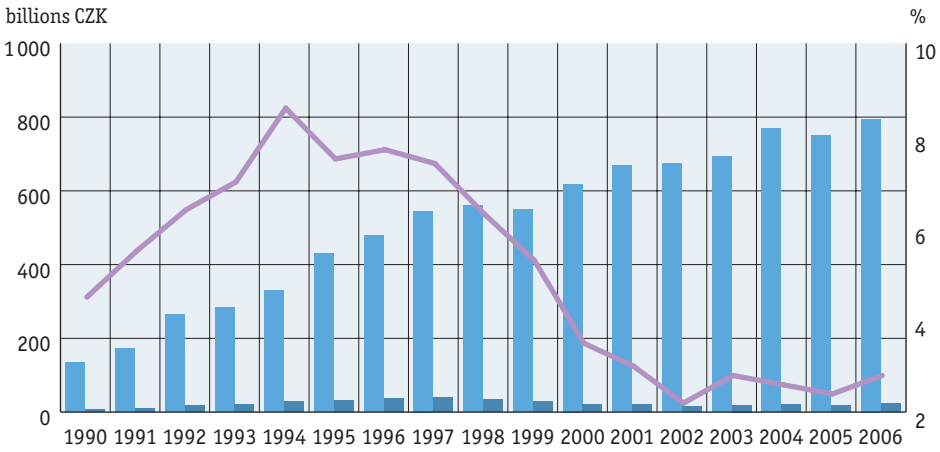
After 1989, it was necessary to begin remedying the environment, and this was naturally connected with high costs. The basis for growing environmental expenditure was mostly provided by new legislation that set strict emission limits for discharging pollutants and tough deadlines by which pollution had to be reduced. The largest amount of financial resources was spent between 1995 and 1997, mainly on air protection (desulphurization) and, to a lesser extent, water protection. Since 1990, the Czech Republic has invested more than CZK 390 billion in environmental protection. The adoption of legislative environmental measures temporarily burdened the economy, with environmental investments constituting more than 8 % of the total investments in 1994 (compared to 1–3 % in other OECD countries). However, we must keep in mind that this disproportion also reflects other facts: the lower labour productivity in the Czech Republic, the condition of the environment in other EU countries does not require investments as large as those in the Czech Republic, the Czech environmental legislation is sometimes stricter than that in other EU countries and, in addition, it often specified very tight deadlines for the implementation of relevant measures in the past (e.g. the Air Protection Act).

**The list of the main environmental strategies:**

- The Rainbow Programme for Environmental Recovery in the CR, approved by the Czech government in December 1990
- The State Environmental Policy of the CR, approved by the Czech government on 23 August 1995
- The State Environmental Policy of the CR, acknowledged by the Czech government on 14 April 1999
- The State Environmental Policy of the CR, approved by the Czech government on 10 January 2001
- The State Environmental Policy of the CR for the 2004–2010 period, approved by the Czech government on 17 March 2004

**The ratio of investments in environmental protection to total gross investments**

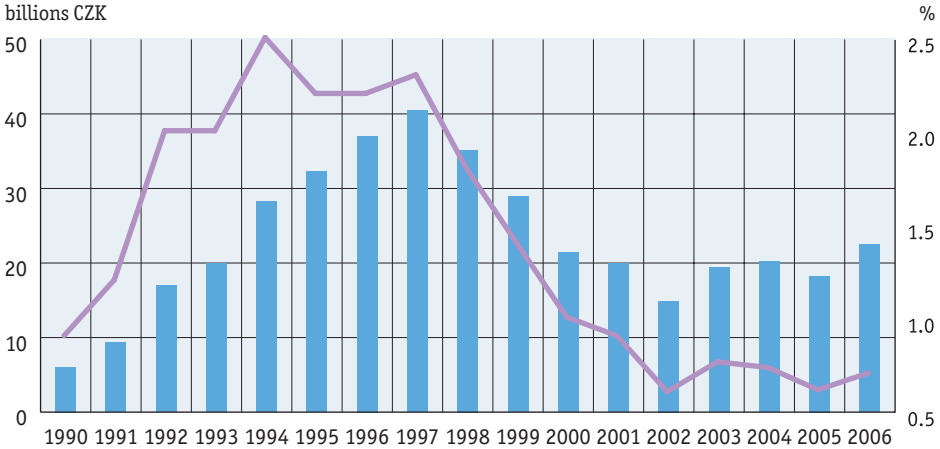
**Chart 1.16**




*Source: Czech Statistical Office and Ministry of Finance*

**The ratio of investments in environmental protection to the GDP**

**Chart 1.17**




*Source: Czech Statistical Office*

**Total investments in environmental protection in the Czech Republic [in billions CSK/CZK, current prices]**

**Table 1.2**

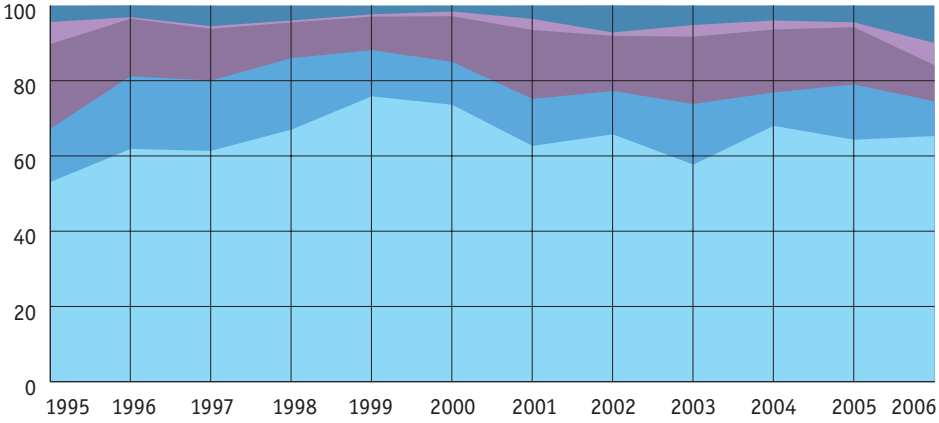
| | 1990 | 1992 | 1994 | 1996 | 1998 | 2000 | 2002 | 2004 | 2006 |
|---|---|---|---|---|---|---|---|---|---|
| Protection of the air and the climate [1] | 1.69 | 5.76 | 13.49 | 21.48 | 20.14 | 8.41 | 4.15 | 4.68 | 4.56 |
| Management of waste waters [2] | 3.27 | 7.22 | 10.84 | 10.01 | 8.29 | 8.57 | 7.03 | 8.43 | 7.35 |
| Waste management [3] | 1.09 | 3.12 | 3.13 | 3.45 | 4.70 | 2.27 | 1.24 | 2.83 | 3.40 |
| Protection and decontamination of soil, water protection [4] | – | – | – | 0.88 | 0.56 | 0.33 | 1.03 | 1.97 | 4.20 |
| Abatement of noise and vibrations [5] | – | 0.79 | 0.65 | 0.57 | 0.31 | 0.28 | 0.37 | 0.44 | 1.19 |
| Protection of the landscape and biodiversity [6] | – | 0.72 | 0.16 | 0.66 | 1.16 | 1.55 | 0.51 | 0.84 | 1.08 |
| Protection against radiation | – | – | – | – | – | – | 0.02 | 0.31 | 0.17 |
| Research and development in environmental protection | – | – | – | – | – | – | 0.13 | 0.08 | 0.04 |
| Other activities in the protection of the environment | – | – | – | – | – | – | 0.45 | 0.62 | 0.51 |
| Total | 6.05 | 16.95 | 28.27 | 37.04 | 3.52 | 21.40 | 14.92 | 20.21 | 22.47 |

[1] until 1995 air protection
[2] until 1995 water protection, until 2001 water protection (with the exception of ground water)
[3] until 1995 waste use and disposal, until 2001 environmental waste management
[4] until 2001 soil and ground water protection, since 2002 also surface water protection
[5] until 1995 reducing the effect of physical factors on the environment, until 2001 reducing the effects of physical factors; with the exception of workplace protection
[6] until 1995 soil reclamation, until 2001 nature and landscape protection

*Source: Statistical Environmental Yearbook of the Czech Republic, Czech Statistical Office, Ministry of the Environment*

**The share of investments in environmental protection based on funding sources [%]**

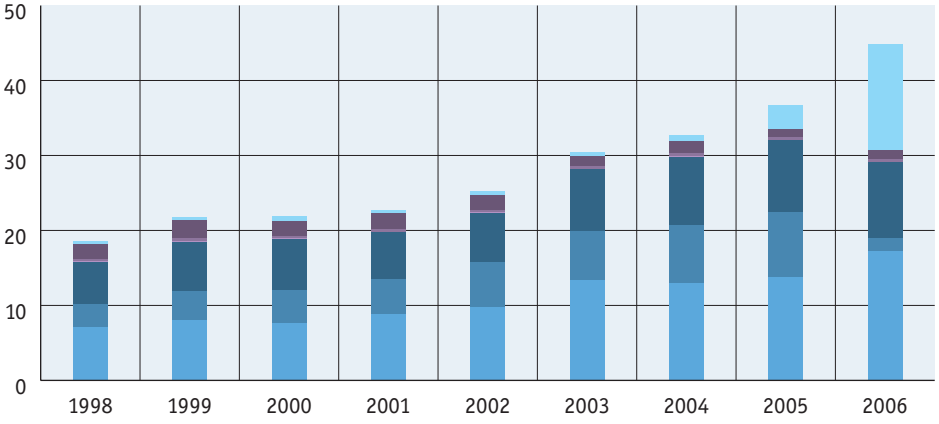
**Chart 1.18**




*Source: Czech Statistical Office*

**Public expenditures on environmental protection in current prices [billions CZK]**

**Chart 1.19**




*Source: Ministry of Finance and Statistical Environmental Yearbook*

These include expenditures from the state budget, the regional budgets and state funds, including compensation for environmental damage. The figures are indicated at current prices.

Structuring the investments into environmental protection in accordance with the programming orientation makes it possible to monitor the accomplishment of the State Environmental Policy's objectives, i.e. the effectiveness of the legislative environmental measures.

From the financial perspective, it is important to monitor the expenditure on environmental protection based on funding sources. These data reflect the development in the structure of funding sources and they also provide the basis for future analyses.

While investments from public budgets have shown a decreasing tendency, self-sourcing still remains the strongest funding source. Their proportion represents nearly 2/3 of investment expenditures provided for this purpose. One of the initial principal problems in environmental protection was ensuring financial resources for the specified measures at the individual investor level.

On the contrary, there was a decline in financial resources from abroad. However, this situation started to change with a gradual increase in the amount of these investments, and the trend has continued even after the Czech Republic's accession to the EU. For the 2007–2013 financing period, it will be possible to use almost EUR 5 billion from EU funding for the Operational Programme Environment. This will be of special significance for essential waste water treatment.

According to Chart 1.19, environmental expenditures have seen consistent growth that notably increased after the Czech Republic's accession to the EU. As expected, the growth was most felt in the area of water protection (requirements for wastewater treatment plants pursuant to the above-mentioned Directive 91/271/EEC). Also significant were expenditures within the categories of waste management and nature conservation (the Natura 2000 network).

Obtaining the financial resources necessary to meet the above-listed European commitments (especially in water protection) is currently the most pressing problem facing the funding of environmental protection. The identical classification of environmental expenditures according to the CEPA 2000 European classification allows for the comparison of public environmental expenditures in the Czech Republic and in other EU countries. Compared to other EU countries, the Czech Republic has spent significantly more financial resources on the environment. The problem is that, in addition to the investment and non-investment expenditures on environmental protection, the environmental expenditure concept also includes a portion of the costs for environmental damage compensation.

The time structure for expenditures on environmental protection is also affected by three transitional periods for the application of European law, which the Czech Republic negotiated during its accession to the EU:

- 94/62/EC on packaging and packaging waste for achieving the proportion of recycled plastic packaging and the reuse of all types of packaging with a deadline of 31 December 2005.
- 91/271/EEC concerning urban wastewater treatment for ensuring adequate wastewater collection and treatment in municipalities with a population equivalent of more than 2 000, by 31 December 2010, provided that adequate wastewater collection and treatment is ensured in municipalities with a population equivalent of more than 10 000.
- 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants, by 31 December 2007 for the non-compliance with $SO_2$ limits for two enterprises – the Teplárna Přerov heating station v and Nová huť, a.s.

## 1.3.2 Public support

Securing financial sources for environmental protection projects is one of the most important preconditions to their implementation. Financial support, therefore, represents an incentive that encourages investors to implement projects aimed at maintaining or improving the condition of the environment. To that end, there presently are a large number of both departmental and extra-departmental programmes in the Czech Republic.

Naturally, most programmes fall under the Ministry of the Environment, which also oversees the State Environmental Fund (SEF). Moreover, some environmental programmes are administered by the Ministry of Agriculture and the Ministry for Regional Development, while some partial programmes are implemented within departments of the Ministry of Industry and Trade, the Ministry of Transport and others.

In addition to the types of support that are unquestioningly positive with respect to the environment, there are also types of support that have an adverse environmental effect, for example tax relieves on aviation and marine fuels, lower taxation of diesel fuels in relation to gasoline and tax relieves on municipal waste incineration. While such types of support are not easy to identify, the processes aimed at reducing or eliminating them are far more complicated. Moreover, some types of support transcend the national boundaries of the individual countries and their reform could only be achieved if there were international agreement and cooperation.

In addition to the ministries, environmental protection programmes are also undertaken by some other institutions such as the State Office for Nuclear Safety and the Czech-Moravian Guarantee and Development Bank. Foreign sources play a significant role in supporting environmental protection, as they make it possible to meet the requirements ensuing from the Czech Republic's membership in the EU.

**Public environmental expenditures from the Czech Republic's central sources [billions CZK]** **Table 1.3**

| Source of environmental expenditure | 1990–1994 | 1995–2000 | 2001–2005 |
|---|---|---|---|
| The state budget | 40.5 | 37.2 | 30.1 |
| State funds | 11.4 | 20.6 | 19.4 |
| The National Property Fund | 0.1 | 9.2 | 17.5 |
| Total expenditures | 52.0 | 67.1 | 67.2 |
| State budget – total expenditures | 1 529.1 | 2 550.1 | 3 804.2 |
| The proportion of env. expenditures in the total state budget | 3.4 % | 2.6 % | 1.8 % |

*Source: Czech Statistical Office, Ministry of Finance, State Environmental Fund*

### 1.3.3 Tax relieves for the purpose of environmental protection

In addition to tax liabilities, there are a large number of tax relieves and exemptions. Tax relief (as a form of support) can be a significant tool for environmental protection. In the early 1990s, tax relieves for the purpose of environmental protection were rather rare. As of 1 January 1993, a large number of relieves giving advantage to less environmentally harmful technologies, fuels and transportation modes were employed. These mainly included the exemption of some types of public transportation from road taxes and tax reductions for vehicles with lower emissions; higher excise taxes for leaded gasoline than for unleaded gasoline (abolished as of 1 January 1996) and on alternative fuels; the exemption of buildings that are important for environmental protection from real estate tax; and the inclusion of environmentally friendly products in the more favourable (lower) value added tax (VAT) rate. However, in 2004, all products that had been placed within the reduced VAT rate on grounds of environmental protection, fuel or energy savings or the use of renewable resources were moved to the basic VAT rate, i.e. 22 % (and 19 % after the Czech Republic's accession to the EU).

### 1.3.4 Fees for polluting and using natural resources

Charges for polluting the environment and for using natural resources have been gradually implemented since the mid 1960s. These included charges for air pollution, charges for discharging untreated or insufficiently treated water, for the extraction of surface water and groundwater and payments for the assignment of agricultural land to non-agricultural purposes. Over the years, up until the present day, the system of charges has developed into 16 types of payments.

The payment of these fees is subject to the rules set out by relevant laws that also specify the rates of the fees per unit. The payers mainly include industrial companies and companies that provide services to citizens (e.g. the drinking water supply, wastewater collection and treatment, communal waste management and centralised heat supplies). In most cases, the factual supervision over the payment of the fees is the responsibility of the Czech Environmental Inspectorate (CEI) or of the relevant regional authorities. The fees are most often collected by the Customs Administration, but also by municipalities, the Czech Mining Office and the watercourse administrators.

If the fees for environmental pollution are set as absolute amounts, their actual weight is affected by the inflation level. For example, the fee for groundwater extraction by industrial enterprises in 1992 was set at CZK 2/m$^3$. This amount remained unchanged until 2002, when the fee increased to CZK 3/m$^3$, yet its actual value was only CZK 1.29 at that time due to the increase in industrial producer prices. However, the prices of industrial products keep increasing and the effect of the fee on the producers is declining. For air protection, however, the rates of most fees do not increase.

**Current charges for polluting and using natural resources:**

- Fees for air pollution (the operators of very large, large and medium-sized stationary pollution sources – the revenue raised from these fees goes to the SEF; the operators of small stationary sources – the revenue raised from these fees goes to municipalities)
- Fees for the production and the import of regulated substances and products that contain freons (the revenue raised from these fees goes to the SEF – however, these fees ceased to exist with the Czech Republic's accession to the EU)
- Fees for extracted amounts of groundwater (50 % of the revenue goes to the SEF, 50 % to the Regions)
- Fees for discharging wastewater into surface water (the revenue goes to the SEF)
- Fees for the permitted discharge of wastewater into groundwater (the revenue goes to municipalities)
- Fees for depositing waste (the revenue from the basic rate goes to municipalities, the revenue from the risk surcharge goes to the SEF)
- Fees to support the collection, processing, use and removal of selected car wrecks
- Fees for the operation of communal waste collection systems, transportation, sorting, use and disposal (the revenue goes to municipalities)
- Fees for the initial registration and annual registration in the list of authorised persons pursuant to the Packaging Act (the revenue goes to the SEF)
- Exploitation area fees (the revenue goes to municipalities)
- Fees for minerals mined in reserved mineral deposits or for reserved minerals after their processing and separation (75 % goes to municipalities, 25 % to the state budget)
- Fees for the permanent or temporary reclassification of land from agricultural or forest land resources pursuant to the Act on the Protection of Agricultural Land Resources and the Forest Act (60 % goes to the SEF, 40 % to municipalities)

The fees for surface water extraction that are used for the management of watercourses and river-basins and the fees for the collection of solid communal waste are user fees.

## 1.4 Relationship between economic development and environmental burdens

In recent years, the issue of the mutual relationship between the environmental burden and economic development, or 'decoupling', has been gaining prominence. Decoupling aims to achieve the situation where the environmental burden dynamics are lower that the dynamics of economic development, which is most commonly expressed as the gross domestic product (GDP) at constant prices. However, in view of the change of the price base to 1995, the use of a longer time series is limited by the need for a single price base. In connection with this, we mainly concentrated on selected indicators that illustrate the burden on air and water and the issue of material flows.

A distinction is drawn between relative and absolute decoupling. Relative decoupling occurs when the GDP growth dynamics are higher than the pollution growth dynamics. Absolute decoupling means that the GDP grows while the amount of pollution decreases. Ideally, of course, the objective is to achieve absolute decoupling, because the overall environmental burden depends on the absolute figures for discharged pollution.

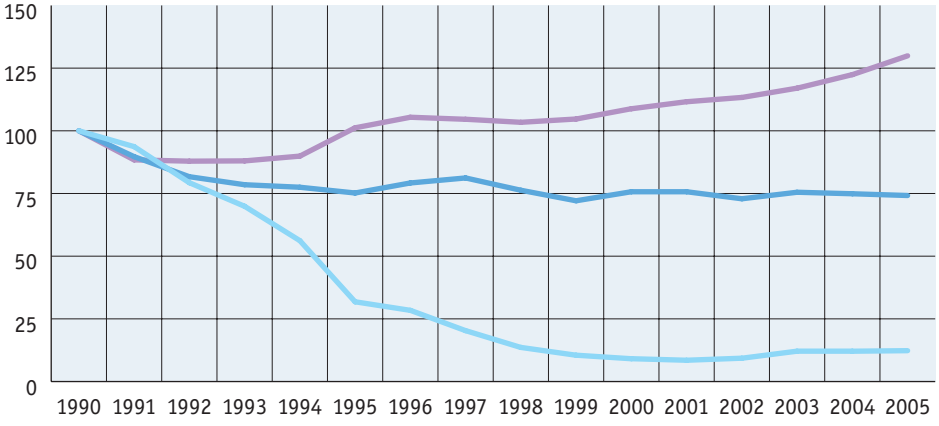
### 1.4.1 Air quality

From the perspective of decoupling in the area of air quality, the entire period of the past years can be viewed as successful. GDP grew by 29.9 %, while particulate matter (PM) emissions decreased by 89.5 % and $CO_2$eq emissions by nearly 24 %. Despite this general trend, the period can be divided into three parts. From 1990 to 1991, the sharp fall in GDP outpaced the reduction in emissions, while between 1992 and 1995 there was an unquestioningly positive development in absolute decoupling. On the contrary, several year to year increases in emissions have occurred since 1996 (for PM in 2001, 2003 and 2005 and for $CO_2$eq in 2000, 2001, 2003, 2004 and 2006). However, based on available data, it is not possible to arrive at any definite conclusion as to whether this is the end of the period of absolute decoupling or a temporary fluctuation. However, while the Report on the Environment in the Czech Republic in 2005 admits that new negative trends may be emerging, the Report on the Environment in the Czech Republic in 2006 speaks of a stagnation in the quality of the Czech Republic's environment.

It is apparent that the period of simple and easy, although cost intensive measures, is over. The total emissions of main pollutants are decreasing, although much slower than during the first half of the monitored period. However, the emissions of some pollutants from certain sectors are increasing (the increase in PM emissions from small sources, i.e. from household heating between 2000 and 2004 and the stagnation in $NO_x$ emissions from transportation, while these are decreasing in the IAT, they are increasing in freight transportation). It is therefore obvious that, currently, the potential danger for air quality lies in emission sources that are 'difficult-to-regulate'.

**Air quality decoupling [GDP at 1990 prices]**

**Chart 1.20**

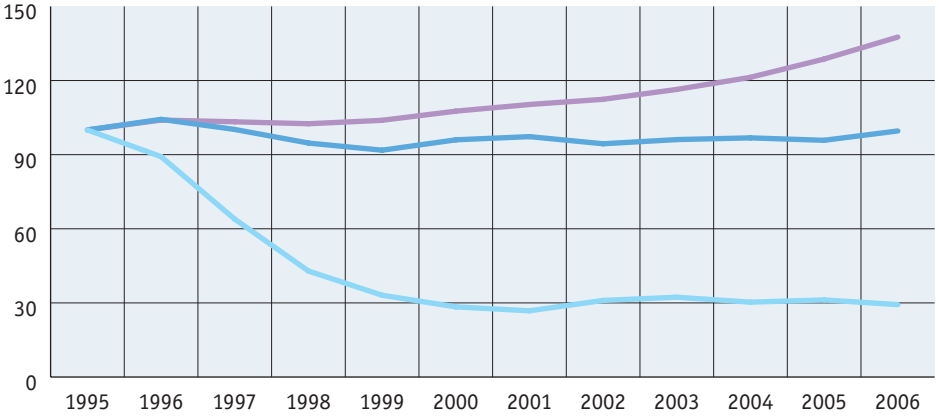



1990 = 100
- GDP (constant prices)
- $CO_2$ [millions t/year]
- PM [millions t/year]

*Source: Czech Hydrometeorological Institute, Czech Statistical Office, calculations by CENIA*

**Air quality decoupling (GDP at 1995 prices)**

**Chart 1.21**




1995 = 100
- GDP (1995 prices = 100)
- $CO_2$ eq.
- PM [t/year]

*Source: Czech Hydrometeorological Institute, Czech Statistical Office, calculations by CENIA*

After an initial marked decrease, greenhouse gas emissions have stagnated since 1998. Thanks to the high emission levels at the beginning of the monitored period, the Czech Republic may have fulfilled its commitments under the Kyoto Protocol; however, by comparison with the EU25, it currently has one of the highest specific greenhouse gas emissions.

## 1.4.2 Water quality

The situation with respect to water quality is similar, although there has been a certain time gap when compared to air quality.

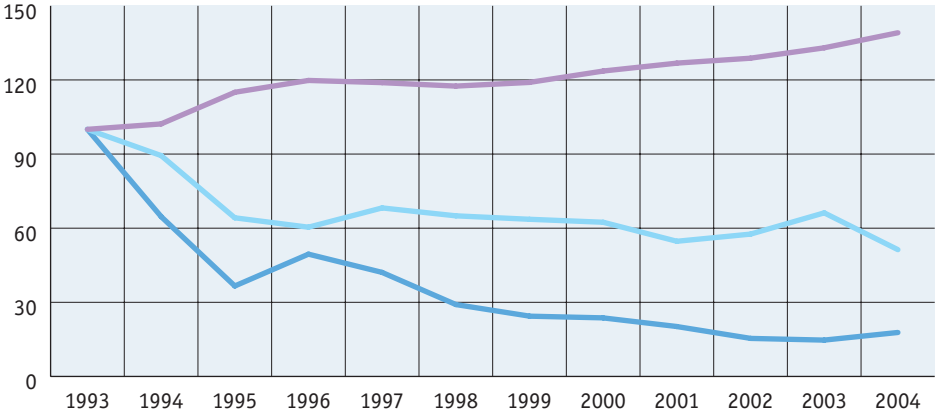
While until 1995, both assessed indicators experienced absolute decoupling, its growth slowed between 1996 and 2002.

After 2002, in view of the stagnation in air quality – with some oscillations, decoupling cannot be claimed.

For the purposes of assessing decoupling, water quality is expressed as the annual average values of selected quality indicators, namely $BOC_5$ and $N\text{-}NH_4$ in mg/l, at the Hřensko-Schmilka water metering station, which reflects water quality in the Elbe River where it leaves the Czech Republic.

**Water quality decoupling (GDP at 1993 prices)**

**Chart 1.22**



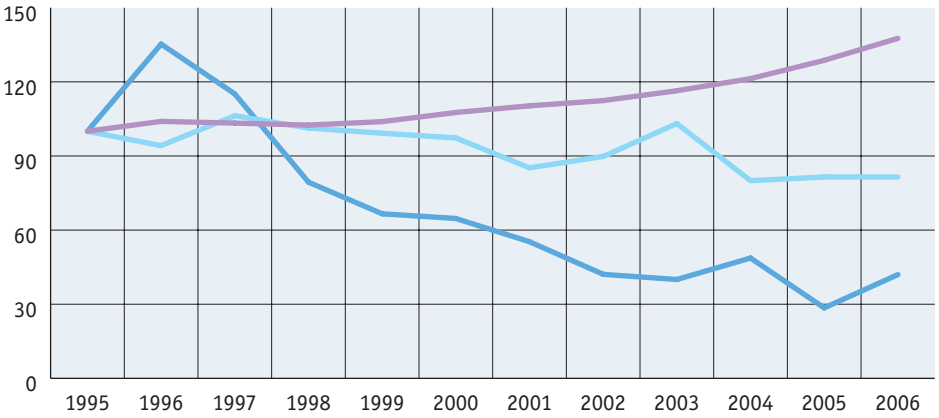

1993 = 100
- GDP (original data of the Czech Statistical Office)
- Ammoniacal nitrogen ($N\text{-}NH_4$)
- Biochemical oxygen consumption ($BOC_5$)

*Source: Czech Hydrometeorological Institute, calculations of CENIA*

Since the GDP time series is recalculated back to 1995, 1995 was used as the base year, even though environmental data have been available since 1993.

**Water quality decoupling (GDP at 1995 prices)**

**Chart 1.23**




1995 = 100
- GDP (recalculated data from Czech Statistical Office)
- Ammoniacal nitrogen ($N\text{-}NH_4$)
- Biochemical oxygen consumption ($BOC_5$)

*Source: Czech Hydrometeorological Institute, calculations of CENIA*

Since the GDP time series is recalculated back to 1995, 1995 was used as the base year, even though environmental data have been available since 1993.

### 1.4.3 Material flows

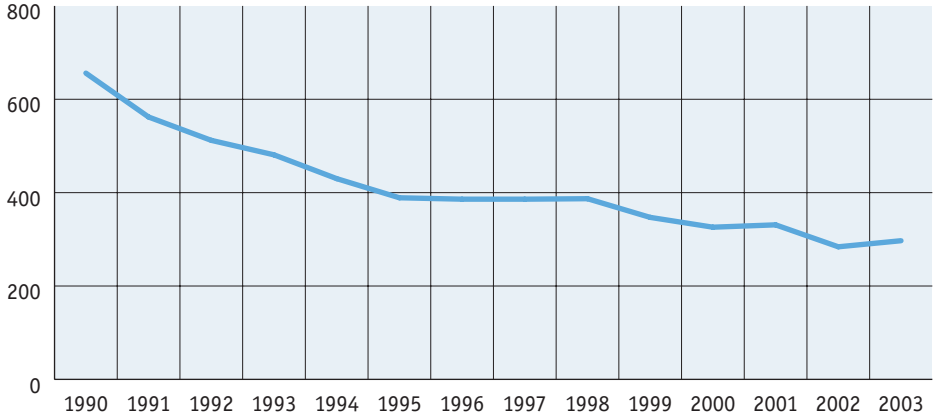
Every material flow, just like any energy flow, affects the environment. The increasing volume of any material flow results in an increased pressure on the environment. If we calculate the material flow volume per unit of GDP, we obtain the material intensity of GDP production. (There is an analogy with a similar approach to energy consumption).

TMC (the Total Material Consumption) is an indicator of the total primary material consumption associated with domestic consumption activities, i.e. the material extracted domestically plus the balance of material exports and imports, including unused extracted material. We include materials that are of economic value and are used directly for production and consumption within the national economy. Despite the general trend of decreasing material intensity of GDP production, there have been two periods in which it increased since 1990 (1995–1997 and after 2002). However, 2002 cannot be definitively marked as the onset of the trend of growing material intensity.

The high material intensity of GDP production is reflected in the decoupling assessment. Sadly, we must conclude that since 1995, neither absolute nor relative material flow decoupling has been achieved.

**Material intensity of GDP production at 1995 prices [kg/CZK 1 000 of GDP ]**

**Chart 1.24**

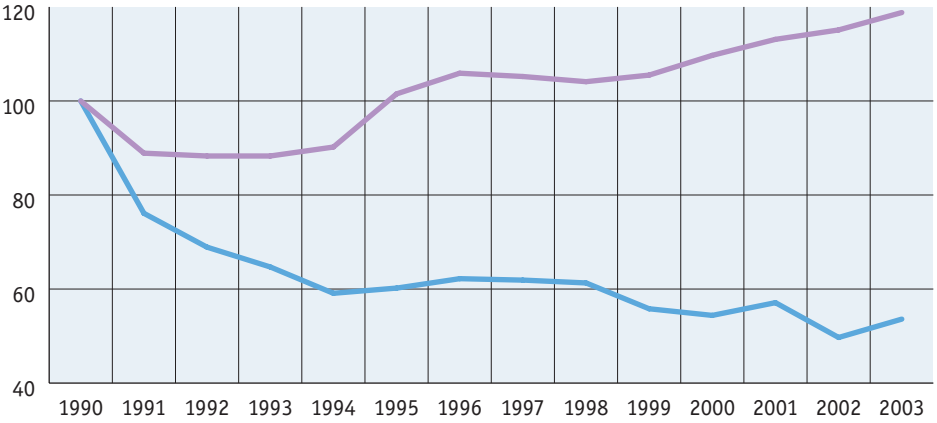



Total material consumption

*Source: Material Flows and the Sustainable Use of Resources, Charles University Environment Centre, CENIA, Czech Statistical Office*

**Material intensity decoupling**

**Chart 1.25**




1990 = 100

Total material consumption [t/inhabitant]

GDP per capita at 1995 prices [thousands CZK]

*Source: Material Flows and the Sustainable Use of Resources, Charles University Environment Centre, CENIA, Czech Statistical Office*

## 1.5 Regional aspects of macroeconomic development

Until the late 1990s, most regional issues had remained outside the main focus of attention. Only three basic problems were identified in this area (neglected infrastructure, devastated environment and the inevitability of structural changes). Since the inherited regional differences appeared to be relatively small (e.g. the low unemployment rate varied little between regions), the prevailing view was that regionally targeted interventions into the market processes were unnecessary. However, this period marked the beginning of regional economic differentiation.

In response to the differentiated development in the regions, Regions with Concentrated State Support were defined (see Figure 1.2). These regions include a population of 3.3 million (32 % of the Czech Republic's total population) and an area of 23.3 thousand km$^2$ (30 % of the state's territory), of which structurally affected regions account for 1.4 million inhabitants, economically weak regions for 1.2 million inhabitants, regions with unemployment high above average at the district level for 0.4 million inhabitants and regions with unemployment high above average at the municipality level with extended competence for 0.3 million inhabitants. The first group mainly includes urbanised areas with a poor environmental quality, while the second group mostly includes rural areas with a less affected environment. (For more information see the Regional Development Strategy of the Czech Republic, the Ministry for Regional Development, 2006.)

In addition to differing growth dynamics, the inter-regional disparity has also been increasing in absolute figures. While in 1993 the absolute difference in GDP per capita between the most and the least developed regions was more than CZK 85 000, in 2006 it amounted to CZK 429 000, i.e. a fivefold increase over the 1993 figure. The growth rate of intra-regional economic disparities is also very high from the EU perspective, where the level of economic disparity between NUTS 3 (regions) is measured through the indicator of GDP per capita at current prices weighed by the number of the region's inhabitants. According to this indicator, economic disparity in the Czech Republic has increased 1.5 times between 1995 and 2005, which ranks us fourth in the EU, after Romania, Lithuania and Latvia. Although the level of economic disparity is increasing in most EU countries, regional disparities decreased in Austria, Spain, Belgium and Italy throughout the same period. On the other hand, absolute regional disparities put the Czech Republic in 16$^{th}$ place, 14 percentage points below the EU average.

**Regions with concentrated state support**

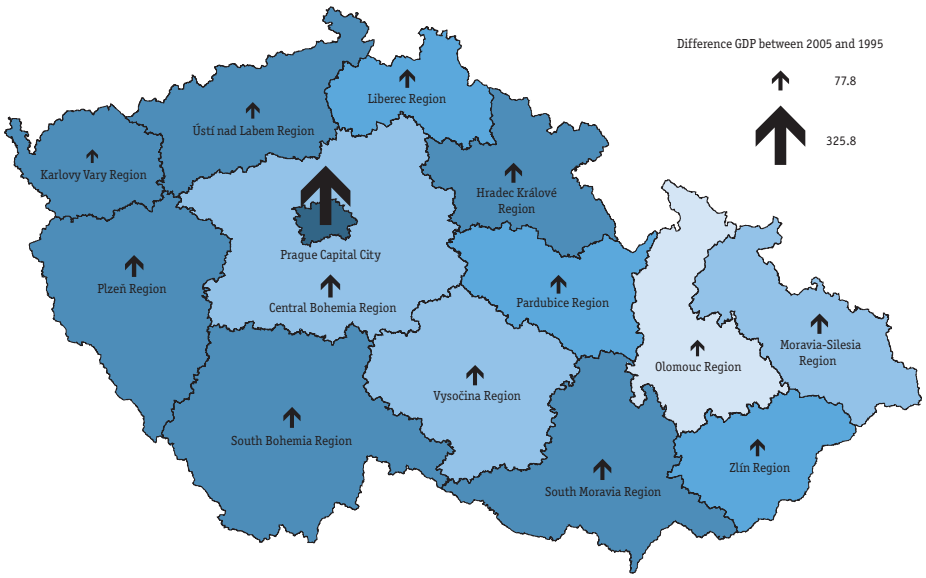
**Figure 1.2**


- Other districts
- Districts with extremely high unemployement
- Economically weak districts
- Districts affected by structural changes

*Source: Regional Development Strategy of the Czech Republic, 2006, Ministry for Regional Development*

**Gross value added per capita, 2005 [thousands CZK at current prices]**

**Figure 1.3**



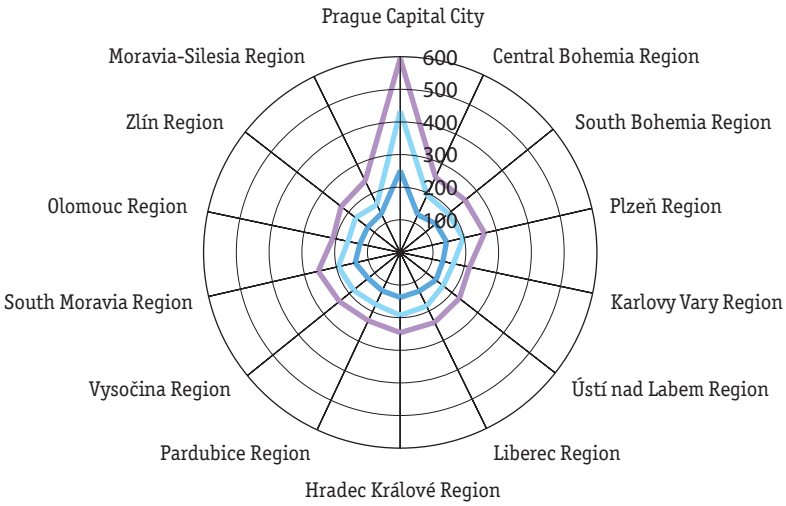

107.1
107.2–112.5
112.6–116.4
116.5–124.2
124.3–219.5

*Source: Czech Statistical Office, calculations by CENIA*

GVA is calculated through the so-called 'workplace method', which means that the data for enterprises are assigned to regions according to the seats of their local units.

**Gross value added per capita [thousands CZK at current prices]**

**Chart 1.26**




1996
2001
2006

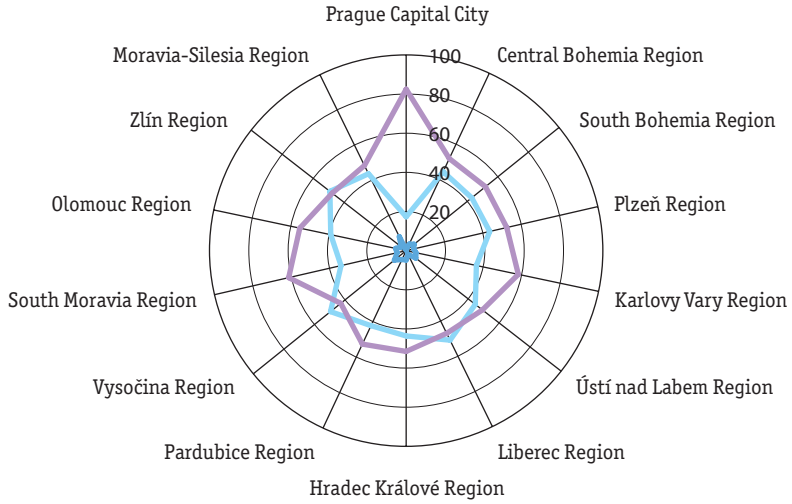
*Source: Czech Statistical Office, calculations by CENIA*

Chart 1.26 uses the production of gross value added per capita to illustrate the uneven regional development. Although Prague's position has been consistently exceptional, this is not due to the Prague-based seats of enterprises' headquarters (see the note below the above table), but rather of the large share of the tertiary sector in GVA production and the density of highly qualified jobs – in 2006 more than 20.2 % of Prague's population were university educated, while for the rest of the country, excluding Prague, it was 7.9 %. In addition, there has been solid consistent growth in the Southern Moravia Region, including Brno as its centre with supra-regional centres of academic and university research, university education, engineering and central state administration, and the Plzeň Region with its centre in Plzeň, which makes significant use of its geographical position, its links with Bavaria and its good transportation infrastructure; it is apparent that it also has supra-regional potential. At the other extreme are the Karlovy Vary and the Olomouc Regions, which lag behind in terms of regional development potential largely due to inadequate (transportation) infrastructure (e.g. the Slavkovský les region and the Jeseník district), bad labour force structure and the disparate character of the Olomoucko area.

Also, the differentiation of regions according to per capita GVA corresponds to the differentiation according to the structure of GVA production per sector. In addition to Prague, which has the highest proportion of the tertiary sector and the lowest proportions of the secondary and the primary sectors, the second position of the Southern Moravia Region is also confirmed.

The exceptional nature of Prague is apparent, even when compared to the European Union. The EU is divided into 254 NUTS2 regions, of which 42 have a gross domestic product per capita (according to the PPP) higher than 125% of the EU average, 143 have a GDP per capita between 125–75 % of the average and the 69 poorest regions have a GDP per capita lower than 75% of the average. Prague, at 160 % of the EU average, ranks 12th among the European Union's statistically richest regions (for comparison, it is ranked between the Danish region of Hovedstaden, which includes Copenhagen and its wider surroundings and Bornholm, and the Dutch Utrecht). It is the only region from the new EU member states to rank in this group. However, the 69 poorest regions with a GDP per capita below 75 % of the EU average include 49 regions from the newly acceded countries, including all remaining NUTS2 regions within the Czech Republic.

**The share of the economic sectors in the production of gross value added per capita, 2006 [%]** **Chart 1.27**




*Source: Czech Statistical Office, calculations by CENIA*

2

# Energy Sector

Historically, the state of the Czech Republic's environment has been profoundly influenced by the condition and development of the energy sector. Up until the mid-1980s, electricity and heat production had been based almost exclusively on the use of coal, both black and brown. The first nuclear power plant was not commissioned until 1985. Power plants and heating plants were not fitted with equipment for capturing sulphur compound emissions and all they did was partially capture dust. This led to substantial environmental damage.

Since 1989, the energy sector has undergone some fundamental changes associated with reducing its environmental impact. Air pollution by large power plants has dropped sharply as a result of the decommissioning of the oldest production units, their modernisation, the installation of desulphurisation equipment and the replacement of outdated boilers with fluidized bed combustion boilers. Despite all these measures, the energy sector remains the sector that contributes most to discharged air pollution.

Since 1994, a project has been in place oriented at promoting and extending the use of gas to replace coal in small boiler plants and households. Even though the use of centralised heat supply has declined, the Czech Republic still ranks among the leading European countries in this area. Large heating plants have been desulphurised, while smaller sources have mostly been modernised, converted to gas combustion or replaced with central heating, or possibly converted to light fuel oil.

In the area of natural gas and oil supply, the Czech Republic is virtually fully import-dependent, which has repercussions on overall energy security.

Even though the energy intensity of the Czech economy has been gradually declining, its energy intensity is still above average compared to other EU countries. The higher value of the GDP energy intensity indicator results from the structure of GDP generation.

Upon its accession to the European Union, the Czech Republic made a commitment to achieve an 8 % proportion of renewable energy sources in gross domestic electricity consumption by 2010. However, this objective fails to be met on a continuous basis and the increase in the use of renewable energy sources has been inadequate to date.

The Czech Republic's energy sector is going to be increasingly influenced by the European Union, which employs a variety of systemic measures (the "Climate action and renewable energy package") in order to increase the competitiveness of European economies while striving to improve the state of the environment.

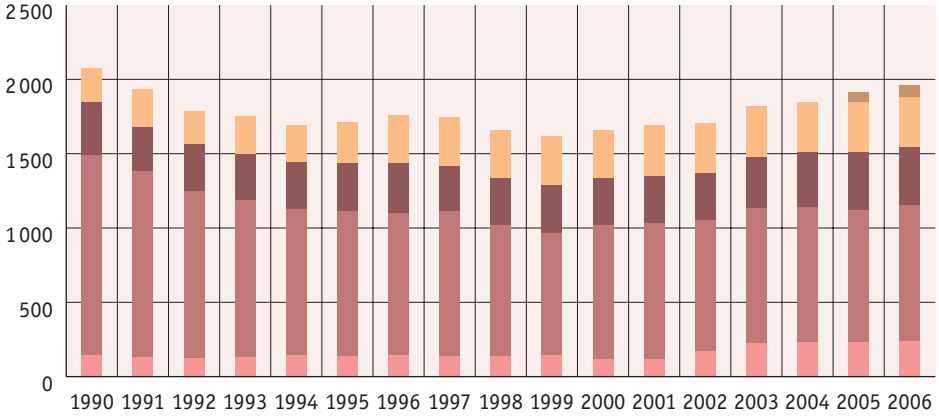
## 2.1 Energy and primary energy sources balance development

Until 1989, the Czech Republic's economy was based on energy intensive industrial production, in which heavy industry played an important part, including the production of basic metallurgical materials, cement and basic chemicals. This was associated with high consumption of primary energy sources (PES). Even though consumption started to decrease after 1990, the trend reversed again in 2000 and in 2004; consumption was at 86.5 % of the 1990 level and continued increasing to 87 % in 2006, i.e. the final consumption level of 1 133 PJ. This moderate increase in the use of primary energy sources is linked to economic growth, especially the growth of industrial production.

**Primary energy sources (PES)** include natural resources, i.e. mined and extracted solid, liquid and gaseous fuels, as well as primary electricity and heat, fuel and energy imports less fuel and energy exports and the change in reserves.

**Development of the consumption of primary energy sources [PJ]**

**Chart 2.1**




*Source: Czech Statistical Office, Ministry of Industry and Trade*

Petajoule (PJ) is a multiple of joule. PJ equals 278 bill. kWh.

The Primary heat and Primary electricity item includes heat produced by nuclear reactors, geothermal and solar heat, while Primary electricity is electricity produced in hydroelectric, wind and photovoltaic power plants and the electricity export-import balance. Gaseous fuels are converted to PJ using combustion heat. Uranium as a primary raw material is not included in the energy balance.

### Consumption of energy and energy sources

The decreasing energy consumption of the early 1990s resulted mainly from reduced production associated with the economic transformation and, to a lesser degree, from improved energy management efficiency and a change in the structure of energy sources.

The decrease in consumption was particularly sharp between 1990 and 1994, when a major drop in industrial and agricultural production occurred. Lower consumption during the second half of the 1990s was attributed to the restructuring of the economy and the gradual improvement of its efficiency, the development of the tertiary sector and the decline of "heavy" industrial production. Since 2000, the demand for energy has been rising in line with the growth of the economy and, at the same time, energy intensity has been decreasing.

Final energy consumption per capita from 1990–1995 decreased and, apart from some minor upswings, it continued decreasing until 2000. After that year, specific consumption began to rise and by 2004, final energy consumption per capita stabilised at a level of approximately 0.110 TJ per capita.

### Energy sector and its dependence on raw material sources

Since the 19th century, the energy sector has been based on the use of coal. It was mainly brown coal from the Sokolov and North Bohemian lignite basins and it was used for energy purposes. Although the proportion of solid fuels in the consumption of energy sources has constantly declined since the beginning of the 1990s (from 65 % in 1990 to 49 % in 2006), it was still high by international comparison. Despite adopted measures, the energy sector represents a major source of environmental pollution, especially with sulphur oxides, nitrogen oxides and particulate matters (PM), as well as with carbon dioxide, which affects the climate.

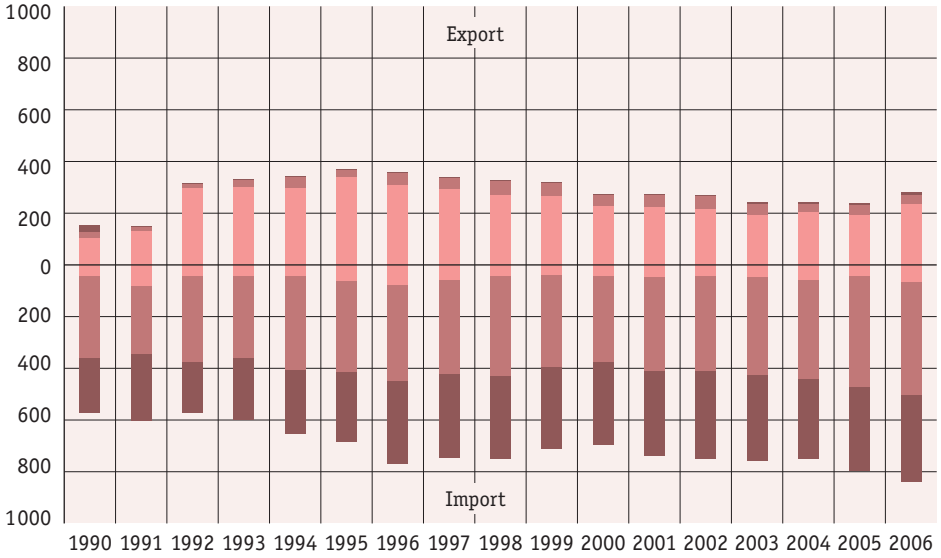
The PES structure has been influenced by the growth of motorised transportation, in particular road transportation, which has led to an increase in the proportion of liquid fuels consumed in transportation from 10 % to 22 %. The conversion of smaller heat sources to gas combustion has resulted in an increased proportion of natural gas in PES from 10 % to 17.6 %. Once both blocks of the Temelín nuclear power plant were put into operation, the proportion of primary heat increased, rising to 12.6 % in 2005. Simultaneously, the proportion of renewable energy sources in PES has been increasing, reaching 4.4 % in 2006.

### Energy imports and exports

The security and reliability of energy supply is a significant precondition to the functioning of a country and its economy. Above a certain level, dependence on energy imports brings about the potential danger of a possible exposure of the economy's functioning to factors whose solution is beyond the powers of national governments. The government has therefore tried to diversify foreign energy sources, as described in the chapter entitled *Mineral Extraction*.

**Development of the consumption of primary energy sources and their import and export in the Czech Republic [PJ]**

**Chart 2.2**




*Source: Czech Statistical Office, Ministry of Industry and Trade*

## 2.1.1 Electric energy

As opposed to some other European countries, the Czech Republic was self-sufficient in the production of electric energy before 1989. Most capacity was concentrated in the České energetické závody state enterprise, including both large power plants and municipal heating plants. In addition, there were "captive" power plants – energy sources built in large industrial companies that supplied heat and electricity to the company itself. These industrial plants also supplied a portion of the public network's electricity. Only a small percentage of electricity was produced in hydroelectric power plants, especially in the power plants of the Vltava cascade. In the early 1990s, České energetické závody was divided into several independent units, with the energy company ČEZ, a.s. being created in May 1992. In 1998, the transmission network was separated as an independent legal entity called ČEPS, a.s. Presently, ČEZ and 5 distribution companies have been re-integrated, with the individual companies being re-structured pursuant to European Directives 1996/92/EC and 2003/54/ES and the Energy Act, i.e. Act No 458/2000 Sb., which stipulates the obligation to separate the area of electricity distribution that is still regulated and the unregulated area of trade in electricity ("unbundling").

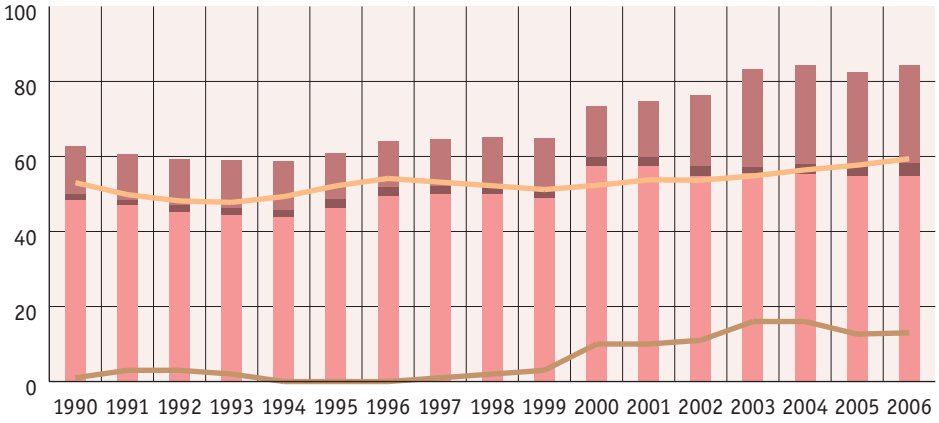
**The Energy Market Operator** – EMO (i.e. the *Operátor trhu s elektřinou, a.s.* company) was established on 1 July 2001 under Act No 458/2000 Sb. Its main tasks on the electricity market include organising the short-term, intradaily and balancing electricity market, settling payments to the participants in the market and assessing and settling variations. EMO maintains the publicly accessible register of greenhouse gas emission allowances trading.

### Electricity generation

In the early 1990s, some electricity generation came from black coal sources (mainly captive sources and heating plants) and from the Dukovany nuclear power plant, while most of it originated from black coal power plants. The 1991Act on Air played a role in ČEZ's decision to decommission part of the black coal power plants' capacity by 1 January 1999 and, in 1993, the government (through Resolution No 109) decided to complete the construction of the Temelín nuclear power plant. During the 1990s, the capacity of the electric generation system was extended through the addition of the Dlouhé Stráně pumped-storage hydroelectric plant (650 MW), the CCGT power plant in Vřesová (370 MW), the ECK Generating Kladno (also 370 MW) and a number of other smaller sources. In 2002, the Temelín nuclear power plant's first 1 000 MW block began operation, with the second 1 000 MW block following suit in 2003. Electricity generation from renewable energy sources (RES) continues to rise. A total of 3.5 TWh of electric energy was produced from RES in 2006, corresponding to 4.9 % of gross domestic consumption. After the first unsuccessful wave of wind power plant construction from 1990–1996, interest in their construction has resurfaced and has been growing since 2004. However, only 41 MW has been installed in our country to date (as of the end of 2006). The capacity of power plants has remained virtually unchanged since 2003.

**Structure of electric energy production and consumption [TWh]**

**Chart 2.3**

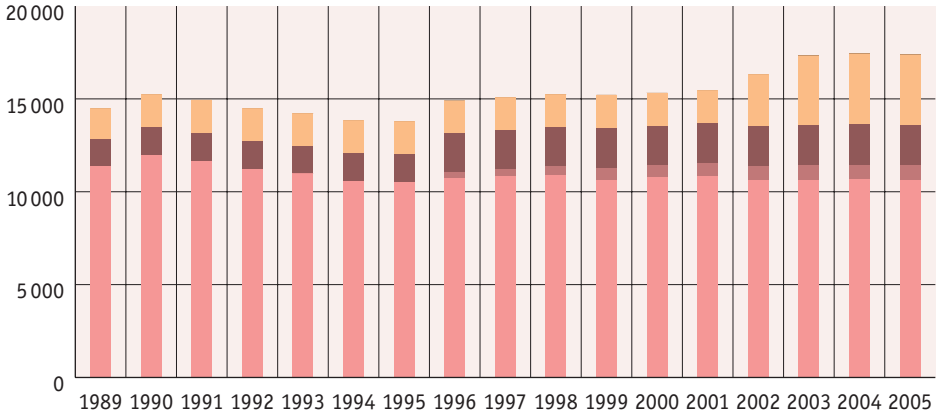



*Source: Czech Statistical Office*

Balance: electric energy exports minus imports

**Installed capacities of power plants [MW]**

**Chart 2.4**




*Source: Energy Regulatory Office*

### Electric energy consumption

After a sharp drop in the early 1990s, electric energy consumption has been growing since 1995 (with only one moderate decrease between 1997 and 1999) in spite of more efficient energy utilisation. Production and consumption trends are shown in Chart 2.3.

Nearly two-thirds of the electricity presently produced in the Czech Republic comes from fossil fuel power plants. The percentage of electricity produced in nuclear power plants has risen to approximately 26 %. The opening of Europe's electric power market after 2000 allowed the Czech Republic to export surplus electricity on a larger scale, which is why there has been no reduction in energy production from coal power plants.

Since 2000, electric energy consumption has increased (Chart 2.4). This is mainly attributable to the growth of the Czech economy and the construction of new industrial capacities. Household demand for electric energy is growing due to the higher numbers of household electrical appliances (even though modern electrical appliances are more energy efficient), the increased use of electric heating and possibly also air conditioners.

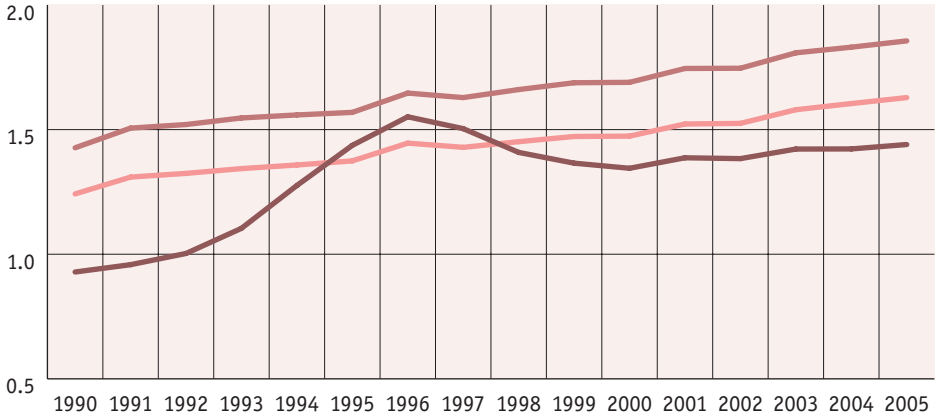
The proportion of the processing industry in total consumption is still high, amounting to approximately 41 %. Within the processing industry, the highest electric energy consumption is found in the chemical and petrochemical industries, metal production, including metallurgical processing and the production of non-metallic mineral products.

Naturally, the increasing number of household electric appliances and the increasing amount of comfort go hand in hand with the increasing household consumption of electric energy, which has increased by about 10 % since 2000 in the Czech Republic. The previous marked increase in household electric energy consumption up to 1996 was heavily influenced by the use of direct electric heating. By international comparison, electric energy consumption is slightly below the European average, amounting to approximately 1.44 MWh per capita. The comparison between household electric energy consumption in the Czech Republic and in the EU is displayed in Chart 2.5.

**The Energy Regulatory Office** (ERO) was established on 1 January 2001 by Act No 458/2000 Sb. to serve as an independent energy market regulator. The ERO regulates prices of services, heat and electricity from RES. It is responsible for the promotion of competition and the protection of consumers' interests in those energy branches where competition is not possible. The ERO also promotes the use or RES and secondary energy sources.

**Comparison of household energy consumption in the Czech Republic and in the EU [MWh/person]**

Chart 2.5




*Source: Eurostat*

The dispatching control of transmission network facilities and systemic sources within the Czech Republic is the responsibility of ČEPS, a.s, which is also in charge of international cooperation with the electricity networks of neighbouring countries using interconnectors. The main advantage of operating interconnected networks is the reduced need to keep reserves of electricity generation capacity and the improved quality of supplied electricity (current stability).

The Czech Republic's electricity network ranks amongst Europe's most interconnected systems and the transmission capacity of the electricity grid is viewed as being above-average.

**ČEPS, a.s.'s transmission network** performs electricity transfers, ensures the operation and development of the transmission network and takes care of the dispatching control of the Czech Republic's electricity network. ČEPS, a.s.'s transmission network is a member of the regional CENTREL organisation and of the international organisation ETSO (European Association of Electricity Transmission System Operators).

## 2.1.2 The gas industry

Within the Czech Republic, natural gas is only extracted in southern Moravia and in very small quantities. More than 99 % of all consumption is therefore covered by imports and, at the same time, the Czech Republic is also an important transit country for supplying Western Europe (especially Germany) with gas from the Russian Federation. In 1996, the government decided to decrease the dependence on a single source, so in 1997, Transgas, a.s. concluded long-term natural gas supply contracts with Norway. Presently, about 80 % of all domestic consumption is imported from the Russian Federation and 20 % from Norway. There is a persisting problem concerning transit, namely the continuing dependence on Russia, but also on Ukraine and neighbouring Slovakia.

Since 1990, natural gas as a fuel has displayed the highest consumption growth and its availability is now almost universal nationwide. However, after 1996, natural gas consumption started to stagnate and this has continued through today (see Chart 2.6). By year-to-year comparison, final natural gas consumption between 2005 and 2006 declined moderately (by 0.7 %) and has continued declining. The reasons behind the stagnating or, as the case may be, declining consumption include, above all, increasing natural gas prices, which are related to international oil prices the climatically more favourable (warmer) winter periods.

In the past, the management of the industry was concentrated within one organisation. This organisation first had the form of a concern and later became the state enterprise Český plynárenský podnik, s.p. Since 1 January 1994, the individual distribution branch plants have become separate stock companies. In 1997, the Český plynárenský podnik state enterprise became the Transgas s.p., state enterprise, which was transformed into a common stock company in 2001. In 2002, the state-held equity share in the energy industry was sold to RWE Gas AG as a strategic investor. This gas company ensures the uninterrupted supply of natural gas year round.

Presently, coal gasification is used to produce syngas, which is used in the energy sector as a fuel and can replace e.g. natural gas. During gasification, all particulate matter is removed and syngas is desulphurised, so that its combustion affects the environment to a lesser degree. The first CCGT power plant was built in Vřesová, where syngas is produced in 26 pressure reactors in which coal gas was produced until 1996.

The Czech Republic presently has a modern network of gas pipelines with sufficient capacity, including underground storage facilities to compensate for gas volume fluctuations in the system. The opening of the natural gas market pursuant to European Directive No 2003/55/EC started on 1 January 2005 and was completed on 1 January 2007, with households also becoming eligible customers. The gas industry is one of the last areas to be opened to competition in this way.

**The Gas Balance Centre (Central Gas Dispatching)**
Pursuant to the amended Act No 458/2000 Sb., the Energy Act, Central Gas Dispatching was transformed into the Gas Balance Centre, which is mainly oriented towards monitoring gas supply planning and the preparation and evaluation of overall balances. It monitors the capacities and the performance of transmission and distribution systems and of underground storage facilities.

**The liberalisation of electricity and gas markets**
The basic rules of the common European energy market were set out by European Directives No 96/92/EC and No 98/30/EC concerning common rules for the internal market in electricity and natural gas, which were transformed into the Energy Act (i.e. Act No 458/2000 Sb.) In 2003, new Directives No 2003/54/EC concerning common rules for the internal market in electricity and repealing Directive 96/92/EC and No 2003/55/EC concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC were passed. The pace of the market's gradual liberalisation in electricity and natural gas is specified by law. With respect to the electricity market, all final customers have been entitled to choose their supplier since 1 January 2006.

### Oil supply

The Czech Republic is dependent on oil imports. Imported oil originates from the following countries: the Russian Federation (approximately 71 %), Azerbaijan (approximately 18.7 %), Libya (3.4 %), Kazakhstan (3.7 %), Algeria (1.7 %), Turkmenistan (0.9 %) and Syria (0.5 %). (These percentages correspond to 2005, in which total oil exports reached 7 736 thousand tonnes). The only domestic oil supplier is Moravské naftové doly a.s., which extracts about 4% of the Czech Republic's annual consumption within its territory. However, only about half of the extracted oil is refined in the Czech Republic, with the rest being exported.

About 96% of all imported oil is processed in the refineries of Česká rafinérská, which operates refineries in Kralupy and Litvínov (fuel production – motor and aviation fuels, fuel oils, asphalt, petrochemical intermediate products). The refinery in Kralupy processes high quality, "sweet" oil and the refinery in Litvínov process oil from the Russian Federation, which has a higher sulphur content. Russian sulphurous oil is also processed by Paramo in Pardubice (fuel production except for motor petrols, fuel oils, asphalt products and lubricant oils). Domestically extracted oil is processed in the refinery in Kralupy.

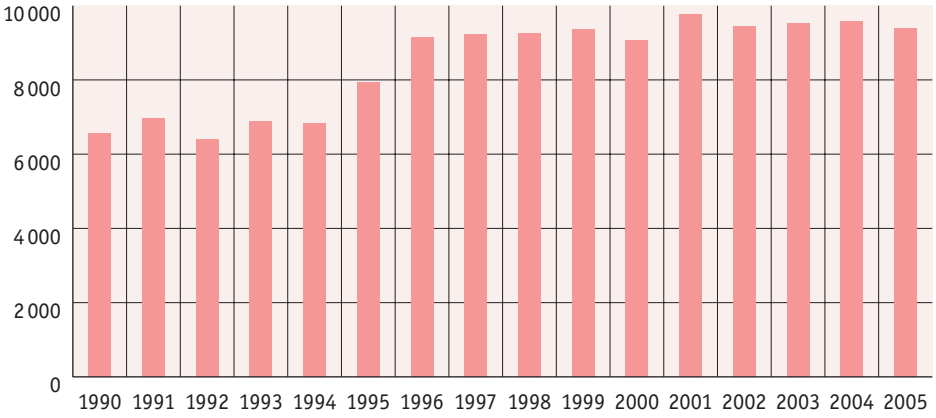
Oil consumption has been rising since 2001, reaching nearly 8 million tonnes in 2006. Oil consumption trends are shown in Chart 2.7.

Oil pipelines in the Czech Republic (IKL and Družba pipelines) and the central oil tank near Kralupy are operated by MERO ČR, while the domestic system of product pipelines and the substantial fuel storage capacities that are scattered throughout the entire country are operated by ČEPRO. The above companies, among other things, store and protect emergency oil and oil product reserves for the Administration of State Material Reserves. The obligation to store oil and oil products at an amount equalling the average 90-day consumption follows from EU requirements.

**Total natural gas consumption [millions m³]**

**Chart 2.6**

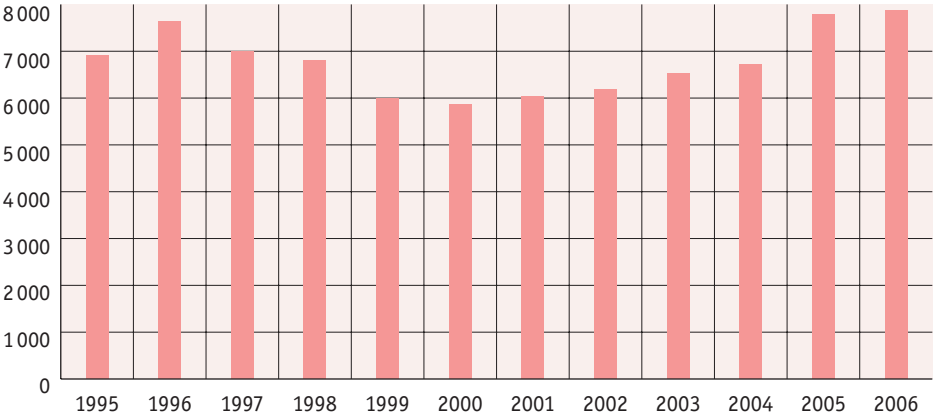
*Source: Ministry of Industry and Trade*




**Oil consumption [thousands of tonnes]**

**Chart 2.7**

*Source: Czech Statistical Office*



### 2.1.3 The supply of centralised heat

Until 1989, the Czech Republic had a very extensive central heat supply network and still ranks high among European countries in the areas of combined electricity and heat generation (cogeneration) and the use of a central heat supply. Although centralised heating is environmentally sound, it was not supported after 1989. In the 1990s, the nationwide promotion of and conversion to gas in some cases led to a reduction in heat supplies from nearby central sources.

The amount of heat supplied to end users through the CHS (central heat supply) has been in a long-term decline. In addition to the promotion of gas use, this is mainly attributable to growing fuel prices (coal, fuel oil) and outdated networks in which high heat losses occur. Measures promoting energy savings and warmer heating seasons also have played a role. The main component of the heat market is CHS systems that represent a significant proportion in both the total energy balance and in the coverage of heat needs. They have a great potential for improving energy efficiency and reducing total pollutant emissions. Significant potential lies in the use of heat from condensation power plants and the conversion of distribution networks to more economical hot-water distribution networks.

Central heat supply is considered to be highly environmentally acceptable and the cogeneration of heat and electricity contributes to more efficient utilisation of the energy contained in fuels. However, heat consumption in the systems is high and energy efficiency is often low. In addition, many systems have excessive capacities due to a tendency towards decreasing heat supplies. Solid fuels remain the decisive source of energy for heat production.

**Cogeneration** is the simultaneous generation of electricity and heat in order to fully utilise the energy of the fuel used.

### 2.1.4 Renewable energy sources

Currently, renewable energy sources (RES) are playing an increasing role. Support for the use of RES primarily stems from Act No 180/2005 Sb., on the promotion of the production of electricity from RES, and is performed mainly through the support of purchase prices of electricity from RES. Available data make it clear that over the past 10 years, the largest relative increase in electricity generation from RES occurred in the category of biomass use (an increase by 142%) and in the case of electric energy from hydroelectric power plants (by 43 %). Increasing the proportion of energy produced from RES is an important tool for minimising the energy sector's negative environmental effects.

In 2006, both electricity and heat production from RES grew as follows:

- Gross electricity generation from renewable sources accounted for 4.9 % of gross domestic electricity consumption
- Gross electricity generation from renewable sources accounted for 4.2 % of total gross domestic electricity generation

The amount of energy from RES displayed a 10 % increase in 2006. At the same time, electric energy production from RES rose by 12.3 % on a year-to-year basis, reaching a level of 3.5 TWh.

However, heat energy production remains the main area of RES use. Heat energy production from RES grew by 3.3 % in 2006, reaching 47 PJ.

Currently, the Czech Republic's most used renewable energy sources (RES) are hydraulic energy and energy from biomass (in particular woody biomass).

The development of the proportion of RES in gross electricity generation is shown in Chart 2.8. The smaller amount of electricity produced in 2003 was due to the damage sustained by most hydroelectric power plants during the floods in August 2002 and due to droughts.

Electricity generation from wind power plants reached 49 GWh in 2005, having increased by 130 % compared to the previous year. However, in spite of such a substantial increase in production, the proportion of wind energy only amounted to 1.4 % of total energy production from RES and 0.05 % in gross domestic electricity consumption in 2006.

In 2005, electric energy production from RES covered 4.5 % of gross domestic electricity consumption and this percentage rose to 4.9 % in 2006, which represents a 0.4 % increase compared to 2005.

The use of renewable sources for electric energy production has increased relatively slowly. The indicative target of the State Energy Policy for 2005, which planned between 5 and 6 % of RES in gross electricity consumption, failed to be achieved. As a member state of the EU, the Czech Republic has committed itself to increasing electric energy production from renewable sources. The indicative target as a commitment towards the EU was set at an 8 % level of proportion in gross electricity consumption by 2010.

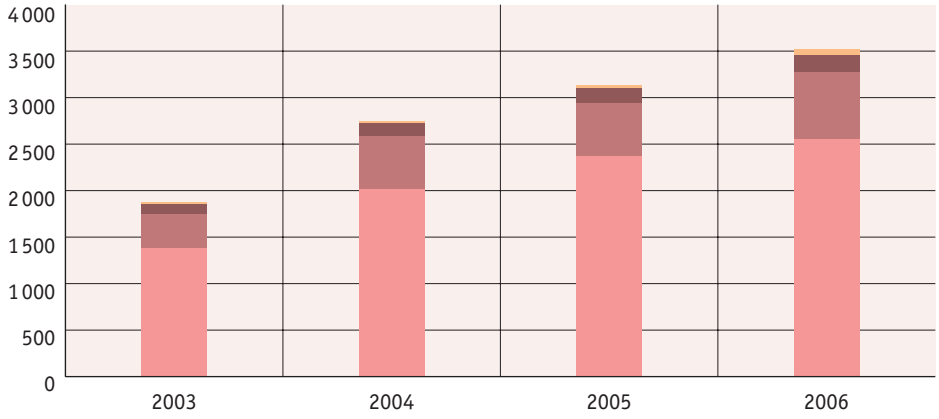
In 2005, Act No 180/2005 Sb., on the promotion of the production of electricity from RES was adopted. It creates conditions for the use of RES that are intended to secure a place on the market for electricity produced from these sources. Pursuant to this law, the price of electricity should be set in such a way that allows for investments into any given renewable source to show a return within a certain period (15 years) and return a reasonable profit.

The indicative targets for the proportion of RES for individual member states stem from Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market. They are defined in terms of the proportion of electricity generation in gross domestic electricity consumption as percentages for each member state. The directive also defines an overall target of 22% for the Community.

In 2003, the state started supporting co-firing of biomass through price determinations. A fixed purchase price was set at CZK 2.50/kWh for the co-firing of biomass and fossil fuels for new sources. In 2004, the price for the co-firing of biomass and fossil fuels decreased to CZK 2/kWh, which is why companies reduced electricity generation from co-firing. As a precondition to support, it is in all cases necessary to precisely document the amount of electricity produced from renewable sources. Since 1 August 2005, Act No 180/2005 Sb., on the promotion of the production of electricity from RES has been in effect, whose Implementing Regulation No 502/2005 Sb. addresses reporting for combined combustion of fossil sources and biomass.

**Development of gross electric energy production from RES [GWh]**

**Chart 2.8**

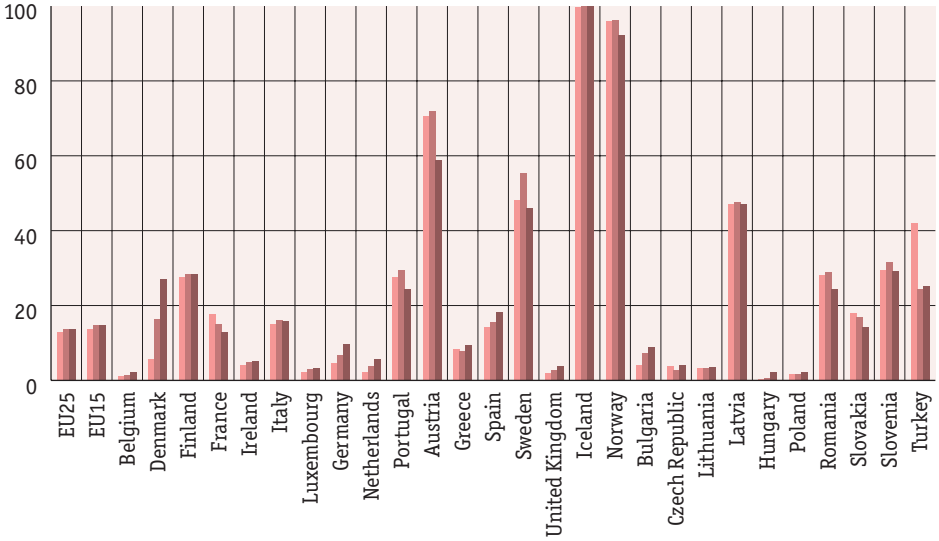



Hydroelectric power plants
Biogas combustion facilities
Biomass combustion facilities
Other (wind power plants, photovoltaic systems)

*Source: Ministry of Industry and Trade*

**International comparison of the share of RES in total electric energy consumption [%]**

**Chart 2.9**




1995
2000
2004

*Source: Eurostat*

With respect to the share of RES in total electric energy consumption, the Czech Republic is amongst the EU countries with a low percentage, as shown in Chart 2.9. The problem is the limited RES potential that are available in the Czech Republic – the possibilities for hydroelectric plants are not as great as those in Norway and Austria and those for wind power plants in Germany. However, the potential for biomass use is comparable to other European countries.

In the Czech Republic, solid biomass has the highest share in heat energy production from RES, while the proportions of other RES in heat production are considerably lower. The decisive factor in estimating heat production from RES is the consumption of biomass in households. Heat produced from the biologically degradable portion of incinerated municipal waste (BDMW) accounts for 28 % of total heat production from RES. Heat production from biogas has had little significance to date (approximately 1.1 %). Energy can also be generated through waste incineration in facilities that have the approval of the relevant Regional Authority for waste disposal with energy recovery. In such a case, this is a secondary energy source.

## 2.1.5 Energy efficiency and energy intensity

Even though energy intensity expressed as the specific consumption of primary energy sources per GDP unit has displayed a decreasing trend since the 1990s, the most pronounced decrease has occurred in recent years with higher economic growth. The development of energy intensity is shown in Chart 2.10. By international comparison, however, the energy intensity of the economy remains quite high, reaching nearly twice the average value of both the EU15 and the EU25. This is connected with the structure of GDP generation. Current production technologies in industry are already comparable to developed countries, and the energy intensity of manufactured products is therefore adequate as well.

The main factors contributing to the higher energy intensity of the economy include above all: the PES structure that has a high proportion of solid fuels, the strong presence of the processing industry and of energy-intensive industrial productions, the stagnation of energy efficiency in the area of energy transformation etc. Also, the significance of energy savings fails to be adequately appreciated.

Energy source savings increase energy efficiency and reduce both energy intensity, environmental burden and the dependence on imported fuels and energies. Furthermore, they improve the competitiveness of domestic products and services. The competitiveness of the economy itself thus gradually increases. State support, i.e. financial, for energy savings is comparatively low.

The share of the energy sector's own consumption in total electricity generation was over 7 % after 1989, decreasing to 6.5 % by 1995. Between 1995 and 2005, the share of own electricity consumption increased to 7.73 %. This increase was also attributable to the operation of end-of-pipe equipment, particularly desulphurisation units, needed to ensure compliance with stricter emission limits for fossil fuel combustion facilities.

Energy consumption per capita is connected with economic growth, the structure of the economy and the material standard of living. Energy consumption in the Czech Republic corresponds to approximately of the EU25 average, as shown in Chart 2.11, and its further growth is to be anticipated in the future.

In international comparison, the condition of the energy sector is best captured by the structure of energy production, the efficiency of its supply to the customer and the level of energy consumption per capita. European Union countries are, for the most part, dependent on energy imports, in extreme cases importing as much as 89 % of their sources (Belgium). On the other hand, the dependence is less strong in the case of the Czech Republic and Poland, whose energy sectors are based on coal (Poland 61 %, the Czech Republic 46 %).

**Development of total energy intensity and GDP**

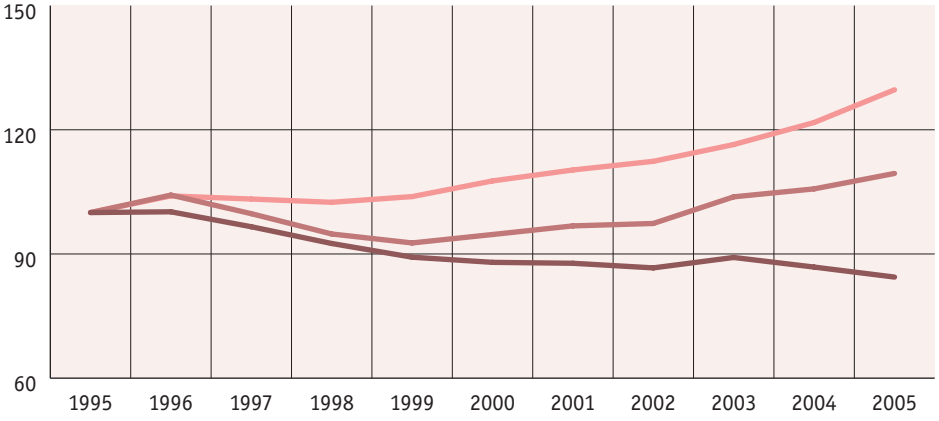



**Chart 2.10**

1995 = 100

- Gross domestic product at constant prices of 2000
- The total consumption of primary energy sources (PES)
- Total energy intensity

*Source: Czech Statistical Office*

**Final energy consumption in selected EU countries on January 1 [toe per capita]**

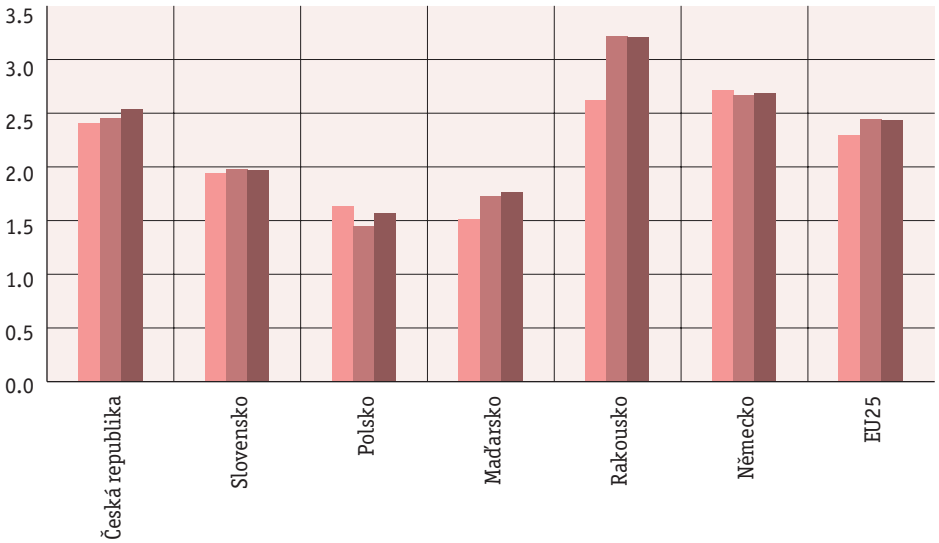



**Chart 2.11**

- 1995
- 2003
- 2006

*Source: Eurostat*

**TOE = tonne of oil equivalent**
Oil equivalent – a parameter for comparing liquid fossil fuel expressed as TOE. i.e. tonnes of oil equivalent.
1 TOE = 42,1 GJ

## 2.2 Environmental impact of the energy sector

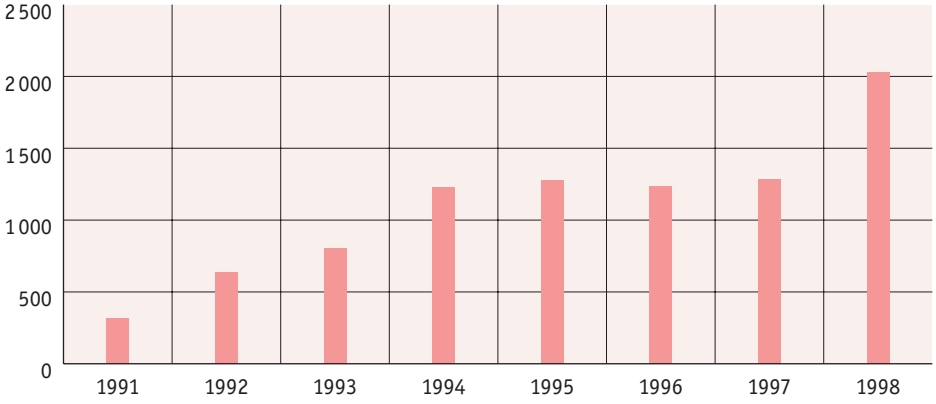
Since 1990, the energy sector has undergone significant changes associated with reducing its environmental impact. Air pollution has dropped sharply as a result of the decommissioning of outdated power generation facilities and the installation of effective equipment for capturing pollutants discharged into the air, especially sulphur oxides.

### 2.2.1 Emissions from the energy sector

Before 1990, the approach to reduce the environmental impact of the energy sector consisted in the construction of tall stacks and the installation of particulate matter filters that were designed to lower the concentrations of particulate matter emissions in the vicinity of power plants and whose efficiency was inadequate from today's perspective. Air pollution charges were extremely low and depended on the height of the stack. In addition to sulphur compounds, growing electricity generation went hand in hand with increasing particulate matter emissions. This resulted in the destruction of forests in the Krušné hory, Jizerské hory and Krkonoše Mountains. Trans-boundary pollution also occurred, notably the "Black Triangle" in northern Bohemia. At the end of the 1980s, stationary energy sources accounted for 97 % of all $SO_2$ emissions, 76 % of $NO_x$ emissions and nearly 96 % of all particulate matter emissions.

Measures to ensure the achievement of emission limits: Connecting polluters to a centralised heating system, installing desulphurizers, modifying particulate matter separators to increase their efficiency; adjusting combustion processes to decrease $NO_x$ emissions; replacing heavy fuel oil pilot burners with natural gas burners; developing fluid boilers.

