Environmental Economics in the Central European Context

Time: Tuesday 4pm – 7pm
Location: at CERGE-EI, Room # 11

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Reading materials: http://home.cerge-ei.cz/richmanova/Teaching.html

Environmental Policy in the Czech Republic – History and current issues

A. HISTORICAL POLITICAL AND ECONOMIC CIRCUMSTANCES (COMMUNISM AND THE TRANSITION PERIOD)

Q: What do you know about Czech history, communism?
Do you think that historical political/economic circumstances are important from the environmental perspective? Why?

Milestones of 20th century

1918 The first Czechoslovak Republic was established.
one of the most developed countries (economically)

1939 The Czech part was occupied by Germany, an independent Slovak State was established.

1945 Liberation by Soviet and US armies, the Czechoslovak Republic was restored.

1946 the Communist party wins elections with about 38% of votes

1948 Communists took over the country.
- purely communist cabinet,
- nationalization
- centrally planned economy
- repressive regime

1968 Prague Spring.
- in January political leaders (led by a newly appointed first secretary of communist party Alexander Dubcek) started to lighten restrictions
- Warsaw Pact armies (Bulgaria, Poland, Hungary, Eastern Germany and Soviet) invaded Czechoslovakia in response (August '68)

1970's formation of a dissident movement represented, among others, by Vaclav Havel

1989 The Velvet Revolution

– turning down the communist regime
– sooner or later it happened also in other countries: Poland, Bulgaria, Eastern Germany, Romania, Hungary, within 3 years totally eradicated from Europe. Mostly peaceful.

1990 The first democratic parliamentary elections after 42 years.

- before, elections every 4 years, with only one party to vote for and compulsory participation
- Václav Havel elected president of the Czech and Slovak Federal Republic.

1993 Czechoslovakia ceases to exist

- establishment of the Czech and Slovak Republics (Jan 1, 1993) and Czech and Slovak Customs Union.
- also other 2 federations disintegrated: Yugoslavia and Soviet Union (1991)
- as regards political orientation the government until 1997 was rightist (Civil Democrats), after its fall, leftists formed a minority government.

1995 The Czech Republic joins OECD

1997 Coalition government (established in 1996) falls

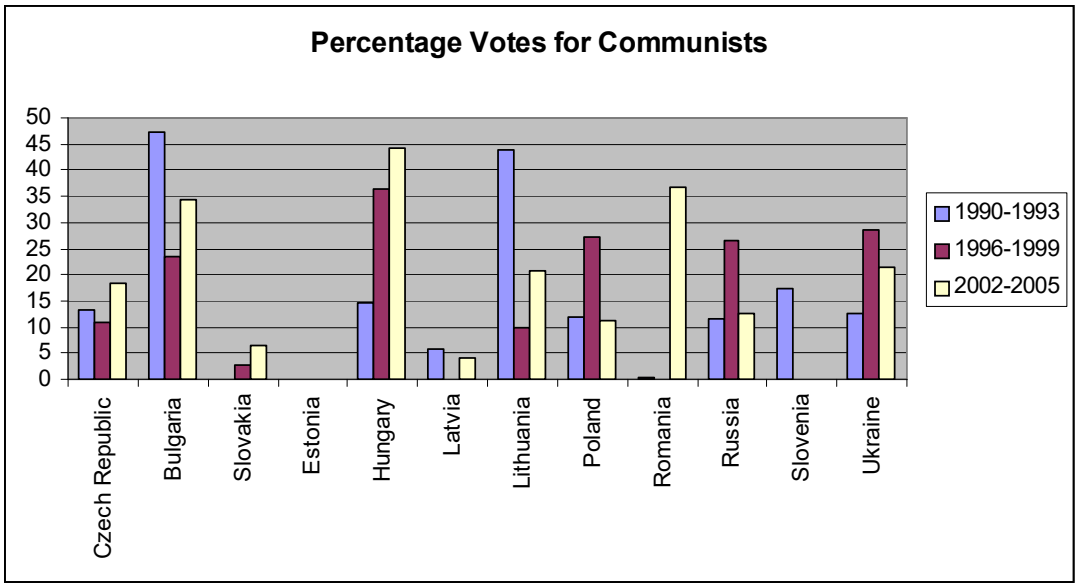
1998 Early parliamentary elections - minority government of Social Democrats

1999 On March 12 the Czech Republic officially joined NATO.

2004 On May 1 the Czech Republic joined the EU.

2007 December, Schengen agreement, border controls with all neighbors abolished

Elections



- the fall of communism did not mean complete disappearance of the communist party from the political life. In many countries, after some time had passed, the support for communists rose again.

Economic transition of the Czech Republic

Initial Conditions:

- the first Czechoslovak Republic (between WWI and WWII) was one of the most developed economies in the world.
- even after the WWII, the economic position was optimistic, with good predispositions for further growth (the country was not much destroyed by the war, with well-preserved infrastructure, oriented to heavy industry)
- Centrally planned economy since 1948
    - **No private ownership** (all means of production nationalized)
    - **5-year plans**: quantity preferred to quality (re-negotiations possible, low quality and low variability of goods**)**
    - **Fixed prices**: administratively set, no market prices
    - **Over-employment**: wastage of resources; not working was illegal
    - Specialization within the Soviet block: **heavy industry, crystal glass, raw materials**
- Consequences
    - **No incentives** (plans could have been re-negotiated, hard work or innovative approach were not rewarded, ordinary workers were valued the most → no incentives for innovation, advance, progress…low variability of goods)
    - **Shortage and low quality** of consumer goods and services
        - periods with complete lack of basic goods -> Economy of shortage (some basic goods becoming luxury, e.g. bananas)
        - production of some goods was supported centrally, without increased domestic demand (e.g. when tractors were decided to be more important, resources were invested into production of tractors sometimes at the expense of basic goods like e.g. shoes).
        - the variation of goods was very low, many families had the same furniture, carpets in their homes.
- Still, thanks to a very good starting position and clear market orientation (heavy industry), the economy was doing well initially
- A rapid economic growth continued over the 1950ties and the 60ties, started to slow down in the 70ties

  - because of fixed prices, lack of incentives and emerging need to re-direct the production (raw materials were becoming scarce) also the central planning was becoming more complex.

- In the 80ties the economy was experiencing increasing problems: slow economic growth, low productivity, slow implementation of technical innovation and also western influence eventually led to a collapse of the system.

"Good" starting position of the CR (after 1989)

- Relative to other transition countries the CR had:
  - no significant external debt
  - low inflation
  - positive trade balance
  - balanced government budget
  - **great political will to liberalize the economy**

- Non-competitive structure of the economy
- Investments into technologies and infrastructure necessary

1990's: What to do?

- **start private ownership** (state ownership is often connected with low effectiveness **Why?**)
  - restitutions
  - privatization
  - support for small and medium enterprises
- **restore price relations** (so that they reflect \economic scarcity **Why is that important?**)
  - exchange rate liberalization
  - price liberalization
- **restore economic incentives (Why is that important?)**
  - trade liberalization
- **create proper institutional and legal framework** to support entrepreneurial activities (and NOT JUST ON THE PAPER)
- **development of banking sector**
- no one really knew what to do exactly, how to transform a centrally planned economy to a market economy. There was no prior experience, the only method was trial and error.

SURPIRSES/PROBLEMS (not necessarily related to environment)

A. **Privatization**

- started in 1990 under three schemes:
  - **restitutions** (property was returned to its pre-nationalization owners or their descendants)
  - **small-scale privatization**
  - **large scale privatization** -> voucher privatization ->
- a mass voucher privatization (something like stocks emission – everyone purchased a book of investment vouchers).
  - Two waves of voucher privatization took place in 1992-93 and 1993-94
  - 1664 firms (first wave: 988 firms, second wave 676 firms plus 185 firms carried over from the first wave).
- the 1995-96 ownership changes were massive, spontaneous and quite unregulated.
- ordinary people did not understand the process clearly
- key companies ended up in hands of insiders, many of who were seeking private profits.
- number of companies folded as a result of asset stripping.

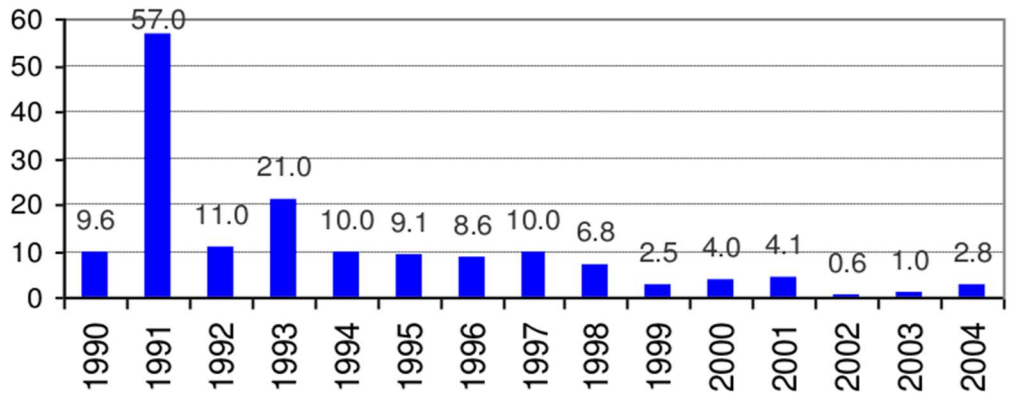
B. **positive surprise**: relative efficiency of firms that remained state owned.

C. **returning (partial) support for the communist party.**

Can you think of the reasons why? What might have people liked about the communism?

D. **high initial inflation**

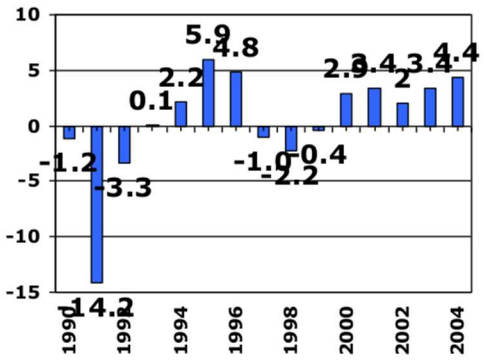
- after 1989 there was a will and a need to abandon fixed prices.
- naturally, price liberalization after long period of time (40 years) led to large initial inflation (the 1993 jump reflects the introduction of VAT (5-25%)).

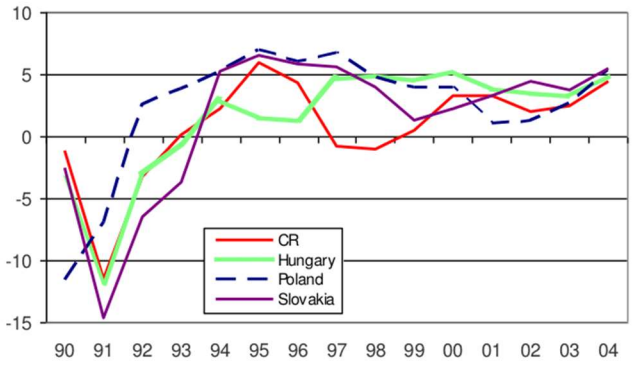


- The main reasons for large initial inflation were:
  1) **uncertainty** (no one was sure how economy will react to massive changes)
  2) **increase in energy costs** (due to past energy dependency on Soviet Union)
  3) **abandonment of large food subsidies** (that were being provided before)
  4) prices were pushed up in order to **maintain over-employment** (initially) – companies were reluctant to fire, they preferred to increase prices even though it was not efficient (only initially)
- later, inflation keeps on lower levels, though before 1998 it remains relatively high (10%)
  - also connected to **gradual quality improvements** (recall that during communism quality was not very important for central planners)
  - after 1989, the economy was opening to western markets, which also led to quality improvements and, price increases

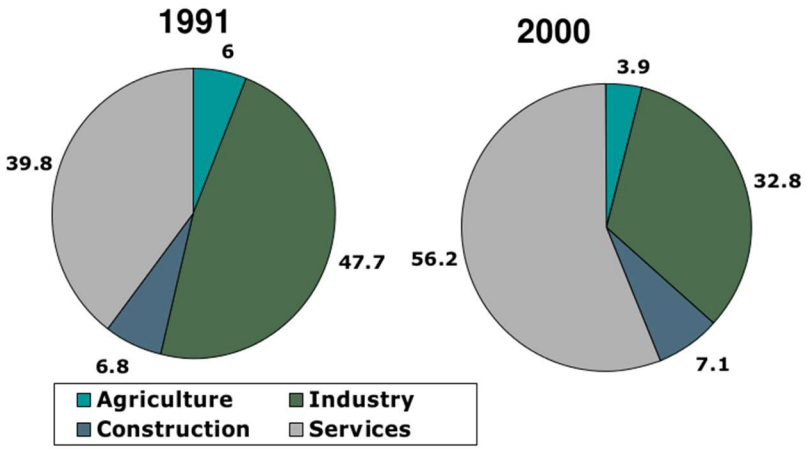
E. initial drop in **GDP growth**

- different opinions on why it happened
  - **a natural thing** to happen (with so many changes and great uncertainty)
  - **loss of export markets** after break down of trade agreements (with Soviet Union)
  - **external shocks** (Persian Gulf war, oil price increase, collapse of COMECON – Council for Mutual Economic Assistance – CR had to re-orient its international trade)
  - **structural changes** - before large quantities of some goods were produced without (internal) demand, just to fulfill the (externally set) plan – need for rapid adjustments (of business plans, technologies, workforce, etc.)
- later, 1998 drop reflects **global recession** which naturally affected small open economy of the CR. But also as a result of some internal problems with privatization of banks and **asset stripping** as a response to which number of foreign investors left. (see on the second figure how CR compares to other V4 countries).



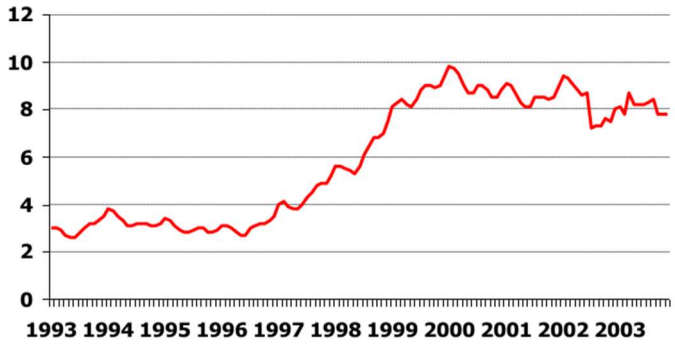


- after a decade the CR **re-oriented from industry towards services**.
- large share of services in GDP is characteristic for western developed economies.



(in 2016, share of services was around 60, of industry (incl. construction) 37.5%)

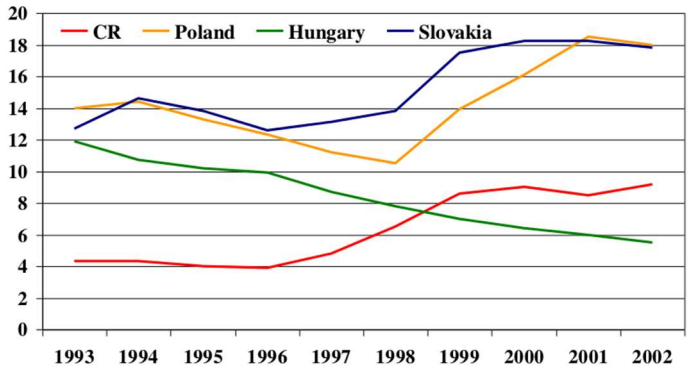
F. delayed increase in **unemployment rate**



- some talk about great success and great failure of the Czech Republic, as regards unemployment.

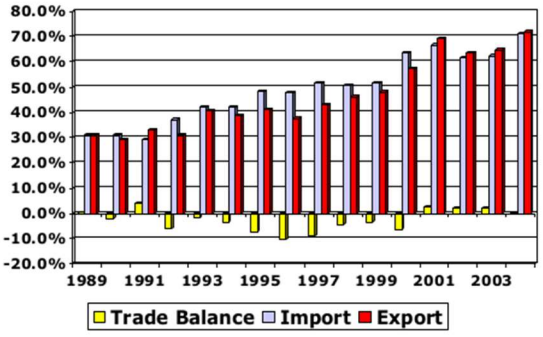
- during first years (before 1997) unemployment was low
  - the CR was the only post-communist country maintaining such low levels of unemployment (corresponding to levels of developed countries)
  - two main reasons
    1. **reluctance to fire** (compensated by increased prices)
    2. **incentives to establish own small businesses** (favorable environment)
- in 1997 oil price shock naturally led to increased unemployment.

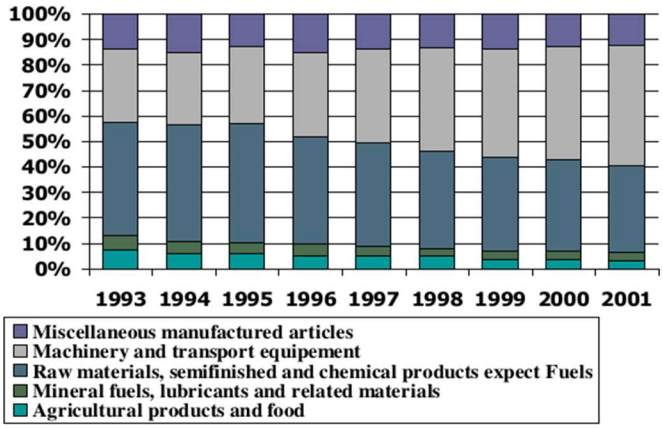
- in 1998, however, begun what one could call a great failure
  - **new central-left government** brought about a social system
    - very convenient to stay unemployed, living on social benefits
  - **low mobility of workers**
    - reluctance to move for work
    - e.g. in Prague there is almost zero unemployment, but despite large regional differences in employment, Czechs don't like to move.



- see that the CR was doing really well initially compared to other V4 countries

G. unavoidable reorientation of foreign trade





CR is a small open economy with large share of export and import (larger imports during the transition period are connected to investments and imports of technologies)

- quick re-orientation of the CR to EU markets (about 70% goes to EU, over 40% to Germany alone) – successful re-orientation from Soviet markets
- as regards sector structure, we observe re-orientation from raw materials and semi-products towards machinery and transport equipment (Skoda accounted for about 8% of

total exports in 2014 which makes about 4.5% of total GDP; whole automotive industry accounts for over 50% of total exports)

H. inflow of **FOREIGN DIRECT INVESTMENT** (FDI)

- an important factor during transition **Can you explain why?**
- a source of necessary capital for restructuring and re-capitalizing banks in transition countries.
- positive spillovers were expected, for firms in the same industry branch, FDI was expected to bring about increase in quality by competition…the thing is that it came with a high cost
- the CR was the most successful among post-communist countries in attracting foreign direct investment; here is the price:
    - corporate tax relief for 10 years
    - duty free imports of machinery and equipment
    - job-creation grants
    - training and re-training grants
    - provision of low-cost building, land, and infrastructure
    - best math and science skills in Europe; *"Czechs are among the most industrious people in the world"* The Economist, Sept. 1999
    - high spending on information and communication technologies

The transition went very well compared to other post-communist countries; the CR is now performing similarly to developed countries. The recent financial crisis and the European debt crisis have shown that within the CEE region, the Czech Republic is perceived very positively by foreign investors; in times of increased market turbulences considered a safe haven with attractive growth potential. If it weren't for the openness of the economy and especially the trade links with Germany and other Western European countries, the Czech Republic would have likely remained close to unaffected by the crisis. The actual slowdown of the Czech economy in the first wave of the crisis (reaction to ill financial instruments) was mostly caused by the dramatic fall in external demand; the Czech banking sector is healthy and well regulated, the exposure of domestic financial system to problematic financial instruments was minimal. The second round of the crisis (reaction to European debt crisis) affected the Czech Republic mainly through a wave of pessimism towards European market, overall EU-skepticism and increased uncertainty and, again, drop of external demand.

…BACK TO ENVIRONMENTAL POLICIES…

B. STATE OF THE ENVIRONMENT IN CR: HISTORY AND CURRENT ISSUES

The Environment in the Czech Republic 1989-2004, …2015
CENIA – Czech Environmental Information agency www.cenia.cz

From the 2004 report: The first 15 years after the velvet revolution

"From the environmental point of view the last fifteen years have been long enough for us to become a standard European country, whose inhabitants can breathe relatively fresh air and drink quality water. On the other hand this time period has not been long enough for forests to become healthy and for soil to be cleared of an abundance of pesticides and pollutants. The youngest generation of people, who still remember yellow fog in the surroundings of the North Bohemian power plants and who used to go to "curative stays" away from their homes, is not even in their thirties yet."

"In the past fifteen years we have had the chance to witness or take part in the process concerning environmental protection, the creation of the basic conceptual and legal framework for this environmental protection and its enforcing at home as well as in terms of international cooperation."

Libor Ambrozek, Minister of Environment

- **situation influenced by geopolitical situation after 1945**
- Czechoslovakia, one of the most developed countries in the world with strong manufacturing industry before WWII **forced by the Soviet bloc to shift its production to heavy industry, especially metallurgy, steel industry, coal carbonization, heavy chemical industry and mechanical engineering**
- enormous energy demands of heavy industry satisfied by mainly **brown-coal fired plants** -> pollution + strip mining; none of the coal plants had a desulphurization equipment
- **socialistic farming** -> adverse impacts on agricultural landscape, excessive use of fertilizers, chemical pest control
- protection on some level existed (water law, forest law, laws on state protection of nature and agricultural land, measures against air pollution) -> **production was, however, the priority**
- adverse effects became very visible in 1970s and 80s ->
    - dead trees in "Krusne hory",
    - unnatural color of rivers in Northern Bohemia (Usti nad Labem),
    - "moonscape" areas …. areas of strip mining,
    - life expectancy of people living in polluted areas of North-Western Bohemia and Northern Moravia significantly **below national average**, which itself **lower than the average in Western Europe**
- emergence of professional and civic environmental activists – some of them **banned and punished by the regime**

- in 1980s the problem became evident -> environmental committees of the communist party were established, some tangible measures were implemented (e.g. fly-ash separators installed in power plants)
- 2nd half of 90s citizens becoming conscious of the problem, the environmental protection became a **recognized priority after 1989**

⇨ **Lots of domestic efforts and policies focused on adverse impacts of socialist economy on the environment and the governments in the years shortly after the fall of communism tried to fix as many urgent issues as possible…**

4 periods of the development of environmental protection in CR after 1989

Founding Period (1989–1992)

- started with the so-called Rainbow Program, a political document focused on preparation and approval of new environmental laws (especially new laws on **waste, air, nature and landscape protection and environmental impact assessment**) and on amendments of some laws from the previous period.
- new regulations struggled to achieve the **best possible improvement of the environment in the shortest time** and contained a number of transformation features (e.g. very strict rules of trans-border waste shipments, temporary emission limit values or temporary unsecured landfills).
- the **assessment of resulting economic impact was not a priority**
    - the economy was in a period of **economic transformation** which made the economic impact assessment almost impossible.
- old public administration institutions were transformed and **new institutions** were established (especially the Ministry of the Environment and the Czech Environmental Inspectorate) as well as supportive organizations (such as the State Environmental Fund of the Czech Republic or the Czech Environmental Institute).
- the public interest in the environment was high, the condition was improving mainly thanks to the **economic transformation: restrictions or shut-downs of many energy-intensive and polluting industries**

Implementation Period (1993–1998)

- the environmental laws had been drafted and their implementation started
- unsafe **landfills closed**,
- **purification devices installed** in power plants and other pollution-producing facilities,
- **gas pipelines installed in cities** and in the country within a global program,
- **waste water treatment plants and sewer** systems built in some places.
- the **environmental impact assessment (EIA)** became a common practice.
- annual investment costs made up between 2 and 2.4 % of the GDP

- the condition of basic environmental elements, namely air and water, started to improve fast (values of some pollution indicators were decreasing by more than 10 % a year).
- on the other hand, the **public interest** in the environment **was receding**.
- In 1995, after long political debates, a **new national environmental policy** was approved with **the aim to achieve the EU15 level of the environmental quality by 2005**.
- 1994 **negotiations with the OECD => certain liberalization of existing laws** (especially on waste management) and preparation of new laws (especially on chemical substances and preparations)

Pre-Accession Period (1999–2003)

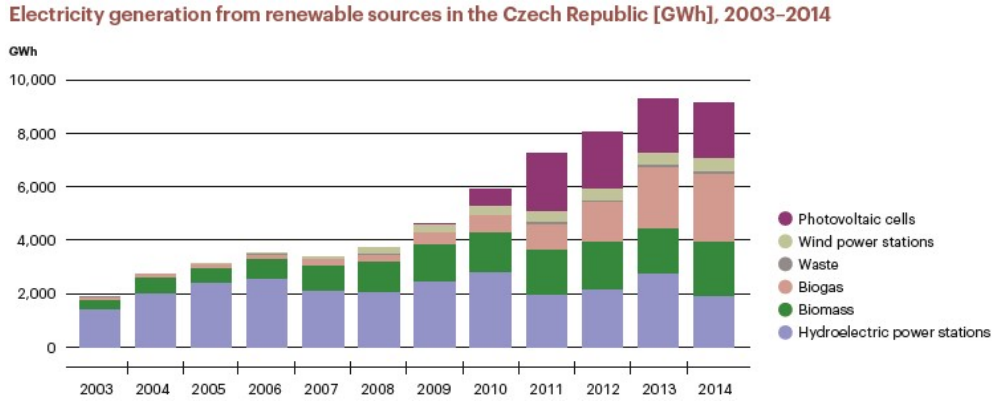
- the main objective was to prepare CR for **accession to the European Union.**
- a second generation of environmental legislation was prepared and passed; **virtually all existing legal regulations** were replaced by new ones and issues which had not been dealt with were newly regulated
    - GMO,
    - industrial accident prevention,
    - integrated pollution prevention and control – IPPC,
    - packaging and package waste,
    - access to environmental information
    - etc....
- the whole process finished in June 2003; the European Commission provided the Czech Republic with three transition periods (concerning directive on packaging and packaging waste, directive on urban waste water treatment and the deadline of emission limits for sulphur dioxide from two large combustion plants).
- the **condition of environmental elements was stabilized at the level of "worse EU average**",
- the **investment in environmental protection dropped** to 0,7 % of GDP
- the **public interest remained quite low**
- the new 1999 national environmental policy, fully compatible with the environmental policy of the European Communities was updated in 2001

European Period (from 2004)

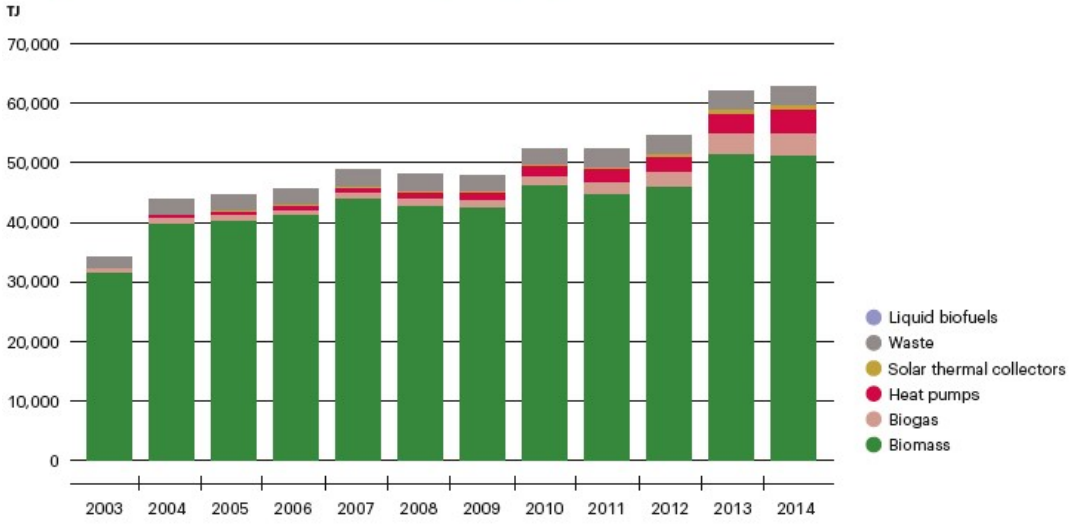
- meant basically a **continuation of trends** which had started in the previous period, i.e.
    - stabilization of the environment,
    - investment of 1 % of GDP,
    - low public interest...
- the **legislation was amended continuously with respect to the development of European regulations** and on the basis of existing experience with the implementation.
- In 2004 a new national environmental policy of the Czech Republic was approved with effect until 2010.