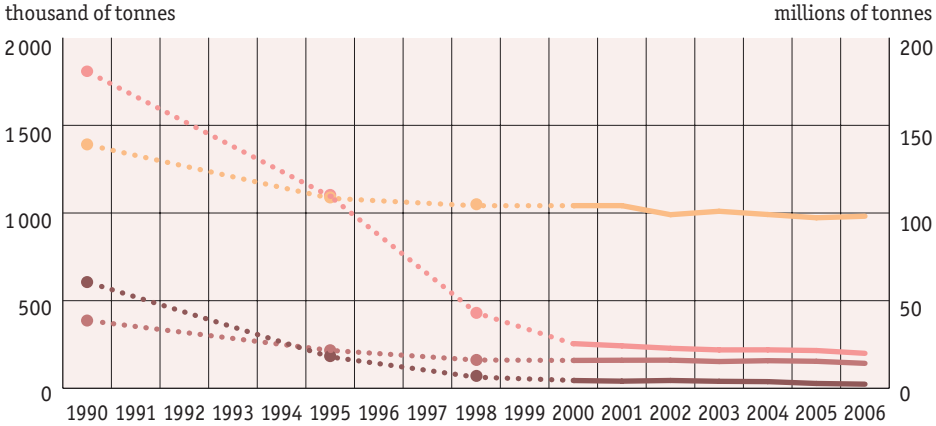
**Implemented programme for coal block decommissioning by ČEZ, a.s from 1991–1999 [MW]** **Chart 2.12**




*Source: ČEZ*

The values in the Chart represent the amounts of decommissioned capacity (in MWe) of brown coal power plants.

**Development of emissions from the energy sector** **Chart 2.13**




$SO_2$ (sulphur dioxide) [thousand of tonnes]
$NO_x$ (nitrogen oxides) [thousand of tonnes]
PM (particulate matter ) [thousand of tonnes]
$CO_2$ (carbon dioxide) [millions of tonnes]

*Source: Czech Hydrometeorological Institute*

Act No 309/1991 Sb., concerning air protection against pollutants introduced strict emission limits on pollutants. The limits were set in 1991 through a Measure of the Federal Committee for the Environment. The deadline for achieving the limits was set of 31 December 1998.

The Act played a role in ČEZ, a.s.'s decision to decommission a total of 2 030 MW of brown coal power plant capacity and to modernise another 6 400 MW of capacity between 1991 and 1998, which brought about a considerable reduction in monitored emissions. The boilers in individual power plants were gradually shut down and modernised, while desulphurization equipment was built in order to reduce $SO_2$ emissions, which, together with $NO_x$ emissions, cause acidification. The progress of decommissioning is shown in Chart 2.12.

Between 1990 and 2006, $SO_2$ emissions from energy generation facilities dropped to 12 %, particulate matter emissions (PM) to 7%, $NO_x$ emissions to 30.8 % and $CO_2$ emissions to 74.1 % (relative to 1990) – see Chart 2.13.

The energy sector accounts for approximately 63 % of all sulphur dioxide emissions in the Czech Republic, while in the case of nitrogen oxide emissions this is 31.5 % (2006). Transportation is the only sector responsible for a higher percentage of nitrogen oxide emissions (33.7 %).

The assessment of the harmfulness of the individual types of emissions has undergone changes. Currently, emphasis is being placed on $CO_2$ and other general greenhouse gases, whose increased atmospheric concentrations contribute to climate changes. Because the Czech Republic's energy sector is largely based on fossil fuel combustion, the share of this sector in total greenhouse gas emissions is predominant.

Sources that discharge pollutants into the air are monitored nationwide in the Register of Emissions and Air Pollution Sources (REAPS). The REAPS database in the Czech Republic is administered by the Czech Hydrometeorological Institute.

In the case of pulverised coal combustion, flue gas must be desulphurised to ensure compliance with air pollution limits. The desulphurisation of one 110 MW block requires 190 tonnes of limestone per day (approximately 3.5 wagons). A modern alternative to pulverised fuel combustion is atmospheric fluidized bed combustion, whose main advantage is the ability to meet environmental protection limits in the combustion of different fuels. However, all flue gas cleaning technologies applied to older combustion units are end-of-pipe technologies and, in addition to increasing operating costs and energy consumption, they are also characterised by a high consumption of limestone.

## 2.2.2 Waste from the energy sector

Historically, the energy sector has been a major waste producer, which is mainly connected to the structure of PES. This is also why during the 1990s, waste production in the energy sector roughly corresponded to electric energy production in brown coal power plants. The production increased due to desulphurisation in power plants. Waste from flue gas desulphurisation is gradually certified as a product most often used in the construction industry. This was one of the main reasons why waste production in the energy sector decreased in 2005 to half of the 2004 level. While in 2002, the energy sector accounted for over 20 % of total waste production, in 2005 its share was less than 10 % of the total production of all waste. Information on waste production in the energy sector and comparison with the production in other sectors is shown in Chart 2.14.

The environmental impacts of nuclear power plants are connected, above all, with the safety of their operation and with the production and subsequent disposal of different types of radioactive waste and spent nuclear fuels. The long-term strategy of the Czech Republic is formulated in a document entitled "The Concept of Radioactive Waste and Spent Nuclear Fuel Management" (Government Resolution No 487 of 15 May 2002).

Spent nuclear fuel is presently stored in intermediate storage facilities (there is an intermediate storage facility for spent nuclear fuel at the Dukovany nuclear power plant and another intermediate storage facility is being built at the Temelín nuclear power plant).

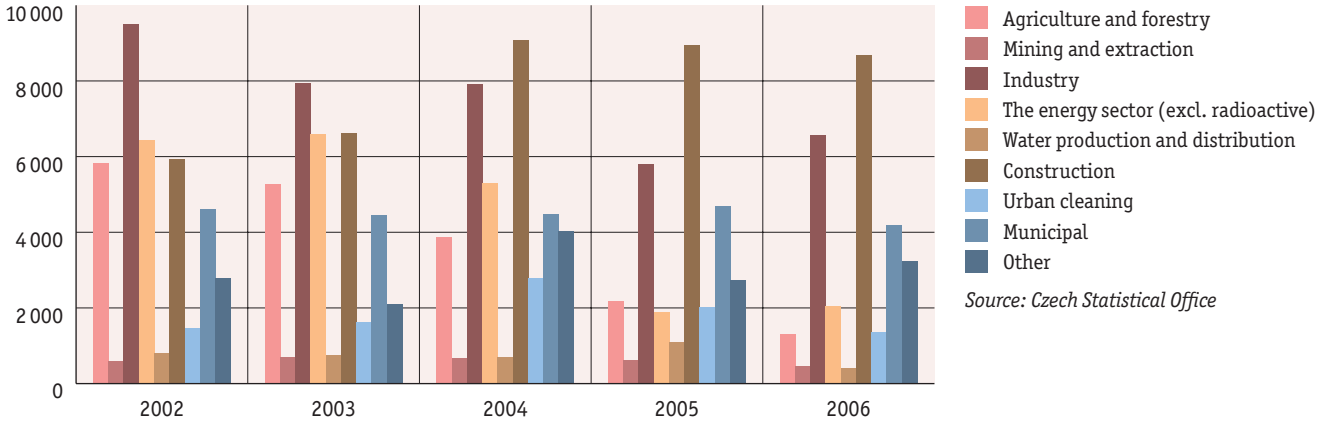
Supervision over the safe disposal of radioactive waste in accordance with the requirements for the protection of humans and the environment against the undesirable effects of such waste is the responsibility of the Radioactive Waste Repository Authority (RWRA), which was established pursuant to the Nuclear Energy Act.

Act No 18/1997 Sb., i.e. the Nuclear Energy Act, governs the legislative conditions pertaining to nuclear energy, nuclear safety and radioactive waste management. State supervision over the use of nuclear energy and ionising radiation and in the area of radiation, chemical and biological protection is performed by the State Office for Nuclear Safety (SONS).

Fly ash, which used to be transported to fly ash landfills, is now used in the reclamation of existing landfills and depleted mines. Fly ash is also mixed with FDG gypsum, producing a substance that can be used for landscaping to restore the original shape of the terrain. Such modified areas are either afforested or used for growing biomass. Furthermore, fly ash can be used in the production of hydroisolation strips, into mixed cement, as an ingredient in cement concrete, in rubber production and as the stabilising component in embankments and bases, as well as a filler for filters in wastewater treatment plants.

Waste, especially liquid and gaseous, from nuclear power plants is thoroughly cleaned before being discharged into the environment. It is discharged into the air mainly using ventilation stacks and into watercourses e.g. via decontamination plants. Pursuant to Decree No 307/2002 Sb., on radiation protection, such discharges have to be regulated in such a way as to avoid exposing one person to radiation exceeding 250 μSv – of that 200 μSv for discharge into the atmosphere and 50 μSv into watercourses. The general limit for the sum of the effective doses of both external and internal irradiation is 1 μSv per calendar year.

**Waste production in the energy sector compared to other sectors [thousand of tonnes]** **Chart 2.14**



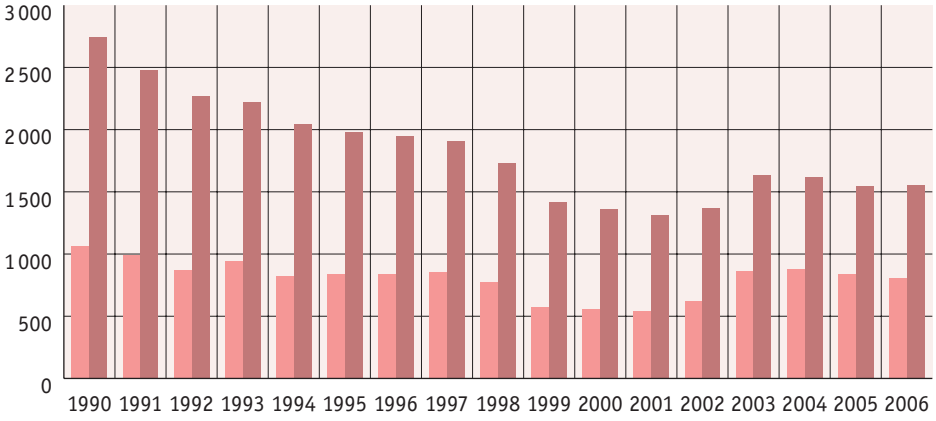

*Source: Czech Statistical Office*

### 2.2.3 Water extraction

The energy sector accounts for a significant portion of extracted water. Cooling and process water is mainly extracted from surface water. Groundwater, both drinking and non-drinking, is extracted, above all, for personal consumption by the employees. The proportion of surface water extracted for the purposes of the energy industry represent more than 50 % of total water extraction – see Chart 2.15 (for groundwater extraction, the proportion is less than 1 %). Pollution of discharged water, including thermal pollution, does not exceed the limits specified in the water legal decisions for individual power plants.

**Energy sector's proportion in total surface water extraction [millions m³]**

**Chart 2.15**




Source: T. G. Masaryk Water Research Institute

### 2.2.4 Other environmental impacts

Power lines also affect the environment. Original distribution was mostly done overhead, while cable distribution was only used in larger cities. Power lines disrupt the character of the landscape, even in areas of low aesthetic value. Power lines can cause bird injuries or deaths. However, today power line towers can be designed in a way that does not pose any danger to birds.

#### The issue of gas promotion

In 1994, the Chamber of Deputies of the Parliament of the Czech Republic transferred CZK 6 billion that had been obtained from small privatisation to the State Environmental Fund of the Czech Republic in order to support changes in heating. Subsidies were granted for the general switch to the use of gas in municipalities, contributing to improved overall energy efficiency and to an overall improvement in the environmental parameters of energy management. However, the promotion of gas in smaller municipalities failed to achieve its objective. Some of the consumers opted not to switch to gas because of increasing natural gas prices, and the objective of gas promotion was not achieved for these people – i.e. air pollution failed to be reduced.

#### The household heating

The use of coal in household combustion equipment for heating purposes remains a pressing problem within the energy sector, as it has a strong negative effect on air quality due to mostly non-existent measures for dust elimination and desulphurisation of flue gases. Coal combustion is incomplete and produces a wide range of hazardous substances that are discharged in the immediate vicinity of humans. In addition, the co-combustion of household waste further complicates the situation, producing very dangerous substances such as dioxins, polycyclic aromatic hydrocarbons etc. This area of the energy sector makes it impossible to increase the quality of life and jeopardises the health for some of the Czech Republic's population.

### 2.2.5 Measures and voluntary activities for reducing the environmental impact of the energy sector

Voluntary activities that positively influence the functioning of industrial companies include the National Ecolabelling Programme. Within the energy sector, there are currently 39 gas boilers for heating that have been ecolabelled as environmentally friendly products. The greatest interest in these boilers existed at the time when municipalities were switching to the use of gas.

In the early 1990s, the State Programme for the Support of Energy Savings and the Use of Renewable Energy Sources was launched. Since 1999, the State Environmental Fund of the Czech Republic has also supported energy savings through its programmes.

The application of Act No 76/2002 Sb., on integrated pollution prevention and control, on the integrated pollution register and amending some acts has contributed significantly to reducing the energy sector's environmental impact. Under this act, 173 facilities within the energy sector are subjected to its policies.

Over the course of the process of obtaining integrated permits, electricity producing companies have gained some specific experience. For example, in the case of combustion facilities in excess of 50 MW, the first integrated permit applicants included ČEZ, a.s. power plants, which satisfied legislative requirements with certain reserves. Mandatory emission limits were therefore successfully stiffened above the legislative framework for nearly all facilities. This precedent was then applied to other power plants and heating plants. With respect to energy production units with a heat input of about 100 MW, the combustion of low-sulphur coal and some technical and organisational measures sometimes made it possible to achieve lower mandatory air emission limits for SO2 than was the case for desulphurisation.

In a number of cases, the issue of noise was addressed systematically during the negotiations concerning integrated permits and the operators had to take technical measures to reduce noise levels (covers for fans, silencers for air outlets etc.)

A brand new concept that has significantly influenced the energy sector is tradable permits for greenhouse gas emissions (the EU Emission Trading Scheme – EU ETS). The national allocation plan (NAP), which formed the basis for the distribution of the first rights to discharge $CO_2$ emissions – emission allowances, stipulated that there would be 3 times 66.96 million permits in the energy sector over the first three years of trading.

The elimination of price subsidies for individual energy commodities contributes to energy savings and to reduced environmental impacts of energy production. The elimination of indirect cross-subsidies was also a basic condition for the opening of the market i n electricity, heat and gas in accordance with European Directives No 2003/54/EC and 2003/55/EC. Price subsidies for heat from CHS were terminated in 1998, gas prices ceased to be subsidised in 2002 and electricity prices in 2003. Furthermore, electricity and gas prices were affected by the transition from the 22% VAT rate to 19% on 1 May 2004. The prices are presently free, without any cross-subsidies. Energy prices represent an important factor in consumer behaviour.

The results of emission inventories for 2005 (for the first year of the operation of the EU ETS) indicated that most countries over-allocated their facilities (with the approval of the European Commission). Companies therefore received more permits than they needed according to their emissions. To be specific, the difference in the Czech Republic alone was 97.6 (allocation) – 82.4 (emissions) = 15.2 million permits. This resulted in a sharp fall in the price of one permit to as little as 10. The situation on the markets later stabilised. It also became apparent that the number of allocated permits did not have to be in direct proportion to the amount of emissions – i.e. a higher allocation did not necessarily have to mean higher emissions.

Cross-subsidies arose due to the difference between energy prices for households and for other consumers. While the lower prices for households did not cover production costs, the business sector and budgetary organisations paid higher prices than actual costs. These higher prices compensated producers and distributors for losses resulting from supplies to households.

## 2.2.6 The energy policy

The first energy concept was adopted in 1992. However, the first comprehensive Energy Policy was adopted through Government Resolution No 50 in January 2000. During its approval, it was subjected to an environmental impact assessment, whose results indicated some problems (the construction of new nuclear energy generation facilities). The main priorities of the government-approved policy included completing the privatisation of the energy sector and correcting energy prices. The Energy Policy placed emphasis on the promotion of environmental protection objectives, respect for the principles of sustainable development and the security of energy supplies.

One of the most important conceptual steps was the adoption of Act No 406/2000 Sb., on energy management. This law, for the first time, imposed the obligation to create an energy policy with a 20-year outlook and to assess this policy every 2 years. The act also mandates the obligation to prepare a 4-year National Energy Management Programme. Territorial energy policies have been developed and an energy savings and audit system has been developed based on the act.

In 2004, the government adopted the updated State Energy Policy (SEP), which has defined the priorities and objectives within the energy sector and has described specific implementation tools for accomplishing these objectives. The policy also includes a vision for the development of energy management until 2030.

The policy corresponds to most of the requirements for environmental protection pursuant to the State Environmental Policy for the 2004 to 2010 period.

The State Energy Policy is currently being updated and detailed by an independent expert commission headed by the Academy of Sciences. Its main task is to assess the energy requirements of the Czech Republic over the long-term 2020–2050 horizon.

Also, it must be noted that the Czech Republic's energy sector is going to be increasingly influenced by the European Union, which has employed a variety of systemic measures (the "Climate action and renewable energy package") in order to increase the competitiveness of European economies while striving to improve the state of the environment. The improvement of energy efficiency is addressed by European Directives No 2006/32/EC on energy end-use efficiency and energy services and No 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products.

Territorial energy policies (TEPs) have to comply with the main provisions of the SEP – i.e. security, independence and sustainable development. It analyses possible ways of supplying a given territory (region, micro-region, city, municipality) with fuel and energy, including the potential for energy savings and the use of RES. Within the TEPs, objectives, tools and measures are proposed to ensure efficient energy management in a given area over a 20-year period. Action plan (AP) discuss TEPs in greater detail for shorter, usually 5-year periods. Programmes for reducing emissions of pollutants are also prepared on the basis of TEPs.

# 3

# Mineral Extraction

Mineral extraction is the economic sector that provides domestic mineral resources for additional use in subsequent industries, particularly the processing, energy and building industries. As a result of the structural changes after 1989, the extraction of most materials dropped by 20 to 50%. The newly emerged market economy brought about the termination of extraction at those sites where the mining or extraction conditions were unfavourable, with extraction only having been possible because of high state subsidies, and at sites where the deposits had a low percentage of usable components.

Because the extraction industry negatively affects the environment, the reduction of extraction from a number of deposits has had a positive effect on the landscape and the nature. In connection with the transformation and restructuring of the state and with the gradual decline of some areas of production, the extraction of all ores, fluorite and barite was terminated, uranium extraction declined sharply and the extraction of other raw materials decreased as well.

The mining decline is currently being replaced by a clean-up and reclamation work stage with the aim of rehabilitating mine damage. Constant attention needs to be focused on toxic metals and acid mine drainage, i.e. the flow of acidic water from abandoned metal mines into the environment.

By contrast, oil and natural gas extraction expanded after 1989, yet its proportion in the total consumption of these raw materials in the Czech Republic remains marginal. The Czech Republic has no practically usable ore reserves and rather limited mineral fuel reserves. However, non-ore and building material reserves are sufficient, with a deposit on the order of tens to hundreds of years.

## 3.1 Sector characteristics

Minerals and mineral substances form the basis of production in such industries as energy, metallurgical, heavy engineering and heavy chemical, as well as ceramics, glass and building material production. While the Czech Republic has sufficient resources of non-ore raw materials for most branches of the processing industry, the liquid and gaseous fuel sectors are dependent on imports of significant energy and chemical raw materials, particularly oil and natural gas. Furthermore, all metal ores, sulphur, salts and phosphates are imported. Foreign dependence on oil and natural gas has resulted in a constantly passive balance of foreign trade in raw materials.

Prior to 1989, the economy had been based on the extensive use of domestic mineral resources. Due to both the stability of the nation's borders and the substantial funding that has been spent on an extensive survey of its mineral potential over the long run, the Czech Republic's mineral resources are very well explored compared to other countries.

**The loss of unity with the landscape**
Despite the development of mining, the landscape in former Sudetenland – the coal basin areas of the former Severočeský Region and the Sokolov area in the former Západočeský Region – was still virtually untouched at the beginning of the 20th century. Tens of thousands of Czechs left for the other regions following the Munich Agreement. After the war, Sudeten Germans were expelled. Northwest Bohemia was settled by people with no links to the landscape or traditions. This may be another reason why the devastation of the landscape resulting from coal mining was so extensive during the second half of the 20th century. 106 villages had to give way to large-scale lignite mining.
*Source: M. Vaněk: Nedalo se tady dýchat (You Could Not Breathe Here), 1996*

### 3.1.1 Coal mining

Within the Czech Republic, coal mining is the most common and the most intensive extraction activity that burdens the landscape. In a number of countries, the Czech Republic not excluded, major significance is being attached to energy raw material deposits, on which the generation of electric and heat energy is still largely dependent.

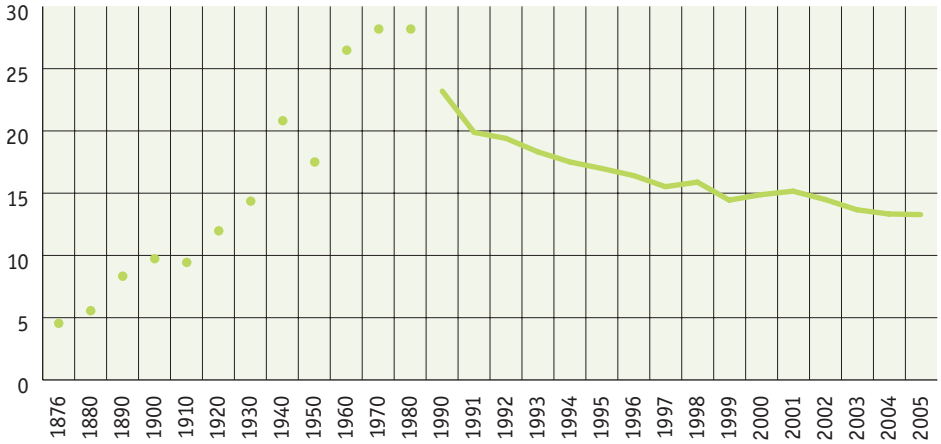
Currently, black coal mining in the Czech Republic is basically restricted to the Upper Silesian coal basin, where top quality black coal is being mined. Since 1990, black coal mining has dropped from 23 200 thousand tonnes (in 1990) to 13 240 thousand tonnes (in 2005), which is a 43% decrease compared to 1990 – see Chart 3.1. The development of black coal sales indicates that the situation in black coal mining has stabilised.

Mines in Ostrava have gradually been closed due to complicated mining and geological conditions, which increased extraction costs. Presently, the only mine still in use is in Paskov. Most mining activities are currently concentrated within the Karviná area of the coal basin. At the current rate of extraction, black coal reserves will last for another 20 years on average – see Chart 3.2.

**Black coal mining for sale millions of tonnes]**

**Chart 3.1**

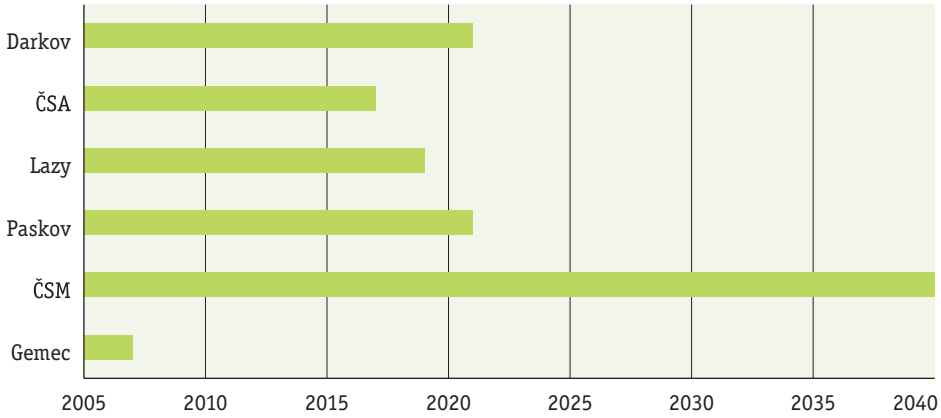
*Source: Geofond*




**Black coal mine reserves as of 1 January 2005 (according to mineable reserves and actual mining volumes in 2004)**

**Chart 3.2**

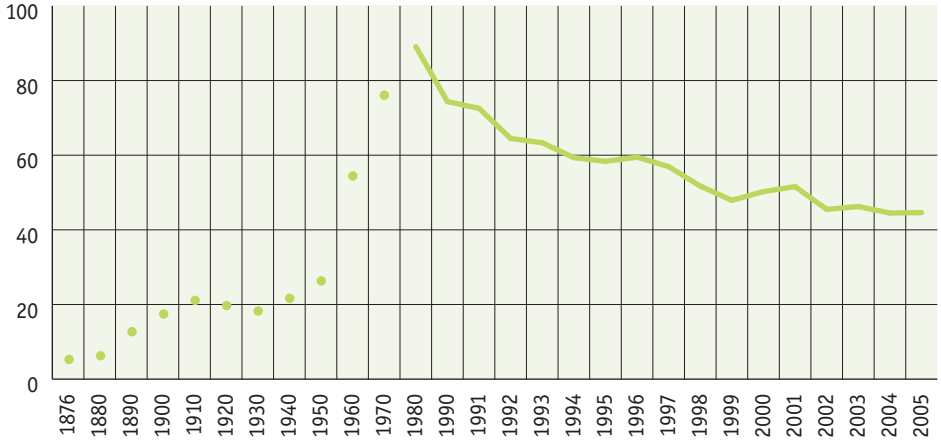
*Source: Ministry of Industry and Trade, VUPEK - ECONOMY, ENVIROS*




**Lignite coal mining for sale [millions of tonnes]**

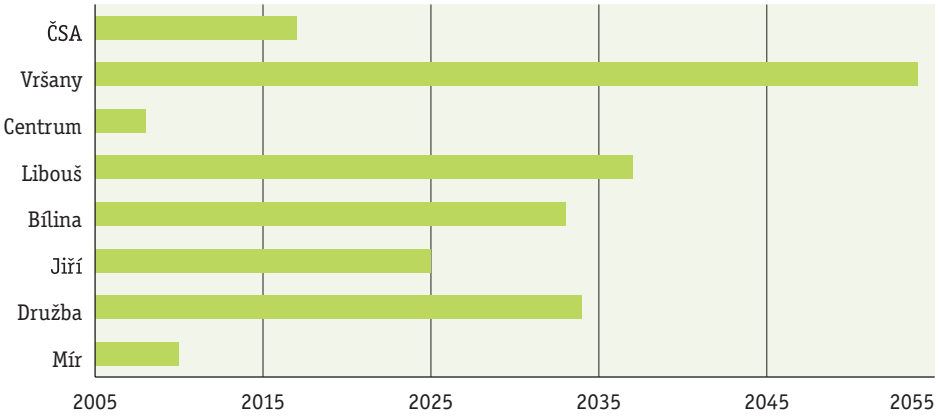
**Chart 3.3**

*Source: Geofond*



**Reserves of opencast and underground lignite mines**
**(according to mineable reserves and actual mining volumes in 2004)**

**Chart 3.4**




*Source: Ministry of Industry and Trade, Vupek-Economy, Enviros*

The availability of domestic mineable lignite reserves is relatively limited, see Chart 3.4. The use of the majority of lignite reserves (120 million tonnes at the Bílina mine and 256 million tonnes within the 2nd phase of development of the ČSA mine) is restricted by territorial ecological limits, which mainly affects the modernisation of coal power plants that are at the end of their life cycle.

The decline of coal mining began as early as the 1980s, when a portion of electricity began to be produced at the Dukovany nuclear power plant. This trend continued in the early 1990s, when the lower demand for energy resulted from a sharp economic decline. Another factor behind the decline of coal mining was the closure of some old power plant blocs in the 1990s (see The Energy Sector chapter).

In the autumn of 1992, the government prepared the Coal Industry Restructuring Programme, which was approved through Government Resolution No 691 in December 1992. The main objective of the restructuring was to create competitive private coal companies, to reduce loss-making extraction sites and to finance this reduction. Coal industry restructuring also includes a reduction programme that addresses the technical, environmental and social impacts of the reduction of chronically loss-making extraction sites.

Pursuant to this programme, three types of companies were established. The first group included companies that had no chance of being economically sustainable, not even in the short term. These companies began to be intensively downsized. The second group included companies that did not need to be immediately downsized from the economic perspective. The third group included companies that were supposed to have a future and be economically strong.

The bulk of lignite is quarried in the opencast mines of the North Bohemian lignite basin and the Sokolov basin. Lignite is only used for energy purposes. Since 1990, lignite mining has dropped from 78 980 thousand tonnes (in 1990) to 48 770 thousand tonnes (in 2005), which is a 38% decrease compared to 1990 – see Chart 3.3. While it continues to be used for electricity and heat production at large power plants and heating stations, its use in small and medium-sized sources has been significantly replaced by natural gas, which established itself firmly in the mid 1990s. Within decades, further lignite mining will reach the ecological territorial limits specified by the government (Government Resolution No 444/1991).

The inappropriate use of lignite in household (local) combustion equipment, which accounts for 40 % of dust emissions in the Czech Republic during the heating season, produces air emissions of other hazardous substances and adversely affects human health, remains a principal problem.

In most cases, strong companies were joined with those that were to be downsized in the future. The state used this measure to impose the obligation to participate in the reduction of economically weaker entities on the companies. Currently, the following companies operate in the mining and extraction sector: Mostecká uhelná, Severočeské doly and Sokolovská uhelná in lignite mining and OKD, a.s., in black coal mining. In addition, the state took up the responsibility for past costs, for costs for past social debts and for costs for the technical liquidation of unneeded capacities. The process of restructuring and reduction in opencast mines was, for the most part, performed and funded from these companies' own resources. Under these conditions, privatisation took place under voucher privatisation. The dynamics of the reduction have gradually increased since 1992. While 6 sites were reduced in 1992, 15 sites in 1995 and 33 sites in 1998, the number of sites under reduction exceeded 40 in 2002, of which 30 were fully operating opencast and underground mines.

## 3.1.2 Uranium mining

Uranium ore began to be mined at Jáchymov along with non-ferrous metals during the first half of the 19th century. It was used in the production of chemical compounds and radium. Uranium mining did not start to develop until the end of the Second World War, when an agreement on uranium ore research and mining was signed with the then Soviet Union. At that time, an independent state enterprise called Jáchymovské doly (Jáchymov Mines) was established; it has since undergone numerous organisational changes and been incorporated into the current DIAMO state enterprise. In years, after its start, mining expanded in west and south Bohemia, in the town of Příbram and in the Trutnov region, as well as in the area near the city of Nové Město na Moravě.

Since the middle of the 20th century, the main product for sale has been uranium concentrate, which was produced through the chemical processing (milling) of ores. The total uranium concentrate production for the 1946–2005 period exceeded 100 thousand tonnes. The Czech Republic ranks among the largest producer, along such countries as the USA, Germany, Canada, South Africa and the Russian Federation. The proportion of individual mines in total uranium extraction is shown in Chart 3.5.

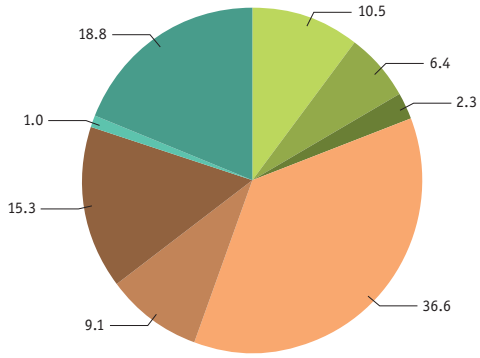
The programme of reducing uranium ore mining and processing, which had been launched before 1989, is being implemented in compliance with relevant government resolutions. The programme represents a very complex set of problems, which requires a number of pressing economic, technical, technological and environmental issues, as well as the statutory social benefits for workers affected by the reduction, to be simultaneously addressed. Currently, deep mining is only employed at the Dolní Rožínka mine, which annually produces

approximately 330 tonnes of uranium concentrate and thus fully satisfies the needs of the Dukovany nuclear power plant. An additional 130 tonnes of uranium concentrate is obtained from the post-chemical extraction clean-up at Stráž pod Ralskem. A certain amount of uranium concentrate (about 30 tonnes a year) comes from mills at sites that are being cleaned-up, where, among other elements, uranium is obtained from DIAMO during mine water treatment. All uranium production is supplied to ČEZ, a.s.

Based on worldwide demand for nuclear fuel, the government issued Government Resolution No 1316 in 2005, which provided for uranium mining and processing to be terminated by the end of 2008. In view of the enormous long-term increase in uranium prices (at the end of June 2007, it reached USD 350 per 1 kg), Resolution of the Government of the Czech Republic No 565 was issued in 2007, which indefinitely prolonged uranium mining and processing at Rožná, the only currently operating mine in the Dolní Rožínka area, from the original 2008 deadline, provided that any proposal for the further development of uranium mining at this site is presented in conjunction with a geological survey of the reserves and of the economic and energy-security aspects by 30 June 2012 (see Chart 3.6).

**Proportion of mining areas in uranium production in 1946–2004 period [%]**

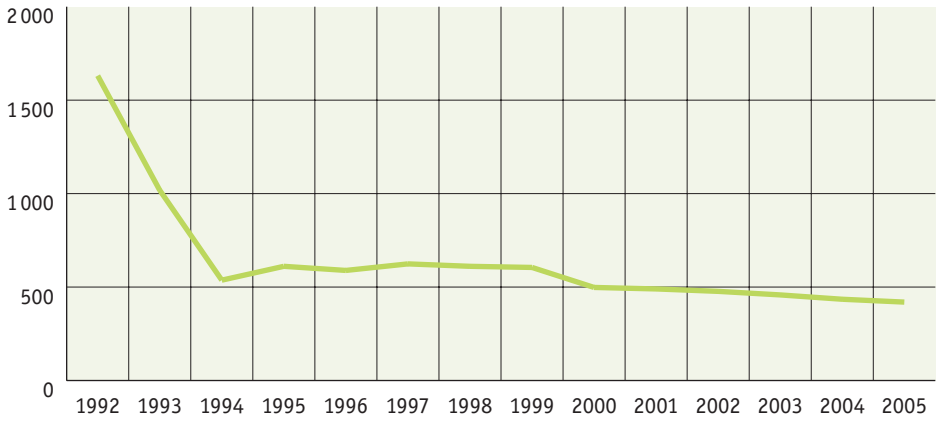
**Chart 3.5**




*Source: DIAMO*

**Uranium mining volumes [tonnes]**

**Chart 3.6**




*Source: Geofond*

### 3.1.3 Oil and natural gas

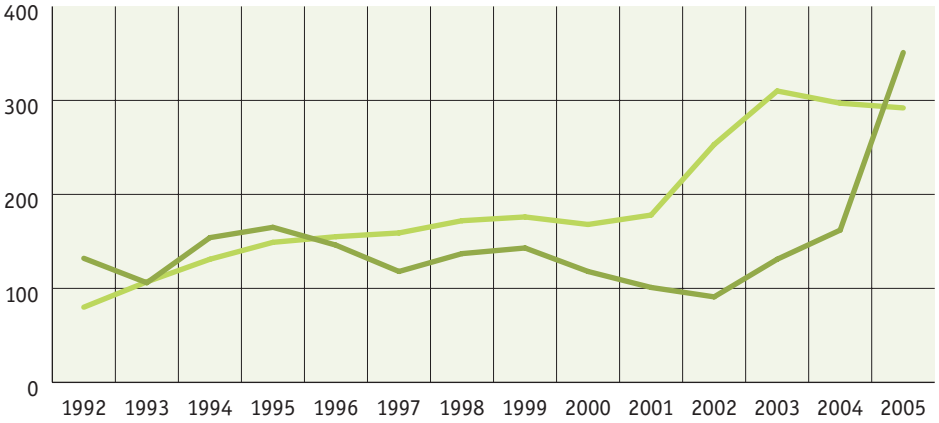
The Czech Republic's reserves of oil and natural gas are rather limited and it is entirely dependent on the import of these commodities. Domestic consumption of oil and liquid fuels is covered by imports, especially through long-distance oil pipelines. Approximately 75 % of our oil is imported from Russia. Over the past years, domestic extraction has been growing and it presently covers about five percent of domestic consumption. Oil extracted in the Hodonín area in south Moravia is high quality. It contains almost zero sulphur and is therefore mostly used in the pharmaceutical industry and in the production of cosmetics. In natural deposits, oil is usually accompanied by natural gas. Most natural gas used in the Czech Republic is imported; domestic extraction only accounts for about 1.5–2 % of domestic consumption. Since 2001, there has been a growing trend in both oil and natural gas extraction – see Chart 3.7.

Formerly, the Czech Republic covered its oil needs exclusively through imports from Russia via the Družba oil pipeline. In 1996, the Ingolstadt (IKL) pipeline was put into operation, which allows for the diversification of oil supplies.

The main natural gas suppliers to the Czech Republic are Russia and since 1997, Norway, which accounts for roughly 25 % of total annual gas imports.

**Extraction volumes of oil and natural gas**

**Chart 3.7**




*Zdroj: Geofond*

### 3.1.4 Other selected raw materials

The Czech Republic is relatively rich in limestone deposits. However, their utilisation is to a large degree limited by the quality of the limestone, geological conditions and environmental protection requirements. This is due to the fact that karst (limestone) areas are mainly situated within PLAs.

Limestone is used in the production of construction materials (lime, cement, mortar mixtures, grit, decorative and building stone etc.), in the chemical, energy and pharmaceutical industries, in agriculture and in other areas (ceramic and glass industries etc.). An ever increasing share of limestone is used in environmental protection and landscape management. It is particularly used for desulphurisation and flue gas treatment, for soil sweetening and lime treatment and for the treatment and purification of both drinking and industrial water.

Ground limestone and lime are presently used for the desulphurisation of flue gases in thermal power plants, heating stations and combustion plants. Even though increasing amounts of limestone are being used in the desulphurisation of flue gases, its total consumption has been slowly decreasing or stagnating since 2000, as shown in Chart 3.8. The driving factors behind this phenomenon include the certification of waste from the energy sector as construction material, which reduces limestone consumption in the building industry.

Gypsum extraction has considerably declined. Sufficient quality FGD gypsum is increasingly used as a suitable source material for the production of plasterboard and building materials. Natural gypsum is only used in situations with the highest quality demands. Currently, the only gypsum quarry still in operation is in Kobeřice.

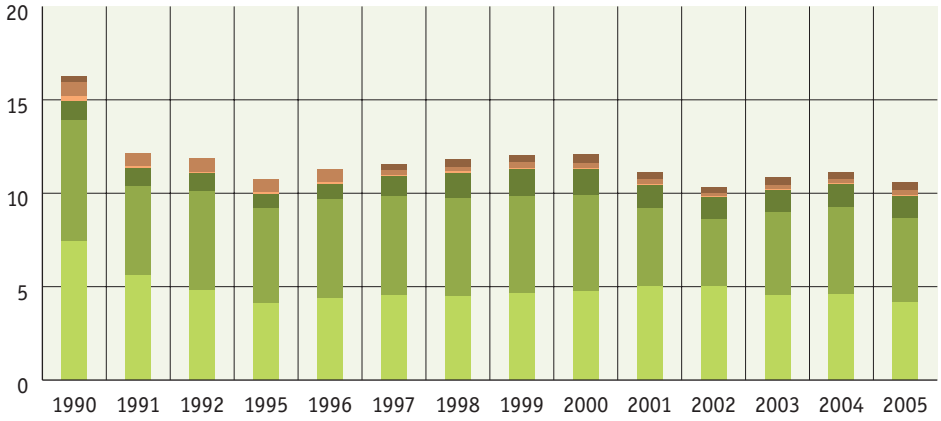
Kaolin is used in the ceramics industry, as filler in paper, rubber, plastics and paints, in the production of heat resistant materials and in other industrial areas. Half of the extracted kaolin is consumed in paper production. The sharp increase between 1999 and 2001 is attributable to the fact that (in addition to kaolin extraction itself) an increased amount of technologically unusable material was extracted from the Pilsen region's most significant sites. Otherwise, kaolin extraction volumes have been stable. The most significant extraction areas are the Karlovy Vary region, where all types of kaolin are mined, and the Pilsen and the Znojmo regions, where kaolin is mined for the paper industry, and the Podbořany region, where kaolin is mined to cover the needs of the ceramics industry.

Similarly to kaolin, the best clays are used in the different areas of ceramics production. It can be seen that following the decrease between 1991 and 1999, clay mining has been stable – see Chart 3.9.

In the distant past, lime produced in Bohemia, namely in the Prague area, used to be highly valued abroad. It used to be exported under the name Pasta di Praga. The lime was used not only in mortar – it was particularly renowned for its use in stucco and plaster. Czech limestone was thus used, for example, in the construction of buildings in Venice and Dresden, or in the repairs of the banks of the Thames in London. The excellent properties of Czech lime were also mentioned by Bohuslav Balbín in his Miscellanea historica regni Bohemiae (17th century).

**Limestone extraction [millions of tonnes]**

**Chart 3.8**

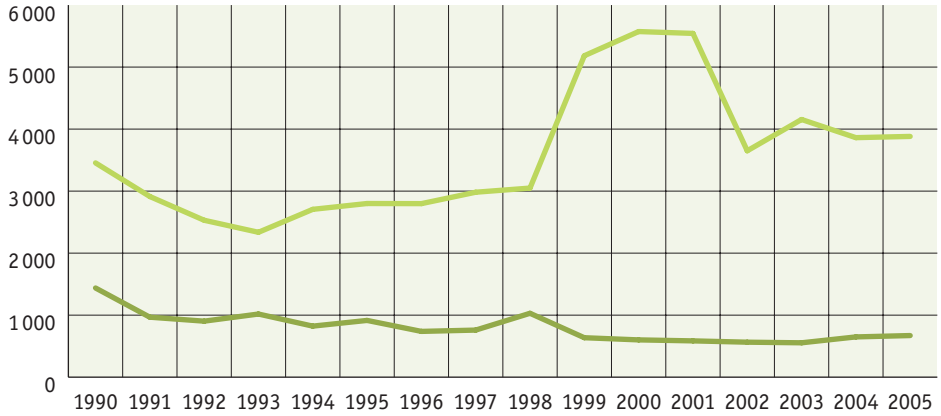



High-percentage limestone
Other limestone
Argillaceous limestone
Carbonates for agr. purposes
Cement and correction raw materials
Dolomites

*Source: Geofond*

**Kaolin and clay mining [thousands of tonnes]**

**Chart 3.9**

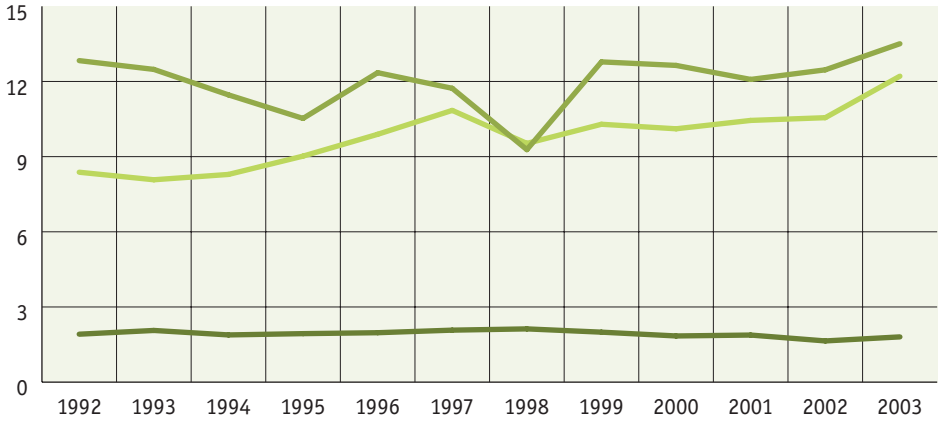



Kaolin
Clay

*Source: Geofond*

**Extraction of building raw materials [millions of tonnes]**

**Chart 3.10**




Building stone
Gravelly sand
Brick raw materials

*Source: Geofond*

Chart 3.10 shows a slight rise in the extraction of the most popular building raw materials (building stone, gravelly sand) at exclusive and non-exclusive deposits. The increasing consumption of these materials results from the development of the building of both residential and non-residential buildings, the modernisation of engineering structures and repairs after the 2002 floods. In addition, building stone and gravelly sand are significant export commodities.

Up until 1998, data on the extraction of building raw materials reported by the Czech Geological Survey – Geofond were partly distorted due to the differentiation between exclusive and non-exclusive deposits. Non-exclusive deposits had not been included in mandatory statistical reports. The actual extraction of building raw materials had therefore been somewhat higher than reported. Since 1999, extraction at non-exclusive deposits has also been monitored.

### 3.1.5 Additional sector characteristics

The changing structure of the Czech national economy and of industry during the 1990s influenced the changed significance and position of those sectors that extract and process minerals and mineral substances of. This is evidenced by the proportion of mineral extraction in gross domestic product, which decreased from 3.7% in 1993 to 2.1 % in 1998. The proportion of mineral extraction in industrial production fell from 6.9% in 1993 to 1.4% in 2002.

Employment in the mineral extraction sector decreased correspondingly to the gradual reduction of mineral extraction. Since 1990, the workforce decreased by almost 75%.

The largest decrease took place in the coal mining sector; see Chart 3.11, where, in addition, workforce reductions were concentrated in certain regions of the Czech Republic. Since the 1990s, employment in the black coal mining sector decreased by approximately 74% and in the lignite sector by approximately 67%. A number of measures have been adopted addressing the social consequences of employment reductions. However, these were not enough to solve the problem and coal-mining districts still have the highest unemployment rates. These include, above all, the Most, Teplice, Chomutov, Karviná and Ostrava regions.

By contrast, while the mines and smelting plants in the Kladno region were also closed, unemployment grew little despite the large number of miners that had been made redundant, because the unemployed were able to find new job opportunities in Prague and in Kladno's newly created industrial zones.

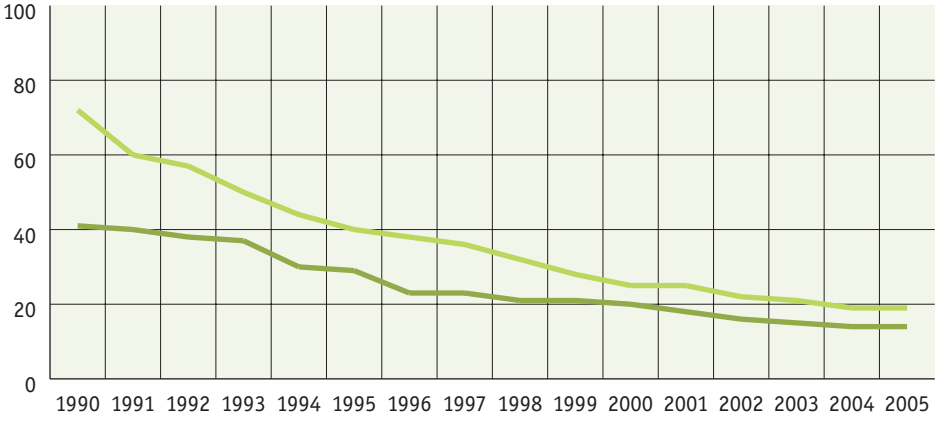
Western Europe also has experience with the reduction of coal mining, as it happened there much earlier. It started as early as the 1960s and has been continuing through today. The reduction affected especially large deposits in Germany, France, the United Kingdom and Belgium, as well as smaller deposits in Spain and Italy.

The largest reduction took place in France, with its current extraction volumes being at 3% of the 1985 level. Extraction in Germany decreased to approximately 40% of the original 1985 extraction volume – see Chart 3.12.

In 1951, the European Coal and Steel Community (ECSC) was founded as the first European Community. The founding countries were France, the Federal Republic of Germany, Italy, Belgium, Luxemburg and the Netherlands. The main objective was to support the development of two key industrial sectors – steel production and coal mining and processing. The ECSC was committed to increasing employment and the standard of living in the member states. The ECSC ceased to exist in 2002, as the ECSC Treaty was limited to 50 years.

**Employment developments in the coal mining sector [thousands of persons]**

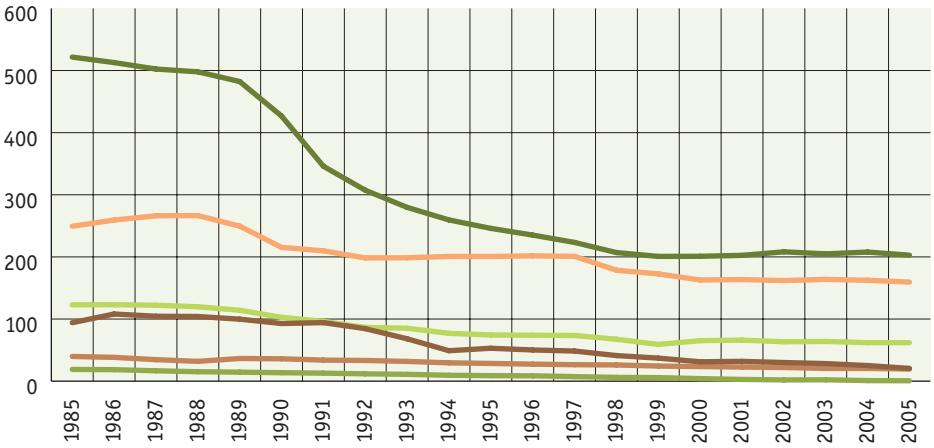
**Chart 3.11**




*Source: Ministry of Industry and Trade*

**Coal mining in selected European countries – black and brown coal [millions of tonnes]**

**Chart 3.12**




*Source: British Petroleum*

## 3.2 Geological environment protection

Geological environment protection in the Czech Republic aims to use gradual steps and entirely or partially eliminate old burdens, which primarily resulted from mineral extraction and other industrial activities, and to employ all possible means in order to keep the level of the geological environment's deterioration at an acceptable level.

Binding legislation with respect to mining was not enacted until the end of the 1980s on the basis of old mining acts. The legal framework includes three acts: Act No 44/1988 Sb., on the preservation and exploitation of mineral resources (the Mining Act), Czech National Council Act No 61/1988 Sb., on mining activities, explosives and on the national mining administration and Act No 62/1988 Sb., on geological work. The amendment to the Mining Act performed through Act No 386/2005 Sb. addresses, among other things, the differentiation of the system and the amount of royalty payments from exploited areas. At present, the only economic tools include exploited area royalties, extracted mineral royalties and, to a certain extent, the creation of financial reserves for clean-up, which are provided for in the new Mining Act and its implementing regulations. Since 2005, exploited area royalties have been set at CZK 100–1 000 per hectare (even only partially) used. Before 2005, these royalties were set at a flat rate of CZK 10 000/km$^2$. Royalties are graduated according to the level of environmental protection in the area affected by extraction activities, the character of the activities performed in the exploitation area and their environmental impacts. Their specific amount is set by the government through regulation. For minerals extracted from reserved deposits, a royalty is paid amounting to a maximum of 10 % of the market price. The volumes of collected royalties are presented in Table 3.1. The set amount of royalties can, in certain cases, be reduced or a full exemption from it can be granted for the purposes of supporting mining activities or in the interest of mineral resource utilisation. The beneficiaries of the royalties are the state budget (25 %), which uses these resources for the remediation of environmental damage resulting from extraction activities at exclusive deposits, with the remaining 75 % going to the budgets of those municipalities in whose territory the relevant exploited area is situated.

Pursuant to Act No 44/1988 Sb., on the preservation and exploitation of mineral resources (the Mining Act), as amended, organisations are obligated to ensure that a clean-up and reclamation of the area affected by mining activities is performed. In connection with the continuing reduction of mining and the clean-up work, financial resources are also allocated by the government. The past years' expenditure is outlined in Table 3.2. Since the beginning of the 1990s, the government has exerted influence on the mineral extraction sector through its decisions on mining reduction, on the division of original mining companies into new ones, through the privatisation of the sector and through setting extraction limits. Up until 1999, when the Raw Material Policy was approved, there had been no conceptual document in the area of minerals. Even though the Raw Material Policy is a relatively old policy in the sector, it still meets most environmental protection requirements ensuing from the State Environmental Policy. As opposed to the State Energy Policy, the Raw Material Policy does not anticipate the territorial ecological limits for lignite mining being breached.

**History of the Mining Act**

Mining law was based on the "horní regál". The king was the owner of all mineral resources and had the right to use them. Early legal regulations included articles on mining law from then 13th century. These were continued in the mining code entitled "Ius regale Montanorum" that was created by King Wenceslaus II (the early 14th century) and that became the best European regulation based on the principle of the monarch's exclusive rights to mineral resources and the "mining freedom". In the 16th century, mining law was influenced by the agreement entitled "Narovnání o hory a kovy". It was not until the 19th century (1854) that a unifying general mining act was promulgated, which remained in effect, with some minor modifications, until 1957, when a new mining act was enacted.

Environmental protection measures in connection with mineral extraction include the closure of the Chabařovice lignite mine near the city of Ústí nad Labem. The coal mined here had one of the lowest sulphur contents in the north Bohemian region, with its sulphur content approximating that of black coal. However, this city with a population of one hundred thousand was situated in the direction of prevailing winds and suffered from particulate matter emissions from mining, overburdens and conveyor belts, ash fallout from the heating station and, during winter, from high sulphur oxide and nitrogen concentrations due to its location in a deep inversion basin. Therefore, a decision was made in 1992 to terminate mining and the emission situation in the city centre objectively quickly improved.

**Royalties from exploited areas and extracted reserved minerals [CZK millions]**

**Table 3.1**

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From the use of land | 22.75 | 24.11 | 24.03 | 23.45 | 22.89 | 23.63 | 23.78 | 23.73 | 22.90 | 21.74 | 21.51 | 21.98 | 16.18 |
| From extraction volumes | 497.0 | 458.0 | 460.6 | 473.4 | 442.6 | 427.1 | 463.7 | 472.5 | 475.6 | 495.2 | 532.8 | 602.5 | 608.6 |

*Source: Czech Mining Office Board*

**Czech Republic's direct subsidies [CZK billions]**

**Table 3.2**

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coal mining reduction | 2.793 | 3.348 | 3.287 | 3.600 | 2.700 | 2.905 | 2.682 | 2.728 | 0.982 | 1.935 | 1.989 | 4.287 | 3.779 |
| Uranium mining reduction | 0.993 | 1.908 | 1.303 | 1.400 | 1.200 | 1.319 | 1.230 | 1.187 | 0.940 | 1.295 | 1.962 | | |

*Source: Ministry of Industry and Trade, Ministry of Finance, Transport Research Centre*

The grants for reduction of mining are not provided since 2004.

## 3.3 Sector's effect on the state of the environment

Mineral extraction activities adversely affect the environment. This mainly includes the use of agricultural and forest land resources, increased dust and noise emissions at the extraction sites, as well as overloading the local road network with freight transportation. Extraction activities cause irreversible changes in the landscape relief, changes in the regime and the level of groundwater reserves and their contamination.

Persistent hazards still include numerous old abandoned mines, particularly ore mines , and their spoil heaps, which contain toxic metals and acid mine water created during pyrite oxidation. The consequences of past mining activities are also still present in river sediments contaminated by heavy metals.

From the environmental perspective, the marked reduction of mineral extraction in protected landscape areas is of particular importance. In the early 1990s, there was a substantial reduction of extraction activities, which dropped to 50 % of the 1990 level in 1994 and approximately 35 % in 2004. In 2003, extraction activities were underway in 17 PLAs and were gradually terminated in 4 PLAs. With respect to the extraction activity burden on the area, there continues to be an unfavourable condition in the Český kras PLA, where the extraction activity burden on the area reached 26 266 t/km$^2$ in 2003 (limestone mining), with 10 000 t/km$^2$ being considered a critical burden on any given area. As shown in Chart 3.13, the extraction of some minerals (black coal and clay) was completely terminated, while the extraction of other raw materials in PLAs gradually decreased.

Presently, the most commonly mined minerals in PLAs include limestone (especially in Český Kras and Moravský Kras) and building raw materials, building stone and gravelly sand in particular – see Chart 3.14. Their extraction significantly affects valuable natural areas.

In addition, crushed stone mining remains a pressing problem, especially in the České Středohoří PLA. Quarries in slopes, which are often only located at the tops of hills, significantly disrupt or even profoundly change the landscape's character. During the privatisation of stone deposits, which took place in the early 1990s, a large number of then un-mined deposits were sold, which represented another serious future threat to the nature and the landscape of the České Středohoří.

Overall, about 4.4% of total stone mining for raw and fine stone production (decorative stone), 22.7 % of total building stone mining (crushed stone), 6.3 % of total gravelly sand mining and 0.8 % of total brick raw material mining is done in PLAs.

Approximately 59.5 % of total feldspar production and 27.2 % of total carbonate production comes from PLAs. Other non-ore minerals are not mined in PLAs.

When permitting new sites where crushed stone or gravelly sand mining should be initiated, it is necessary to consider the possibility of substituting recycled materials for gravelly sand. Gravelly sand mining has substantial irreversible effects on groundwater reserves and quality. In addition, gravelly sand deposits are often situated in places with high soil quality, which results in the loss of top quality soil.

Above all, negative environmental impacts are associated with coal mining. The most pressing problems include the use of land, dust emissions and often noise from technical equipment and machinery. The process of allocating land for mining and of the disposal of mined earth has been decided in a Mining Solution. Both dust and noise emissions in the vicinity of mines are monitored by accredited laboratories. Dust emissions are associated with both the mining and the transportation of coal and the overburden. The possibilities of reducing dust emissions include covering conveyor belts, catching dust particles during coal processing through water mist, using industrial vacuum cleaners, etc.

Potential environmental threats lie in the prospective breach of the territorial ecological limits for lignite mining – the binding lines for opencast mines and outer spoil heaps in the North Bohemian lignite basin. The limits were set by Government Resolution No 444/1991 primarily in order to preserve one of the last corridors within the basin that had not been covered by an additional layer, to preserve an important ecological corridor between the Krušné Mountains and the České Středohoří Mountains, and to protect the remaining municipalities at the foothills of the Krušné Mountains from advancing mining activities.

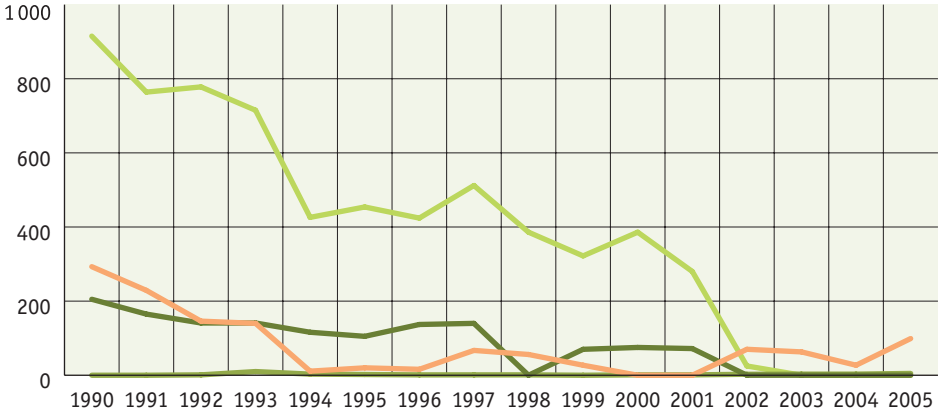
**Mineral reserves** include the deposits of reserved minerals (exclusive deposits). Their breakdown is as follows:

- exclusive deposits of ores and trace elements
- fuel and energy minerals
- non-ore minerals.

The territorial ecological limits apply to the mines of the Czechoslovak Army and the Bílina mine. Two municipalities would have to give way to mining, namely the municipalities of Horní Jiřetín and Černice. In the past century, 106 original municipalities gave way to mining activities, including the 650-year-old royal city of Most.

**Extraction at exclusive deposits of selected minerals in PLAs [thousands of tonnes]**

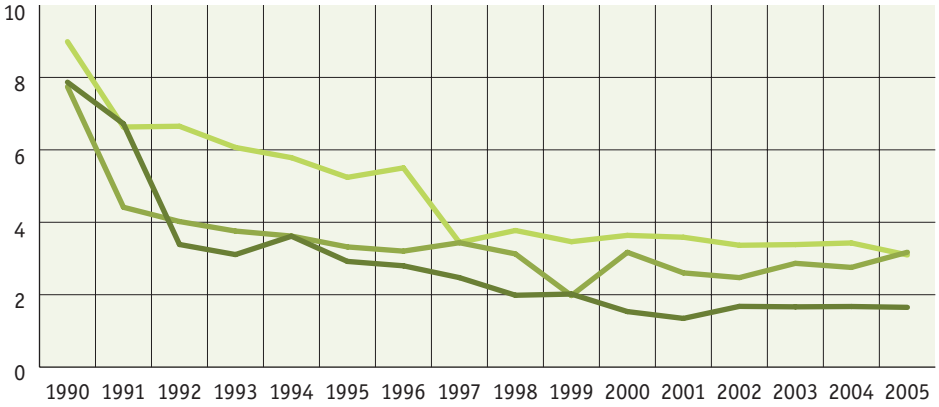
**Chart 3.13**




*Source: Geofond*

**Extraction at exclusive limestone and building raw material deposits in PLAs [thousands of tonnes]**

**Chart 3.14**




*Source: Geofond*

Major problems, which occur mainly in connection with black coal mining, include undermined areas at risk of subsidence, the contamination of the geological environment from sludge processing settling pits, the contamination of the geological environment with mine water. In accordance with the reclamation work plan, damage to the geological environment is gradually being remedied, mainly through the reclamation of undermined areas and settling pits.

The efflux of firedamp – methane also occurs during deep mining, especially in the Ostrava-Karviná area. Under certain conditions, there is risk of ignition or explosion of the methane-air mixture. Firedamp is pumped out of mines and is supplied as a raw material for energy generation to heating facilities and to technological processes in industrial production. The liquidation and clean-up work after black coal and lignite mining consists mainly in the reclamation of spoil heaps and in the pumping and disposal of mine water that, however, does not represent a significant environmental burden.

From the fuel and energy minerals, only oil and natural gas are extracted in PLAs. They are extracted in the Beskydy and Bílé Karpaty PLAs. In view of their total production, oil totalling approximately 0.4 % and natural gas 9.3 %, the environmental impacts are less significant.

The Ministry of the Environment ensures that old mines, which pose risks to a legally protected general interest, are secured or liquidated to the necessary extent. The main financial sources used for securing and liquidating old mines and their consequences come from the royalties for extracted minerals that are provided to the ME pursuant to Government Resolution No 906 of 12 September 2001. The amount of incurred costs is shown in Table 3.3.

Along with the gradual reduction of uranium mining and processing, a growing share of former uranium mines and processing plants are being cleaned-up or liquidated by DIAMO. After uranium mining, the surrounding environment, especially water, is contaminated with natural radionuclides, which are removed in decontamination plants through special technologies. As part of the liquidation, contaminated water is pumped away from the mines and mills that are being cleaned-up, and is subsequently purified and discharged into watercourses. During the process of cleaning-up underground mines, a certain portion of pumped contaminated water is used as a secondary raw material source for the production of a valuable chemical product. Government Resolution No 687 of 12 June 2000 anticipates all consequences from uranium mining and milling to be eliminated by 2040.

**An old mine** is either an abandoned underground mine or an abandoned opencast mine or quarry. Neither the original operator nor its legal successor exists or is known. The ME is responsible for securing old mines and keeps a register of old mines.

**Uranium mining** at Stráž pod Ralskem was terminated after 1996. The mining had been performed using the in-situ chemical leaching method and, as part of the mining, more than 5 million tonnes of sulphuric acid had been pumped into the rock strata, which contaminated approximately 260 million $m^3$ of groundwater.

**Overview of costs for securing or liquidating old mines [CZK millions]**

**Table 3.3**

*Source: Ministry of the Environment*

| Year of notification | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Expended finances | 59.7 | 53.2 | 73.3 | 67.8 | 75.1 | 84.4 | 83.6 |

**Development of reclamation after mineral extraction [areas, km²]**

**Table 3.4**

*Source: Geofond*

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Mining affected area, to date unreclaimed | 1005 | 814 | 818 | 820 | 838 | 776 | 714 | 679 |
| Reclamations in progress | 98 | 97 | 93 | 98 | 114 | 99 | 113 | 116 |
| Reclamations completed since start of mining | 150 | 156 | 156 | 162 | 171 | 172 | 180 | 183 |
| Reclamations completed in the given year | 8.7 | 5.5 | 6.3 | 4.7 | 4.6 | 9.5 | 11.5 | 8.1 |

An important stage of environmental protection is corrective measures that take place after mineral extraction. Section 31 of the Mining Act No 44/1988 Sb., as amended, obligates mining companies to reclaim the areas affected by mining activities and to create financial reserves for such reclamation. For the purposes of the profit tax, these reserves are considered part of the mining costs. As can be seen in Table 3.4., mining affected areas decreased between 2000 and 2007, while reclaimed areas increased.

Reclamations completed since the start of mining include agricultural 36.8 %, forest 41.9 %, water 8.6 % and other 12.7 % reclamations, which correspond to the original land use.

4

# Manufacturing Industry

While the manufacturing industry is the backbone of economic activity and growth, it also affects the environment. The environmental impact of industry has been known for a long time and statistics have been available since the early 1970s, but decisive improvements were not attempted in the past. To a large extent, the information was kept secret.

In the early 1990s, the state of the environment was influenced by the dwindling industrial production, especially in heavy industry. In subsequent years, structural changes shifted the industry towards fields with lower energy and emission intensities. The energy and emission intensities per unit of production have thus been decreasing in the manufacturing sector.

Among the various sectors of the national economy, industry stands out as one of the major polluters. Current statistics show that the improvement of the environmental situation, which began at the close of the last century, has slowed down since 2000. Some indicators have even slightly deteriorated. In some developing fields (the chemical industry and the restructured metallurgical industry), the emissions of some polluting substances ($NO_x$, VOC, $PM_{10}$) and the greenhouse gas $CO_2$ have been slowly increasing.

The recycling of secondary raw materials appears to be a promising by-product of the manufacturing industry. By involving consumers, this important aspect of eco-industry allows for the closing, in part, of the cycles of material circulation and thus contributes to increasing the material productivity of the entire Czech economy.

More contributions for improving the environment can be achieved from applying voluntary tools (e.g. environmental corporate management systems) that utilise the strategies of economic and environmental profit, where economic savings also produce environmental benefits with a subsequent positive impact on the health of the population.

## 4.1 Characteristics of the development of the manufacturing industry in the Czech Republic

The distribution of industrial branches across the Czech Republic speaks volumes about the dependence of industrial development on energy and raw material sources.

Historically, the centres of industry were located in the Ostrava region and the region adjacent to Prague, both with black coal mines, and the Ústí nad Labem region with its brown coal mines. The extraction of raw materials was accompanied by the production of basic commodities, especially coke, pig iron and steel (steelworks in Ostrava, Třinec and Kladno), and by the production of basic chemical substances (Ústí nad Labem, Litvínov, Lovosice, Ostrava). Heavy engineering production was established near steelworks, but, in addition to general engineering plants, other important centres engineering also developed in Prague, Plzeň, Brno, Mladá Boleslav, Zlín, Vsetín and elsewhere.

The textile and glass industries depend on water energy; hence they appeared at the foothills of the Krkonoše, Jizerské, Krušné and Šumava Mountains. The development of industry led to its encroachment into the landscape, including all positive and negative implications. The dependence of the Czech economy on heavy industry with an enormous consumption of coal after 1948 burdened the country with considerable pollution.

The state of industry prior to the advent of communism was competitive internationally, but it started to fall behind under the conditions of the centrally planned economy. Central planning was responsible for the plunge of competitiveness in Czech industry. Nevertheless, a number of remarkable technologies were created. The innovations of research and development in textile engineering have been applied in weaving and spinning factories all over the world.

After the changes in 1989, the transfer of ownership rights to industrial companies was one of the priorities. Privatisation of large and medium-sized companies proceeded pursuant to Act No 92/1991 Sb. on conditions of the transfer of state ownership to other entities. It concerned companies of all branches except for property specifically excluded from privatisation (natural resources, the post, water works, etc.)

New owners were selected based on the privatisation projects they submitted. Roughly three fourths of all shares were privatised through the voucher method and one fourth of the privatised companies were sold directly. In this way, most industrial companies found themselves with a new owner.

### 4.1.2 Trends in industrial production

In the early 1990s, when the economic transition was launched, Czech industry played a significant role in the economy. The economy, however, was dominated by a monopolistic, centralised organisational structure with a low number of small and medium-sized companies. Competition and the private sector were missing. Obsolete and environmentally unfriendly technologies were used not only in light and consumer industries, which were not considered prestigious, but also in the flagship branches of heavy industry. This resulted in a low increase in the value of material and energy inputs in the production process, high labour intensity and low labour productivity. Foreign trade relied heavily on the Eastern markets.

The adaptation of the economy to new concepts and rules triggered positive structural changes in the respective shares of economic sectors in the gross domestic product (GDP). The previously large share of industry, construction and extensive agriculture sank in favour of the rapidly developing sector of market and non-market services. Industry's prominence with regards to GDP came to an abrupt halt in 1995.

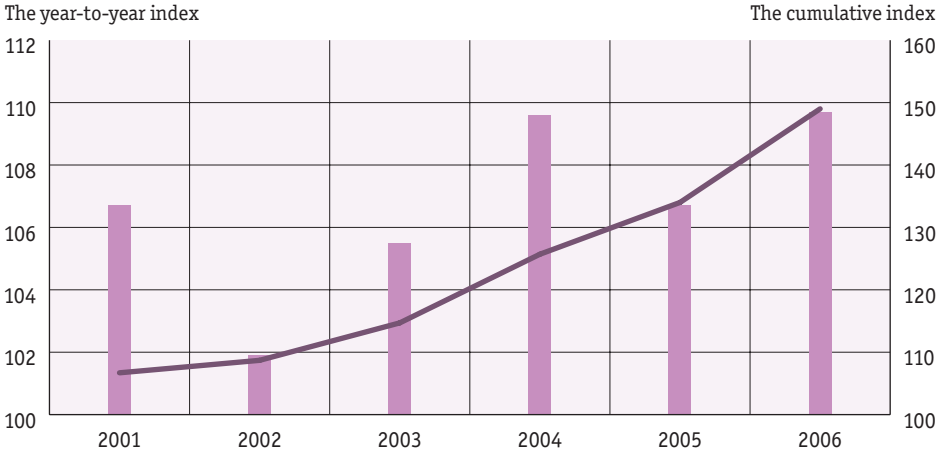
### 4.1.3 Development of the manufacturing industry after 1995

The manufacturing industry has managed to retain its importance for GDP; since 1995, its overall share has been rising despite small fluctuations. In 2006, industrial production increased by 9.7 % over the previous year, which was the largest increase since 2000 and is comparable to 2004. The growth of Czech industry dwarfs the EU25 and EU27 averages; the Czech rate of growth is nearly twice as high. According to international comparative statistics, industrial production in the EU25 grew by 3.6 % in 2006 (or 3.8 % in the Euro zone). Chart 4.1 depicts the development of the industrial production index in the Czech Republic.

**The index of industrial production** measures the output of industrial branches adjusted for inflation. The year-to-year index of industrial production is an indicator that describes the change compared to the previous year. The cumulative index expresses the development of production compared to a predetermined base year.

**Year-to-year index of industrial production**

**Chart 4.1**



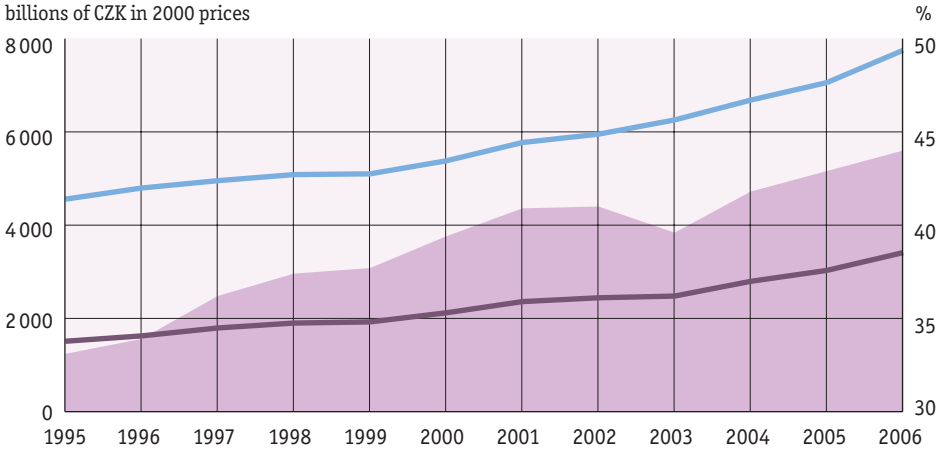

The year-to-year index of industrial production

The cumulative index of industrial production (the average value of 2000 = 100)

*Source: Czech Statistical Office, Ministry of Industry and Trade*

**Comparison of the output of the manufacturing industry and the total output**

**Chart 4.2**




Share of the output of the manufacturing industry in the total output [%]

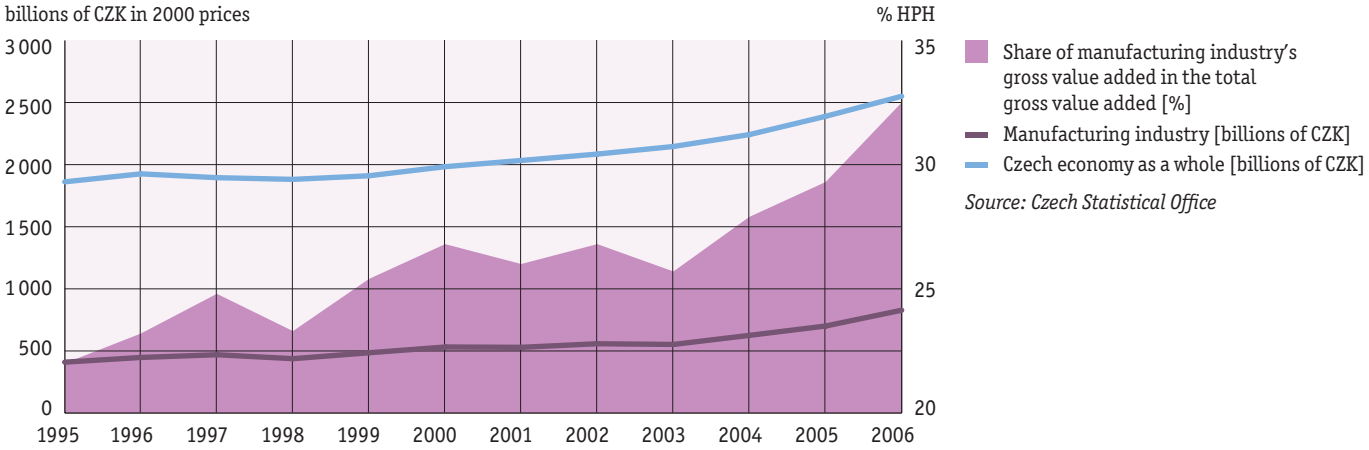
Manufacturing industry [billions of CZK ]

Czech economy as a whole [billions of CZK]

*Source: Czech Statistical Office*

**Comparison of the gross value added of the entire Czech economy with that of the manufacturing industry**

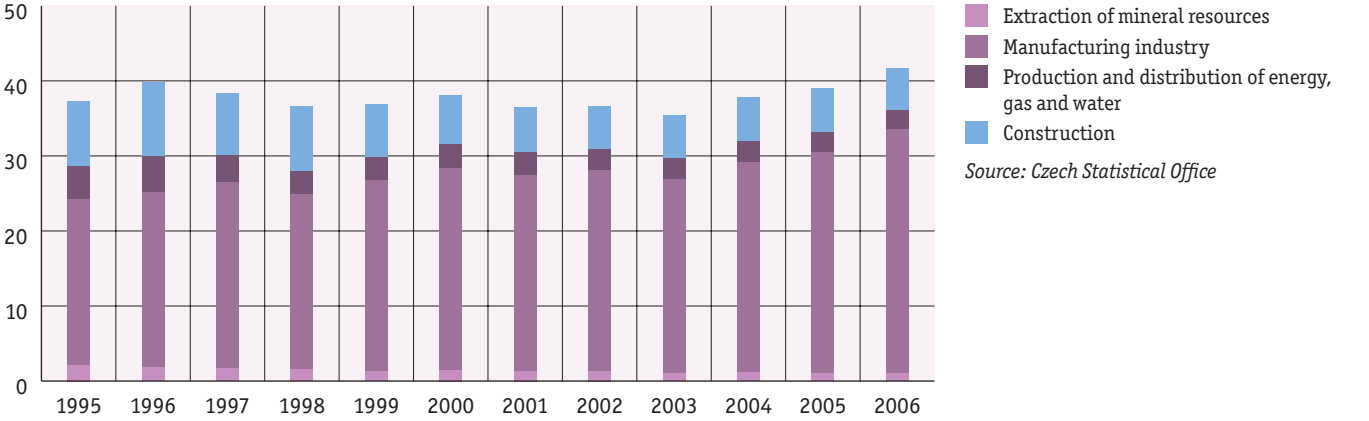
**Chart 4.3**




*Source: Czech Statistical Office*

**Share of individual categories of industry in the gross value added [%]**

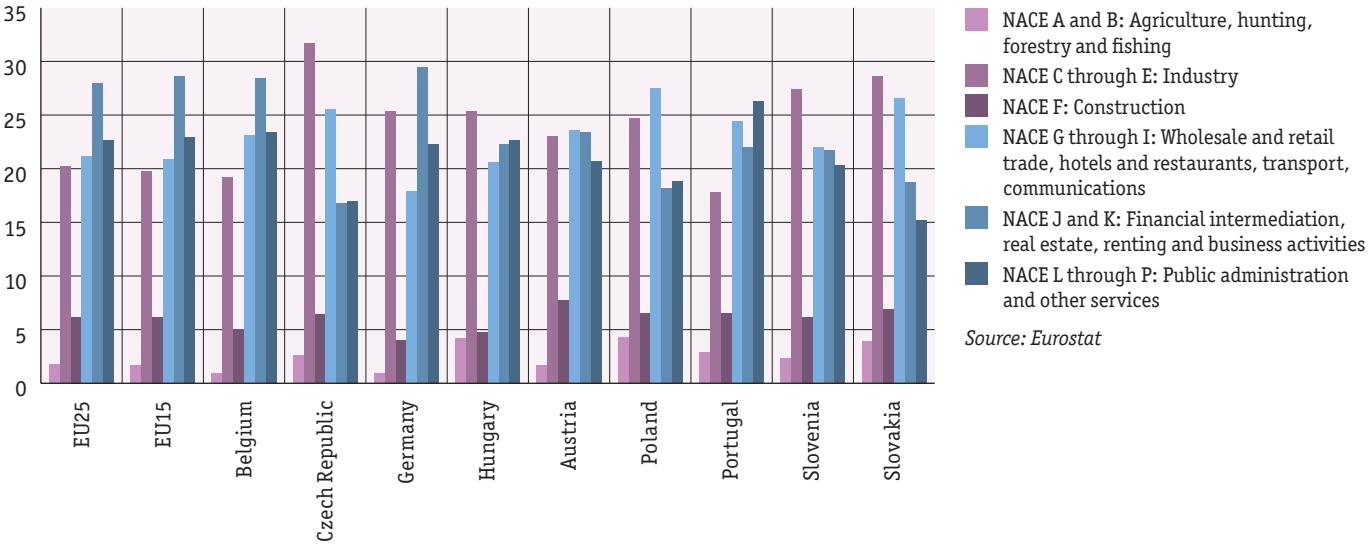
**Chart 4.4**




*Source: Czech Statistical Office*

**Comparison of the gross value added in the EU [%]**

**Chart 4.5**




*Source: Eurostat*

**The production of the manufacturing industry**

The production of the manufacturing industry has been enjoying a positive upswing since 1995. The development of the manufacturing industry and its comparison with the total production of the economy is depicted in Chart 4.2. Except for 2003, the share of the manufacturing industry in the total production of the Czech economy has been steadily rising.

As in Germany, the production of motor vehicles accounts for the largest share of gross value added in the Czech Republic. The chemical and steel industries are prominent as well, but in comparison to some other countries, they show a deficit of products with a high value added (particularly for qualified chemical production and the production of sheet steel for the car industry).

**Gross value added**

Gross value added of the manufacturing industry (in 2000 prices), which is an indicator expressing the share of the manufacturing industry in the overall gross value added, has been developing in lockstep with the development of its output (see Chart 4.3).

The share of the manufacturing industry in gross value added reached roughly 32 % (in 2006). The manufacturing industry has been increasing its role in view of the overall economy (see Chart 4.4) and the trend is expected to continue in the coming years as well.

**International comparison of gross value added in industry**

A comparison with other European countries shows that within the EU, only Ireland outperforms the Czech Republic in the share of industry in value added. The growth of industry is expected to exceed the growth of the gross value added and, consequently, the growth of the gross domestic product. Hence, this percentage with rise even further. Chart 4.5 depicts the comparisons with the EU average and with other central European countries.

## 4.2 Characteristics of selected branches of the manufacturing industries that have a considerable environmental impact

Different branches of the manufacturing industry have different negative environmental impacts. In addition to branches that have a substantial negative environmental impact (chemical production, metallurgy), some advanced technologies are nonetheless relatively environmentally friendly. The branches with the largest environmental risks were placed into the following set, although all branches actually went through technological innovation development in the 1990s. Some selected branches are characterised in what follows. The classification is inspired by the Branch Classification of Economic Activities.

### 4.2.1 Branches of the manufacturing industry with the largest environmental impact

**Oil refining**

The Czech refining plants produce a standard range of refined products in the quality required by the valid EU norms. The setup of their production units suggest that they will maintain their competitiveness in the future, which is supported by the securing of imports from diversified sources and by selecting the optimum quality.

The Czech producers capitalise on a unique distribution network of pipelines and terminals as well as on a direct connection of refining plants to the production units of the petrochemical industry.

In 2001, the sale of leaded patrol was terminated in the Czech Republic. The country thus fulfilled one of the main requirements of Directive 98/70/EC relating to the quality of petrol and diesel fuels. In the second half of 2005, a goal prescribed by Act No 189/1999 Coll. on emergency oil reserves was fulfilled; the Czech Republic had created the required reserve that can cover the average consumption of oil and oil products for 90 days.

After the modernisation period in the 1990s, the investment activity of Česká rafinérská, a.s. focused on the implementation of technological innovations for the "Clean Fuel" initiative, i.e. sulphur-free fuels starting in 2006. Paramo finalised the investment that conditioned the plant for production of sulphur-free diesel oil. In 2005, the preparation of investments needed for adding bio-fuels into produced petrol and oil began in the Česká rafinérská refining plant. This measure is a part of a wider European trend that includes substituting alternative fuels for fossil fuels.

**Production of chemical substances**

Products of the chemical and the pharmaceutical industries are used in virtually all parts of our economy. Three fifths of all sales are generated by basic chemical substances (No 24.1 in the Branch Classification of Economic Activities), 17 % come from the sales of pharmaceuticals, 10 % from washing, cleaning and cosmetic products and 9 % from the production of chemical specialties and chemical fibres.

The chemical sector has a huge potential for improving public health and the environment.

**Production of rubber and plastic products**

This branch is represented by two product lines: the production of rubber products, where tyres and muck-locks prevail, and the production of plastic goods over a wide range of products (plastic parts for machines, appliances, vehicles, products used in construction, etc.). Rubber and plastic articles also affect the environment during their production process through the widespread usage by consumers. They have been one of the most dynamically growing branches of the manufacturing industry in recent years. A further increase in demand is expected to take place mainly in Central and Eastern Europe, where the average consumption of plastic per inhabitant reached 42 kg per year (while the EU15 had an average consumption of nearly 100 kg per year). The rubber and plastics industry in the Czech Republic can compete with the developed EU25 countries

**The production of non-metallic mineral products**

Another important branch of the manufacturing industry is production of glass and glass products and production of concrete, plaster, lime and cement products. Prices of raw materials being relatively stable, the growth of production prices is mainly due to the current trend of considerable increases in prices of energy inputs.