More recent developments (based on "2010 and later" reports)

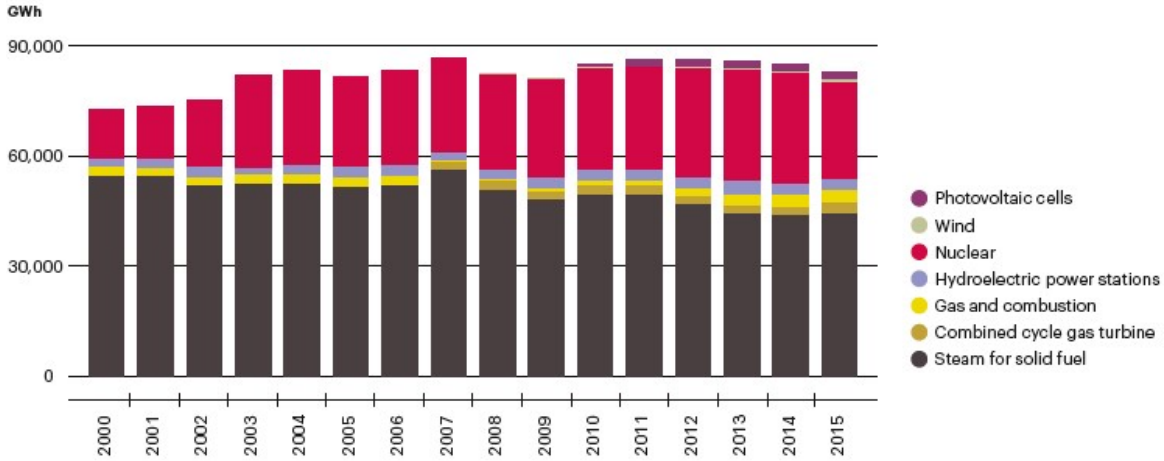
- The State of the environment in the Czech Republic is **improving,** albeit decline of the economy in 2012 contributed to the improvement, then the period of economic recovery has contributed to somewhat worsened trends in selected environmental indicators in recent two years
- As a result of **technological development and growth of material and energy efficiency** of the economy, there is gradual decline in specific environmental burden per unit of GDP.
- The environmental impact of the economy has been decreasing in long terms, although it is **still above the average in the context of the EU27 countries** → due to the
    - **significant share of industry** in the GDP creation,
    - **high mining/extraction and consumption of fossil fuels** (the volume has been declining since 2000 though)
    - **over-generation of electric energy** (CR is net exporter!).
- emissions of the following pollutants have all been **decreasing** in long terms:
    - acidifying substances,
    - ozone precursors,
    - emissions of primary particles and secondary particulate precursors
    - greenhouse gas emissions from manufacturing industry
    - surface and groundwater pollution
- In the energy sector, electricity and heat generation from renewable energy sources has been growing,
    - in 2012 this was mainly due to **biogas stations**.
    - Over 2010-2011 it was mainly due to the large increase in the proportion of photovoltaic power stations in electricity (small inter-annual fall in 2012 due to changes in support policy)
    - The generation of electricity in **coal-fired power stations** and associated environmental pollution, however**, is declining only very slowly** due to significant exports of electricity ☹



Heat production from RES in the Czech Republic [TJ], 2003–2014



Electricity generation by the type of power stations in the Czech Republic [GWh], 2000–2015



Electricity generation by fuel type in the Czech Republic [%] 2015

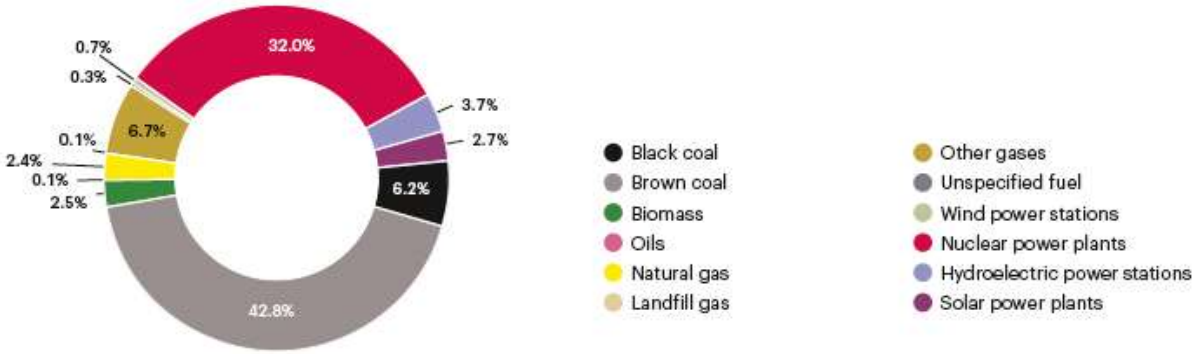


Chart 1 → **Final energy consumption trends by resource in the Czech Republic [PJ], 2000–2013**

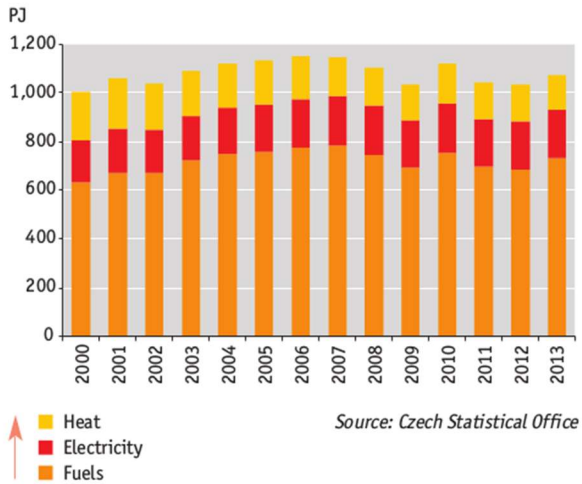
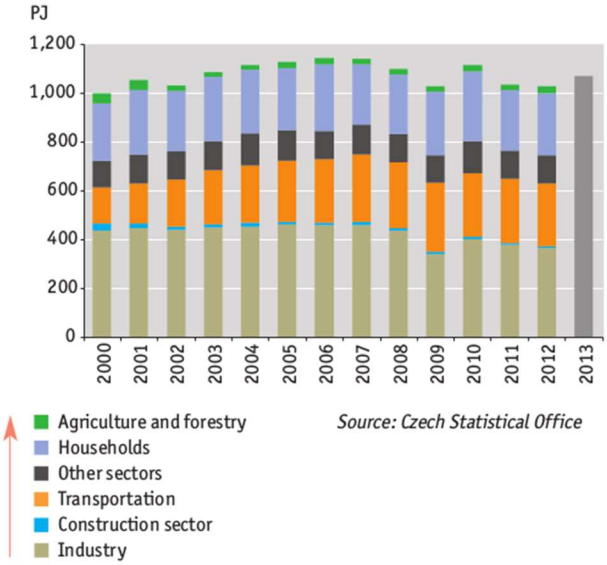
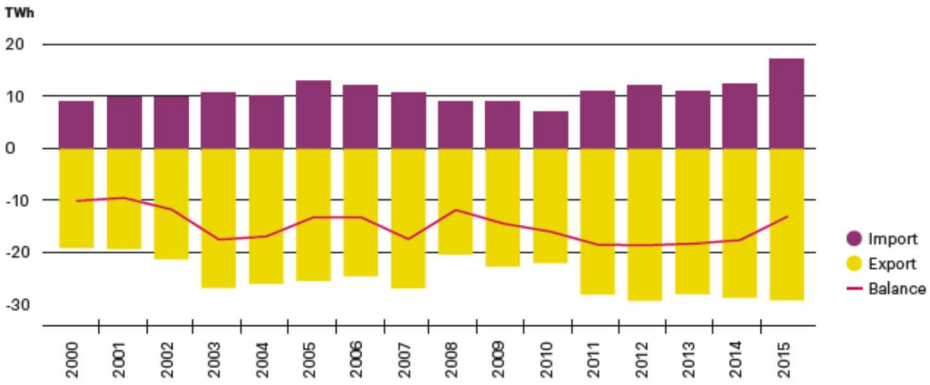


Chart 2 → **Final energy consumption trends by sector in the Czech Republic [PJ], 2000–2013**



Electricity imports and exports in/from the Czech Republic [TWh], 2000–2015



- Although the air pollution limits set for concentrations of single pollutants are not generally exceeded, **air quality in certain regions and localities still remains unsatisfactory:**
  - the agglomeration of Ostrava/Karviná/Třinec,
  - cities with heavy traffic (Prague!)
  - small settlements in valleys and localities with frequent inversions where local resources from household heating represent the major burden (a major source of emissions of suspended particles, PM10)
- A positive development can be observed in the (passenger) transport sector
  - **increase in rail transport within the passenger transport**
  - even though the share continues to increase (scale), the **fleet of motor vehicles is being modernized**.

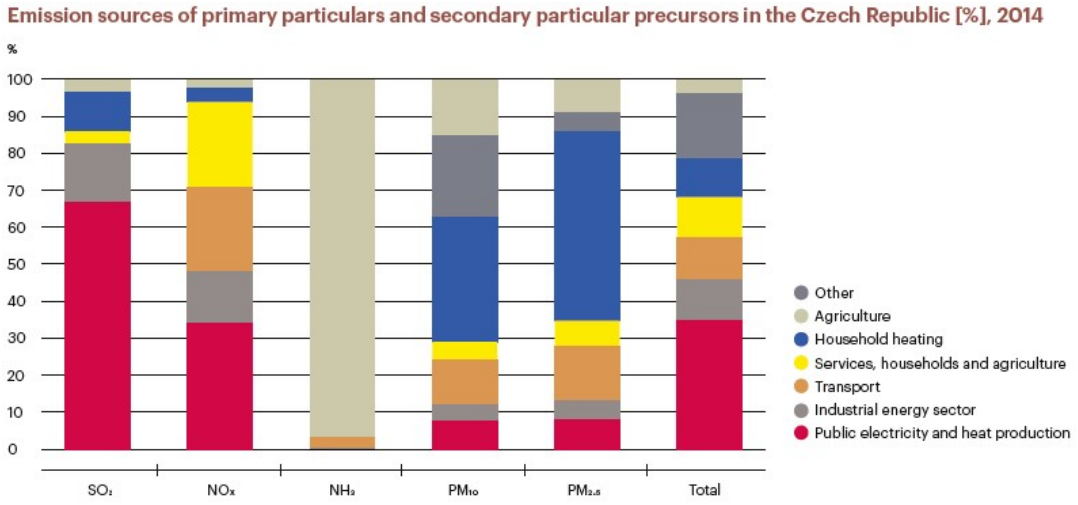
→ However, the structure of **freight transport remains a problem** (a great predominance of road transport; vehicles are being decommissioned only slowly)

- Road transport takes a significant part in the production of NOx emissions and contributes to increased noise and dust.
- As a result of increasing extent of built-up and other areas, including transport infrastructure, **landscape fragmentation has been growing.**
- there has been a **continued decline in water consumption and the quality of surface water has been improving.**

Key messages of the 2014 and 2015 reports (the more recent ones):

The state of the environment in the Czech Republic is **not satisfactory**.

- **The positive trend of the previous years has stopped; the main factor of the current development is the growing impact of household consumption**
- the fundamental problem of the environment remains **low air quality** in settlements, especially in the Moravian-Silesian Region and the Ústí nad Labem Region with main factors being
    - household heating (mainly in small settlements)
    - traffic
- The most problematic situation in the long term is in the Ostrava/Karviná/Frýdek-Místek agglomeration where the air quality is especially low due to
    - significant industrial load,
    - local household heating,
    - transport,
    - adverse dispersion conditions (settlements in inverse positions)…
    - long-range transmission of pollution
- in 2014, about 25% of the population of the Czech Republic was exposed to above-the-limit concentrations of PM10 which contributes to the increase in overall mortality, limit values were exceeded repeatedly also in 2015
- In 2014, **33.9%** of the total emissions of PM10 were caused by **home heating**!!!



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- **more than 50% of the population** live in areas where the maximum permitted concentrations of carcinogenic polyaromatic compounds **expressed as benzo(a)pyrene are exceeded.**

- The influence of **road freight transport** on air quality in sites congested by traffic and urban areas remains significant

  ➔ **Greenhouse gas emissions** and emissions of pollutants into the air are altogether decreasing; the Czech Republic fulfils the currently valid international commitments.

  ➔ The development of emissions reflects the declining energy intensity of the economy, reduction of the share of fossil fuels, technological progress in manufacturing industries => the air quality in the problematic areas of the Czech Republic is not improving, though

- positively, the **energy and material intensity** of the economy is decreasing.
  - share of coal burning power plants is gradually decreasing in favor of renewable energy sources and the use of nuclear energy.

  ➔ As a result of these trends, emissions of greenhouse gases and pollutant emissions are slightly decreasing.

  ➔ still, the foreign trade with electricity retains its export nature.
- the use of alternative fuels and drives is still negligible, we observe though a reduction in both emissions and energy consumption in transportation and growing share of public (personal) transportation

- Although the amount of discharged pollution from point sources has decreased, surface **water quality** is improving only slowly also due to continuing substantial pollution of water resources **from agriculture.**
  - large area of intensively farmed arable land with above average (of EU) and constant amount of mineral fertilizers
  - agriculture also affect the state of biodiversity → long-term declining populations of all species of birds, unsatisfactory amount of species of animals, plants and natural habitats (+impacts of landscape fragmentation mostly due to growing transportation)
- The **total water abstraction** started to stagnate; the proportion of the population connected to water supply systems and to public sewerage systems and the quality of waste water treatment is improving.
  - 19.2% of the population is still not connected to a sewerage system connected to a waste water treatment plant
- The reduction of the total amount of discharged waste water continues

➔ the health condition of **forests** (degree of defoliation), has been unsatisfactory in the long term (due to long-term air pollution load), after 2000 further deterioration was noted

➔ The quality of **agricultural land is not improving**, the contents of hazardous substances (e.g. PAHs, DDT) still exceed the permissible limits ➔ mostly caused by residual pollution from the past.

➔ The total acreage of agricultural land resources of the Czech Republic is decreasing; also a growth of organic farming continues, about **11.8%** of the total cultivated acreage agricultural land resources was **farmed ecologically** in 2015.

➔ about one third of **animal and plant species** of Community importance were marked as species in an unfavorable status and more than half of natural habitat were marked as habitats in an insufficient status.

- The quantity of bird species in the Czech Republic as well as in Europe is decreasing in the long-term.
- In 2014, about 16% of the territory of the Czech Republic was protected by the state and almost 14% of the total area of the country was protected as part of the Natura 2000 network.

➔ About one-tenth of the population living in the agglomerations of the Czech Republic are exposed to **excessive noise levels**, which are caused mainly by road transport.

➔ **The total waste generation** as well as the generation of municipal waste is stagnating.

- The material recovery of waste significantly prevails (83.2% of the total generation of waste in 2015)
- the most common method of waste disposal is landfilling (8.6% in 2015)
- Landfilling also prevails in the treatment of municipal waste (47.4% in 2015), 35.6% of municipal waste undergoes material recovery (over the years the trend is favorable, but changes are not too fast).
- The generation of packaging waste is increasing, the extent of recycled packaging waste is also increasing, though.

➔ **Investment in environmental protection increased** thanks to financial support from EU funds which might have positive impacts in the years to come; important investments into

- air protection
- support programs of insulation and energy savings
- support of heating technologies

➔ Overall, public expenditure on environment remains at mere 1% of GDP

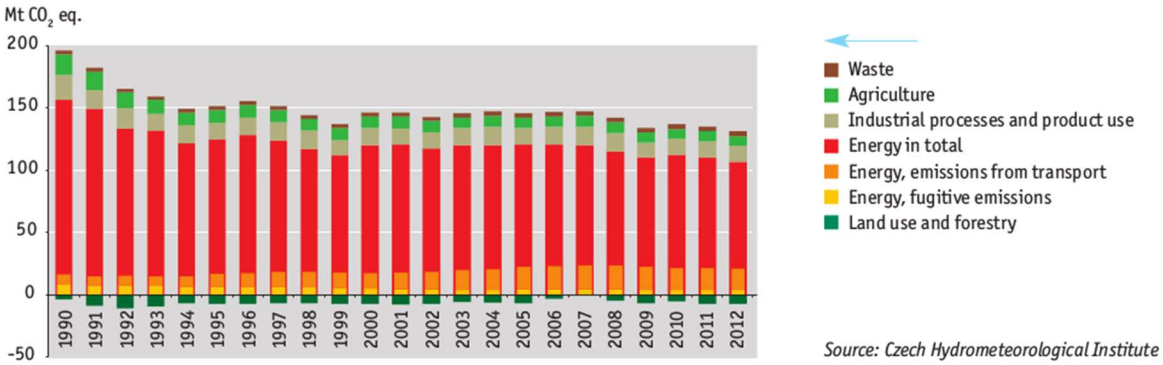
INDIVIDUAL AREAS OF ENVIRONMENTAL PROTECTION OVER TIME

(from late 1990's until 2014-15)

CLIMATE

- after more pressing problems (air and water pollution, waste management) have been solved, at the beginning of the pre-accession period, climate protection became more important, now no.1 issue in common with the EU

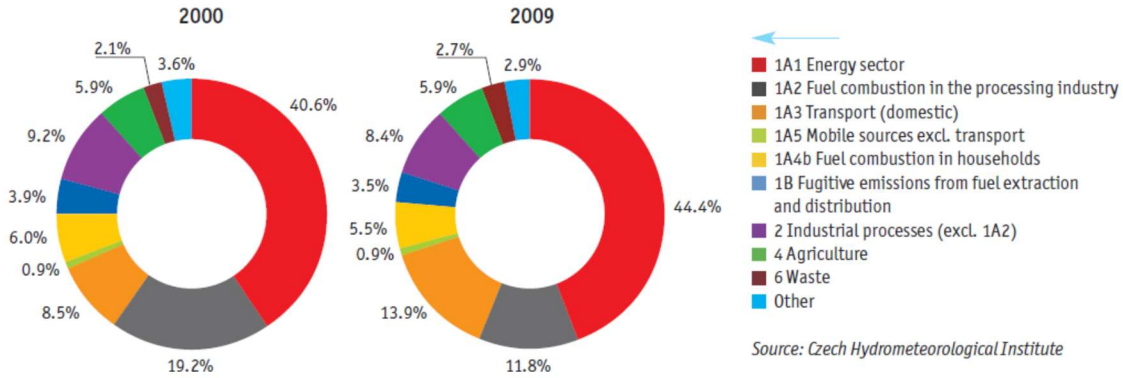
Chart 1 → **Development of aggregate greenhouse gas emissions by sectors in the Czech Republic [Mt CO_2 eq.], 1990–2012**



Source: Czech Hydrometeorological Institute

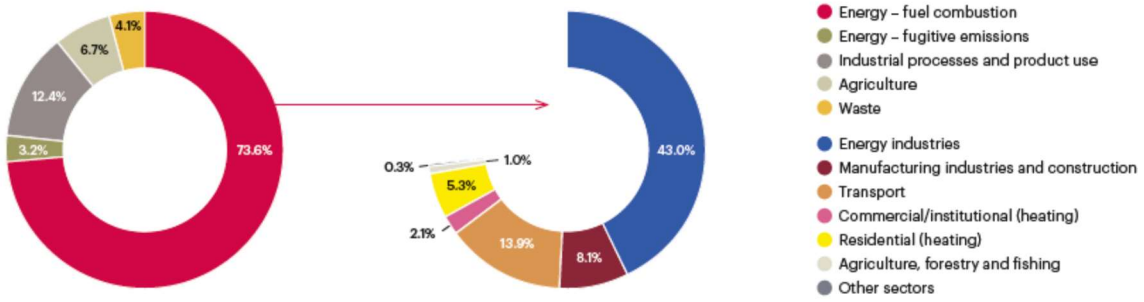
Data for year 2013 are not, due to the methodology of their reporting, available at the time of publication.

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



Source: Czech Hydrometeorological Institute

Structure of greenhouse gas emissions by major source categories [%], 2014 (excluding LULUCF)



Data for the year 2015 are not, due to the methodology of their reporting, available at the time of publication.

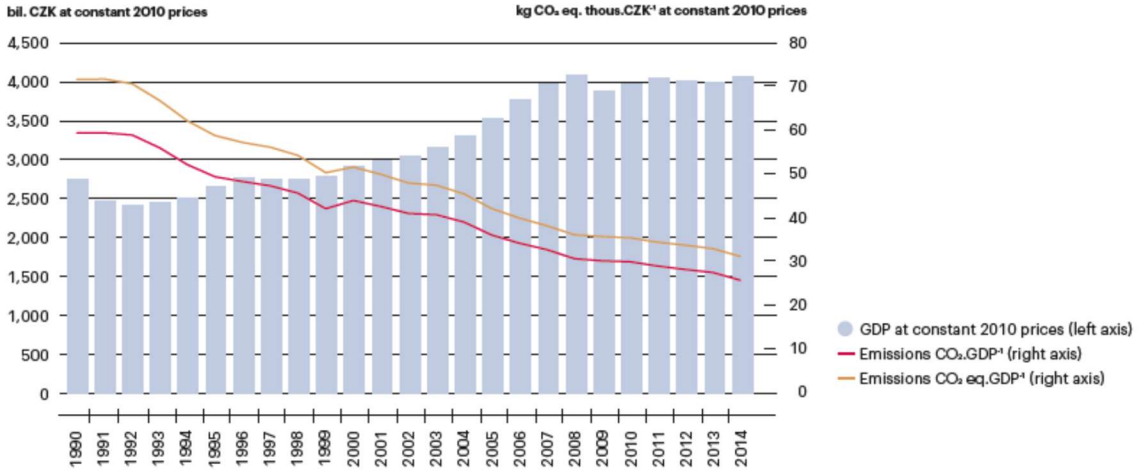
Source: Czech Hydrometeorological Institute

- absolute majority of carbon dioxide, comes from **fossil fuel combustion in power industry** (fossil fuels make up almost 90 % of primary domestic energy sources), and from **transportation**
- the decrease in emissions between 1990 and 1992 **without any doubt caused by a drop in industrial production and the economic transformation** (reduction or complete shutdown of some energy-intensive productions)
- in 90s more than 2000 MW of installed output in coal-fired power plants was closed, smaller sources changed fuel (to natural gas) and increasing industrial production came along with modern and energy efficient installations.
- since 1998 the emissions have stabilized at about 76 % of the base year 1990

- **current problem:**
  - levels of specific carbon dioxide emissions per capita and year for CR exceeds both the OECD average and the EU15 average
  - there had been an increasing proportion of emissions from transport, which accounted for 13.9% of the total national emissions in 2009 (not much of a change until 2014 due to some offsetting trends, see above)

- **positive facts:**
  - compliance with the Kyoto Protocol commitments
  - between 2008 and 2009, annual emissions decreased by 5.8% (the largest year-to-year decline since 1994) and the emission intensity of the economy has been decreasing (a 32.6% drop compared to 2000).
  - share of green energy has been growing as well (we will discuss that later), in line with commitments
  - emission intensity of the economy has been on a declining trend partly due to growing GDP

Evolution of the emission intensity of the economy of the Czech Republic [kg CO_2 eq.thous. CZK^{-1} at 2010 constant prices] and GDP [bil. CZK, at 2010 constant prices], without the LULUCF sector, 1990–2014



Data for the year 2015 are not, due to the methodology of their reporting, available at the time of publication.

Source: Czech Hydrometeorological Institute, Czech Statistical Office

Ozone Layer

- the risk of the depletion of the Earth ozone layer is viewed as a serious global problem, which has been successfully handled at the international level
- first addressed in the CR in the early 1990s, when appropriate legal regulations based on international treaties (Vienna Convention, Montreal Protocol) were passed and implemented.
- In the early 1990s the annual use of ozone depleting substances in CR was over **5,000** tons
- Since January 1, 1996, the production and import of “CFCs” (Chlorofluorocarbon = a class of chemical compounds that deplete ozone) were outlawed and more restrictions were placed on other categories of regulated substances.
- The basic use of ozone depleting substances is now covered by imports and does not exceed **200** tons per year.
- CR meets its obligations resulting from the Montreal Protocol and its amendments
- Between 1990 and 2010, the emissions of ground-level ozone precursors (VOC, NOX, CO and CH4) dropped by approximately 61%. The decline in emissions for 2000–2010 was 22%.

Chart 1 → **Total emissions of ozone precursors in the Czech Republic and the levels of the national emission ceilings (for VOC and NO_x) for 2010 [index, 2000 = 100]; [kt. year^{-1} weighted by the TOFP], 2000–2013**

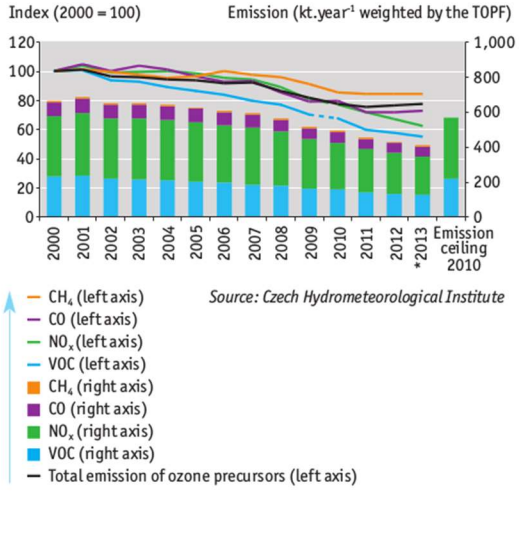
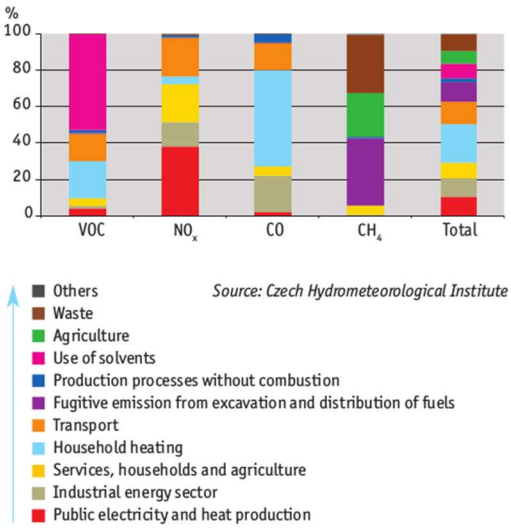


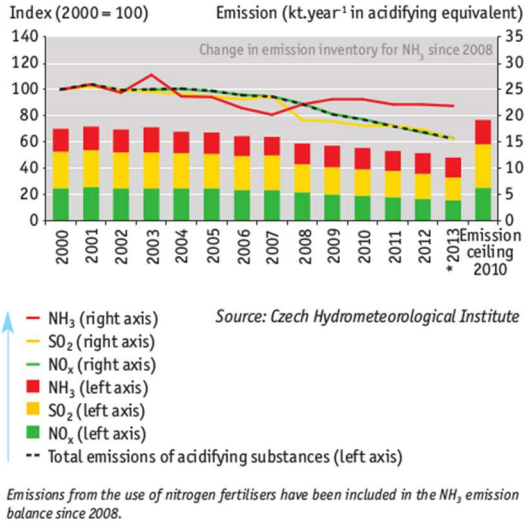
Chart 2 → **Sources of ozone precursors emissions in the Czech Republic [%], 2012**



Air

- **air pollution was the most pressing issue at the beginning of the Founding Period**
- national emissions of most major pollutants (especially **suspended particular matter**, **sulphur dioxide** and **nitrogen oxides**) were <u>one of the highest in the world</u> and the air pollution of some regions (especially in North-Western Bohemia and Northern Moravia) was causing serious **health problems** and **large forest damage**.
- **1st generation of new legal regulations of air protection, passed in 1991, was focused on the biggest air pollution decrease possible in the shortest time**.
- In late 90s the emission and pollution levels stabilized and more attention was paid to the transposition of EC regulations
- air protection can be divided in two areas: emissions and air pollution levels
- emissions of all monitored pollutants dropped between 1990 and 1998; like with GHG emissions, the main reason during the Founding Period was **economic transformation** and resulting **cuts or shutdowns in some energy-intensive and polluting productions**.
- between 1993-1998 the decrease in air pollution was caused by the implementation of **emission reduction measures** like the
    - introduction of dust filters,
    - introduction of desulphurization units,
    - installation of gas pipelines,
    - implementation of protective measures in industrial pollution sources,
    - installation of smog warning and regulation systems

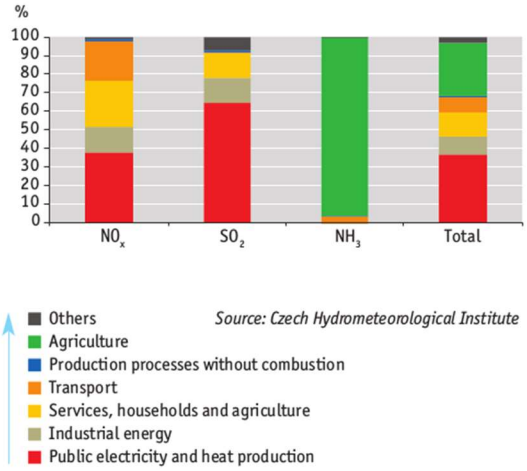
Chart 1 → **Total emissions of acidifying substances in the Czech Republic and the level of national emission ceilings for 2010 [index, 2000 = 100]; [kt.year^{-1} in acidifying equivalent], 2000–2013**



Source: Czech Hydrometeorological Institute

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

Chart 2 → **Sources of emissions of acidifying substances in the Czech Republic [%], 2012**



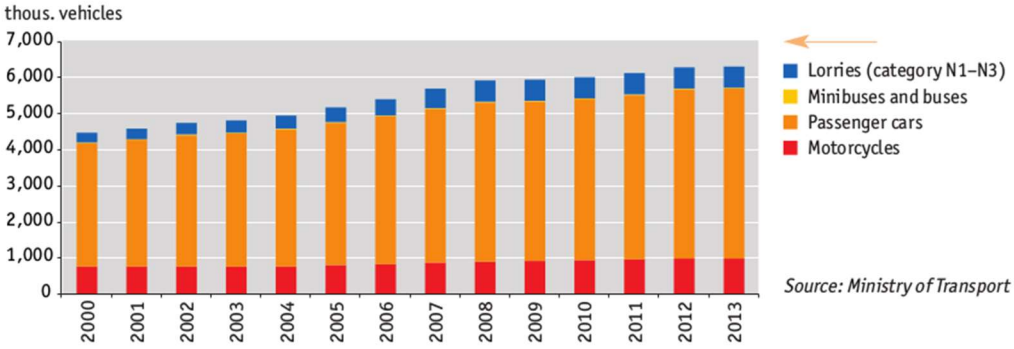
Source: Czech Hydrometeorological Institute

Emissions of NH_3 come from livestock breeding and use of mineral nitrogen fertilisers.