This branch does not produce dangerous waste that would have to be processed in specialised production plants. Most waste is further processed in the glass and ceramics industry (shards) as well as in production of building materials (bricks, earthenware, concrete, etc.).

**Metallurgical production**

Czech metallurgy is one of the branches that went through a process of broad modernisation, especially with respect to the environment. This production depends on imported inputs, mainly on iron ore for the production of pig iron, as well as on imported primary metals that are further processed by companies involved in non-ferrous plants and by the foundry industry. Metallurgy and metal processing are major energy consumers within the manufacturing industry. The consumption of fuels and energy in manufacturing amounts to more than 24 GJ per tonne of production.

The favourable economic performance has made investment into innovation possible. The quality of production has thus increased and producers have been able to switch to products with a higher value added.

All key production facilities in metallurgy have already gone through the Integrated Pollution Prevention and Control (IPPC) process and the technological equipment used employ the best available techniques (BAT).

The problems with $PM_{10}$, $PM_{2}$, and $NO_{x}$ and air dust persist in the some parts of the Moravian Silesian Region that have been traditionally burdened by emissions.

**The production of electrical machines and equipment**

Electric motors, generators, transformers, electrical distribution and switching appliances, cables and isolated conductors and accumulators are traditional products in this sphere. The branch of other electric equipment, especially for the car industry, is important as well.

The trend of switching to more sophisticated products has been enhanced by the building of new or the extension of old development capacities in recent years.

Even before the Czech Republic joined the EU, Czech legislation regulating the technical aspects of electro-technical production had been compatible with the Community norms. In the environmental field, some new directives have been incorporated into Czech legislation only recently. Companies have to come to terms with the prohibition of lead solder and with collecting their waste products (according to Act No 185/2001 Sb.) Most companies have already solved the environmental problems related to their production, be it waste water or the emission of aromatic hydrocarbons from paint shops and impregnating stations into the air.

**The production of motor vehicles**

Car production is chiefly responsible for the strong economic results of the Czech Republic and it has established itself as a major player in the Czech economy.

In 2006, more than 800 000 passenger cars were produced. Roughly 650 000 of them were exported. In the future, the Škoda Auto plant in Mladá Boleslav and the TPCA plant in Kolín will be responsible for up to 15 % of all Czech exports. Along with another car producer, Hyundai, they can reach one fifth of all Czech exports.

One of the key goals of the branch is compliance with **REACH**, the new EU regulatory framework for chemistry that came in force in 2007. It concerns all companies that produce chemical substances in the EU or import more than one tonne of them into the EU. The legislation makes registration, testing, authorisation and restriction of chemical substances obligatory. The ultimate goal is to ensure that by 2020 exclusively chemical substances with known negative characteristics are used in a manner that does not harm the environment or human health.

In 2003, **the most plastics** in Europe were used for the production of packaging materials (37.2%), in construction (18.5%) and in the electrical industry (8.5%). The structure of consumption has been altered with the consumption of plastics in the car industry and in engineering, which is rising the most rapidly.

The development in the branch is to a large extent shaped by EU environmental legislation. To fulfil the requirements prescribed by the legislation, it is expected that by 2012, roughly CZK 4–6 billion will have to be invested each year to make **metallurgical production** environmentally friendly.

Producers in the EU are obligated to meet ever stricter environmental norms regulating **the operation of vehicles**. In the latest norm, the requirements regarding CO2 emissions produced by cars were made even stricter. In the future, the share of recyclable car parts is expected to grow. As of now, no domestic company produces passenger cars using compressed gas, which are the most beneficial cars from the environmental point of view.

**The recycling of secondary raw materials from the manufacturing industry**

In plants recycling secondary raw materials, in particular metallic and non-metallic waste and other kind of used and unused products are processed to secondary raw materials, whose quality makes them suitable for further use in the manufacturing industries of the metallurgical, glass, paper, textile, construction and other industries. By involving the consumers, this important part of eco-industry allows closing, in part, the cycles of material circulation and thus contributes to the increase in the material productivity of the whole Czech economy.

The total weight of waste processed and made usable in the manufacturing industry has been fluctuating around 5 million tonnes a year in the recent years. Waste containing iron (over 2 million tonnes), construction and demolition waste (almost 2 million tonnes) and waste paper (0.6 million tonnes) represent the largest share of the processed materials. As far as the weight of the processed waste is concerned, non-ferrous metals, glass shards, plastic waste and others dominate. Production of steel and cast iron, non-ferrous metals, glass, paper and some other products of the Czech manufacturing industry consistently depend on re-used waste. The industrially usable natural sources of non-ferrous metals in the Czech Republic have been exhausted. Consequently, secondary resources are the only domestic source of non-ferrous metals (which includes precious metals) on an industrial scale.

Some companies in this branch operate technologies of follow-up metallurgical primary production and, in some cases, technologies of metallurgical secondary production, whose commodity diversification and deepening of product finalisation has a considerable impact on the economic weight of the branch.

The future development of this branch depends on the worldwide approach to management of non-renewable resources. The EU countries adopted a framework deriving from the principles of sustainable development. In addition to material savings related to management of primary resources, the energy economies represent an immense benefit in using secondary materials in numerous applications. In production of aluminium and plastics, the savings exceed up to 90 % of the energy consumed. In other energy-intensive branches, e.g. zinc, glass and rubber production, the energy savings amount to more than 70%.

The Plan of Waste Management of the Czech Republic set a goal to increase the usage of waste materials, preferably in recycling, to 55 % until 2012 and to increase the material use of communal waste to 50 % by 2000, the base year being 2000. The Government Regulation No 197/2003 Coll. on the Waste Management Plan of the Czech Republic contains many goals focusing on an improved waste use. The corresponding Implementation Programmes, e.g. for waste oil, car wrecks, construction and demolition waste and other commodities, have been prepared.

Unsurprisingly, **legislation** – in particular Act No 185/2001 Sb. on waste and Act No 244/2001 Sb. on packaging – significantly influences the branch of secondary raw materials. The main conceptual tool for the increase in the degree of recycling in the Czech Republic is the document Raw Material Policy in the Area of Mineral Resources (approved by the Czech Government in Resolution No 1311 of 13 December 1999 and Resolution No 639 of 30 June 2003), which, after an assessment of the condition of the Czech raw material base, laid out the government policy regarding exploitation of secondary resources. The Plan of Waste Management of the Czech Republic announced on 4 June 2003 in Government Regulation 197/2003, whose impact on waste management has been increasing ever since, is an indispensable policy document

## 4.2.2 The role of industrial zones

The development of industrial zones for potential investors is one of the main elements of promoting enterprise and of the development of entrepreneurial conditions. The Ministry of Industry and Trade has been responsible for this agenda since 1998. Several important changes occurred. One of the most important ones is the support of brownfields (unused territories and industrial premises) that can – in addition to economic and social benefits – help improve the environment. The Ministry of Environment unequivocally prefers the support of brownfields. Recently, this trend has been manifesting itself through the effort to limit the number of prepared greenfields (zones prepared from the scratch) to those that are supposed to attract strategic investors and to territories where demand for undeveloped plots is not met.

Between 2001 and 2006, there was a document called the "Programme of Support of Industrial Zones" created by the experts of the Ministry of Industry and Trade. Since 2005, a similar document called the "Programme for Support of Industrial Premises and Infrastructure" has been in use. It embraces other sub-programmes, e.g. the Preparation and Development of Entrepreneurial Parks, the Regeneration of Unused Territories (brownfields), the Construction and Reconstruction of Buildings for Strategic Investors etc.

Since 1998, 102 industrial zones have been funded from the government budget for the development of industrial zones. Until the end of 2006, CZK 7.23 billion was expended in this way. Through the system of support, almost 2960 hectare industrial zones have been built.

In the 2007–2013 programming period, a draft of a new operational programme entitled **"Enterprise and Innovation 2007–2013"** was prepared for the use of funds from the EU Structural funds. It was authored by the Ministry of Industry and Trade, which also includes a programme focused on the support for the construction and modernisation of entrepreneurial premises. One of its goals is the regeneration of unused and dilapidated buildings and sites (brownfields).

## 4.3 Energy intensity of the manufacturing industry

Since 1990, there been an observable decrease in the energy efficiency of the manufacturing industry. This is a result of a shift in its structure, which brought about a change in the share of the respective branches in output, as well as a result of the growing production of goods with high value added (e.g. computer technology).

Nevertheless, the role of the steel, chemical, refining and petrochemical industries in manufacturing is still significant. This fact influences the energy intensity indicator, which has been gradually falling due to technical modernisation and the dynamics of development of other branches of manufacturing. This trend should continue. The energy efficiency indicator now compares to the steel, chemical, refining and petrochemical industries of developed countries.

The fact that energy-intensive branches still play a prominent role in Czech manufacturing amplifies the importance of products with a high value added. Chart 4.6 depicts the development of energy intensity.

The highest final consumption of electrical energy in 2006 was recorded in the chemical industry, namely 4 868 GWh. The production of metals came in second with 3 600 GWh and glass and ceramics followed with 2 520 GWh.

The structural changes in manufacturing are obvious when you look at the downward trend of heat intensity (see Chart 4.7). The decrease (in volume terms) in the consumption of fuels, heat and electric energy per unit of production attests to changes in favour of technologies with a lower energy intensity. The paper industry is truly an exception with its share of renewable energies – more than 50 %.

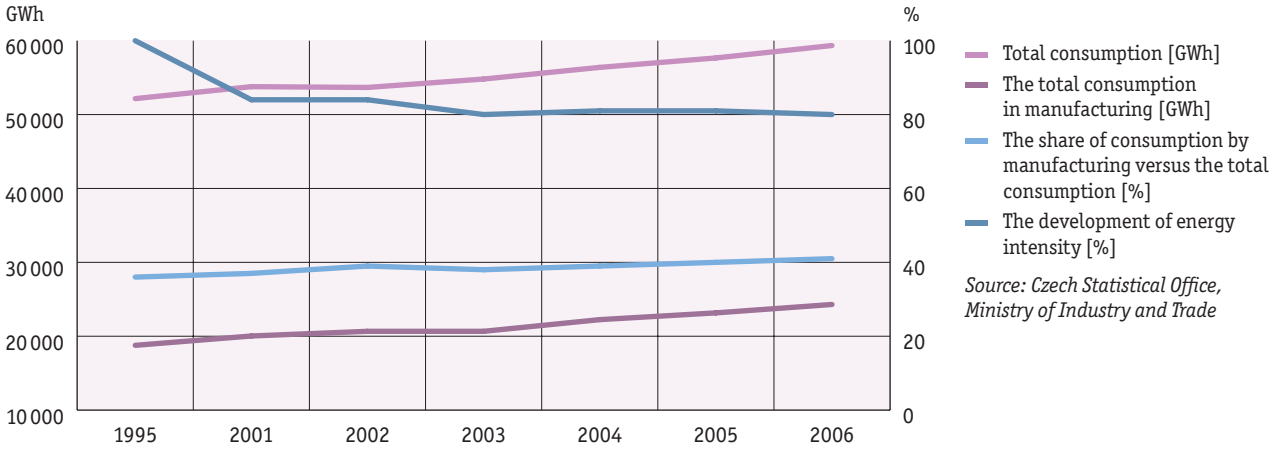
Once again, the highest final consumption of heat energy was recorded in the chemical industry (31 329 TU) followed by the production of metals (5 599 TU) and the food industry (12 258 TU).

The energy intensity of Czech industry per unit of production has been falling primarily due to the introduction of **best available techniques (BAT)**, changes in the structure of the manufacturing industry, the refocus of production to sophisticated goods and changes in the fuel base of industry.

Due to changes in methodology, **the consumption of heat energy** in manufacturing in the chart starts in 2003. The technological consumption of heat energy has fallen as much as consumption of electric energy since 1995.

**Consumption of electrical energy and the development of energy intensity in manufacturing**

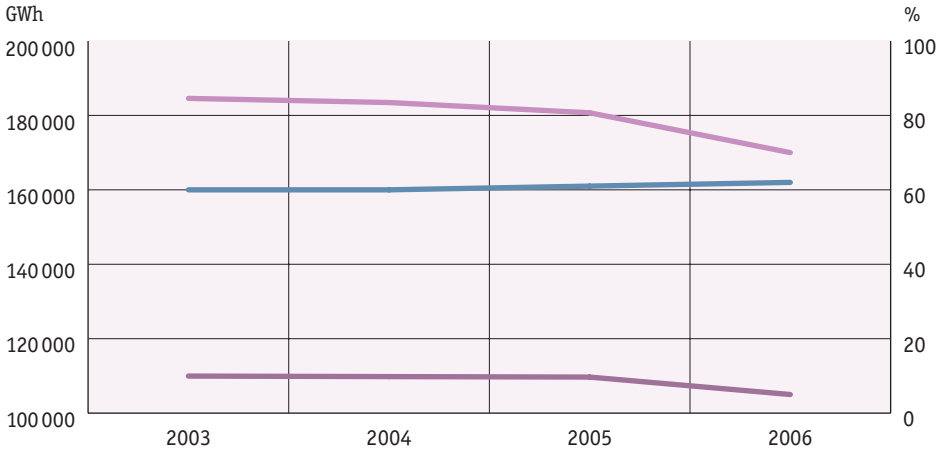
**Chart 4.6**




*Source: Czech Statistical Office, Ministry of Industry and Trade*

**Consumption of heat energy in manufacturing (in thermal units)**

**Chart 4.7**




*Source: Ministry of Industry and Trade*

## 4.4 The environmental impact of the manufacturing industry

The current state shows that the improvement of the environment, which began at the end of the last century, has slowed down since 2000. Some indicators have even slightly become worse. The reason is the robust economic growth driven by the growth of industrial production.

As a bearer of economic activity and economic growth, the manufacturing industry produces a number of harmful substances ranging from toxic substances to inert waste. It also consumes non-renewable resources and influences the environment. The relation of industry and environment is best described by a comparison between the development of industrial production and the development of emissions, waste, water consumption and costs incurred in the process of making the production more environmentally friendly.

As far as polluting is concerned, there is a clear link between the structural changes in the industry, changes in production technologies and environmental protection according to legislation and voluntary agreements. If the development of industrial production meant an increase of pollution of all elements in the past, the manufacturing industry achieved a decrease in the volume of harmful substances emitted into nature. The exact improvement varies but is still very obvious. Some fast developing industries, however, seem to have been polluting more in recent years.

### 4.4.1 The emissions of main polluting substances in the industry

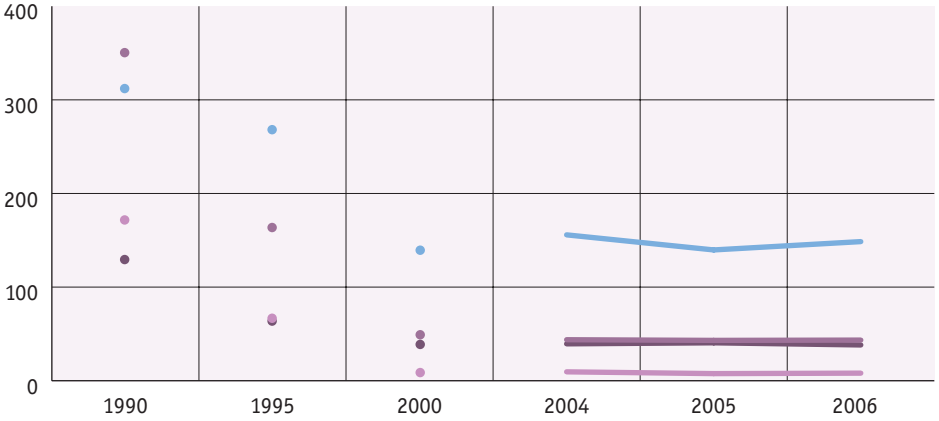
Pursuant to Act No 86/2002 Sb. on clean air protection (the Clean Air Act), sources of pollution can be divided into stationary (and subdivided into particularly large, large, medium-sized and small) and mobile. In particular large, large and medium-sized sources, for which public and industrial energy industry are mostly responsible, are individually monitored as point sources. Public and industrial energy production generates more than 75 % of the total $SO_2$ emissions and more than 40 % of $NO_x$ emissions. The steel industry's share in CO emissions falls just short of 50 %. Chart 4.8 depicts the development of emissions of some selected polluting substances from the manufacturing industry.

The volume of emissions of polluting elements into the air by individual branches of the manufacturing industry depends on several factors. The principal ones are the development of production in the branch, the rate of introduction of modern, low-emission technologies, changes in the fuel base and the amount of funds invested into equipment decreasing emissions (in particular dust and $SO_2$). The employment of the best available techniques (BAT) and considerable investments into eco-technology are the chief factors responsible for the decrease of emissions in the manufacturing industry.

Between 2000 and 2006, a mild increase of characteristic emissions in the industrial sector was recorded e.g. in the chemical, electrical industries, in the restructured steel industry and in the production of mineral non-ferrous products. In the chemical industry, emissions increased in all four main indicators chosen for analysis. In the electrical industry and in the production of mineral non-ferrous products, an increase was recorded for indicators describing $NO_x$ and CO. In metallurgy, the emissions of CO increased.

**Development of emissions of polluting substances from the manufacturing industry [thousands of tonnes]**

**Chart 4.8**

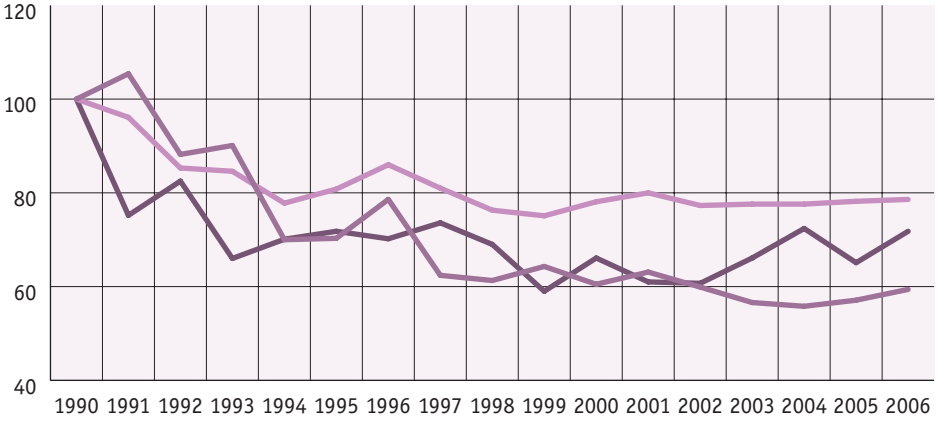



- Solid pollutants
- $SO_2$
- $NO_x$
- CO

*Source: Czech Hydrometeorological Institute*

**Development of carbon dioxide emissions generated in the manufacturing industry [%]**

**Chart 4.9**




1990 = 100

- Total $CO_2$ emissions generated by the combustion of fuels
- Emissions from combustion processes in the manufacturing industry and in construction
- The emission of $CO_2$ from industrial processes

*Source: Czech Statistical Office*

**The emissions of carbon dioxide**

The total emissions (including the decrease in the emission of greenhouse gases) in the Czech Republic expressed by the carbon dioxide equivalent fell from 194.5 million tonnes in the 1990s to 142.3 million tonnes in 2004, where they remained for the following two years, which amounts to 13.9 tonnes of $CO_2$ equivalent per inhabitant. The emission of carbon dioxide itself (not counting the emissions and LULUCF-related decrease) fell from 196.3 million tonnes to 147.2 million tonnes. In relative terms, this is a decrease of 25 % compared to the base year of 1990. The obligations arising from the Kyoto Protocol are thus being fulfilled.

$CO_2$ emissions generated in production of energy fell by more than 20 % compared to 1990, while $CO_2$ emissions generated in production of energy in the manufacturing industry decreased by more than 40 %. A similar decrease took place for $CO_2$ emissions from industrial processes. These trends can be seen in Chart 4.9. The decrease in the first half of the 1990s was due to the slump of industrial production, while changes in the structure of industrial production and changes of technology account for the decrease in later years.

The production and processing of metals followed by chemical production are mostly responsible for $CO_2$ emissions by industrial processes.

The same can be said about $CO_2$ emissions that fall within the scope of the European emissions trading system (the year-to-year index in 2006 reached 1.0145 and the absolute value was 83.7 million tonnes of $CO_2$). The decrease of carbon dioxide emission factors notwithstanding, $CO_2$ emissions have been slowly increasing. Considering the expected growth in industrial production, this trend will probably continue and it will, to a large extent, depend on the steel industry, which has the highest emissions share in the manufacturing industry.

LULUCF stands for Land Use, Land Use Change and Forestry.

The steel industry is very specific in this respect. Two opposite trends clash: The more frequent employment of electric arc furnaces in steel production tends to decrease the emission factor, while the growth of steel production from iron pig, which is accompanied by the more frequent occurrence of processing technological gases, tends to increase it. The emission factor reached by the Czech steel industry is in line with the prevailing EU levels.

## 4.4.2 The discharge of waste water into surface water

In 2006, 2 023.9 million m³ of waste water were discharged into surface water, which is a slight increase compared to the previous year. The downward trend of recent years has thus come to a halt. The share of industry in the volume of discharged waste water was 18.4 % and has been decreasing steadily. Chart 4.10 compares the volume of waste water discharged by the manufacturing industry with other sectors.

A striking rise in the share of waste water discharged into surface water by industry around 2000 was due to the inclusion of heat production into the energy category in 2002 (earlier, heat production was classified as a part of industry). This also led to a relative change of the share of waste water discharged into surface water by industrial plants versus the total water withdrawal.

**The withdrawal of surface water**

The discharge of waste water into surface water is directly related to the withdrawal of water. In 2006, 1 556.9 million m³ were withdrawn from surface sources, which is almost equal to the previous year (1 553.4 million m³). Decreases have been consistently observed in all withdrawal categories for many years. The highest decrease took place in agriculture. Withdrawals for production and the distribution of electricity, gas, steam and hot water have been falling (after a major increase from 2001–2003). Nevertheless, they still account for more than a half of the total withdrawals.

The share of industry in the total withdrawal of surface water had been falling since 2001–2003 (it fell to 21.24 %), but there was a slight temporary increase to 23.04 % in 2005, which was due to the development of industrial production. Chart 4.11 confirms these trends.

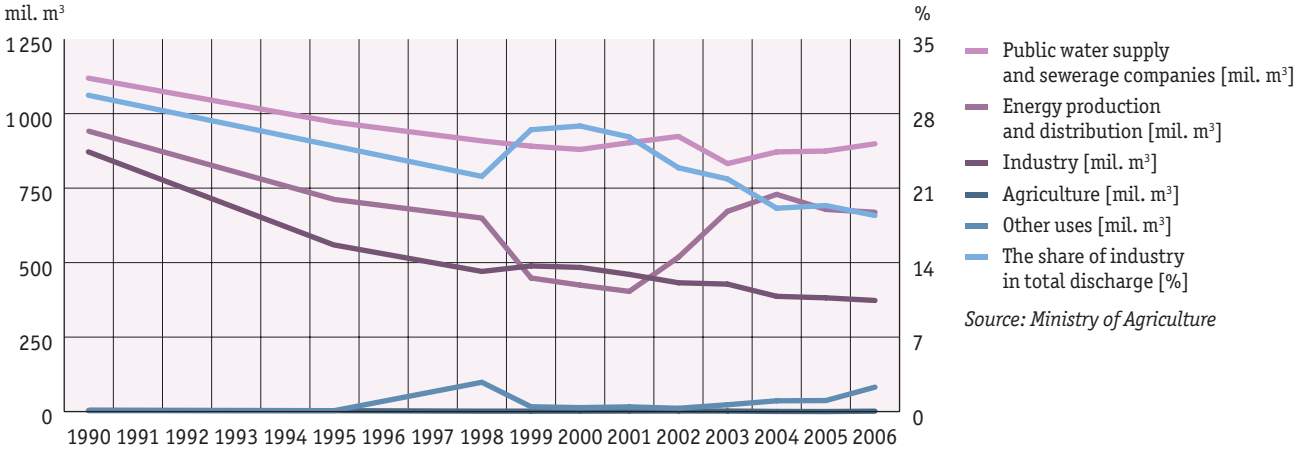
The increase in withdrawals of surface water for energy production between 2001 and 2003 can be explained by the gradual putting into operation of both generating blocks of the Temelín nuclear power plant and by the inclusion of heat production into the energy production category in 2002. The relative change in the share of surface water withdrawal by industry versus the total withdrawal follows along the same lines.

**The withdrawal of underground water by the manufacturing industry**

379.3 million m³ of water were withdrawn from underground sources in 2006, which means a year-to-year decrease by 1.8 % and a continuing slow downward trend of withdrawal. Decreases were recorded in all categories except for agriculture, where withdrawals slightly increased compared to 2005. Withdrawals of underground water for water treatment and distribution decreased by more than 7.1 million m³, which corresponds to a decrease of almost 1.8 %. Withdrawal of underground water for energy production is almost negligible (2.4 million m³, i.e. less than 2 %, see Chart 4.12). The share of industry in the total withdrawal of underground water is more or less stable.

**Volume of waste water discharged by the manufacturing industry in comparison with other sectors.**

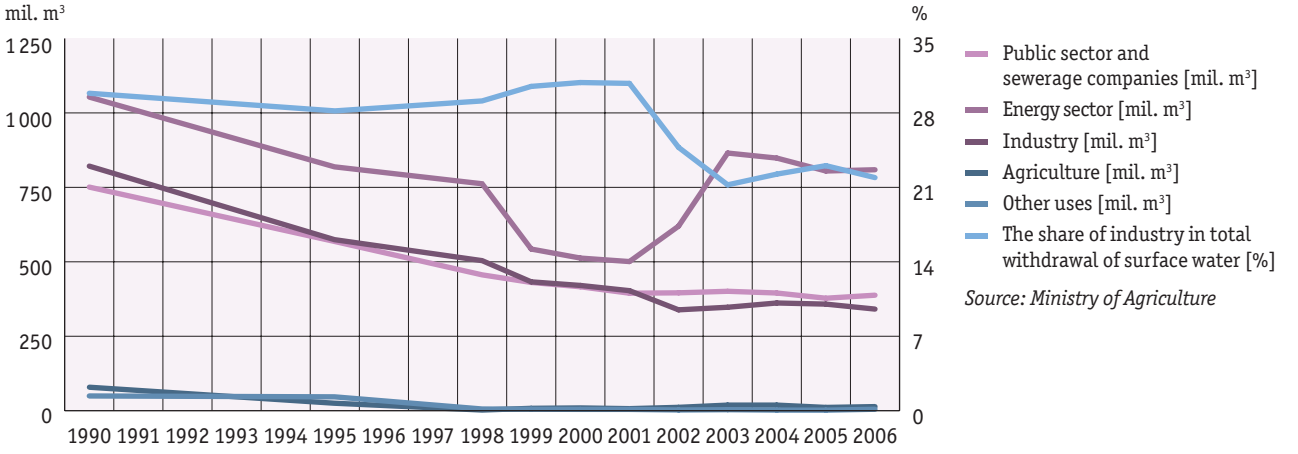
**Chart 4.10**




*Source: Ministry of Agriculture*

**Withdrawal of surface water in the manufacturing industry**

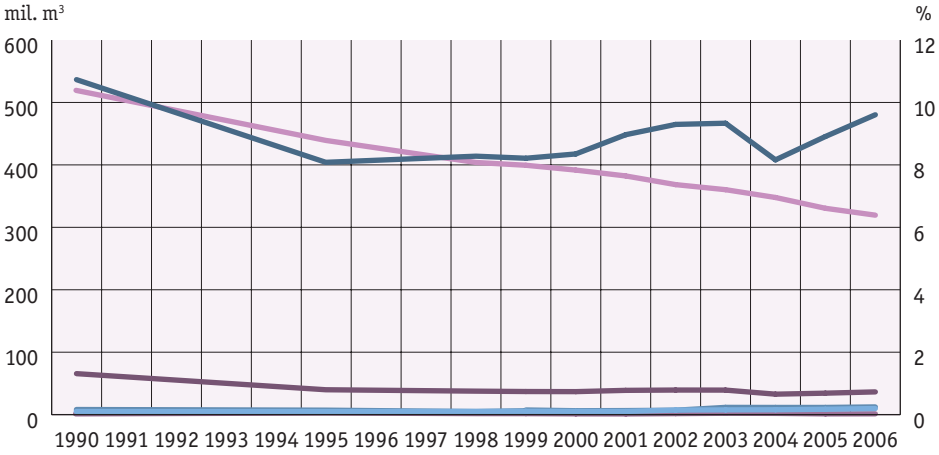
**Chart 4.11**




*Source: Ministry of Agriculture*

**Withdrawal of underground water in the manufacturing industry**

**Chart 4.12**




- Public water supply and sewerage companies [mil. m³]
- Energy production and distribution [mil. m³]
- Industry [mil. m³]
- Agriculture [mil. m³]
- Other uses [mil. m³]
- The share of industry in total withdrawals of underground water[%]

*Source: Ministry of Agriculture*

## 4.4.3 Waste management

Waste management in the Czech Republic is primarily regulated by Act No 106/2005 Sb., as amended. The framework for waste management is laid out in the Waste Management Plan of the Czech Republic for 2003–2012, approved by the government of the Czech Republic. In 1995, 66.3 million tonnes of waste (of all types) was produced. Construction waste, industrial and energy production waste and communal waste are the most significant categories. In 2005, 17.9 million tonnes of all waste was recycled and used as secondary raw materials. A relatively low share of waste is burnt and used for energy purposes. In 2005, 748 500 tonnes of waste were used for energy purposes. The quantity of separately collected re-usable communal waste and the harmful portions of communal waste have been steadily increasing. Chart 4.13 depicts the production of waste in the manufacturing industry.

The share of waste generated by the manufacturing industry versus the total production of waste in the Czech Republic has remained more or less stable and is slightly less than 30 %. The production of waste in the manufacturing industry, however, fell by roughly 50 % between 1998 and 2006. The production of dangerous waste has been falling slowly since 2002 (871 209 t in 2002 compared to 683 459 t in 2006). The largest share of dangerous waste is produced in the chemical and pharmaceutical industry (99 246 tonnes in 2005), the car industry (77 318 tonnes in 2005), the metal processing industry (56 101 tonnes in 2005) and in the processing of secondary raw materials (44 849 tonnes in 2005).

During the period in question, the share of individual branches of the manufacturing industry in total waste production also changed. The share of processing of secondary raw materials is now higher due to the existing character of production and due to development in that field. The share of car production has also risen because of the dynamic growth in the branch. For all branches, however, the volume of waste produced significantly fell. The production of waste compared to the total output is even clearer proof of this decrease.

The consumption of waste as secondary raw materials represents a notable source of materials for the manufacturing industry (see table 4.1).

The methodology of computing data in the "hazardous waste" category was changed between 2000 and 2002. Consequently, data computed before the change in the methodology are not fully comparable with the new data.

**Production of waste in the manufacturing industry (including dangerous waste)**

**Chart 4.13**


- The production of waste in the manufacturing industry [thousands of tonnes]
- The production of harmful waste in the manufacturing industry [thousands of tonnes]
- The share of waste produced by the manufacturing industry [%]
- The share of the harmful waste produced by the manufacturing industry [%]

*Source: Czech Statistical Office*

**Consumption of waste in the form of secondary raw materials, 2006 [t]**

Table 4.1

| | Product name | The quantity of waste used |
|---|---|---|
| The total consumption of waste | | 5 260 628 |
| – waste glass | glass and glass products | 397 954 |
| – waste containing iron | basic metallurgical products from iron and steel | 2 645 028 |
| – waste containing aluminium | aluminium in basic metallurgical shapes | 60 689 |
| – waste containing lead | lead and lead alloys in the basic metallurgical shapes | 30 517 |
| – waste containing copper | copper and copper alloys in basic metallurgical shapes | 10 095 |
| – textile waste | textile fibres and yarns | 7 068 |
| – paper waste | pulp, paper and cardboard | 293 580 |
| – used tyres | cement (usable in energy production) | 47 379 |

*Source: Ministry of Industry and Trade*

## 4.5 Solving the problem of environmental protection in the manufacturing industry

A number of new laws contributed to solving the problem of environmental protection. In addition to laws regulating specific elements of environmental production (in particular Act No 86/2002 Sb. on clean air protection, Act No 254/2001 Sb. on water and Act No 185/2001 Sb. on waste), Act No 76/2002 Sb., on the integrated pollution prevention and the Integrated Pollution Register, are prominent. The results of voluntary tools that appropriately complement legislation (EMS, EMAS and ISO 14001) are also a valuable contribution.

**Voluntary tools** permit the strategy of economic and environmental profit, where economic savings have environmental impacts and vice versa. These activities go beyond the requirements of the binding legal norms.

### 4.5.1 Integrated Pollution Prevention and Control (IPPC)

The primary goal of integrated prevention as defined by relevant laws is the protection of the environment as a whole (so that the transmission of pollution from one element of nature into another is excluded) and the application of best available techniques (BAT).

The total number of Czech facilities that fall under the Act on Integrated Prevention had reached 2 384 by the end of 2007. This is more than had been expected in the previous years. According to the Act on Integrated Prevention, all relevant facilities were supposed to have obtained integrated permission by 30 October 2007 in order to be allowed to operate after that date. The whole IPPC process culminated in 2007. The largest growth in applications for the integrated permission in 2007 was recorded in category 2 of industrial activities – the production and processing of metals (209 applications).

**Integrated pollution prevention control** in the Czech Republic is governed by Act No 76/2002 Sb. on the integrated pollution prevention control, the Integrated Register of Pollution and by the amendment of some laws (the Act on Integrated Prevention). By approving this law, Directive 96/61/EC concerning integrated prevention and control was implemented into Czech legislation.

**Number of facilities going through the process of integrated permission**

Table 4.2

| The category of industrial activity | The number of facilities going through the process as of 31 December 2007 | The number of facilities that entered the process in 2007 |
|---|---|---|
| 1 – energy production and distribution | 274 | 83 |
| 2 – the production and processing of metals | 541 | 209 |
| 3 – the processing of mineral resources | 139 | 40 |
| 4 – the chemical industry | 265 | 68 |
| 5 – waste management | 325 | 101 |
| 6 – other facilities | 804 | 190 |
| Total | 2384 | 691 |

*Source: CENIA*

The process of integrated permission secured the application of the best available techniques (including progressive environmental limits and a reduction of energy intensity) in the relevant facilities.

## 4.5.2. Environmental Management Systems (EMS) in the manufacturing industry

In environmental management, the economic areas of the productive and non-productive sectors employ two voluntary tools – the international ISO 14001 norm and the Eco Management & Audit Scheme (EMAS). The number of ISO 14001 certified companies reached 1 948 in 2007.

The increase in the number of companies that use an EMS system attests to their approach to sustainable development and consumption. At the same time, it sometimes amounts to an indispensable element in evaluating competitiveness. The largest share of companies using an EMS can be found in branches with the most dynamic economic development.

EMAS is a system whereby companies introduce a system of environmentally considerate corporate management and audit systems in line with the requirements of Regulation 761/2001/EC of the European Parliament and of the Council. It makes it possible for companies to monitor environmental impacts of their activities, to reduce the negative impact, to identify weaknesses, to increase the efficiency of organisational activities and competitiveness. It has a twofold benefit for companies, environmental and economic.

Organisations using EMAS employ roughly 18 450 people. An increased growth of registrations was recorded in construction. The EMAS system also expanded into other fields – namely recycling and transport.

**Number of companies using an EMS**

**Table 4.3**

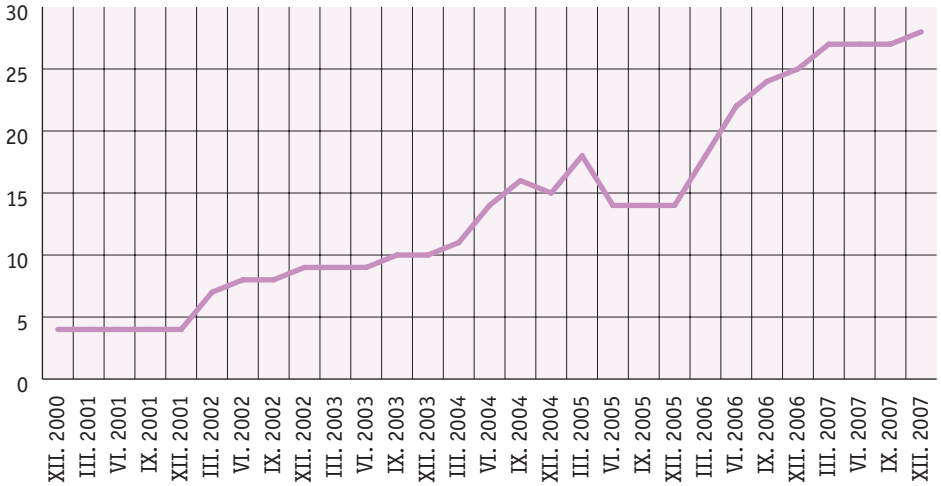
*Source: CENIA*

| The branch of industry | 2003 | 2004 | 2005 |
|---|---|---|---|
| Food and tobacco | 24 | 37 | 55 |
| Textiles and clothing | 11 | 16 | 24 |
| Leather manufacturing | 0 | 1 | 2 |
| Wood processing | 2 | 6 | 13 |
| Paper and printing art | 6 | 17 | 35 |
| Coke production, oil refining | 3 | 3 | 3 |
| Chemical and pharmaceutical industry | 23 | 33 | 53 |
| Rubber and plastic industry | 26 | 50 | 73 |
| Glass, earthenware, china and building materials | 15 | 28 | 43 |
| The production of metal and metal products | 51 | 86 | 145 |
| The production of machinery and equipment | 22 | 43 | 92 |
| The production of electric and optic instruments | 46 | 85 | 149 |
| The production of vehicles | 34 | 45 | 57 |

**Number of companies using EMAS**

**Chart 4.14**

*Source: CENIA*



## 4.6 Investments into environmental protection

Legal norms and environmental agreements on environmental protection also help shape the rules of market behaviour of businesses with respect investment activity. Until 2002, only investments were monitored in the Czech Republic. Non-investment costs of environmental protection have been included in monitoring since 2003.

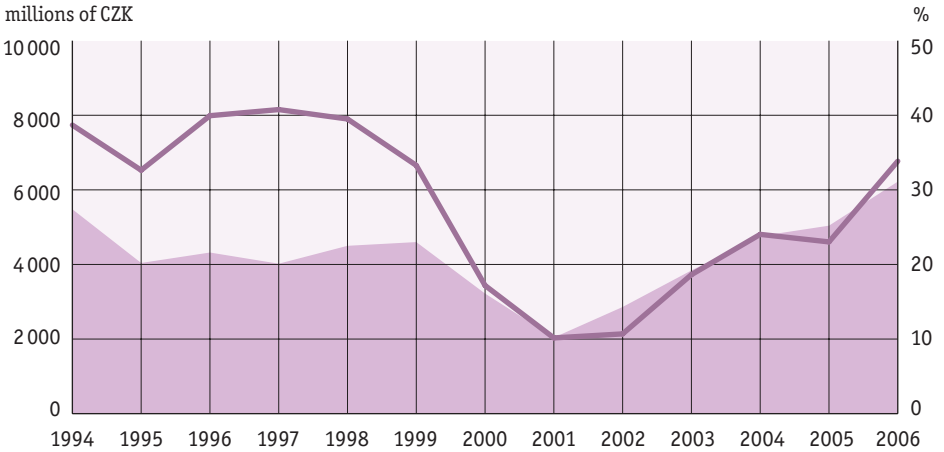
After 1990, the environment-related investment outlays have been rapidly increasing their share in GDP – from 1.1 % in 1990 to 2.5 % in 1994. The share of environment-related expenses in GDP oscillated around the latter percentage until 1997. After that, it plunged and has been around 0.7% ever since 2003. From the perspective of individual branches, the share of environment-related investment expenses in the gross value added of the chemical and pharmaceutical industry was 3.0 % in 1995, 4.9 % in 2000 and 2.4 % in 2005. In paper production, the indicator reached 3.0 % in 1995.

The share of environment-related investments made by the manufacturing industry versus the total environment-related investment in the Czech Republic is lower than the manufacturing industry's share of gross value added versus the total Czech gross value added. The upward trend of investments made since 2001 has been accompanying the dynamic development of the manufacturing industry in recent years.

The amount of environment-related investments in individual branches of the manufacturing industry is determined by the legislation, the type of technology used and by financial circumstances. Accordingly, the highest percentages (data as of 2006) are observed in the chemical and pharmaceutical industry (40.3 %), in coke production and oil refining (12.9 %) and in the production of metals and metal products (12.8 %). Due to its dynamic development, the car industry is chiefly responsible for the figure reached by vehicle production (6.1 %).

**Share of environment-related investment expenses in the manufacturing industry and the investments made**

**Chart 4.15**




The share of environment-related investments in the manufacturing industry versus the total environment-related investment [%]

Environment-related investments made in the manufacturing industry [millions of CZK]

*Source: Czech Statistical Office, Ministry of Industry and Trade*

**Break-up of environment-related investment according to branches, 2006 [%]**

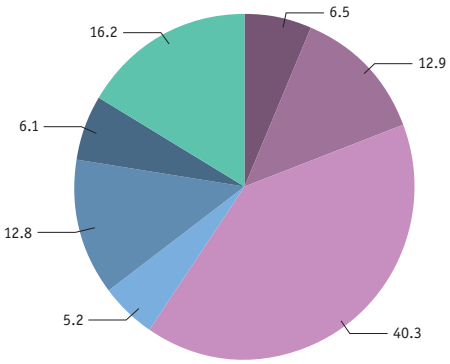



**Chart 4.16**

- The food industry
- Coke production, oil refining
- The chemical and pharmaceutical industry
- Glass, earthenware, china and building materials
- The production of metal and metal products
- The production of vehicles
- Other branches of the manufacturing industry

*Source: Czech Statistical Office, Ministry of Industry and Trade*

# 5

# Construction

Construction is one of the most significant manufacturing sectors in our national economy. It is related to the development of many other branches of industry, trade and services and influences the appearance of towns, municipalities and the landscape. After 1990, because of the transformation of the economy, a significant real decrease in building operations occurred. The positive development of the national economy from 1994 to 1996 and the investment related to it helped to revitalise the sector. After a period of decline from 1997 to 1999, construction has been constantly on the rise, with minor fluctuations. Between 1992 and 2007, the increase in the volume of construction work in current prices reached CZK 245 billion (i.e. a growth of 323%).

An assessment of the environmental impact of construction must be, in compliance with EN ISO 14040, comprehensive, and must include the entire life cycle of materials (from extracting raw materials through the production of construction materials and structures, construction, use, as well as demolition and waste disposal). Negative environmental impacts from the building industry are assessed from the material (consumption of natural non-renewable resources, the production of building waste), energy (energy consumption during raw material extraction, the production of structural materials and construction work) and emission points of view.

In connection with the requirement to ensure sustainable development, changes in the construction industry's approach to drawing resources and regulating harmful emissions and waste are necessary. Therefore, the ultimate goal is to eliminate negative impacts, e.g. by means of using recyclable and renewable materials, decreasing heating costs through the use of high-quality heat cladding, modernisation and renovation. During the construction and modernisation of buildings, the standards establishing energy consumption in the new buildings are gradually being tightened in order to achieve the lowest possible energy usage during the operation of the buildings.

## 5.1 The position and role of the construction

Changes in the volume of construction production are connected with changes in the creation of gross domestic product (GDP). The share of construction in creating gross value added has been constantly decreasing, from 9.8 % in 1996 to 5.5 % in 2006. However, the sector shows long-term stabilised employment at about 9 % of the population. In addition, their average gross wage has been increasing, though more slowly than the average for the entire national economy, and the absolute wage level has been under the national average since 2000 (e.g. in 2004, it was 95 % of the average wage). The construction of buildings is an essential part of the gross fixed capital, the creation of which is one of the growth factors attesting to the efficiency of the entire economy and its dynamics are an indicator of the boom state of the national economy.

In 2007, the costs for construction projects returned by construction companies amounted to CZK 511 billion and the decisive enterprise base (data only as of 2006) was formed by 2 482 companies with 20 and more employees, which performed the construction projects amounting to CZK 321 billion. Between 1992 and 2006, based on the size of the companies, the highest increase in the volume of construction projects (by 687 %) occurred within companies with up to 299 employees. On the other hand, for medium-sized enterprises with 300 to 999 employees, the volume of construction projects increased by only 57 %.

Over the last ten years, the volume of deliveries for the construction of motorways, roads and modernisation of railway corridors (on the year-to-year basis from about 9 % to as much as 46 % in current prices), for building projects and civil engineering works and for finishing works were have grown the most rapidly. State housing aid in the form of savings for building purposes, mortgage loans and the reduced 5 % VAT rate for housing construction have contributed to the growth of residential construction.

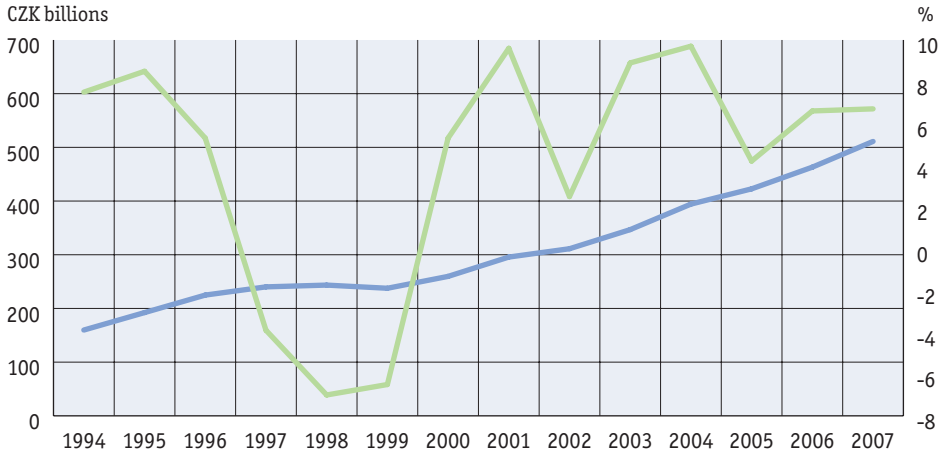
In connection with the Czech Republic's EU accession, the VAT Act was amended, which increased the rate from 5% to 19% for a chosen assortment of products and construction projects (except for housing construction, where the VAT rate of 5 % was valid until 31 December 2007). These alterations significantly influenced the returned data on building operations between 2003 and 2004, when the construction sector saw unusual growth, and the subsequent slight fall in 2005.

The basic legal regulation is Act No 183/2006 Sb., on territorial planning and the building code (the Building Act), which became effective on 1 January 2007. It had been preceded by Act No 50/1976 Sb., on territorial planning and the building code, as amended, implementing Decrees No 132/1998 Sb. (as amended by Decree No 492/2002 Sb.), No 137/1998 Sb. and No 135/2001 Sb. (as amended by Decree No 570/2002 Sb.) and Decree No 369/2001 Sb.

**Construction projects** are the projects in the construction, modernisation, expansion, renewal, repair and maintenance of permanent and temporary buildings both in this country and abroad. They also include assembly works of building structures and the value of built-in material and structures. The data on the volume of construction projects based on the size of groups may be distorted by the high number of hired and often unregistered workers from abroad and also by activities of self-employed people.

**Development of total building operations**

**Chart 5.1**

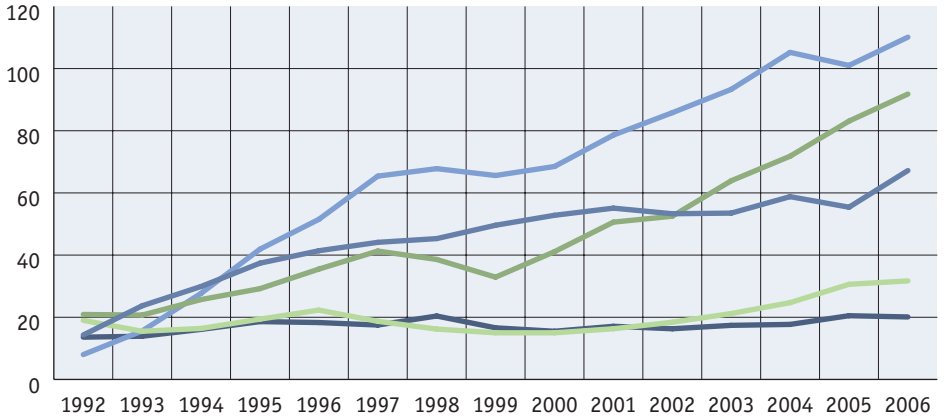



Total construction projects [CZK billions, current prices]
The growth rate of construction production [%, constant prices]

*Source: Czech Statistical Office*

**Volume of construction works according to size groups of companies [CZK billions, current prices]**

**Chart 5.2**

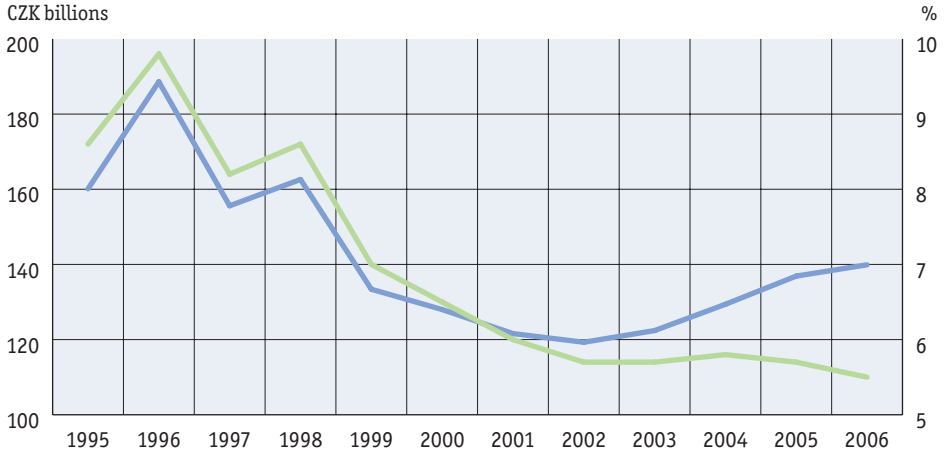



20–99 employees
100–299 employees
300–499 employees
500–999 employees
1000 and more employees

*Source: Czech Statistical Office, Ministry of Industry and Trade*

**Development of volume and share of gross value added in construction (prices of 2000)**

**Chart 5.3**




Construction [CZK billions]
Share of construction in total value added [%]

*Source: Czech Statistical Office*

The highest share of growth over the last ten years has been seen in civil engineering projects (motorway construction, modernising railway corridors, town by-pass roads), additional construction of non-residential buildings and housing construction. On the contrary, the lowest share is seen in the construction and maintenance of water-management works.

The development of the volume of construction projects may also be looked at based on the number of building permits issued by the building authorities between 1995 and 2005, as shown in Chart 5.2. Though the number of issued building permits has decreased, the value of permitted construction has increased. Thus, the value of construction work falling under one building permit has been significantly increasing, namely most often for the adaptation of already completed residential and non-residential buildings. Between 1992 and 2005, the largest amount of the building permits was issued in the Central Bohemia Region (247 452), followed by the South Moravian Region (207 067) and in the Moravian-Silesian Region (159 557). On the contrary, the fewest were issued in the Karlovy Vary Region (44 032). According to the number of building permits per capita, the highest intensity was in the Central Bohemian Region, the Pilsen Region and the South Moravian Region, the lowest in the Ústí Region, in the Moravian-Silesian Region and in Prague.

In the 2nd half of the 1990's a slight decrease in the number of construction workers occurred, namely due to the influence of changes in technological procedures, the restructuring of companies and labour productivity growth and an economic recession. In recent years, the number has increased again and in 2006 it reached 436 000 workers (9 % of the total employment in the Czech Republic), of which 162 000 people were in companies with more than 20 employees. Most workers were employed in the construction of buildings and civil engineering works (132 061 employees, i.e. 82 %) and in medium-sized enterprises (with 50–299 employees). In terms of employment, the construction situation in the Czech Republic is comparable e.g. to Italy, Portugal, Germany or Austria.

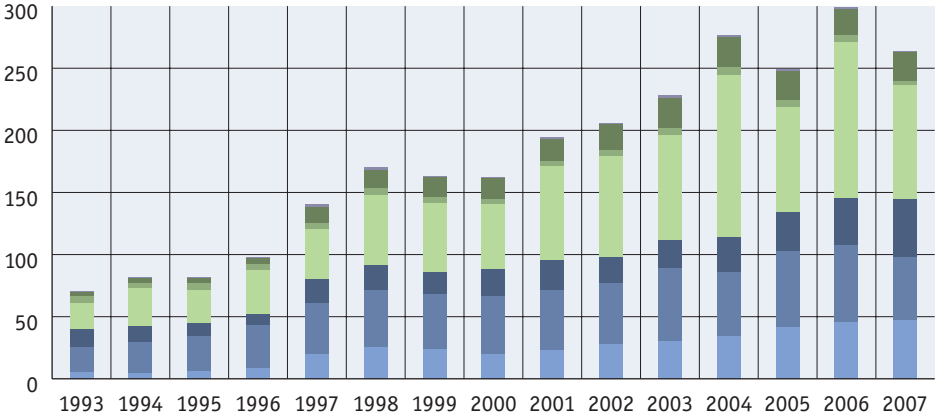
From 1992 to 2006, labour productivity in construction fluctuated. In 1992, it almost did not differ in construction companies of various sizes. In 2006, it increased in companies with more than 1 000 employees by more than 12 times, while in the smallest companies it was only by 191 %. Due to the different capital base, employees in the largest companies are 3.5 times more productive than those in small companies.

**The construction companies** that have their registered offices in the Czech Republic since 1997 include: a) construction companies with 20 and more employees (the data are taken from the statements of the Czech Statistical Office); b) construction companies with less than 20 employees and entities with a trade licence (a monthly estimation of construction projects is carried out). Generally, the growth rate of construction production mimics development (Chart 5.1), the fall from 1997 to 1999 was caused by overall trends in the economy.

**A building permit** is a document that stipulates binding conditions for the execution and use of a building, with a period of validity of 2 years from the date of issuance.

**Construction contracts [CZK billions, current prices]**

**Chart 5.4**

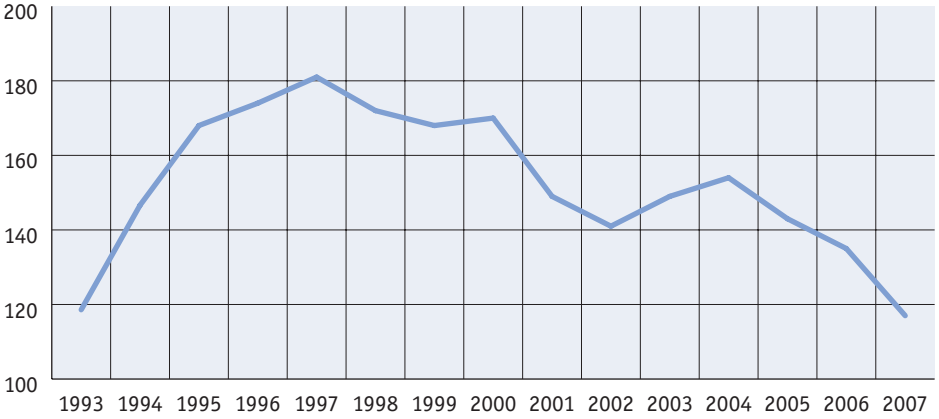



*Source: Czech Statistical Office*

According to classification of types of constructions.

**Issued building permits [thousand pieces]**

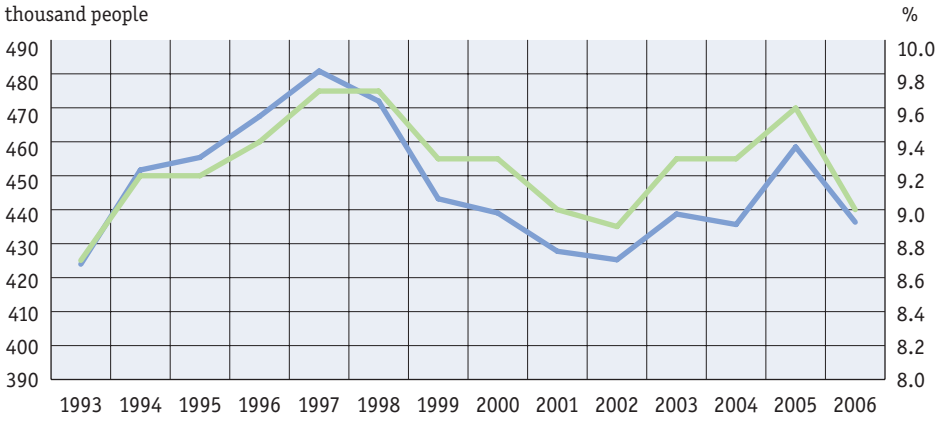
**Chart 5.5**




*Source: Czech Statistical Office*

**Employment in construction**

Chart 5.6



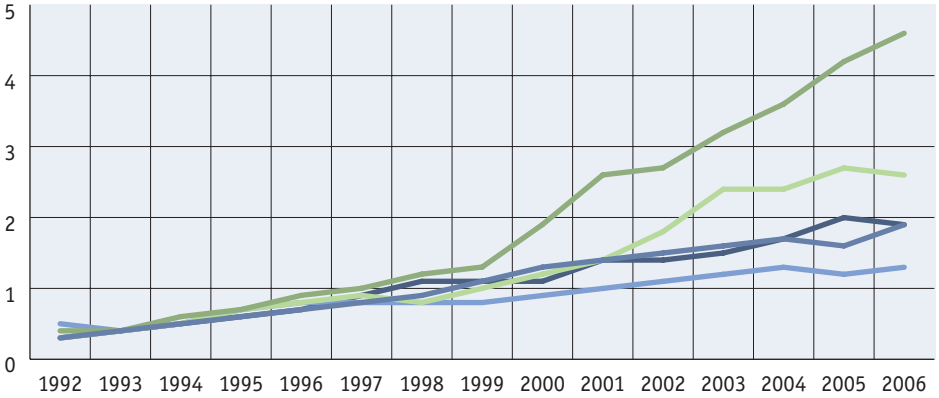

The number of people employed in construction [thousand people]

The share of construction employees versus total employment [%]

*Source: Czech Statistical Office*

**Productivity of labour in the construction sector according to size groups [CZK millions/employee]**

Chart 5.7




20–99 employees

100–299 employees

300–499 employees

500–999 employees

1 000 and more employees

*Source: Czech Statistical Office, Ministry of Industry and Trade*

## 5.2 Environmental influence of construction

The principal environmental aspects of construction are the acquisition of land, extraction of construction raw materials, building waste and the operation of buildings (energy consumption). The operation of buildings is energy-intensive and negatively influences air quality from the emission of pollutants arising from fossil fuel combustion. For this reason, energy savings in the operation of buildings (e.g. the reduction of energy losses by heat cladding, improvement in the quality of windows, the efficient regulation of heating systems, warm water preparation and distribution) are one of the ways to decrease the emissions of pollutants into the air, which is defined in the State Emission Reduction Programme in the Czech Republic.

The construction and modernisation of transport works leads to changes in the landscape, the aesthetic quality of the territory, disturbs environmental stability of the territory and valuable natural elements (territorial systems of environmental stability, nature reserves and natural parks). Traffic influences fauna and flora through irreversible landscape fragmentation, and thus interruption of migration routes occurs. In this respect, road transport has the greatest negative influence, mainly due to the emission of pollutants into the air, the acquisition of land (it is involved in nearly 86% of the total acquisition of land by transport infrastructure) and high noise levels.

A significant indirect environmental influence of building operations is the extraction of mineral resources. This is similar to trends in the construction sector over the observed period. The chapter devoted to the raw material extraction deals with this in greater detail.

One of the possibilities of how to influence the negative environmental impact of construction is to choose, as early as the design stage, suitable materials, technologies, technical equipment and structural systems. A suitable construction design and its insertion in the landscape, the sensitive choice of materials and colour matching, proper construction techniques and other factors may limit the disturbance of the landscape character, territorial fragmentation, influences on the water regime, aerial dispersion conditions and the related emission and acoustic pressure levels. During the final evaluation of a building's life cycle, it is possible to achieve, if all requirements are met, the certification of a building from an environmental friendliness perspective.

In addition, Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings, deals with the influence of reducing the energy performance of buildings on the environment, and it was transposed into the amendment of Act No 406/2000 Sb., on energy management, effective 1 July 2006, and into the related decrees.

Environmental aspects are also covered by Directive 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products.

**Specific environmental parameters of building structures**

**Table 5.1**

| Parameter | Unit | Steel structure | Brick masonry | Wooden structure |
|---|---|---|---|---|
| Energy consumption | MJ/kg | 30.0 | 6.0 | 4.0 |
| $CO_2$ emissions | t/m³ | 20.0 | 0.8 | 0.2 |
| $SO_2$ emissions | g/kg | 1.8 | 1.0 | 0.0 |
| Solid pollutant emissions | g/kg | 5.0 | 0.5 | 0.0 |
| Water consumption | m³/t | 55.0 | 0.8 | 0.0 |

*Source: prof. Ing. Pytlík Petr, CSc., Ekologie ve stavebnictví, 1997*

Residential buildings, such as family houses and blocks of flats, are distinguished according to the type of bearing structure, such as prefabricated, walled, wooden or other types of materials used (including combinations). According to Table 5.1 that describes specific environmental parameters of the most often used building structures, most energy and water are consumed for steel production, which is, at the same time, the largest $CO_2$, $SO_2$ and solid pollutant emission producer. From an assessment of material bearing capacity, most energy is consumed for the production of bricks (1 470 $MJ.m^{-3}.MPa^{-1}$). On the contrary, the processing of recyclable wood consumes material and energy resources only to a very small extent.

## 5.2.1 Impact assessment process of projects and concepts

The environmental impact assessment process of projects and concepts (EIA) and the strategic environmental assessment (SEA) is based on a systematic examination and assessment of their potential environmental impacts. The purpose is to comprehensively determine, describe and assess the expected impacts of projects or concepts being prepared on the environment and public health. The aim of the process is to mitigate adverse environmental impacts from the implementation of a project or concept being assessed.

EIA process results serve as an expert basis for the subsequent decision-making processes on permitting a project and without this basis, a permit may not be issued. The EIA process for projects defined by law always takes place before the projects are permitted and before they can begin.

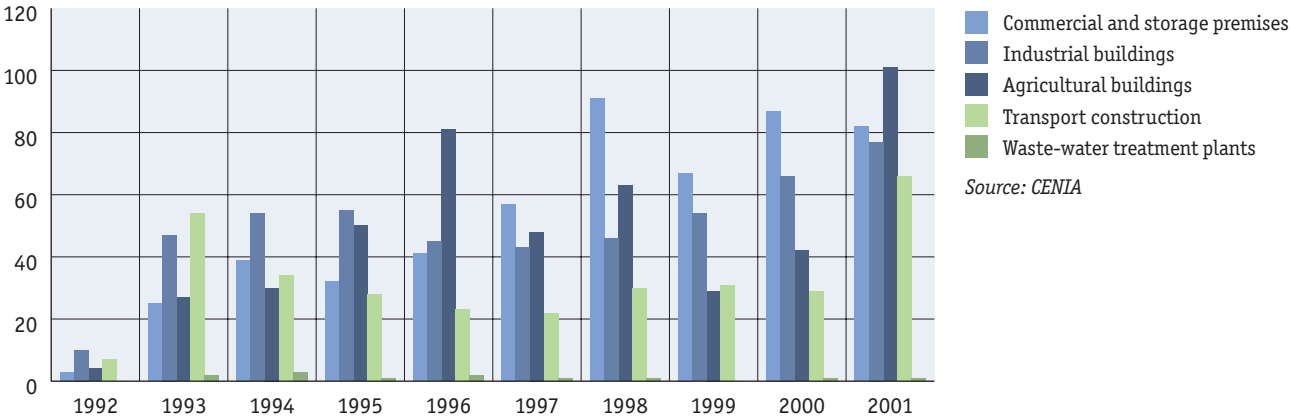
The environmental impact assessment process has its original legislative basis in Act No 244/1992 Sb., on environmental impact assessment.

On 1 January 2002, the Act was replaced with respect to the part on the impact assessment of projects (EIA) by Act No 100/2001 Sb., on environmental impact assessment and on amendments to some related acts, and further by an amendment that came into force on 1 May 2004; the impact assessment of concepts is also regulated by it (SEA).

On 27 April 2006, amendment to Act No 100/2001 Sb., as amended by Act No 93/2004 Sb., occurred by Act No 163/2006 Sb. Among others, the Act takes "sub-limit projects"(i.e. smaller ones) into account, which account for the most common type of project. Since 22 August 2007, the Act has been amended by Act No 216/2007 Sb., in which the assessment of "sub-limit projects" is regulated. Hence, the administrative burden of the assessment of these projects has been reduced.

**Number of projects assessed in 1992–2001 according to individual branches of construction**

**Chart 5.8**




*Source: CENIA*

The types of projects subject to the EIA process are mentioned in Annex No 1 to the Act and include the following: industrial buildings, operating premises, transport construction, energy facilities, agricultural buildings, commercial and storage complexes, the extraction of minerals, sport and recreational facilities.

Under Act No 244/1992 Sb., 2 498 projects were assessed in 1992–2001. From 1992 to 2001, 2 291 opinions were issued, of which 52 were dissenting. The dissenting opinions concerned mostly extraction, incineration plats, landfills, several commercial complexes and agricultural buildings.

Since 1 January 2002, a new act on environmental impact assessment has come into force. It has reacted to the requirements of the implementation of European Community directives. In this respect it has broadened the range of projects assessed, and thus also of the number of projects announced.

Between 2002 and 2007, 7 838 projects were assessed, including sub-limit projects, the assessment of which was introduced by an amendment to the Act in 2006 (since 27 April 2006). 2 187 sub-limit projects were assessed. Due to the necessity to simplify the assessment of the sub-limit projects, the Act was amended again in 2007 (on 22 August 2007). The assessment has been simplified in such a way that on the basis of a simplified announcement, the competent regional authority issues a notice if a project is subject to proceedings. From 2002–2007, 496 opinions were issued, of which 20 were dissenting. The dissenting opinions mainly concerned construction of wind power stations and additional extraction.

The area of towns (and generally, developed areas) grew between 1989 and 2001, and after a short-term decline around 2005, it began to grow again as seen in Chart 5.10. Regarding regional distribution (see Table 5.2), the highest share of developed area (according to the situation in 2007) is in Prague (10 %), then in the Moravian-Silesian Region (2.2 %), in the South Moravian Region (2 %) and in the Central Bohemian Region (1.9 %). On the contrary, the lowest share of developed area (1 %) is in the Karlovy Vary Region and the South Bohemian Region.

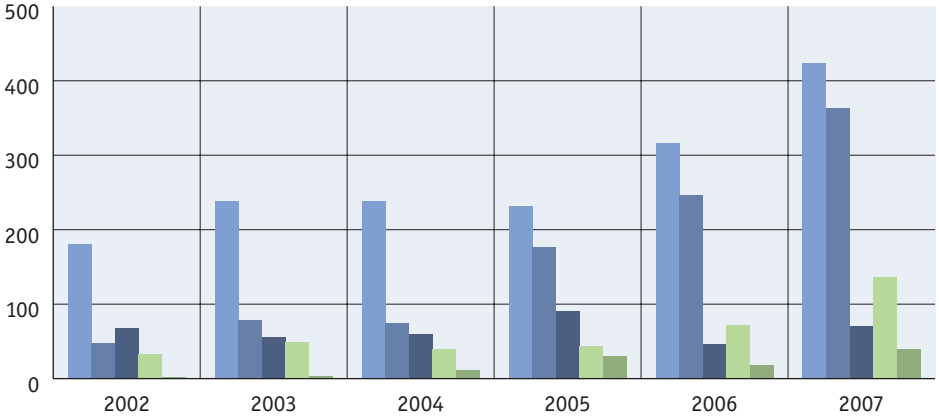
The acquisition of agricultural land resources and wooded areas by road infrastructure has been increasing since 2000, however since 2004 it has decreased year-to-year as seen in Chart 5.11.

Towns have a specific climate, referred to as the urban heat island. It is characterised by higher temperatures; their difference may amount to around 1°C of the annual average, under especially favourable conditions. In summer months in evening hours, the immediate temperature difference may amount to more than 5 °C. This is a consequence of buildings' operation (heat losses in winter period) and different thermal characteristics of artificial surfaces (in summer period). In addition, it is necessary to pay attention to the town design of urban areas, which may considerably affect the airflow in developed spaces.

It is possible to limit landscape fragmentation by the efficient use of existing transportation capacities and routes, combining transportation types, coordination during the construction of transport infrastructure and assessing the landscape from the environmental and nature preservation perspectives. However, these possibilities are not universally considered in the Czech Republic's transport policy.

**Number of projects assessed in 2002–2007 according to individual branches of construction**

**Chart 5.9**

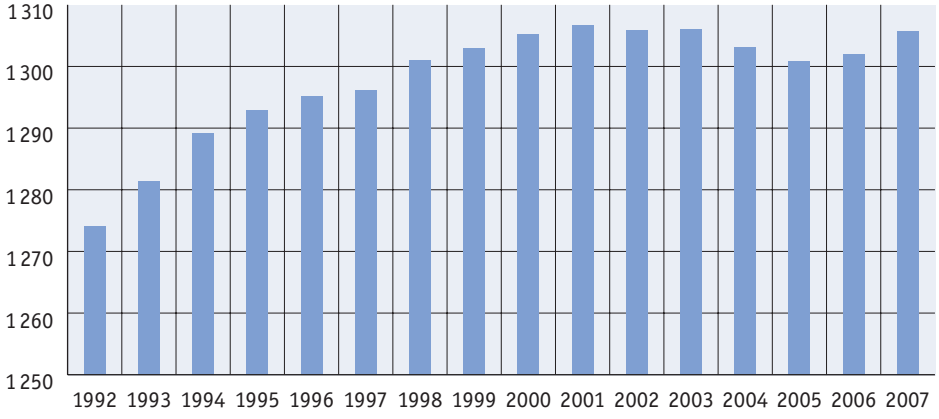



*Source: CENIA*

Sub-limit projects are not included here.

**Developed areas in the Czech Republic as of 31 December for 1992–2007 [km²]**

**Chart 5.10**




*Source: Czech Office for Surveying, Mapping and Cadastre, Statistical Yearbook of the Land Fund*

**Developed areas in individual regions [ha] and share in the total land fund area, 2007**

**Table 5.2**

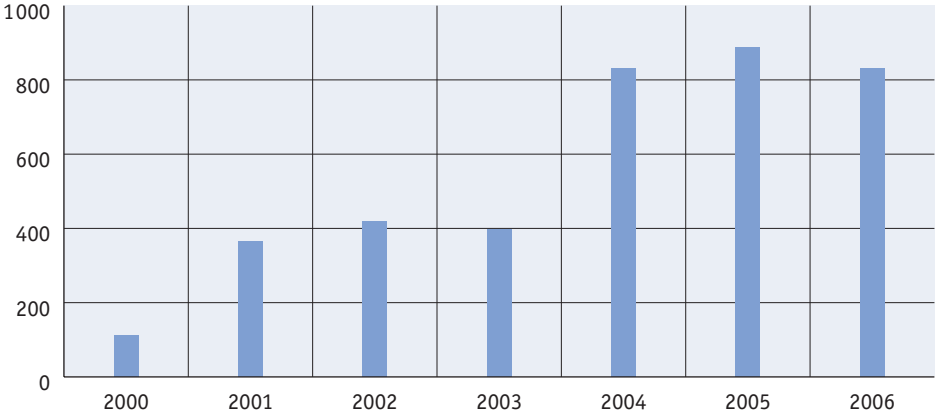
*Source: Czech Office for Surveying, Mapping and Cadastre, Statistical Yearbook of the Land Fund*

| Region | Developed area [km²] | Area [km²] | Developed area [%] |
|---|---|---|---|
| Prague | 49.6 | 496 | 10.0 |
| Central Bohemia | 211.6 | 11 015 | 1.9 |
| South Bohemia | 105.5 | 10 057 | 1.0 |
| Pilsen | 97.3 | 7 561 | 1.3 |
| Karlovy Vary | 32.1 | 3 315 | 1.0 |
| Ústí | 91.5 | 5 335 | 1.7 |
| Liberec | 52.3 | 3 163 | 1.7 |
| Hradec Králové | 92.5 | 4 758 | 1.9 |
| Pardubice | 72.2 | 4 519 | 1.6 |
| Vysočina | 85.0 | 6 796 | 1.3 |
| South Moravian | 141.5 | 7 196 | 2.0 |
| Olomouc | 82.7 | 5 267 | 1.6 |
| Zlín | 72.2 | 3 964 | 1.8 |
| Moravian -Silesian | 119.9 | 5 427 | 2.2 |
| **Czech Republic total** | **1 305.7** | **78 867** | **1.7** |

**Total acquisition of land by road infrastructure [ha]**

**Chart 5.11**

*Source: Road and Motorway Directorate (ŘSD)*



## 5.3 The energy performance of buildings and the waste from construction

The operation of buildings is energy-intensive, not only from the viewpoint of energy consumption for heating, but also for ventilation, cooling, illumination and water heating, which means an environmental burden with pollutants arising during energy production. For this reason (and also for economic reasons), there is the ever-increasing endeavour to reduce the energy performance of buildings by using heat cladding, improving the quality of windows and the efficient regulation of heating systems, water heating and distribution. The construction of low-energy houses (energy consumption for heating up to 50 kWh/m$^2$/year) and of passive houses (energy consumption for heating up to 15 kWh/m$^2$/year) that make use of renewable energy sources to a greater extent, have a healthy internal environment because of controlled ventilation and waste heat recuperation and lower energy performance due to excellent heat insulation is an environmentally friendly solution. Building compact buildings and orienting the glazed areas to the south are stressed. A comparison of the energy performance of individual types of buildings is seen in Table 5.3.

The level of energy performance in buildings is assessed by an energy audit. The duty to conduct an energy audit for buildings and energy economy is regulated by Act No 406/2000 Sb., on energy management, as amended by subsequent regulations. The energy consumption levels, from which it is obligatory to perform the energy audit, are defined by Decree No 213/2001 Sb., on details of energy audit requisites, as amended by Decree No 425/2004 Sb., on energy audit requisites. The energy audits are component parts of applications for aid from the State Programme of the Ministry of the Environment, the Ministry of Industry and Trade and others.

Within the framework of the State Programme of the Ministry of Industry and Trade to support energy savings and use renewable energy sources, subsidies amounting to approximately CZK 50 million were allocated to conduct energy audits for schools, hospitals, blocks of flats and civic amenity facilities (Chart 5.12) in 2001–2005. The implementation of the recommended measures brings an energy savings of approximately 5.5 million GJ/year, and in connection with it, reduced pollutant emissions into the air.

Construction and the industrial production are the largest waste producers in the Czech Republic. Waste from the production of building materials, construction and demolition accounted for approximately 30 % of all waste produced in 2004.

From 2002 to 2006, the production of solid building waste increased (see Chart 5.13) and at the same time the share of building and demolition waste in total waste volume grew. On the basis of the objectives of the EU Sixth Action Programme and the State Raw Material Policy in the area of mineral resources from 1999, it is necessary to increase the share of recycling of building waste and utilise it. The recycling of building waste where it occurs brings, in addition to raw material and energy savings, a decrease in the demand for transport needs and the additional dust, pollutant emissions and noise burdens connected with them.

The legal regulations concerning energy savings for use in buildings are Act No 406/2000 Sb., on energy management, which transposes Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings and Decree of the Ministry of Industry and Trade No 148/2007 Sb., on the energy performance of buildings. This Decree is binding for the construction and modification of buildings. Details for fulfilling the requirements for the energy performance of buildings, calculating its assessment and content of the proof of energy performance containing a summary of all requested indicators and, in particular the class of energy performance of the building are contained in the Decree. A component part of the data are also proposals of measures that would lead to a reduction of the total energy performance of a building and thus help reach a better evaluation class.

**Energy consumption, $CO_2$ equivalent emissions and operational costs of various types of buildings**

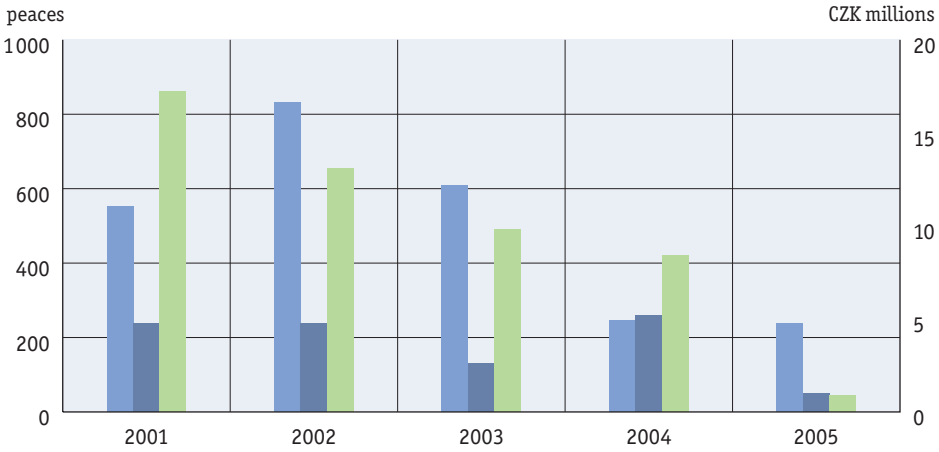
**Table 5.3**

| | Old house | Contemporary house | Low-energy house | Passive house |
|---|---|---|---|---|
| Energy consumption for heating [MWh/year] | 24 | 10 | 4.5 | 1.8 |
| $CO_2$ equivalent emissions [tonne/year] | 8.1 | 3.4 | 1.5 | 0.8 |
| Operational costs for heating | 21 600 | 9 000 | 4 100 | 2 500 |

*Source: Passive Houses, Ing. Martin Vonka, Ph.D.*

## Energy Audit

**Chart 5.12**

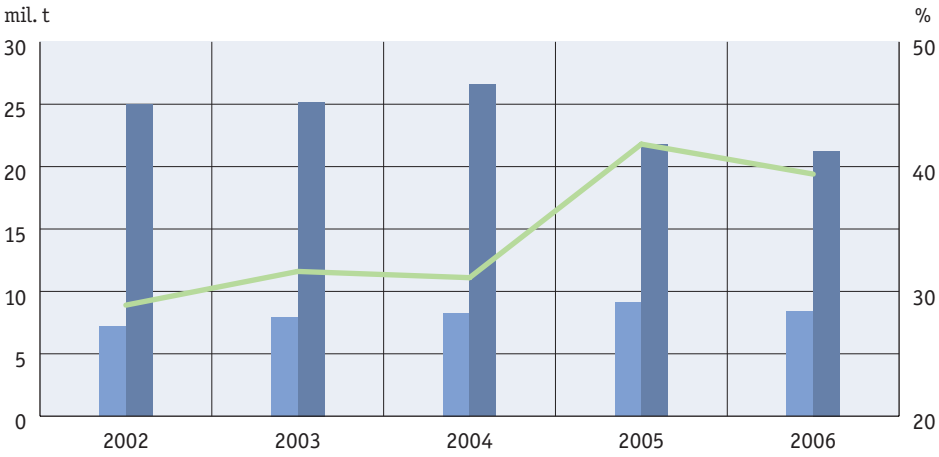



The number of audits performed [pieces]
The total number of applications submitted [pieces]
Subsidies of the Ministry of Industry and Trade [CZK millions]

*Source: Czech Energy Agency*

## Annual production of waste from construction

**Chart 5.13**



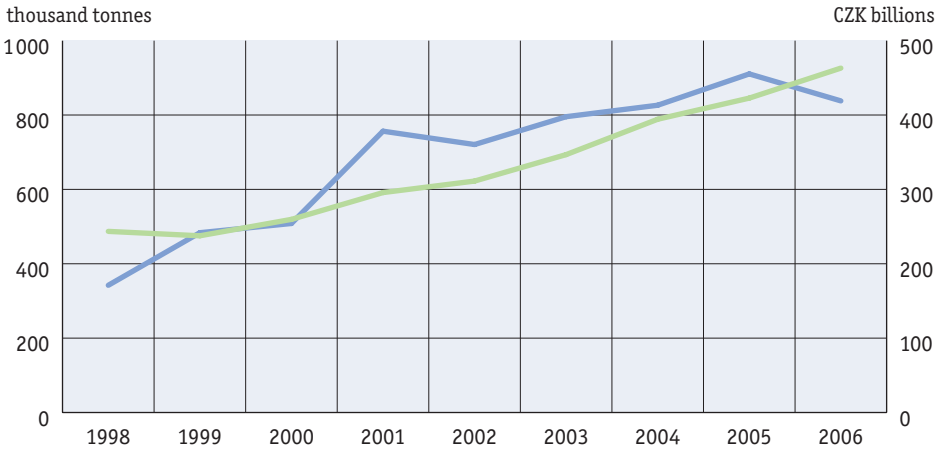

Production of waste from construction [mil. t]
Total production of waste in the Czech Republic [mil. t]
Share of the production of construction waste versus all wasted production in the Czech Republic [%]

*Source: Czech Statistical Office*

In 2002, **Act No 185/2001 Sb., on waste** came into force that, among others, reduces the list of dangerous wastes and shifts some of them into the category other waste. Under these circumstances, the methodological instruction for calculation has not been changed, and therefore, the reported amount of waste decreased between 2001 and 2002.

## Development of construction production and building waste

**Chart 5.14**




Building waste (thousand tonnes)
Total construction projects [CZK billions, current prices]

*Source: Eurostat, Czech Statistical Office*

# 6

# Transportation

From 1989 to 2006, transportation in the Czech Republic was changing ever closer towards resembling the situation in Western European countries. The steady increase in passenger transportation volume was mainly due to a dynamic growth in both air and passenger automobile transportation. While the total volume of freight transportation has grown little since 1989, both the structure of transported goods and freight transportation have changed considerably. Industrial restructuring, along with the subsequent reduction in the demand for bulk transportation (e.g. coal, iron ore) and the concurrent increase in the demand for more flexible and faster road transportation, have led to a freight transportation shift from rail and ship to the road. By 2006, road freight transportation volume had more than tripled compared to the 1989 levels.

Due to the development in both the passenger and freight transportation structure, the negative environmental effects of transportation increased, in contrast to most other economic sectors, even though the specific energy and emission intensity of transportation decreased as a result of technological advances and a more effective application of environmental measures. As pollution from large industrial sources decreased, transportation in many respects gradually became the decisive factor in air quality. In 2006, transportation was the largest producer of both carbon monoxide and nitrogen oxides and the second largest producer of dust particles (the first being small sources, particularly household heating). It significantly contributes to low level ozone precursor emissions, it emits mutagenous and carcinogenic polycyclic aromatic hydrocarbons (PAH) and volatile organic compounds (VOC) into the air. The share of greenhouse gas emissions caused by motorised transportation modes keeps rising. Road transportation, through its growing land-related demands on transportation infrastructure, adversely affects the structure and the function of the landscape – this mainly includes the use of land and the fragmentation of biotopes and ecological corridors, which also brings about the risk of biodiversity loss. Last but not least, it is a source of noise pollution that has a detrimental effect on human health.

What is the solution to the environmental problems of transportation? Such solutions are undoubtedly very complicated, especially with respect to the implementation of proposed measures. The problem is that environmental and economic interests are usually conflict. The task presently at hand is to devise a new concept for further transportation development that is environmentally friendly and, at the same time, has no significant negative impacts on the population's standard of living (e.g. a worse availability of transportation) and on the national economy in general.