- **for nitrogen oxides the change is less distinct: the positive influence of reduction measures was partially offset by transport increase**
- the **share of road transport is increasing**, although it is **partly moderated by fast car enhancement** (increase in the number of cars with catalyzers from zero in 1990 to approximately 47.5 % in 2004).

INDICATOR ASSESSMENT

Chart 1 → **Development of the number of registered motor vehicles in the Czech Republic [thous. vehicles], 2000–2013**

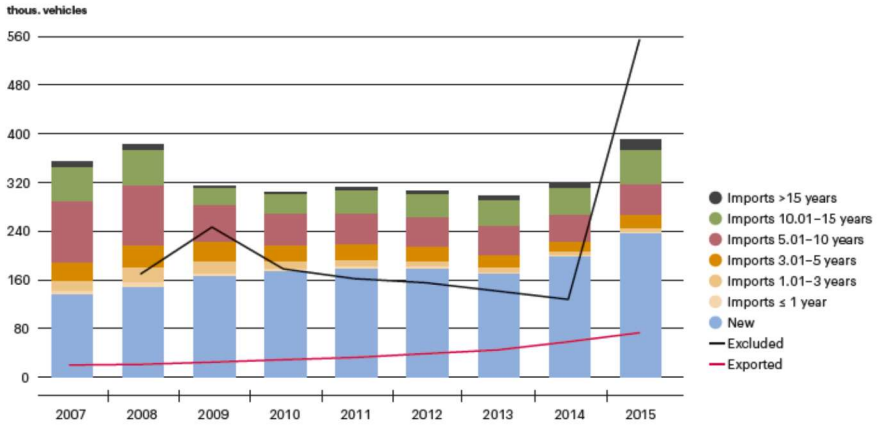


Source: Ministry of Transport

Due to transition to the new vehicle registration system in the Central Register of Vehicles in accordance with EU legislation, the data for 31st December 2012 are not available; the data for the year 2012 are related to 1st July 2013.

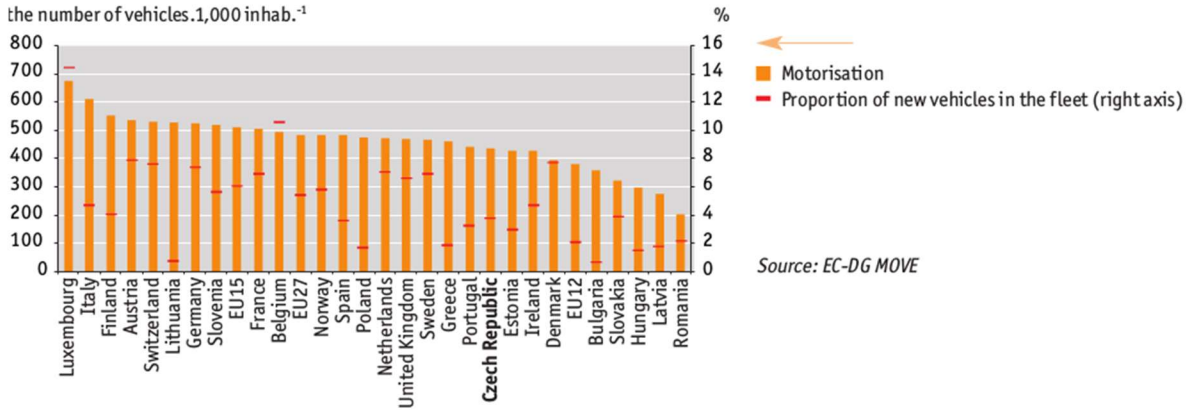
- Still, see **the share of imported second-hand cars and average age of cars**...

Number of registrations of new passenger cars, imported second-hand cars, exported and excluded vehicles [thous. vehicles], 2007–2015



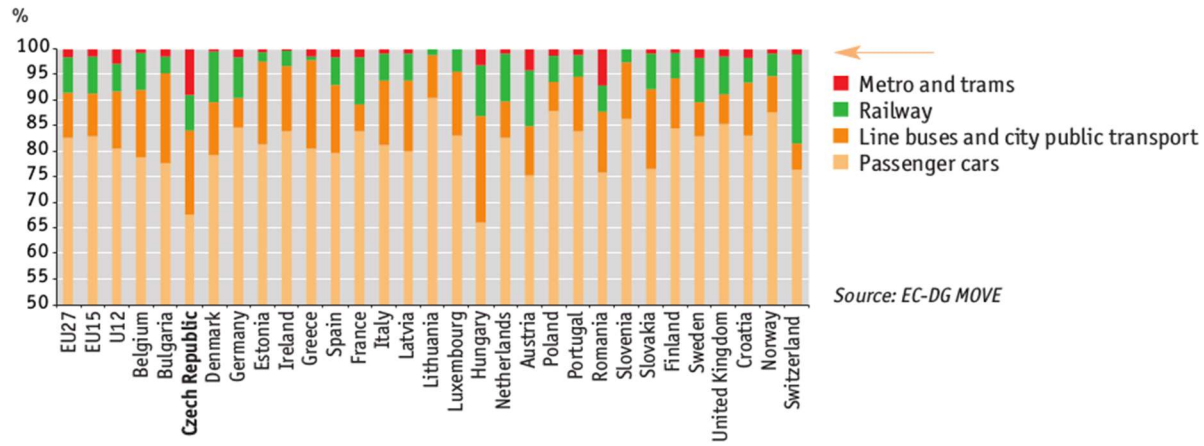
The significant increase in deregistered vehicles in 2015 includes most of the administrative deregistration of non-existent vehicles and vehicles in the half-transfer from the Central Vehicle Register. According to the information of the Car Importers Association only 111,222 vehicles were physically discarded.

Chart 3 → **Motorisation and the proportion of new vehicles in the total size of passenger cars fleet [the number of vehicles.1,000 inhab.$^{-1}$, %], 2011**

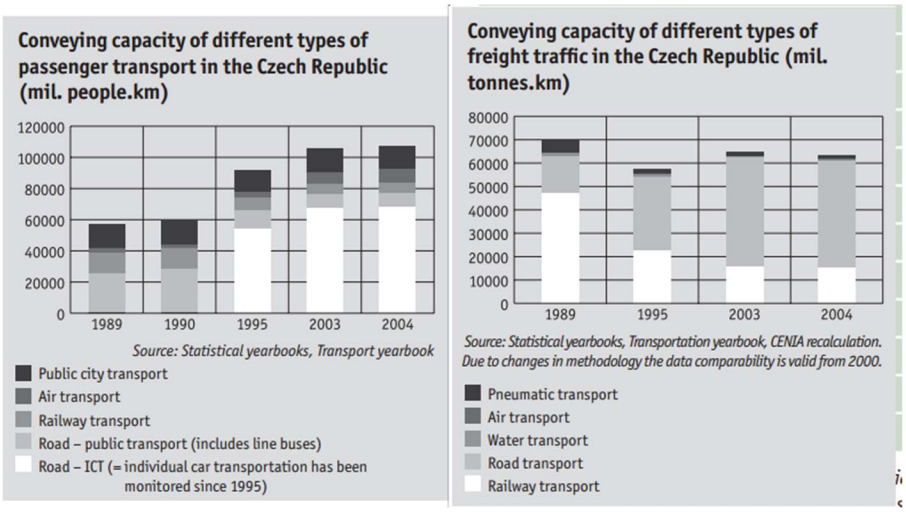


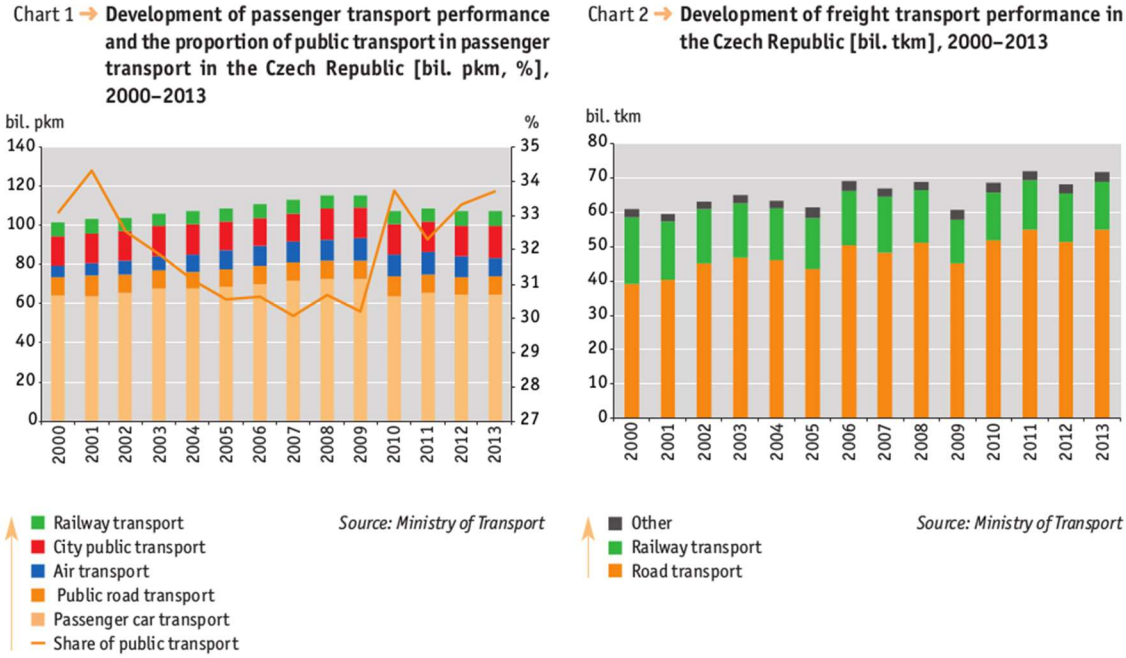
Source: EC-DG MOVE

Chart 2 → **The structure of passenger transport performance according to modes of transport, excluding air transport [%], 2011**



Source: EC-DG MOVE





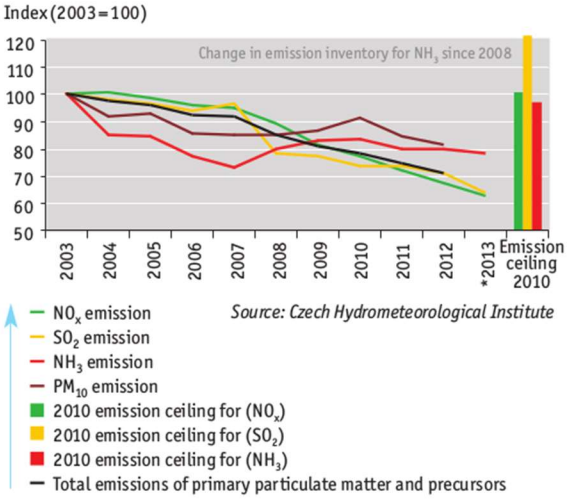
[Note: methodological change for passenger car transport in 2010, public excludes air transport]

- after 1998 the emission reduction slowed -> stabilization (only exception is 50 % y/y drop in lead emissions caused by the prohibition of leaded petrol distribution effective from January 1, 2001)

...Back to air quality indicators....

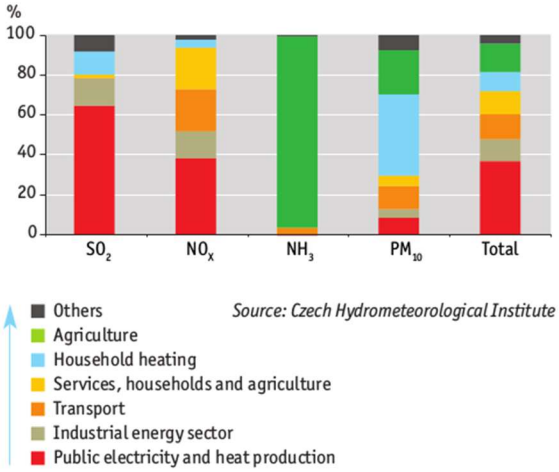
- Alongside nitrogen oxides, high emission **of dust (PM_{XY}) and ground-level ozone** is also one of **the most pressing problems** of the Czech Republic

Chart 1 → **Development of emissions of primary particulate matter and secondary particulate matter precursors in the Czech Republic and the national emission ceilings (for NO_x, SO_2 and NH_3) for 2010 [index, 2003 = 100], 2003–2013**



Source: Czech Hydrometeorological Institute

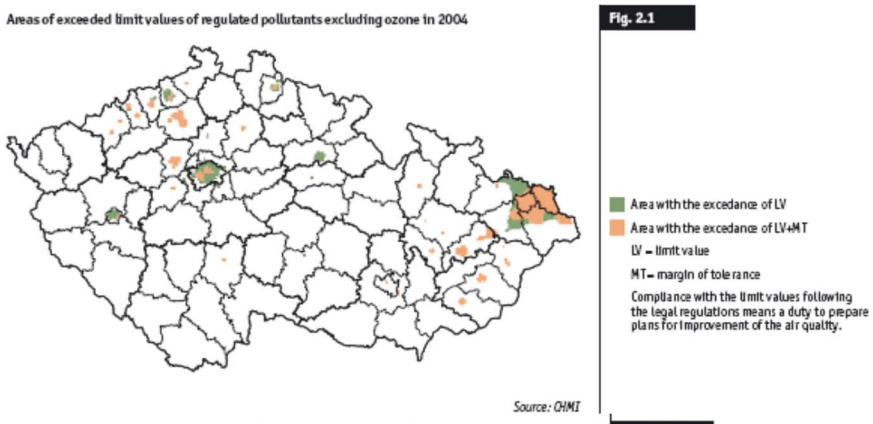
Chart 2 → **Emission sources of primary particulate matter and secondary particulate matter precursors in the Czech Republic [%], 2012**

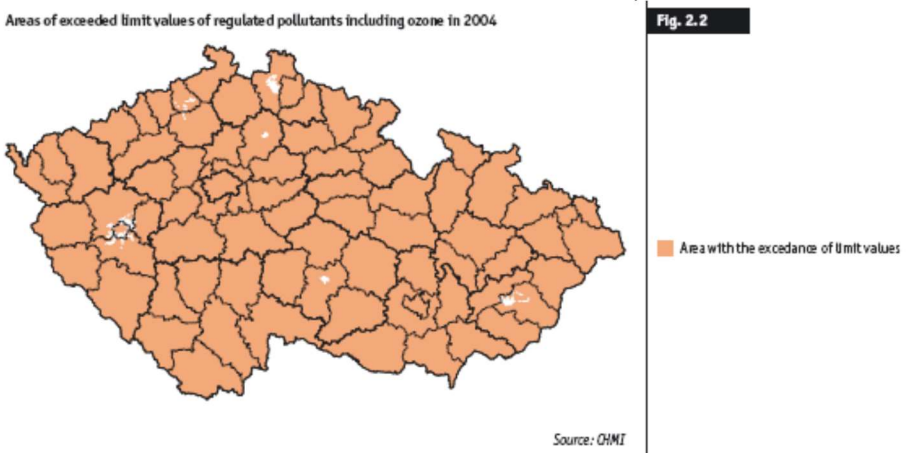


Source: Czech Hydrometeorological Institute

-

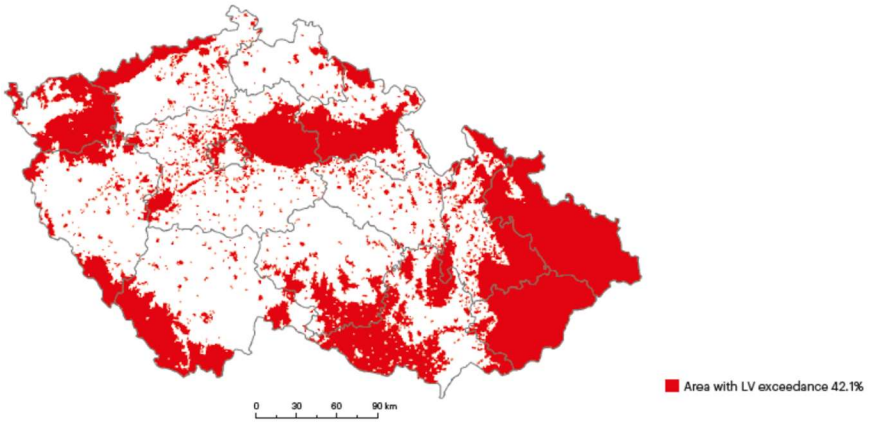
- emission of dust is reflected in exceeding limit values for human health protection for suspended particulate matter (PM10),
- most exceeded areas concern PM10, other limit values are exceeded only in very limited but densely populated areas, especially in Prague and Ostrava





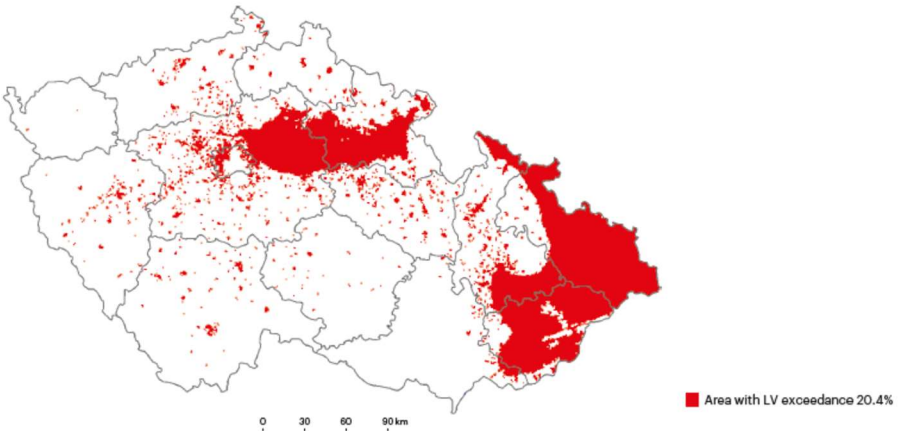
⇨ at least one pollution limit value (usually for ozone) exceeded in majority of area 15 years after the Velevet Revolution; 2015 →

Areas within the Czech Republic with exceeding of the health protection limit values (including ground-level ozone), 2015



Source: Czech Hydrometeorological Institute

Areas within the Czech Republic with exceeding of the health protection limit values (excluding ground-level ozone), 2015



Tropospheric ozone

From Wikipedia, the free encyclopedia

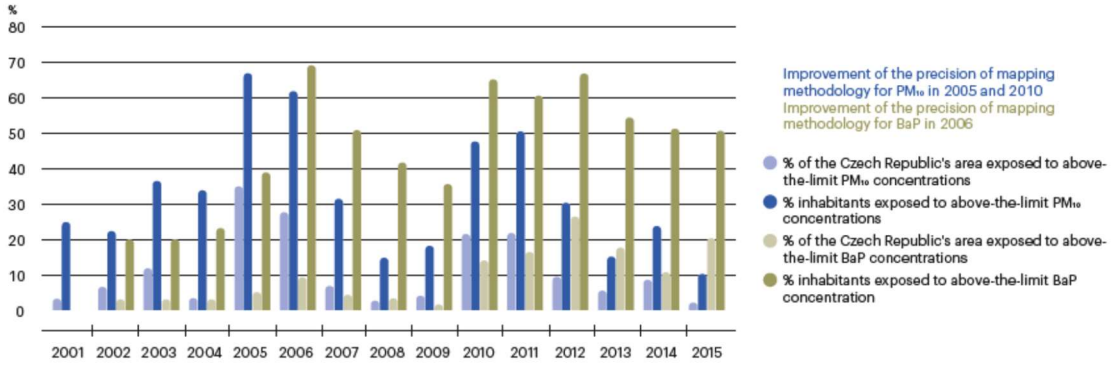
At abnormally high concentrations brought about by human activities (largely incomplete combustion of fossil fuels, such as gasoline, diesel, etc.), it is a pollutant, and a constituent of smog. Many highly energetic reactions produce it, ranging from combustion to photocopying. Often laser printers will have a smell of ozone, which in high concentrations is toxic. Ozone is a powerful oxidizing agent readily reacting with other chemical compounds to make many possibly toxic oxides.

Tropospheric ozone is a greenhouse gas and initiates the chemical removal of methane and other hydrocarbons from the atmosphere. Thus, its concentration affects how long these compounds remain in the air.

- in recent years, the picture (including ozone) is better
    - partly because ground-level ozone concentrations **are influenced by weather** in the warmer half of the year.
- pollution caused by tropospheric ("ground") ozone has been a long-term problem of whole Europe; it comes from photochemical reactions between gas precursors (nitrogen oxides and VOC), as the main sources of the precursors are combustion engines, it is very difficult to reduce the emissions

- As for (**non-)compliance** with ambient air quality standards for **suspended particulate matter** PM10, this has remained a problem in CR (and in number of other states)
- most problematic regions are
    - the Moravian-Silesian region,
    - Prague,
    - parts of the Central Bohemia,
    - Usti nad Labem
- The biggest proportion of air pollution comes from **local furnaces burning solid fuels** and from **traffic** (not only exhaust fumes, but also abrasion of tires and brakes and road surface) – primary particles
- another group of major air pollutants are **"secondary particles" from gas precursors** (sulphur dioxide, nitrogen oxides, VOC and ammonia)
- health-wise, fine PM2.5 suspended particulate matter (or smaller ones) presents the biggest hazard
- In spite of the continuing drop in all emissions since 2000, concentrations of air pollutants remain the same.
- Limit values for NO2 are being repeatedly exceeded in heavy-traffic areas.
- one **positive fact** is that the limit values for sulphur dioxide in the whole country are complied with and the limit values for nitrogen dioxide are most of the time exceeded only in Prague
- CR complies with its international commitments for air protection (the UN ECE Convention on Long-Range Trans-Boundary Air Pollution and 8 related protocols).
- **despite that the zones with worse air quality represent relatively small % of the CR area high % of population lives there!**
- the impacts of long-term exposure to these substances (PM_{XY}, BaP – carcinogen, results from incomplete combustion of organic matters, O_3) are serious, for short-term respiratory problems, increased incidence of asthma, cardiovascular problems to long-term problems and cancer (see more detail in the report, 2015, p.38)

Percentage of the Czech Republic's area and population exposed to above-the-limit 24-hour concentrations of PM_{10} and above-the-limit annual concentrations of BaP [%], 2001–2015



In 2005, a refinement of the mapping methodology was carried out and a model that combines the SYMOS model, the European EMEP model and the altitude data with the measured concentrations at rural background stations was first used in the construction of maps of PM_{10} concentration fields. In the year 2009, the methodology was refined again by applying the CAMx model. The SYMOS model includes emissions from primary sources. Secondary particulate matter and resuspended particulate matter that are not included in the emissions from primary sources, are taken into account within the EMEP and CAMx models. Between the years 2002–2007, the benzo(a)pyrene mapping methodology was gradually refined. In addition to the increase in the number of monitoring stations, a refinement in the mapping methodology was carried out in 2006. In 2006, a number of cities and towns were subsequently included in the territory with an exceeded BaP limit value.

Source: Czech Hydrometeorological Institute

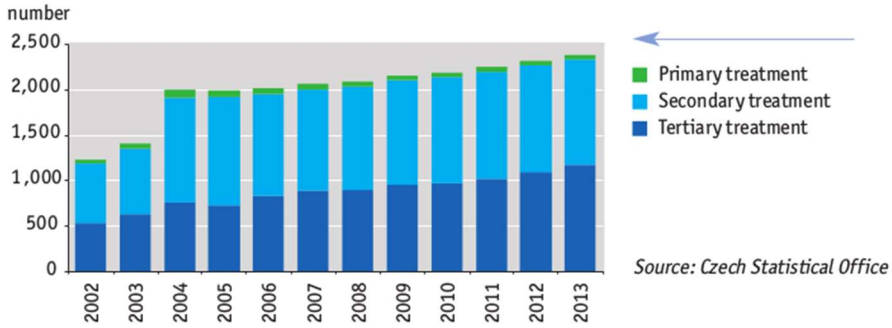
Water

- at the beginning of the 1990s water pollution was considered **the second most pressing issue**, with most important watercourses belonging to the category of polluted or heavily polluted and the contamination of groundwater being also high
- unlike with air pollution no new legal regulations were prepared and the situation was addressed by amendments to the law passed in the 1970s.
- Water protection focuses on two areas: emissions (water contamination, especially surface water) and water quality (both surface and underground water sources)
- attention was focused mainly on pollution discharged into surface water, i.e. construction, **rebuilding and intensification of waste water treatment plants and construction of sewer systems** (the number of households connected to sewer systems was increasing from 72.6 % (of which 71.2 % was treated) in 1990 to 78.8 % (of which 93.8 % was treated) in 2004; now over 80%

Waste water treatment plants 1990–2004

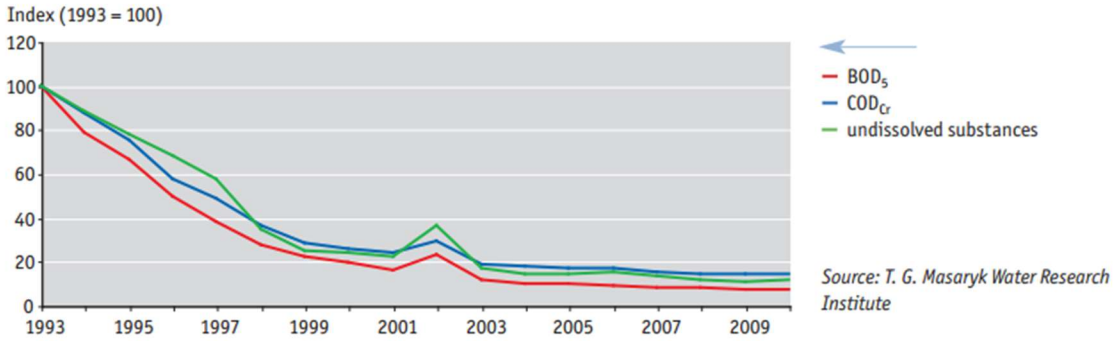
Source: CSO, WRI T. G.M., CENIA

Chart 3 → **Number of waste water treatment plants according to treatment stages in the Czech Republic, 2002–2013**



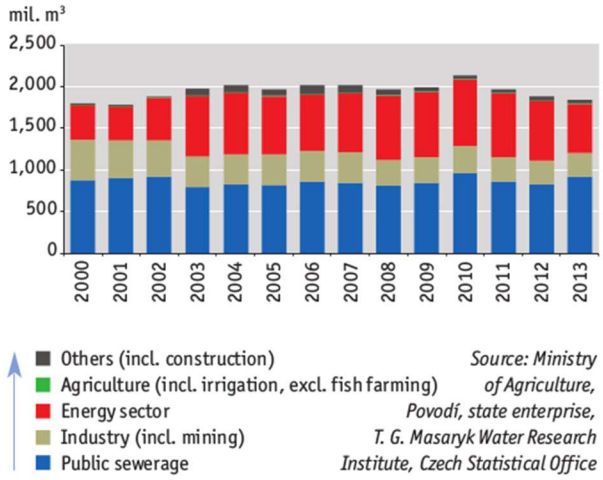
- Between 1993 and 2010, there was a significant decrease in pollution discharged by point sources in the Czech Republic.