## 6.1 Development of the sector and its socio-economic context

### 6.1.1 Passenger transportation

Between 1989 and 2006, the development of transportation in the Czech Republic reflected both the economic development of the country and societal changes (as well as other socio-economic changes) and progressed in line with EU trends. Throughout this period, the total passenger transportation volume increased by 33 % (from 82 267 million pkm to 109 792 million pkm). The largest absolute increase took place in individual automobile transportation (IAT) – by 83 % to 69.63 billion pkm, while air transportation was the most dynamically developing (by 290 % to 10.23 billion pkm). By contrast, transportation performance decreased for passenger rail transportation (by 52 % to 6.92 billion pkm), public bus transportation (by 23 % to 9.5 billion pkm) and public transportation in cities (CPT) – by 14 % to 13.5 billion pkm. Passenger transportation performance development is shown in Chart 6.1.

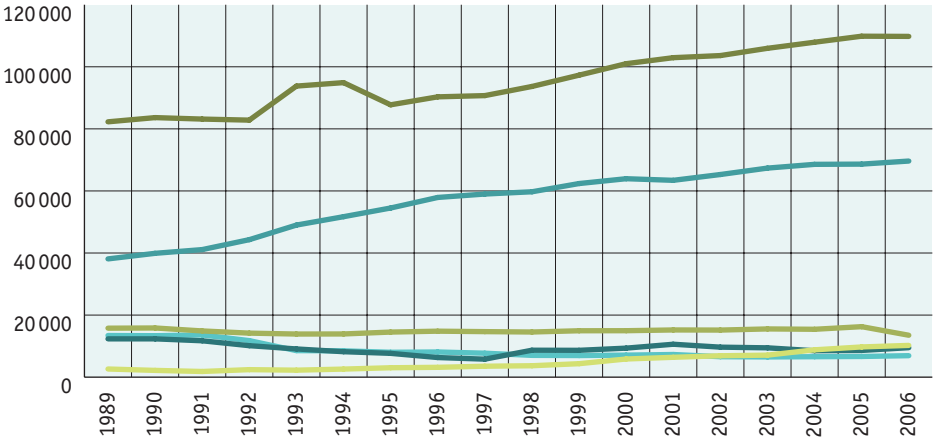
In 2006, air transportation from and to the Czech Republic carried a total of 6.7 million passengers, a figure 4.5 times higher than 17 years earlier. This development follows both European and worldwide trends in air transport development. The Czech Republic's integration into Europe, the development of enterprise, transnational corporations and the expansion of low-cost airlines also played a significant role.

**The basic passenger transportation indicators** are:

- The number of transported passengers
- Transportation performance in passenger-kilometres (pkm) – the number of transported passengers multiplied by the average distance travelled
- Transportation performance in seat-kilometres stated (seatkm) – the stated passenger transportation capacity in public passenger transportation multiplied by the number of km done
- Transportation performance in vehicle-kilometres (vehkm) – how many kilometres a certain vehicle type travelled, regardless of their capacity or load factor.

**The performance of the individual passenger transportation modes(index 1989 = 1) [millions pkm]**

**Chart 6.1**

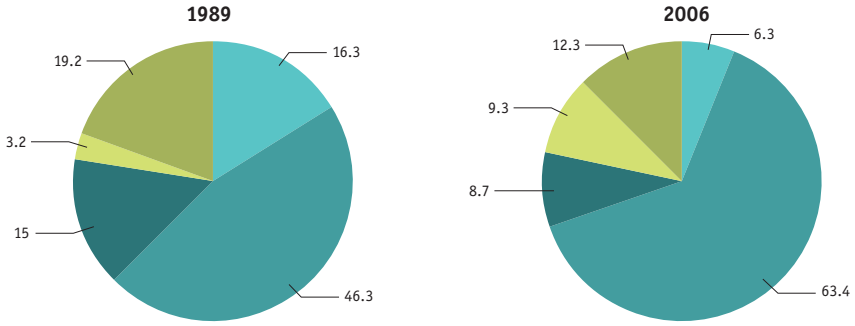



*Source: Statistical Yearbook (1989), Transportation and the Environment in the Czech Republic in 1998, Transport Research Centre, Transportation Yearbooks (since 1995)*

The time series is not adjusted for a number of methodological changes. Therefore, the data are not fully comparable. In air transportation, this concerns the performance of businesses registered in the Czech Republic.

**Structure of performance of private passenger transportation [%]**

**Chart 6.2**




*Source: Statistical Yearbook, Czech Statistical Office, 1991, Transportation Yearbook 2006*

The largest decline in public transportation performance took place up until the mid-1990s. Since then, transportation performance has stagnated (with the exception of the continuing moderate decrease in rail transportation). On the CPT side, certain fluctuations in transportation performance have been observed in recent years. Since 2000, bus transportation (except for CPT) has been characterised by slight fluctuations in transportation performance, while the number of transported passengers has been declining. This is indicative of the development of long distance transportation at the expense of regional transportation that is loss-making for companies and sometimes even ceases altogether. The development of the passenger transportation performance structure between 1989 and 2006 is shown in Chart 6.2. While in 1989 more than a half of the total transportation performance was provided by public transportation, in 2006 it was unquestioningly dominated by private transportation. The individualisation of transportation has clearly been influenced by the development of socio-economic factors – the growing individualisation of the way of life, the development of suburban zones and trends in shopping and leisure activities (hypermarkets, large amusement centres). Economic factors have played a role too: the new and used car market has experienced dynamic development, the taxation of vehicles and fuels has decreased (relative to inflation, average wages and market prices) and the competitive environment has not allowed any significant price increases; these have remained under the level of inflation. This has been combined with public transportation cuts, notably to smaller and remote municipalities. For many, the automobile has thus become a necessary means of transportation.

Public passenger transportation has struggled to compete with this trend in the areas of quality, price and coverage, and has been losing its existing clients, while being unable to find new ones. Despite continuing subsidies for public transportation and its infrastructure from public funds, the increase in fares outpaced inflation. In 1989–2005, average train fares increased by 337 %, and line-bus fares by 340 %, while consumer prices only increased by about 329 %. Another significant problem was the substantial increase in the purchase price of public transportation vehicles, which lead to a slow renewal of the fleet and, in turn, affected the quality of transportation. The renewal of public transportation fleets, especially rail, was very low during the 1990s, which made it less attractive for passengers. Since 2000, this has primarily meant the modernisation of older vehicles. The state contributed little to the renewal (most often about CZK 400 million/year). With the exception of 2006, the support only went to the renewal of the vehicles in line-bus and city public transportation.

While transportation performance in vehicle-kilometres and seat-kilometres is relatively well recorded for public transportation, the number of transported passengers is estimated. The estimated performance in pkm is the least accurate.

**In freight transport, the basic indicators** are:

- The weight of transported cargo
- Transportation performance in tonne-kilometres – the weight of transported cargo multiplied by the average distance travelled

In accordance with Eurostat methodology, transportation and transportation performance in air, waterway and road freight transportation (FRT) is calculated as transportation and transportation performance of entities registered in the Czech Republic, regardless of where it takes place. They also include their performance abroad and do not include the performance of foreign-registered carriers in the Czech Republic.

In real terms, passenger waterway transportation includes recreational cruises and the performance of ferries. Its volume is low.

For the first half of the 1990s, there are no credible data that would allow for the quantification of subsidies into the loss-making operation of public transportation. In passenger rail transportation, indirect cross-financing from the profit of freight rail transportation was predominant. In 2006, public budgets provided CZK 4.1 billion in funding to the loss-making operation of line busses, CZK 7.3 billion to passenger rail transportation and CZK 11.8 billion to CPT.

In large urban regions, integrated transportation systems (ITS) were created in order to reduce the costs for ensuring the availability of public transportation services. These systems started to significantly develop after 2000. The backbone of the individual ITS was rail and other track transportation; only the Central Bohemia Region has been building its 4 ITS without railway. However, the fundamental obstacle to faster ITS development is the poor condition of most of the railway network.

## 6.1.2 The fleet

The number of motor vehicles has considerably increased since 1989 (see Chart 6.3). In 2007, the number of passenger cars exceeded 4.3 million (an increase of 84 %), the number of trucks increased by 249 % to 534 000, while the numbers of motorcycles and buses declined.

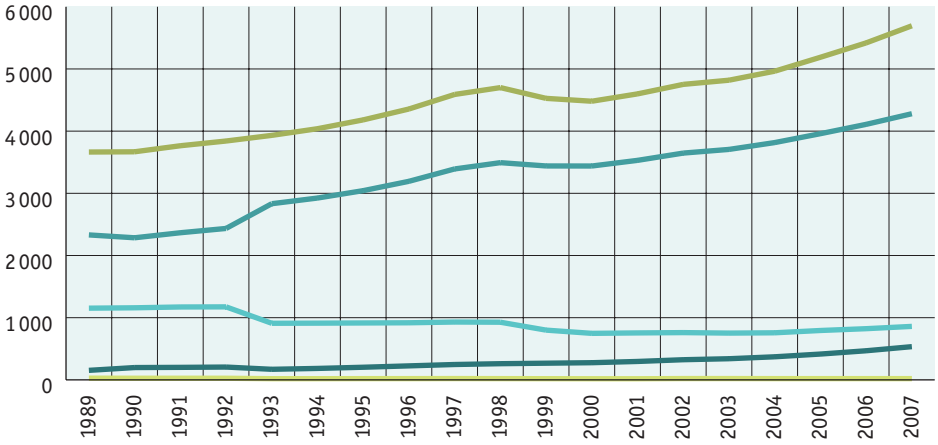
The increase in passenger car numbers was markedly higher in the Czech Republic than the EU average. Between 1990 and 2005 (the period with comparable data), the original EU15 experienced an average increase of 24%, the EU25 of 31 % while in the Czech Republic alone the increase amounted to 73 %. These data reflect the dynamic growth in motorisation in the Czech Republic after 1989, in contrast to Western Europe, where the market was a lot more saturated in 1990.

In 2006, there were approximately 400 vehicles per 1000 inhabitants in the Czech Republic (approximately one passenger automobile per 2.5 people). Prague had the highest number of registered automobiles per capita, namely one automobile per less than 2 residents. The Czech Republic thus is near the top among the EU accession countries, is close to Western European countries and has even overtaken Denmark. Of the new EU member states, it is second only to Slovenia, where the level of motorisation was markedly higher even before 1989 and this trend has continued in subsequent years.

The average age of registered vehicles is among the oldest in the EU (17.2 years total, 13.9 for passenger cars in 2007).

**Development of number of motor vehicle, 1989–2007 [thousands of vehicles]**

**Chart 6.3**




*Source: IRTAD, Transport Research Centre*

Two wheelers also include mopeds. Special trucks are not included (auto cranes, firetrucks, etc.).

## 6.1.3 The transportation network

Historically, the Czech Republic has been among the world's leading countries with respect to the density of transportation networks. In 2004, there were 0.12 km of railway per one square kilometre of the country's territory (the highest number in the EU, 0.046 km in the EU15), 0.7 km of roads (0.99 km in the EU15) and 0.012 km of highways (0.016 km in the EU15, 0.034 km in Germany, 0.057 km in Belgium). The length of routes stagnated between 1989 and 2006 (see Table 6.1). While the total length of roads decreased by 1 % during this period, the length of motorways and high-speed roads increased considerably (by 71 %). Rail transportation experienced a pronounced increase in electrified railway, by 19 % to 3 041 km in 2006. The use of the road network, while its length stagnates, is massively increasing. In the areas with the heaviest traffic, transportation intensity reaches tens of thousands of vehicles per day. The most frequented is the D1 motorway where, near Prague's city limits, the average intensity is close to 100 000 vehicles per day. The capacity of the most frequented routes is becoming insufficient, resulting in frequent traffic congestion and a higher risk of road traffic accidents. On average, there were 70 passenger cars per 1 kilometre of the road network in 2006 (including the less frequented class III roads).

Between 1989 and 2006, the operating length of the Prague metro increased by 72 % to 55 km, the operating length of tramways increased by 14 % to 376 km and the operating length of trolleybus routes increased by 38 % to 412 km. Officially, the length of waterways increased due to the inclusion of numerous waterways for recreational cruises on reservoirs into waterways. The length of oil pipelines in the Czech Republic increased from 504 km to 674 km after the completion of the Ingolstadt pipeline in 1996. The length of high-pressure and very-high-pressure gas pipelines was 3 640 km throughout the entire period.

The Czech Republic still lacks a dense capacity network of safe cycle routes for daily use, separated from car traffic. In 2007, there were only about 1 067 km of routes suitable for cyclists for daily commuting. The most suitable are safe cycle routes with quality flat and smooth surfaces that are physically separated from car traffic. As of 1 January 2008, the Transport Research Centre had on record 31 105 km of marked cycle routes pursuant to the single technical regulations methodology. However, in 2006, about 60 % of the cycle routes lay along roads without any separation from road traffic, where the cyclists were exposed to the same risks from cars as on normal roads.

**Development of the length of transportation routes, excluding electric CPT [km]**

**Table 6.1**

| Year | Transport. routes total | Railway total | Electrified railway | Roads total | Motorways and high-speed roads | Class I roads | Oil pipelines | Waterways |
|---|---|---|---|---|---|---|---|---|
| 1989 | 66 518 | 9 446 | 2 561 | 56 265 | 563 | 6 239 | 504 | 303 |
| 1990 | 66 056 | 9 451 | 2 579 | 55 798 | 590 | 6 290 | 504 | 303 |
| 1995 | 66 111 | 9 430 | 2 743 | 55 500 | 672 | 6 201 | 504 | 677 |
| 2000 | 66 190 | 9 444 | 2 843 | 55 408 | 798 | 5 732 | 674 | 664 |
| 2006 | 65 584 | 9 597 | 3 041 | 55 585 | 962 | 5 844 | 674 | 664 |

*Source: Transportation Yearbooks, Transport Research Centre, Road and Motorway Directorate, Czech Statistical Office. Class I roads without high-speed roads.*

## 6.1.4 Freight transportation performance

Even though the total performance of freight transportation in the Czech Republic changed little from 1989 to 2006 (an increase of 3 % to 68.93 billion tkm), the structure of freight transportation changed more significantly than in passenger transport. Road freight transportation performance increased to 50.37 billion tkm, i.e. by 219 % (it more than tripled). In 2006, its share of the total freight transportation volume reached 72.7 % (Chart 6.4). On the contrary, the performance of freight rail transportation, waterway transportation, air transportation and pipeline transportation declined. From the environmental perspective, this development was unquestioningly negative.

The development of transportation structure was influenced by the Czech Republic's sectoral and territorial development. In the 1990s, the volume of trade with former 'socialist' countries including Slovakia, which was largely performed by rail, decreased considerably. Economic transformation reduced the significance of the then traditional industrial sectors with large volumes of transported coal, iron ore and steel. Therefore, the most pronounced decrease took place mainly in bulk cargo commodities, which are suitable for waterway and rail transportation. On the other hand, the number of low-volume items with higher added value was markedly increasing, for whose transportation the more flexible and faster road transportation was better suited. With a few exceptions, new industrial zones were built without any railway connection, which further decreased its significance for freight transportation. Freight transportation structure in 1989–2006 according to the individual transportation modes is shown in Chart 6.5.

The development of private transportation modes was also influenced by the distribution of investments in the development, repair and maintenance of their respective transportation infrastructures. In 2006, public budget funding invested in road infrastructure was approximately CZK 58 billion, railways received CZK 21 billion, waterways CZK 0.6 billion and the development of cycling transportation only about CZK 0.1 billion from the State Fund for Transport Infrastructure (SFTI). The development of airports is financed from private sources. The costs for the maintenance, repair and development of transportation infrastructure in the Czech Republic, covered from public sources, are shown in Table 6.2.

It is notable that, with the exception of waterway transportation, the majority of investments went into large developmental projects (the costs for motorway construction at constant construction work prices increased 6.7 times between 1990 and 2004), while the maintenance and repair of other roads and railway routes was considerably underfinanced and their technical condition deteriorated. The operation of three railway routes with a total length of 42 km even had to be stopped due to technical unsuitability. In 1998, Word Bank estimates put the neglected maintenance and repair of railway routes at approximately CZK 150–200 billion, which seems realistic, provided that we do not allow for the costs for the construction of missing railway routes and the need of fundamental modernisation on a number of other railway routes. Since 1996, the majority of investment in railway infrastructure went to the construction of the 1st and 2nd connecting corridors.

The data indicating a decrease in freight air transportation performance probably result from the methodology of statistical monitoring, as it is largely performed by foreign carriers. The data on waterway transportation performance are adjusted for transportation in third countries.

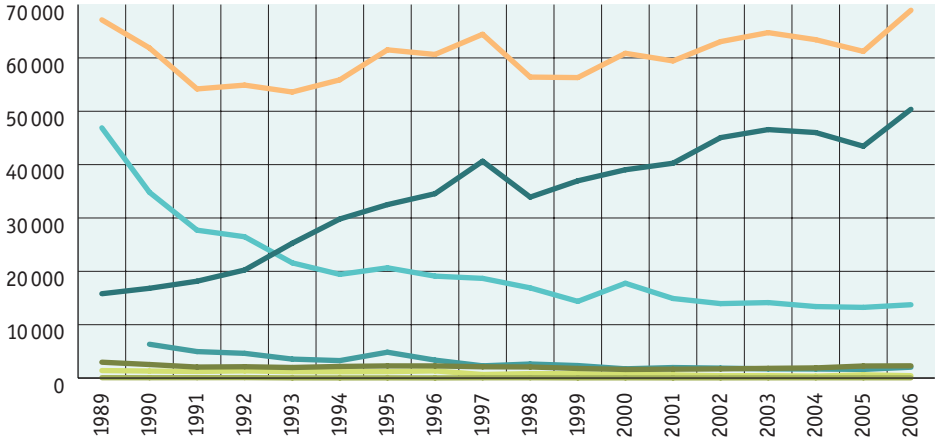
The 1st railway corridor includes the Děčín–Prague–Česká Třebová–Brno–Břeclav route, the 2nd railway corridor the Petrovice u Karviné–Přerov–Břeclav route, the connecting corridor the Česká Třebová–Přerov route, the 3rd railway corridor the Cheb–Pilsen–Prague and Dětmarovice–Mosty u Jablunkova route (the side branch the Pilsen–Česká Kubice route), the 4th railway corridor the Prague–Tábor–České Budějovice–Horní Dvořiště route (the side branch Veselí n. Lužnicí–České Velenice) + the segments to the state border. For the purpose of savings, some railway junctions and some additional segments were excluded from the 1st and 2nd corridors that are being built additionally.

The construction of corridors includes modernising the Czech Republic's main railway routes for speeds up to 160 km per hour and a railway track load of up to 22.5 t per axle, flexible bedding of railway tracks, fitting the railway routes with modern interlocking installations, building new platforms, installing anti-noise barriers etc. In some segments of the railway routes, the construction of corridors also means electrifying them, adding a second (third) railway track, partial rebuilding in order to increase the radius of the bends in the track, thereby allowing for greater speeds, etc. Standard railway modernisation projects are different in that they only require modernisation for speeds of up to 120 km/hour.

The sustainable transportation indicator – freight transportation performance in relation to gross domestic product (GDP) – looks positive for the Czech Republic, as GDP grows despite stagnating freight transportation performance. However, this indicator does not take into account the development in transportation structure that is very unfavourable from the environmental perspective – the rapid growth in road freight transportation at the expense of rail, waterway and pipeline transportation.

**Development of the performance of the individual freight transportation modes in the Czech Republic from 1989–2006 [millions tkm]**

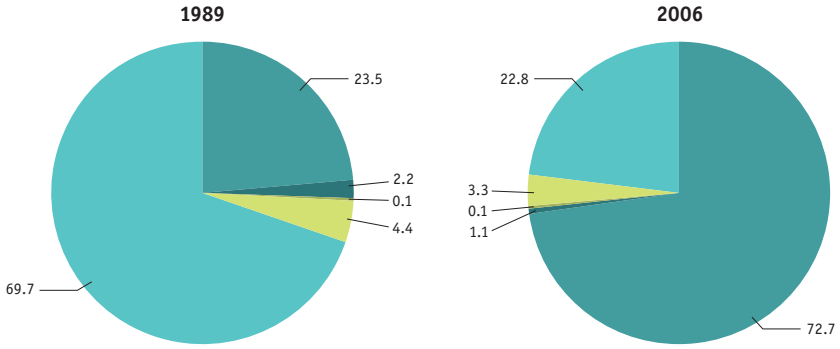
**Chart 6.4**




*Source: Federal Statistical Office (1989), Transport Research Centre (1990–1994), Transportation Yearbook of the Czech Republic (since 1995)*

**Performance of the individual freight transportation modes in millions of tkm in the Czech Republic in 1989 and 2006 [%]**

**Chart 6.5**




*Source: Statistical Yearbook, 1990, Transportation Yearbook 2006*

**Finance from public budget for the maintenance, repair and development of transportation infrastructure in the Czech Republic from 1989–2006 in current prices [billions CZK]**

**Table 6.2**

| Year | Road | Rail | Waterway | Air | CPT | Pipeline | Total |
|---|---|---|---|---|---|---|---|
| 1989 | 6.3 | 6.8 | 0.2 | 0.5 | – | – | 13.8 |
| 1995 | 15.8 | 7.9 | 0.2 | 0.3 | 1.7 | 1.4 | 27.3 |
| 2000 | 20.1 | 22.3 | 0.5 | 0.2 | 2.6 | 0.4 | 46.1 |
| 2006 | 57.7 | 20.6 | 0.6 | 0 | 6.0 | 0 | 84.8 |
| 2006/1989 N | 9.1 | 3.0 | 2.7 | – | – | – | 6.1 |
| 2006/1989 R | 1.9 | 0.7 | 0.6 | – | – | – | 1.3 |

*Source: For 1989, Annual Report of the Federal Ministry of Transport. Since 1993, except for CPT, Transportation Yearbooks. For CPT, these are only data for Prague and the subsidies from the State Environmental Fund.*

N = the nominal index that represents public budget expenses for transportation infrastructure at current prices.
R = the real price index that represents expenses at constant prices, i.e. it takes account of the inflation in construction work prices.

### 6.1.5 Transportation employment

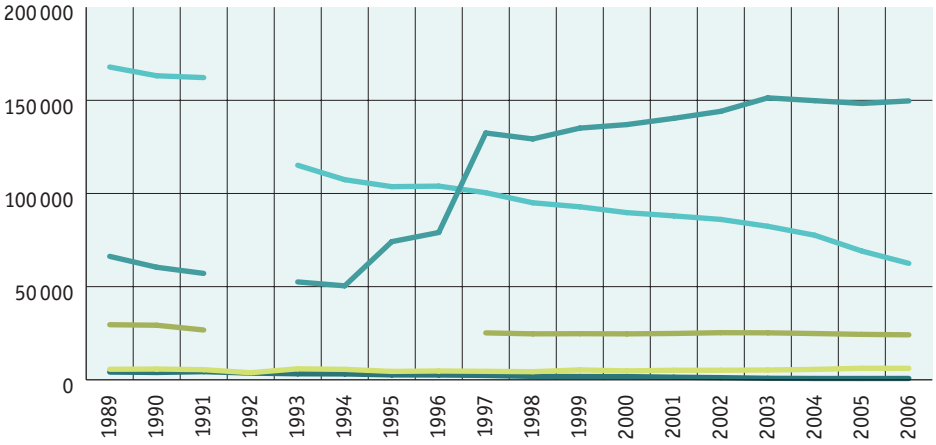
Transportation employment decreased by 9% from 1989 to 2005 (see Chart 6.6). While employment in road transportation increased by 124% and in air transport by 10%, employment in rail transportation decreased by 59%, in waterway transportation by 83% and in the CPT by 18%.

Employment in rail and waterway transportation was in steady decline in the 1990s, largely due to the decreasing transportation performance. Since 2000, these factors have mainly included the modernisation of selected main routes and the implementation of remote control systems in rail transportation.

Also significant are the indirect effects of transportation on employment. Inadequate availability of transportation services increases unemployment among the population of economically weaker regions, especially in conjunction with low offered wages. Conversely, good transportation availability (e.g. by connecting the region to the highway network) stimulates investment and creates new job opportunities.

**Employment in the individual transportation modes**

**Chart 6.6**




*Source: All data for 1989–1992 and the 1993–1996 totals are according to the Czech Statistical Office. The CPT since 1997 according to the annual reports of the association of 19 major CPT businesses, the data for 1992–1996 are missing. Other data are according to Transportation Yearbooks of the Czech Republic.*

Data for 1992 is not available; 1992–1996 data is not available for public transport.

### 6.1.6 Energy consumption in transportation

With the declining energy intensity of the national economy between 1989 and 2006, traction energy consumption in motorised transportation increased and the share of motorised transportation in total energy consumption increased from 10% in 1989 to 22% in 2006 (see Chart 6.7). The overall increase in traction energy consumption in motorised transportation reached 91% from 131 000 to 251 000 TJ.

Traction electricity consumption in rail transportation in the Czech Republic decreased after 1989 from approximately 1 754 GWh in 1989 to 1 508 GWh in 1993 and 1 173 GWh in 2006. One of the reasons was the marked decline in freight rail transportation performance. The share of traction consumption by electric transportation modes in the Czech Republic's final energy consumption decreased from 0.76% to 0.5% in 1990–2005.

The development of traction energy consumption stemmed from the development of the performance of the individual transportation modes, both passenger and freight, and their 'specific energy intensity'. This indicates the ratio between the transportation performance and the energy consumed – i.e. the average number of pkm or tkm transported per unit of consumed energy. Logically, the lower the transportation performance of a specific transportation mode per one unit of consumed energy, the more energy intensive the given transportation mode is.

As shown in Table 6.3, the highest energy intensity is in individual automobile and freight road transportation. The increase in energy consumption throughout the monitored period is therefore attributable to the increasing transportation volume of the most energy-intensive transportation modes. On the other hand, the lowest energy intensity is in the electric traction of freight rail transportation and, for passenger transportation, in the metro, which is followed by trams, trolleybuses and the electric traction of the railway. This is explained by the fact that the resistance given by railway tracks to steel wheels of rail vehicles is 6 times lower than that given by asphalt roads to tyres. In addition, the load factor also plays a major role, and this is highest in CPT.

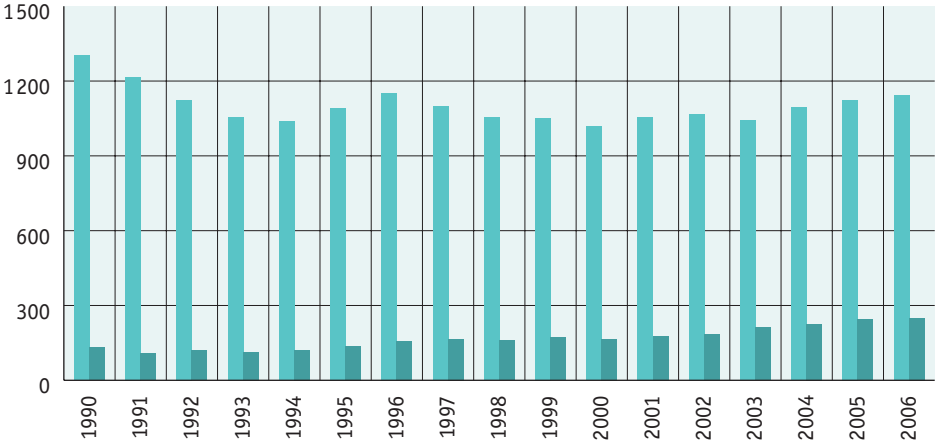
While the motorised transportation modes' traction consumption increased by 91%, their transportation performance increased by 46% in passenger transportation and by 116% in freight transportation (excluding oil pipelines).

Traction consumption means the energy consumed to power vehicles, total consumption also includes energy consumption in the associated activities (within airports, railway stations, ports, transportation vehicle repair facilities, etc.). The latter also includes some activities that are only loosely connected with transportation – services for passengers and employees in transportation, etc.

Traction energy consumption is determined according to fuel production, exports, imports and sales balance. The energy content of the individual fuel types is converted into TJ. From 2005–2006, however, the basic data on fuel consumption, i.e. emissions, underwent major recalculation, reducing diesel fuel consumption in waterway transportation by 20%, in motorised railways by 40% and in buses by about a third. To date, the recalculation was only performed back to 2000, meaning that the period up to 1999 and since 2000 is of limited (and in the case of waterways, motorised rail and bus transportation, of rather very low) informational value.

**Final energy consumption and traction energy consumption in motorised transportation [TJ]**

Chart 6.7




*Source: Czech Statistical Office, Transport Research Centre*

The 2000–2006 period is affected by the change in the methodology for estimating fuel consumption by motorised transportation.

**Energy efficiency of vehicles in passenger [1 000 pkm/TJ] and freight [1 000 tkm/TJ] transportation in the Czech Republic, 2005**

Table 6.3

| | Motorised railway | Electric railway | Waterway | Air | IAT/FRT | Bus | Metro | Tram | Trolleybus |
|---|---|---|---|---|---|---|---|---|---|
| Passenger | 746 | 2 459 | – | 673 | 545 | 624 | 8 625 | 5 420 | 3 004 |
| Freight | 1 032 | 7 681 | 3 880 | – | 665 | – | – | – | – |

*Source: calculations of CENIA on the basis of the Transportation Yearbook, the Transport Research Centre, the Czech Railways (ČD), ČEZ and the Czech Statistical Office*

## 6.1.7 Fuel sales

Fuel sales nearly doubled in 1990–2006 (see Table 6.4). For petrol, the sales increase amounted to 69 %, for diesel fuels 70 % and for jet fuel 32 %. Some environmentally friendlier fuels have recently emerged – biodiesel, liquid petroleum gas (LPG) and compressed natural gas (CNG). Leaded petrol was taken off the market as of 1 January 2001.

The increase in fuel sales is attributable to growing transportation performance in energy-intensive road and air transportation. The consumption has been increasing in spite of raising fuel prices.

**Fuel sales in the Czech Republic from 1990–2006 [thousands tonnes]**

Table 6.4

| Year | Unleaded petrol | Leaded petrol | Aviation gasoline | Petrol total | Jet fuel | Diesel fuel | Biofuel | LPG | CNG |
|---|---|---|---|---|---|---|---|---|---|
| 1990 | 10 | 1 175 | 8 | 1 192 | 256 | 2 275 | 0 | 0 | 0 |
| 1995 | 782 | 893 | 9 | 1 684 | 177 | 1 983 | 25 | 1,6 | 3,2 |
| 2000 | 1 562 | 356 | 2,8 | 1 921 | 192 | 2 393 | 228 | 62,1 | 4,9 |
| 2005 | 2 055 | – | 2,0 | 2 057 | 335 | 3 704 | 10 | 70 | 3,5 |
| 2006 | 1 999 | – | 2,0 | 2 001 | 339 | 3 396 | 19 | 72 | 4,0 |

*Source: Czech Association of Petroleum Industry and Trade*

## 6.2 Environmental repercussions of transportation development

Transportation is one of the sectors with significant environmental impacts. It affects air quality, leads to both extensive appropriation of land and fragmentation of the landscape, thereby disrupting its structure, and it is a source of excessive noise. Along with the growing transportation intensity, these environmental burdens increase despite major technological advances and a more consistent incorporation of environmental aspects into transportation policy.

### 6.2.1 Transportation emissions

Emissions from motorised transportation modes (hereinafter 'transportation') represent a major burden on the environment and also a pressing problem of today. The share of transportation in total air pollution is on the increase even in spite of clearly decreasing specific emissions (per unit of transportation performance of the individual transportation modes), especially for private automobile transportation.

The main mobile source air polluter is road transportation (both freight and passenger), which, with the exception of $SO_2$ emissions, discharged 92.6–98.7 % of all monitored pollutants from motorised transportation in 2006. With respect to emissions, road freight transportation has gradually become the most harmful component within road transportation, as both its absolute emissions and its share in the total emissions of most transportation pollutants increased throughout the monitored period. On the private automobile transportation side, the situation is, according to most indicators, better, despite the dynamically growing number of vehicles and transportation performance. The development of transportation emissions from 1990–2006 is shown in Table 6.5.

Between 1990 and 2006, $CO_2$ emissions from motorised transportation increased by 87 % and the emissions of solid pollutants by 45 %, not including tyre and brake wear, amounting to approximately 17000 t per year, and secondary dust pollution. In contrast, carbon monoxide (CO) emissions decreased by 25 %, volatile organic compound (VOC) emissions by 24 %, nitrogen oxide (NOx) emissions by 9 % and lead emissions by 99.5 % from the 1990 level due to gradual reductions in the permissible amount of lead in petrol, culminating in its total ban in 2001. $SO_2$ emissions are difficult to assess in view of the fundamental change in the methodology of their monitoring after 2000. Up until 2004, while there was comparable methodology, they are likely to have grown. They markedly decreased in 2005 in connection with the legislative reduction of the permissible amount of sulphur in diesel fuel. The emissions of highly harmful polycyclic aromatic hydrocarbons (PAH) originating from transportation increased from 8 690 to 20 860 kg from 1990–2003, i.e. 2.4 times and, according to gross estimates from the Transport Research Centre, their share in total PAH emissions reached about 85 % in 2003. The development of motorised transport emissions is show in Chart 6.8.

Secondary dust pollution means particulate matter settled on routes that is stirred up by passing vehicles and returns to the atmosphere. This can include both transportation emissions, tyre and brake wear, and pollution from other sources, e.g. from heating, construction activity etc. The danger of dust pollution (both primary and secondary) lies mainly in the fact that dust particles attract other toxic substances, e.g. carcinogenic benzo[a]pyrene, for which it is easier to enter the human respiratory tract on such particles, jeopardizing human health.

**Motorised transportation emissions in kt and the relative change in emissions since 1990**

**Table 6.5**

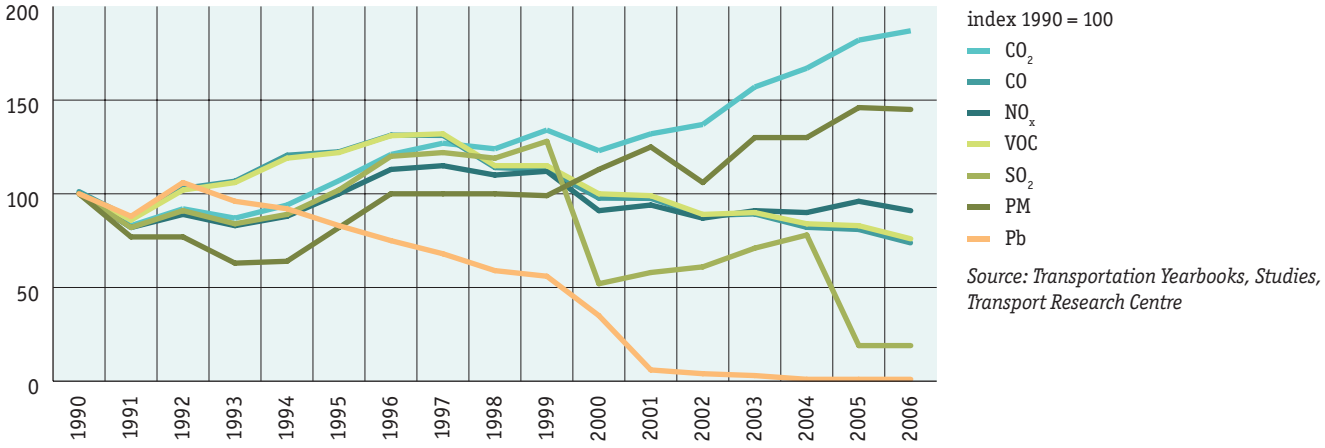
| Year | $CO_2$ | | CO | | $NO_x$ | | VOC | | $SO_2$ | | Pb | | Particulate matter | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kt | % | kt | % | kt | % | kt | % | kt | % | t | % | kt | % |
| 1990 | 9 987 | 100 | 285 | 100 | 106 | 100 | 57 | 100 | 3.3 | 100 | 193 | 100 | 4.4 | 100 |
| 1995 | 10 660 | 107 | 348 | 122 | 106 | 100 | 70 | 123 | 3.4 | 103 | 160 | 83 | 3.6 | 82 |
| 2000 | 12 252 | 123 | 278 | 98 | 97 | 92 | 57 | 100 | 1.7 | 52 | 67 | 35 | 4.9 | 111 |
| 2005 | 18 191 | 182 | 233 | 82 | 102 | 96 | 47 | 83 | 0.62 | 18 | 1 | 0.5 | 6.4 | 145 |
| 2006 | 18 560 | 187 | 213 | 75 | 97 | 91 | 42 | 74 | 0.63 | 19 | 1 | 0.5 | 6.4 | 145 |

*Source: Transport Research Centre*

Data up to 2000 are influenced by the new emission calculation methodology. Particulate matter emissions do not include 17 000 t from tyre and brake wear etc.

**Development of emissions from motorised transportation modes, (index 1990 = 100)**

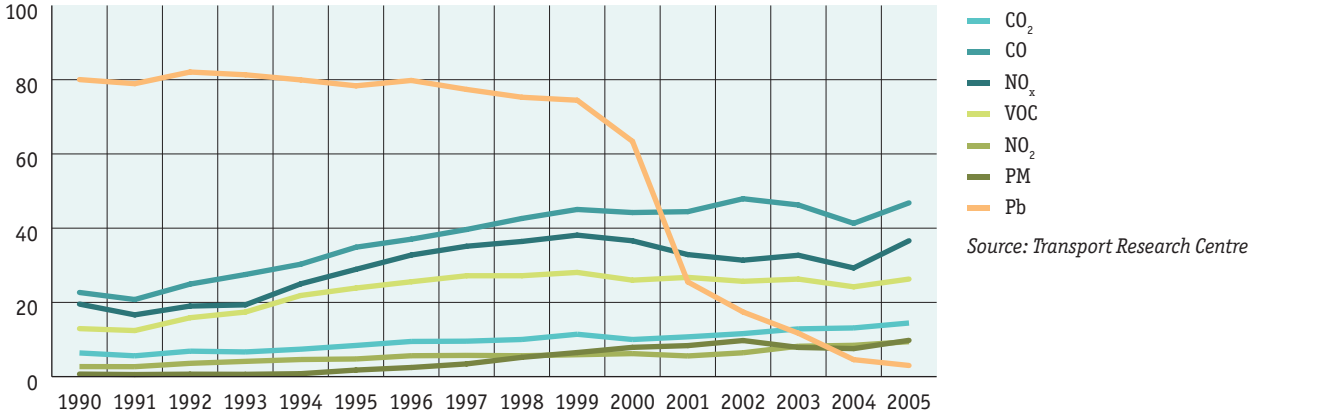
**Chart 6.8**




*Source: Transportation Yearbooks, Studies, Transport Research Centre*

**Share of motorised transportation in total air pollution [%]**

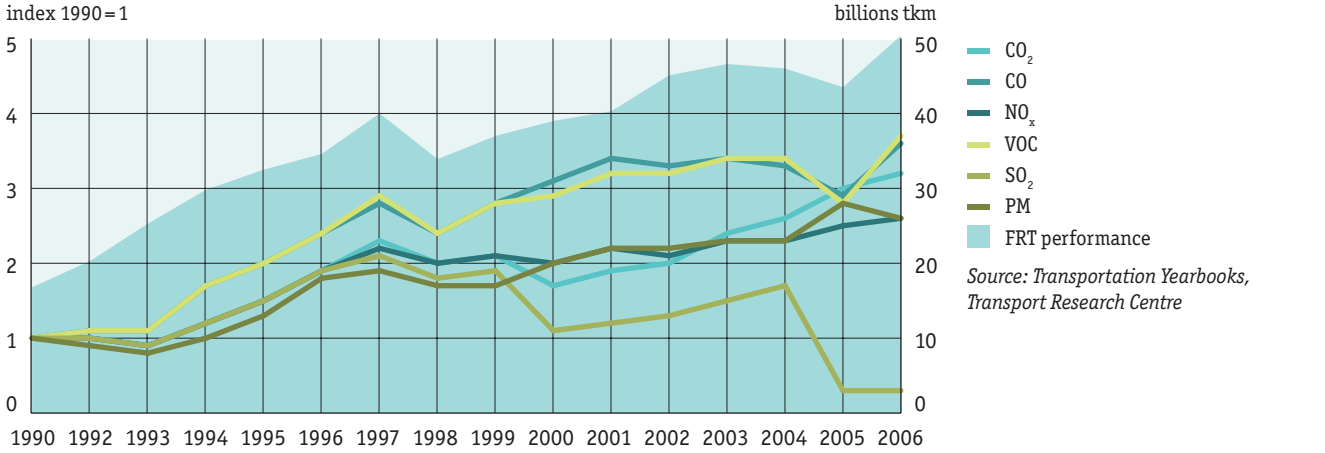
**Chart 6.9**




*Source: Transport Research Centre*

**Freight road transportation performance [billions tkm] and the development of the emissions of basic pollutants from road freight transportation [t]**

**Chart 6.10**

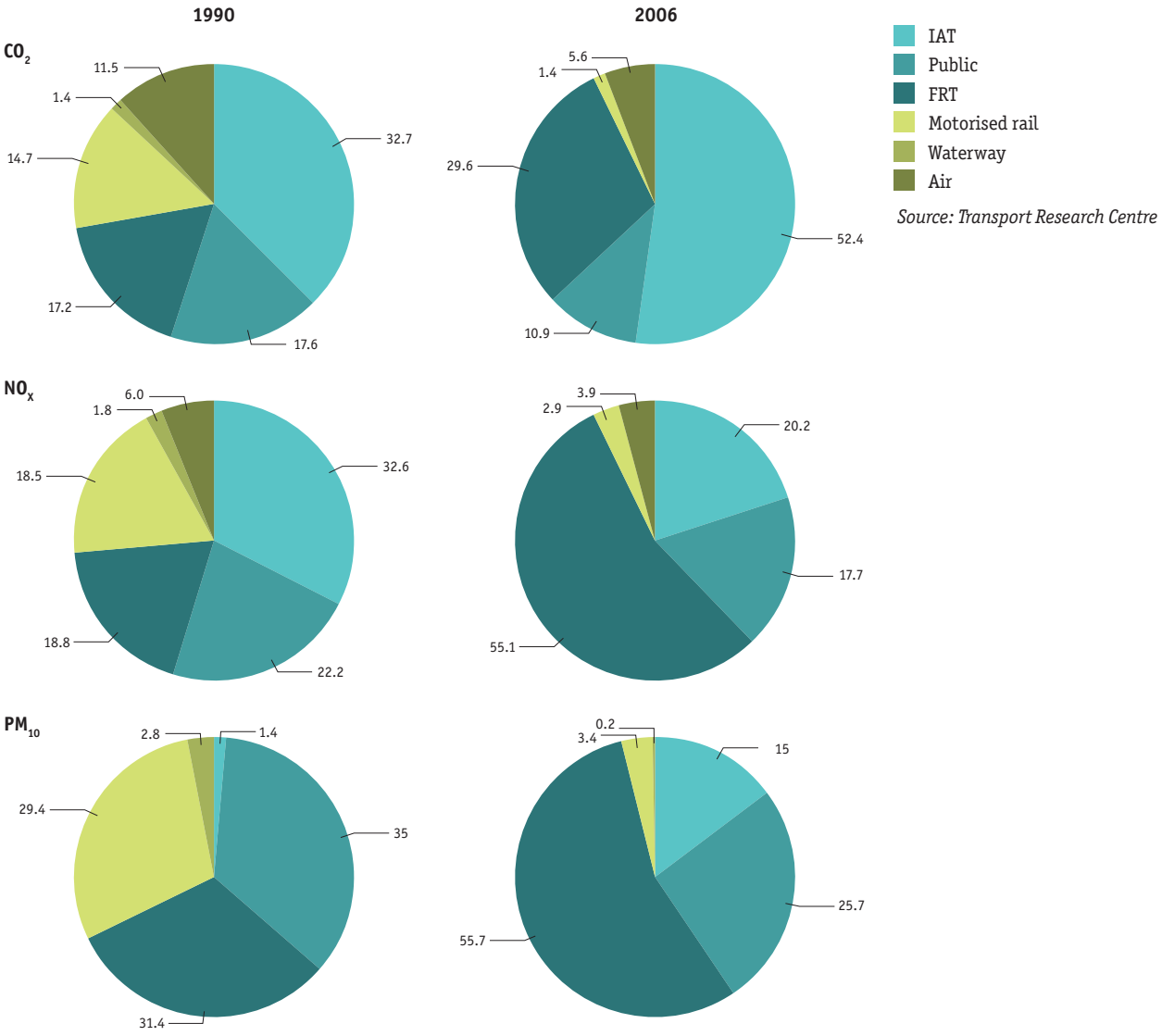



*Source: Transportation Yearbooks, Transport Research Centre*

As shown in Chart 6.9, the share of transportation in the total air pollution in the Czech Republic increased for most monitored substances in 1990–2005. A significant aspect for pollution-related health risks is that transportation pollutes the surface layer of the atmosphere, especially in densely populated areas, which contrasts, for example, with the energy industry, which is characterised by long-distance pollution transmission affecting more remote areas that are often less densely populated.

**Shares of the individual types of motorised transportation in $NO_x$, $PM_{10}$ and $CO_2$ emissions in 1990 and 2006 [%]**

**Chart 6.11**




*Source: Transport Research Centre*

In 1990, individual automobile transportation (IAT) was the largest source of transportation emissions. Between 1990 and 2006, CO emissions decreased by 55 %, VOC by 60 % and $NO_x$ by 43 % while, at the same time, transportation performance grew by approximately 75 %. Lead emissions were almost completely eliminated in connection with the removal of leaded petrol from the market as of 1 January 2001. However, there was considerable growth in $CO_2$ emissions, which more than doubled throughout this period, and in the emissions of solid pollutants in connection with the increasing popularity of diesel engines in passenger cars and the reclassification of vans up to 3.5 t of weight as IAT (a more than tenfold increase to 948 t, with utility automobiles up to 3.5 tonnes accounting for about half of these emissions). Despite this administrative change, freight road transportation remains the source of most solid emissions from transportation (these increased 2.6 times to 3 527 tonnes).

Despite stricter emission standards for new vehicles and some renewal of the truck fleet, emissions from road freight transportation (FRT) grew nearly along the lines with its transportation performance (Chart 6.10). According to almost all indicators, the share of FRT in total motorised transportation emissions increased during the monitored period, see Chart 6.10. While in 1990 the share of freight road transportation in $NO_x$ emissions from motorised transportation was 19 %, in 2006 it reached 55 %.

The structure of the sources of $NO_x$, $PM_{10}$ and $CO_2$ emissions from transportation, according to the individual transportation modes in 1990 and 2006, is shown in Chart 6.11, which makes the dominance of road transportation in emission production clearly visible. Most $NO_x$ emissions are generated in road freight transportation, the share of IAT in these emissions even decreased in the monitored period (from 32 % to 20 %) despite a considerable increase in both the number of vehicles and the total transportation performance. This structure reflects the fact that diesel engines produce more $NO_x$, while emissions from passenger automobiles are reduced by ever more efficient catalytic converters.

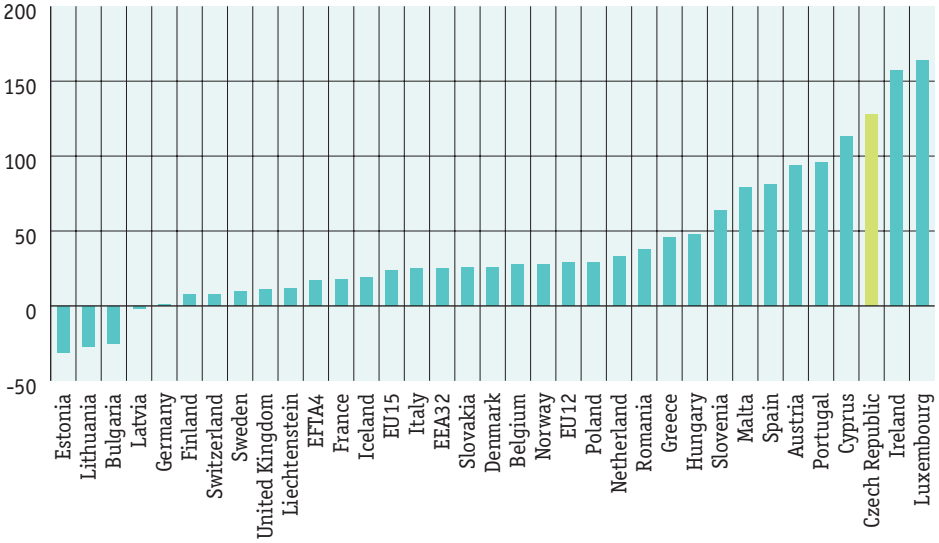
The situation is similar in the case of particulate matter emissions (PM10), where the FRT dominance is even more pronounced (petrol combustion produces considerably less solid emissions). The extensive increase in the share of IAT from nearly zero to 15 % has resulted from the increasing number of diesel-powered passenger automobiles and the reclassification of vans weighing up to 3.5 t from FRT to IAT. Also characteristic of the $NO_x$ and $PM_{10}$ emission structure is the decrease in pollution from motorised rail and waterway transportation, which is presently almost negligible. It reflects the decrease in transportation performance, the changes in the basic data on diesel fuel consumption by the railways and the electrification of additional routes.

With respect to $CO_2$ emissions (the most significant human-influenced greenhouse gas), the situation is different. Since 1990, the share of IAT in its total transportation-originated production has been growing, accounting for more than half of $CO_2$ emissions from transportation by 2006. The FRT share reached approximately one thirds of all emissions from transportation in 2006, with the remaining one sixth was produced by buses and air transportation. This situation arose from the large number of passenger vehicles and their low transportation efficiency – i.e. the number of transported passengers per unit of fuel consumed and pollution produced.

Greenhouse gas production from transportation has been markedly increasing since 1990. While in 1990 emissions from motorised transportation accounted for about 5 % of total $CO_2$ emissions, in 2006 this was more than 13 %. Given the present decline in greenhouse gas emissions from stationary sources, transportation emissions are the leading cause behind the stagnating or even moderately growing trend in total emissions, while also contributing to the burden on the climate. The increase in greenhouse gas emissions from transportation in the Czech Republic between 1990 and 2005 was the third largest in Europe, as shown in Chart 6.12.

**Changes in greenhouse gas emissions from transportation in the member states of the European Economic Area, 1990–2005 [%]**

**Chart 6.12**




*Source: European Topic Centre/Air and Climate Change, EEA 2008*

## 6.2.2 The Assignment of land to transportation infrastructure

Assignment of land to transportation infrastructure, given the methodological changes in its monitoring, increased from 840.8 km² in 1990 to 842.9 km² in 1998 and 856.8 km² in 2006. Assignment of land to railway transportation decreased from 141.8 km² in 1990 to 141.5 km² in 1995–2004. Assignment of land to air and water infrastructure amounted to 11.7 km² over the entire period. The total assignment of land to transportation infrastructure amounted to about 1 021 km² in 2006, i.e. approximately 1.3 % of the entire Czech Republic.

A distinction must be drawn between the direct and the total assignment of land to transportation routes. Direct assignment of land includes the area on which transportation routes are built. The difference between this and the total assignment of land is the area where no transportation routes are directly built, yet, due to its proximity; it is rendered useless for any other purpose (trenches, embankments, ditches). Large total land appropriation use occurs at airports.

### 6.2.3 The effects of transportation on the atmosphere

Emissions from transportation, especially in highly-trafficked localities, considerably reduce air quality. Transportation tends to be connected mainly with nitrogen oxide pollution (the highest concentrations have consistently been detected in Prague, in Legerova street, where there is no other significant pollution source) and the photochemical smog. This means air pollution by toxic products of photochemical processes in the atmosphere (especially low level ozone) from the precursors that are largely generated by transportation (nitrogen oxides, VOC and others). These processes mainly take place in summer, at higher temperatures and when there is more intensive solar radiation, which is why photochemical smog is also sometimes referred to as summer smog. In recent years, permissible concentrations of low level ozone have been consistently exceeded in almost the entire Czech Republic – not only in the proximity of routes and in the centres of municipalities, but also in the mountains, to which ozone precursors are transported and where the photochemical processes are more efficient – see Figure 6.1.

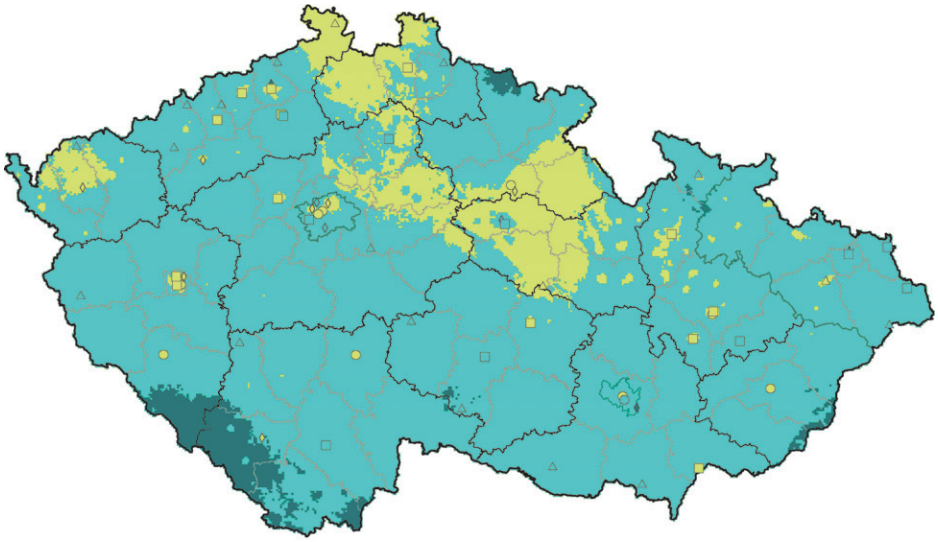
The State Air Quality Monitoring network includes 97 Automatic Emission Monitoring (AIM) stations that are operated by the Czech Hydrometeorological Institute, the information system also includes measurements taken at the stations of other organisations (e.g. the Forestry and Game Management Research Institute, Ekotoxa)

An important factor in air quality assessment is the **classification of the stations**, which is performed according to a uniform methodology specified by European legislation. The classification of localities consists of 3 components:

1. The type of locality (transportation, industrial, background)
2. The type of the zone (urban, suburban, rural)
3. The characteristics of the zone (residential, commercial, industrial, agricultural, natural and their combinations).

**Array of the 26th highest maximum daily 8-hour moving average for ozone concentration on a 3-year average, 2004–2006**

**Fig. 6.1**




*Source: Czech Hydrometeorological Institute*

### 6.2.4 Transportation noise

Excessive noise is a significant pollutant with a physical character. It damages the auditory system, increases the overall illness rate, and induces fatigue and other unspecified subjective complaints by people. The problem is that the population's exposure to noise is not sufficiently systematically monitored. The greatest amount of noise pollution is generated by road transportation. Tramways, air and a portion of rail transportation are also excessively noisy. The operation of trolleybuses, boats and recently gas buses is quiet, whereas the noise from metro poses little disturbance since it is underground.

According to expert estimates, about 1.8 million inhabitants were exposed to excessive transportation noise over 65 dB/A in the Czech Republic in 1990. In subsequent years, noise pollution from road transportation increased and that from rail and air transportation decreased, with the exception of the neighbourhoods near large airports. Data for 2004, the latest available, are shown in Table 6.6.

Rail transportation experienced a considerable decrease in the performance of the most noisy freight trains, the decommissioning of the most noisy railway engines, the installation of flexible bedding for railway tracks and of anti-noise barriers in the corridors (sometimes also outside the corridors) and the electrification of some additional railway routes, which led to reduced noise pollution from rail transportation. Air transportation underwent a substantial renewal of the aircraft fleet in favour of less noisy models.

In the past, excessive transportation noise was defined as harmful to human health when a level of 65 dB/A existed during the day, and Regulation No 258/2000 Sb. reduced the limit to 60 dB/A. For night transportation, the limit used to be set at 55 dB/A and, in 2000, it was reduced to 50 dB/A.

Reducing noise pollution through the modernisation of tramway routes using flexible track bedding is only now emerging in the Czech Republic. For example, the tramway modernisation in Prague's Jindřišská and Vodičkova streets was supposed to reduce noise by 6 dB/A.

**Human exposure to excessive noise from road, rail and air transportation in 2004 in population percentage (expert estimates with an accuracy of + 25%)**

Table 6.6

| Equivalent acoustic pressure level in dB/A | Road | | Rail | Air |
|---|---|---|---|---|
| | day | night | day | night |
| 65.0–69.9 | 18.1 | 13.2 | 5.1 | 0.5 |
| 70.0–74.9 | 3.9 | 1.1 | 1.7 | 0.2 |
| 75.0 and over | 1.0 | 0.5 | 0.1 | 0.1 |

*Source: Statistical Environmental Yearbook of the Czech Republic 2004, Ministry of the aenvironment (National Institute of Public Health, Ministry of Transport of the Czech Republic, Techson)*

The exposure of the population to noise from tramways is not indicated.

## 6.2.5 Quantification of the environmental impacts of transportation through externalities

When assessing the economic preferability of individual transportation modes, environmental impacts can partly be evaluated through the quantification of externalities – external costs incurred by society due to the disruption of the environment and of other goods. Externalities can be divided into monetary – e.g. damage to technology, infrastructure, losses resulting from forced idleness of persons at a productive age, costs for treatment; and into non-monetary – e.g. non-economic damage to human health (deaths and injuries in accidents, sickness due to emissions and noise, reduced working performance due to stress or fatigue etc.)

The minimum amount of specific externalities per unit of transportation performance of the individual transportation modes in the Czech Republic in 2004 is shown in Table 6.7.

The given data make it clear that in 2004, the highest specific externalities within passenger transportation were in private automobile transportation, while the metro and trolleybuses had the lowest. The most harmful within freight transportation is road freight transportation; the lowest externalities are in waterway transportation and in the electric traction of rail transportation.

In the Czech Republic, external costs for damaging the environment are presently not covered by the polluters, which is favourable for road transportation, whose externalities are markedly higher (in road transportation in 2005, these externalities totalled at least CZK 66 billion/year, in rail transportation about CZK 1.6 billion).

Absolute **externalities** are indicated in monetary units. Specific externalities represent the total economic losses incurred on average per unit of transportation performance – 1 tkm or pkm. Obviously, the larger the specific externalities per unit of transportation performance, the more harmful the given transportation mode is.

Externalities resulting from the emissions of PM, CO, $NO_x$, VOC and $SO_2$ from extensive traffic noise and accidents are calculated using a modified method of J. Polena et al. from the Central Transport Institute, while for greenhouse gas emissions, they are calculated based on recommendations by the European Conference of Ministers of Transport, Paris, 1997.

**Specific externalities of the basic modes of passenger [hal./pkm] and freight [hal./ktm] transportation, 2004**

Table 6.7

| | Motorised railway | Electric railway | Waterway | Air | IAT / FRT | Line bus | CPT bus | Metro | Tramway | Trolleybus |
|---|---|---|---|---|---|---|---|---|---|---|
| Passenger | 12.3 | 6.5 | – | 6.9 | 58.9 | 39.1 | 38.0 | 1.1 | 17.7 | 4.4 |
| Freight | 17.2 | 4.4 | 1.1 | – | 45.0 | – | – | – | – | – |

*Source: calculations of CENIA*

## 6.3 Measures for reducing environmental impacts of transportation

The measures for increasing environmental friendliness of transportation can be divided into the following categories:

- reducing air pollution (emissions) and noise from transportation
- reducing transportation's effect on the structure and functions of the landscape (e.g. preferential development of track transportation, considerate placement of new routes and, as the case may be, the construction of ecoducts across highways near biocorridors)
- systemic and environmentally friendly waste management (car wrecks, batteries, used motor oil)

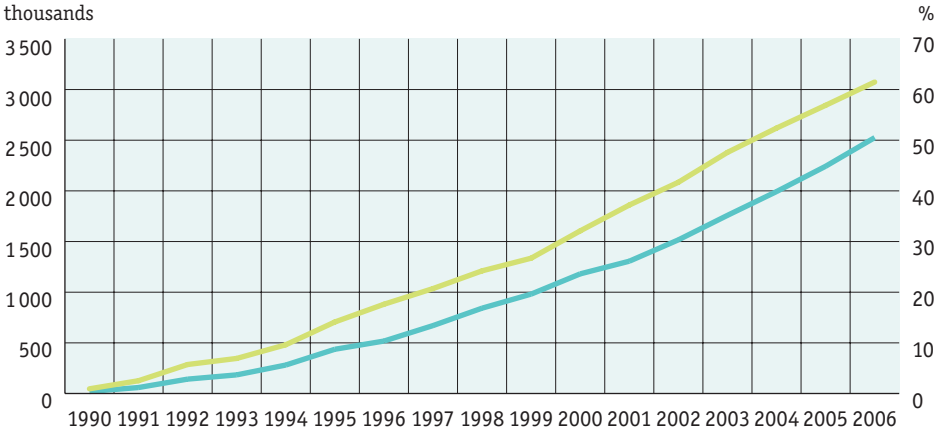
The measures can be of a technical character (e.g. the construction of anti-noise barriers, reduction of noise from rail transportation by installing flexible bedding for tracks or by reducing electrification of railway routes, the construction of ring roads around cities), a legislative character (e.g. emission limits for automobiles) or an economic character (taxes, charges, subsidies).

Emission limits specified by legislation are effective for the protection of air quality. Such limits can only be met by fitting new automobiles with three-way catalytic converters. The share of these automobiles increased from 1990–2006 (see Chart 6.13).

Alternative methods for the propulsion of motor vehicles have yet to establish themselves. While the number of electric automobiles has stagnated, the number of LPG-powered passenger cars is the only figure to see any increase, with LPG use becoming more widespread in road freight transportation. The state uses lower excise tax rates to promote the production and consumption of environmentally friendly fuel types. The amount of this support, including the support for biodiesel through its placement under the lower Value Added Tax (VAT) rate, has fluctuated considerably, see Table 6.8.

**Number and the percentage of passenger automobiles fitted with catalytic converters**

**Chart 6.13**




*Source: Study on Transportation Development from the Environmental Perspective in the Czech Republic, Transport Research Centre.*

**Amount of economic advantages for alternative fuels through excise tax and VAT in the Czech Republic [millions CZK]**

**Table 6.8**

| Year | Unleaded petrol | Biodiesel | LPG | CNG | Total | Biodiesel-VAT |
|---|---|---|---|---|---|---|
| 1995 | 1 103 | 209 | 15 | 28 | 1 355 | 19 |
| 2000 | 0 | 322 | 1 054 | 50 | 1 426 | 958 |
| 2005 | 0 | 37 | 334 | 13 | 383 | 0 |

*Source: calculations of CENIA, Transport Research Centre, Ministry of Agriculture*

Although the advantage provided to unleaded petrol through its lower excise tax rate in comparison with leaded petrol was abolished as of 1 January 1996, the trend of substituting unleaded petrol for leaded petrol remained unaffected. The state supports the use of biodiesel through subsidies (whose amount is not monitored), zero or reduced excise tax rates (the methyl ester portion of rapeseed oil is exempt from taxation) and, up until 31 December 2003, also through the placement of biodiesel in the lower (i.e. 5 %) VAT rate. Up to 2004, the state promoted the use of gas in transportation through exempting compressed natural gas (CNG) from excise taxes on fuel. However, this was abolished as of 1 January 2004 as part of tax harmonisation with the EU. The exemption of CNG intended for vehicle propulsion from excise taxes was reintroduced on 1 January 2007. Since 1993, the state has applied lower excise tax rates to LPG as well.

International air and international waterway transportation is exempt from excise taxes on fuels under international agreements. The Parliament of the Czech Republic extended this exemption to domestic air transportation and, for the 2004–2006 period, also to domestic waterway transportation. Similarly, international transportation (in passenger transportation only regular transportation) is exempt from VAT, including VAT on consumed fuel and energy.

Table 6.9 shows that international agreements provide the greatest advantage to energy intensive air and road transportation, which is also highly dependent on the ever more expensive crude oil.

As of 1 January 2004, biofuels, which had been placed under the lower (5 %) VAT rate, were reclassified under the basic rate. This step resulted in a significant decrease in biofuel sales (from 257 kt in 2003 to 105 kt in 2004 and 10 kt in 2005. Preliminary data put the 2006 sales in transportation at 65 kt).

The sales of transportation services within the individual transportation modes for 1993 are unknown, which is why this year is not included. The data for road transportation are relatively complete up to 2002. In 2005, the proportion of the support for fuel and energy consumption in the total tax support for international transportation totalling about CZK 32 billion was more than CZK 13 billion.

**Amount of the exemption of the Czech Republic's individual transportation modes from excise taxes and VAT in transportation under international agreements [millions CZK]**

**Table 6.9**

| Year | Road | Rail | Waterway | Air | Total |
|---|---|---|---|---|---|
| 1994 | 7995 | 48 | 198 | 2159 | **10 400** |
| 1999 | 14 912 | 722 | 387 | 4 438 | **20 459** |
| 2005 | 22 020 | 2 130 | 259 | 7 519 | **31 928** |

*Source: calculations of CENIA are based on data of the Transport Research Centre on the structure of fuel consumption, the applicable rates for excise taxes and VAT, the transportation volumes and the sales of (transportation) services in the individual transportation modes.*

7

# Agriculture

After 1989, agriculture adapted with difficulty to the new social conditions arising out of the process of economic transformation and preparation for EU accession. The transformation of agriculture, in conjunction with the extensive restitution of agricultural property, resulted in a sharp decrease in agricultural production. The Czech Republic thus lost its food self-sufficiency and was faced with a new and formerly unknown problem, namely that of uncultivated arable land. Agricultural development was later also adversely affected by cheap imported agricultural products. Decreased employment in agriculture and lower wages in this sector had an adverse effect on rural development.

On the other hand, agriculture's detrimental environmental impacts decreased considerably after 1989. Land resources also underwent some positive changes – the amount of meadows and pastures increased at the expense of arable land. The use of fertilizers decreased, which in turn reduced the amount of general surface water and groundwater pollution. In spite of that, surface water remains heavily polluted by nitrogen. Considerable ammonia emissions are the result of animal husbandry. The use of pesticides decreased by half.

Yet agriculture fulfils other social functions as well, the most important being the management of rural land and landscape: care for the landscape, its inhabitability, balance and aesthetic appearance. Ecological stability must be restored to the landscape, which is mainly ensured by its diversity: hedgerows, copses, scattered vegetation, alleys, ponds, wetlands and bank vegetation. Agriculture should also include systematic protection of plant and animal biodiversity. Therefore, since 2000, a concerted effort has been made to develop 'multifunctional agriculture' that also makes use of the non-production functions of land, such as landscaping, water management, anti-erosion and recreational functions. The gradual development of ecological agriculture has also been positive. Multifunctional agriculture can play an important role in rural development, i.e. in the development of environmental and social functions, including new job opportunities.

## 7.1 Sector dynamics from 1990–2006

After 1989, agriculture was influenced by several factors that adversely affected its development. In 1990, food subsidies (a negative sales tax) were abolished, which resulted in a 25 % increase in prices. Subsequently, the demand for food decreased. Agricultural subsidies, whose initial levels corresponded to agricultural subsidies within the EU, were significantly reduced. At the same time, the Czech food market opened to foreign competition. Imports of agricultural products grew. This resulted in both a relative over-production of agricultural products and a pressure to reduce agricultural production.

Since 1991, agricultural development has been significantly influenced by the restitution of agricultural property, whose scale has been unmatched anywhere in Europe. Land and compensation for animals and equipment were handed out to persons who, for the most part, were not active in agriculture and usually did not even live in the country. Compensation through payment in kind contributed to a considerable reduction in livestock, especially cattle. Monetary compensation resulted in yet greater indebtedness for a portion of the transformed agricultural co-operatives. While a smaller number of them disintegrated, the majority re-transformed, mostly into non-cooperative business entities. This led to a situation where about 90% of agricultural land was rented, and a portion of it was not being cultivated at all.

Consequently, restitution caused a great fragmentation of land ownership. Most agricultural land (over 3 400 000 hectares) is owned by natural or legal persons, of which 3 million are small owners with an average of 0.44 ha of land. However, the market with land under such ownership was minimal, as the vast majority of agricultural land owners did not cultivate the land, but instead rented it out. A large number of small businesses shared a small portion of agricultural land. As of 31 December 2005, small businesses with up to 10 ha of agricultural land comprised 65.4 % of all businesses, yet they only cultivated 2 % of the total amount of agricultural land. Large businesses with over 1 000 ha of agricultural land, which comprised a mere 2.3 % of all businesses, shared nearly 57.5 % of all agricultural land.

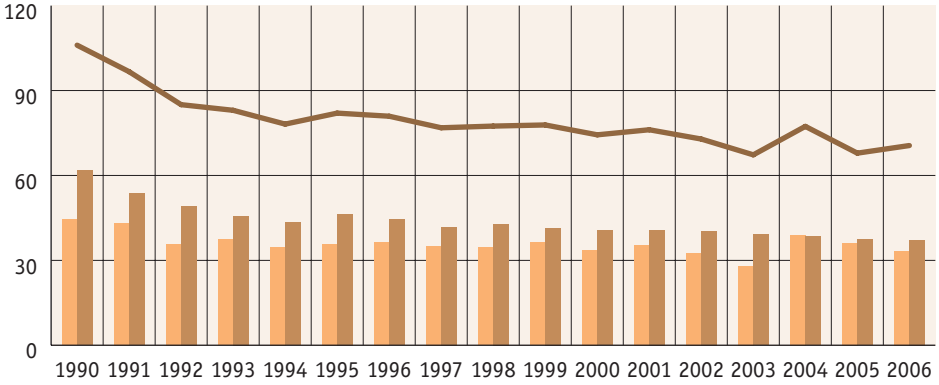
Agriculture includes **crop production and animal husbandry-primary production**. Together with conditioning agricultural services (these are monitored outside agriculture, but not separately) and the subsequent food industry, agriculture forms the agro-food complex. This, along with the suppliers of industrial inputs into agriculture, forms the agricultural-industrial complex.

The **restitution** took place pursuant to Act No 229/1991 Sb., on the regulation of ownership relations to land and Act No 42/1992 Sb., on the regulation of property relations in co-operatives (including their amendments and implementing regulations).

According to the Agrocenzus 2000 nationwide agricultural census, the proportion of land cultivated by agricultural businesses was 92% rented from others. According to a 2003 structural survey, the proportion of rented land within the total amount of agricultural land cultivated by the survey's respondents was 89 %, of which 97 % were legal persons and 70 % natural persons.

**The development of the volume of gross agricultural production at 1989 constant prices [CZK billions]**

**Chart 7.1**

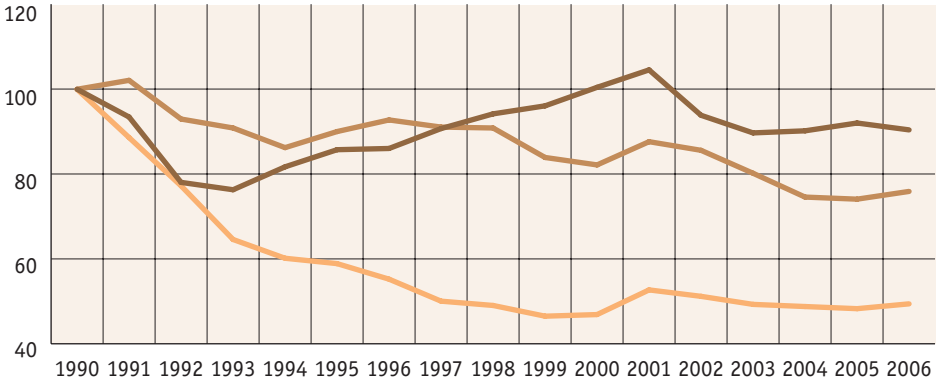



Gross crop production
Gross animal husbandry
Gross agricultural production

*Source: Ministry of Agriculture of the Czech Republic*

**Livestock breeding intensity (spring numbers, index 1990 = 100)**

**Chart 7.2**




Cattle
Pigs
Poultry

*Source: Czech Statistical Office*

Pigs and poultry per 100 ha of arable land, cattle per 100 ha of agricultural land.

The development of the volume of gross agricultural production from 1990–2006 is shown in Chart 7.1. The total decrease in the volume of agricultural production between 1990 and 2006 amounted to approximately 34 %. The bumper year of 2004 was the only to experience an increase in agricultural production, which was 27 % lower versus 1990.

As a result of this decrease, the Czech Republic ceased to be self-sufficient in food products for our climate zone. In addition, the decrease in agricultural production was also reflected in decreased employment in agriculture (see Chart 7.5). The production of energy crops (virtually only rapeseed oil) only exacerbated the situation.

Particularly noticeable was the decrease in animal husbandry as shown in Chart 7.2. Livestock numbers decreased to approximately 49 % of the 1990 level, which has caused adverse environmental effects in the form of both increased amounts of unused meadows and pastures and a lack of quality farmyard manure. A large portion of old herb-rich meadows that are of natural value was neglected and, when not mowed for longer periods of time, both their biodiversity and natural value decreased. The reduction of pig breeding by 24 % (from 142 to 108 animals per 100 ha of arable land) and in the case of poultry by 10 % (from 1 035 to 936 animals per 100 ha of arable land) is positive from the environmental perspective, since such intensive animal industry is a significant source of pollution, especially pollution from nitrogen compounds (ammonia).

Also important for the environment are the numbers of sheep and even goats, whose grazing in medium and higher altitudes helps manage meadows and pastures. However, the number of sheep decreased from 430 000 in 1990 to 90 000 in 2000, which then increased to 148 000 in 2006. The number of goats decreased from 42 000 in 1990 to only 14 000 animals in 2006.

Within the Czech Republic's total area of 78 864 km², agricultural land resources (ALR) covered 42 544 km² as of 31 December 2006, i.e. 54 % of the total area. Its overall amount changed little in 1991–2006. By 2006, it only decreased by about 0.8 % (in absolute numbers, by 331 km²). More significant were the changes in the structure of the ALR, which are outlined in Table 7.1. The area of arable land decreased by 5.6 %, mainly in favour of permanent grasslands (an increase by 17.2 %), which contributes to the fulfilment of the landscape's natural functions. In 2006, the amount of arable land per capita decreased to 0.287 ha, which is 7.6 % less than in 1990. Although the agricultural land resources' structure has improved, arable land still comprises 71.5 %. It is desirable to further decrease the proportion of arable land and to divide large pieces of land with scattered vegetation, anti-erosion hedgerows, etc.

**The agricultural land fund** (agricultural land) is comprised of arable land, meadows, pastures, vineyards, hop gardens, orchards and gardens. Non-agricultural land includes woodlands, the land occupied by streams and reservoirs, infertile land (e.g. rocks), other land (parks, graveyards, sports grounds etc.) and developed land.

**The development of agricultural land resources [thousands ha]**

**Table 7.1**

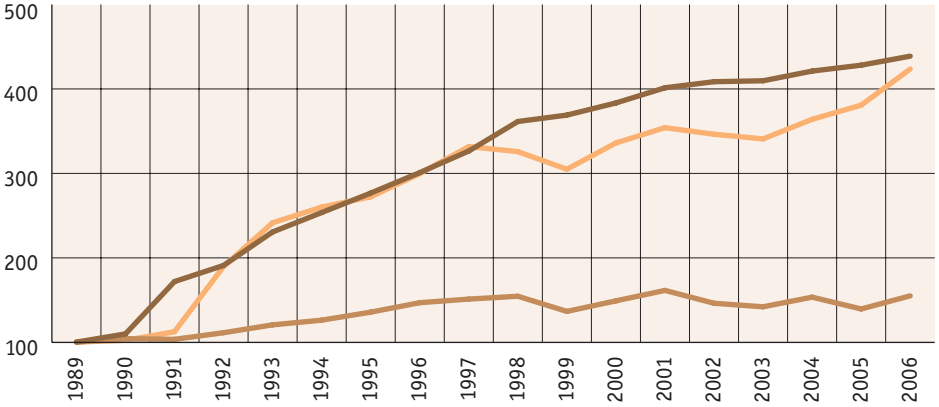
| | Arable | Permanent grassland | Gardens | Orchards | Vineyards | Hop gardens | ALR total | % arable |
|---|---|---|---|---|---|---|---|---|
| 1991* | 3 219 | 833 | 158 | 51 | 16 | 11 | 4 287 | 75 |
| 1995* | 3 158 | 887 | 158 | 50 | 16 | 11 | 4 281 | 73 |
| 2000** | 3 082 | 961 | 161 | 49 | 16 | 11 | 4 280 | 72 |
| 2006** | 3 040 | 976 | 162 | 47 | 19 | 11 | 4 254 | 71 |
| 2006/91 | 0.94 | 1.17 | 1.03 | 0.92 | 1.19 | 1.00 | 0.99 | 0.95 |

*Source: Czech Office for Surveying, Mapping and Cadastre*

* the situation as of 1 January
** the situation as of 31 December

**The development of agricultural product prices, the prices of agricultural inputs and the inflation between 1989 and 2006 (index 1989 = 100)**

**Chart 7.3**




The development of the prices of agricultural imputs
The development of agricultural product prices
The development of inflation

*Source: Czech Statistical Office, Research Institute of Agricultural Economics*

The appropriation of land use continued after 1990, in particular for the construction of roads and highways, shopping centres, industrial zones, satellite towns and flats, especially in the regions around large cities, which is undesirable from the environmental perspective. These changes are only partially recorded. New industrial businesses were mostly built on greenfield land; the use of deserted industrial areas (brownfields) was apparently inadequate.

Payments for the removal of agricultural land from agricultural production have been applied since the 1960s in order to reduce the assignment of agricultural land to non-agricultural use, especially the assignment of top-quality land. The current amount of payments for the assignment of agricultural land to non-agricultural use was set in 1992 based on an economic evaluation of land-ecological units at 100 times the net agricultural production under 1989 conditions, because no other background information was available. After 1990, the amount of unused agricultural land increased as a result of the transformation of agriculture. The reason was a marked decrease in agricultural production and, in localities that were attractive for building development, land speculation. Unused agricultural land quickly becomes weed-infested (weeds are one of the sources of pollen allergens) and is exposed to other influences that are detrimental to the environment. From 1995 to 2003, the Czech Statistical Office put the amount of unused agricultural land at about 300 000 ha, i.e. at approximately 7 % at the total amount. Since then, this indicator has not been reported.

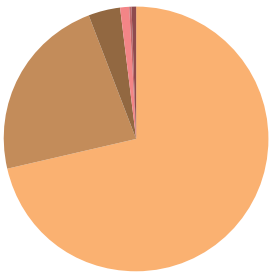
An important issue is that of ensuring the quality of food products with respect to the permissible level of harmful substances. The very strict, although not always fully enforced or complied with standards ceased to be applied to imported food products after 1989, to the detriment of consumers. Act No 110/1997 Sb., on foodstuffs and tobacco products and on amendments to some related acts along with its implementing regulations, introduced standards for the permissible level of harmful substances that were applicable in EU countries. According to the Ministry of Health, consuming marketed food products poses no danger to the health of Czech citizens.

A positive trend can be seen in the ever growing supply of organic food products. Currently, the problem of organic food is no longer in the production sphere; it is in the distribution sphere. It is connected, for example, with collection and other economically acceptable transport costs.

The proportion of the gross national product (GNP) generated in agriculture (including forestry and fishing) in the total GNP decreased in 1989–2004 from 9.33 % to 2.13 %. However, the significance of agriculture for society is far greater than this indicator might suggest.

The development of industrial product prices from 1989–2006 corresponded neither with the development of the prices of inputs nor with the inflation rate – see Chart 7.3. While the inputs experienced a 324 % increase and aggregate inflation reached 339 %, agricultural product prices only increased by 55 %, which had a considerable effect on the economic situation of farmers and on the level of both nominal and real wages.

**ALR structure in 2006 [% ]**



Arable land 71.5 %
Permanent grassland 22.9 %
Gardens 3.8 %
Orchards 1.1 %
Vineyards 0.4 %
Hop gardens 0.3 %

*Source: The Czech Office for Surveying, Mapping and Cadastre*

A distinction must be made between unused agricultural land and land that is effectively unusable for agriculture and is suitable for afforestation. Its amount was assessed before 1989 and shortly thereafter (in 1989 it was 88 759 ha and in 1992 it was 78 302 ha).

## 7.2 The social aspect of the agricultural sector

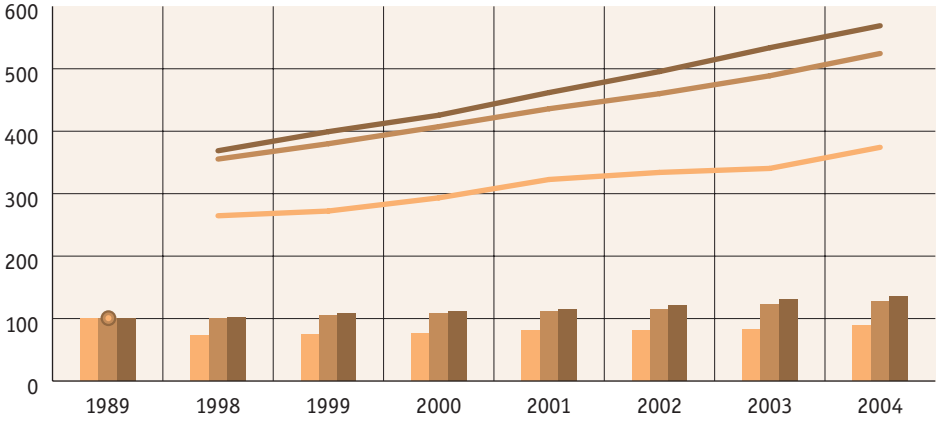
Throughout 1989–2005, labour productivity in agriculture increased to 265%. The number of workers in agriculture decreased more steeply than the respective production volume. The average gross wage in agriculture was CZK 13 625 in 2005, i.e. 72 % of the average gross national wage. Once adjusted for inflation, it was lower than in 1989 – see Chart 7.4.

Employment in agriculture and its related sectors decreased sharply, as shown in Chart 7.5, which had repercussions for the economic stability of the countryside. However, in addition to the decreased agricultural production (see Chart 7.1), decreased employment levels in this sector are the result of a number of other factors: the structural and technological changes in agricultural production, the bad economic situation of agricultural businesses (virtually no new job opportunities are created here) and the rural technical infrastructure. The increasing average age of the agricultural population is mainly caused by little interest among young and qualified workers in working in agriculture, largely due to the physical demands of such work, low wages, unsatisfactory working hours and the working environment, low social prestige and the uncertain perspective of agricultural enterprise.

Employment statistics only include the workers in crop production and animal husbandry in agriculture. Up until 1990, these statistics also included the workers of construction teams, agrochemical businesses and other agricultural services, as well as of the associated non-agricultural production. Since 1995, records have been kept for businesses with more than 20 workers. The data for smaller business are estimated.