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



- The most significant decrease in the amount of discharged pollution occurred in the 1990s, mainly due to the **restructuring of the national economy and also due to the extensive construction and modernization of waste water treatment plants.** The trend in discharged pollution since 2003 has been gradually positive.
- **cuts or shutdowns of some big industrial production entities brought also an important decrease in pollution from point sources**; some of the productions were phased out and all the exemptions from the water law were cancelled in 1990
- and the trends have continued after 2000

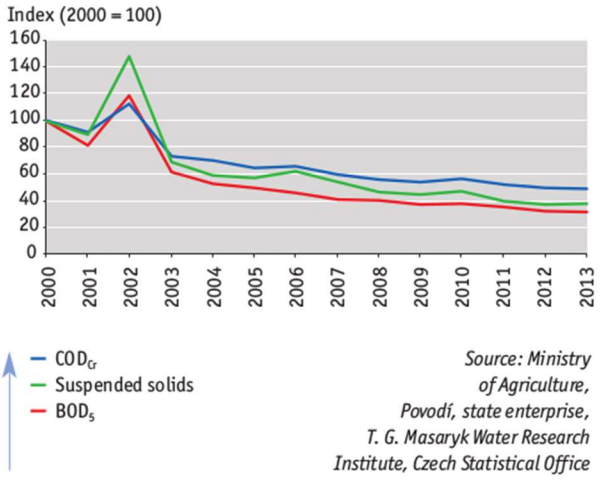
Chart 1 → **The quantity of waste water discharged into surface water in the Czech Republic [mil. m³], 2000–2013**



Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

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

Chart 2 → **Relative representation of pollution discharged from point sources – the BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 2000 = 100], 2000–2013**



Source: Ministry of Agriculture, Povodí, state enterprise, T. G. Masaryk Water Research Institute, Czech Statistical Office

- at the beginning of the Pre-Accession Period the quality of surface water was significantly improved and the quality of groundwater was stabilized => more attention was paid to the transposition of EC legal regulations which culminated when new comprehensive regulations concerning water were approved
- while treatment of waste water from **point sources** is technically feasible, though expensive, **surface sources have remained a pressing problem**, which is caused by the impossibility to reduce soil fertilization and plant treatment under a certain level and the fact that the fertilizers are washed out from the soil very slowly.

SURFACE WATER QUALITY

- "current" problems
    - **contamination of some parts of watercourses with specific pollutants** (hazardous chemicals, radioactive substances)
    - **risk of eutrophication** of water reservoirs (= *an increase in the concentration of chemical nutrients in an ecosystem => negative environmental effects such as anoxia and severe reductions in water quality, fish, and other animal populations may occur.*), caused mainly by nitrates and phosphates from sewage water
    - **denudation of cultivated land** (from diffusive sources).

Quality of surface water in the Czech Republic 1991–1992

Fig. 2.3

Class	Classification
I and II	Non-polluted and slightly polluted water
III	Polluted water
IV	Strongly polluted water
V.	Heavily polluted water

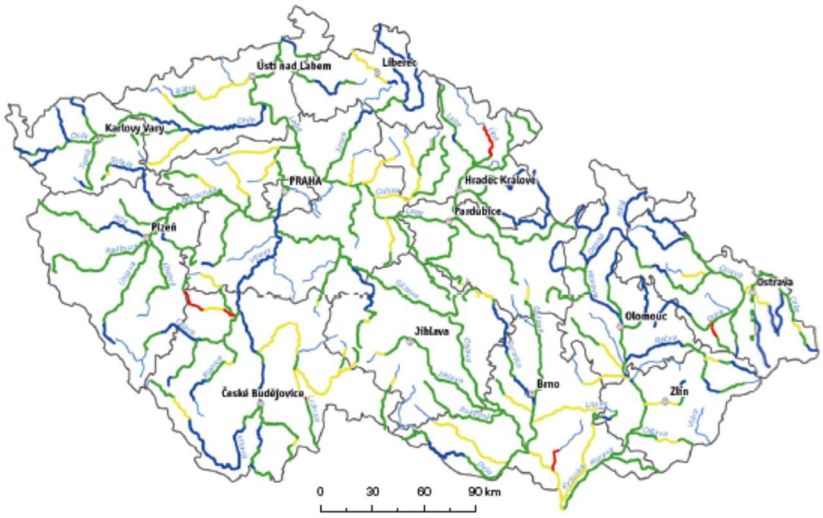
Source: WRI T.G.M. on the base of CHMI data

Quality of surface water in the Czech Republic 2003–2004

Fig. 2.4

Class	Classification
I and II	Non-polluted and slightly polluted water
III	Polluted water
IV	Strongly polluted water
V.	Heavily polluted water

Water quality in watercourses in the Czech Republic, 2014–2015



Assessments pursuant to CSN 75 7221

Class

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

Summary evaluation of the indicators BOD_5, COD_{Cr}, $N\text{-}NH_4^+$, P_{total} and saprobic index of zoobenthos.

- As all watercourses flow out of the Czech Republic and there is no water fed into the country, the whole Czech Republic was defined as a "**sensitive area**" in the EU terminology, meaning that it is subject to stricter parameters for treated sewage water.

GROUNDWATER

- the present quality of groundwater can be considered **stabilized and more or less satisfactory**
- there is a certain risk of "old environmental load" (old waste landfills, contaminated industrial zones)
- groundwater pollution, e.g. ammoniated ions from agriculture, which existed in the early 1990s, has been removed

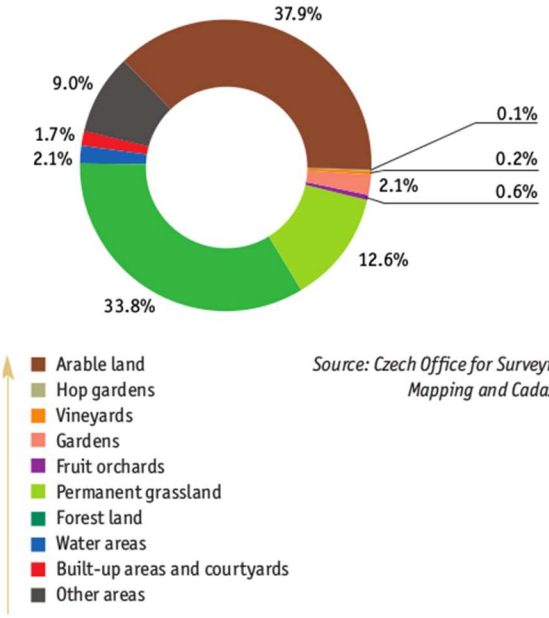
DRINKING WATER

- the number of inhabitants connected to the public water supply lines increased from 83.2 % in 1990 to 89.8 % in 2004; about 94% now
- the quality of supplied drinking water is mostly sufficient
- the problem is that more than 10 % of people, connected to the public water piping, are not connected to a sewage system

Soil

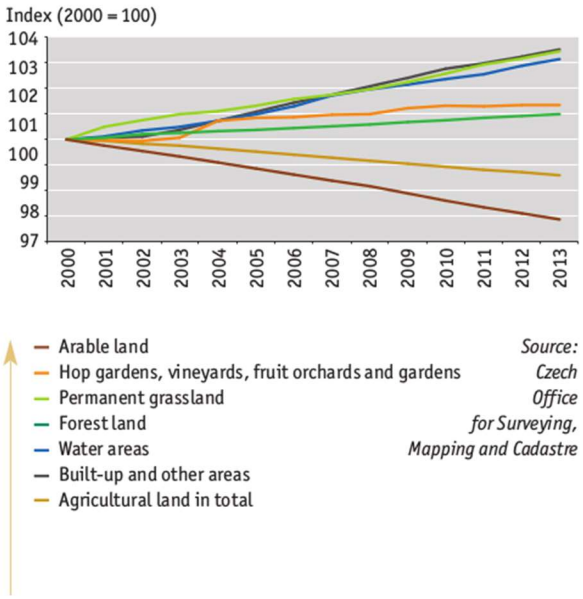
- The structure of land use is characterized by a high proportion of arable (37.8%) and forest land (33.8%) in the total land resources.
- The proportion of agricultural land resources in the total land resources of the Czech Republic in 2014 amounted to 53.5%, of which about 70.7% is arable land.
- the decreasing of the farm land cultivation area is very slow, cultivation of almost 71 % of agricultural land remains relatively high compared to the EU15 average (60.1 %)
- the quality of soil in the Czech Republic at the beginning of the Founding Period was affected by "socialist" agriculture (plant and animal large-scale production with a high use of fertilizers and pesticides) and by the atmospheric deposition due to high pollutant emissions into the air
- after 1990 there was a **radical decrease in the use of mineral fertilizers and pesticides**
- the Implementation Period brought environmentally positive changes in agriculture, cuts in some agriculture productions and a decrease in the atmospheric contamination fall-out.
- fast reduction of the negative impact on soil has, however, a **very slow response**
- in the early 1990s the content of **cadmium and lead** in the Central Bohemian region, the content of cadmium and mercury in Northern Moravia were **above the threshold levels,** and the content of **chromium** in Southern Moravia was occasionally high -> since then the situation has come under control, which can be explained by drop in use of mineral fertilizers and their quality and by lower atmospheric deposition
- **organic pollutants** (polychlorinated biphenyls, polycyclic aromatic hydrocarbons and organic chlorinated pesticides) exceed the threshold levels occasionally, they were used in large uncontrolled amounts in the past and due to their persistence they are only slowly eliminated

Chart 1 → **Land use in the Czech Republic [%], 2013**



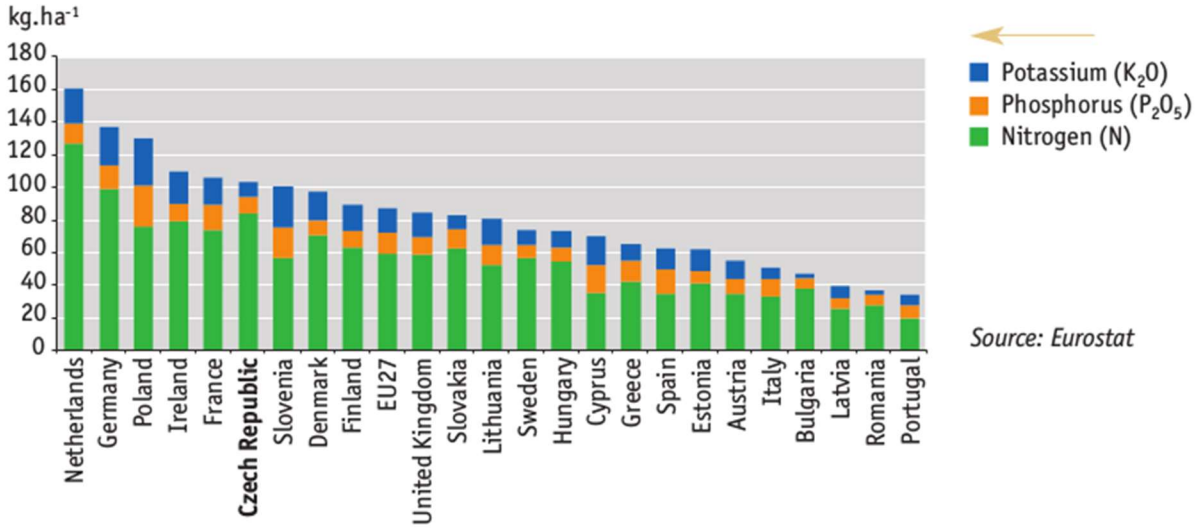
Source: Czech Office for Surveying, Mapping and Cadastre

Chart 2 → **Land use development in the Czech Republic [index, 2000 = 100], 2000–2013**



Source: Czech Office for Surveying, Mapping and Cadastre

Chart 2 → **Consumption of mineral fertilisers (N, P_2O_5, K_2O) [kg.ha^{-1} of utilised agricultural area], 2011**

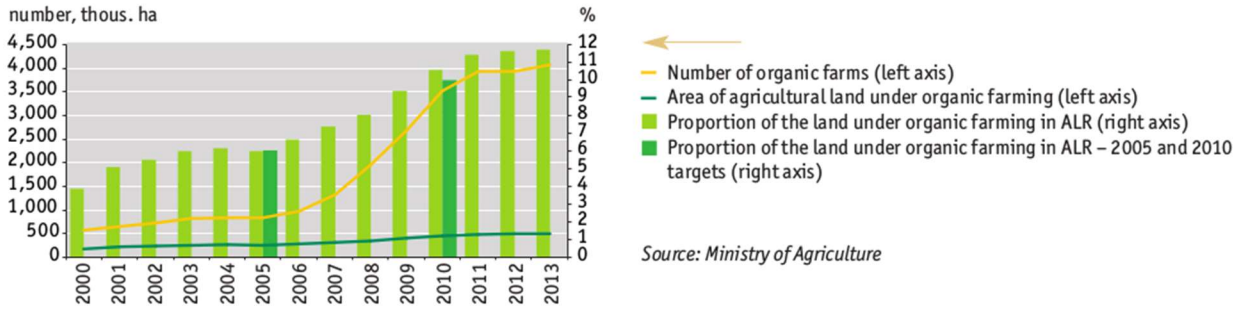


Source: Eurostat

-

- **erosion**, especially water erosion, remains a pressing problem. It is the result of long time intensive exploitation of soil; 50% of agricultural land is threatened by water erosion and 8.7% by wind erosion.
- other soil-related issues include compacting caused by heavy machinery and subsequent water retention and worse plant growth.