**The comparison of the development of nominal and real wages in agriculture, industry and the national economy (index 1989 = 100)**

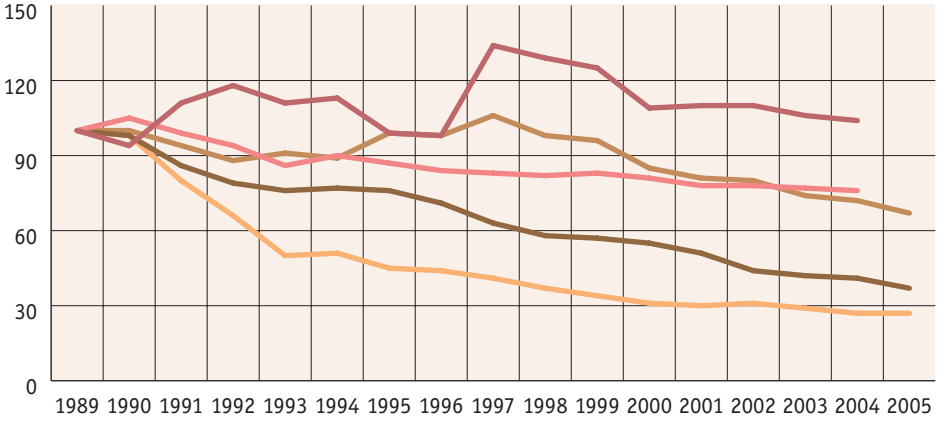
**Chart 7.4**




*Source: Czech Statistical Office*

**Employment in agriculture, forestry, water management and the food industry (index 1989 = 100)**

**Chart 7.5**




*Source: Czech Statistical Office*

The time series is not adjusted for methodological changes. The food industry reports businesses with more than 20 employees. Source: The Czech Statistical Office

## 7.3 The environmental impact of agriculture

Two levels can be differentiated within the environmental impacts of agriculture. First, there is environmental pollution (especially water and soil pollution) by foreign substances originating from agricultural chemicals (fertilizers, pesticides) and from agricultural facilities, especially from animal husbandry. Secondly, there is the effect of agriculture on the character of the landscape and the disruption of the landscape's natural functions, which can be mainly seen as reduced biodiversity in areas subject to intensive cultivation.

### 7.3.1 Energy consumption

According to the Czech Statistical Office, energy consumption in the Czech Republic's agriculture and forestry sectors decreased from 81 to 25 PJ, i.e. to 31 % in 1990–2006. The Research Institute of Agricultural Engineering puts the total energy consumption in Czech agriculture in 2006 at 17 PJ. Agriculture consumed approximately 422 million litres of diesel fuels. It is safe to assume that emissions from combustion decreased accordingly.

### 7.3.2 Industrial fertilizer consumption

After 1990, the consumption of industrial fertilizers decreased. Later, however, it stagnated, with the exception of lime fertilizers, and the consumption of nitrogen fertilizers even slightly increased – see Chart 7.6. While the amount of nitrogen fertilizers consumed, in kg/ha in net nutrients, decreased by 54 % from 1990 to 1993, it increased by 94 % to 77.4 kg/ha from 1993–2006. There has been a considerable decrease in the use of lime fertilizer, reaching as little as 3.9 % of the 1990 level. The marginal use of lime fertilization has resulted in an overall increase in soil acidity, even in spite of reduced soil acidification caused by decreasing emissions of sulphur and nitrogen dioxides. Although the reduced use of industrial fertilizers decreased crop yields, the decrease was less than proportionate to the reduction in industrial fertilizer consumption. From the viewpoint of environmental protection, the marked decrease in the use of industrial nitrogen, phosphate and potash fertilizers has unquestioningly been a positive phenomenon.

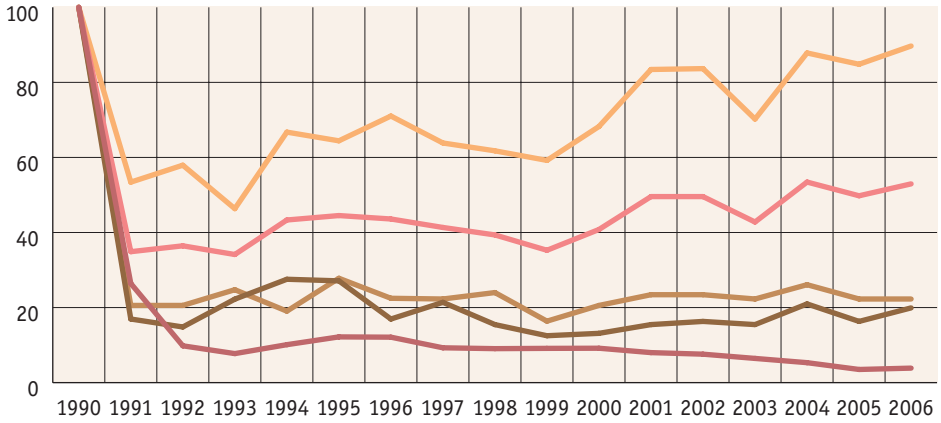
Despite the decrease in industrial fertilizer consumption, the pollution of water by nitrogen compounds that originate almost exclusively from agriculture remains a problem. Although there have been some positive changes and pollution has been slowly decreasing over the past 17 years, in some areas under intensive cultivation, both surface water and groundwater pollution has stagnated or even moderately increased. Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (the Nitrates Directive) was enacted in the Czech Republic through Government Regulation No 103/2003 Sb. It defined the vulnerable zones and the use and storage of industrial fertilizers and farmyard manure, crop rotation and the implementation of anti-erosion measures in these zones. In 2005, ammonia emissions from animal husbandry were estimated at 64 kt. Generally, ammonia emissions into the air do not exceed the defined limits, and so the Czech Republic already meets the 2010 national emission ceiling for ammonia (80 kt/year) specified under the Gothenburg Protocol.

Even though phosphate fertilizer consumption decreased by 82.6 % in 1989–2006, water eutrophication increased. The reason for this is also to be found outside agriculture (e.g. an increased use of washing powders containing phosphates). Despite the decreased amount of polluted water by nitrates, dams are becoming increasingly infested with algae and toxic cyanophytes. This is probably partly caused by the increasing summer water temperatures. For additional information about the issue of eutrophication, see the *Water Management* chapter.

The methodology for the real determination of ammonia emissions from agricultural facilities through specific methods is relatively complicated, which is why expert estimate and calculation-based methods are used as well. Ammonia remains the most frequently reported substance in the pollution register from the agricultural sector pursuant to the Act on Integrated Prevention.

**Industrial fertilizer consumption (index 1990 = 100)**

**Chart 7.6**

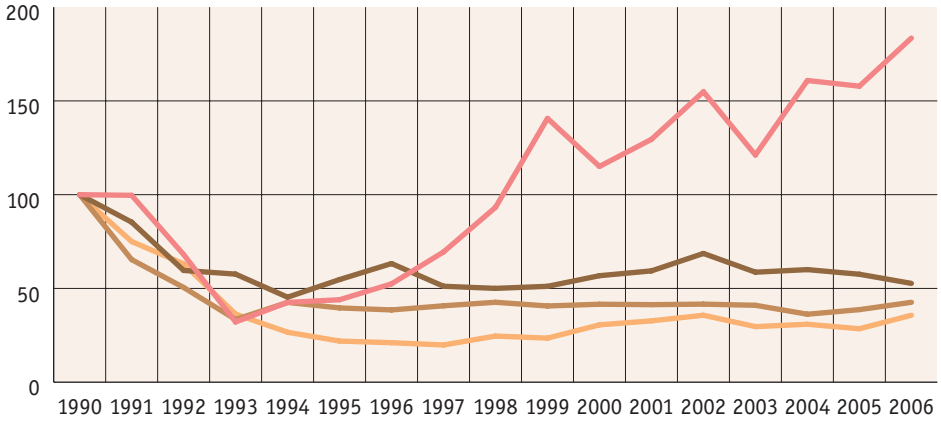



*Source: Ministry of Agriculture*

N (nitrogen), $P_2O_5$ (phosphate) and $K_2O$ (potash) fertilisers expressed in kg of net nutrients per hectare of agricultural land, Ca (lime) in absolute numbers in tonnes.

**The use of pesticides according to their purpose in kg of active component (index 1990 = 100)**

**Chart 7.7**




*Source: Ministry of Agriculture*

## 7.3.3 The consumption of pesticides

The use of pesticides is decreasing, with the exception of growth regulators – see Chart 7.7. The total amount of these preparations that was applied to agricultural land in 2006 was half the 1990 level. Over the past three years, the consumption of active components per 1 ha of agricultural land was at the level of approximately 1 kg/ha, while in 1990, the consumption was 2 kg/ha.

## 7.3.4 The impact of agriculture on water quality

Surface water quality has been improving in line with the decreasing use of agricultural chemicals. The most vulnerable to pollution is the quality of shallow groundwater. While this was slightly, yet consistently improving from 1995 to 2005, the incidence of above-the-threshold nitrate concentrations has increased over recent years – see Table 7.2. Although the situation is better when compared to the 1980s, it still requires further attention.

One of the tools that make it possible to deal with the adverse effects of large poultry and pig breeding facilities is the Integrated Pollution Prevention and Control (IPPC). In 2007, 138 decisions on integrated permits pursuant to Act No 76/2002 Sb., on integrated prevention, as amended, were issued in the environmental sector (109 decisions in 2006, 61 decisions in 2005, 69 decisions in 2004 and 5 decisions in 2003). Among other things, measures designed to reduce the bad odours from animal husbandry are being promoted within IPPC.

In most cases, current technical and environmental standards in the Czech Republic's large poultry and pig breeding facilities make it possible to meet the criteria of using best available techniques (BAT), provided that the conditions specified by component laws are fulfilled.

The most investment-intensive tasks include compliance with the requirements of the Nitrates Directive, compliance with the BAT criteria for the processing of pig and poultry excrement and the application of technologies for reducing the emissions of ammonia, odours and other substances.

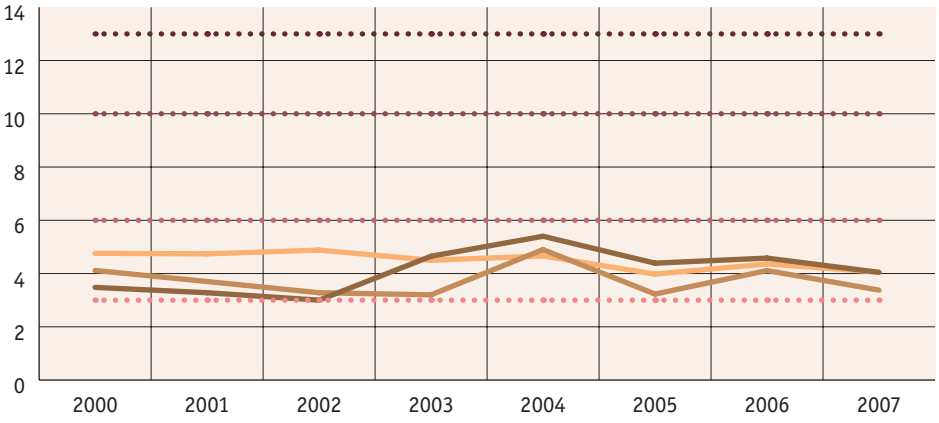
The application of both scientific progress and the latest scientific knowledge is mainly reflected in the use of automatic systems for feeding, air-conditioning, sorting, candling, marking and packaging eggs and in the implementation of national BAT. Presently, BAT that reduce water and energy consumption are commonly used. The recuperation of heat from poultry barns is an exception as it is too expensive. Raw materials – feed and fodder, water, vitamins, mineral compounds, drugs etc. can be saved through the use of computer units and medicators in both poultry and pig breeding and by switching to liquid feed in pig breeding.

Conversely, the requirement for the documentation and the keeping of records on the operation of the facilities and their conditions is the most commonly violated procedure, although it is the least financially demanding one. The techniques that can be implemented the fastest are the principles of sound agricultural practice; the longest amount of time is required for the implementation of BAT that are associated with high financial costs, such as biogas stations.

In 2005, a total of 147 shallow boreholes were monitored, which were mainly concentrated in the flood plains of the Elbe, Orlice, Jizera, Ohře, Dyje, Morava, Bečva, Opava and Odra Rivers. Such groundwater is highly vulnerable, has a high permeability coefficient and the pollution progresses quickly. A total of 150 indicators were measured twice a year.

**The development of water quality in border profiles according to the nitrate nitrogen indicator [mg/l]**

**Chart 7.8**




*Source: Ministry of Agriculture*

**The number of cases in which limits for nitrogen compounds were exceeded (drinking water) in water from shallow boreholes [%]**

**Table 7.2**

| Indicator | Permissible values for drinking water | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|
| Ammonium ions | < 0.5 mg/l | 27.3 | 23.3 | 21.4 | 19.2 | 21.5 | 21.6 | 20.5 |
| Nitrates | < 50 mg/l | 21.2 | 16.4 | 18.3 | 20.6 | 22.9 | 19.2 | 20.8 |

*Source: Czech Hydrometeorological Institute*

### 7.3.5 Agricultural land compaction and erosion

Approximately 50 % of arable land is in danger of compaction, i.e. detrimental changes in both soil structure and the indicators of the spatial configuration of soil mass. The principal cause of compaction is compression of the soil by the running gear of machinery that is used for cultivating the land. The deteriorated physical properties of soils caused by compaction represent the starting point for the deterioration of both the biochemical and biological properties of soils. This results in worsened conditions for cultivated crops, reduced crop yields and, in the case of sugar beets, a lower quality. From the environmental perspective, the main risk factor is a reduced permeability of compacted soil to water, which results in an increased surface runoff of precipitation water that is associated with both water erosion and water pollution from hazardous substances. Soil compaction also increases the consumption of diesel fuels during soil cultivation and often makes it necessary to repeat some pre-seeding operations.

Winter frosts mitigate soil compaction. It can be reduced through preventive and corrective measures, preferably complex. Soil compaction is also reduced through the use of new running gear designs (low-pressure tyres, multiple-axle running gears) and the use of harvesters with containers (sugar beet harvesters, forage harvesters). Separating technological transport on agricultural land from transport on ground communications and purposefully connecting work operations plays a significant part. It is beneficial to employ the technologies of protective soil processing and of establishing such vegetation that can be expected to increase the soil's resilience to compaction. Compacted soil layers must be tilled.

In 2006, 1 797 thousand ha (i.e. 41.2 % of the agricultural land) was at risk of water erosion and 320 thousand ha (i.e. 7.5 % of the agricultural land) was at risk of wind erosion (The Research Institute for Soil and Water Conservation and the Report on the Environment in the Czech Republic in 2006, respectively). In connection with this, CZK 78.4 million was spent on anti-erosion measures as a part of land consolidation. Within the framework of the support provided by the Agro-environmental Measures programme (AEM), there has been consistently high interest in growing interim crops with anti-erosion properties. In 2006, such crops were sown on over 203 thousand ha.

### 7.3.6 The condition of the agricultural landscape

Over the past decades, agriculture has markedly transformed the face of the landscape. Agricultural landscape is at risk both because of the long-term absence of extensive forms of farming on meadows and pastures and because inappropriately farmed arable land is threatened by erosion. In concrete terms, scattered greenery has been cut down, anti-erosion hedgerows have been ploughed, watercourses have been straightened, agricultural land has been drained, agrochemicals have been overused, agricultural land, and arable land in particular, have been exposed to considerable compaction caused by heavy agricultural machinery. Thus far, there has been little success in rectifying this situation. Despite complex land consolidation, farmers' interest in change has been low. The current agricultural landscape is deteriorating. In many places it is becoming wild and neglected due to the large amount of uncultivated, weed-infested agricultural land. The agricultural landscape surrounding large cities suffers from urban expansion, including the construction of new buildings and roads. Despite the country's grave experience with massive floods, building continues in the flood plains of rivers.

Intensive farming of meadows and pastures and letting such lands lie fallow sometimes leads to a reduction in their biodiversity. Currently, there are efforts to gradually remedy this situation within the subsidy titles of the Ministry of Agriculture. However, only a very small part (usually about 5 %) of the relatively high costs for land consolidation (CZK 1 249 million in 2005) goes to landscape improvement. For this purpose, the Ministry of the Environment has its Landscape Management and River System Rehabilitation Programme (CZK 600 million in 2006), which is mainly aimed at supporting the diversity of flora and fauna, maintaining the cultural condition of the landscape and supporting anti-erosion protection measures. The Countryside Renewal Programme aims to restore an environmentally and socially stable countryside.

Since 1989, the environmental burden caused by agriculture has been gradually decreasing as a result of the economic pressure to save environmental inputs, the implementation of stricter limits for discharging toxic substances and the existence of new approaches to farming (the integrated crop production systems, in which environmentally and economically beneficial procedures are applied).

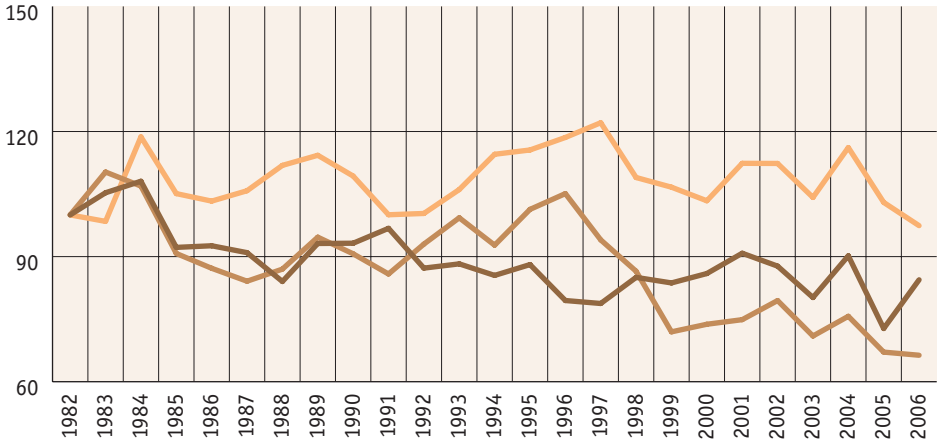
A useful indicator for the health of the agricultural and forest landscape is the index of change in the abundance of common bird species (Gregory et al., 2005). The development of this indicator in the Czech Republic is shown in Chart 7.9.

Medieval agriculture had a positive effect on both the landscape and the biodiversity of nature, because it replaced the former, mostly monotonous forest landscape (90–95 % coverage of the total area by forest) with a picturesque landscape of fields, meadows, small woods and forests, a mosaic-like agricultural landscape featuring a large amount of scattered vegetation, both property and anti-erosion hedgerows, numerous alleys etc., i.e. with an environment that supported a myriad of plant and animal species that had no chance of survival in a forest landscape. Such landscape retained water better, did not suffer from soil compaction and was much less threatened by soil erosion. Also, the population and their nutrition were much lower than today.

Agricultural amelioration is known as irrigation (from the environmental viewpoint, this does not pose a problem, provided that good water is used), drainage (this usually leads to a reduction in biodiversity and sometimes soil compaction, although there are exceptions, see for example the medieval fertilization of the Třeboň region) and "melioration" – cutting down scattered vegetation, ploughing anti-erosion hedgerows, straightening watercourses etc., which causes serious harm to the landscape, worsens floods and, by increasing soil erosion, is sometimes even counterproductive from the agricultural point of view.

**The development of the abundance of common bird species (index 1982 = 100)**

**Chart 7.9**




*Source: The Czech Society for Ornithology*

The index of change in the abundance of farmland birds (Chart 7.9, 13 common species) indicates that some improvement probably occurred during the first half of the 1990s, which resulted in a temporary increase in their abundance. Generally, however, we can see a negative trend occurring from 1982 to 2006 to the present day. In the long term, the abundance of woodland birds (31 common species) has been stable or even moderately increasing, which may be connected with the improving species and age structure of forests, as well as an increase of their area.

## 7.3.7 Ecological agriculture

**Ecological agriculture** excludes the use of artificial fertilizers and pesticides for pest extermination and for killing other undesirable plants and animals. The final products (the 'organic food') are therefore more beneficial for human health. Ecological agriculture not only supplies healthy raw materials for the production of organic food, it also creates a lifestyle that is friendly to natural resources and livestock.

The beginning of the 21st century has seen a significant development of ecological agriculture that is friendly to the environment. The greatest boom of ecological agriculture took place from 1998 to 2001 in connection with the changes in the subsidy policy for organic farmers. In 2006, the area of organically farmed land amounted to 281.5 thousand ha, with a total of 963 organic farms (134 more than in 2005). After a minor decrease in 2005, this represents a significant positive increase, as shown in Chart 7.10. The share of organically farmed agricultural land reached 6.61 % of the ALR in 2006.

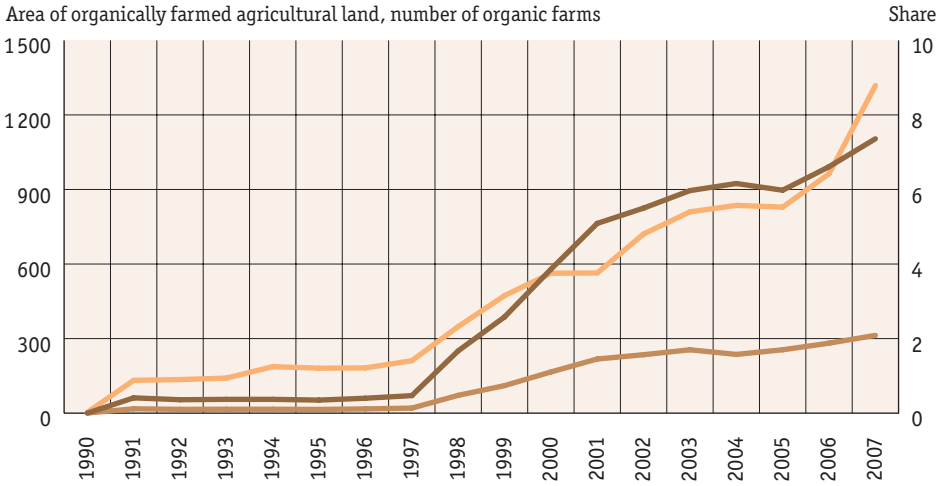
Although approximately 83 % of ecological agriculture is done on permanent grasslands, their share has decreased by about 8 % since 2003. On the contrary, the proportion of arable land (8.3 %) and of permanent and other areas (9.2 %) has increased. The main focus of ecological agriculture is animal husbandry, namely cattle breeding.

In 2006, the number of organic food producers increased by 27, to a total of 152 businesses. The demand for organic raw materials on the part of organic food producers keeps growing, while the sales opportunities for organic food is improving as a result of increasing consumer interest. From 2003 to 2006, the organic food turnover grew fourfold, from CZK 180 million in 2003 to over CZK 700 million in 2006.

In 2006, the subsidy support for ecological agriculture continued in the form of agro-environmental measures within the Horizontal Rural Development Plan. Effective as of 30 December 2005, Act No 553/2005 Sb. entered into force, which amends Act No 242/2000 Sb., on ecological agriculture. The purpose of this amendment was to eliminate from the law all duplicate provisions that co-existed with the European legislation (Council Regulation 1991/2092/EEC on organic production of agricultural products). As part of the legislative changes, legal regulations pertaining to ecological agriculture were significantly simplified.

**The development of ecological agriculture 1990–2005**

**Chart 7.10**




*Source: Ministry of Agriculture*

**Financial resources disbursed under the agro-environmental measure entitled "Ecological Agriculture" – subsidies allocated to land included in ecological agriculture**

**Table 7.3**

*Source: Ministry of Agriculture*

| Year | Disbursed financial resources (in millions of CZK) |
|---|---|
| 1998 | 48.09 |
| 1999 | 84.17 |
| 2000 | 89.10 |
| 2001 | 167.97 |
| 2002 | 210.86 |
| 2003 | 230.81 |
| 2004 | 292.20 |
| 2005 | 285.83 |
| 2006 | 305.00 |
| 2007 | 540.40 |

## 7.4 Agricultural sector policy

Before 1989, the main objective of agricultural policy was to ensure food self-sufficiency. After 1989, the transformation of agriculture and environmental protection became the main priority. Then, before 2000, the preparation of agriculture for EU accession also became a large part of agricultural policy. In 2004, the Conception of the Czech Republic's Agricultural Policy for the Period After EU Accession 2004–2013 was adopted that, within the conditions for EU accession, has strived to improve the competitiveness of the Czech Republic's agriculture . The most significant tool of environmental policy in agriculture became granting subsidies per hectare of agricultural land only under the condition that the principles of sound agricultural practice are complied with, which also include environmental protection criteria.

In April 2006, the National Strategic Rural Development Plan of the Czech Republic for the 2007–2013 Period (hereinafter "the NSRDP") of the Ministry of Agriculture of the Czech Republic was adopted. The NSRDP stems from the main strategic EU priorities for 2007–2013 with an emphasis on increasing economic growth, creating new job opportunities and sustainable development. Its cornerstone, same as that of the entire agricultural policy, is ensuring the competitiveness of agriculture.

In spite of its considerably general character, the National Strategic Rural Development Plan of the Czech Republic for the 2007-2013 Period from April 2006 respects the State Environmental Policy of the Czech Republic for the 2004–2010 Period, The Czech Republic Strategy for Sustainable Development and the State Nature Conservation and Landscape Protection Programme of the Czech Republic, although some partial issues are neither included nor addressed.

Ensuring the competitiveness of agriculture contains two basic risks: If agriculture is not competitive, this will lead to a decay of agriculture, the agricultural landscape will become neglected and the rural population will decrease, which is also undesirable from the environmental point of view. However, increasing the competitiveness of agriculture can result in the deterioration of agricultural land, water pollution and other negative effects detrimental to the environment. As long as the principles of sound agricultural practice are consistently applied, the second option should not occur.

If both of the above problems are successfully avoided, numerous positive environmental effects ensuing from the implementation of the NSRDP are to be expected, for example an increased agricultural landscape biodiversity that results from suitable farming systems, greater water and soil protection, land consolidation, sustainable development and continued farming in less favourable areas, which mitigates the risks associated with land abandonment and contributes to a sustainable balance between urban and rural areas, etc.

# 8

# Forest Management

Recently, forest management has undergone an important transition process. The principles of market economy were re-introduced into this area and some forests have been returned to their original owners. The forest economy, however, has been faltering due to the adverse fluctuation of rising raw timber prices. The development of forest management has been shaped by the new Act No 289/1995 Sb., on forests.

The environmental aspects of forestry have improved. Forest coverage and natural reforestation have been on the rise; afforestation of farmland has continued and the occurrences of salvage felling have been less frequent since 2005. The species composition of forests, in particular the share of deciduous species on reforested sites, has improved. Felling has been rising, but with the exception of 2006 and 2007, it has not exceeded the new growth rate. Forests have thus not been overburdened. Despite a considerable decrease in pollution, the health of forests has been deteriorating because of defoliation present in most forests. The restoration of environmental stability in the forest systems has been insufficient.

## 8.1 Forest categories and forest coverage in the Czech Republic

In the Czech Republic, conscious forest management had been evolving since the mid-1700s, when a timber shortage throughout the country compelled Empress Maria Theresa to issue decrees to remedy the situation. Act No 166/1960 Sb. (the Forest Act) introduced the categorisation of forests into protective forests, special-purpose forests and productive forests. In the latter category, the goal of securing high timber outputs over a long-term basis shaped economic activities. The progressively increasing requirements on the irreplaceable non-production functions of forests were not sufficiently taken into account because they were never expressed in specific terms, and also because the main criterion of efficiency employed in forest management was always maximum long-term timber production.

As recently as in 1990, almost all forests fell under the administrative competence of the Forests of the Czech Republic, a state enterprise. Military forests and forest enterprise nurseries also existed, albeit to a small extent. A substantial portion of forests fell under the category of special-purpose forests (recreational forests, spa forests, forests in natural water accumulation protected areas, protective zones around sources of drinking water, specially protected areas) and some of them fell under the category of protective forests (usually with the goal of preventing forest land erosion), see Table 8.1.

Since 1996, forests severely damaged by air pollution have not been counted as special-purpose forests. The analysis is complicated by the fact that the fundamental categories overlap in practice. Special-purpose forests are frequently managed in the same fashion as productive forests. The requirement for different management systems in special-purpose forests has never sufficiently been anchored in legislation. Today, the overriding concern of private owners is profit, which amounts to interest in coniferous monocultures as the most profitable species.

From the minimum level of roughly 25 % recorded in the mid-1700s, the percentage of Czech lands covered by forests has risen to 33 % (as of 1990). This is mainly true because mountain slopes sub-mountain regions that could not efficiently have been used for farming were afforested. For higher yields, mainly spruce monocultures and, on sandy soil, pine monocultures were planted. However, they were and are very vulnerable to adverse weather conditions and parasites. The development of industry was accompanied by rising emissions of harmful solid and gaseous substances. Air pollution affected the health of spruce forests. The deteriorating environment also influenced the non-production function of forests.

The forested area in the Czech Republic has been slowly growing. Between 1989 and 2006, it rose by 20 000 ha (see Chart 8.1). It reached 2 649 000 ha in 2006. The forest coverage in the Czech Republic increased from 33.3 % in 1989 to 33.6 % in 2006 and is the eighth highest in the European Union. The regions with the highest amount of forest coverage in 2006 were the Liberec Region (44.4 %), the Karlovy Vary Region (43.3 %) and the Zlín Region (40 %). On the other hand, the regions with the lowest values were Prague (10%), Central Bohemia (27.2 %) and South Moravia (28.1 %).

**Forest categories**
According to Act No 289/1995 Sb., on forests, forests are divided – according to their prevalent function – into protective forests, special-purpose forests and productive forests. Protective forests are forests located at extraordinarily unfavourable sites, high-mountain forests at the highest levels of tree vegetation, protecting lower forests, forests on exposed ridges, and forests in the scrub forest class. Special-purpose forests are forests that are not classified as protective and are located in the 1st class hygiene protection zones of water sources, in the protective zones of natural medicinal and mineral water tables and within national parks and national nature reserves. Special-purpose forests also include forests in which there is public interest in the improvement of the environment or other qualified interests in the non-wood-producing functions of the forest are superior to the productive functions (forests in spas and metropolitan areas, forests strongly connected to water protection, forests located in natural water accumulation protected areas). Productive forests are those that are not labelled protective or special-purpose forests.

Forest survey in the Czech Republic executed in years 2001–2004 showed out about 106 000 ha of forests more than had been registered but Chat 8.1 does not display this results.

**Development in the classification of forests [%]**

**Table 8.1**

*Source: Forest Management Institute*

| Year | Productive forests | Protective forests | Special-purpose forests |
|---|---|---|---|
| 1980 | 78.2 | 4.0 | 17.8 |
| 1990 | 58.4 | 2.5 | 39.1 |
| 2000 | 76.7 | 3.5 | 19.8 |
| 2004 | 75.3 | 3.1 | 21.6 |
| 2006 | 75.8 | 2.8 | 21.4 |

**Permanent occupation of forested land by construction [ha]**

**Table 8.2**

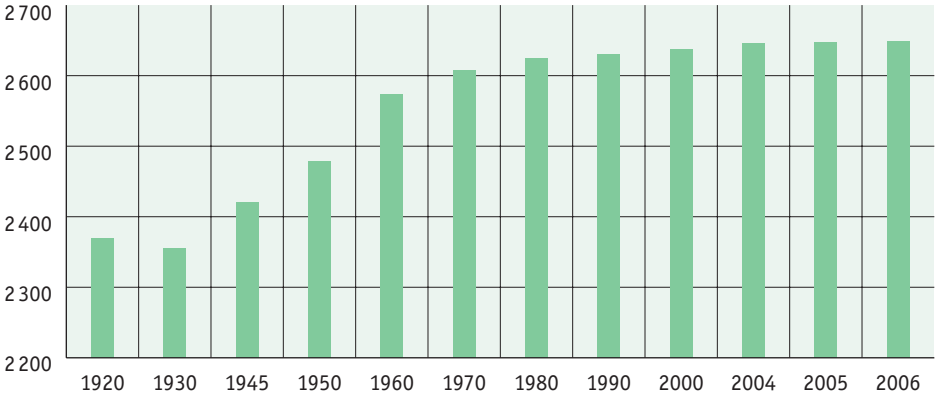
*Source: Ministry of Environment*

| Year | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|
| ha | 125 | 107 | 93 | 137 | 206 | 75 | 154 | 136 |

**Development of forest land area [thousands of ha]**

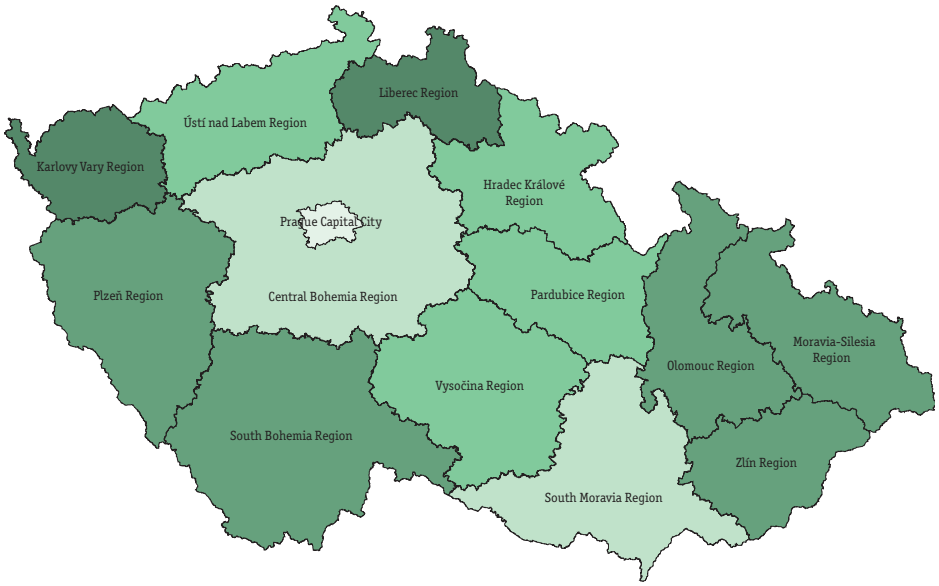
**Chart 8.1**

*Source: Czech Office for Surveying Mapping and Cadastre*




**Forest coverage of Czech regions, 2006 [%]**

**Figure 8.1**




0–10 %
11–28 %
29–31 %
32–40 %
41–45 %

*Source: Ministry of Agriculture*

Forest coverage is the share of forested land within a territory [%].

The construction of transport infrastructure results in either the permanent or temporary occupation of forest land. Such occupation leads to a decrease in forested areas. Fees for permanent and temporary occupation of forest land should discourage this practice. In the Czech Republic, theses fees were introduced on 1 January 1996. They are derived from the net timber production of the forest multiplied by 50 and by a coefficient of non-production forest functions (water management, the protection of land, climate, aesthetic and recreational functions).

**Forested land** is land covered by forest stands or otherwise used in forest management (clearings arising during forest regeneration after felling, forest roads, etc.).

## 8.2 Forest management economy

It should be stressed that even a poorly managed productive forest has a very positive impact on the environment. The economic benefits associated with the non-productive functions of forests (water management, climate, the protection of land, recreation and health) are several times larger than the economic benefits of wood production, which can be evaluated in various ways. The current prevailing economic evaluation of the non-productive functions of forests translated itself into the coefficient used for calculating the fees for the occupation of forested land for construction. However, these spontaneous positive environmental effects on forests do not enter into calculating their economic efficiency.

For the productive (wood, animals, forest fruits and mushrooms) and non-productive effects of forests to be stable, a stable, long-term forest management system based on forest management plans is needed. This requirement has a long tradition in the Czech Republic: from the Imperial decrees of the mid-1700s to forest acts (the Austrian Forest Act from 1852, Act No 166/1960 Sb., Act No 61/1977 Sb. and the new Forest Act No 289/1995 Sb.). The current act mainly lays out conditions for the protection of areas that are supposed to fulfil the function of forests, the duty to secure proper forest management, and the elimination of the effects of extraordinary events like windbreaks, fires and parasitic outbreaks. The owner or authorised lessee may harvest timber up to the volume determined by the forest management plan as long as they respect the principle of sustainable management. At the same time, the owner/lessee is obligated to afforest unstocked cuts within two years and to properly care for the new forest stands. Owners are obligated to protect forests from all external harmful influences.

### 8.2.1 Timber harvesting

The cornerstone of a forest economy is and always has been the harvesting and selling of timber. In addition to regular harvesting, which is stated in the Forest Management Plan, there is also salvage felling, which deals with the consequences of forest damage. Salvage felling has to be distinguished from unauthorised harvesting, which is in breach of the Forest Act.

Harvesting need not necessarily lead to financial profit. In the Krkonoše National Park, for example, harvesting is used for environmental purposes, namely to switch from a spruce monoculture to a forest with a more diverse composition. In the Czech Switzerland National Park, harvesting is used to eliminate the invasive Eastern White Pine.

In order not to jeopardize the productivity of forests, the volume of harvested wood must not exceed the average amount of growth. The stock of large timber must not fall, see Chart 8.2.

Between 1989 and 2005, timber harvesting was exceeded by wood growth. The large timber stock thus increased (see Chart 8.2) and woods were not overburdened. Timber harvesting grew by 28 %, but forest use was kept within its production capacity (sustainable yield). However, the difference between growth and harvesting has been declining over the last 10 years. In 2006, timber harvesting was slightly higher than its growth due to forest damage. This can be expressed by the intensity of harvesting, see Table 8.3.

**Standing timber**
= total usable standing timber stock in a forest

**Large timber stock**
= stock of timber larger than 7 cm in diameter (also standing timber); the most commonly harvested timber in a forest. The large timber stock is expressed without bark.

**Small timber stock**
= stock of timber smaller than 7 cm in diameter.

**Harvesting of timber**
= quantity of timber larger than 7 cm in diameter harvested per year (usually in $m^3$ without bark).

**Total average increment of volume of wood**
= the potential increment under the assumption of balanced and sustainable harvesting. Due to the unbalanced age structure of trees, the total average increment is lower than the actual total increment (i.e. the true increment within a given year).

Extensive increases of timber stock are given for the most part by improvement of survey of forests, less by enlarging of wood area and by increasing the timber stock in the forests.

Forest survey in the CR executed in years 2001–2004 found a timber stock about 33 % higher than a sum total of a timber stock from forest economic plans, which are mentioned in graph 8.2.

**Intensity of timber harvesting [% of wood growth]**

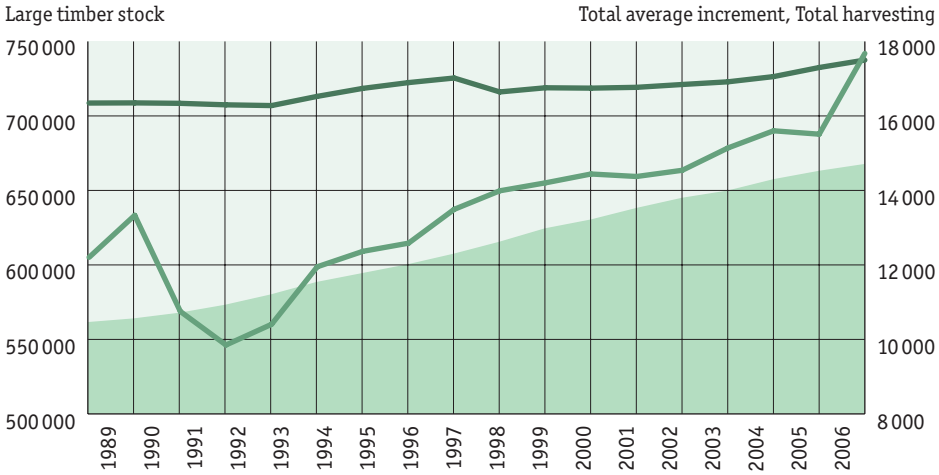
Table 8.3

| Year | 1990 | 2000 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Timber harvesting as a percentage of wood growth | 81.8 | 85.9 | 90.7 | 89.7 | 101 |

*Source: Forest Management Institute, Czech Statistical Office*

**Development of large timber stock, the total average increment of wood and total timber harvesting [thousands of m³ (without bark)]**

**Chart 8.2**




*Source: Forest Management Institute, Czech Statistical Office*

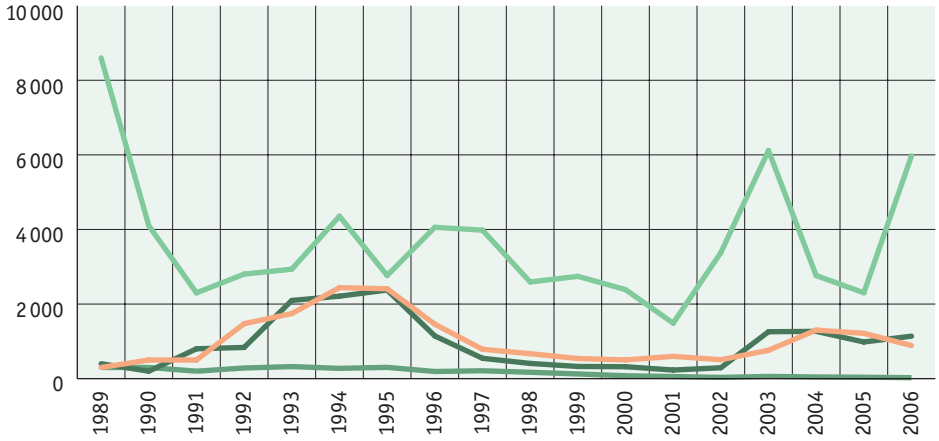
## 8.2.2 Salvage felling

Salvage felling occurs because of adverse natural conditions, but humans can influence it as well (air pollution, the seeding of foreign monocultures, structurally poor designed forests, negligence caused by the thinning and pruning of young forest stocks, etc.). For the environment and for forest management, a decrease in the volume of harvested timber by salvage felling, i.e. felling caused by forest damage, is a favourable phenomenon.

Salvage felling is a very stochastic phenomenon. It fell considerably between 1990 and 2001, but it reached as much as 8.2 million m³ in 2003, after a hot, dry winter and a disastrous gale-force wind. 2006's figures were similar. In 2007, the January gale itself accounted for 10.8 million m³ of salvage felling, which is a preliminary figure. Some changes can also be observed in the structure of salvage felling. While salvage felling caused by natural disasters and air pollution has fallen substantially, salvage felling due to damage caused by insects and other reasons like diseases (Armillaria ostoyae on spruce trees, etc.).

**Development of salvage felling [thousand of m³]**

**Chart 8.3**




*Source: Czech Statistical Office*

## 8.2.3 Reforestation

Since the mid-1700s, the laws have made it obligatory to reforest unstocked sites soon after a harvest. Reforestation includes natural growth of woods from the seeding of plants from other forest as well as purposeful seeding of young trees that need to be treated for several years. The development of reforestation in the Czech Republic is depicted in Chart 8.4.

Reforestation is one of the indicators that have considerably fallen since 1989. Artificial reforestation plunged to as little as 18 010 ha in 2006, which is 52 % of 1989 (see Chart 8.4). Natural reforestation, however, tripled in the period in question (up to 3 417 ha), which is a very positive development from the viewpoint of both forest management and the environment. Another positive phenomenon was a decrease in repeated reforestation, which is reforestation carried out when the first planting fails, to 3 054 ha, i.e. 32 % of 1989. In total terms, reforestation fell by roughly 40 % (to 21 630 ha in 2006). The massive reforestation in the early 1990s was necessary to remedy the consequences of natural disasters or damage brought about by insects.

The share of deciduous species (e.g. beeches, oaks, maples, rowans) in reforestation has been steadily rising to the detriment of coniferous species (spruces, pines) – see Chart 8.5. Thus, the species composition of forests has been approaching a more natural and stable pattern.

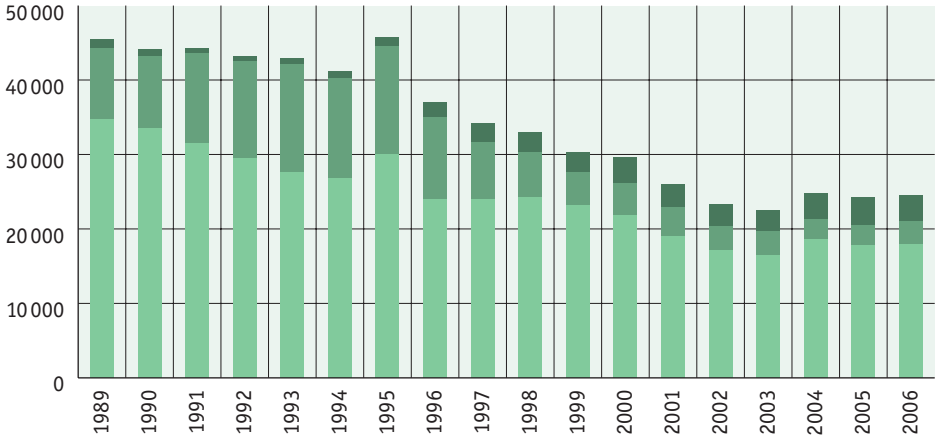
The development of young forest stands with comparatively varied species still raises concerns. Forests originally planted as mixed can inadvertently evolve into predominantly spruce-based because of grazing by an excessively large deer population and inappropriate thinning and pruning intervention.

**Artificial reforestation** means the planting of forest tree species on unstocked cuts or planting under an original forest stand

**Natural reforestation** occurs by the natural seeding of trees on clearings (regenerated forest stands).

**Reforestation [ha]**

**Chart 8.4**

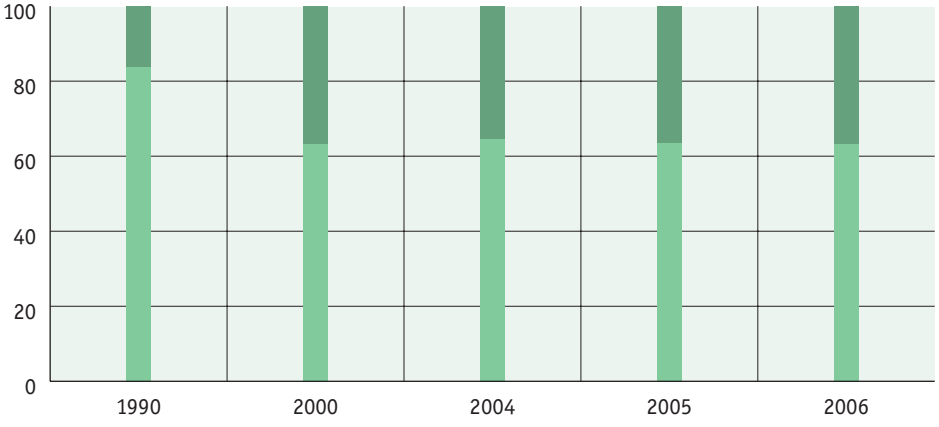



Artificial reforestation without forced repetitions
Artificial reforestation with forced repetitions
Natural reforestation

*Source: Forest Management Institute, Czech Statistical Office*

**Coniferous and deciduous species in artificial reforestation [%]**

**Chart 8.5**




Coniferous
Deciduous

*Source: Czech Statistical Office*

## 8.2.4 Timber prices

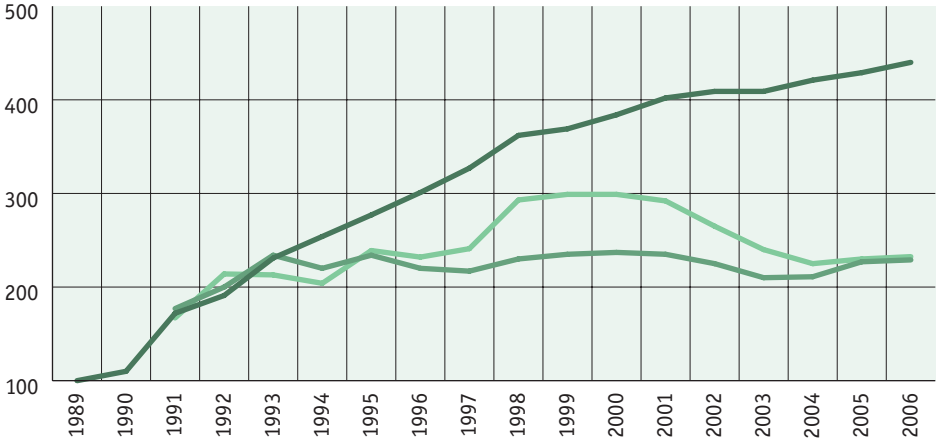
The volume and price of timber sold are crucial factors for a forest economy. Timber prices, however, tend to be volatile, which impacts the profitability of forest management.

Between 1989 and 2006, prices of raw coniferous and deciduous timber lagged behind the rather fast increasing consumer prices because supply exceeded demand. In real terms, average prices of raw coniferous and deciduous timber in 2006 amounted to a mere 53.9 % and 53.5 % of the 1989 value, respectively. See Chart 8.6. This price trend hampered the forest economy.

Huge forested areas are usually able to generate profits. However, the economic situation of small forests, which came into existence as a consequence of property restitution, is delicate. The number of employees in forest management fell by 65 % between 1989 and 2006. Wages in forest management – the average was only CZK 14 908 in 2005 – trailed the average wage in the Czech Republic.

**Trend of raw timber prices versus inflation**

**Chart 8.6**




Average prices of raw coniferous timber [CZK/m³]
Average prices of raw deciduous timber [CZK/m³]
Consumer price index [%], year 1989 = 100

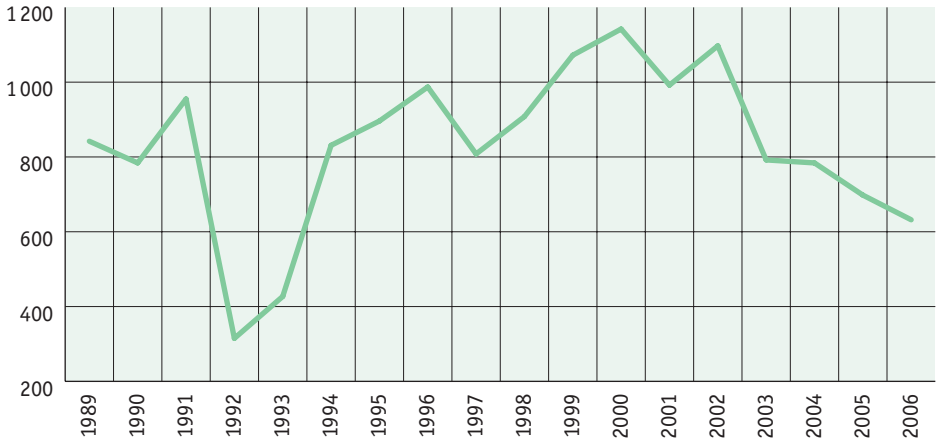
*Source: Czech Statistical Office*

## 8.2.5 Subsidies

The government provides owners of forests with specialized help and also earmarks subsidies for selected activities deemed in the public interest (especially reforestation, forest soil reclamation, care for genetic material, protection from harmful influences and afforestation of farmland). Chart 8.7 depicts these trends.

**Subsidies in forest management [CZK millions ]**

**Chart 8.7**




*Source: Green reports on the condition of forests in the Czech Republic, Ministry of Agriculture*

### 8.2.6 The afforestation of farmland

The expansion of forest land area in the Czech Republic occurs primarily through the afforestation of farmland. According to ČÚZK data, roughly 20 000 ha were afforested in the Czech Republic between 1989 and 2006. Afforestation has been proceeding gradually, without substantial fluctuations.

### 8.2.7 Transition in forest management

In 1991, restitution of forest land to their original owners and privatisation of a large part of both tangible property administered by the state-owned forest organizations led to profound changes in forest management. By 2006, the share of state-owned forests had fallen to a mere 59.6 % (out of which the Forests of the Czech Republic, a state enterprise, was in charge of 85.9 %). Municipal forest organizations, private companies and other entities administered 15.6 %, 23.3 % and 1.5 %, respectively.

The contribution of forest management to GDP fell from 1 % in 1989 to 0.6 % in 2004. Its share in the gross value added in the entire Czech economy reached 0.62 % in 2007 in current prices (green reports on the condition of forest in the Czech Republic). This indicator, however, fails to reflect the importance of forests and of their non-production functions (climate, water management, protection of soil, recreation and health) as well as the fact that forests are one of the most prominent natural resources and elements that positively influence the environment. If we create "a forestry complex" consisting of forestry, logging, manufacture of products of wood and inputs to silviculture, the share of this "complex" on a total employment and a gross domestic product will be in both cases approximately 5 %. These activities are generally concentrated to countryside with shortage of job opportunities.

**Natural, present and recommended tree species composition [%]**

**Table 8.4**

*Source: Green report on the condition of forest in the Czech Republic in 2005, Ministry of Agriculture*

| Forest composition | Natural | Present | Recommended |
|---|---|---|---|
| Spruce | 11.2 | 53.1 | 36.5 |
| Fir | 19.8 | 0.9 | 4.4 |
| Pine | 3.4 | 17.2 | 16.8 |
| Larch | 0.0 | 3.9 | 4.5 |
| Other coniferous | 0.3 | 0.2 | 2.2 |
| **Coniferous total** | **34.7** | **75.3** | **64.4** |
| Oak | 19.4 | 6.6 | 9.0 |
| Beech | 40.2 | 6.6 | 18.0 |
| Hornbeam | 1.6 | 1.2 | 0.9 |
| Ash | 0.6 | 1.2 | 0.7 |
| Maple | 0.7 | 1.1 | 1.5 |
| Elm | 0.3 | 0.0 | 0.3 |
| Birch | 0.8 | 2.9 | 0.8 |
| Lime | 0.8 | 1.0 | 3.2 |
| Alder | 0.6 | 1.5 | 0.6 |
| Other deciduous | 0.3 | 1.5 | 0.6 |
| **Deciduous total** | **65.3** | **23.7** | **35.6** |
| Unstocked land | 0.0 | 1.0 | 0.0 |

## 8.3 Health of forests

An evaluation of the health of Czech forests is ambiguous. According to domestic methodology, it has been getting better, which can be demonstrated by the rising stock of standing timber, increased forest coverage, improving species composition and the ever-increasing positive impact of forests on the landscape. According to foreign methodologies of special environmental protection, the health of Czech forests has been deteriorating. In particular, the species biodiversity of forest ecosystems has been deteriorating.

### 8.3.1 Damage caused by air pollution

The negative impact of air pollution on forests can be determined by the extent of salvage felling carried out due to pollution. Its development was positive and never reached 1 % of the total salvage felling during the period in question (see Chart 8.3).A major decrease of $SO_2$, particulate matter and $NO_x$ emissions in the 1990s radically reduced the damage caused by air pollution. Nevertheless, the development of forest stands, mainly in the Krušné and Jizerské Mountains, is still influenced by acidic elements, which accumulated in forest soil in the past, as well as by current, albeit substantially reduced air pollution. In the most severely affected sites, forest stands are reclaimed chemically; through liming and fertilisation.

Of all air pollutants, ground-level ozone currently represents the most severe stress factor for forests. Its concentration considerably exceeds the target pollution limit expressed as the AOT40 exposition index for the monitoring of ecosystems and vegetation (pursuant to Government Resolution No 597/2006 Sb. on monitoring and evaluation of air quality) in a large part of the Czech territory. Ground-level ozone visible symptoms on leaves and needles influences the physiological functions of plants and leads to the premature withering of plants and to changes in the ecosystem (the suppression of more sensitive species in favour of the more resistant ones).

### 8.3.2 Defoliation

Foreign methodologies assess the health of forests mainly according to defoliation, which is evaluated either with the help of satellite images taken of the vegetation from the spring through the late summer (so that they do not reflect the year-long development of defoliation) or with the help of field surveys at the monitoring sites of ICP forests (a total of 306 sites), which have been maintained in the Czech Republic (and previously in Czechoslovakia) since 1986. According to these methodologies, the defoliation of coniferous forests older than 60 years deteriorated sharply after 1990. After 1998, the deterioration started slowly advancing (Chart 8.8). Defoliation class 2 (e.g. defoliation reaching 25–60 %) has the largest share. Luckily, the area of forest stands classified as defoliation class 3 and 4 has not been expanding.

The annual monitoring of the health of forest plants is also conducted in other European countries. Data about defoliation for 32 countries were collected in 2006 and almost 130 000 trees in 6 000 sites were assessed. For almost 25 % of all trees, the loss of needles or leaves exceeded 25 %. Accordingly, they were classified as damaged or dead trees. These results show that a watchful eye needs to be kept on European forests and that mechanisms for their salvation have to be researched.

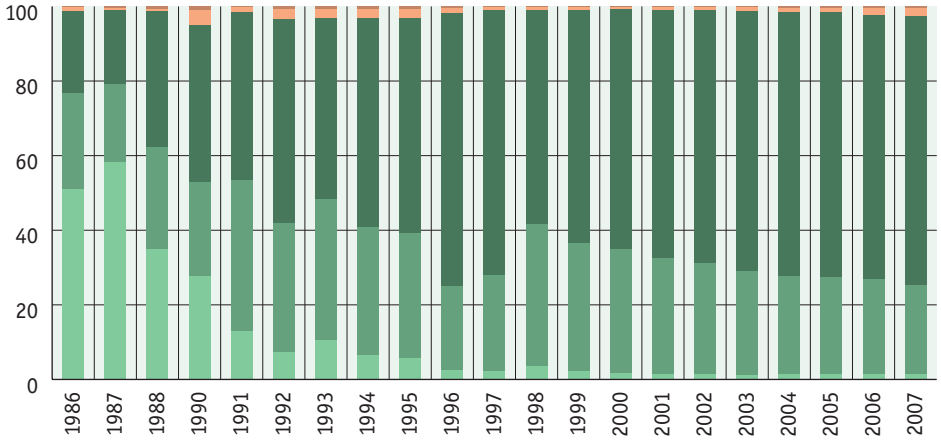
One of the current EU/ICP Forests programmes focuses on the efficient monitoring of insect parasites, which is currently the most important cause of defoliation. In addition, influences of extreme situations like the intense drought in central Europe in 2003 are monitored and quantified.

**Defoliation** is caused by various negative factors (physiological drought, biotic parasites like fungi, bark beetles and defoliating insects, air pollution and mechanical influences). It is expressed as a percentage with an accuracy of 5 %. There are 5 classes. Defoliation adversely affects the production and non-production functions of forests.

The defoliation of forests younger than 60 years has been monitored since 1998. Unlike coniferous forests, deciduous forests older than 60 years are not particularly prone to defoliation. Defoliation class 1 is the most common.

**Defoliation of coniferous trees – forest stands older than 60 years [%]**

**Chart 8.8**

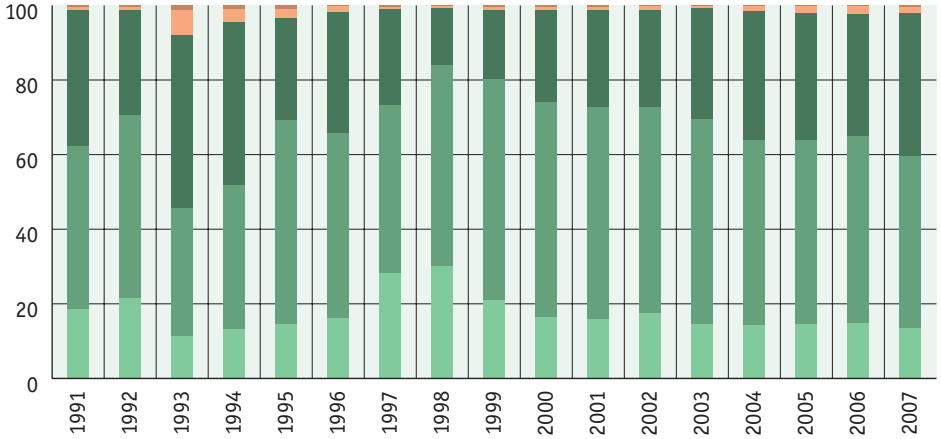



Class 0 (< 10 %)
Class 1 (> 10–25 %)
Class 2 (> 25–60 %)
Class 3 (> 60 %)
Class 4 (100 %)

*Source: Forestry and Game Management Research Institute*

**Defoliation of deciduous trees – forest stands older than 60 years [%]**

**Chart 8.9**

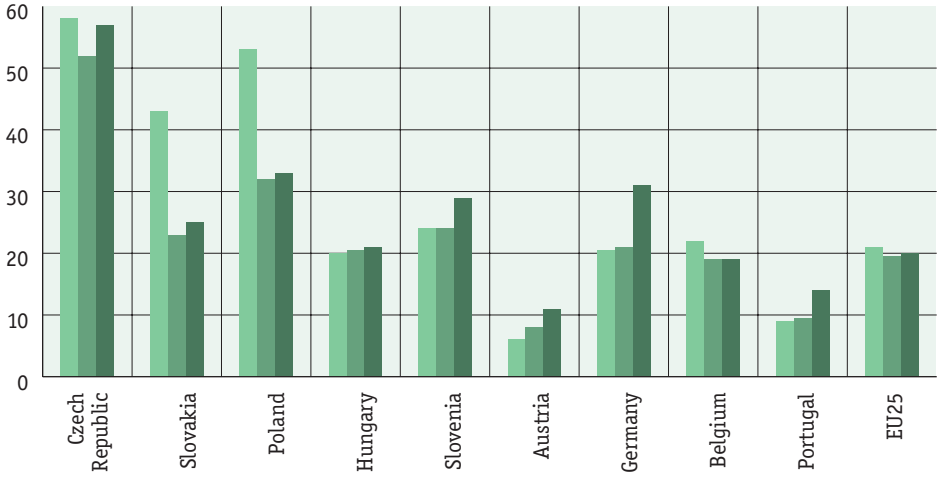



Class 0 (< 10 %)
Class 1 (> 10–25 %)
Class 2 (> 25–60 %)
Class 3 (> 60 %)
Class 4 (100 %)

*Source: Forestry and Game Management Research Institute*

**International comparison of forest defoliation [%]**

**Chart 8.10**




1995
2000
2004

*Source: Eurostat*

From 26% reached in the mid-1990s, defoliation in the EU27 fell to 20.8 % at the close of the century. It started increasing again after 2000. Despite a small decrease in 2006, the average rate of increment between 2000 and 2006 exceeded 1 %. Defoliation is caused by various factors. In the summer of 2003, for example, defoliation in the same year and in subsequent ones was triggered by extremely hot weather and drought in a large part of Europe. In 2006, the highest rate of defoliation within the EU27 was found in the Czech Republic, Luxembourg and Bulgaria with more than of the 40 % showing damage. In Estonia, Denmark, Ireland and Finland, the rate of defoliation was lower than 10 %. Chart 8.10 demonstrates the high rate of defoliation in Czech forests compared to other countries (comparison by Eurostat).

## 8.4 The impact of forest management on the environment

The economic benefits of the non-production functions of forests can be evaluated differently. The currently prevailing method has translated itself into the coefficient used for calculating fees for the occupation of forest land for construction (see Act No 289/1995 Sb.).

Since the 1950s, forest management – not only in the Czech Republic – has been faced with increasing social requirements on the non-production functions of forests. The spontaneous existence of non-production functions as a positive side effect of forest management is no longer sufficient. Therefore, new categories of protective and special-purpose forests have been introduced with a special management regime. This can lead to a lower timber yield, higher costs or both. One of the tasks for the current forest policy is to fulfil the requirements in practice.

Forests tend to be damaged by external factors like adverse weather fluctuations (gales, heavy wet snow, frost, and drought), air pollution, an excessively large population of hoofed animals and murid parasites, inconsiderate visitors, and by forest management itself. Many adverse influences reinforce each other; poor forest management makes the negative consequences of external factors more severe.

### 8.4.1 Monocultures

The desire to reach maximum forest yields triggered off a general trend of converting original mixed forests in lower altitudes into monocultures.

The conversion of the original, mostly mixed forests into spruce-based (on sandy soils pine-based) monocultures started in the middle of the 18$^{th}$ century. Such forests are economically more profitable because they permit a long-term maximum yield of timber, but they are more affected by abiotic (wind, snow, hoarfrost) and biotic (insects, fungi diseases, murid rodents) factors, which can result in large-scale windbreaks or bark beetle calamities. Damage and the costs for fixing such calamities are high. In the second half of the 20$^{th}$ century, air pollution caused by industry became relevant. Spruce monocultures are also more sensitive to pollution caused by anthropogenic activities, which can be seen in areas of the Krušné, Jizerské and Orlické Mountains that are unstocked because of air pollution. The reforestation of affected areas and the conversion of monocultures into mixed forest stands by planting original species (beech, fir, maple, rowan etc.) require investments in the order of millions of CZK. Spruce is a natural plant at mountain altitudes with mountain spruce stands. At lower altitudes, however, spruce monocultures are not justified from the viewpoint of environmental stability. In the 1970s, the growing pressure of industrial pollution, to which the monocultures of Norway Spruce were not resistant, led to a reduction of planting spruce monocultures. Nevertheless, the effort to plant the most profitable spruce and pine monocultures in Czech forests persists. It has to be faced by environmentally motivated forest management planning. Over the past 17 years, the share of deciduous and mixed forests has increased to the detriment of coniferous forests. Considering the very long period of rotation, however, the percentage of changes in the overall species structure of forests is rather negligible.

**A monoculture** is a forest stand consisting of one species of approximately the same age. In forest jargon, this term is most commonly associated with spruce-based monocultures and with problems they cause in the landscape. Such forest stands are less resistant than mixed stands featuring trees of various ages. The reason for its lowered resistance is the lower environmental stability resulting from a paucity of environmental connections which appear in ecosystems with a richer representation of fauna and flora species.

The substantial increase in windbreak occurrence is due to windstorms in spruce monocultures primarily caused by the weakening of spruce forests from high temperatures, droughts and the virulent growth of fungal disorders. Over-grazing of trees by animals and damage caused by logging and skidding also promotes fungal disorders. The role of under-bark and leaf-eating insects is essentially lower than tends to be reported. The largest windbreak in the Czech Republic from 1917–1927 was caused by the nun moth, whose population substantially increased because of the lack of forest management during WWI. These insects destroyed one-third of all Czech spruce forests.

### 8.4.2 Damage caused by poor forest management

The forest ecosystem is influenced by timber harvesting and transportation. The technologies employed in harvesting should be as efficient as possible from the economic perspective, but also as environmentally friendly as possible (anti-erosion measures, the lowest possible occupation of land for the building of forest paths, the protection of water and non-harvested trees). Specialists contemplate a solution whereby negative environmental impacts would be entirely eliminated. The reduction of such influences and the utilisation of technologies conforming to the requirements of sustainable, nature-friendly management follow from the ISO 14001 Environmental Management Systems norm.

Poor discipline during harvesting and transportation of timber has a negative influence on forests and on the environment. The felling of firm forest belts opens the way for destructive wind and windbreaks. Utilising heavy forest equipment makes forest soil denser and often inflicts considerable damage on trees (the abrasion of trees can cause their withering due to an attack by fungi diseases). The bad condition of forest paths combined with heavy agricultural equipment considerably accelerates erosion of forest soil.

Young forests also suffer from missing or inadequate thinning and pruning. The failure to thin and prune forests results in too thick forest stands and the trees can be broken by heavy wet snow. Inadequate interventions can eliminate the positive influence of a higher share of deciduous trees in reforestation when compared to the past.

A part of poor forest management is the excessively large population of hoofed animals - deer, stags, fallow deer and big-horned sheep. Grazing by a proportional population of hoofed animals would inflict damage of not more than 10 %. In reality, natural reforestation is for all intents and purposes impossible because the over-abundant hoofed animal population eats a majority of the seedlings, especially those of deciduous trees and pines, which are desirable in forests. Consequently, forest management companies are forced to enclose reforested stands by fences and the need for costly repeated artificial reforestation is intensified. In addition, mature forests stands incur serious damage. The peeling of tree bark invites fungi diseases and other tree diseases. While green reports on the conditions of forests estimate the costs caused by animals at tens of millions of Czech crowns, some surveys arrived at sums between CZK 1 and 1.5 billion per year. A similar situation can be found in other European countries, except Poland.

### 8.4.3 Non-native trees

A major problem inherited from the past is the planting of non-native tree species, e.g. Black, Locust, Eastern White Pine and European Black Pine. Some of them became invasive, i.e. they suppress other species of trees, bushes and herbs in forests. They should be eliminated progressively, in particular from especially valuable territories. But this has not been happening to a sufficient degree. So far, they have been eliminated to a non-negligible extent, and only in some specially protected areas (e.g. in the Czech Switzerland National Park or in some natural reserves). Since 2003, European Black Pine trees have been withering away.

# 9

# Water Management

Water is essential not only for preserving life on our planet, including human life; it is also an important economic raw material. Since using water means polluting it, both businesses and citizens must contribute with their fees not only for water extraction, treatment and distribution, but also for the management of polluted waste water and the fees for discharging it. Funding for anti-flood measures is primarily provided by the state, regions and municipalities.

The principal services provided within the sector include water production and distribution. The steep decline in extracted water after 1990 indicates that water is being used more economically, which is also friendlier to the environment. Advancements have been achieved with respect to both the number of people connected to public water supply systems and the quality of supplied water. Room for improvement can be seen in the high percentage of drinking water losses within the distribution networks that persists despite considerable investment in the development of technologically advanced water-management infrastructure. The need to extend the availability of the services, along with the generally rising price and the privatisation of water supply and sewage systems resulted in a substantial increase in water and sewage rates. Significant achievements from 1990–2006 were the reduction of watercourse pollution from point sources that was achieved through the construction of new wastewater treatment plants , the improvement in the quality of waste water treatment and, at the same time, a decline in production and industrial restructuring. On the other hand, the problem of diffusion and area pollution, especially with nutrients, as well as pollution from hard-to-remove substances from point sources persists. Presently, as much as 94 % of the waste water that is collected in sewer systems is treated. However, the waste water coming from the 20 % of the population whose households are not connected to any sewerage system remains a problem. Most households that are not connected to a sewerage system use septic tanks, which often leak untreated waste water.

In connection with highlighting the extreme manifestations of climate change, and the increase in flood activity in particular, current objectives also include changing the landscape water management. Various programmes and new approaches towards water management planning in river-basins help reduce flood risks. These approaches should also contribute to the longer retention of water in the landscape during dry periods.

## 9.1 Watercourse management

The watershed between three seas – the North Sea, the Black Sea and the Baltic Sea – also separates the three main river-basins, i.e. those of the Elbe, Morava and Odra Rivers. There are 8 main river-basin regions within the above main river-basins (5 regions within the Elbe basin, 2 regions within the Morava's basin and the basins of other tributaries of the Danube and smaller neighbouring river-basins and 1 region in the Odra's basin and in boundary basins).

Significant watercourses totalling nearly 17 000 km, including weirs and most reservoirs, are administered by the River basins state enterprises (Povodí s.p. – Povodí Labe, s.p., Povodí Vltavy, s.p., Povodí Ohře, s.p., Povodí Moravy, s.p., and Povodí Odry, s.p.). The Povodí s.p. manage state property and provide water management services in the public interest. Until the end of 2000, they were publically traded companies, but since 2001 they have been state enterprises.

Minor watercourses with a total length of 35 700 km and the facilities on these watercourses are the responsibility of the Agricultural Water Management Authority (AWMA) – operating since 2001; its legal predecessor was the State Melioration Administration (SMA). Up until 31 December 2004, the main melioration facilities (MMF) were administered by the Land Fund of the Czech Republic (LF CR). Since 2005, the LF CR only retained the administration of those MMF that had been designated for privatisation based on requests made by third persons. However, pursuant to an agreement, the administration of the MMF has been performed by the Agricultural Water Management Authority since 1996, while the LF CR covered the costs for the maintenance, repairs and the operation of the MMF. The state enterprise esy ČR, s.p. administers 19 500 km of predominantly torrential watercourses.

The remaining 5.5 % of watercourses (with an estimated length of 3 800 km) is administered by the Forests of the City of Prague, the national park and military training grounds administrations (the Ministry of Defence), municipalities and some legal persons.

**Significant watercourses** are rivers whose parts that are listed in Annex 1 to Decree No 470/2001 Sb.

**Watercourses are professionally managed** in compliance with the provisions of Section 47 of the Water Act). The administrators' obligations include monitoring the condition of watercourses and adjacent lands, maintaining watercourse channels, preparing and implementing their modifications, maintaining streamside vegetation, and operating and maintaining their water works. For significant watercourses, additional obligations include maintaining the navigability of water ways important for transportation and controlling the management of water within their reservoir systems.

## 9.2 Water extraction

The total amount of extracted water reflects our society's requirements of water use and their development. Water extraction exceeding 500 m³/month or 6 000 m³/year is registered with the relevant river-basin administrator. From the long-term development perspective, there has been a considerable decrease (from 1990 to 2006 by 44 % to 1936 million m³) as shown in Chart 9.1.

The shares in water extraction vary for the individual sectors (the public sector which is supplied through public water supply systems, industry, the energy industry and agriculture). In view of the different purposes of water use, the individual sectors also have characteristic environmental impacts that burden their recipients with different types of pollution. In general, reduction of water extraction is desirable in order to minimize the impacts on the natural water regime, circulation and quality.

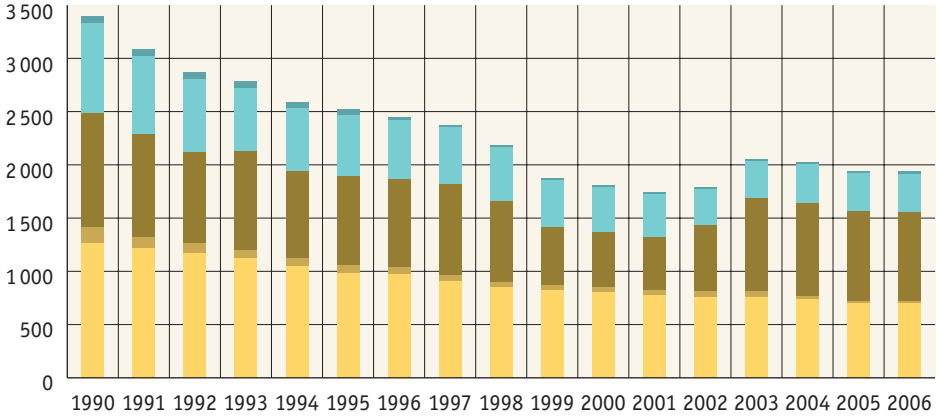
In this context, the increase between 2002 and 2003, for example, which resulted from the start-up of the Temelín nuclear power plant and the resumption of extraction for flow cooling in the Mělník power plant, cannot be viewed as a significant deterioration of the situation. Decreasing water extraction in the energy industry throughout the 1990s was influenced not only by reduced production and the shut down of some thermal power plants (especially between 1997 and 1999), but also by statistics (e.g. from 1988 to 2003 water extraction for flow cooling in the Opatovice power plant was not included due to a dispute over whether this constituted extraction from a watercourse or not).

Surface water extraction is mainly performed by water supply companies. The conditions allowing authorised water use are defined by the watercourse administrators, of which the most important are the Povodí state enterprises. In 2006, fees for surface water extraction (CZK 3.8 billion) accounted for 66% of their revenue.

Fees for groundwater extraction are imposed by the Czech Environmental Inspection (ČIŽP) and collected by customs authorities. These revenues are split evenly between the regional authorities and the State Environmental Fund (SFŽP). The term groundwater administration is not defined in the current wording of the Water Act.

**Water extracted by individual sectors [millions m³]**

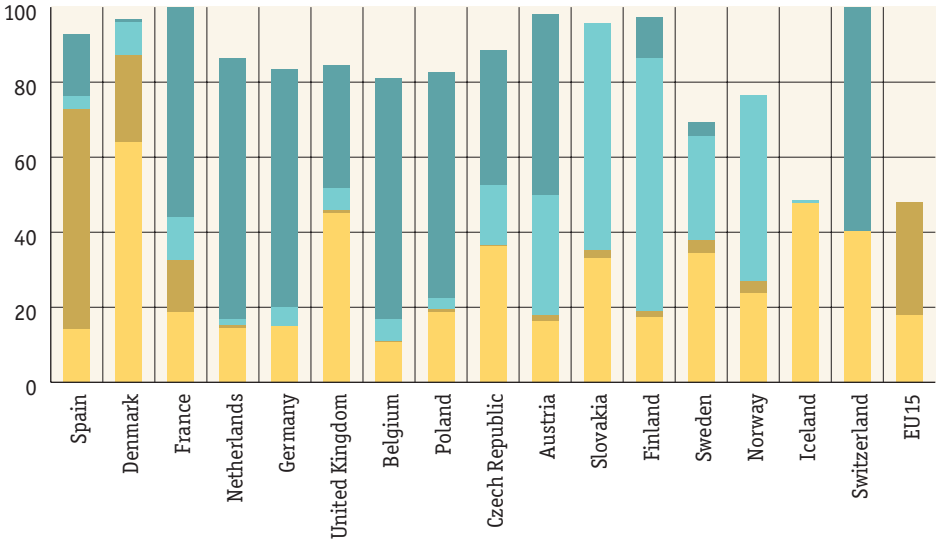
**Chart 9.1**




*Source: T. G. Masaryk Water Research Institute, P.R.I.*

**International comparison of the individual sectors' shares of total water extraction, 2001–2004 average [%]**

**Chart 9.2**




*Source: OECD*

The sum of relative water inlet shares of particular sectors is lower than 100 % because some usages of water are not included (for instance other usage of water in agriculture than irrigation and usage of water for cooling in industry).

The long-term decrease in extraction in connection with the reduction of industrial production and the restructuring of the national economy and its energy intensity from the beginning of the 21st century was replaced by stagnation. A similar trend can be observed in water extraction for the public sector, which is dealt with in more detail in Chapter 9.3. By international comparison, the industrial and public sectors' share in water extraction remains higher than in most Western European countries, where most water is extracted for cooling and electricity production. As an example, we can name the Netherlands, Germany, the United Kingdom, Belgium, and also Poland. By contrast, the Nordic countries and Slovakia show a higher share of water extraction for industry – at the expense of the energy industry. The use of water for agriculture has traditionally been low in the Czech Republic. Since the beginning of the 1990s, irrigation has further declined and the subsequent fluctuation is influenced by irrigation and therefore also by the variability in total precipitation. Within Europe, a significant proportion of irrigation exists in Spain, Denmark and France.

In the Czech Republic, total water extraction per capita is 200 m³/inhabitant/year, which is approximately 2.5 times less than the EU15 average. The situation is particularly problematic in Portugal and Spain, not only due to extreme extraction volumes over 800 m³/inhabitant/year, but also due to lacking water sources. This is connected with the prevalent use of extracted water for irrigation.

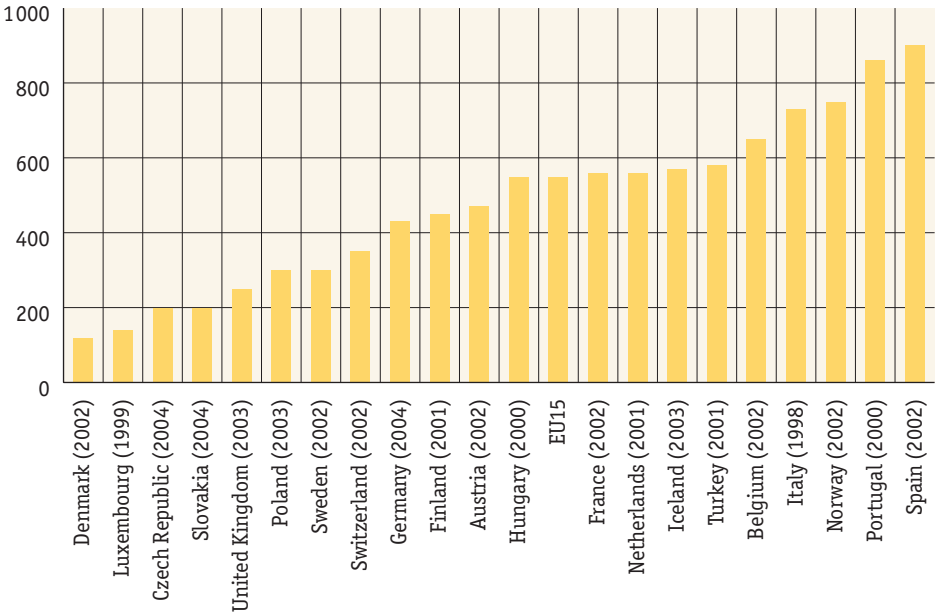
The sources of extracted water differ according to the required quality and the availability of water sources. The majority of groundwater extraction is performed for distribution in public water supply systems. Half of the surface water is used within the energy industry, with the rest being mainly used in the public sector and industry. In total, most water (75–80 % over the long run) is extracted from surface sources in our country, which corresponds with the average European conditions.

Surface water sources are used more than groundwater sources in most EU countries. In Luxembourg, the situation is nearly balanced (52 % of extraction from groundwater sources). Interestingly, in Denmark and Iceland, 97 % of the water is extracted from groundwater sources.

**International comparison of per capita water extraction, latest available data [m³/inhabitant]**

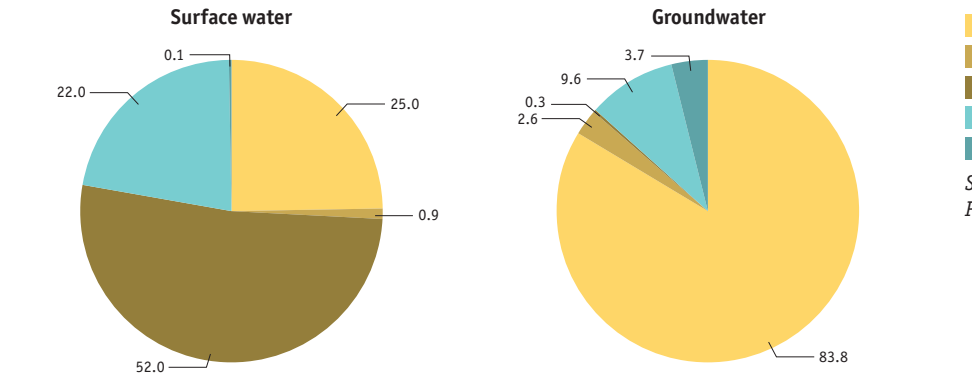
**Chart 9.3**

*Source: OECD*




**Surface water and groundwater extraction structure, 2006 [%]**

**Graf 9.4**




*Source: T. G. Masaryk Water Research Institute, P.R.I.*

## 9.3 Drinking water supply

The public sector is a major water user, which is also very demanding with respect to the quality of supplied water. Due to water pollution in nature, drinking water has to be produced. Water extraction and treatment for producing drinking water, its distribution to consumers and the collection and treatment of waste water is provided by water supply and sewerage companies.

In the area of water supply, most towns and municipalities apply the operational model. Although water supply infrastructure is owned by municipalities, the activities associated with drinking water production, its collection in the sewer systems and treatment are performed by private companies, especially those owned by foreign investors. Veolia Voda is the largest of these, operating water management infrastructure in 1 200 towns and municipalities within the Czech Republic, i.e. 45 % of the supplied population. If the mixed model is applied, municipalities or, as the case may be, private companies are both the owners and the operators of the water supply infrastructure.

Compared to 1990, public-use water supply systems presently produce about half the amount of water (699 million $m^3$ produced in 2006 equals only 53 % of the 1990 volume). Presently, the actual amount of invoiced water (2006) totals 528 million $m^3$, of which 64 % (337 million $m^3$) is supplied to households. In view of the stringent requirements for drinking water quality, the water supply sector is the largest user of groundwater. In 2006, the 318 million $m^3$ accounted for 84 % of the total extraction, covering 45 % of the total water production within the public sector.

The total volume of produced drinking water declined in line with the changing specific water consumption per capita in households from 171 l/person/day in 1990 to 98 l/person/day in 2006, which was mainly attributable to reduced consumption due to increasing water rates. Other significant changes in the users' behaviour are not expected. Water consumption includes neither water supplies from private wells, nor packaged water. The development of total drinking water consumption will subsequently be affected by the number of connected people and the losses within the water supply distribution networks.

Over the past years water and sewage rates have been seen some of the fastest growing prices. Until the end of 1990, water supply was subsidised by the state with a single price nationwide – the water rate for households was CSK 0.6/$m^3$ and the sewage rate was CSK 0.2/$m^3$, while the water rate for industrial enterprises was CSK 3.7/$m^3$ and the sewage rate was CSK 2.4/$m^3$. Since 1991, the rates have differed within the regions, but are regulated. The costs for water and sewage have not been state-subsidised since 1994. Increased prices have brought improved water management services and waste water treatment, which are subject to stricter requirements with respect to the level of treatment and clarification. In 2006, water rates averaged CZK 23.5/$m^3$ and sewage rates averaged CZK 20/$m^3$ for households and businesses alike. The average 56 fold (13 fold in real terms) increase in drinking water and sewage rates generated pressure towards reducing drinking water consumption. Additional motivation for saving drinking water occurred when water meters began to be installed in every flat, with payment for actual consumption.

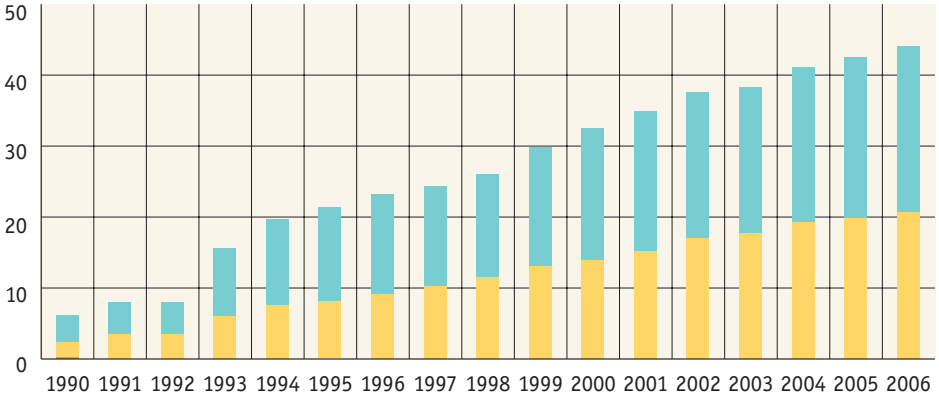
Originally state or municipal enterprises, water supply and sewage companies were privatised after 1989.

**Water fees** are payments for the use of water from a public water supply system. Primarily, they include payment for consumed drinking or service water, the services associated with supplying it and the rent for metering devices.

**Sewage fees** are the price for the services concerning the collection and treatment of waste water. The entitlement to pay water fees arises the moment waste or rain water flows into the sewer system.

**Development of water and sewage rates in Prague [CZK, incl. VAT]**

**Chart 9.5**




Sewage rate
Water rate

*Source: Water supply and sewerage company of Prague*

Water and sewage rates are given as of 1 June of the respective year.

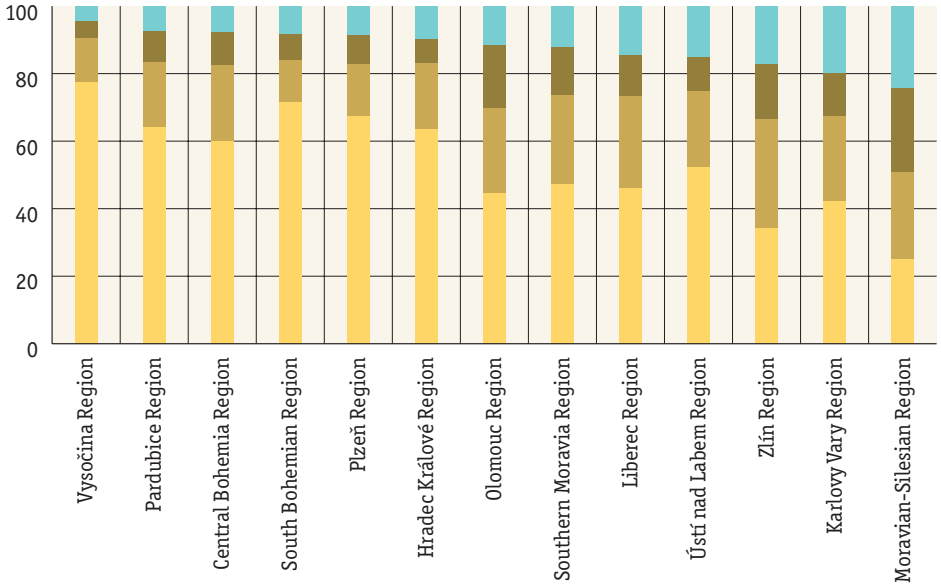
Specific per-capita water consumption is indicative of the efficiency of drinking water management.

Connections to public water supply systems are indicative of both the availability and the supply of quality drinking water. The length of the water supply system without connections increased by 45 % from 1990 to 2006, totalling 70 000 km. The number of people connected to public water supply systems has steadily increased from 8.6 million in 1990 to 9.5 million in 2006, which represented a 9% increase throughout this period, to 92.4 % in 2006 (see Table 9.1). The highest proportion of the population supplied with water from water supply systems in 2006 was in Prague (99.2 %) and in the Karlovy Vary Region (98.4 %), the lowest in the Plzeň (82.4 %) and Central Bohemia Regions (82.8 %). The use of water supply systems by the population and within the individual regions is connected with population density and the size of municipalities and cities. Most often, connections to water supply systems are lacking in small municipalities and solitary houses, in which case larger investments and longer water supply systems are needed to connect the same number of people.

The persistently high percentage of losses of drinking water within the distribution systems remains a negative factor, ranging from 16.3 % in the Moravia-Silesia Region to 25 % in the Ústí nad Labem Region. These enormous water losses result from the age and the quality of the distribution system.

**Share of municipalities in the Czech Republic's regions by size categories, 2006 [%]**

**Chart 9.6**




*Source: Czech Statistical Office – Statistical Yearbooks of the regions*

**Population supplied with drinking water**

**Table 9.1**

| Rok | Population supplied with water from water supply systems | | Drinking water [millions m³/year] | | | Length of public water supply systems [2] |
|---|---|---|---|---|---|---|
| | [thousand people] | [%] | Produced [1] Total | Invoiced [1] Total | Households | [km] |
| 1990 | 8 624 | 83.2 | 1 256 | 937 | 546 | 47 723 |
| 1994 | 8 831 | 85.5 | 1 021 | 696 | 416 | 46 025 |
| 1998 | 8 879 | 86.2 | 843 | 580 | 358 | 49 633 |
| 2002 | 9 156 | 89.8 | 753 | 545 | 343 | 56 273 |
| 2006 | 9 483 | 92.4 | 699 | 528 | 337 | 69 435 |
| **2006/1990** | **1.1** | **1.1** | **0.56** | **0.56** | **0.62** | **1.5** |

*Source: Ministry of Agriculture*

[1] The difference between produced and invoiced water includes mainly water losses within the distribution network.
[2] From 1992 to 2002, this figure included the main operators of water supply and sewage systems excluding municipalities (1991 = 45 519 km). The 2006 figure is affected by a change in methodology.

## 9.4 Waste water discharge and treatment

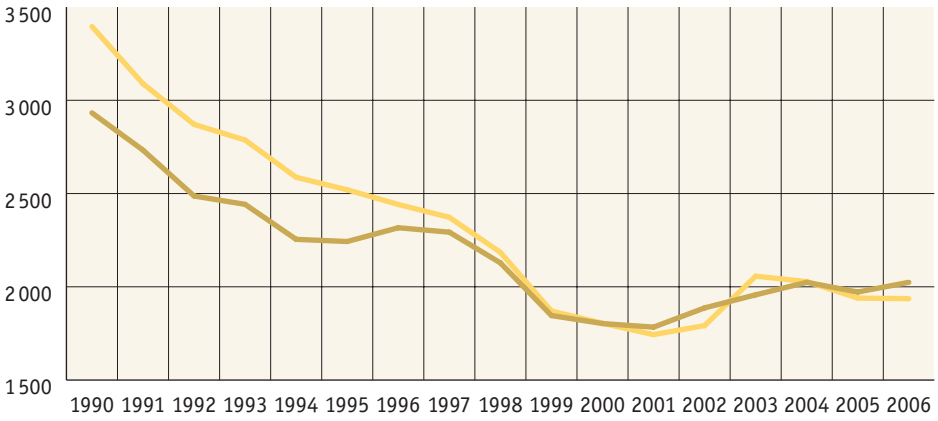
The total amount of waste water discharged into surface water is connected with reduced extraction – in 2006 it reached 2 024 million m³, which is 31 % less than in 1990. Since 1996, the difference between the total amount of extracted and discharged water has been fractional. The reason is to be found not only in the reduced water intensity of industry and energy industry along with the reduced water consumption within the public sector and in agriculture, but also in statistical monitoring, which only considers extraction above a certain level. Therefore, in some case water extraction may not be subject to monitoring. In industry, the amount of discharged waste water is increased by mine water.

Public sewer systems account for the largest share of discharged waste water. Sewer systems are most often used to dispose of waste water from households, services and production enterprises, as well as rainwater. In order to allow for the assessment of the public sector's effect on water pollution, the discharge and treatment of waste water is also statistically monitored excluding rainwater, which is usually collected within the same sewer system and into the same municipal wastewater treatment plants (hereinafter WWTP). Over the past 16 years, the amount of waste water that has been discharged into sewer systems (see Chart 9.8) has developed in line with the decreasing volume of produced and supplied drinking water, i.e. its decreasing consumption. This is also connected with the decrease in the total amount of purified water (excluding rainwater) in municipal WWTPs from 647 million m³ to 510 million m³ between 1990 and 2006.

Similarly to water extraction, waste and mine water discharge into surface water is only monitored if it exceeds 500 m³/month or 6 000 m³/year.

**Surface water and groundwater extraction and the total amount of waste water discharged into surface water [millions m³]**

**Chart 9.7**

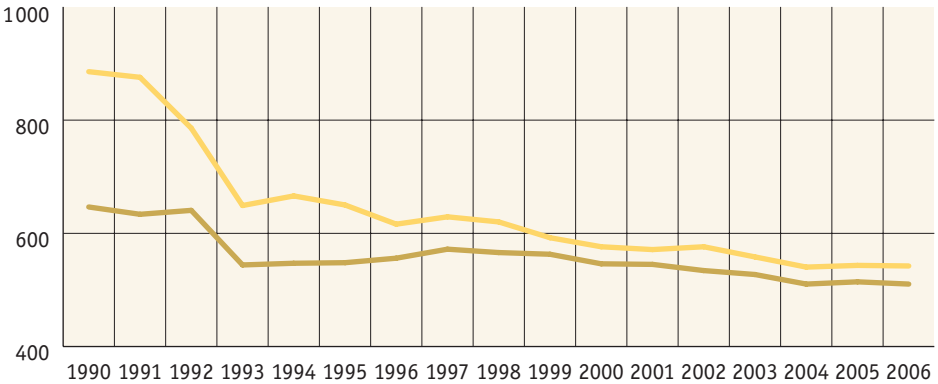



Total water extraction
Total amount of waste water discharged

*Source: Ministry of Agriculture*

**Development of water discharge into public sewer systems and waste water treatment [millions m³]**

**Chart 9.8**




Discharged waste water
Treated waste water without rainwater

*Source: Ministry of Agriculture*

The number of people who are connected to sewer systems has increased from about 7.5 million people in 1990 to 8.2 million in 2006. This trend is not as rapid as the increase in the length of the sewer systems [1] – between 1990 and 2006 it increased by 68 % to 36 629 km. The development of the number of connected people is affected by the size of municipalities. At first, sewer systems and waste water treatment plants (WWTPs) were completed in larger towns and cities. The coverage of smaller municipalities, where population density is lower, requires more financial resources, while the construction itself takes a longer time. To date, the 20 % of the population unconnected to any sewer system (in 1990 this figure was 27.4 %) suggests that there still is room for improvement in waste water management. For comparison, as said earlier, 7.6 % of the population lacks water supply connections. In 2006, the highest share of the population connected to a sewer system was in Prague (99 %) and in the Karlovy Vary Region (91.6 %). Despite the gradually improving situation in the region, a traditionally low sewer system connection rate has been seen in the Central Bohemia Region (66 %), which has the largest number of small municipalities.

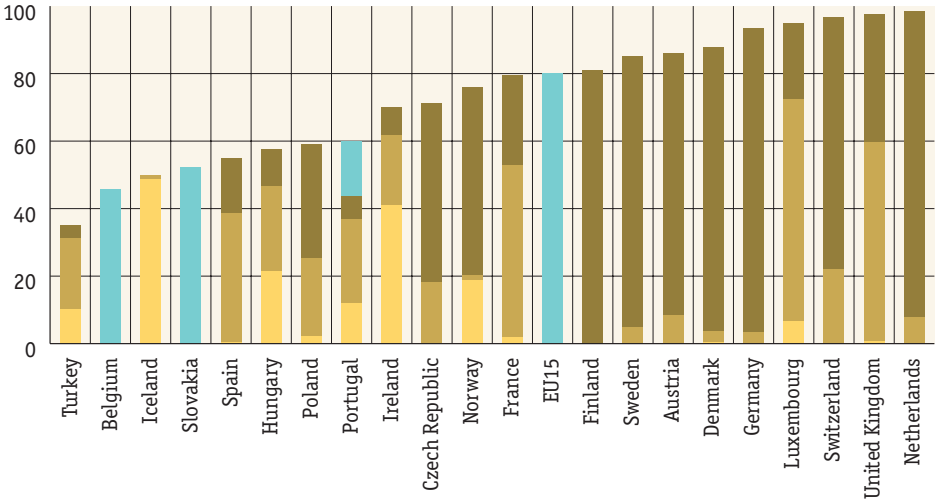
Sewer systems ensure the collection of waste water. Although in most cases this water is treated, there are still sewer systems that are not connected to a WWTP. In spite of that, the positive development in the area of the treatment of waste water from sewer systems is evidenced by both the markedly increased percentage share of treated water and the increasing number of waste water treatment plants – in 2006, 94.2 % of waste water (excluding rainwater) was treated in 2 017 WWTPs in contrast to 777 WWTPs treating 75 % of waste water in 1990. The present significance of the problem is underlined by the obligation of compliance with EU Directive No 91/271/EEC, namely to treat and to improve the technology of the treatment of waste water in all agglomerations of more than 2 000 p.e. within the Czech Republic by the end of the negotiated transitional period – i.e. by the end of 2010. The differences between waste water treatment levels in selected European countries are shown in Chart 9.9. There is still room for improvement in the Czech Republic, especially with respect to the share of the population whose waste water is treated, which is below the Western European average. On the other hand, Southern European countries are worse off. The situation in other post communist countries is also worse than in the Czech Republic.

[1] Even though the time series is affected by changes in statistical survey methods and the after-effects of the gradual transformation of the former water supply and sewer system enterprises, it evidences a clear trend of the sewer systems' lengthening.

The size of a municipality, in connection with waste water pollution, is expressed as the population equivalent (p.e.). The population equivalent of 1 person represents the production of pollution amounting to 60 g $BOD_5$ per day, i.e. the average pollution produced by one inhabitant per day. The daily pollution by the population equivalent of 1 person includes not only municipal pollution, but also pollution from other sources that is recalculated as if it were produced by people. The burden expressed as the population equivalent figure is calculated from the maximum average weekly burden at the inflow into a WWTP, with the exception of unusual situations such as heavy rains and floods.

**International comparison of the proportion of the population connected to WWTPs by treatment stages, 2001–2004 average [%]**

**Chart 9.9**



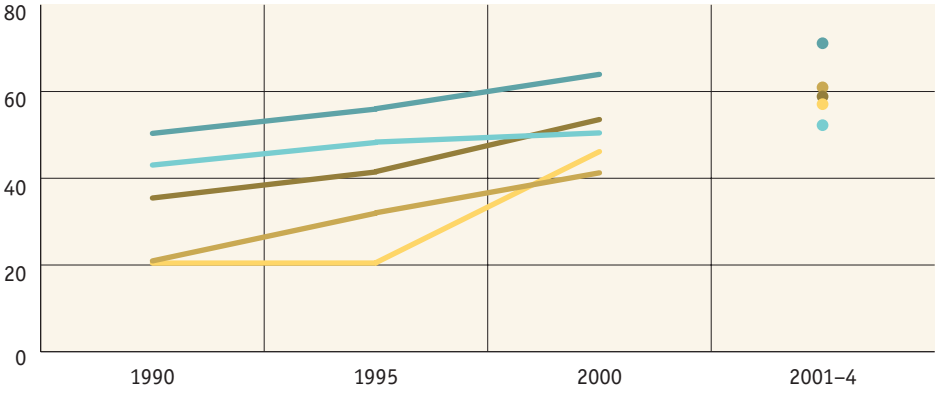

Primary (mechanical) treatment
Secondary (mechanical and biological) treatment
Tertiary (mechanical and biological, with chemical removal of additional substances) treatment
Treatment stage not differentiated

*Source: OECD*

Within the Western European countries, there are relatively inadequate waste water treatment levels in Belgium, Ireland and, due to a considerable proportion of only primary-stage waste water treatment, also in Norway.

**Development of the proportion of the population connected to wastewater treatment plants in selected countries [%]**

**Chart 9.10**




Hungary
Portugal
Poland
Slovakia
Czech Republic

*Source: OECD*

The most dynamic development since1990 has been seen in Portugal and Hungary, which caught up with Slovakia – despite its more favourable starting position. Compared to select comparable countries, the Czech Republic has retained its above-average position with a stable trend of increasing waste water treatment level.

## 9.5 Discharged pollution

While in the first half of the 1990s the decline in the amount of pollution discharged into watercourses was mainly due to reduced production, the effect of extensive construction and technological modernisation of WWTPs has made itself increasingly felt ever since the mid 1990s. According to Table 9.2, the amount of pollution discharged from point sources decreased by 94 % for $BOD_5$, by 87 % for CODcr, by 90 % for IS and by 9 % for dissolved inorganic salts between 1990 and 2006, which represents one of the most spectacular achievements in the area of environmental protection.

One persistent problem lies in the pollution of diffusion and areas, i.e. incontrollable waste water from scattered buildings and agricultural facilities and, in particular, the leaching of fertilisers and plant protection chemicals (especially pesticides) from intensively farmed land.

Basic water management legislation:
Act No 138/1973 Sb., on water, its major amendments from 1992 and 1998;
The new Act No 254/2001 Sb., on water and amending some acts (implementing framework Directive 2000/60/EC of the European Parliament and of the Council, the EU's 'Water Framework Directive') and its 2004 amendment; Act No 274/2001 Sb., on water supply systems and sewer systems.

**Development of the amount of pollution discharged into water from point sources [tonnes]** **Table 9.2**

| Year | $BOD_5$ | $COD_{Cr}$ | IS | DIS | Petroleum substances |
|---|---|---|---|---|---|
| 1990 | 148 200 | 406 500 | 190 500 | 989 057 | 974 |
| 1994 | 79 200 | 276 700 | 108 300 | 842 869 | 547 |
| 1998 | 27 338 | 114 896 | 42 425 | 605 393 | 157 |
| 2002 | 22 949 | 92 265 | 44 153 | 760 753 | N/A |
| 2006 | 8 832 | 53 689 | 18 498 | 901 215 | N/A |
| **2006/1990** | **0.06** | **0.13** | **0.1** | **0.9** | N/A |

*Source: Ministry of the Environment; T. G. Masaryk Water Research Institute, P.R.I.*

$BOD_5$ = Biochemical oxygen demand for 5 days;
$COD_{Cr}$ = Chemical oxygen demand determined by the 'dichromate method';
IS = insoluble substances in water ;
DIS = dissolved inorganic salts, cont. in water;
Petroleum substances = petroleum and similar substances contained in water;
N/A data not available.

## 9.6 Running and stagnant water pollution

Reduced amounts of discharged pollutants are reflected in the gradual improvement in the quality of the surface water into which the pollution is discharged. On the whole, if we rank watercourses within different categories of surface water quality, most significant watercourses have experienced a shift from categories IV and V in the early 1990s to categories II and III in recent years, which can be viewed as positive.

Although the classical pollution of watercourses (characterised through $BOD_5$, $COD_{Cr}$, IS) decreases, the significance of pollution with substances that are more difficult to remove increases (DIS, specific pollutants, PPCP – Pharmaceutics and Personal Care Products and other dangerous chemicals). A very serious problem is pollution with extensive phosphate and inorganic nitrogen emissions originating from agriculture and households (washing powder in particular). Some point sources that lack third-stage waste water treatment also contribute to this problem. As a result, a number of ponds and reservoirs are at risk of eutrophication and its consequences. For this reason, the Czech Republic's three main river-basins have been declared sensitive areas with mandatory tertiary stage treatment in all municipalities of more than 2 000 p.e. (pursuant to Directive No 91/271/EEC).

**Surface water quality pursuant to the ČSN 75 7221 standard**

I unpolluted water
II moderately polluted water
III polluted water
IV highly polluted water
V very highly polluted water

Euthropication means that increased levels of nutrients get into a body of water, especially P and N. Natural euthropication results from the leaching of nitrogen and phosphorus from soil and from the decomposition of dead organisms. Human-induced water euthropication is caused by phosphate and nitrogen fertilizers being washed off from fields, waste water with increased phosphate content (from detergents and washing powder), from faecal matter etc. Initially, this results in the gradation of plankton, during which the 'bloom' can be observed. Once the plankton has died off en-mass, a lack of oxygen occurs in water (especially near the bottom, where it is consumed in the decomposition of matter) and this results in fish and other organisms dying off. In extreme cases, toxic and allergenic substances originating from blue-green algae and bacteria can affect most of or the entire fish population and, at the same time, cause skin irritation in humans.

## 9.7 Runoff modifications

Of the total length of watercourses (76 000 km), approximately a third have been altered (23 624 km in 2006). The side effects of specific alterations to a watercourse on the runoff conditions vary according to the type and purpose of such alterations.

Culminating in the 1970s and 1980s, extensive watercourse alterations, including their straightening, the reinforcement of riverbanks and the construction of smooth river beds, have been going on in our country systematically since the floods of 1882. While such altered portions of watercourses may improve the navigability and the flow of rivers, they have much poorer biodiversity, much lower retention capacity and faster water runoff, which appears undesirable from the environmental and flood protection perspectives. The term "altered watercourse" does not only include the above alterations, but also the portions of revitalised watercourses. In the case of correctly performed revitalisation, the alterations restore the watercourses, including their flood plains, to a near-natural state, with a positive effect on runoff conditions.

Support for revitalisation projects has been provided by the Ministry of the Environment since 1992 through the River System Rehabilitation Programme (further RSRP). Since 1996, the Agency for Nature Conservation and Landscape Protection of the Czech Republic has been responsible for the project's organisation (until 1995 this was the responsibility of the Povodí enterprises). The RSRP is formulated as the programme of restoration, stabilisation and maintenance of the landscape's water regime. The main focus of the projects is the restoration of watercourses to their natural functions and of those elements that improve the landscape's retention capacity. Most projects focus on the construction and renewal of reservoirs and, since 2003, there has been another important sub-programme called 'The Construction and Renewal of WWTPs and Sewer Systems, Including Artificial Wetlands', which helps solve problems related to the construction of sewer systems and to waste water treatment in municipalities with up to 2 000 equivalent residents.

The statistical data on altered watercourses do not differentiate between the types of alterations, i.e. their purpose. Large water courses are the most altered, especially their lower reaches. The changes in the lengths of watercourses are sometimes affected by their moderate lengthening due to the transfer of border rivers under the administration of Povodí enterprises or due to a more accurate specification of the watercourses' lengths during the monitored period. A certain decrease in the length of artificial channels and the number of facilities under the administration of Povodí enterprises took place as a result of the privatisation and restitution back to private ownership.

Most of the increase in the length of watercourses under the administration of the Agricultural Water Management Authority (ZVHS) and in their alteration is attributable to the re-categorisation of the length of amelioration channels as altered watercourses. This fact, along with the privatisation of irrigation systems, also contributed to shortening the length of amelioration channels.

Alterations to watercourses, their revitalisation and the effects of water reservoirs are highly topical issues that are being discussed in connection with influencing the runoff conditions during floods. The extreme floods in Moravia and Silesia in July 1997 claimed 50 lives, with direct economic losses totalling CZK 63 billion. Other destructive floods came in August 2002 in Bohemia, claiming 17 lives and causing direct economic losses amounting to CZK 73 billion. Also significant were the floods in July 1998 in the Rychnovsko area, in March 2000 in North East Bohemia and the floods in March and April 2006. Retaining water in the landscape is mainly important in connection with the Czech Republic's location at the watershed of three different seas, with the overwhelming majority of our watercourses originating in our country and our water resources being primarily dependant on atmospheric precipitation. The negative effects of watercourses that have been straightened or even placed in underground conduits and of the inappropriate use of the landscape are apparent, especially during floods with a lower peak flow. Better water retention in a watercourse's basin helps slow down water runoff during major floods and increases the time to the peak flow (allowing for specific regulations and anti-flood precautions) and flattens the flood wave. Retention of water in the landscape and both surface water and groundwater management, as well as anti-erosion and other measures also play a major role in mitigating the impacts of dry periods. For more information on anti-erosion measures, see the *Agriculture* chapter.

**The length of watercourses** includes natural, altered and artificial watercourses without channels, feeders or water transfers.

Ideally, the use of landscape should respect the following rules: nothing valuable is to be built or stored in **flood areas**, the land near watercourses is not to be farmed, higher weirs in municipalities and cities are to be modernised into folding weirs (to avoid raising the level of the watercourse during floods). Existing cities and municipalities that are located in flood areas are to be protected by dikes, provided that the relevant watercourse cannot be sufficiently widened. Outside municipalities and cities, the existing, mostly straightened watercourse channels should be restored to a near-natural condition, e.g. by creating meanders, roughening the river beds and reducing the channels' depths to allow for overflowing in places where it does no harm.

As an example of the **improper use of landscape**, we can mention using watercourses' flood plains as arable land that is often compressed by machinery, draining land, ploughing anti-erosion hedgerows, cutting down scattered vegetation and generally constructing a large number of buildings in an area which then makes it impossible for water to soak into the soil.

**Extent of alterations to watercourses and artificial channels**

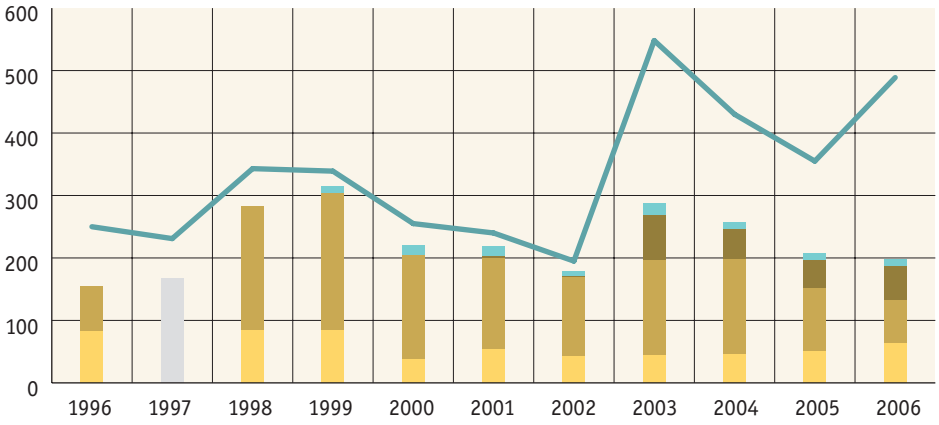
**Table 9.3**

| | | 1990 | 1996 | 2006 |
|---|---|---|---|---|
| Povodí enterprises | The length of watercourses [km] | 16 720 | 16 636 | 16 916 |
| | – altered [%] | 33.1 | 33.9 | 33.8 |
| | The length of channels (excl. navigation channels) [km] | 608 | 585 | 416 |
| Agricultural Water Management Authority | Natural watercourses [km] | 33 814 | 33 999 | 35 700 |
| | – altered [%] | 34.8 | 39.1 | 40.3 |
| | amelioration channels [km] | 14 937 | 12 683 | 11 531 |

*Source: T. G. Masaryk Water Research Institute, P. R. I.*

**Projects implemented within the River System Rehabilitation Programme and their financial costs**

**Chart 9.11**




Revitalisation of watercourses and of the landscape's retention capacity, interventions on watercourses and in river basins, fish ladders

The construction and restoration of tanks, including mud removal

The construction of WWTPs and sewer systems and the creation of artificial wetlands

Project documentation

Costs [CZK millions]

*Source: T. G. Masaryk Water Research Institute, P. R. I.*

In 1997, categorisation was only performed for newly initiated projects, which is why only the total number of implemented projects is given.

The significance of influencing the runoff regime through human interventions into the landscape and the watercourses themselves is further underscored by the increased incidence of floods in recent years and the associated high damage to property. In addition, the damage tends to be even more serious due to past irresponsible construction activities in flood areas. After 2002, the Act on Water and the amended Act on land-use planning and building rules no longer allowed such construction projects. However, new Act No 183/2006 Sb., on land-use planning and building rules, does not ban such construction projects, meaning that construction activities in flood areas often continue.

Because the last floods with serious consequences occurred in our country at the end of the 19th century, the principle of precaution and preventive measures was weakened and neglected. In response to the catastrophic floods of 1997 and 1998, the Flood Protection Strategy for the Czech Republic was prepared and adopted through Government Resolution No 382 of 19 April 2000 as the fundamental document of the systemic approach in this area and as the starting point for the formulation of necessary measures. It provided the basis for preparing the Flood Prevention programme.

After the implementation of the first stage of the Flood Prevention programme (2002–2006), a loan from the European Investment Bank amounting to EUR 60 million (CZK 1.8 billion) was approved. Additional funding was obtained from the privatisation revenues via an account entitled "Operations of State Financial Assets" and from the state budget. These resources were supplemented with the applicants' own resources (namely the resources of the state enterprises Povodí s.p. and Lesy České republiky, s.p.) Almost 400 anti-flood measures were implemented with total a cost of CZK 4.15 billion. The main objective of the programme's second stage is to further decrease the risk level in the flood areas of watercourses. The programme is designed as a framework programme and will be implemented until all resources allocated for its funding are used by effective projects.

After its accession to the EU, the Czech Republic gained access to the system of financial aid with the Structural Funds as its main instrument. Projects in the areas of revitalising watercourses, performing alterations for the recovery of spring areas and wetlands, and renewing retention reservoirs and dry polders were supported by the Operational Programme Infrastructure within Measure 3.1 – Recovery of the environmental functions of the landscape.

The Operational Programme Infrastructure was adopted for the 2004–2006 period by the Commission and is funded from the ERDF. The programme's priorities stem from the State Environmental Policy, which was adopted through Resolution of the Government of the Czech Republic No 38/2001, while respecting the objectives of environmental protection formulated within the National Development Plan. For the 2007–2013 period, the area of water protection has became one of the principal priorities of the Operational Programme Environment, which was approved by the Czech government in November 2006.

The new strategic document of state policy in the area of water, which integrates the objectives and intentions of departmental policies of central water-legal authorities and creates the framework for the formation of the policy of care for water and its environment, is the Plan of Major River Basins that was approved in May 2007.

The Plan of Major River Basins of the Czech Republic is a binding fundamental document for the formulation of plans for river-basin areas and for the definition of binding framework measures, which will be announced through a government regulation. This plan represents a long-term concept in the water sphere, with its main focus on the 6-year period from 2007 to 2012, and it will be renewed every 6 years. Eight plans for river-basin areas are to be adopted by the individual regions by the end of 2009. Within the framework provided by these plans, groundwork documentation for the preparation of draft anti-flood measures will be formed.

An important element within the system of water management structures on watercourses are water reservoirs. Most dams, especially the largest ones, were constructed between 1945 and 1989. Since 1989, the major reservoirs completed were Hněvkovice and Kořensko on the Vltava and Slezská Harta on the Moravice. In addition, the Dlouhé Stráně waterwork was completed and its tanks are used for a pump-storage power plant. In 2006, there were a total of 107 large water reservoirs in our country. 497 small water reservoirs were under ZVHS administration. There are approximately 24 000 other small water reservoirs and ponds.

The use of dam reservoirs can serve many functions, the primary of which is use for energy purposes. Although water power is a renewable resource (electricity production does not generate emissions), the construction of a dam reservoir or a weir brings about the destruction of the river ecosystem. From the environmental perspective, small water power plants are preferred, as the flooding of land and sometimes also of municipalities or localities of environmental value is not as extensive as in the case of large water reservoirs. For additional information on water energy, see the *Energy Sector* chapter.

However, the energy, recreational, navigation and sometimes also water supply functions conflict with the anti-flood function. The scope and consequences of less extensive floods were for the most part eliminated with the accumulation volume of the reservoirs. Yet, more often than not, the manipulation regulations of dams do not make any provisions for large floods and, under some circumstances, can make matters even worse. For additional information on navigation, see the *Transportation* chapter.

The planning process is complementary to the policy of the EU and to the National Programme for Mitigating the Effects of Climate Change in the Czech Republic. It comes as a response to the issue of both floods, which are connected with area erosion, and droughts, which adversely affect the resources and quality of water. In contrast to former water management planning concepts, comprehensive solutions are required, in line with pursuing sustainable development, which will strike a balance between the requirements for the use of water resources and for the protection against the adverse effects on water and the environmental requirements for the protection of water and water-bound ecosystems.

The amended Water Act from 2004 abolished flood commissions for the all river-basins, which had been responsible for optimizing the manipulation of waterworks during major floods.

# 10

# Waste

The area of waste management has undergone dynamic development after 1989. New laws have been enacted, basic waste management indicators have improved, better quality waste management technologies have emerged and, consequently, the condition of the environment has also improved. The population's environmental awareness has increased, without which many measures could not have been implemented.

The implementation of the fundamental changes has resulted in the gradual introduction of payments for waste disposal, a ban on depositing waste into unsecured landfills, a tougher regime of trans-border waste transportation, the adoption of the European Waste Catalogue, the approval of the Waste Management Plan of the Czech Republic, the creation of general waste management rules and a gradual harmonisation of our legal system with European regulations.

The transformation that has taken place can be considered successful, despite the fact that it has necessitated radical changes and high investments. Czech waste management regulations have been harmonised with European regulations and, in addition, basic strategic documents, concept and plans concerning waste management have been created and, apart from several problematic areas, are being successfully implemented. However, some problems persist. One example is in the area of municipal waste management, where "landfilling" still remains a more common method of disposal than re-using. Waste also has a high content of biodegradable elements.

At the time of the Czech Republic's accession to the European Union, waste management was already relatively problem-free. Clearly, this is the result not only of the measures adopted in the 1990s, but also of the long-term positive attitude of both Czech citizens and legal entities towards the environment.

## 10.1 Waste Production

By comparison to the market economy, the centrally planned economy that had been in place in the Czech Republic before 1990 was characterised by lower consumer goods production and sales volumes and, at the same time, a lower amount of used packaging materials. Therefore, by comparison with Western European countries, municipal waste production was significantly lower.

Up until 1989, municipal and industrial waste production had not been regularly monitored in a way that would meet today's requirements for statistical evaluation, with information only being obtained through one-off statistical surveys by the Federal Statistical Office (FSO). The first statistical survey in 1987 put the total amount of waste production at 630.8 million tonnes per year. Municipal waste did not total 2.6 million tonnes per year, yet the methodology of the survey nor the monitored categories of production were comparable with current statistical outputs.

In 1991, waste production was estimated at 187 million tonnes, which, in real terms, represents six times the total waste production figure for 2004. The first data on waste production did not begin to be systematically collected until the mid-1990s, when the first Act on Waste entered into force. While this figure is indicative of the differences in the data collection methodology, it is otherwise of little informational value. By that time, the increase in consumption and the use of new packaging materials had already begun to be fully felt, causing a gradual increase in the proportion of plastic and paper in municipal waste. For example, the use of PET drink packaging, three-layer drink boxes (cardboard packaging) and food films and foils has gradually become widespread. Also, the increased production of waste from electronics and electrical appliances emerged as yet another brand new phenomenon.

**Waste** includes any and all movables that a person is disposes of, or that a person intends or is obligated to dispose of and that belong to any of the waste groups specified in the Waste Catalogue (Annex 1 to Act No 185/2001 Sb., on waste).

**Other waste** is waste that does not display any hazardous properties, does not appear on the Hazardous Waste List (or for which all hazardous properties have been ruled out), all waste produced in municipalities by natural persons that is specified as municipal waste by an implementing legal regulation – with the exception of waste produced by legal persons or natural persons that are authorised for business activities.

**Waste production [millions of tonnes]**

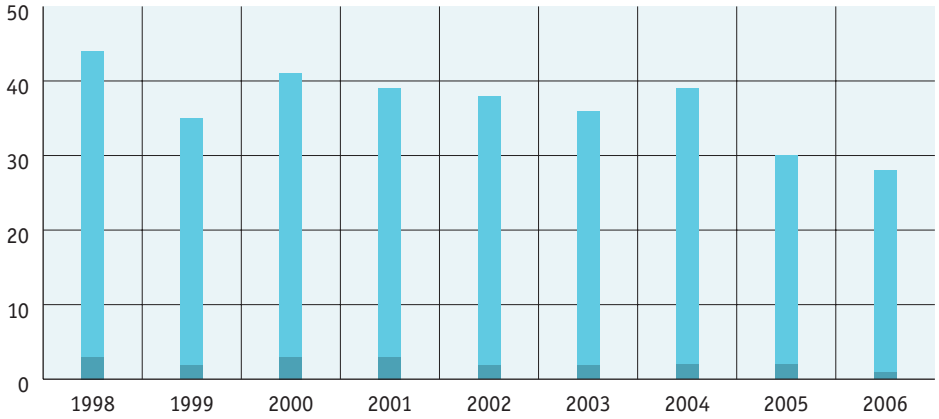



**Chart 10.1**

Total waste production
Hazardous waste production

*Source: T. G. Masaryk Water Research Institute, P.R.I., Czech Environmental Institute*

Production monitoring methodology changed in 2002.

Data on waste production has only been collected, i.e. in line with current requirements for their quality, since the second and third generations of waste legislation entered into force in 1998. Waste production dropped considerably between 1998 and 1999 in connection with methodological changes in data collection, and has displayed a slightly growing tendency ever since. In 2002, third generation legislation was adopted and the monitored waste categories were restructured. This has resulted in a considerable decrease in reported production, especially with respect to hazardous waste. After 2002, similarly to the preceding period, waste production grew slowly and steadily until 2004. The described development is influenced, above all, by the growing industrial production and the population's increasing standard of living. A very important breakthrough occurred after 2005, when, despite continuing economic growth, the amount of produced waste displayed a slight annual decrease.

Since 1989, there has been a tendency of slight growth and then stagnation of annual waste production. In the period between 2002 and 2005, production fluctuated around 4.5 million tonnes, and in 2006 it dropped to 4 million tonnes.

Due to the above significant changes in the waste production monitoring methodology, it is now possible to produce long-term comparisons going back to 2002 and, for total waste production, back to 1998.

Total waste production from 1998 to 2006 is shown in Chart 10.1. In the post-revolution period, these data can be considered the first indicators to provide reliable information about the actual waste management situation in the Czech Republic.

As regards the measurement and collection of qualitative and quantitative data, the situation is more favourable for municipal waste. The first long-term monitoring surveys took place in Prague in the early 20$^{th}$ century in connection with the planned construction of an incineration plant, which was intended to solve the problem of insufficient landfill capacities in central Prague. In the end, the then preferred solution was to transport the waste (according to the then valid terminology) by rail out of Prague and the incineration plant was only built in the early 1930's in Vysočany in response to a dysentery epidemic.

In modern times, the interest in determining the properties of municipal waste dates back to the 1960s and 1970s as part of state-organised research tasks focusing on mechanised municipal waste sorting, which were undertaken in connection with an orientation towards the utilisation of secondary raw materials. For the same reason, extensive analyses of municipal waste were organised by the Local Economy Research Institute in Prague between 1981 and 1984, with the results being used well into the 1990s and the chosen methodological procedure having been borrowed and used by all organisers of subsequent analyses up to the present day. As part of the development of mechanised municipal waste sorting in the Kutná Hora-based Institute for Mineral Resources, the most detailed analyses of household waste from centrally heated areas were performed in 1988; an extensive amount of data was obtained from household waste analyses that were carried out by KORT Hradec Králové in East Bohemia in 1989.

**Municipal waste** includes all waste produced in a municipality by natural persons, with the exception of waste produced by legal persons or natural persons that are authorised for business activities. The municipality is deemed the originator of this waste.

**Hazardous waste** is any waste appearing on the Hazardous Waste List, which is specified by the Ministry of the Environment's Decree No 381/2001 Sb., as amended, and any other waste displaying one or more hazardous properties that are defined in Annex 2 to Act No 185/2001 Sb., on waste. Hazardous properties include being explosive, flammable, carcinogenic, mutagenous, infectious or ecotoxic.

### 10.1.1 The structure of produced municipal waste

Municipal waste analyses have been organised more frequently since the early 1990s. They have been carried out mainly in České Budějovice, Třeboň (the Kutná Hora-based Institute for Mineral Resources, 1990, ECO trend, 2000), Benešov, Prague (the Prague-based Institute for Community Economics, 1992–1994, EKO-KOM, continually since 2003), Brno (SAKO Brno, 1997), Ostrava, Třebíč and Černošín (The Faculty of Science, Charles University in Prague, 2001). From 1993–1995, KZT Prague monitored the amount and the structure of municipal waste using a different methodology based on the separation of waste directly at its source, i.e. in households. Based on this monitoring, it was estimated that a total of approximately 306 to 328 thousand tonnes of municipal waste was produced in Prague in 1993. The structure of municipal waste produced in Prague in 1993 is shown in Chart 10.2.

In 1993, it was discovered by monitoring the household waste structure that the average inhabitant of Prague produced (according to the methodology used for the monitoring) a weekly average of approximately 3.42 kg of municipal waste, which included 0.32 kg of paper, 0.11 kg of plastic, 0.19 kg of glass, 0.24 kg of reusable waste, 0.92 kg of bio waste, 0.8 kg of residual waste and 0.83 kg of ash. The average volume of this waste is 21.12 $dm^3$. Detailed information is presented in Chart 10.3.

An analysis of the municipal waste structure that was performed in 2000 provided an interesting comparison, both in terms of the historical development of the household waste structure – with 1993 being the reference year, and among the individual types of developed areas. This analysis was commissioned by the Ministry of the Environment in the form of a Science and Development Project, and some of its findings are shown in Chart 10.4. When comparing large cities' housing estates, mixed developed areas and village developed areas, the structure of municipal waste reflects quite visibly some influences, namely the selected combustion equipment and the possibility of composting bio waste or using it as fodder.

If we compare the municipal waste structure in Prague in 1993 according to Vrbová (1995) with the situation in large cities' housing estates and in mixed developed areas in 2000, we see a marked increase in the proportion of plastic and paper and, on the other hand, a decrease in the proportion of bio waste, which may be connected with the increased use of packaging materials and the growing consumption of non-food goods.

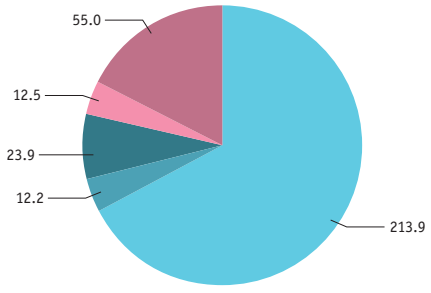
After 2001, the amount of municipal waste has stabilised at about the current production level and, according to data from the Czech Statistical Office, it has ranged between 400 and 500 kg of municipal waste per inhabitant annually. This indicator, i.e. its value, thus approximates the situation in comparable EU countries.

For total waste production, it is difficult to put together a credible international comparison. In municipal waste production (per capita), the Czech Republic is below the waste production average of both the EU15 and the EU25. We are among the countries with the lowest specific waste production per capita, such as Croatia and Slovakia. The comparison of municipal waste production is shown in Chart 10.5.

Monitoring confirmed the results previously obtained by the Institute for Community Economics in Prague (ICE Prague). It came as a surprise for both experts and the public that the amount of household waste indicated in these estimates was at least a third lower than all previous estimates.

**Municipal waste production in Prague in 1993 [thousands tonnes]**

**Chart 10.2**

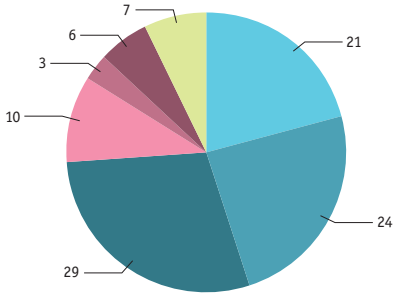



Household waste
Bulky waste
Green waste
Street-cleaning residues
Waste similar to municipal waste from civic facilities

*Source: Vrbová (1995)*

**The break-down of municipal waste in Prague in 1993 [%]**

**Chart 10.3**

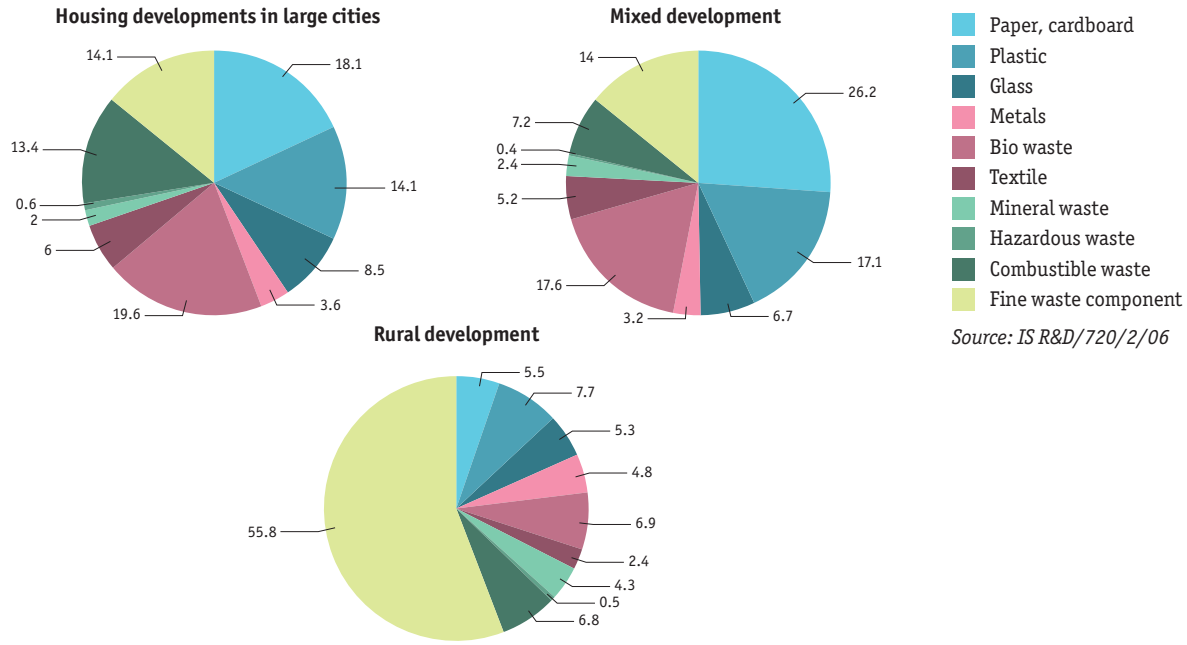



Ash
Residual waste
Bio waste
Paper
Plastic
Glass
Re-usable waste

*Source: Vrbová (1995)*

**Waste structure comparison according to individual types of developed areas, 2000 [%]**

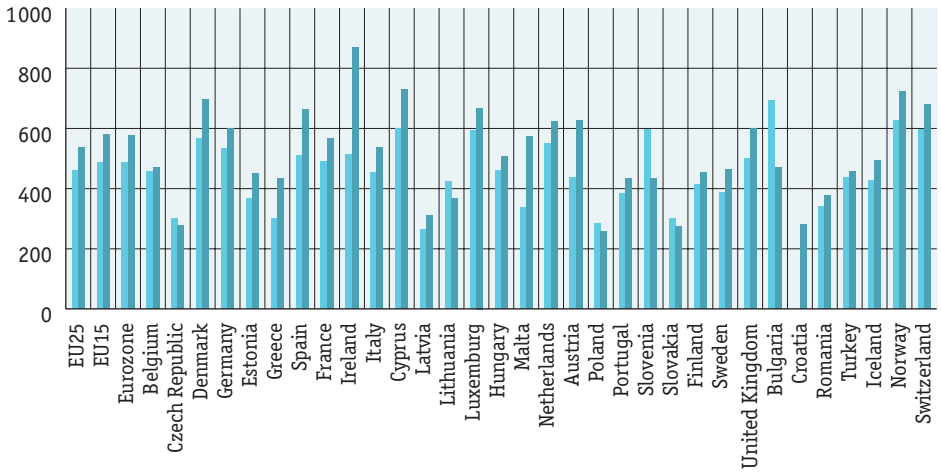
**Chart 10.4**




*Source: IS R&D/720/2/06*

**An international comparison of municipal waste production[kg/ inhabitant/year]**

**Chart 10.5**




*Source: Eurostat*

Presently, the EU municipal waste production annual average is estimated at 500 kg per capita. The OECD estimates that municipal waste production within the OECD area will increase by 43 % between 1995 and 2020, reaching an annual level of 640 kg per capita at the end of that period. In addition, growing municipal waste production is one of the main reasons why the new EU waste policy has been proposed – the Thematic Strategy on Waste Prevention and Recycling. The policy is aimed at making the European Union a "recycling society" that seeks to avoid waste and uses waste as a resource. The basic objectives of the existing EU waste policy that are defined through the "waste hierarchy" will still be valid. The prevention of waste production and the promotion of reuse and recycling will result in an increased efficiency of the use of resources and in reduced adverse environmental impacts. The objective is to retain the material basis that is necessary for sustainable economic growth. The implementation of highly environmentally-friendly standards will support the internal market for waste recycling and reuse. Life cycle analysis procedures will be implemented through the modernisation of the existing legal framework, which will simplify and improve the efficiency of EU legal regulations.

## 10.2 Waste management

Prior to 1990, there was no special legal regulation governing waste management at the national level. The legal regulation of waste management was only created in the early 1990s in response to the then current condition of the environment.

However, the organisation and efficiency of collecting secondary raw material were at an excellent level, even by international standards. Before 1989, the system of buying and reusing certain collected waste materials was organised relatively well. It was anchored within the legal system through government decrees and guidelines and its practical implementation was performed through a network of establishments of the state-owned enterprises Sběrné suroviny, n. p., and Kovošrot, n. p. The above network ensured the collection and transportation of secondary raw materials and the "take-back collection" system, organised as described above, covered virtually the entire then-existent Czechoslovakia. While before 1989 the motives behind the establishment of the network of secondary raw material collecting points were not primarily of an environmental character, but rather of an economic and historical nature, these measures eventually resulted in improved environmental protection in the area of waste management. Even though the regulations governing the management of these selected types of collected waste materials/wastes were carefully designed, they only applied to several selected types of waste materials.

Between 1998 and 2001, the gradual implementation of the provisions of Act No 125/1997 Sb., on waste took place, which contributed considerably not only to improving waste management rules, but also to improving the system of data collection and the methodology for their processing. Since 1998, the number and the capacity of facilities for the reuse and the disposal of waste have been monitored, as well as waste production itself, the proportion of the reuse of all waste and other environmentally significant economic indicators of waste management.

Currently, the main problem is the growing proportion of municipal waste disposed of in landfills (from about 66 % in 2002 to 81 % in 2006). However, the proportion of municipal waste used for material recovery has increased from 12% in 2002 to 20 % in 2006.

In general, the Czech Republic's waste management structure can be viewed as favourable. In compliance with EU requirements, the Act on Waste defines the waste management hierarchy. The use of waste for material recovery is preferred to its use for energy recovery, which, in turn, is preferred to waste disposal. The employment of economic tools, especially waste landfilling charges, creates pressure to reduce the amount of waste being disposed of. In recent years, this pressure has multiplied due to the integration of European regulations. Most objectives that have been defined are being successfully accomplished and there are adequate economic tools for controlling waste production and management.

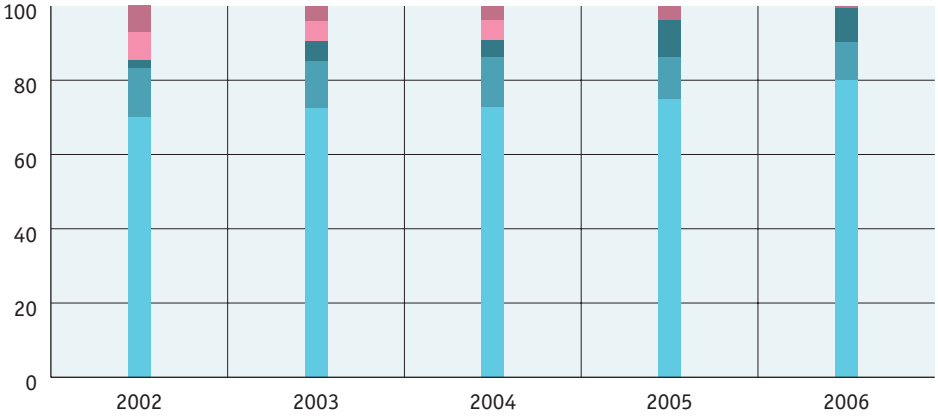
Preparing a credible international comparison is rather problematic, as waste management data from a number of EU countries are missing. This applies especially to new member states, which only started to provide internationally comparable data on waste management after their EU accession.

**Waste management** (pursuant to Act No 185/2001 Sb.) means the collection, concentration, gathering, buying, sorting, transport, storage, processing, use and disposal of waste.

For example, the state-owned enterprise Sběrné Suroviny reached an annual amount of 9.6 kg of paper per capita, which was not surpassed until 2003 using the method of separate collection with the assistance of AOS EKO-KOM.

**The development of the structure of municipal waste management [%]**

**Chart 10.6**




*Source: T. G. Masaryk Water Research Institute, P.R.I.*

Data in the chart has been processed in compliance with Regulation (EC) No 2150/2002 of the European Parliament and of the Council on waste statistics and does not include the N waste management codes that are included in material recovery under national legislation.

## 10.2.1 Landfilling

It is estimated that in early 1990s, there were more than 6 thousand unsecured or illegal landfills, most of which have become an old ecological burden. At that time, it was the high number of landfills that appeared to be the most pressing problem, along with their poor technical safety, their possible adverse effects on both surface water and groundwater quality and the risk of methane emissions being released.

A major general breakthrough in landfilling and waste management occurred after 1990 with the adoption of the first Act No 238/1991 Sb., on waste. On the one hand, it imposed a ban on depositing waste into unsecured landfills, but it also obligated the originators to sort waste separately, to store it and use it as a secondary raw material and it introduced payment for landfilling waste. Unsecured landfills were subjected to waste deposit payments charged at progressive rates and a timeline was defined for their existence, which created conditions for the establishment of secured landfills compliant with European standards. Landfills were newly fitted with technical safety features that markedly reduced their possible negative environmental impacts, especially on air, groundwater and surface water.

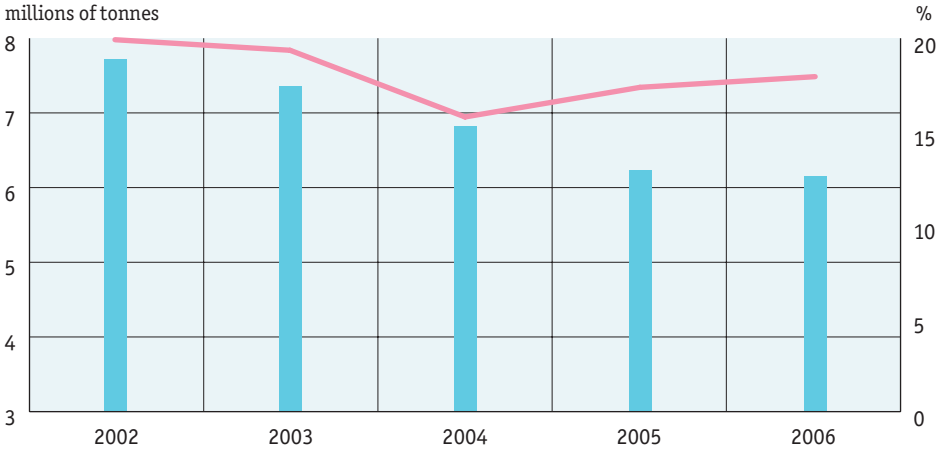
The proportion of landfilled waste in the total volume of waste has been moderately declining over the long run. If we consider the period for which comparable data is available (i.e. since 2002), it has decreased by approximately 3 % and is currently ranging from 16 to 18 %. However, there is a major problem in the growing proportion of municipal waste deposited into landfills, which can be viewed as the key problem in the area of waste management in the Czech Republic. In 2006, the proportion of landfilled municipal waste in total waste production reached 81%, increasing by as much as 12 % annually. In absolute figures, the amount of landfilled municipal waste slightly increased in the same year, even though, on a year on year basis, there was a decrease in total municipal waste production.

The implementation of the system of **payments for depositing municipal waste** into landfills has probably strengthened the trend of minor illegal waste dumps being created in open landscape. This lack of waste disposal discipline among the population reflects insufficient civil awareness. Although this constitutes a violation of the Act on Waste, such activities are extremely difficult to penalise. The perpetrator is almost never identified and penalties can only be imposed on the owner of the land or on the municipality in whose cadastral area the illegal landfills are located.

**The proportion of waste** disposed of by means of landfilling is shown in Chart 10.7, which clearly demonstrates that since 2002, there has been a continuous decrease in landfilled waste, despite the increase in waste production in 2004. Within the area of reducing the sector's environmental impacts, this can be regarded as a success, because the assignment of land to non-agricultural purposes has decreased, and so has the risk of negative environmental effects.

**The proportion of landfilled waste in the total production**

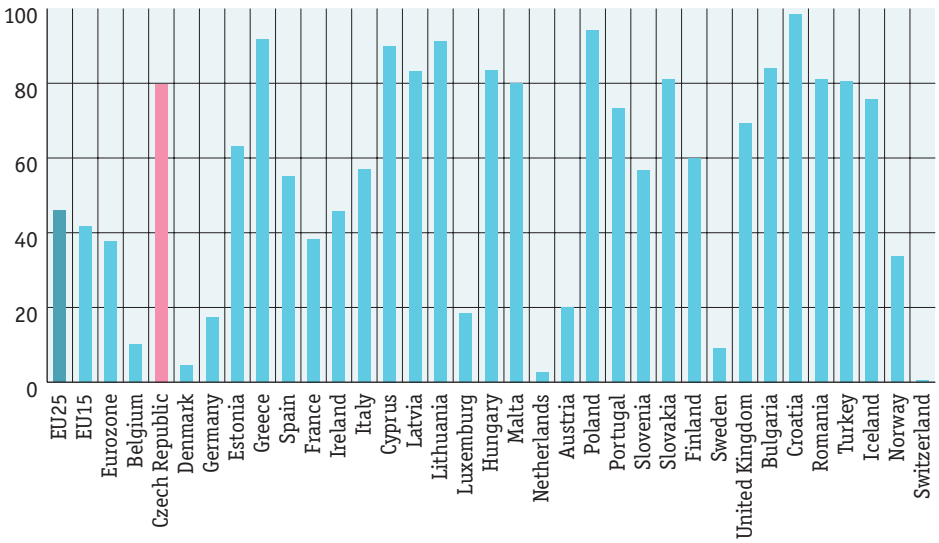
**Chart 10.7**




*Source: T. G. Masaryk Water Research Institute, P.R.I.,*

**The proportion of landfilled municipal waste in the EU, 2004 [%]**

**Chart 10.8**




*Source: Eurostat*

**Hazardous and other waste landfills location, 2007**

**Figure 10.1**


- Group S – OO
- Group S – NO
- Multiple group landfills

*Source: T. G. Masaryk Water Research Institute – Centre for Waste Management*

According to Eurostat's assessments, the Czech Republic, with it´s approximately 80% landfilled municipal waste (2004), is above the Eurozone's average (38 %), the EU average prior to expansion (42 %) and its current average (46 %). By comparison to "developed" countries, the proportion of municipal waste that is landfilled in our country is many times higher. For example Germany, Switzerland, the Netherlands, Denmark and Belgium landfill up to 10 % of their municipal waste. In these countries, the use of waste for material and energy recovery is predominant.

As an alternative to municipal waste landfilling, the Waste Management Plan of the Czech Republic and the Ministry of the Environment's general policy promotes its use for material and energy recovery, and its disposal through incineration with energy recovery. In the Czech Republic, a larger percentage of municipal waste is used for material recovery (12 % in 2004 and 20 % in 2006) than for energy recovery (9 % in 2004 and 9.5 % in 2006). The situation is shown in Chart 10.15, which compares the percentage of municipal waste used for energy recovery, including waste disposed of through incineration, in selected EU countries.

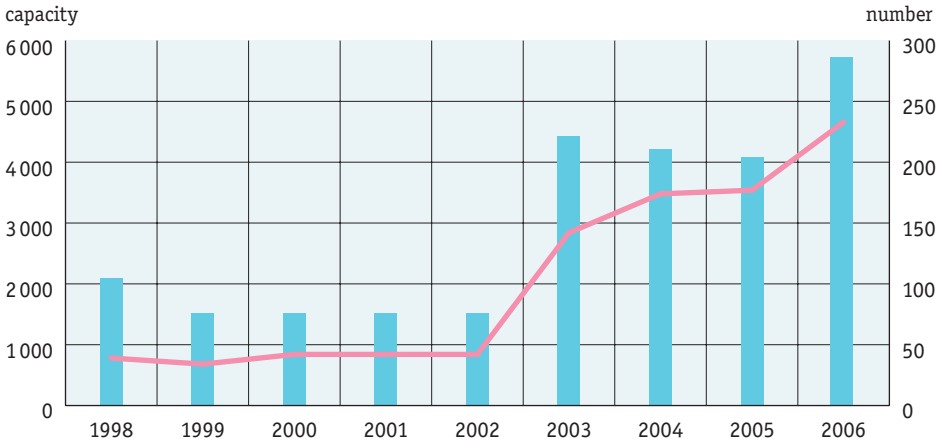
## 10.2.2 The use of waste for material recovery and recycling

Under the influence of the application of the statutory Waste Management Hierarchy, facilities for waste utilisation started to appear on a larger scale, such as composting plants, recycling facilities and plastic separation and collection lines. However, it only became obligatory to keep records of waste utilisation facilities after the entry into effect of Act No 125/1997 Sb., on waste. Comprehensive data on waste management facilities has therefore only been available since 1998. The number and the capacity of recycling facilities has grown since 2001, i.e. after the adoption of Act No 185/2001 Sb., on waste, and amending some acts, as amended (hereinafter the Act on Waste), which gives preference to the use of waste rather than its disposal. Since the current Act on Waste has been in effect, the number of recycling facilities increased from 42 to 233 (relative to 2006), with their capacity increasing from 1.5 to 5.7 million tonnes. Over the same period, the number of composting plants has increased from 18 to 99 and their capacity has increased from 245 to 886 thousand tonnes per year. The long-term development of the number and the capacity of recycling facilities since the beginning of their monitoring is shown in Chart 10.14 and the development of the number and the capacity of composting plants for the entire monitored period is shown in Chart 10.10. In the case of composting plants, complications may arise in the future due to the implementation of some new veterinary directives of the EU that restrict the use of waste from restaurants, animal husbandry and food production.

An international comparison of waste management is possible for packaging waste. The difference between the use of packaging waste for material and for energy recovery (or its total utilisation) is best demonstrated in Chart 10.11, which makes it clear that with respect to the use of waste for material recovery, the Czech Republic is sixth among the EU27, while it ranks eighth in overall waste utilisation. The chart also shows the difference in waste utilisation between the original and new EU member states.

**The development of the number and the capacity of recycling facilities**

**Chart 10.9**



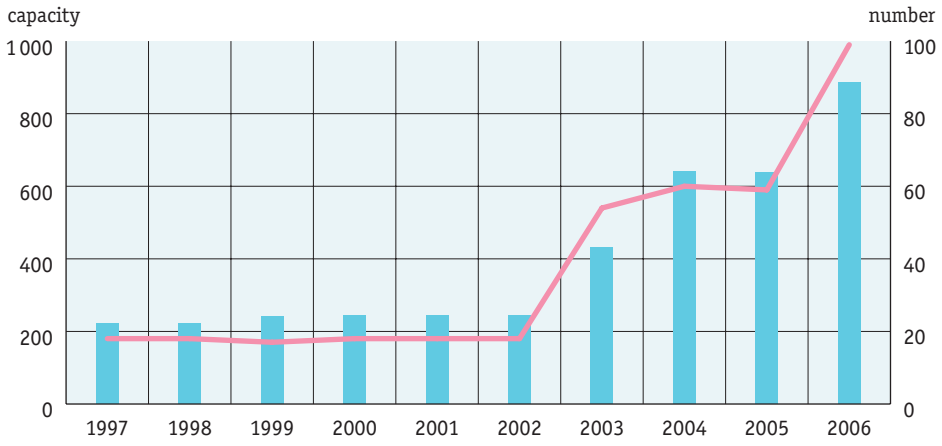

The capacity of recycling facilities [thousands tonnes per year]

The number of recycling facilities

*Source: T. G. Masaryk Water Research Institute, P.R.I.*

**The development of the number and the capacity of composting plants**

**Chart 10.10**



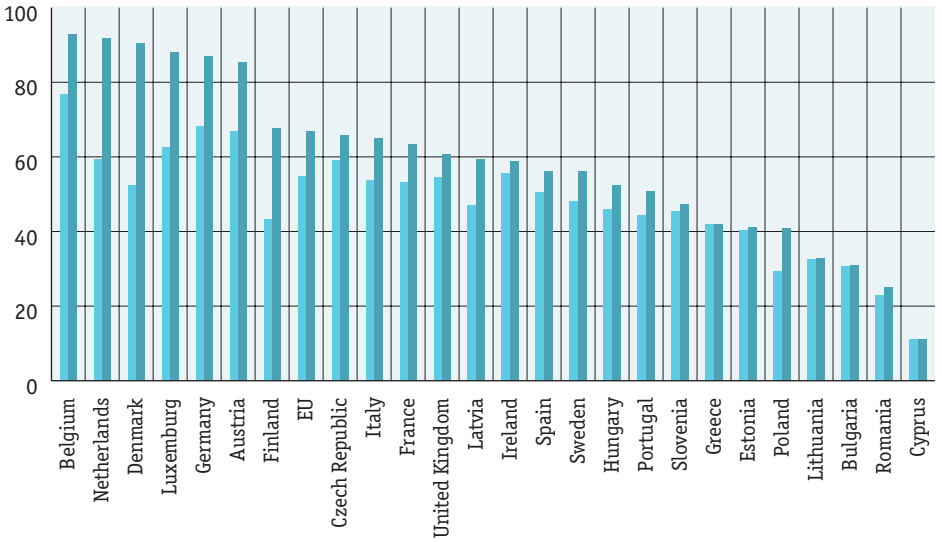

The capacity of composting plants [tonnes per year]

The number of composting plants

*Source: T. G. Masaryk Water Research Institute, P.R.I.*

**Differences in packaging waste utilisation within the EU27 [%]**

**Chart 10.11**



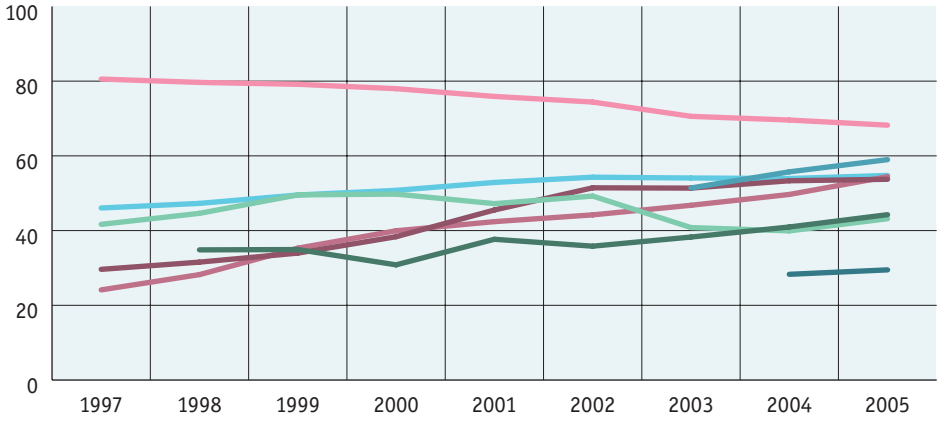

Total utilisation

Use for material recovery

*Source: European Commission*

**An international comparison of packaging waste used for material recovery [%]**

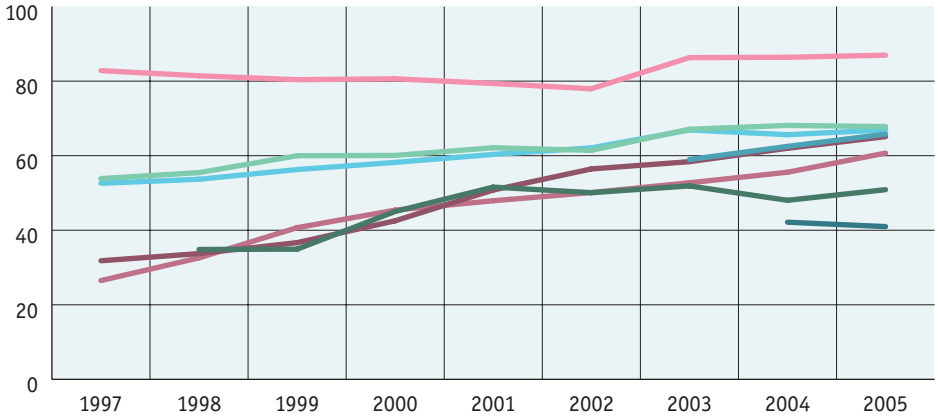
**Chart 10.12**




*Source: European Commission*

**An international comparison of packaging waste utilisation [%]**

**Chart 10.13**




*Source: European Commission*

As shown in Chart 10.12, the Czech Republic is among the leading EU countries with respect to the use of packaging waste for material recovery and its proportion of waste used for material recovery ranks in amongst economically developed countries (such as Germany and the United Kingdom). The rate of use for material recovery is even markedly higher in the Czech Republic than in some original member states, such as Portugal and Finland. By contrast, the total utilisation of packaging waste places the Czech Republic slightly below the EU average, which is the result of the low percentage of packaging waste used for energy recovery. This situation can be examined in detail in the case of Finland, which uses 16 % less packaging waste for material recovery than does the Czech Republic, however, its total percentage of utilised packaging waste is 2 % higher than the Czech Republic's.

## 10.2.3 The use of municipal waste for energy recovery

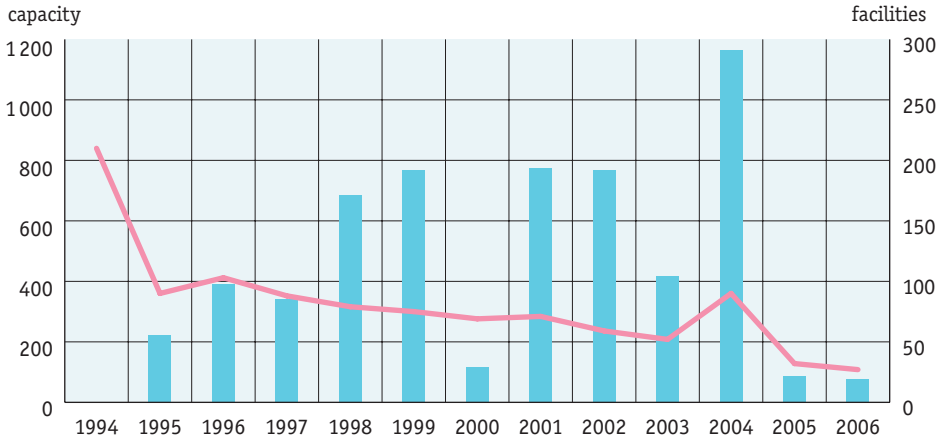
The third most significant waste management method is incineration with heat recovery. By contrast to facilities that use waste for energy recovery, waste incineration plants (e.g. for hazardous waste) do not utilise waste heat. Over the course of their historical development, the stage of waste heat utilisation was added to all three municipal waste (MW) "incineration plants", which has transformed all three MW "incineration plants" that are currently in operation into facilities for the use of waste for energy recovery. The MW incineration plant in Brno has been in operation since 1989 with a design capacity of 240 thousand tonnes per year, the MW incineration plant in Prague – Malešice since 1998 with a capacity of 310 thousand tonnes per year and the MW incineration plant in Liberec since 1999 with a capacity of 96 thousand tonnes per year. Since 2005, municipal waste incineration plants have been operated based on an IPPC permit as facilities for the use of waste for energy recovery, meaning that the heat generated in waste incineration is utilised. The total capacity of incineration plants is 646 thousand tonnes per year and their utilisation factor was about 90.5 % in 2006.

The increase in the number and the capacity of waste incineration plants was not as pronounced as in the case of recycling facilities and composting plants, since the use of waste for energy recovery has received less support than its use for material recovery. After the Czech Republic's EU accession, there was substantial concern over a possible disproportional increase in waste imports for the purpose of energy recovery, without considerably increasing the amount of waste used for energy recovery originating in the Czech Republic. The development of the number and the capacity of incineration plants is shown in Chart 10.14.

Up until 1998, the majority of incineration plants (in 1998 this was 68 incineration plants out of 98) did not meet the prescribed emission limits and were gradually shut down. In the period after 1993, the number of waste incineration plants has wildly fluctuated. Their capacity markedly fell in 2005 in connection with the tougher regulation of their operations under Act No 86/2002 Sb., on air protection.

**The development of the number and the capacity of waste incineration plants**

**Chart 10.14**



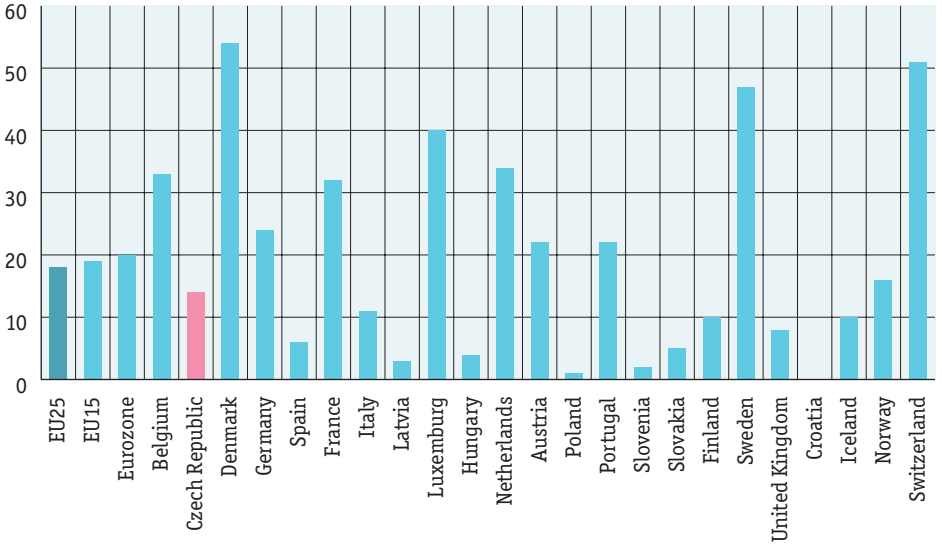

The capacity of incineration plants [thousands of tonnes/year]

The number of facilities

*Source: T. G. Masaryk Water Research Institute, P.R.I.*

**The percentage (%) of municipal waste disposed of through incineration, including energy recovery in selected EU countries, 2004 [%]**

**Chart 10.15**




*Source: Eurostat*

**The spatial distribution of waste incineration plants, 2007**

**Table 10.1**

*Source: CENIA*

| Management site | Date of opening | Capacity [t/year] |
|---|---|---|
| **Municipal waste incinerators** | | |
| Praha | 1998 | 310 000 |
| Brno | 1989 | 224 000 |
| Liberec | 1999 | 96 000 |
| **Hazardous waste incinerators** | | |
| Rybitví | 1994 | 15 000 |
| Ostrava – Mariánské Hory | 2000 | 12 500 |
| Kralupy nad Vltavou | 1976 | 10 000 |
| Valašské Meziříčí | 2000 | 10 000 |
| Trmice | 1993 | 9 000 |
| Ústí nad Labem | 2002 | 5 000 |
| Prostějov | 1993 | 4 000 |
| Zlín | 1993 | 3 200 |
| Plzeň | 1993 | 3 100 |
| Pustiměř | 2004 | 2 840 |
| Praha | 2005 | 2 360 |
| Chropyně | 1995 | 2 250 |
| Frýdek-Místek | 1996 | 1 600 |
| Strakonice | 1990 | 1 500 |
| Jihlava | 2005 | 1 500 |
| Benešov | 2001 | 1 400 |
| Kolín | 1993 | 1 100 |
| Hradec Králové | 1996 | 1 100 |
| Praha | 1995 | 1 000 |
| Trutnov | 1996 | 1 000 |
| Jablonec nad Nisou | 2000 | 950 |
| Nové Město na Moravě | 1997 | 864 |
| Znojmo | 1994 | 780 |
| Pardubice | 1994 | 750 |
| Olomouc | 1994 | 750 |
| Liberec 1 | 1995 | 400 |
| Těchonín | 2007 | 365 |
| Uherské Hradiště | 1996 | 350 |
| Luže | 1993 | 350 |

Currently, municipal waste energy recovery is primarily performed in three large incineration plants: in Prague, Brno and Liberec. The number of hazardous waste incineration plants has been gradually declining (67 in 2001, 27 in 2006), mostly due to tougher emission limits that older facilities find difficult to meet, a reduction in the amount of produced hazardous waste and the preference for the use of waste for material rather than energy recovery. The design capacity of the hazardous waste incineration plants that are currently in operation is approximately 160 thousand tonnes per year. According to data from the Centre for Waste Management at the T. G. Masaryk Water Research Institute, approximately 9.6 % of municipal waste and 8.2 % of hazardous waste was incinerated and used for energy recovery in 2006. However, for the category of other waste, which is the most significant with respect to weight, this was only 2.3 %.

While the spatial distribution of landfills is generally balanced, incineration plants display considerable differences and a major imbalance with respect to their distribution – see Figure 10.1 and Figure 10.2. These differences have resulted mainly from the historical development of the establishment of hazardous waste incineration plants, which were tied to major hazardous waste producers.

## 10.3 The management of selected products

In line with the implementation of EU directives into the Czech legal system, a take-back regime has been prescribed for some products and the waste from such products. For other waste flows, a special management regime has been specified by the Act on Waste. These wastes often display hazardous properties or their disposal and utilisation are problematic.

The Act on Waste prescribes obligations for entities that produce or supply selected products onto the market, obligating them to ensure the take-back of the products at the end of their life. If these obligations are not stipulated in the Act on Waste directly, the law stipulates such provisions in the form of a decree on waste management particulars. Such obligations also include the take-back obligation for certain products.

In the Czech Republic, a take-back obligation has been gradually implemented since 2001 and it applies to mineral oils, electric accumulators, galvanic cells and batteries, discharge lamps and fluorescent tubes, tyres and consumer electrical equipment. The take-back obligation means that the producer is obligated to take-back, free of charge, the used product from the consumer and provide for its reuse or disposal in line with applicable legislation at its own cost. The take-back success rates are outlined in Table 10.1.

The success of take-back is limited by the fact that the obligation only applies to that part of the products that has been launched on the Czech market (i.e. purchased in the Czech Republic). Also, entities that use these selected products for their business activities may dispose of them in ways outside the take-back regime (e.g. use them as raw materials or hand them directly over to a waste management facility), thus being in the position of waste producers. Once it has been used, this part of the products can be recorded as waste and not enter the take-back record keeping at all, see Table 10.2.

The obligation to ensure take-back has been specified for legal and natural persons authorised to perform business activities and who produce the listed products or supply them onto the market in the Czech Republic (hereinafter the "Obligated Person"), irrespective of the brand and the quantity produced or imported during the reporting period. This obligation has been in place since 23 February 2002. Since 13 August 2005, under the amended Act on Waste No 7/2005 Sb., it has also applied to consumer electrical equipment.

The implementation of take-back for some products can be viewed as a very progressive and effective measure that mainly reduces the production of hazardous waste and can produce highly positive environmental effects.

**Selected products** containing PCBs and equipment containing such products, mineral oils, batteries and accumulators, sludge from wastewater treatment plants, waste from the production of titanium dioxide, asbestos waste, car wrecks, electrical and electronic devices.

**The take-back success rate of the listed products in 2005**

**Table 10.2**

| Commodity | The amount of products that are subject to take-back [t] | The amount of products taken back [t] | The take-back success rate [%] |
|---|---|---|---|
| Mineral oils | 103 533 | 2 370 | 2.3 |
| Tyres | 71 227 | 37 070 | 52 |
| Pb-accumulators and batteries | 15 227 | 4 939 | 32.4 |
| Ni-Cd accumulators and batteries | 219 | 512 | 233.9 |
| Other accumulators and batteries | 3 774 | 215 | 5.7 |
| Discharge lamps and fluorescent tubes | 2 142 | 557 | 26 |
| Refrigerators and freezers | 9 791 | 162 | 1.65 |

The fact that the amount of Ni-Cd accumulators and batteries taken back exceeds their amount that is subject to take-back may have resulted from the long-term nature of their consumption or from inadequate record keeping. By contrast, the low take-back success rate for mineral oils is due to their labelling as hazardous waste and separate management and, in the case of refrigerators, freezers and accumulators, to their long life.

The obligated person must ensure that the consumer is informed by the "immediate seller" about the take-back procedure for these used products and about other rules applicable to disposing of these products, as well as about the obligation to earmark their use for material recovery once their usefulness has ended. In addition, the immediate seller must inform the consumer about the harmful effects that the hazardous substances contained in the electrical equipment may have on the environment and on human health.

**The methods of disposing tyres taken back, 2005 [%]**

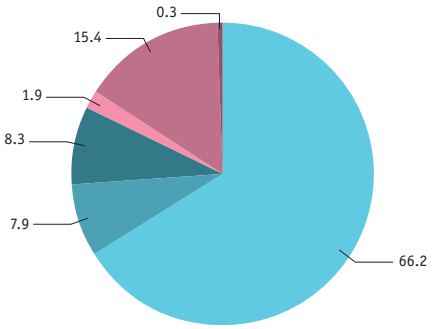



**Chart 10.16**

- Energy recovery
- Material recovery
- Reuse
- Disposal through incineration
- Other disposal methods
- Storage balance

*Source: T. G. Masaryk Water Research Institute, P.R.I.*

**The methods of disposal of Ni-Cd accumulators and batteries taken back, 2005 [%]**

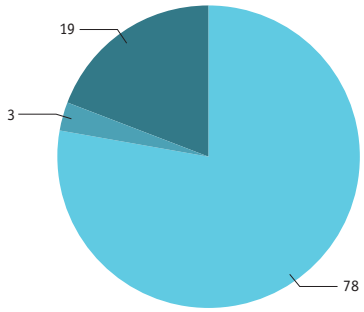



**Chart 10.17**

- Storage balance
- Disposal
- Material recovery

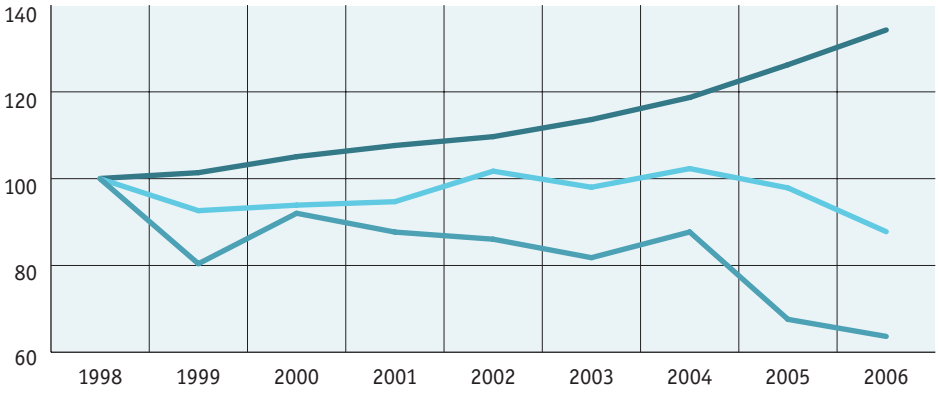
*Source: T. G. Masaryk Water Research Institute, P.R.I.*

## 10.4 The interdependence of waste management and economic development

Over the past years, the once neglected area of waste management has given rise to a brand new economic sector. This is regulated not only through laws pertaining to the individual environmental components (particularly the Act on Waste and the Act on Packaging), but it also accounts for approximately 0.5–1 % of GDP. Since this is a newly created sector, relevant statistics including the number of employees and average salaries for the entire waste management sector are not yet available. Total waste production and the dynamics of the entire sector roughly parallel trends seen in the national economy. A very positive development has been the marked decrease in total waste production in 2005 and 2006, which occurred independently of the GDP development.

**Decoupling of waste production and economic development (index 1998 = 100)**

**Chart 10.18**




Total waste production relative to 1998
Municipal waste production relative to 1998
GDP at constant 2000 prices

*Source: Czech Statistical Office, T. G. Masaryk Water Research Institute, P.R.I.*

## 10.5 The environmental impacts of waste management

By its very nature, waste production results from inefficiency and is directly connected with the technological standard of industrial production and the economy. Whenever waste is disposed of instead of reused, it means that at the very least, a certain amount of land has to be used. The risk of negative environmental effects associated with waste and its inappropriate management was particularly strong after 1989, when neither waste production nor waste management were controlled. There were no relevant legal or technological standards, nor were any other waste management tools applied. Landfills were not secured e.g. to prevent water seepage, the occurrence of infections and the fly-off of lighter waste fractions into the environment, they were not degassed and there was no obligation to reduce the amount of waste produced or to focus on waste utilisation over disposal, as is the case today.

By contrast, there currently tends to be exaggerated concern about the possible negative environmental impacts associated with the construction and the operation of new facilities for the use of waste for energy recovery. These facilities are subject to very strict conditions, both during the permitting phase and during operations, which include emission limits that are stricter than those for other energy sources (e.g. power plants, heating stations or boiler plants). So far, they represent the most economically feasible way of increasing the utilisation of municipal waste to the level that we committed ourselves to in the adopted Waste Management Plan of the Czech Republic. The prospective use of municipal waste for energy recovery will also allow for a reduction in the proportion of biodegradable waste that is landfilled, which is another objective of the Waste Management Plan.

As opposed to the combustion of municipal waste in household combustion equipment, which is not suited for this kind of fuel and a variety of undesirable combustion products are therefore released, the operation of municipal waste "incineration plants" is a controlled and monitored process with minimum environmental effects.

## 10.6 Instruments for improving the environment in the area of waste management

### 10.6.1 Legislation

The first Act on Waste was adopted in 1991. Most obligations imposed on waste producers were not only of a declarative or preventive character, they resulted in the reduction of the amount of produced waste and in giving preference to its utilisation. This law was transparent, which meant that sanctions for non-compliance could be specified and easily enforced.

A large number of imposed measures and obligations were time-limited, e.g. the charges for "disposal" of waste through landfilling, permitting only the temporary operation of existing unsecured landfills and a tougher regime for trans-border movement of waste. During the first half of the 1990s, these transformation measures resulted in the subsequent closure of unsecured landfills, whose number was estimated in excess of 6 000. In addition, the fulfilment of this act received a boost when the newly established Czech Environmental Inspectorate came into existence, i.e. began monitoring compliance with the act, and when the State Environmental Fund was established, which has made it possible to obtain subsidies for waste management. The general awareness of waste management that was environmentally sound was still inadequate. It was necessary to physically close and secure illegal and unsecured landfills.

At that time, the Czech Republic's accession to the EU was getting closer and it became evident that a relatively large number of legislative changes would have to be implemented. First, the second Act on Waste (Act No 125/1997 Sb.) was adopted in 1997. It implemented a significant portion of the relevant European regulations its concept directly preceded current waste legislation. For the first time in the Czech Republic's history, it became possible to process, utilise and eliminate waste in facilities, places and buildings designated for that purpose. The act imposed an obligation on the producers to sort waste according to the Waste Catalogue, defined the Hazardous Waste List and prescribed methods for managing such waste that had been specified through a ministerial decree (on waste management matters).

In the spirit of the preceding act, the new act obligated landfill operators to implement such technical designs for landfills as to ensure environmental protection throughout the landfills' entire operation and after the end of their economic lives, and to allow for the subsequent use of the landfills' area (e.g. for agriculture). In addition to improving the situation in the area of depositing waste, the act also:

- Extended and detailed the competencies of municipalities concerning municipal waste management.
- Divided imported and exported waste into categories according to which public administration body could more easily decide on their permitting their transit.
- For the first time, it prescribed obligations to be complied with during waste management.
- It detailed the reporting and record-keeping conditions with respect to waste.
- It repeatedly delimited the performance of public administration in the area of waste management.
- It made it possible to rule out hazardous properties in the case of hazardous waste.
- As of 2001, it banned the production and the import of packaging made from PVC and, through a decree, it specified the scope of the obligatory recycling and reuse of these packaging materials for producers and importers.

**Act of the Federal Assembly No 238/1991 Sb., on waste,**
did the following, without limitation:

- It defined waste as an object that its owner wants to discard, or any movable that needs to be eliminated (disposed of) as a part of healthy living conditions and environmental protection.
- It defined the categories of special and hazardous waste, specified waste management and defined a waste producer.
- It imposed a ban on importing waste for disposal purposes (i.e. elimination using the terminology of the current act).
- It specified the scope of the public administration's competencies and of both natural and legal persons' waste management obligations .
- It obligated waste producers to prepare a waste management programme.
- It obligated waste producers to sort and separately store produced waste, to use it as a source of secondary raw materials and energy and to allow competent public administration bodies to perform inspections at any time, while providing them with necessary information.
- It specified the obligations of carriers and the sanctions for non-compliance with the act.
- For the first time, it introduced charges for the disposal (elimination) of waste through landfilling.
- It prescribed sorting according to the Waste Catalogue that was published by the Federal Committee for the Environment in the Collection of Laws (No 69/1991 Sb.)
- The act used the term "secondary raw material" and the use of waste as secondary raw material, while the modes of managing such waste or raw material were governed by special regulations.

Nevertheless, it was necessary to include other areas in the act, such as take-back collection or the management of special products. This fact resulted in a relatively quick adoption of the new Act on Waste (Act No 185/2001 Sb.), which, with its relevant amendments, has remained in effect until today.

For the first time in the Czech Republic's history, the act has specified, through its decrees, the minimum required technical equipment for legal entities authorised in waste management. In addition, also for the first time, the rules for the management of selected products, such as tyres, car wrecks, electronic waste, PCBs, etc., have been specified. Producers have been obligated to provide for the free take-back of some products.

However, even though the obligation to perform material balancing of raw materials against waste has still not been imposed, this has been a significant step forward. Also, with the exception of landfills and the trans-border transportation of waste, the Act on Waste has not imposed any obligation to keep financial reserves for emergencies or for waste management errors. Such measures could help minimise numerous negative impacts for which the private sector has not been able to effectively address thus far.

Another significant act in the area of environmental protection that has considerably affected waste production is Act No 477/2001 Sb., on waste and amending some acts. It aims to protect the environment through preventing packaging waste production, particularly by reducing its weight, volume and harmfulness. Before its adoption, the Act on Packaging had no parallel in Czech legislation.

Presently, Act No 76/2002 Sb., on integrated pollution prevention and control, on the integrated pollution register and amending some acts (the Act on Integrated Prevention), is also applied in the area of waste management. It is aimed at achieving a high level of environmental protection as a whole, and at applying an integrated prevention and control of pollution resulting from the activities of the listed facilities.

In the area of waste management, the facilities listed in the Act on Integrated Prevention include, without limitation, the following:

- Incinerators with a rated heat input of over 50 MW
- Facilities for the elimination or reuse of hazardous waste and facilities for waste oil management, in each case with a capacity over 10 tonnes per day
- Facilities for municipal waste incineration with a capacity over 3 tonnes per hour
- Facilities for the elimination of waste that is not classified as hazardous waste, with a capacity over 50 tonnes per day
- Landfills that accept over 10 tonnes of waste per day or whose total capacity exceeds 25 000 tonnes, with the exception of the landfills of inert waste

**New Act No 185/2001 Sb., on waste**, has brought the following changes, without limitation:

- It has precisely defined the obligation to prevent waste production and specified its preferred use.
- It has defined the position of Waste Manager.
- It has specified the obligations in the management of selected products, waste and equipment (e.g. waste oils, accumulators, car wrecks, etc.)
- It has specified the take-back of some products.
- It has specified in detail the management of selected commodities (car wrecks, electrical appliances, PCBs, etc.)
- It has obligated waste producers to prepare waste management plans.
- It has imposed the obligation to create financial reserves for the reclamation and clean-up of landfills and, in the case of the trans-border transportation of waste, the obligation to deposit a financial reserve.

**Act No 477/2001 Sb., on packaging stipulates**, without limitation, the following:

- The legal obligations of natural and legal persons that run business activities and the competencies of administrative authorities
- Obligations in the management of packaging and in launching packaged products on the market or into circulation, in the take-back and reuse of packaging waste
- Fees and protective measures, corrective measures and penalties.

## 10.6.2 The Waste Management Plan

The Czech Republic's current waste management strategy has been laid down by Government Regulation No 197/2003 Sb., on the Waste Management Plan of the Czech Republic (WMP CR). The WMP CR's basic strategic objectives are to reduce specific waste production independently of economic growth, to achieve the maximum utilisation of waste in substitution for primary natural resources and to minimise the negative impacts on human health and the environment arising during waste management. The objectives of the plan are derived from the commitments and obligations prescribed by the European Union and its action programmes.

The basic principles incorporated into the obligatory section of the Waste Management Plan include the prevention of waste production and the reduction of waste production, waste management principles that aim to increase the ratio of utilised waste to landfilled waste, the principles for the management of selected facilities and types of waste (hazardous waste, car batteries, electronic waste, etc.), the creation of a single, adequate waste management network and some decision-making principles concerning the international transportation of waste and, last but not least, the proportion of biodegradable materials in landfilled waste.

The Waste Management Plan incorporates both specific objectives with concrete deadlines and general objectives that are continuously fulfilled and are aimed at raising general awareness of sound waste management techniques. Most objectives that can be evaluated are complied with. The objectives that have failed to be met over the long run include, above all, increasing the proportion of municipal waste used for material recovery, reducing the proportion of landfilled municipal waste by 20 % compared to 2000 and reducing the proportion of landfilled biodegradable waste. The objectives for the take-back and subsequent reuse of car wrecks and waste oils have also not been met either.

## 10.6.3 Charges

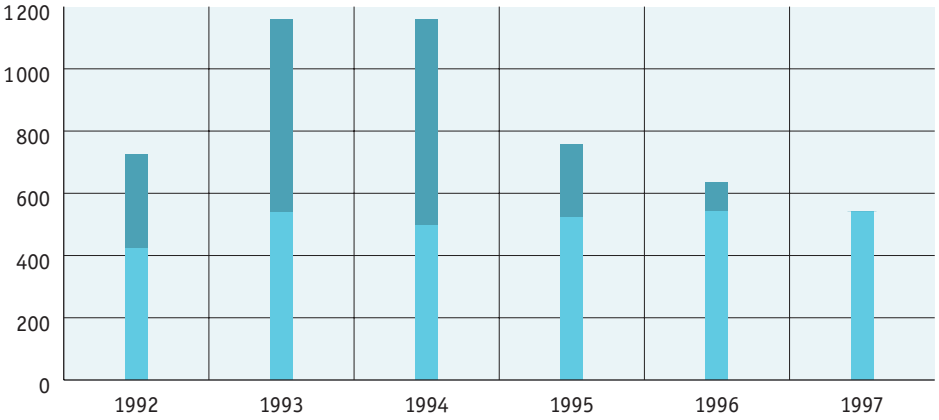
Waste landfilling charges were the first economic instrument used in the area of waste management under the Czech Republic's conditions. Its positive effect can be seen in the amount of waste deposited into individual types of landfills. The revenues from waste landfilling charges are shown in Chart 10.19.

The progressive rates of waste landfilling charges were intended to favour the use of secured landfills, which have higher investment and operating costs than unsecured landfills. Waste landfilling rates, prescribed by Act of the Federal Assembly No 238/1991 Sb., on waste, are shown in Table 10.2.

Current waste landfilling rates pursuant to Act No 185/2001 Sb. are shown in Table 10.3.

**The revenue from waste landfilling charges [CZK millions]**

**Chart 10.19**




Rate I – Landfills secured pursuant to the Act on Waste

Rate II – Landfills unsecured pursuant to the Act on Waste

*Source: Ministry of the Environment*

**Waste landfilling rates [CZK/tonne] pursuant to Act No 238/1991 Sb., on waste, Act No 62/1992 Sb., on charges for depositing waste**

**Table 10.2**

| Rate | Year | Soils and mine waste | Other waste | Sorted MW | Special waste | Hazardous waste |
|---|---|---|---|---|---|---|
| Rate I | 1992–1997 | 0 | 10 | 20 | 40 | 250 |
| Rate II | 1992 | 1 | 25 | 20 | 110 | 3 000 |
| | 1993 | 3 | 70 | 70 | 320 | 4 000 |
| | 1994–1996 | 6 | 140 | 210 | 640 | 5 000 |

*Source: Act No 62/1992 Sb., on charges for depositing waste*

As of 1 August 1996, the law made it impossible to deposit waste into unsecured landfills, for which rate II had been charged.

**Waste landfilling rates [CZK/tonne] pursuant to Act No 185/2001 Sb., on waste**

**Table 10.3**

| Waste category/Year | 2002–2004 | 2005–2006 | 2007–2008 | 2009 and later |
|---|---|---|---|---|
| **Basic rate** – the recipient is the municipality on whose land the landfill is located | | | | |
| Hazardous waste | 1 100 | 1 200 | 1 400 | 1 700 |
| Municipal and other | 200 | 300 | 400 | 500 |
| **Hazardous rate** – the recipient is the State Environmental Fund | | | | |
| Hazardous | 2 000 | 2 500 | 3 300 | 4 500 |

*Source: Act No 185/2001 Sb.*

## 10.6.4 Inspection and sanctions

The environmental legislative changes adopted after 1989 have brought about a variety of obligations. It is necessary to ensure that compliance is verified. Therefore, the Czech Environmental Inspectorate (CEI) was established through Act No 282/1991 Sb. The CEI shares some inspection responsibilities in the newly created area of waste management with local self-government authorities. CEI's responsibilities include, above all, performing inspections and verifications and imposing sanctions and corrective measures, especially fines.

The area of waste management (WM) has long been among the three areas with the highest number of performed inspections.

With respect to serious violations against the environment, the number of waste management-related fines imposed by the CEI can serve as an important indicator of environmental awareness and entrepreneurial ethics. Its development has been moderately unfavourable over this period. Fines result from waste management inspections performed mainly by the CEI and occasionally by municipalities. However, fines imposed by municipalities are not included in this comparison. The CEI is historically the first institution that started to perform systematic inspections in the areas of waste production and management.

The effective time of Act No 185/2001 Sb., covers the first period with firmly specified waste management principles. The amount of waste management-related penalties imposed by the CEI grew markedly during the entire time it was in effect. Government Regulation No 197/2003 Sb., on the Waste Management Plan of the Czech Republic has made it possible to consistently monitor the condition and the development of waste management in the Czech Republic using strictly specified indicators.

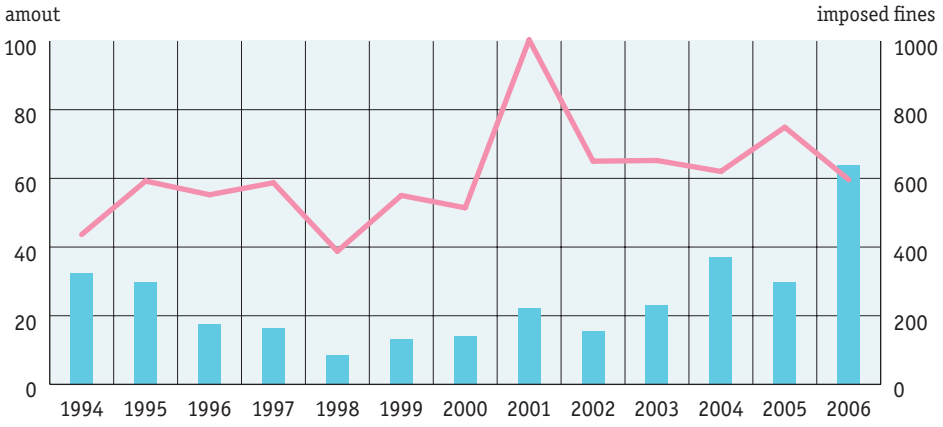
Since 2001, the area of waste management has had the highest number of imposed sanctions and corrective measures of all monitored areas, as shown in Chart 10.21.

In the area of waste management, the CEI currently inspects not only compliance with the Act on Waste, but also with the Act on Packaging, on chemical substances, on the placing of biocidal products on the market and other regulations. Nonetheless, the number of fines imposed under the Act on Waste remains the highest amongst the total number of fines imposed in the area of waste management, as shown in Chart 10.22.

Until 1998, the number of imposed fines in the area of waste management ranged between 400 and 600, while their total amount gradually declined from CZK 32 to 8 million. The marked fall in both the number and the amount of imposed fines in 1998 is partly attributable to the problems associated with the change in legislation in 1997, when a new Act on Waste was adopted. This trend lets us assume that there has been a gradual improvement in the waste management situation, especially with respect to serious violations. In 1998, the total amount of imposed fines reached its historical minimum to date.

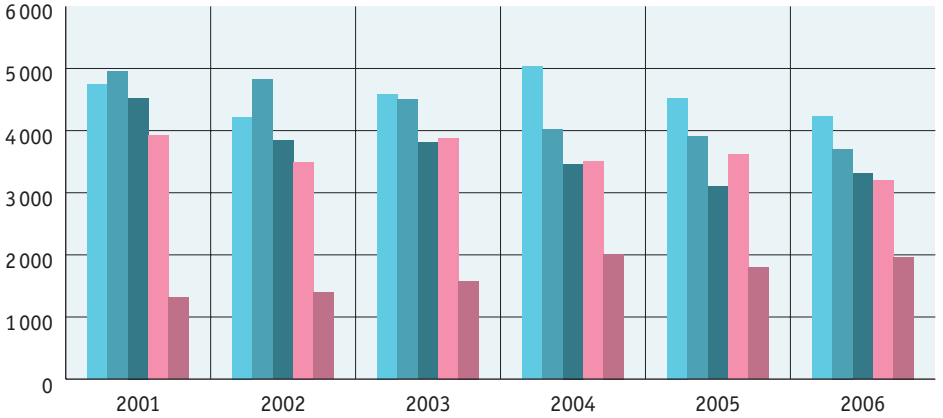
Except for 2001, the number of fines imposed by the CEI from 1999 to 2004 ranged approximately from 500 to 650, totalling CZK 13 to 23 million. The only exception was 2001, which saw 1 004 imposed fines totalling CZK 22.1 million. Generally, there has been a slightly growing trend with respect to both the number of imposed fines and their total amount (see Chart 10.20). This trend also continued in 2004, when the highest fines to-date were imposed, totalling almost CZK 37 million, while their number moderately decreased – from 652 in 2003 to 620 in 2004.

**The number and amount of waste management-related fines imposed by the CEI** **Chart 10.20**




*Source: Czech Statistical Office, Czech Environmental Inspectorate*

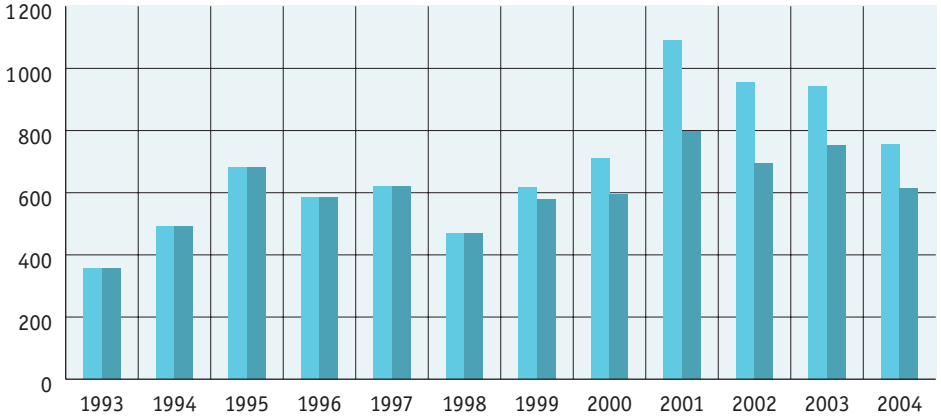
**The trend of CEI-imposed sanctions and corrective measures according to components** **Chart 10.21**




*Source: Czech Environmental Inspectorate*

**The number of fines imposed under the Act on Waste versus the total number of sanctions in the area of waste management**

**Chart 10.22**




The number of sanctions
of that fines under the Act on Waste

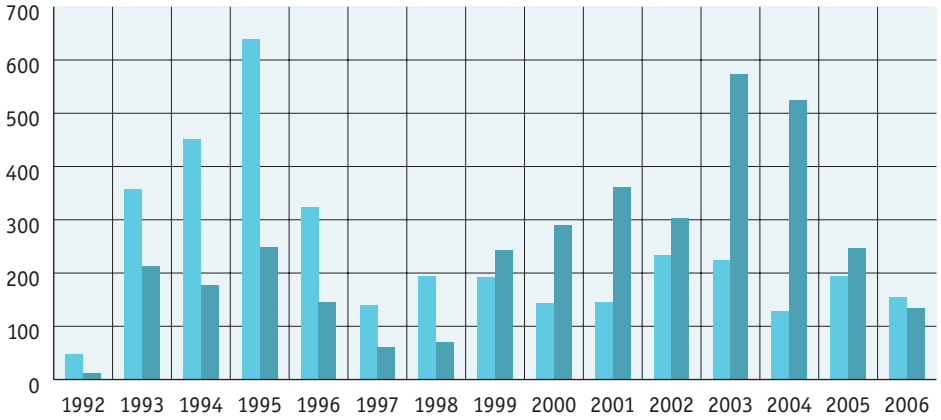
*Source: Czech Environmental Inspectorate*

## 10.6.5 The State Environmental Fund

The State Environmental Fund of the Czech Republic was established in 1991 in order to ensure financial support for protecting and improving the condition of the environment. Its revenues mainly come from environmental pollution charges and fines. The SEF has become an important source of financial support for environmentally sound projects, among others, in the area of waste management. An overview of the revenues and the subsidies granted by the fund in that area is shown in Chart 10.23. Recently, subsidies in the area of waste management provided by the fund have considerably exceeded its revenues.

**The SEF's revenues and provided support in the area of waste management [CZK millions]**

**Chart 10.23**




Revenues
Support

*Source: State Environmental Fund*

# 11

# Trade

The trade policy of the Czech Republic requires pro-environmental changes in trade. There are voluntary and obligatory instruments. The most prominent voluntary instruments are eco-labels for goods that have a reduced adverse environmental impact. The Czech Republic ranks among the best of the post-Communist countries in this area. The main obligatory instrument is energy labelling, which indicates the energy requirements of products and which should motivate the consumers to choose energy-saving appliances.

Czech foreign trade has also evolved rapidly in its ownership structure and pattern of commodities and territories. Currently, it is run by private entities and mainly focuses on industrial products and developed markets. Its dynamics and volume substantially contribute to the country's economic growth and its consistently positive balance fosters the economic stability of the Czech Republic.

Integral to the Czech Republic's international commercial relationships is its involvement in the environmental programmes of the World Trade Organization (WTO), which requires its member countries to address – over the long term – the interrelationships between trade and environment.

## 11.1 Retail

Before 1989, Czechoslovak retail was a centralised activity concentrated in the hands of the state. It lacked the elements of a market economy and had a peculiar structure of state-controlled prices. In villages, retails shops were formally operated by co-operatives, but the degree of state intervention was overwhelming nonetheless. The current retail network features 389 trade companies with more than 620 000 employees and a per capita selling space of 0.3 $m^2$, about 1/3 of the figure in west-European countries. In 1989, 34 % of the total selling space was devoted to food and only 38 % to non-food items. In 1998, the share of food-related sales space plunged to 16% and the share of non-food space increased to 56 %, while the total area of selling space more than doubled.

As in other parts of the economy, the concept of transition was felt in retail after 1989. In fact, it proceeded faster here than in other sectors.

In 1990, the network of state-owned shops included 20 000 state-owned shops, out of which roughly 10 500 were included in the privatisation of small companies. During the restitution process, which happened concurrently, about 5 500 shops were returned to their original owners. Roughly 4 500 stores were included in the privatisation of large and medium-sized companies.

In the short run, the privatisation and restitution of small companies introduced a scattered ownership pattern into the retail network. The privatisation of large and medium-sized companies was supposed to generate new distribution networks. In the early 1990s, retail companies with fewer than 25 employees accounted for two-thirds of the retail turnover. Starting in 1994, the retail structure began to gradually change. Saturation set in and the first foreign retail chains appeared.

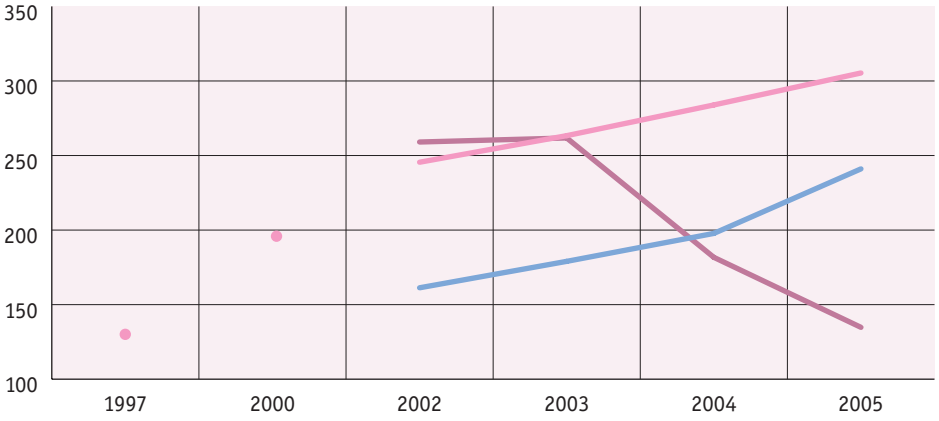
The structure of retail units started resembling what we had seen in developed market economies. In addition to outlets common before 1989 (specialised shops, self-service shops and department stores), new types appeared: supermarkets, hypermarkets, discount stores, shopping centres, catalogue shops, factory outlets, mail-order companies and e-shops. Second-hand shops (especially for clothes) and marketplaces (frequently with goods of uncertain origin) became common. They catered to down-market customers.

The ownership structure of the retail sector underwent major changes as well. The privatisation process led to an increase in the number of stock companies by 304 % after 1990, while the number of co-operatives rose by mere 5% and the number of state-owned companies plummeted by 93 %. The number of natural persons running retail businesses jumped by 122 %.

**Characteristics of trade**
In general terms, trade can be defined as the exchange of goods, services and capital for money or other services. It can be classified according to various and sometimes overlapping criteria. According to types of trading organisations, it can be classified into wholesale trade (the exchange of goods among wholesalers and producers) and retail trade (retailers sell goods to end consumers). Based on the territories involved, we can distinguish internal trade and foreign trade. When considering what is being traded, there is trade in goods (consumer goods and capital goods) and trade in services (finance, transport, etc.). In the following sections, only retail trade and foreign trade will be discussed (e.g. we will ignore trade in services as well as trade in financial capital in the form of securities and currencies).

**Structure of revenues from retail sales [billions of CZK]**

**Chart 11.1**




Owned by a Czech citizen and more than 100 citizens

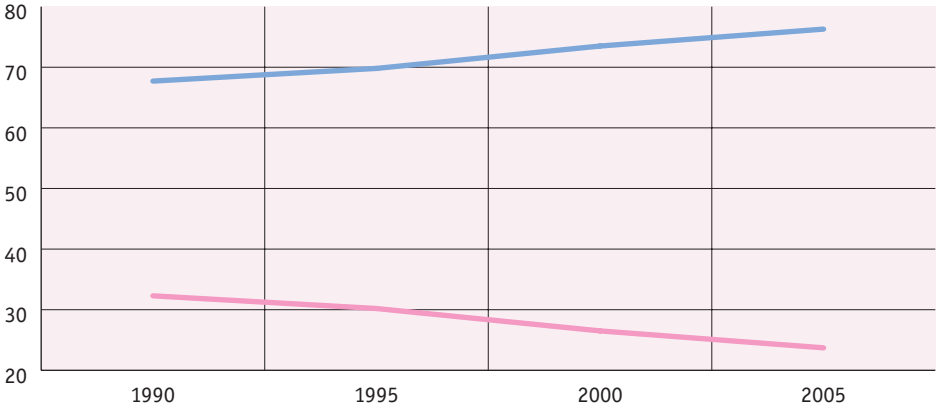
Owned by a Czech citizen and fewer than 100 employees

Owned by foreign citizens

*Source: Czech Statistical Office*

**Net monetary outlays of Czech households [%]**

**Chart 11.2**




Food, including beverages and tobacco

Other outlays

*Source: Computed by CENIA according to 'Obchod-doména spotřebitele', 2001, Ministry of Trade and Industry and 'Obchod v České republice v roce 2004', Ministry of Trade and Industry*

Since 2000, the growth in the number of companies has slackened. The number of stock companies and co-operatives has fallen by 35 % and 10 %, respectively, and the share of state-owned companies has withered away – eventually, only 4 of them remained in business. Concentration in the retail sector has continued. 150 active businesses with fewer than 99 employees hold a market share of 62 % and 171 companies with more than 100 employees have a share of 38 % (64 of the largest companies have foreign owners). Within the group of large companies, those with 250–499 employees prevail.

With the rising penetration of the Internet, online sellers (e-commerce) have started competing with brick and mortar businesses in some segments. Contrary to all expectations, however, this new phenomenon has not slowed down the expansion of the overall selling space. From the environmental viewpoint, the impacts of e-commerce are not clear-cut. This type of outlet saves energy, but on the other hand, it creates demand for packaging and air shipping.

The service standard (measured as the number of inhabitants per one person employed in retail) as well as the space standard (selling space per 1 000 inhabitants) has approached the levels of the west-European countries. The preference for individual types of outlets mimics what can be observed in Western Europe to a higher degree than in other post-Communist countries. In 2006, for example, 250 shopping centres combined to occupy 1.4 mill. $m^2$, which corresponds to 132 $m^2$ per 1 000 inhabitants, 20 % less than the European Union average. For example, the selling space per 1 000 inhabitants is 322 $m^2$ in the Netherlands. During the preparation of the Czech Republic for its accession to the European Union, the retail sector had to adopt EU norms, mainly with regards to sanitary sales conditions; this did not represent a major problem for the sector.

Today, hypermarkets, discount stores and supermarkets are the most successful outlets. There were 161 hypermarkets in 2005 and, taking into account only the 50 largest Czech retailers, their receipts amounted to roughly 40 %. By 2008, their number increased to 231 and there was one hypermarket for fewer than 50 000 inhabitants. Discount stores have gradually caught up with supermarkets. Taking into account the 50 largest Czech retailers again, each category reached a share of 17 % of receipts (however, supermarkets have been losing ground and some chains have had to withdraw from the market).

Since the 1990s, the pattern of retail sales has followed Western European trends; the share of food has been decreasing in favour of non-food goods and services. Czech retail is similar to the retail structures of developed countries, and the same can be said for other types of stores.

**Supermarkets:** Those with a sales area of at least 400 $m^2$ with, the main focus on food.

**Hypermarkets:** Those with a sales space of at least 2 500 $m^2$ with a wide range of food and non-food items, situated mostly on the outskirts of towns and cities and featuring huge car parks.

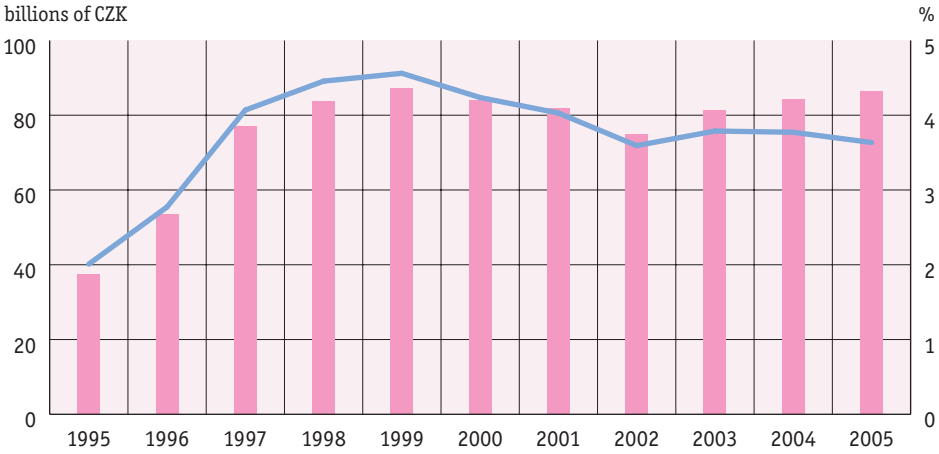
**Discount stores:** Modestly equipped stores with a comparatively narrow range of goods of medium and low quality.

**Shopping centres:** In addition to hypermarkets, they feature specialised shops and other services (e.g. restaurants, cinemas, travel agencies, fitness centres); they are mostly located on the outskirts of cities and feature huge car parks.

**Gross value** added is the difference between the total production of goods and services and intermediate goods (the value of goods and services used in production).

**Creation of gross value added in retail**

**Chart 11.3**




The creation of gross value added in retail [billions of CZK]

The share of retail in the creation of gross value added [%]

*Source: Czech Statistical Office*

**Type of store preference based on money spent on food of outlet types [%]**

**Table 11.1**

| Type of store | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|
| Hypermarket | 4 | 23 | 23 | 25 | 33 | 38 | 34 | 35 |
| Supermarket | 26 | 26 | 26 | 25 | 24 | 19 | 21 | 20 |
| Discount store | 13 | 15 | 15 | 15 | 16 | 19 | 18 | 22 |
| Small shops | 41 | 34 | 34 | 33 | 25 | 23 | 25 | 20 |
| Other | 16 | 2 | 2 | 2 | 2 | 2 | 2 | 4 |

*Source: Obchod v České republice v roce 2004 a 2005, Ministry of Industry and Trade*

**Proportion of retail, wholesale and automotive trade in gross value added [%]**

**Table 11.2**

| | 1990 | 1995 | 2000 | 2005 |
|---|---|---|---|---|
| Belgium | 12.2 | 12.2 | 10.3 | 10.9 |
| Germany | – | 10.9 | 11.1 | 10.9 |
| Austria | 13.0 | 13.0 | 13.4 | 13.3 |
| **Czech Republic** | **–** | **11.1** | **16.0** | **18.4** |

*Source: Eurostat, computations by CENIA*

For statistical purposes, trade includes retail, repairs to consumer goods, wholesale and commercial mediation and automotive trade. Consequently, the average values for the sector reflect this structure.

**Number of employees and wages in trade**

**Table 11.3**

| | 1990 | 1995 | 2000 | 2005 |
|---|---|---|---|---|
| The number of employees | 523 760 | 782 421 | 712 478 | 629 767 |
| The average wage in trade | 2 818 | 7 201 | 14 171 | 16 555 |
| The average wage in retail | – | – | 10 246 | 12 178 |
| The total average wage | 3 286 | 8 172 | 13 614 | 19 024 |

*Source: Czech Statistical Office*

The retail sector's proportion of gross value added (see chart 11.3) and employment amounts to almost 19%. It employs roughly 20 % of Czech women and the number of employees has risen by 20 % over the last 15 years – see Table 11.3 and Chart 11.4.

Retail (i.e. wholesale activities are excluded) is thus a major part of the Czech economy. Although its share in the creation of gross value added has been stagnant since 2001, its volume has rebounded after a decrease between 1999 and 2002. Between 1990 and 2005, the creation of gross value added in trade increased by 131 %. Trade ranks among the nine fastest-growing fields of the Czech economy.

**Employment in trade [%]**

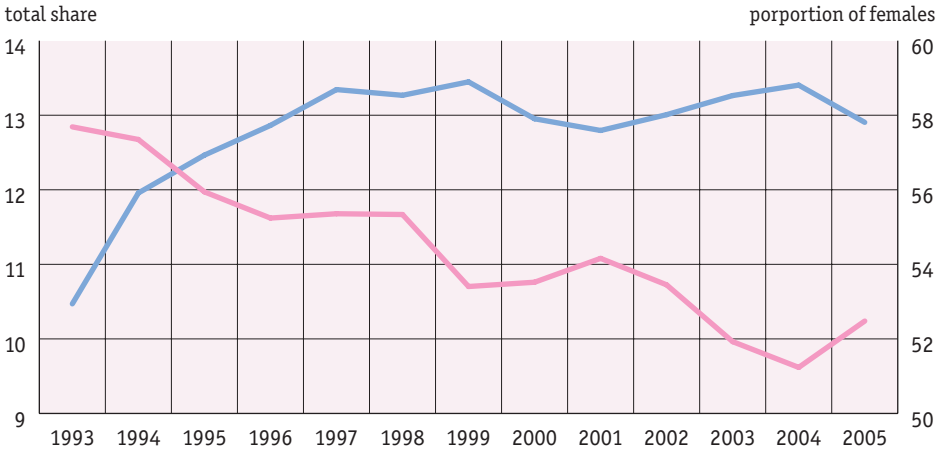



**Chart 11.4**

The share of retail employees in overall employment

The porportion of females in the total retail employment

*Source: Czech Statistical Office*

**Employment in trade in selected European countries, 2001 [%]**

**Table 11.4**

| | Retail | Wholesale | Automotive trade | Total |
|---|---|---|---|---|
| Belgium | 48.7 | 37.9 | 13.4 | 100 |
| Germany | 60.8 | 28.6 | 10.6 | 100 |
| Austria | 48.8 | 36.9 | 14.3 | 100 |
| **Czech Republic** | **54.1** | **33.7** | **12.2** | **100** |

*Source: Obchod v České republice v roce 2005, Ministry of Industry and Trade*

**Turnover in trade in selected European countries, 2001 [%]**

**Table 11.5**

| | Retail | Wholesale | Automotive trade | Total |
|---|---|---|---|---|
| Belgium | 20.6 | 60.4 | 19.0 | 100 |
| Germany | 30.9 | 57.3 | 11.8 | 100 |
| Austria | 26.3 | 58.6 | 15.1 | 100 |
| **Czech Republic** | **29.5** | **56.4** | **14.1** | **100** |

*Source: Obchod v České republice v roce 2005, Ministry of Industry and Trade*

The average wage in trade has increased faster than the average Czech wage. On the other hand, the wage level in the trade sector was persistently 13–14 % below the overall average. In the retail sector, wages are roughly 36 % below the average wage, which makes retail one of the worst-paying sectors in the Czech economy along with the textile industry and agriculture.

Czech trade achieved European standards in most areas soon after 2000. From the macroeconomic perspective, it converged with west-European patterns also in the contribution to gross value added, employment and turnover.

## 11.2 Foreign trade

Until 1989, foreign trade was controlled by a state monopoly through companies specialising in individual commodities, to which foreign currency (for import) and goods (for export) were assigned by the authorities. The authorities also prescribed export plans for companies. Phenomena like price and exchange rates were purely formal. Foreign trade was considered a necessary evil and its goal was to generate foreign currency to finance indispensable imports since the Communist regime preached autarky. Most exchange was conducted with other countries within the Soviet bloc (including the import of raw materials) and the balance of mutual trade was cleared bilaterally in a system of bilateral barter trade with streams of goods prescribed by the authorities.

After 1989, the state monopoly and directive were abolished and foreign trade became an integral part of the market economy. Under the pressure of market forces, trade shifted from Eastern markets to developed economies. Foreign trade was gradually liberalised, and no customs and tax measures have been in place to regulate it since 1995. The preparation for the accession of the country into the European Union intensified the integration of the Czech economy into the world economy. After its accession to the EU, Czech trade policy regarding third countries has fallen within the exclusive competence of the EU and its common trade policy. The CTP is one of the most integrated joint activities of the EU member countries. The main tools of the CTP are agreements on trade and economic cooperation, the integrated community tariff, customs preferences and other preferences, and non-tariff measures. The European Union is a stand-alone law entity in foreign trade.

A prerequisite for any open market economy and advanced foreign trade is a convertible national currency. The change from internal convertibility to full external convertibility was achieved through several foreign currency laws – Act No 528/1990 Sb., its amendment No 228/1992 Sb. and No 219/1995 Sb. The latter amendment introduced the full convertibility of the Czech crown.

During the period of stagnant GDP (1990–1993), foreign trade was also nearly non-existent (mainly due to structural adjustments). The GDP recovered between 1994 and 1997, but its growth provoked a foreign trade deficit, whose magnitude presented a threat to the macroeconomic stability of the Czech economy. Since the late 1990s, the deficit has somewhat dwindled and the trade balance was actually positive in 2005. Since 2001, exports have been rising faster than imports, although the Czech crown has been appreciating and the prices of raw materials (in particular fuels) have been rising.

The value of foreign trade has been consistently dwarfing GDP since 2000 and it has even been outpacing GDP; the value of foreign trade has risen by 718 % since 1990, whereas GDP (in current prices) has risen just by 366 %. Starting in 2005, the balance of foreign trade has always been positive. See Chart 11.5 for details.

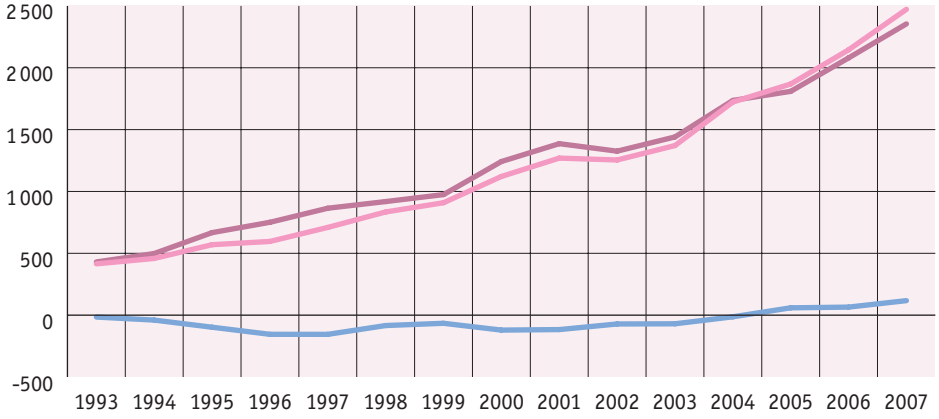
As far as the regional pattern of Czech foreign trade is concerned, the shares of advanced market economies in Czech imports and exports are lower than 50 %. By 2005, their shares in imports and exports had risen to 80.3 % and 90.3 %, respectively. On the other hand, the share of developing countries decreased somewhat, and the share of transition economies plummeted – see Table 11.7. The positive development of the balance of payments is also due to the monetary composition. More than 60 % of Czech exports end up in the euro zone, while imports from the same territory are about 10 percentage points lower. Another boost for Czech foreign trade is the faltering US dollar, in which most raw materials are traded.

The commodity pattern of Czech foreign trade has changed over the last 15 years. Raw materials and intermediate products, which prevailed before the transition, have been overshadowed by industrial goods. The proportion of machines and equipment in the volume of imports reached 41.8% in 1990, whereas the number rose to 62.4 % in 2005. The Czech Republic is a net importer of fuels and raw materials. Their share in imports fell from 42.1 % in 1990 to 23.2 % in 2005.

The development of kilogram prices, e.g. the value of 1 kg of imported and exported goods, attests to the increasing quality of Czech participation in international trade – see Table 11.8. The export kilogram price has swollen by 56 % over the last 7 years, while import kilogram prices have risen by only 33.4 %, a dizzying hike in prices of raw materials notwithstanding. The more efficient processing of local raw materials also has had an indirect environmental impact in that it alleviates the need to extract domestic deposits of raw materials.

### Trade balance of the Czech Republic [billions of CZK]

**Chart 11.5**




*Source: Czech National Bank*

### Czech Republic foreign trade [billions of CZK, current prices]

**Table 11.6**

| | 1990 | | | 1995 | | | 2000 | | | 2005 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Old classification** | **I** | **E** | **B** | **I** | **E** | **B** | **I** | **E** | **B** | **I** | **E** | **B** |
| Breeding livestock and food | 13 | 12 | -1 | 44 | 33 | -11 | 60 | 43 | -18 | 97 | 73 | -24 |
| Fuels, substances and raw materials | 100 | 76 | -24 | 162 | 108 | -54 | 298 | 153 | -145 | 425 | 223 | -202 |
| Machines, equipment and tools | 102 | 90 | -12 | 326 | 248 | -78 | 625 | 639 | 14 | 937 | 1 170 | 233 |
| Industrial goods | 22 | 37 | 15 | 137 | 186 | 49 | 258 | 286 | 28 | 375 | 409 | 34 |
| **Total** | **238** | **215** | **-23** | **668** | **575** | **-94** | **1 242** | **1 121** | **-121** | **1 835** | **1 875** | **40** |

*Source: Czech Statistical Office*

To standardise the data over the entire time period in question, aggregation was performed following the classification from the early 1990s.

### Territorial pattern of the Czech foreign trade [%]

**Table 11.7**

| | Import | | | Export | | |
|---|---|---|---|---|---|---|
| | **Developed market economies** | **Developing countries** | **Transition economies** | **Developed market economies** | **Developing countries** | **Transition economies** |
| 1990 | 47.3 | 7.6 | 45.1 | 43.6 | 10.9 | 45.5 |
| 2000 | 71.9 | 4.6 | 23.5 | 74.8 | 3.8 | 21.4 |
| 2005 | 80.3 | 5.7 | 14.0 | 90.3 | 3.6 | 6.1 |

*Source: Czech Statistical Office*

### Trend of kilogram prices of exports and imports

**Table 11.8**

| | Import | | | Export | | | Ratio of kg prices in export/ import |
|---|---|---|---|---|---|---|---|
| | **Net [millions of tonnes]** | **billions of CZK** | **CZK/kg** | **Net [millions of tonnes]** | **billions of CZK** | **CZK/kg** | |
| 1999 | 42.92 | 973.17 | 22.67 | 39.49 | 908.76 | 23.01 | 1.01 |
| 2000 | 47.58 | 1 241.92 | 26.10 | 40.82 | 1 121.10 | 27.46 | 1.05 |
| 2001 | 50.06 | 1 385.56 | 27.68 | 40.29 | 1 268.15 | 31.47 | 1.14 |
| 2002 | 47.81 | 1 325.67 | 27.73 | 41.93 | 1 254.86 | 29.93 | 1.08 |
| 2003 | 51.17 | 1 440.72 | 28.16 | 44.53 | 1 370.93 | 30.79 | 1.09 |
| 2004 | 61.64 | 1 749.10 | 28.38 | 53.54 | 1 722.66 | 32.18 | 1.13 |
| 2005 | 60.67 | 1 834.86 | 30.25 | 52.24 | 1 875.22 | 35.90 | 1.19 |
| 2005/1999 [%] | – | – | 33.40 | – | – | 56.00 | 16.94 |

*Source: Czech Statistical Office, calculations by CENIA*

According to the Czech Statistical Office, pre-1999 data are not comparable with more recent figures because the methodology has changed and the ČSÚ does not publish it. Since 2006, aggregate data on the volume of foreign trade have not been published.

## 11.3 Trade in environmental goods

Environmental goods are mainly items used for measuring, preventing, limiting and remedying environmental damage incurred by waters, air and land, further noise-reducing appliances, products needed in waste management and in ecosystem management as well as clean technologies, products and services that reduce environmental risks and minimise pollution.

The share of environmental goods in total imports has fallen from 7.3% to 6.4%, but their share in exports has increased from 4.4% to 5.1% in the same time period. The ratio of export kilogram prices to import kilogram prices has been steadily increasing. The export and import of environmental goods has increased by 249.2% and 166.5%, respectively. The most frequently imported items are equipment for cleaning sewage water, equipment for monitoring air pollution and equipment for waste management. A similar pattern can be seen in exports. As far as the territorial orientation of exports and imports is concerned, the OECD and EU countries have prevailed, with Germany being most prominent destination and source of goods.

**Czech foreign trade in environmental goods**

**Table 11.9**

| billions of CZK | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|
| Import | 31.6 | 33.4 | 41.9 | 32.9 | 51.1 | 53.6 | 60.0 | 75.7 | 88.6 | 84.2 |
| Export | 18.3 | 18.7 | 23.2 | 26.1 | 29.9 | 35.9 | 39.9 | 48.7 | 61.1 | 63.9 |
| Balance | -13.3 | -14.7 | -18.7 | -6.8 | -21.2 | -17.7 | -20.1 | -27.0 | -27.4 | -20.3 |

*Source: E. Tošovská, Foreign Trade in Environmental Goods in the Czech Republic (1993–2002), Prague Economic Papers, 4, 2004*

## 11.4 Environmental impact of trade development

One of the phenomena with a high environmental impact is the construction of hypermarkets and shopping centres on the outskirts of towns. In addition to high land use, the increased traffic results in air pollution and other negative influences. Supermarkets are also built in the centres of settlements, where all their negative territorial impacts compound; they bring traffic to settlements or make it denser, they often occupy municipal green spaces and they take up sites where better architecture serving more important social functions would have been more appropriate. The demise of small shops from downtown areas also destroys the natural municipal ambience with display windows featuring a variety of goods and with strolling customers.

Store food chains have a near-monopolistic status and siphon off an important part of profit from agricultural produce. They dictate prices to their suppliers, who in turn pass them on the farmers, whom the Common Agricultural Policy of the EU shields from international competition through subsidies. In fact, those subsidies end up in the pockets of chain stores, which transfer a large part of it beyond the market with agricultural produce. The subsidised agricultural prices also distort the cost calculations and make it possible to attain profit for goods unnecessarily transported over long distances where road transport, both domestic and cross-border, prevails (see the *Transport* chapter for details).

## 11.4.1 Environmentally friendly trade

To make trade and services more environmentally friendly, it is necessary to shift the burden of responsibility onto the customers, who can, based on accurate information, choose environmentally friendly goods and services. In 1999, the Ministry of Industry and Trade elaborated the first short-term **Concept of Consumer Policy** for 1999–2000. New versions were prepared for 2001–2005 and for 2006–2010. Among other issues, the Concept of Consumer Policy for 2006–2010 includes support for the implementation of specific sustainable consumption programmes in the Framework of sustainable consumption and production programmes, which the Government Council for Sustainable Development approved in 2005. The document anchors the right to make environmentally responsible choices as one of the main consumer rights. In practice, this translates into support of activities conducive to the sustainable development of consumption, e.g. through a change in consumption patterns, including the below mentioned forms.

## 11.4.2 Eco-labelling

For retail, **eco-labelling** is an enormously important voluntary regulatory instrument. The National Programme for Labelling Products with an Environmentally Friendly Product/Service Trademark and the European Programme for Labelling Products and Services with the EU Eco-label have been used in the Czech Republic. The tested and subsequently certified products have to comply with requirements related to their environmental impact throughout their life cycle, as well as to their usefulness, quality and impact on the health of consumers.

### Environmentally friendly products

The Czech Republic was the first post-Communist country to launch a national eco-labelling programme. The first eco-label was awarded as early as June 1994. In 2000, the Czech programme became a part of the Global Eco-labelling Network, an association of more than 35 prestigious eco-labelling programmes throughout the world. Currently, more than 350 products can display the **Environmentally Friendly Product** label. 197 licences have been awarded to 89 companies in 54 product categories – see Chart 11.6. The accession of the Czech Republic to the EU provided Czech companies the impulse to obtain The Flower, the EU-sponsored eco-label.

In 2005, the first Environmental Product Declaration about Type II label products was published. The declaration features precise environmental data according to identified parameters; it is a kind of eco-labelling of goods evaluated according to ISO 14025 norms. Basically, it is a list of product properties that have some environmental impact. The impact is assessed through a Life Cycle Analysis, i.e. the entire process of sourcing and production itself is considered.

Government Resolution No 159 of 7 April 1993 charged the Minister of the Environment with the task of implementing the National Programme for Labelling Products with an Environmentally Friendly Product/Service Trademark. On 7 June 1994, CLIMATIZER PLUS – a heat and noise insulation system produced by CIUR a. s., Brandýs nad Labem was the first product to be awarded the eco-label.

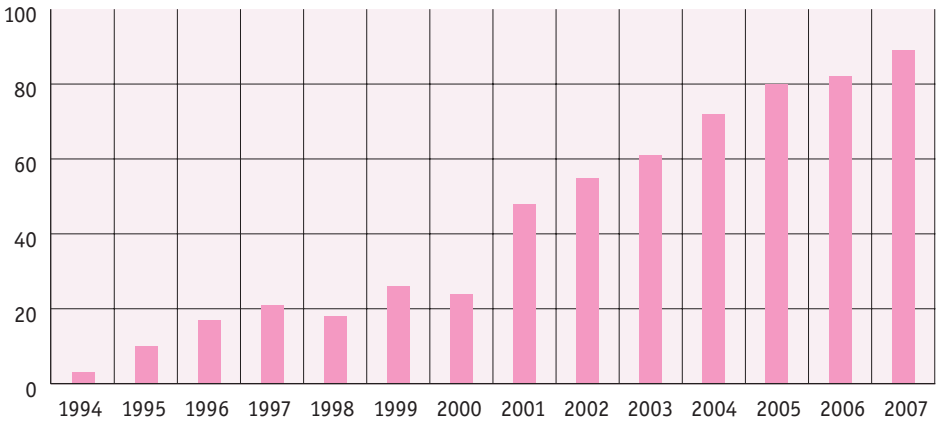
The first Flower label was awarded to the textile products of a Czech company, HYBLER TEXTIL a. s., on 11 February 2005, and the second one to the accommodation services of the Adalbert Praha Hotel.

In Resolution No 720 of 19 July 2000, the Czech government stimulated the development of the production and use of environmentally friendly products. It approved measures supporting the development of production and use of environmentally friendly products and recommended its members, heads of other state administration authorities and heads of district authorities to choose products bearing the eco-label when awarding public contracts.

**Number of companies awarded the Environmentally Friendly Product label**

**Chart 11.6**

*Source: CENIA*



## 11.4.4 Energy labelling

Energy saving programmes are an important part of environmental care. The programme of energy labelling concerns the retail sector. In the European Union, common legislation introducing energy labelling was enacted in 1992 for all member countries, and the Czech Republic adopted the necessary legislation in 2001. In 2005, class A refrigerating devices (refrigerators, freezers and combinations thereof) represented more than 35 % of the market and together with class B devices, they constituted more than 90 % of the market – see Chart 11.7. Energy labels are important for assisting customers interested in buying electrical appliances. However, they should be continually updated and expanded to include more appliances and the energy classes should be adjusted as needed.

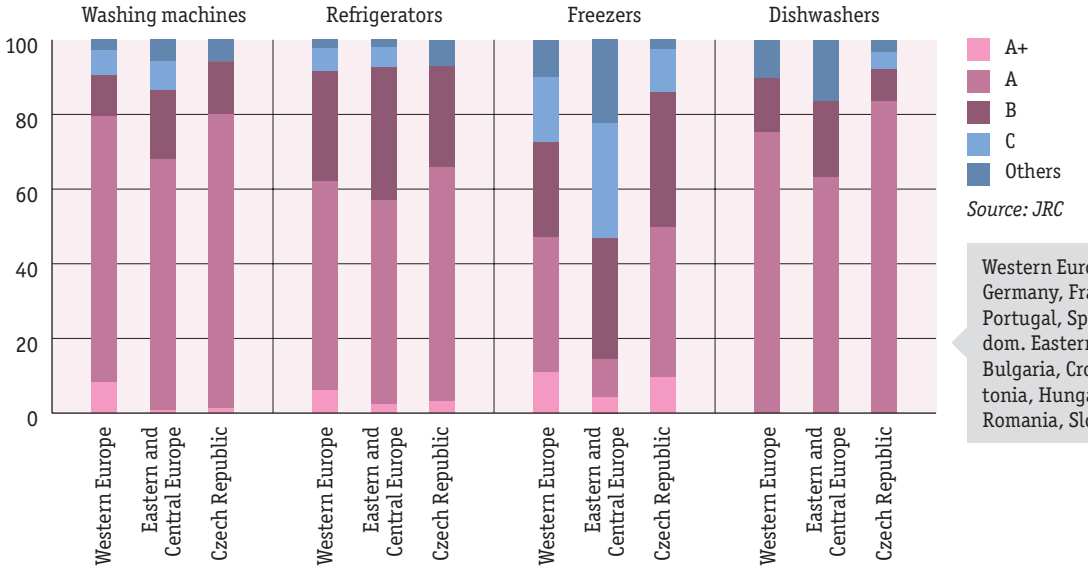
Energy labelling concerns the following electrical appliances: automatic washers, tumble dryers, washers combined with dryers, electric refrigerators, freezers and combinations thereof, dishwashers, electric ovens, electric water heaters, sources of light, fluorescent lamp ballasts, air-conditioning units.

A specific voluntary instrument is the Energy Star logo, which is used for personal computers, monitors, faxes, scanners, copying machines, printers, i.e. office and computer technology. The logo was originally introduced in the USA and pursuant to an agreement between the USA and the EU from 2006, it will be used in Europe as well. It is awarded to appliances with low operational and stand-by energy consumption.

Decree of the Ministry of Industry and Trade No 215/2001 Sb., which implements Council Directive 92/75/EEC, lays out details for energy labels and for the minimum energy efficiency required for electrical appliances launched on the market. Directive 2006/32/EC on energy end-use efficiency and energy services is a continuation of an EU effort to decrease energy intensity. In addition to energy efficiency, it also covers funding issues.

**Share of sold domestic appliances by energy class [%]**

**Chart 11.7**




*Source: JRC*

Western Europe includes Austria, Belgium, Germany, France, Italy, the Netherlands, Portugal, Spain, Sweden and United Kingdom. Eastern and Central Europe include Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

## 11.4.5 Fair Trade

The goal of the Fair Trade movement is to support disadvantaged producers from developing countries directly and efficiently. This goal is to be reached by applying Fair Trade conditions for the producers involved, by stressing the importance of complying with fundamental laws and environmental standards and by raising the awareness of the situation of small farmers and artisans in developing countries among consumers. The fixed purchase prices shield producers from price fluctuations on global markets, which frequently push prices below the production costs and thus ruin producers.

The Fair Trade movement has three priorities: nature, people and finance. The Fair Trade movement puts people first (the social dimension), then finance (the economic and social dimension) and nature (the environmental dimension). The process of making production more environmentally friendly is gradual and three basic minimum measures are necessary: Fair Trade producers are not allowed to use agro-chemical substances that have been prohibited e.g. by the World Health Organization and international agreements on toxic substances. There is also a need for precise rules for handling, storing, using and disposing of agro-chemical substances that can be used. To develop farming procedures, there are agro-environmental measures that can positively influence the species variety of fauna and flora (biodiversity).

The movement was born after World War II and by the end of the 1980s, some of its practices had found their way into chain store. Since 1998, the informal international association (working group) called FINE has been coordinating the movement. Currently, several organisations are active in Fair Trade in the Czech Republic. Links can be found below. In 2004, a Fair Trade Association was established in the Czech Republic to unite most organisations involved in Fair Trade.

Products with a Fair Trade label are most commonly sold in shops specialising in organic food and in Internet cafes. Unlike organic food, they are rarely found in department stores. An exception is Marks&Spencer that offers several Fair Trade products (coffee and tea) and the former Delvita chain, which offered several products under its Delhaize brand.

Czech retail turnover related to Fair Trade products reached roughly CZK 27 000 000 in 2007. The most prominent items were coffee, tea, chocolate and other sweets.

## 11.4.6 Organic products

For organic products, environment is a primary concern, followed by people (specifically consumers and their health and not producers) and finance, e.g. a fair price for high-quality products.

The consumption of organic food reached CZK 1.29 billion in 2007, which is 70 % higher than in 2006. The Czech market in organic food has been steadily expanding. Over the last 3 years, consumption has increased by 153 %. Chocolate and sweets have represented 32 % of the total turnover, coffee 28 % and tea 18 %. Cane sugar and processed products each have a 4% share. Organic food accounted for 0.55% or the total consumption of food and beverages in the Czech Republic in 2007.

The largest retailer offering organic food in the Czech market is the Plus discount chain. Surprisingly, the drugstore dm drogerie markt is second. Most organic food is purchased in supermarkets and hypermarkets (67 %), then in shops specialising in healthy food and organic food (22.5 %). In 2007, meat and meat products had the highest share of Czech organic products in total turnover. 98% of the products originated on Czech farms. Baked goods were second, with 91% of the organic products baked in the Czech Republic.

The number of people regularly purchasing organic food rose from 3 % in 2005 to 4.8 % in 2007. 27.9 % of the population is aware of organic food and buys it irregularly. The average per capita consumption of organic food amounts to CZK 126.

The "bio" and "eco" prefixes, as well as the usage of the word "organic" in relation to food are legally protected by Council Regulation (EEC) No 2092/91 on organic production and labelling of agricultural products and food. In the Czech Republic, the state-sponsored bio label called Bio-produkt ekologického zemědělství (a bio-product of ecological agriculture) has become common. Pursuant to Act No 242/2000 Sb. on organic agriculture, the label is obligatory for Czech bio products. The development of organic agriculture and the production of organic products are regulated by the Action Plan of the Czech Republic for the Development of Organic Agriculture until 2010.

## 11.4.7 Packaging waste production

The environmental impact of retail is significant with regards to packaging, which accompanies sold products. The quantity of packaging usually corresponds to the overall development of trade, but the composition of used packaging material can vary (whereas it is given for environmentally friendly products). The quantity of packaging has been steadily increasing. It reached a total of 2.6 million tonnes in 2005, of which 1.8 million tonnes were returnable and the rest non-returnable.

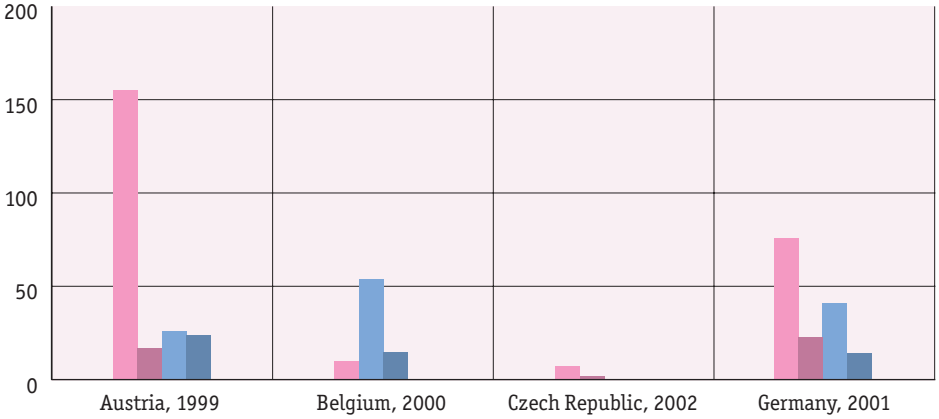
According to an international comparison involving some selected OECD countries, the Czech production of sorted packaging waste per inhabitant and year is considerably different from Western European countries – see Chart 11.8. However, there are vast discrepancies in national definitions of waste and in methodologies of data collection.

Traditional measures with positive environmental impacts are deposit money for packaging and the withdrawal of some types of packaging (pursuant Act No 477/2001 Sb. on packaging). In 2002, Act No 185/2001 Sb. on packaging introduced the mandatory withdrawal of some products – the success of this measure is depicted in Chart 11.9.

Withdrawal is mandatory for: mineral oils, tyres, refrigerators and freezers, batteries, discharge lamps and fluorescent lamps.

**International comparison of the production of packaging waste in selected countries [kg per inhabitant]**

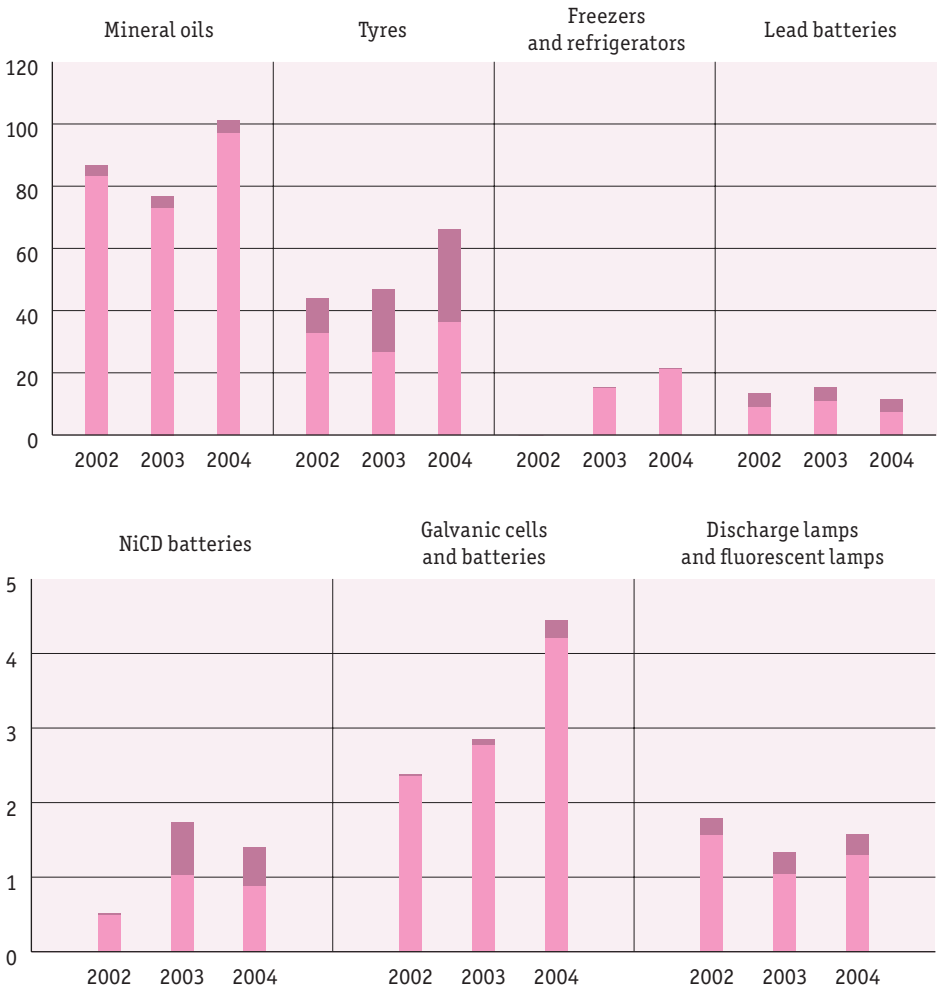
**Chart 11.8**




*Source: OECD – Environmental Data Compendium, 2004, calculations by CENIA*

**Success of mandatory product withdrawal [thousands of tonnes]**

**Chart 11.9**




*Source: T. G. Masaryk Water Research Institute – Centre for Waste Management*

For NiCd batteries, more products were withdrawn in 2003 and 2004 than what was expected according to Act No 185/2001 Sb. This situation was probably caused by the long life cycle of NiCd batteries and by the failure of some vendors to comply with legal mandates.

## 11.4.8 Environmentally friendly trade in the context of international institutions

Over the last 15 years, trade has evolved from a disregarded and environmentally indifferent sector into an active player in the process of making the economy more environmentally friendly. A comparison of the current trade activities with the Environmental Measures contained in the *Trade* chapter, Sector Policies section, State Environmental Policy of the Czech Republic, 2004–2010 reveals congruence in a large number of issues. On the other hand, the goal of making retail more environmentally friendly became a part of the Concept of Consumer Policy for 2006–2010 through sustainable consumption programmes.

In a global economy, environmental policy and the condition of the environment are directly influenced by the activities of international institutions. An important player is the World Trade Organisation (WTO) established in 1994 (the Czech Republic was one of its founding members). The WTO Marrakech conference in 1994 approved a document on the necessity to harmonise environmental and trade policies. The same conference established a Committee on Trade and the Environment (CTE). Its main goal is to ensure that measures in trade and environmental policy support sustainable development.

As a part of the Dauha Development Programme, the 4$^{th}$ WTO conference in 2001 charged the member countries with the long-term task of addressing trade and environmental issues. This is a visible shift from negligence on environmental issues with empty declarations to striving for consensus. The goal should be to make environmental standards universal so that environmental measures like eco-labelling are not considered and employed as trade barriers. Eco-labelling is, however, in accordance with the WTO's Agreement on Technical Barriers to Trade.

The existing body of research on environmental standards and international trade led to the conclusion that stricter environmental policy stimulates exports, and there are no substantial impacts of stricter environmental policy on the export of "dirty industries" (nonferrous metallurgy, strip mining and chemistry) was ascertained.

Article XX of GATT grants each member country the right to select its environmental standards and to adopt temporary measures, including the principle of preliminary caution. In addition to eco-labelling products, the most prominent environmental aspects of international trade within the WTO are eco-labelling processing and production methods (the issue of equivalent products produced by methods with varying degrees of environmental friendliness) and the potentially contradictory relationship between WTO rules and multilateral environmental contracts.

# 12

# Science, Education and the Information Society

At present, research and development is still less prominent in the Czech Republic than in the majority of other developed countries. Funds expended on research and development have been, compared to developed countries, minimal. Despite significant growth, these expenditures equal only one-fifth of the EU15 average. When looking at the practical application of research and development for innovation, the Czech Republic's long-term lagging behind the rest of the world is readily apparent. More and more, protecting the environment is an area requiring increased research and development. Scientific research has been studying health and environmental risks and various effects of pollution on the environment. Within the framework of innovating and developing technology, energy-non-intensive, low-emission low-waste technologies (cleaner technologies) and technologies addressing hazardous waste disposal have been the priority.

The Czech education system has recently undergone significant systemic changes. Both the total number of schools and students has decreased. However, growth has been seen in higher education, where both the number of university students and the number of graduates have significantly increased. However, by international comparison, the Czech Republic still has a low proportion of citizens with a higher education. On the other hand, the high share of the population with a secondary education is favourable. At the beginning of the 1990s, environmental education was embodied in the curricula of primary and secondary schools. The number of schools specialising in environmental studies has increased, and regarding universities, new environmental programmes have come into existence. Within the framework of environmental education and awareness (EEA), the system of informing the public about environmental problems has improved and a National Network of EEA Centres now exists.

In the 1990s, the Czech Republic took its first steps towards embracing the information society. In connection with its EU accession, great focus was placed on introducing information technologies and tools. However, in spite of this development, the Czech Republic is still lagging in certain areas such as e-Government, the application of household information technologies, and general computer literacy levels. Regarding the use of information technologies in the environmental sector, significant improvement has been seen over the past 10 years – the process of creating a Unified Environmental Information System was started and a new "Facts and Data" portal was launched as gateway to environmental information. The Register of Emissions and Pollution Sources and the Integrated Pollution Register were developed as tools for maintaining comprehensive data on pollution.

## 12.1 Research and development

### 12.1.1 General research and development characteristics in the Czech Republic

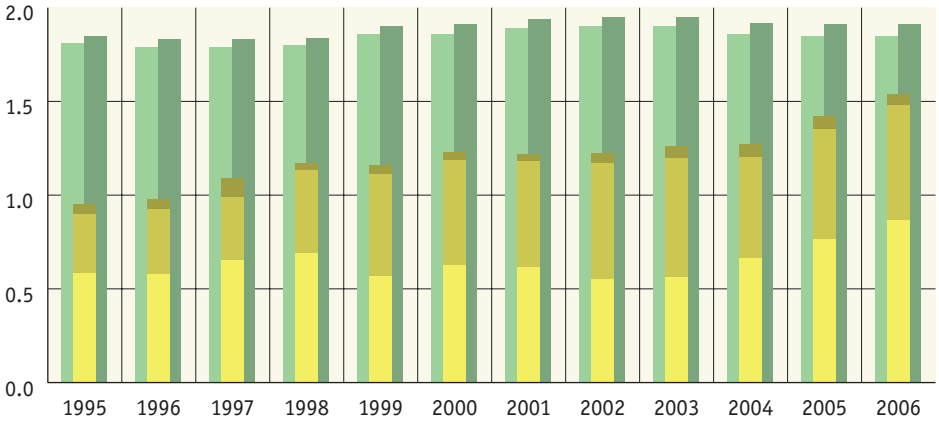
At present, research and development (R&D) is still less prominent in the Czech Republic than in the majority of other developed countries. Up to 1989, deficiencies in natural and technical sciences were mainly influenced by a lack of modern instrumentation and limited communication with the scientific community outside the Eastern Bloc. Social sciences were regulated ideologically, especially after the late 1960s (the normalisation period). Applied research was negatively affected by the commercial sector's lack of interest in innovation, mainly as a consequence the country's products being earmarked for export to less demanding markets.

At the beginning of the 1990s, a reduction of funds from the state budget, the limitation of activity in some industrial research institutes resulting from privatisation and the dissolution of departmental research institutes occurred (in the environmental area e.g. the Institute for the Environment). On the other hand, newly-found freedom of research, the possibility of international cooperation and introducing special financing through public tenders were all positive developments. In addition, the new trend of using information technologies for research and development purposes was a welcome addition.

In connection with the Lisbon Strategy (2000), its incorporation into the Barcelona Objectives (2002) and the Action Plan for Europe (2003), the National Research and Development Policy of the Czech Republic was drawn up and approved for the new five-year period for the years 2004 to 2008 (by means of Government Resolution No 417 of 28 April 2003). It was subsequently amended by Government Resolution No 272 concerning the proposal of the National Research Programme II of 9 March 2005.

**Gross domestic expenditure on R&D (GERD), international comparison, 1995–2006 [% GDP]**

**Chart 12.1**



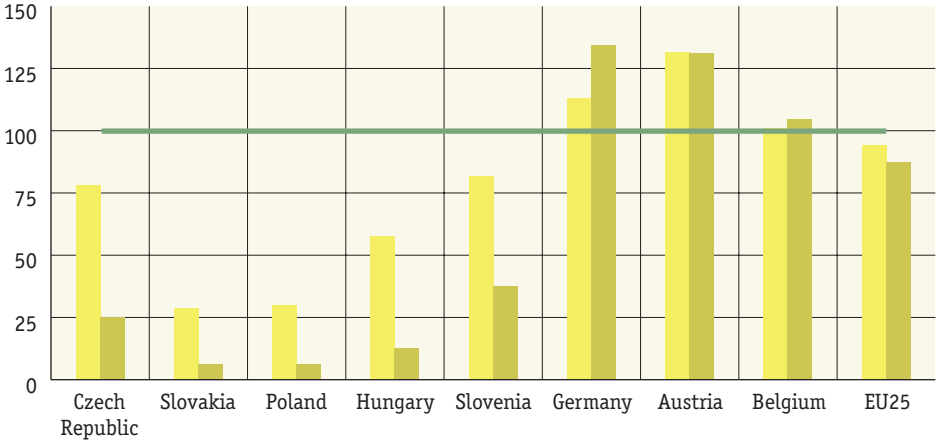

Czech Republic – entrepreneurial sources
Czech Republic – public sources
Czech Republic – foreign and other sources
EU25
EU15

*Source: Eurostat*

EU25 and EU15, 2006 – estimation

**GERD per one R&D employee (in full-time equivalent), international comparison, 2005 [%]**

**Chart 12.2**




GERD per 1 R&D employee
GERD per 1 inhabitant
EU15 = 100 %

*Source: Eurostat*

In 1999, the National Research and Development Policy of the Czech Republic was drawn up (approved by Government Resolution No 16 of 5 January 2000). In 2002, Act No 130/2002 Sb., on research and development support from public funds and important coherent implementing regulations, was adopted. In preparing for its EU accession, the Czech Republic was gradually included in the European Research Area. In addition, the Memorandum of Understanding between the European Community and the Czech Republic on its Association to the 6th Framework Programme for Research, Technological Development and Demonstration Activities for the 2002–2006 period was adopted.

The volume of funds spent on research and development was, in the middle of the 1990s, considerably lower than in the developed countries of Western Europe. The Gross Expenditure on Research & Development, GERD, amounted to less than 1 % of Gross Domestic Product. The situation has begun to improve only during the past ten years – in 2006, the share significantly increased to approximately 1.55 % of GDP. Thus, the Czech Republic is now quickly approaching the European average, which has stabilised in recent years and in 2006 amounted to approximately 1.9 % of GDP for the EU15 (see Chart 12.1).

In spite of a relatively high GERD growth rate compared to other European countries and European averages, it is highly probable that the main objective of the Lisbon Strategy, according to which the total R&D expenditure in the EU should be at 3 % of GDP by 2010, will not be met.

It is obvious from Chart 12.1 that the enterprise sector (i.e. private financial sources for R&D) has the highest proportion of R&D financing in the Czech Republic, and in 2006, it contributed 57 % of this amount from its own funds on R&D. However, even though the proportion of private resources has been gradually increasing, it still does not reach 2/3 of the total expenditures on R&D, which was mandated by the Lisbon Strategy. Nevertheless, this is similar in most European Union countries; in 2005 the EU25 average share of enterprise financial sources in the total expenditure on R&D was approximately 55 %.

In 2006, public sources contributed roughly 40 % of all R&D financing. Institutional support still accounts for the largest share of these sources and from the branch orientation perspective, technical sciences and engineering had the highest – three-quarter – share. Earth and environmental sciences received 7.6 % of public aid (see Chart 12.3).

**GERD** represents total expenditures on research and development financed from public, private and foreign sources. The Lisbon Strategy sets the target GERD level at 3 % of GDP for 2010 (of which 1 % is from public sources and 2 % is from entrepreneurial sources).

When comparing R&D efficiency (the number of publications, citations, patents, etc.), the data related to one employee in R&D have higher informational value, where the Czech Republic is at (recalculated for PPP) almost 80 % of the EU15 level, or per one inhabitant, where the situation in the Czech Republic is considerably worse – the Czech Republic is only at approximately one quarter of the EU15 average expenditure. These differing results may be attributed to the below-average number of researchers working in the Czech Republic.

21 providers grant public support in the Czech Republic – ministries, central state and public administration bodies, the Academy of Science of the Czech Republic (AS CR) and the Czech Science Foundation (GACR). The largest providers are the Ministry of Education, Youth and Sports, the AS CR, the Ministry of Industry and Trade and the GACR.

The number of employees (in full-time equivalent (FTE)) in research and development decreased from approximately 138 000 in 1989 to approximately 23 000 in 1995, when the number stabilised. Later, the number of employees was increasing again almost to 48 thousand in 2006, when 10 employees were employed in research and development per 1 000 workers. This is, compared to the last available data for the EU15 average (year 2005), approximately 80 % of the European average (see Chart 12.4).

Researchers logically represent the most numerous group of R&D employees (next to the auxiliary, technical and administrative employees of R&D). Compared to other European countries, the share of researchers versus the total number of R&D employees is relatively low in the Czech Republic. In 2005, researchers represented approximately 55 % of the R&D employees, while the EU25 average (or, as the case may be, EU15) amounted to approximately 63 % (or, as the case may be, 61 %). This comparison shows that a relatively high number of professional-technical employees conduct research in the Czech Republic, and they also provide R&D support services.

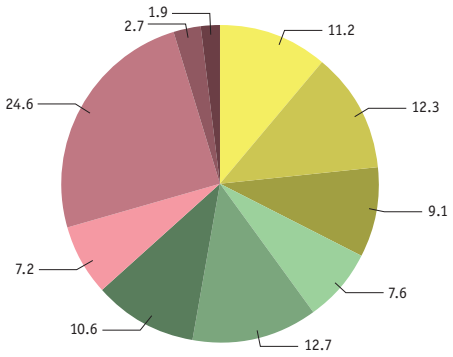
From the perspective of R&D outputs, a gradual slight improvement in publication performance of R&D has occurred in the Czech Republic. It appears that Czech scientists have improved their situation compared to their peers. As early as ten years ago, Czech scientists were quoted in scientific texts at a rate of one-half of the global average. In 2004, this percentage reached three-quarters, and in 2006, the Czech Republic was nearly at the international average (see Chart 12.5). However, the gap from other developed countries is still considerable. The main causes for this lagging are the above-mentioned lower relative expenditures on R&D, the lower number of researchers, and a lower demand from public aid providers on the quality of R&D results.

Even if Czech research outputs are comparable at the international level, they are, on nonetheless, not widely-utilised economically. In 2006, Czech companies applied for 20 patents in Europe and 30 in America. However, this is considerably less than Western countries. As a result, in 2006, Czechs earned only CZK 0.75 billion from the sales of patented inventions, but paid CZK 5 billion to the foreign companies for patents.

**FTE = Full-Time Equivalent**
= a person (an employee) recalculated to full-time employment.
In 2006, 22 % of the total number of research and development employees worked in the governmental sector (mostly for the Academy of Science of the Czech Republic), 27 % in universities and higher vocational institutions and approximately 51 % in the private sector.
Of this number, the most research and development employees worked in technical sciences (48.4 %), then in natural sciences (25.4 %), social sciences and humanities (12.4 %), medical sciences (8.4 %) and lastly agricultural sciences (5.5 %). From 2001 to 2006, the largest increase occurred in the areas of medical and social sciences and humanities (2.2 times). Technical and natural sciences saw a 1.7 time growth and agricultural sciences a 1.4 time growth in the number of employees.

**Shares of aid for individual sciences, Czech Republic, 2006 [%]**

**Chart 12.3**

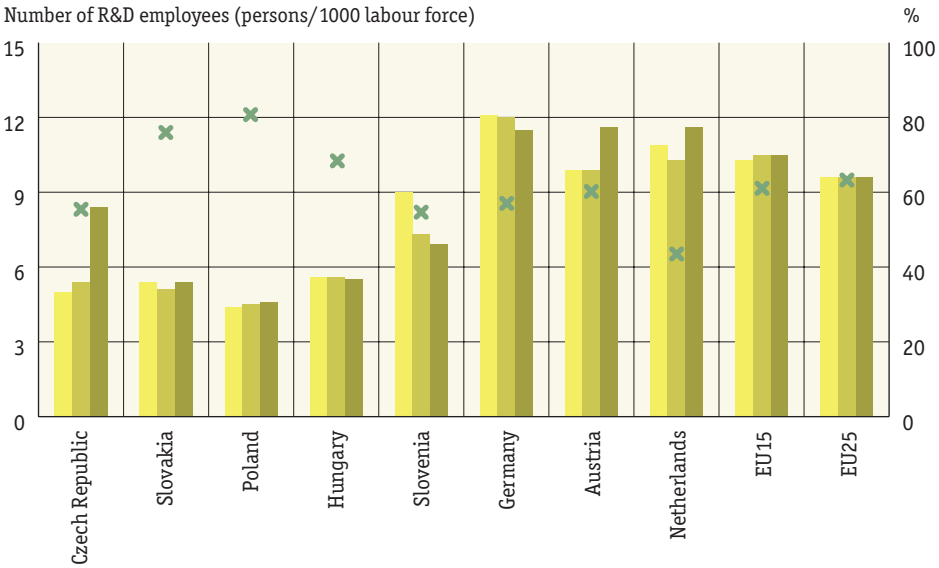



- Social sciences
- Mathematics and physics
- Chemistry
- Earth and environmental sciences
- Biology
- Medical science
- Agriculture
- Technology and engineering
- Military
- Information

*Source: R&D Information System, Central Project Register*

**The number of research and development employees and the share of researchers in R&D, international comparison, 2001–2005**

**Chart 12.4**

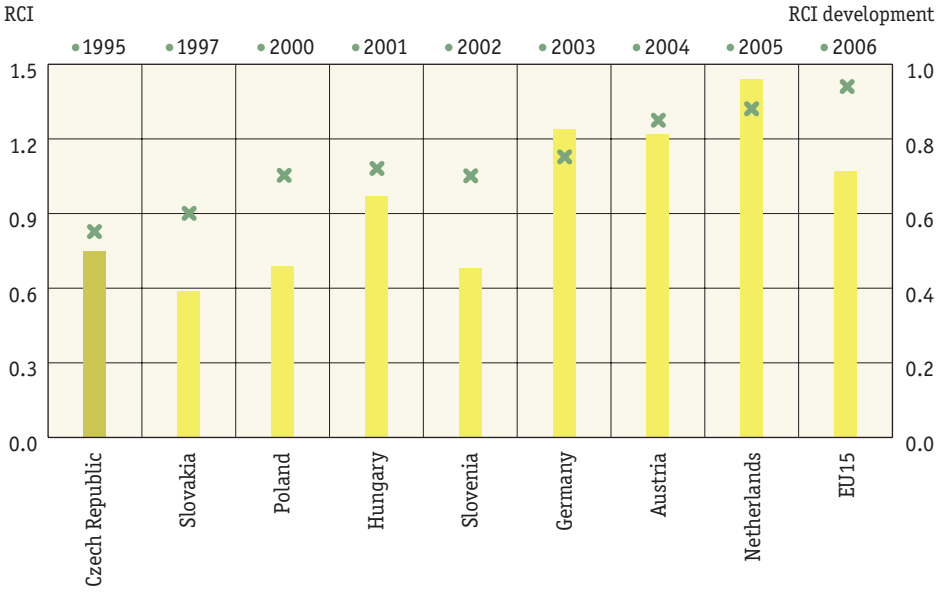



- Number of R&D employees , 2001
- Number of R&D employees , 2003
- Number of R&D employees , 2005
- Share of researchers in R&D, 2005 [%]

*Source: Eurostat*

**Relative Citation Index, international comparison, 2002–2006, and development in the Czech Republic, 1995–2006**

**Chart 12.5**




RCI

RCI development in the Czech Republic

*Source: Thomson ISI National Science Indicators*

The Relative Citation Index/Impact (RCI) shows how many citations fall per one publication. The impact compares the country's result to the citations of an average scientific work in the international Thomson ISI database. A country is above-average if it has an RCI value higher than 1. The RCI of the Czech Republic for the 2002–2006 period amounted to 0.75 and in 2006, it reached 0.94 (compared to 0.55 from 1995). The improving bibliometric quality of publications is connected with implemented structural changes, especially in the area of basic research, with growing R&D support and the development of international cooperation.

## 12.1.2 Research and development in the environmental area

From 1990 to 1992, basic and applied research in the environmental area began to develop compared to other sectors, thanks largely to its inclusion in the Environmental Restoration Programme of the Czech Republic of the Ministry of the Environment. In addition, a partial change of the orientation of some research and development organisations engaged in environmental projects occurred. Between 1993 and 1998, the Ministry of the Environment managed the Environmental Care Programme, which was focussed on practical application of knowledge smaller projects. Similarly, aid was granted to larger research projects (research and development projects – R&D). Some R&D projects were co-financed both from European Union funds (PHARE) and bilateral support programmes. In addition to project implementation, research was carried out both in the institutions managed by the Ministry of the Environment and by the Ministry of Agriculture, and in the institutes of the Academy of Science of the Czech Republic and at universities.

The State Environmental Policy of 1995 included environmental scientific research in its priorities with a focus on studying health and environmental risks and on energy-non-intensive, low emission and low-waste technologies (cleaner technologies). The present State Environmental Policy of 2004 acknowledges the Lisbon process and the implementation both of the 6th EU Environmental Action Programme and the 6th EU Framework Programme for science and research.

Despite this, the OECD Report on Policy, State and Development of the Environment in the Czech Republic states that environmental research and development is insufficient, which the Sustainable Development Strategy of 2004 also shows. The lasting problems are fragmentation and insufficient targeting of scientific and development projects on the long-term objectives of environmental protection, which is, because of the non-existence of a long-term environmental protection strategy, very difficult. As stated in the above-mentioned OECD report, it is necessary to strive for a reduction of material and energy intensity, a reduction of pollution and of imports of raw materials.

The Teplice Project (detailed research on the impact of air pollution on the state of health of the population), the Silesia Project (an assessment of the environmental risks in an industrial agglomeration), the Elbe Project (complex river basin research) and the Black Triangle Project (an environmental assessment in North-West Bohemia, South-West Poland and South-East Saxony), the Košetice Project (monitoring of chosen persistent organic pollutants in the environment), the Zlínsko Project (measuring emissions in the Zlín Region) and the research project entitled "A Human Being's Denaturalisation" are the most significant research projects.

### Financing of environmental research and development

Expenditures on environmental research and development increased from approximately CZK 90 million in 1995 to CZK 535 million in 2005. In 2007, it was CZK 416 million. Additional funds were also provided from other sources (the Czech Science Foundation, the Grant Agency of the Academy of Science of the Czech Republic, departmental budgets). However, of the approximately CZK 20 billion from public sources for research and development in all areas, only less than 2 % are given for environmental research and development.

Between 1998 and 2007, the amount of funds for R&D projects in Earth and environmental sciences increased from CZK 442 million to more than CZK 600 million. Also, the number of projects increased in response to the increased support; in 2007, 504 projects were implemented compared to only 348 in 1998. The average size of environmental projects (expressed as average costs) was approximately CZK 1 million. However, these projects are small when compared to those abroad.

### Results of environmental research and development and their practical utilisation

Just as the rating of the bibliometric quality of all R&D publications in the Czech Republic is performed utilising RCI, the level of individual sciences may be assessed according to the Relative Citation Impact of the Science RCIS (see Chart 12.6).

Of the three environmental sciences, Czech researchers achieve the best results in environmental engineering and power engineering. In 2002–2006, the RCIS exceeded the international average. In the field of the environment and ecology, the RCIS values were slightly below the international average over the entire period, which is significant progress compared to 1994–1997, when the RCIS of this branch equalled only 62. The numbers of publications in both branches may be considered as relatively high compared to the third field of environmental studies, geography and developing countries, where in 2006, only 3 publications were published (see Chart 12.7).

Research and development is the main source of innovation. The Czech Republic's long-standing lagging behind international development is easily seen when transposing research results into innovations. This is partly conditioned historically, when the past regime suppressed any independent initiative and later by insufficient financial and non-financial support of innovative behaviour (mainly recognisable in the '90s) and insufficient coordination of the activities of individual ministries.

The environmental protection necessarily requires innovations. We succeeded in incorporating a number of innovations in the 1990s, e.g. EIA, the development of the Geographical Information Systems (GIS) and of some voluntary protection tools, such as eco-labelling, environmental management systems (EMS) and eco-design. During the pre-accession period we succeeded incorporating other innovations – SEA, IPPC, best available techniques (BAT) and the Integrated Pollution Register (IPR). For the time being, conceptual support of innovations has appeared only in the area of environmental technologies. The necessity to define the national implementation programme of the EU Environmental Technologies Action Plan lead, in 2005, to the drawing up of the Programme of Support of Environmental Technologies in the Czech Republic approved by Government Resolution No 181/2006 of 22 February 2006. The support of environmental innovations and environmental technology is also accentuated in the National Innovation Policy, but without defining concrete measures.

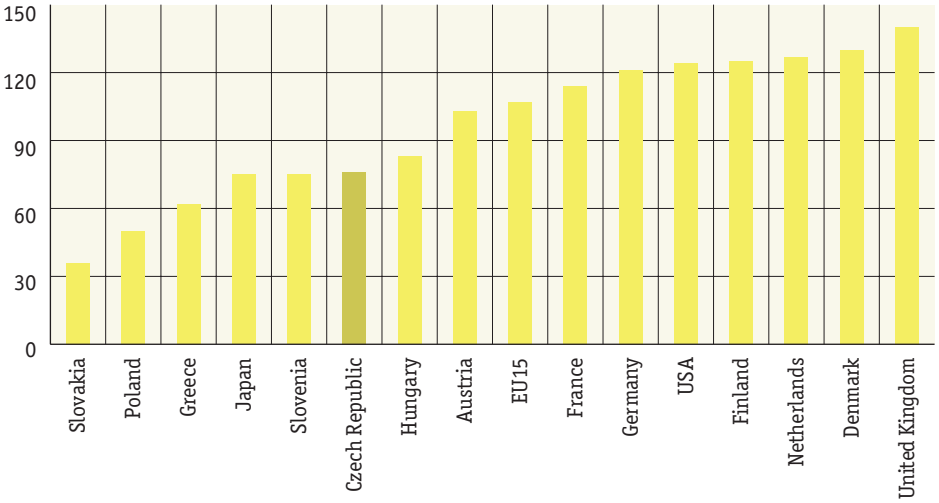
RCIS compares the level of the bibliometric quality of publications for a given science in a given country to the international average within the same branch over a given period of time (here for 2002-2006) according to the international Thomson ISI database (the citation register). An RCIS value higher than 100 represents an above-average level of publications within a given branch.

Environmental technologies are the technologies, the use of which are less harmful to the environment than that of comparable alternatives; they produce less pollution and waste, they enable a higher degree of recycling and waste utilisation, they use energy, raw materials and other sources more efficiently, and they are directly intended for environmental protection. Energy-non-intensive and low-emission and low-waste technologies (cleaner technologies) and the technologies for hazardous waste disposal have become a priority

EIA – Environmental Impact Assessment
SEA – Strategic Impact Assessment
IPPC – Integrated Pollution Prevention and Control

**RCIS ecology and the environment, an international comparison, 2000–2005**

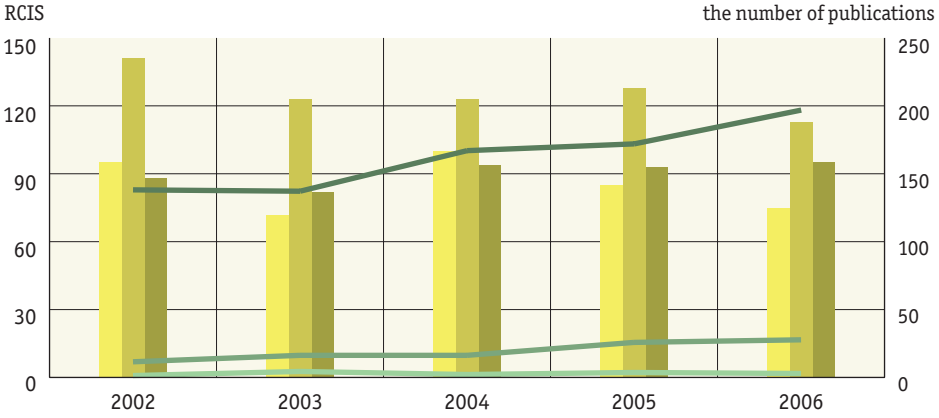
**Chart 12.6**




*Source: The Czech Republic Government Council for Research and Development*

**RCIS and the number of publications for environmental sciences**

**Chart 12.7**




*Source: Thomson ISI National Science Indicators*

## 12.2 Education

### 12.2.1 General characteristics of education in the Czech Republic

Since 1990, the Czech education system has recently undergone significant systemic changes. The method of financing and the administration of regional education have been modified, standardised curricula have been replaced with the possibility to choose from several educational programmes, the state monopoly for textbooks has vanished, universities have obtained full autonomy and private schools have entered the system at all levels.

**Nevertheless, the educational system in the Czech Republic has imperfections, which mainly include:**

- The lasting concept of one-time education at a younger age instead of the life-long learning concept; the Czech Republic has one of the lowest proportions of adults in life-long education.
- The prevalence of teaching methods focused on communication and rote memorization of a great quantity of partial information instead of on developing skills and cultivating the pupils' personalities, including inquisitiveness, natural longing for knowledge and discovery, discussion, teamwork and creativity.
- Insufficient access to education beyond compulsory school attendance. For this reason, the system is not able to adequately react to the requirements of the fast changing society, which may lead to the decreased competitiveness of Czech graduates on the global labour market, where invention, initiative and flexibility are more appreciated than obedience and factual knowledge.

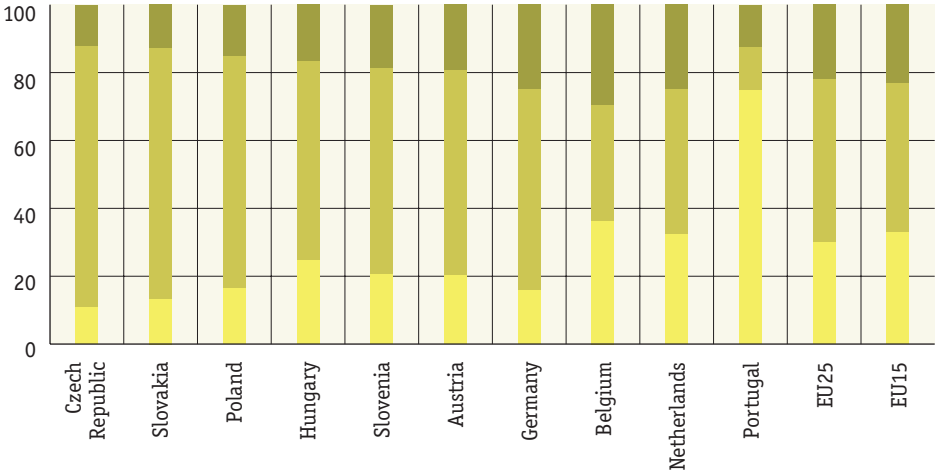
**Czech education shows following important tendencies:**

- The total number of schools has decreased – in 2006/2007 there were approximately 16 % fewer schools than in 1990/91, namely as a consequence of optimising the network of schools, pre-school and school facilities.
- The structure of schools according to type has changed – the largest change occurred in the reduced share of nursery schools (from 55 % to 43 %) and in the increased share of secondary schools (from 10 % to 17 %), the number of universities has increased in connection with the entry of the private sector into higher education.
- The total number of students has decreased – in 2006/2007 by 12 % at individual types of schools than in 1990/1991, mainly as a consequence of the decrease in the population of children in nursery schools and students of primary and secondary schools.
- In comparison, a contrary trend seen in higher education – the number of university students increased 1993 to 2007 by 174 %, and the number of graduates increased by 193% for the same period. However, the lack of high-quality teachers may impact not only the quality of teaching, but also of research and other creative activities in schools. In 1990, most university students graduated from technical (37 %), teaching (24 %) and economics (11 %) programmes. In 2007, most graduates were from economic programmes (25 %), then technical (23 %) and lastly in teaching and social sciences (approximately 14%).
- In spite of the growth of expenditures on education in recent years, education financing is still insufficient and the share of this expenditure in GDP has stagnated at 4.3–4.5 % over the last five years. The Czech Republic finds itself among the countries with the lowest proportion of expenditures on education in GPP within the EU (in 2005, the share of GDP spent on education in the Czech Republic was approximately 4.3 %, compared to 5% of the EU25 average).
- By international comparison, the Czech Republic has a low share of people with higher education (only 12 % of the population aged 25–64 in 2005; in this respect, the Czech Republic, in spite of minor growth, still is one of the lowest in the EU). On the other hand, the high share of the population with secondary education is favourable. It is possible to positively assess the high share of the population with secondary education (almost 77 % in 2005) and the low share of the population with the lowest level of education (11 % in 2005). For these two groups, the Czech Republic ranks among the best in the world, as seen in the Chart 12.8.

**White Paper, curricular reform**
The basic step used to remedy problematic teaching methods was the approval of the most important educational document after the November revolution – the National Programme for the Development of Education (the "White Paper"), adopted by the Government of the Czech Republic in 2002. The new Education Act (Act No 561/2004 Sb.), adopted in 2004, stems from the White Paper. Its most important section is curricular reform, which transfers the focus from knowledge to competency and increases the schools' autonomy. Its tools are the framework educational programmes, which have come into existence separately for pre-school education, primary education, grammar school education and the individual fields of secondary vocational education. Based on these framework educational programmes, the schools are obligated to create their own school-specific educational programmes that should lead e.g. to acquisition of e.g. communication and work-related skills or the ability to resolve problems independently.

**The structure of the population aged 25–64 according to the highest level of successfully completed education, 2005 [%]**

**Chart 12.8**




ISCED 0–2: primary education and without education
ISCED 3–4: secondary education
ISCED 5–6: higher education

*Source: Eurostat*

It is necessary to view the comparison at its face, for in the Czech Republic, in comparison to other countries, graduates of apprentice schools (secondary education without the school-leaving examination) are included in the same group as graduates with secondary education.

## 12.2.2 Environmental education, education towards sustainable development

After 1989, the development of environmental education (ecological and environmental education) continued, in many aspects, the previous history that in the Czech Republic dates back to the 1960's. Thus, the earlier-initiated trends continued – especially the shift from a predominantly voluntary approach to more fixed anchorage in the system of institutions (including education) and in legislation, a shift towards a wider approach to the topics (among others from focussing above all on the specially protected areas of nature towards comprehensive approach to education on the environment) and towards wider variety of methods.

Since 1989, the following stages have been observed in the area of environmental education:

- **1990 to 1994**
  Bases of the system of environmental education were created and dynamic legislative development occurred (statutory fixing, government resolutions), as well as from the inclusion in the agenda of state administration, self-government and nongovernmental institutions. International cooperation was developing, the thematic content and the methods were gradually elaborated and, especially grant aid from the Ministry of the Environment (MoE) and foreign foundations came into being.
- **1994 to 1998**
  This stage in the area of environmental education may be characterised as an attenuation stage. Reviewing and sometimes even negating created bases and slowing down the dynamics of development occurred. Limiting support led to the verification of the viability of created structures and activities and to the strengthening of the self-help activities.
- **The period after 1998**
  Throughout this period, new impulses have come and the area has taken on new dynamics – e.g. the State Programme of Environmental Education and Awareness (hereinafter referred to as the EEA) and the National EEA Network has come into being, the inclusion of "environmental education" as a compulsory cross-sectional topic in educational programmes has occurred, investment support has appeared for the first time (from the State Environmental Fund (SEF), regional support, aid from the European Structural Funds has begun, the concepts of education for sustainable development and their relationships with environmental education have been discussed.

**Today**, all the substantial components used in other countries with developed environmental educational systems have been re-created in the Czech Republic:

- incorporating in legislation and documents from acts to subordinate legislation and documents of ministries and many regions, including incorporating into the school system
- institutional and personnel capacities, including specialised workplaces
- developed tools for financing from public sources
- elaborated the spectrum of objectives, topics, methods, forms, educational programmes

However, at the same time, considerable problems and risks are obvious – e.g. regional imbalances, some areas being only slightly developed and supported (informal education), the low rate of stability and sustainability of the EEA system (usually as a consequence of a single "grant"– unrepeated financing and great dependence on foreign sources) or in some institutions, the tendency only for formal inclusion.

**Terminology**
Over the course of the 1990's, several designations gradually appeared for education focused on the environment in the Czech Republic, both in practise and in documents. From the content point of view it was termed as "ecological", and since the second half of the 1990's also as "environmental". The terms "for sustainable development" (accentuating focusing on the relationship between development and the environment) and "towards a sustainable way of life" are also close. In addition, the name of the process appears in various forms – first as "training" (as a comprehensive process including education) , "training and education" and finally put more precisely "education and awareness". It is sometimes only "education" (again understood as an overall designation of influencing the sites of knowledge, skills and approaches). In documents adopted since the end of the 1990's, the term "environmental education and awareness" (abbreviation EEA) has emerged as the most frequently-used term. In normal practice, "environmental education" prevails, however other modifications are occasionally used.

**The EEA content and concept**

Similar to general education, environmental education influences the informal impacts (e.g. of surroundings, events in the family and in society, education not organised into settled institutions) and formal impacts (organised especially by means of a school system), which combine.

We have managed to only estimate the influence of informal education, not understand it and control it. In the Czech Republic, the rapidly deteriorating environmental state greatly influenced the awareness and interest of the public during the 1970s and 1980s much more than educational activities. In addition, we have gained a lot of knowledge about the critical influence of natural environmental stimuli on the creation of skills, habits, approaches and values important from the viewpoint of the relationship with the environment. However, we have not yet managed to sufficiently understand and master the informal impact in environmental education through research methods or to reflect it in educational strategies.

At the beginning of the '90s, environmental education in the Czech Republic already played a prominent role within the framework of informal influence in various out-of-school activities run by teachers, volunteers, and nongovernmental organisations (by international comparison). These activities became a kind of "experience laboratory" and during the last decades of the 20th century, one of the trends of environmental education was it being shifted into formal (school) education. Thematically and methodically varied leisure-time, out-of-school and awareness activities in environmental education are typical in the Czech Republic today.

Within the framework of formal education, the entire observed period is characterised by the push to reform the system of education, which has, understandably, impacted environmental education. For example, the concept of education as a life-long process, focusing mainly on developing basic competencies, and the related stress on corresponding methods and enabling alternative ways of how to achieve these competencies, are important. This endeavour has resulted in pre-school, primary and secondary education introducing framework educational programmes, which give schools broad latitude in creating their own procedures and curricula.

However, it is possible to point out that from the perspective of schools and their educational programmes, the environmental dimension of sustainable development is very often accentuated, while the economic and social dimensions connected to sustainable development are often neglected, usually in spite of the fact that economically and socially oriented topics are a part of teaching. Thus the students do not miss essential information on environmental problems, but they miss an overview of the possibilities, how to resolve them, and thus a global view of sustainable development. This should be the basic output of education towards sustainable development, which differs from the classical environmental education. It emphasises comprehensive social conditions, and above all a positive relationship with the given culture which involves conscientious participation in its formation. Education on sustainable development supports learning about real-life situations and practical applications, motivation for life-long learning, awareness of social and culturally based relationships and broadening the scope for creative and responsible behaviour.

In 1990, a subject entitled "Fundamentals of Ecology" (in spite of its narrow name, it is focused mainly on environmental education) was introduced in all secondary schools where biology was not taught. In 1994, Josef Vavroušek proposed teaching "Ecology of Human Beings" in all degrees and types of education. As a result of this proposal, the "Human Being and the Environment – Education towards a Sustainable Way of Life at Primary and Secondary Schools" programme has come into existence. Several secondary school textbooks have been published that attempt to comprehensively cover the entire spectrum of environmental issues. Separate compulsorily optional subjects have been introduced at some primary schools. In-house training programmes (courses) at the centres for environmental education have a similar extent and character.

The following are clear long-term trends in developing the content and concept of environmental education from 1989 to 2006:

- a shift to a more active and complex concept of educational objectives (from "learn and protect" to a "sustainable way of life");
- a shift to a broader concept of topics (from focusing mainly on specially protected areas of nature to comprehensive education on the environment and cross-sectoral topics) ;
- a shift to a greater variety of methods ;
- a shift from the occasional inclusion of individual activities towards comprehensive educational programmes, which take into account education in the spirit of sustainable development.

**Objectives:** Development of the EEA is closely connected with overall changes in education. The objective ceased to be the comprehensive knowledge about a topic, but rather the ability of a human being to act. This orientation was obvious in the programmes at the centres for environmental education and it was accentuated in 1992 by the Environmental Act (No 17/1992 Sb.) (...education shall lead to "behaviour that complies with the sustainable development principle, to awareness of responsibility for maintaining the quality of the environment" and "to respect for life in all its forms"). Thus, environmental education in the 1990's was mainly one of the significant sources of inspiration to effectuate comprehensive changes in education. Clear formulation of how this affected teaching methods at schools appeared in official documents after 2000.

**Topics:** Since the beginning of the 1990s, the obvious trend has been a shift from individual partial topics to comprehensive programmes offering a complex view of the environment (see the forms for more information). At the same time, the significance of some topics has gradually increased – in addition to the traditional ones (e.g. nature conservation, environmental pollution in the Czech Republic) – some new ones emerged, e.g. practical skills, how to deal with nature, practical knowledge about the nearest vicinity, environmentally friendly consumer behaviour, civil engagement, global problems and connections and the connection between economic development and the environment.

**Methods:** Frontal teaching, which prevailed at schools in the 1980s, proved an insufficient tool for reaching the objectives of environmental education. Since the beginning of the 1990s, the methodical approach, which may be comprehensively described as "education by experience", has been spreading from informal education and from abroad into formal education – e.g. field education (practical activities in nature in favour of nature conservation), problem solving and experimentation, simulation games and creative activities.

**Forms:** There has been a push to gradually create comprehensive educational programmes on the environment – namely both as specialised secondary and university fields of education and as a part of general education. Today in higher education, there are 161 programmes focused on environmental issues. It is possible to graduate from 47 bachelor degree, 39 master degree and 40 doctoral programmes at 31 faculties in 19 different universities.

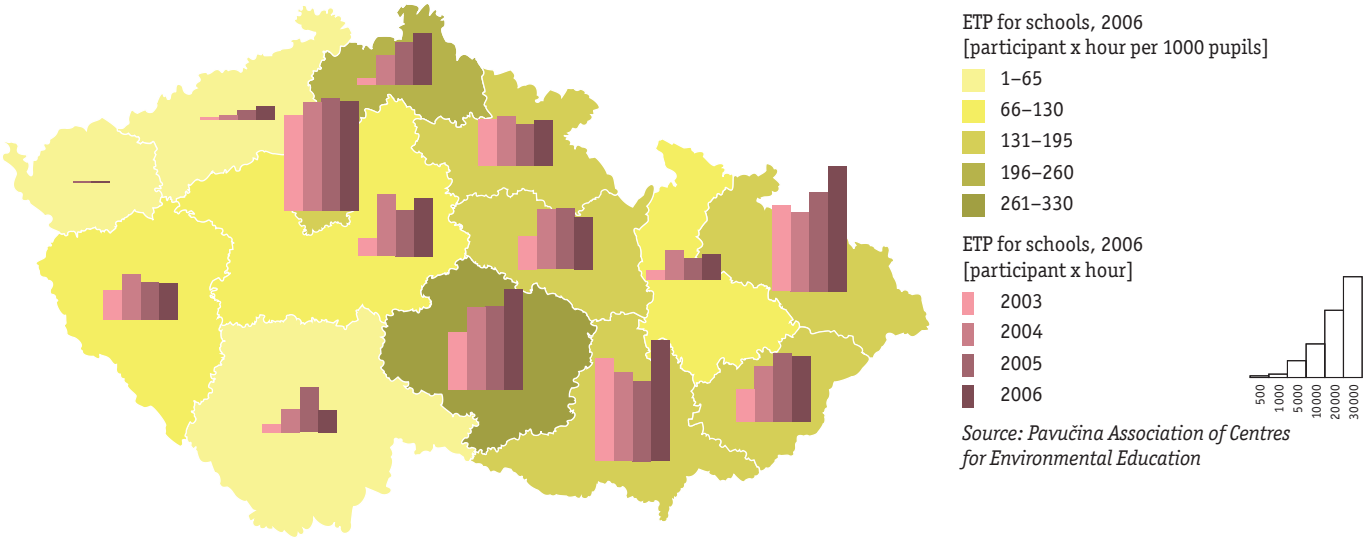
Coordination of environmentally oriented universities is managed by the Charles University Environment Centre (CUEC), which has also developed the module entitled the "Forum of University Teachers", enabling communication between university professors so that they may joint resolve various issues. In addition, the Centre participated in the establishment of the "Prague Environmental University" in 1993 (since 2006, it has been known as "Prague University Cooperation Agreement to Introduce and Conduct Sustainable Development and Environmental Studies"), the aim of which is to increase students' mobility among individual faculties at the five Prague universities so that they may attend various lectures concerning the environment.

During the 1990s, some other specific forms of environmental education came into existence – e.g. environmental teaching programmes (ETP) provided to schools by the centres for environmental education (see Figure 12.1), school environmental projects and environmental consultancy

The MoE created the environmental minimum for public administration employees. In 2005, the Ministry of Education, Youth and Sport approved Standards for the Further Education of Pedagogical Employees in the EEA.

**ETP for schools implemented within the framework of the "National Network of Centres for Environmental Education" programme, 2003–2006**

**Figure 12.1**




*Source: Pavučina Association of Centres for Environmental Education*

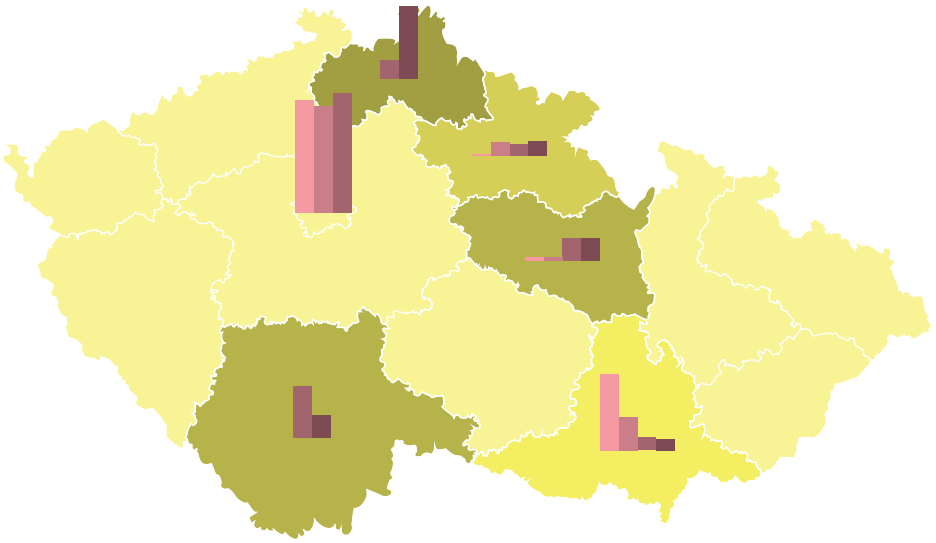
### Support and conditions of EEA

In relation to the specialised programmes and organisations focused on environmental education, the clear prevailing trend has been the gradual improvement of financial conditions, staffing, material arrangements and premises (with a fluctuation in the middle of the 1990s). Immediately after the establishment of the Ministry of the Environment and the Federal Committee for the Environment in 1990, systems of grant financing for environmental education were created. Next to them, foreign foundations were the most important source during the majority of the 1990s. In 1999, the MoE created the National EEA Network programme, the importance of which consists mainly in the fact that it does similar to rant financing, but of a long-term public tender for providing EEA throughout the entire Czech Republic. At the end of the 1990s, investment support through the State Environmental Fund appeared for the first time. After formation of the regions in 2000, support from the majority of the regions acceded, provided mainly through grant programmes for EEA, and also sometimes through the system of orders, direct financing of the organisations being founded or by means of providing an investment and non-investment grant (see Figure 12.2). Since 2002, a smaller grant programme for EEA at schools and in the Ministry of Education, Youth and Sport (MEYS) has been functioning. Since 2005, aid from the European Structural Funds has begun by means of a special grant scheme administered by the MoE and by means of more general programmes.

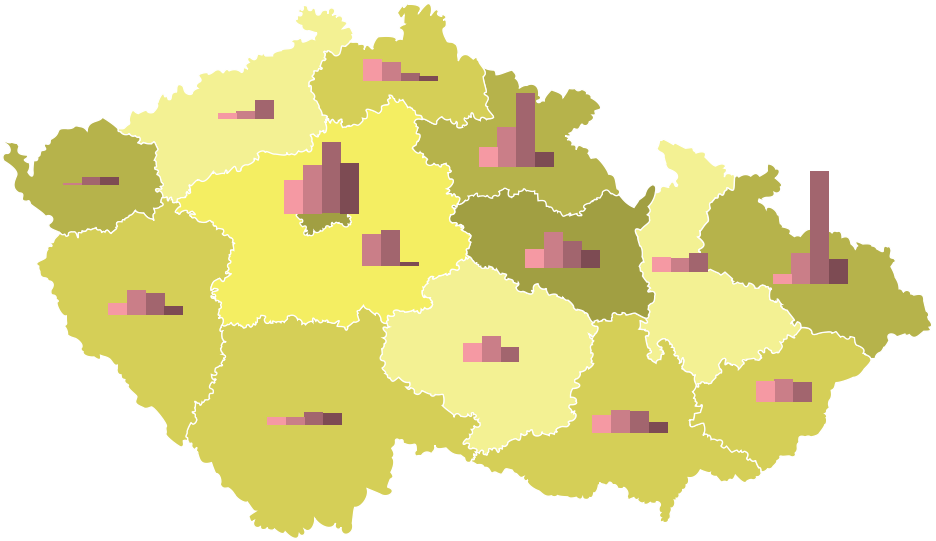
However, in spite of this positive development, this support is still insufficient. Not only the total volume of funds, but also the character of the aid is concerned – "grant financing" prevails, which is sporadic, occasional financing, and limits the sustainability and effectiveness of environmental education programmes. A substantial risk today is the significant dependence of financing from temporary means (the European Structural Funds). Also – in spite of more clearly formulated support (see below) – significant antagonistic trends are obvious, e.g. the background for practical contact with the environment has been deteriorating (e.g. waning school gardens, increased barriers for teaching outside of school and decreasing natural areas in big cities).

**Investment and non-investment support of EEA from regional budgets, 2003–2006**

**Figure 12.2**




*Source: Regional Authorities, Czech Statistical Office (Indicators for evaluation of the regional EEA systems)*




*Source: Regional Authorities, Czech Statistical Office (Indicators for evaluation of the regional EEA systems)*

### Institutional arrangements and staffing

From the state institution perspective, a key role is played by the responsible ministries responsible for education and the environment. From this point of view, the establishment of an independent Ministry of the Environment in 1990 and the formation of an independent section focused on education and awareness and cooperation with non-profit organisations were key moments. In the course of further development, this section has been reorganised several times, however its basic orientation has remained.

The Ministry of Education, Youth and Sport (MEYS) had traditionally been responsible for education on the environment (provided by the Government Resolution of 1977), but it was not staffed for its fulfilment. After adoption of the government resolution on environmental education in 1992, employees in certain sections were earmarked in the MEYS who should have been dealing with environmental education. In the section of pre-school education and primary education, a position was created for coordinating activities in this area. From 1990 to 1992, an important role in the development and support of environmental education was also played by the Federal Committee for the Environment.

Of the organisations promoted by the MoE, the organisations of state nature preservation were the traditional holders of the activities within the framework of environmental education.

This was historically based on the period before 1989, when the state's nature preservation fell under the Ministry of Culture and environmental education had a strong background there, thanks to specific people (e.g. Dr. Jan Čeřovský). Mainly the administration of national parks, but also the administration of protected landscape areas have gained more significant institutional support from regional environmental education as of late. In the 1990s, the Czech Environmental Institute (an independent department was founded here as well) was reorganised as CENIA,Czech

Currently, the Interdepartmental EEA Working Group works at the MoE within the framework of the Government Council for Sustainable Development. It prepares the Strategy of Education for Sustainable Development of the Czech Republic for the 2008–2015 period. A similar separate group of material has not been drawn up for this area in the Czech Republic so far, and therefore a document is concerned, according to which this type of education in the Czech Republic should develop systematically and in coordinated manner.

Especially the Czech Nature Preservation Institute, and later the Agency for Nature Conservation and Landscape Protection (ANCLP), the Administration of Protected Landscape Areas (today merged with ANCLP) and since the very beginning the Administration of the Krkonoše Mts. National Park, have traditionally been the best equipped state workplaces for environmental education, both with regard to personnel and premises.

Environmental Information Agency, and it became an important holder of environmental education activities.

In 1990, in the area of education, the responsibility for environmental education rested mainly in the Central Children and Youth Centre (later reorganised as the National Institute of Children and Youth) – thus in the area of leisure time activities. Today, a more important role is played by the Research Institute of Education and the National Institute of Technical and Vocational Education, where employees having an environmental education have been utilised. In addition, the workplaces of the Pedagogical Centre, which was partially replaced with the National Institute for Further Education after its dissolution, had an important role in environmental education in many regions.

Of the public administration institutions at the regional level (besides those already mentioned organisations of state nature preservation), a significant role was played by district authorities – since 1992 a greater part of them succeeded (by means of the Government Resolution on environmental education) in creating and establishing the position of an employee responsible for environmental education in their environmental departments. Since 2000, this role has been taken over by regional authorities – most of them have specialists for EEA in their environmental departments (and also in the education departments). There also exist several municipal self-governments that earmarked more significant capacities for environmental education (either directly inside the authority or as founded organisations).

Of the organisations promoted by the regional public administration (today by regions and municipalities), schools and school facilities understandably play an important role. Here, the key fact is that since 2002, they should have established, based on the methodical instruction of the MEYS, school EEA coordinators. It is worthy of attention, that in the course of the '90s, several secondary and high schools focused on the environment were founded.

Within the framework of higher education, an important role is played by institutes and departments oriented at education on the environment – in the 1990s e.g. the Environmental Centre of Charles University, the Centre of Environmental Education at the Faculty of Education of Charles University, the Department of Humanity Environmentalistics at Masaryk University in Brno and the Department of Social and Cultural Ecology at the Faculty of Humanity Studies of Charles University acceded to the Institute of the Environment of the Faculty of Science of Charles University existing since 1981 (originally as a department). Moreover, the background for environmental education was created at some faculties of education (in addition to Prague, more significantly in Brno, Olomouc and after 2000, in Liberec).

The nongovernmental non-profit organisations (NGO) played a key role in environmental education. At the turn of the 1980s and the 1990s the initiators were mainly the Hnutí Brontosaurus (Brontosaurus Movement), distinctively focussed on working with the youth, and a number of basic organisations of the Czech Union for Nature Conservation (ČSOP) that has today, together with the Association of Young Nature Conservationists, a national reach. During the 1990s, a number of centres for environmental education and environmental advice bureaus came into existence either on the basis of them or for the first time. Great development took place from 1990 to 1992.

In the middle of the 1990s, when support for environmental education was more limited, some centres ceased to exist or they substantially limited their activities. Consequently, in the middle of the 1990s, a lot of organisations associated in two specialised networks – the Association of Centres for Environmental Education "Pavučina" (1996) and the Network of Environmental Advice Bureaus STEP (1997). In the second half of the 1990s, some new centres for environmental education and environmental advice bureaus came into existence. The obvious increase in their number after 2000 is connected with the increased support from both national and European sources – in particular from the programme of the MoE entitled the "National EEA Network", from grants and orders from some regions and from the grant scheme entitled the "Network of Environmental Information and Consultancy Centres" (financed from the European Social Fund and administered by the MoE). Thus, a number of new centres and advice bureaus, whose stability is currently difficult to assess, now operate on a long-term basis. Figure 12.3 shows the entities incorporated into the National Network of Centres for Environmental Education in 2006.

Consultancy represents a very useful tool for work with the public, as well as with public administration, small entrepreneurs and farmers. It mainly focuses on prevention, thus on preventing negative impacts on the environment. Until now, this consultancy has been understood as a part of environmental education and awareness, however, by the adoption of the Government Resolution No 408 of 16 April 2008, on the Development Programme of Environmental Consultancy in the Czech Republic for the 2008–2013 period, it has established itself as a separate tool of environmental policy.

NGO handles of a network of centres that conduct educational and awareness events. In addition to providing services for schools, they also work with out-of-school education and prepare awareness events for the public. Their role here is irreplaceable.

A certain role has been also understandably played by **organisations under other ministries**. At the beginning of the 1990's, the Institute for Cultural and Educational Activity, under the direction of the Ministry of Culture, contributed work with cultural centres, libraries and the like to expand the public's background of awareness and education. In the following years, they were e.g. the National Institute of Public Health under the direction of the Ministry of Health (projects entitled Healthy Town and Healthy School) or the Ministry of Agriculture (in departmental education).

Some regions and towns also established specialised contributory organisations (the oldest and for a long time the only one of them was in Brno – the House of Environmental Education Lipka). Today, it is called School Facilities for Environmental Education Lipka. In 2005, the Centre for Environmental Education of the Liberec Region – STŘEVLIK was newly established). As the case may be, they established more or less independent sections of contributory organisations – e.g. of zoos (e.g. the independent centre for environmental education Divizna Liberec) or of school facilities (Alcedo Vsetín, Vila Doris Šumperk, an interesting example is the Centre for Environmental Education Dřípatka Prachatice, which has been included as an independent section in several different organisations promoted by the MEYS and the town).

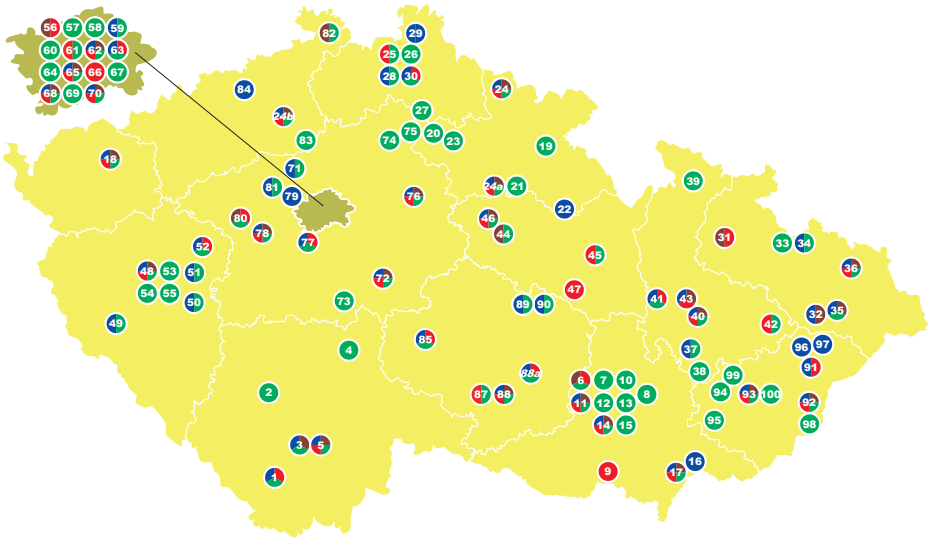
Public administration may be also a promoter of nongovernmental non-profit organisations – public benefit societies (VIS Bílé Karpaty, Sluňákov Olomouc). Of course, a number of other educational, cultural and awareness organisations established by public administration take partial actions in environmental education.

Of the oldest existing NGOs, we mention e.g. the Chaloupky Centre for Education in Nature (today, the only nongovernmental school in this field), Ekocentrum Paleta, Rosa České Budějovice, the SEVER Centre for Environmental Education, the Tereza Association for Environmental Education, the Toulcův Dvůr Centre in Prague, Vita Ostrava and Veronica Brno.

Another long-term operating NGO is the Club of Environmental Education. A lot of awareness and educational activities are also conducted by NGOs that do not specialise only in environmental education – e.g. the associations associating the environmental NGO Zelený kruh (Green Circle), e.g. Arnika, Děti Země (Children of the Earth), Hnutí Duha (Rainbow Movement) and Společnost pro trvale udržitelný život (the Society for Sustainable Life).

## Entities incorporated into the National Network of Centres for Environmental Education, 2006

**Figure 12.3**



- Centre
- Other workplaces of the centre
- ETP
- Education for university and higher education students
- Education for the professional public
- Public education and awareness

*Source: Pavučina Association of Centres for Environmental Education*

**South Bohemia Region**
1. ČSOP 1506 ZO Šípek
2. ČSOP 1802 ZO Makov
3. ROSA
4. Sdružení pro ochranu botanické zahrady v Táboře
5. ZČ HB Forest CEGV Cassiopeia

**South Moravia Region**
6. ČSOP 5444 ZO Veronica
7. ČSOP 54RS Brno
8. ČSOP 5507 ZO Pozořice
9. ČSOP 5615 ZO CEV Pálava
10. Děti Země, Klub za udržitelnou dopravu
11. EkoCentrum Brno
12. Hnutí Brontosaurus Brno
13. Hnutí DUHA – Přátelé Země ČR
14. Lipka – Dům ekologické výchovy, Brno
15. NESEHNUTÍ Brno
16. SVČ Hodonín, CEV Důbrava
17. VIS Bílé Karpaty, o.p.s.

**Karlovy Vary Region**
18. ČSOP 2401 ZO Oharka
19. Centrum rozvoje České Skalice
20. ČSOP 4506 ZO Křižánky
21. ČSOP ZO 4301 Orlice
22. INEX-SDA Kostelecké Horky
23. Muzeum přírody Český ráj
24. SEVER, Brontosaurus Krkonoše
24a. SEVER Hradec Králové

**Liberec Region**
25. ČSOP 3602 ZO při SCHKO JH
26. ČSOP 3608 ZO Armillaria
27. Ochrana Klokočských skal
28. Společnost přátel přírody
29. STŘEVLÍK
30. ZOO Liberec – MSEV DIVIZNA

**Moravia-Silesia Region**
31. ČSOP 6708 ZO Bruntál
32. ČSOP 7002 ZO Nový Jičín
33. ČSOP 7206 ZO Opava
34. ČSOP ZO 7205 Areka
35. Hájenka
36. Vita

**Olomouc Region**
37. ČSOP 61RS Iris
38. ČSOP 6106 ZO Haná
39. Hnutí Brontosaurus Jeseníky
40. Hnutí DUHA Olomouc
41. PermaLot
42. Sdružení lesních pedagogů ČR
43. Sluňákov

**Pardubice Region**
44. ČSOP 4416 ZO Klub ochránců p.p. Habrov
45. ČSOP 5215 ZO Zlatá studánka
46. Ekocentrum PALETA
47. Ekocentrum Skřítek

**Plzeň Region**
48. Ametyst
49. ČSOP 2207 ZO Libosváry
50. ČSOP 2704 ZO Spálené Poříčí
51. ČSOP 2901 ZO Rokycany
52. ČSOP 2902 ZO Radnice
53. Děti Země Plzeň
54. Nadační fond Zelený poklad
55. Sdružení IRIS
56. Svoboda zvířat

**Prague Capital City**
57. Centrum inovací a rozvoje
58. ČSOP 0104 ZO Praha 10
59. ČSOP 0114 ZO Natura quo vadis
60. ČSOP 0171 ZO Koniklec
61. ČSOP 0185 ZO Dinosaurus
62. ČSOP SMOP
63. Ekocentrum Podhoubí
64. Ekodomov
65. PRO-BIO LIGA
66. Sdružení SRAZ
67. SSEV Pavučina
68. Tereza
69. ÚESS Spodek
70. ZČ Hnutí Brontosaurus Botič

**Central Bohemia Region**
71. ATOM 19071 Javory Černuc
72. ČSOP 0209 ZO Vlašim
73. ČSOP 0210 ZO Votice
74. ČSOP 0801 ZO Klenice
75. ČSOP 0808 ZO Bousov
76. ČSOP 0907 ZO Polabí
77. ČSOP 1111 ZO Zvoneček
78. Ekocentrum Kavyl
79. Iris, o.p.s.
80. Křivoklátsko, o.p.s.
81. NSEV Kladno Čabárna

**Ústí nad Labem Region**
82. ČSOP 3304 ZO Tilia
83. ČSOP 3701 ZO Ciconia
84. Šťovík Teplice
24b. SEVER Litoměřice

**Vysočina Region**
85. ČSOP 1701 ZO SEV Mravenec
86. ČSOP 5911 ZO Jihlava
87. ČSOP 6288 ZO Kněžice
88. Chaloupky, o.p.s.
88a. Chaloupky, SEV Ostrůvek
89. Sdružení Krajina
90. SEV Krajinka

**Zlín Region**
91. ALCEDO – DDM Vsetín
92. ČSOP 5701 ZO Kosenka
93. ČSOP 5703 ZO Čtyřlístek
94. ČSOP 6003 ZO Planorbis
95. ČSOP 6303 ZO Buchlovice
96. ČSOP 76/17 ZO Javorníček
97. ČSOP 7608 ZO Radhošť
98. IS Moravské Kopanice
99. LOCUS
100. Zelené bydlení

**Legislation and Documents**

**Acts:**

- **Beginning of the 1990s:** Legal framework for environmental education was created within the framework of educational and environmental legislation.
- **May 1990:** This area of education was partially codified for the first time by an amendment to the Educational Act (No 171/1990 Sb.), where the obligation of primary and secondary schools to conduct "environmental education" was formulated.
- **1992:** The Act on the Environment (No 17/1992 Sb.) formulated basic principles and defined education on the environment, the Act on Nature and Landscape Protection (No 114/1992 Sb.) defined the duties of the state nature conservation authorities in environmental education.
- **1998:** The Act on the Right for Information on the Environment was approved (No 123/1998 Sb.). It deals in the most complex way with environmental education (in Section 13, it stipulates the duties of state administration bodies, and after the 2005 amendment, also those of regions).
- **2004:** The New Educational Act (No 561/2004 Sb.) reflects in the more recent manner the significance of environmental education, which it defines as one of the basic objectives of education.

**Government Resolutions:**

- The first government resolution on environmental education was adopted in the 1970s (1977) and till 1990, it was the only document possible to base on.
- **1991:** Government Resolution to the "State Programme of Environmental Care", in which environmental education was included as one of seven priorities.
- **1992:** Government Resolution to the "Strategy of State Environmental Support of Environmental Education in the Czech Republic for the 1990s" – for a long time, the only detailed document that minimally ensured the basic state support of the EEA. It contributed e.g. to institutional fixing of environmental education in regional public administration (district authorities) and at the MEYS, to mutual communication and coordination of ministries and to maintaining the support of environmental education in the middle of the 1990s.
- **2000:** Replacement of the previous strategic document with the new Resolution to the "State EEA Programme" that supports education towards sustainable development. This resolution is updated and concretised in a three-year period with Action Plans of the State EEA Programme that, adopted as a government resolution.
- **2001:** The National Programme for the Development of Education (the "White Paper") was adopted – a significant government document in the area of education that also emphasises the significance of environmental education.
- **2004:** The State Environmental Policy (an updated document for 2004–2010) and the Sustainable Development Strategy were adopted, where the area of education on the environment was partially reflected.

**Ministerial documents:** In 2001, in education, the Methodical Instruction of the MEYS was issued to the EEA intended for all schools and school facilities – it describes in detail how the EEA system at schools should look (it introduces the position of a school EEA coordinator and creates school EEA programmes). The Framework Educational Programmes (adopted gradually since 2003) that define environmental education as a compulsory cross-sectional topic in primary and secondary education are the documents of principal importance for environmental education.

**Regional documents:** Since 2002, the regional councils have been gradually adopting their Regional EEA Concepts. Today, most of the regions have processed and adopted them in various qualities. The EEA area also appears in some regional development strategies and programmes and in other partial concepts, programmes and documents in the areas of education and the environment.

**School documents:** The key fact at the individual school and school facility level is that in accordance with the methodical instruction of MEYS of the 2001, they draw up their school EEA programmes and, additionally, in accordance with framework educational programmes, they elaborate or will elaborate environmental education as a compulsory cross-sectional topic in their school educational programmes.

## 12.3 Information society

*"A society, where the quality of life and prospects of social changes and economic development depend on information and the ability to use it, i.e. information becomes a key factor in such a society"* is nowadays understood by the information society in general [1]. The efficient use of information and information technologies not only at the public administration level, but also at the household and enterprise levels, is necessary for the successful development of the information society.

[1] Dytrt, Z., Mikulecký, P., Nejezchleba, M., Prillwitz, G., Roudný, R. (editoři): Etika podnikání a veřejné správy: Informační společnost – etická výzva pro 21. století. The proceeding of the 2nd international conference Hradec Králové, 18–20 May 1999

### 12.3.1 Information society – public administration

Up to 1989, the technical use of information had been significantly influenced in the ministries of defence and of the interior; however support to increase the use information by the public was missing. It must be admitted that at the beginning of the '90s, great progress in the utilisation of computer technology occurred, but the targeted support and deeper education, orientation at the content and utilisation of information were missing. Databases from individual organisations and concepts of creating departmental systems and subsequently for the entire information system came into existence.

In accordance with the Czech Republic's accession to the European Union, Act No 127/2005 Sb., on Electronic Communications, was prepared and it was followed by the State Information and Communication Policy e-Česko 2006 that defined the basic priorities through 2006 in the area of available and safe communication services, informational education, modern public online services (e-Government) and the dynamic environment for electronic business.

In 1995, an interdepartmental commission for managing the state information system to support building the Czech Republic's state information system came into being (Government Resolution No 534 of 20 September 1995). Then in 1998, this interdepartmental commission was substituted by the newly established Government Council of the Czech Republic for State Information Policy (based on Government Resolution No 850 of 16 December 1998).

#### Electronic paperwork

Introducing electronic paperwork – e-Government that should have lead to a more effective performance of public administration and limited the growth of the number of employees in public administration proceeded slowly with regard to the problematic optimisation of public administration processes. Even if during the last two years, a marked increase in the utilisation of modern information and communication technologies (ICT) to facilitate contact between citizens and entrepreneurs with authorities and in and among the authorities occurred, the massive public sector investment (amounting to EUR 1.1 billion in 2006) in ICT has not yet brought about the expected result.

The reason is both in adjusting ICT to obsolete processes and the absence of an institution above the ministries that would manage and co-finance e-Government projects. Separate ministerial e-Government projects were built and financed in an uncoordinated manner that do not communicate with each other, even if some of them are interesting, e.g. the social security agenda and taxes projects.

In 2007, the independent Ministry of Informatics of the Czech Republic was dissolved and the Government Council for an Information Society was established as an advisory body of the Government for the areas of ICT and e-Government. The coordination role for information and communication technologies (e-Government) was taken over by the Ministry of the Interior, while the Government Council for Information Society will be in charge of coordination above the separate ministries.

In 2003, the Public Administration Portal was launched (http://portal.gov.cz/) and partial projects for some ministries started (e.g.: the Integrated Portal of the Ministry of Labour and Social Affairs). An example of good functioning of e-Government should have been the CzechPOINT project launched in 2007. CzechPOINTs, communication terminals between citizens and public administration, of which there are supposed to be up to 4 000, should appear at municipal authorities, post offices and eventually at notary offices. The objective is to provide inhabitants with certificates of incorporation and extracts from the register of trades, from the land register and also extracts from the penal register. Though the extracts are fast and more easily accessible, they are subject to a charge of CZK 50 per page.

The first countrywide e-Government project in Europe began in Great Britain in 1995, when the central information technology unit (CITU) was formed at the Office of the Government. The main aim of CITU was to map and optimise public administration projects and subsequent launch of the portal, on which all public services are available online today. In 2000, the project entitled BundOnline 2005 e-Government Initiative began in Germany, the aim of which was to carry out optimisation and automation of 1 600 main processes in public administration of Germany within five years. As a consequence, e.g. issuance of trade permit certificates shortened from several weeks to one hour. A citizen is no longer forced to submit a number of documents, to which the officials have, thanks to optimisation, direct access. France approached their records and the optimisation of its processes from the perspective of their citizens. They carried out a review of all state services and made a list of life situations to simplify them and to increase their efficiency through information technologies.

### Utilisation of information and communication technologies

Resulting from a survey of the Czech Statistical Office on utilising the ICT in public administration, the utilisation of personal computers (PCs) has been increasing since the beginning of the 1990s, and presently, the public administration is fully equipped with computers (with the exception of some municipalities). In 2005, an absolute majority of all public administration institutions had a connection to the Internet. All regional authorities had their own web sites, in the case of small municipalities, only 60 % of them). Of the institutions that mentioned they have their own websites, most of them published information on how to solve various life situations and problems on their sites, but they used them significantly less to offer on-line services (on-line forms, electronic submissions etc. – see Chart 12.9).

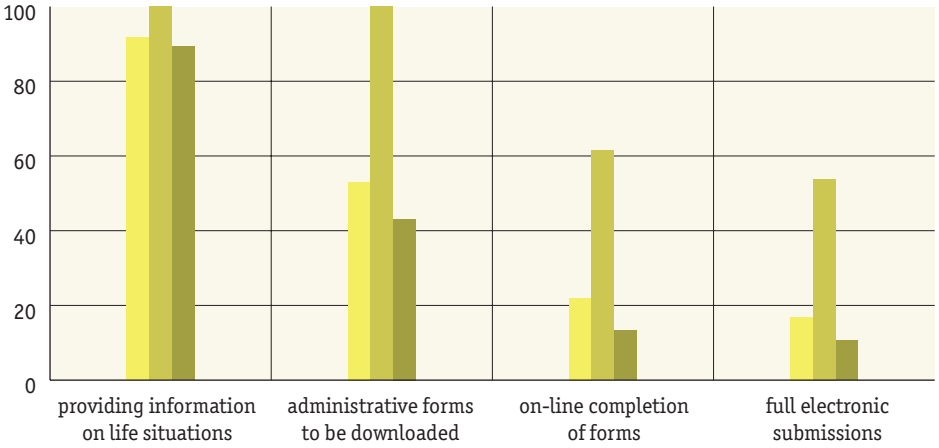
In 2006, an international comparison of the online availability of public services in Europe in the indicators observed, i.e. in the online availability of public services and in the number of fully available online public services, the Czech Republic placed 22nd and 23rd respectively out of 28 countries. A 2004 similar analysis did not show any improvement, while countries that had previously scored lower did improve. This is shown in Chart 12.10.

All regions had at their disposal a high-speed Internet connection. In addition, 85.5 % of state structural entities and 60.8 % of the municipalities with more than 500 inhabitants had at least one PC with a high-speed Internet connection at their disposal.

A report on the availability of public services in Europe provides an international comparison on – "Online Availability of Public Services: How Is Europe Progressing?". http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/online_availability_2006.pdf

**Percentage of public administration bodies (of public administration bodies with their own web site) offering on-line services on their web sites, as of 31 December 2005 [%]**

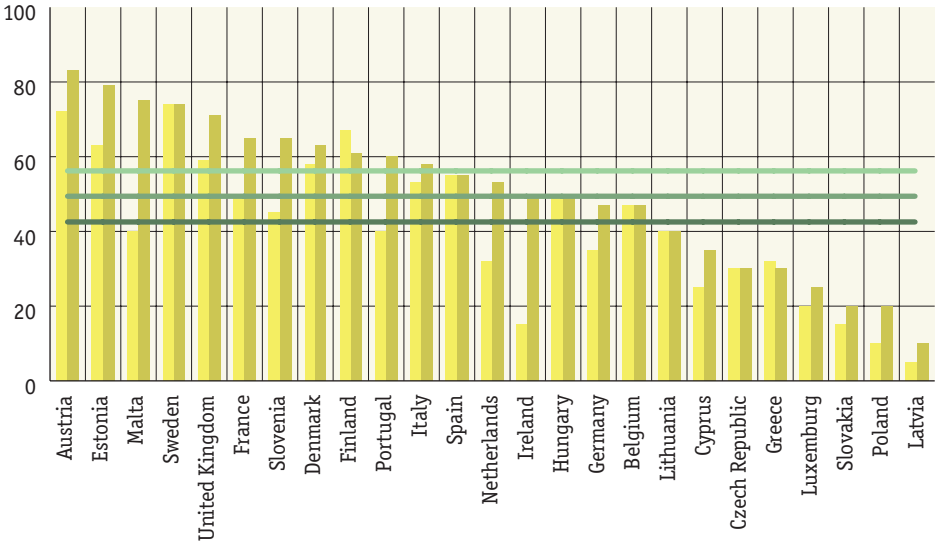
**Chart 12.9**




*Source: Czech Statistical Office*

**On-line availability of public services – an international comparison, 2004 and 2006**

**Chart 12.10**




*Source: Online Availability of Public Services: How Is Europe Progressing?, Capgemini*

## 12.3.2 Information society – households

### Equipment in households with computers

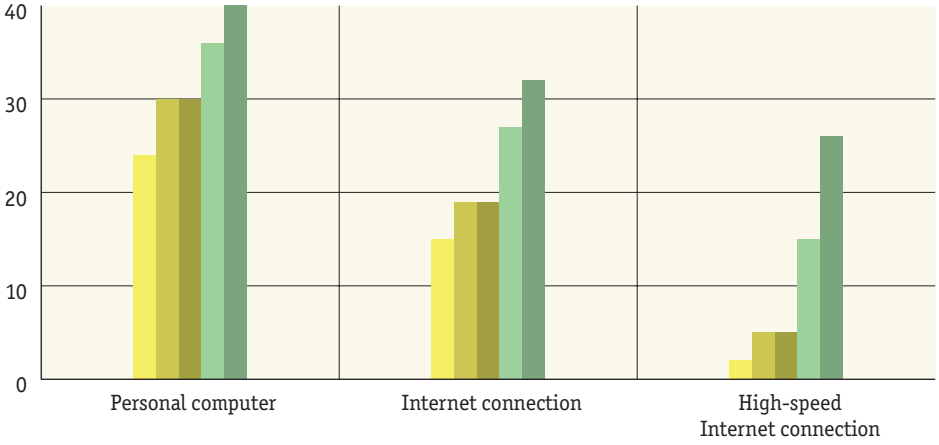
In 2007, in the household sector, 40 % had a PC at home (1.68 million households). 32 % of all households had an Internet connection (1.36 million households), 80% of those had a high-speed connection (1.08 million). From 2003 to 2007, the number of households equipped with a PC and an Internet connection significantly increased, as seen in Chart 12.11. Over the last year, the method of Internet connection to households has changed significantly: dial-up connections have decreased significantly, whereas ADSL connections increased.

Nonetheless, an international comparison of households with an Internet connection in the Czech Republic still falls significantly behind the countries of Western and Northern Europe, as well as pan-European averages (the Czech Republic: 29 %, EU 15: 54 %, EU 25: 51 %), see Figure 12.4.

In addition to the normal use of the Internet, purchasing on the Internet has slowly begun to rate among the most popular activities. The share of individuals aged more than 16 purchasing via the Internet increased between 2003 and 2007 from 3 to 15 %. According to the latest survey by the Czech Statistical Office in 2007, the Internet was used by 34 % of all Internet users, which represents 16 % of the population aged over 16.

**Households with a personal computer and an Internet connection [%]**

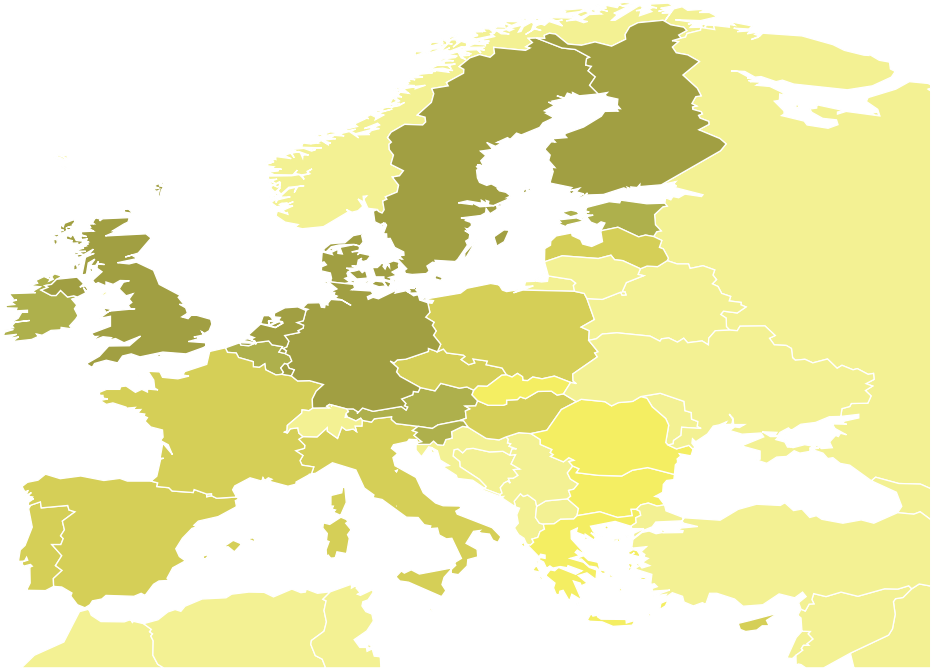
**Chart 12.11**




*Source: Czech Statistical Office*

**Households with an Internet connection, an international comparison, 2006 [%]**

**Figure 12.4**




*Source: Eurostat, Czech Statistical Office*

Share of the total number of households, where at least one member is aged 16 to 74.

### Computer literacy of the population

A worse situation exists in the general level of information literacy, or **computer literacy**, where the systematic education of the population of all age categories in using information technologies is missing, e.g. also "the European Computer Driving Licence, ECDL)" is missing, which is a common standard in education. However, it is not taught systematically in our country and it is also not required e.g. for performing state administration functions.

In 2005, according to the Research of Computer Literacy, the share of computer literate people was 27 % of the Czech working-age population. The research focused on the following parameters of computer literacy: knowledge of IT terms, control of a PC, a text editor, a spreadsheet, the Internet and graphics. It also is clearly seen in the research (see Chart 12.12) that 55 % of the Czech population aged 15–17 is computer literate, but only 2 % of the people older than 61. The higher proportion of computer literate people is among men and the people with higher education.

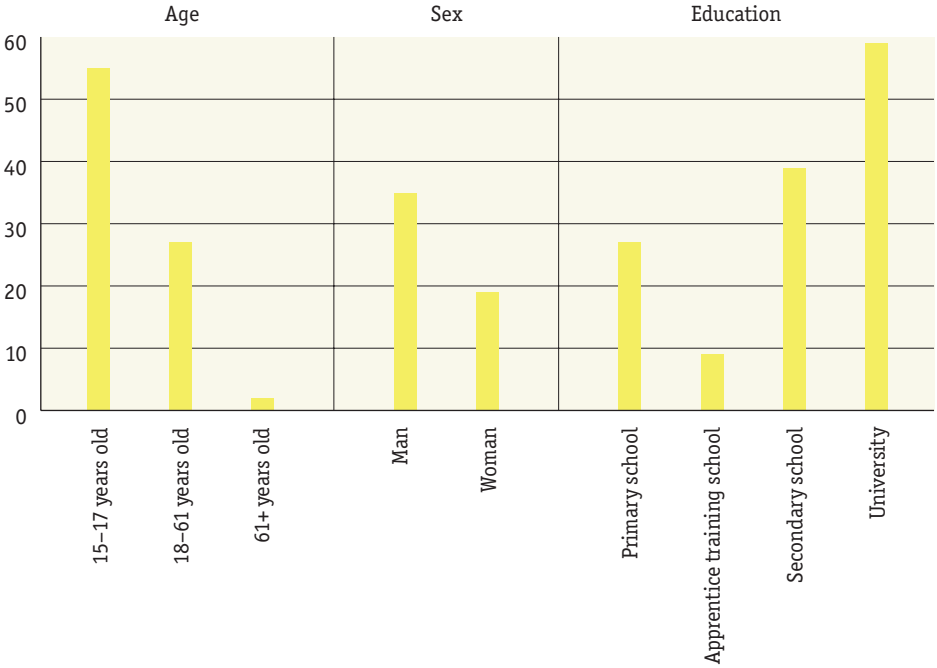
The Czech Statistical Office conducts its own surveys focussed on ascertaining working knowledge with a PC and the Internet. The latest data from 2007 indicates that at least 51 % of the entire population aged 16 or more have at least a basic working knowledge of PCs, and 49 % of them have a basic working knowledge of the Internet. The survey from the Czech Statistical Office differs from the STEM/MARK survey because it follows the working knowledge of a PC from a narrower definition of computer literacy and it also uses another division of age groups

**Information literacy** is a general term that includes functional and computer literacy and represents the ability to find out, evaluate and efficiently use required information.

**Computer literacy** represents the ability to use information and communication technologies for one's work.

**Computer literacy of the Czech Population, 2005 [% of population]**

**Chart 12.12**




*Source: STEM/MARK, Ministry of Informatics of the Czech Republic*

## 12.3.3 Information cociety – entrepreneurial sector

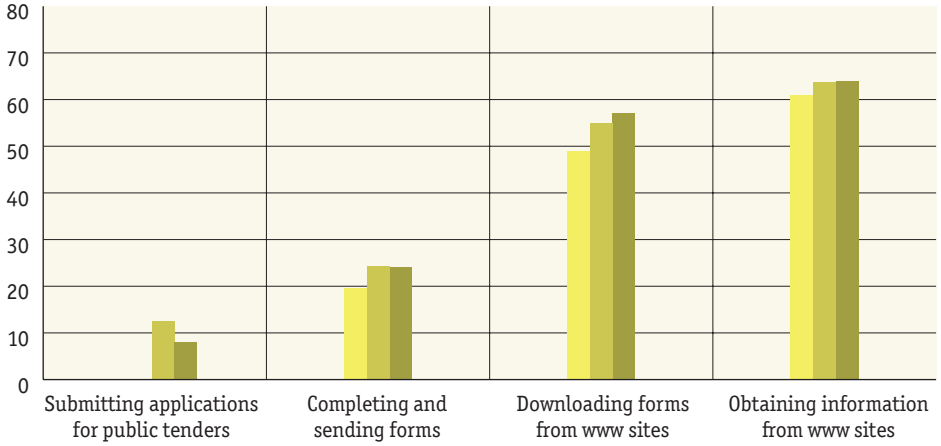
### Using the Internet

As seen in the survey from the Czech Statistical Office on using ICT in the entrepreneurial sector in 2005, more than three-fifths (62.8%) of all economic entities with 5 or more employees had their own web sites, of which the highest share fell on large companies (approximately 95% of these companies) and this share has been constantly growing. In using web sites and the Internet, the Czech Republic rates among the EU average.

A significant negative year-to-year change occurred in enterprises using electronic trading. In 2005, less than one-quarter of all companies submitted electronic orders (purchased) and one-twelfth of all companies received electronic orders (sold). A steep fall in both purchases and sales via the Internet is obvious from Chart 12.14. With the fall in the number of economic entities selling or purchasing via the Internet, there was a corresponding fall in the share of electronic sales in total turnover, especially for large and medium-sized companies (by approximately 1-2% compared to 2004). As an international comparison of sales via the Internet, the Czech Republic has one of the lowest rates.

**Share of enterprises with 5 or more employees using the Internet in the relation to public administration [%]**

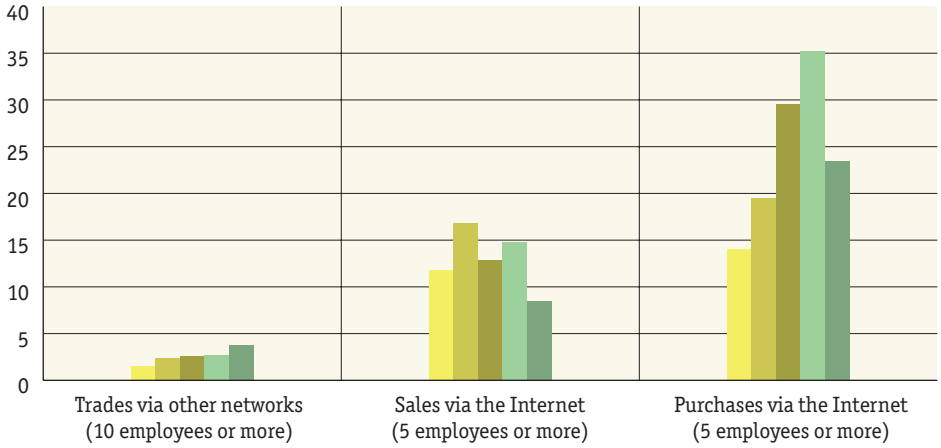
**Chart 12.13**




*Source: Czech Statistical Office*

**Share of enterprises using technology for electronic trading [%]**

**Chart 12.14**




*Source: Czech Statistical Office*

## 12.3.4 Information society and the environment

In the area of the environment, it was mentioned in the State Environmental Policy from 1990 that the first prerequisite of the necessary ecologisation of people's behaviour would be informing them on the extent and character of problems connected with destruction of the environment and the possible ways to solve them. It was stipulated that the information system on the environment must come into existence right from the systems being built worldwide, especially within the framework of the UN and the European Union, so that it might be possible to ensure comparability of the data.

However, in the middle of the 1990s, problems with an important element of the information chain – environmental monitoring – still existed. The single system for assessing environmental and health risks was not applied and the methodology for monitoring expenditures on environmental protection was incomplete. Therefore, an integrated monitoring and information system was completed during the following period that addressed European Environmental Agency standards and a system of assessing products their entire service life was implemented.

Based on the measures contained in the past two groups of State Environmental Policy materials, the Register of Pollution Sources and Emissions was developed so that it would comply with EU requirements. In addition, the Integrated Pollution Register (IPR) was founded as one of the main e-Government tools of the sector, and a central registration office was established as a unified point for electronic reporting of data from enterprises. It was intended that this office should be the focus of the Integrated System for Fulfilment of the Reporting Duties (ISFRP) under construction. At the same time, the system of environmental statistics and environmental accounting improved with regard to harmonisation with the EU and the OECD. A new unified management system of environmental risks should have been introduced, but the floods showed that the implementation of this system was insufficient.

**The State Environmental Policy** was approved by the Government of the Czech Republic by Resolution No 210/1990 of 18 July 1990 and by the Federal Government by the Resolution No 511/1990 of 26 July 1990. The subsequent State Programme of Environmental Care was approved by Federal Government Resolution No 229/1991 of 18 April 1991.

**IPR** (www.irz.cz) is a database of chosen pollutants, their emissions and transfers that have an unambiguous territorial link (an enterprise or operational premise). Thus, the IPR may be used to determine the quality of the environment in a specific location. Making this information accessible supports public participation in decision-making processes in environmental matters and public control. As such, it also affects more responsible environmental behaviour by enterprises.

In compliance with the objectives of the State Environmental Policy for the 2004–2010 period, the transformation of the Czech Environmental Institute to CENIA, Czech Environmental Information Agency, occurred for ensuring the modern functions of collecting, processing and disseminating information, and CENIA provides these functions.

In the area of information, the transformation of the Unified Environmental Information System to the Integrated Environmental Information System (IEIS) that provides comprehensive environmental information, simplifies and speeds up access to relevant environmental information was planned. The system includes a departmental network of information subsystems and databases with its central point in the new Environmental Portal "Facts and Data" launched in 2006. This portal works as a single gateway to the information on the state of the environment and the activities of the state for its protection. Within the framework of the Unified Information System, the information and data clearinghouse, the meta-information system and the Information System of Statistics and Reporting (ISSaR), which provides a number of environmental indicators and statistical data to persons interested in the information and data on the development and state of the environment, were further put into operation .

In 2004, Map Services were launched within the Portal. They provide citizens and enterprises with thematic exercises on spatial relationships from different areas of the environment, transport and socioeconomic spheres. In the future, this spatial data should become a part of the infrastructure for EU spatial data (**IN**frastructure for **SP**atial **I**nfo**R**mation in **E**urope – INSPIRE). The map services based on these data should then be jointly accessible through the European geo-portal for all EU member states.

The map server of the environmental information agency CENIA (http://geoportal.cenia.cz) shows about 20 000 unique visits daily. The server is used not only by the general public, but also by public administration. Thanks to the availability of the data, the costs to acquire territorial technical documentation on municipalities has decreased anywhere from a third to a half. Similarly visited are e.g. the map servers of the Czech Geological Service, the Czech Geological Service-Geofond and of the Agency for Nature Conservation and Landscape Protection.

The most visited server, from all public administration portals, is the server from the Czech Hydrometeorological Institute. During the floods of 2002, the average daily access was, according to the Czech Hydrometeorological Institute's statistics, over 2 million hits a day and during the height of the floods, over 4 million hits a day.

In the environmental area, the interest of the public and other target groups has been growing, which has lead to greater awareness about environmental protection. This development may be observed from number of requests for information submitted to the MoE, as documented by the following Chart 12.15.

Currently, the "ENVIKLIK" project – Environmental Helpdesk is being implemented as the next step in fulfilling the e-Government principles in the sector of the environment. An information service is used to allow single access to authorised information on the environment, which all persons interested in the information should be able to use – citizens, entrepreneurs, public administration and others. ENVIKLIK should thus become the focus of the "CzechPOINT of the environment" (see Figure 12.5).

For environmental protection, information technologies helped solve the problems of obtaining, holding and processing a great amount of data. Environmental issues have further stimulated the introduction of this technology and an increase in information literacy. More mass use of information and telecommunication technologies decreases pressures on the environment mainly as a result of limiting pollution by more efficient and precise inspections pollutant emissions, and because of the reduced need of transport for work, to go to government offices, cultural facilities and shopping.

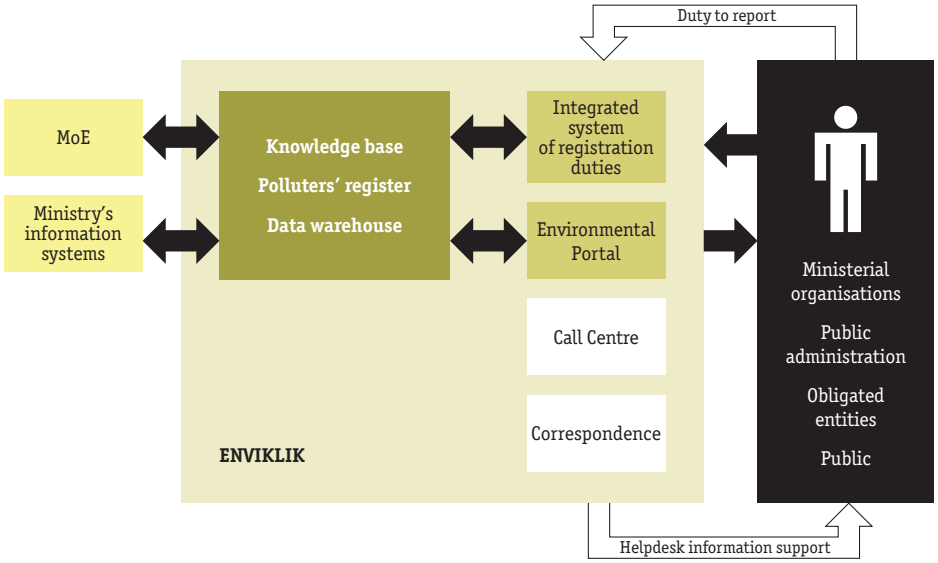
**Examples of departmental portals and information systems:**

| | |
|---|---|
| http://portal.env.cz | "Facts and Data" portal on the environment |
| http://issar.cenia.cz/issar | Information system of statistics and reporting |
| http://geoportal.cenia.cz | Map portal |
| http://mis.env.cz | Meta-information system |
| http://www.centralniohlasovna.cz | Central registration office |
| http://www.nature.cz | Information system of nature conservation |
| http://heis.vuv.cz | Hydro-ecological information system |
| http://www.chmi.cz | Air quality information system<br>Meteorological and climatological information system |
| http://ceho.vuv.cz | Waste management information system |
| http://www.geofond.cz | Geofond / Raw-material information system |
| http://www.ippc.cz | IPPC information system |
| http://www.env.cz/ris | Information system of public librarians and information services |

**CzechPOINT of the Environment**

**Figure 12.5**

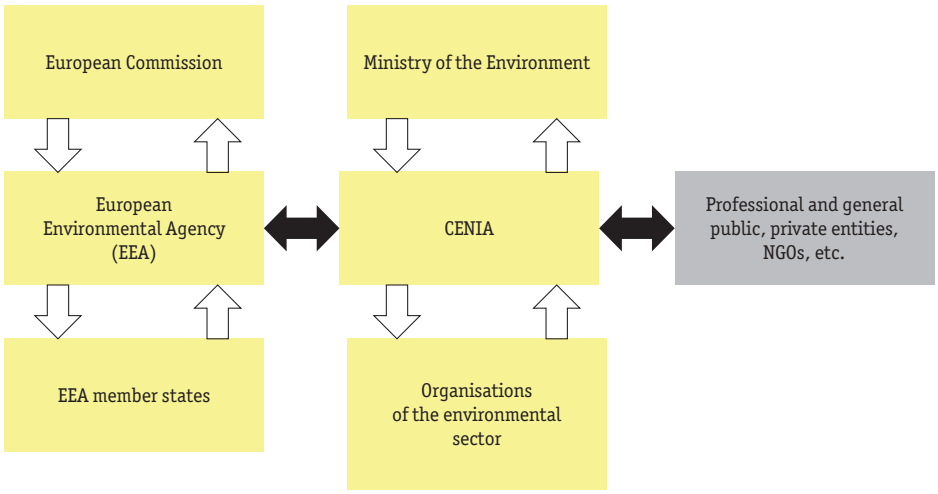
*Source: CENIA*




**Management of the information exchange within the sector of the environment**

**Figure 12.6**

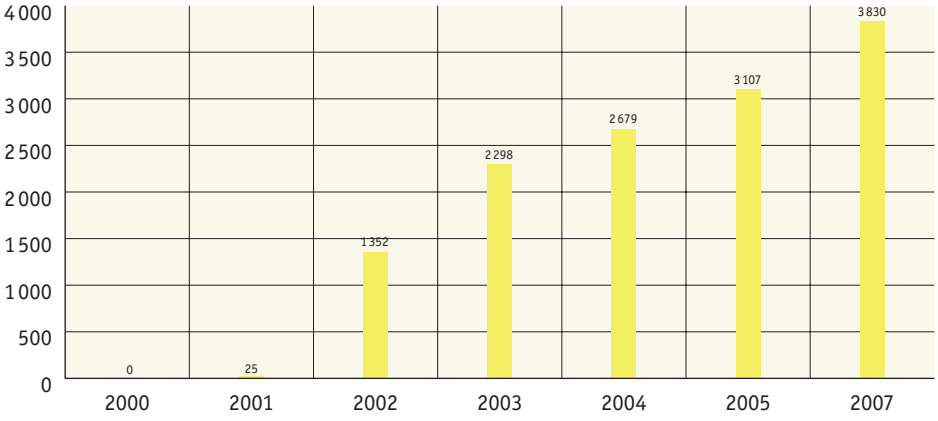
*Source: CENIA*




**Number of citizen requests for information submitted to the MoE in accordance with Act No 123/1998 Sb., on the Right for Information on the Environment**

**Chart 12.15**

*Source: Ministry of the Environment*



Information technologies are responsible for approximately two per cent of all carbon dioxide emissions worldwide. However according to the study entitled **"Saving the Climate @ the Speed of Light"** from the World Wildlife Fund (WWF) and the European Telecommunications Network Operators' Association (ETNO), the use of information technologies (ICT) makes it is possible to save up to ten times more emissions than these technologies produce. How and in which areas?

**Information and communication technologies**
- Using more efficient servers and virtualisation – better utilisation of disk space, limiting the need of hardware (up to 85 % energy savings)

**Transport**
- Broadband Internet access – possibility to work from home
- Mobile applications – a reduction in the number of business trips and commuting

**The administration of buildings**
- Intelligent ICT – reduction of energy consumption in buildings by means of ensuring the essential operation of heating, air-conditioning and light (up to 20 % more effective operation of buildings)

**Manufacturing companies**
- Utilisation of network technologies for more efficient process management (saving up to 8 % of $CO_2$ emissions)

**Logistics**
- Optimisation of managing rides and planning rides with consignments

**The public sector**
- Electronic submission of all tax returns in Europe (possible annual savings up to 196 thousand tonnes of $CO_2$)

It would be possible to save up to 22.2 million tonnes of $CO_2$ if 10 % of all European employees did not have to commute and worked remotely. 2.1 million tonnes of $CO_2$ would be saved if half of all the employees replaced one meeting per year with videoconferences. Up to 22.4 million tonnes of $CO_2$ emissions would be saved if 20 % of all business trips were replaced with videoconferences (the equivalent emissions produced by 29 thousand flights from London to New York).

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# The Economy and the Environment in the Czech Republic after 1989

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