Chart 1 → **Organic farming trends in the Czech Republic [number, thous. ha, %], 2000–2013**



Source: Ministry of Agriculture

Geological environment

- affected by strip and underground mining of coal and other mineral materials (large-scale uranium leaching in Northern Bohemia)
  - ⇨ **vast landscape devastation**
  - ⇨ **imminent risk of land slip and large surface water contamination.**
- **black and brown coal mining** substantially decreased in the 1990s, **ore extraction discontinued completely** (reorientation of industry, reducing share of coal-fired power plants, employment of other fuels, like natural gas)
- **uranium extraction should be abandoned soon** (CR is the only EU country producing uranium, still the nuclear fuel needs to be imported because of lack of technology to turn crude uranium into fuel)

Forests

- CR is a country with an average forest area (the forest percentage is 34.1%, the OECD average was 34.4% in 2000), although it is the 8th most wooded OECD country in Europe
- **catastrophic condition of forests in 1989** was the best-known symptom of the bad environment (e.g. air pollution affecting particularly spruce mono- cultures).
- despite that pollutant emissions on forests were decreasing ("passive measures" like liming, fertilization and artificial forest reproduction and gradual changes in forest composition), **the condition of the forests has not improved sufficiently.**
- the age, species and spatial structure is not good
- **forest health is a chronic problem and solving it will take a long time, situation has not improved much, defoliation rate remains very high**

Nature and Landscape

- involves **landscape and species protections**
- at the beginning of the Founding period the condition of nature and landscape was equivalent to the condition of fundamental environmental elements – air and water

  - the landscape infrastructure was disturbed and the biological diversity was decreasing
  - the only national park established before 1989 was in the Giant Mountains (1963)
  - only 20 protected nature areas covering only 12% of the territory.
  - Act on Nature Protection, was passed in 1992 to serve as a comprehensive regulation for nature and landscape protection
- CR is a relatively densely populated country with extensive linear infrastructure which divides the landscape into fragments and limits the natural species migration, large parts of the territory are endangered by water erosion and are easily affected by floods
- a hot issue is the conflict of interests between the land required for the building of **transport infrastructure and utility buildings** and the effort to improve the landscape condition.
- the percentage of specially protected areas in the Czech Republic (15.9%) is slightly above the EU 15 average (12.1%) and the OECD average (12.4%)
- 3/4 of the existing national parks and 5/25 existing protected landscape areas were proclaimed after 1989
- at the moment the Czech Republic is building a part of the European network of protected areas known as NATURA 2000
- a recent issue of species protection is the genetically modified organisms (GMO) which might threaten the natural biological safety if they spread without control… Regulations concerning GMO were passed in the late 1990s

Waste

- main problems were **illegal landfills**, a **lack of legislative interest** and very little information about waste, its disposal and landfills before 1989
- waste disposal has changed significantly over the last 15 years
- the first generation of legal regulations from 1991 contained a number of time-limited transformation elements (e.g. stricter rules of trans-border waste shipment, temporary unsecured landfills)
- In early 90s **insecure landfills were closed down** (approximately 8,000 landfills) and new landfills were built, complying with the relevant environmental safety parameters and European regulations.
- at present the capacity of secured landfills is sufficient for decades
- in 1997 a second generation of legal regulations was approved influenced especially by the OECD requirements and in compliance with the Basel Convention on trans-boundary shipment of hazardous waste, bringing about certain **liberalization** of the waste movements and termination of waste management programs
- during the Pre-Accession period a third generation of legal regulations was approved, in compliance with the EC requirements**: the disposal of selected waste commodities was changed comprehensively** (electrical scrap, wrecked cars, batteries and accumulators, sludge, etc.), packaging disposal and return of some products.

- **"On one hand, waste disposal is closely related to environmental protection; on the other hand it is an industry with important turnover."** Three generations of regulations show that to set parameters in this industry is very difficult
- during the 90s the production of hazardous waste decreased and the volumes of municipal waste are comparable to other developed European countries.

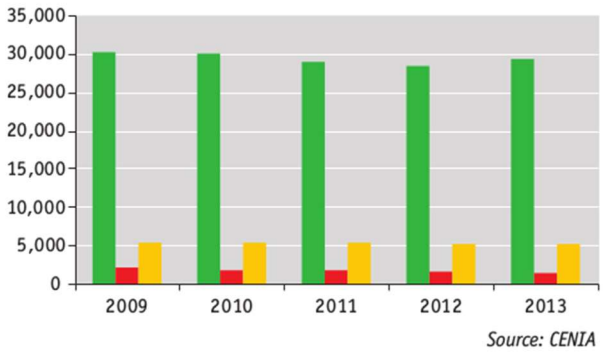
Chart 2 → **Total waste production by category (hazardous, non-hazardous and municipal) in the Czech Republic [thous. t], 2003–2010**

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

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

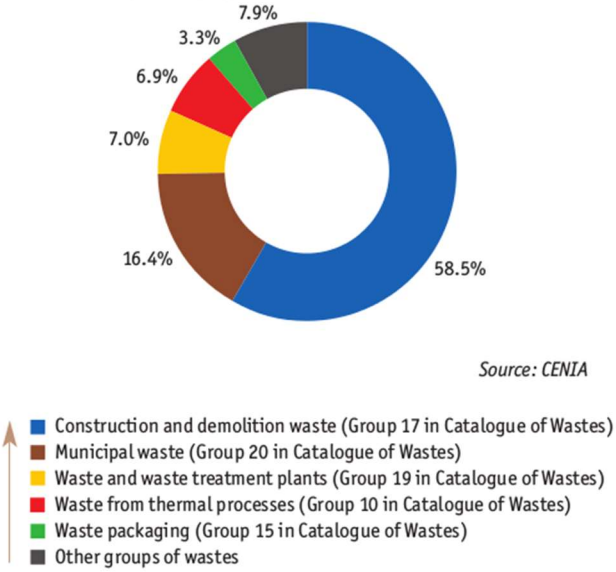
INDICATOR ASSESSMENT

Chart 1 → **Total waste production by category (hazardous, non-hazardous and municipal) in the Czech Republic [thous. t], 2009–2013**



Source: CENIA

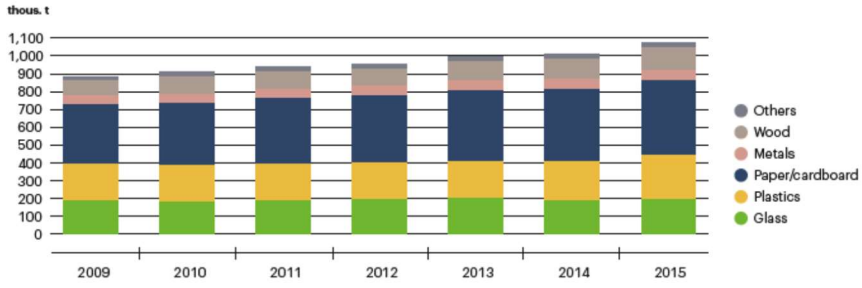
Chart 2 → **Structure of total waste production in the Czech Republic [%], 2013**



Source: CENIA

- waste monitoring was in the 1990s rather difficult.
- **increased waste recycling and the use of waste as secondary raw material are very positive**; In 2010, 70% of the total amount of produced packaging waste was recycled and 7.9% was used for energy recovery.

Packaging waste and packaging waste material structure in the Czech Republic [thous. t], 2009–2015

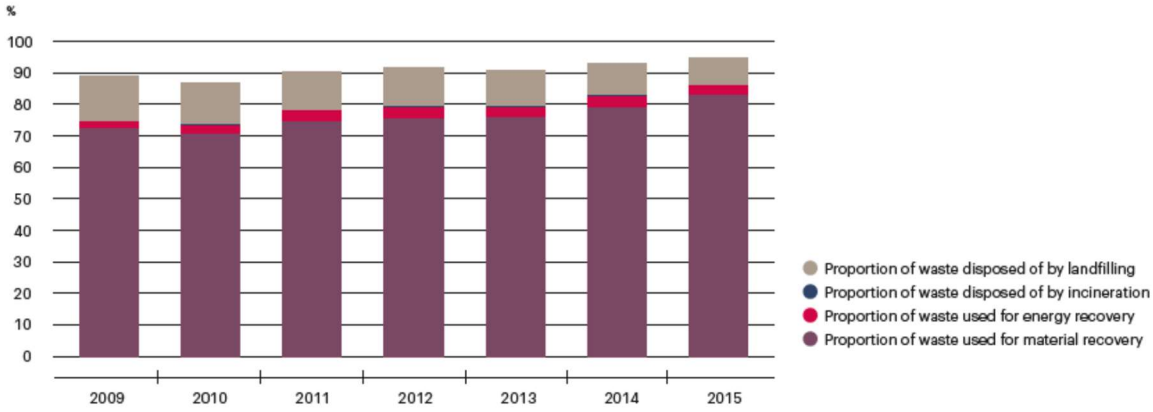


Source: Ministry of the Environment

Recovery of packaging waste in the Czech Republic [thous. t], 2009–2015

Source: Ministry of the Environment

Proportions of selected waste treatment methods in the total waste generation in the Czech Republic [%], 2009–2015



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

Landfilling, however, remains one of the most common methods of **municipal waste** management; in 2003, a total of 63.3% of **municipal waste** was landfilled; in 2015 it was 47.4%

- there are 298 landfills, 33 of them with the possibility of depositing hazardous waste, there are three incineration plants (Prague, Brno and Liberec); the number of incineration plants for hazardous waste has been decreasing (67 in 2001,24 in 2004).

Selected municipal waste treatment methods as percentages of the total generation of municipal waste in the Czech Republic [%], 2009–2015

Treatment method [%]	2009	2010	2011	2012	2013	2014	2015
Proportion of municipal waste used for energy recovery	6.0	8.9	10.8	11.8	11.9	11.8	11.8
Proportion of municipal waste used for material recovery	22.7	24.3	30.8	30.4	30.2	34.7	35.6
Proportion of municipal waste disposed of by landfilling	64.0	59.5	55.4	53.6	52.2	48.3	47.4
Proportion of municipal waste disposed of by incineration	0.04	0.04	0.04	0.04	0.05	0.07	0.07

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

Source: CENIA

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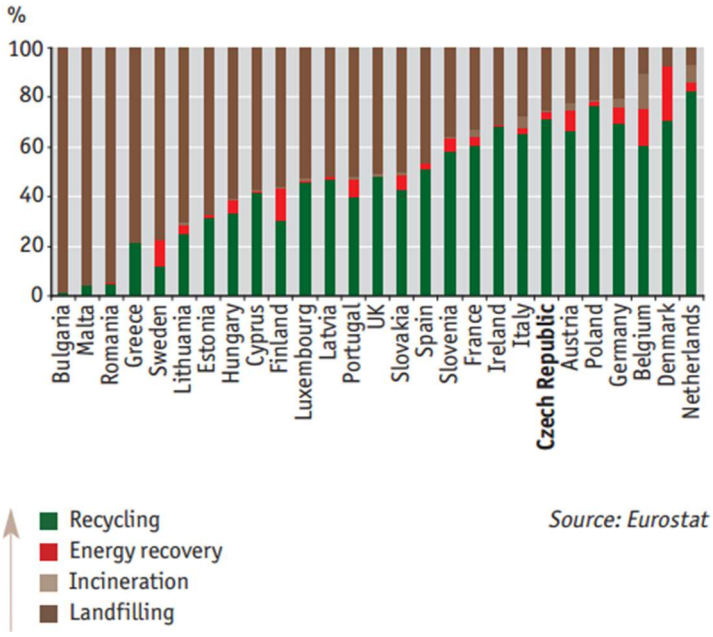
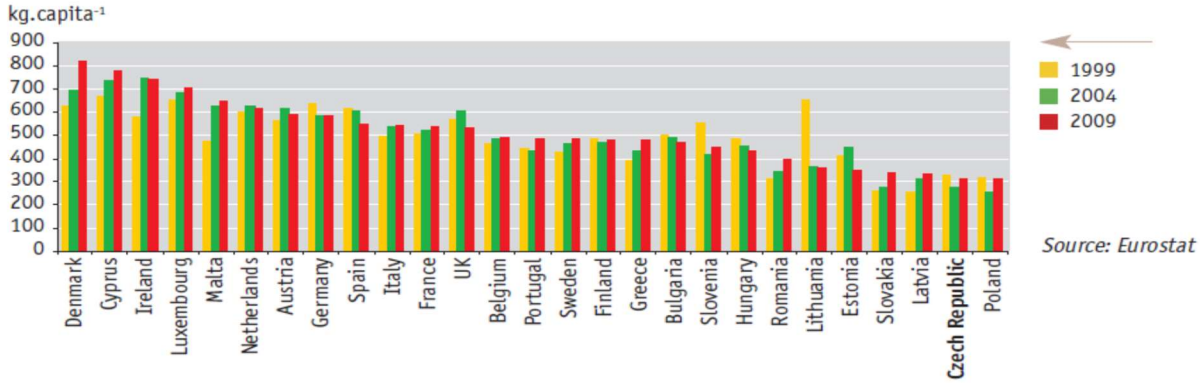
International comparison

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



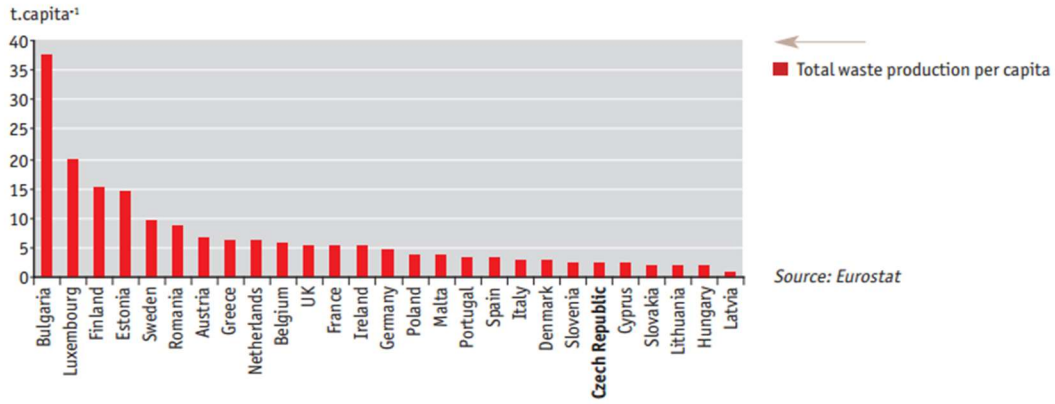
Source: Eurostat

Chart 2 → **International comparison of municipal waste production [kg.capita⁻¹], 1999, 2004, 2009**



Source: Eurostat

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

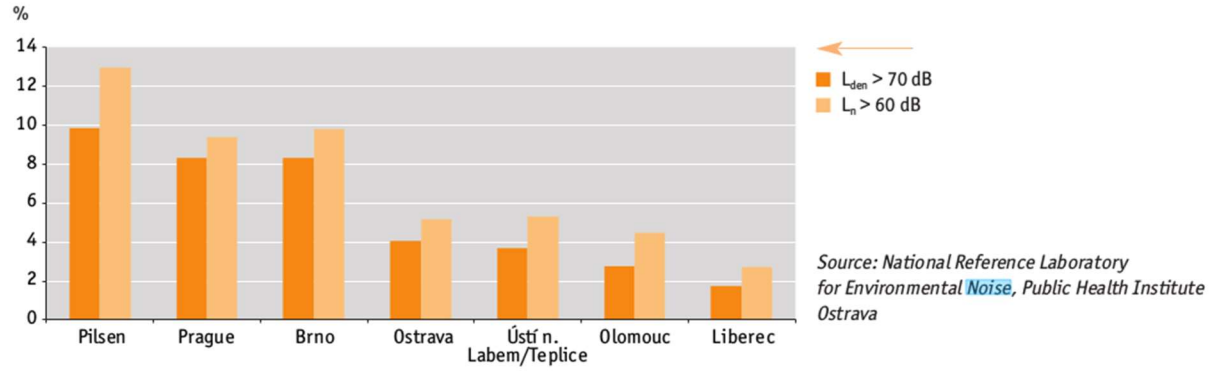


- as for material intensity of production, the CR is above average within the EU, mainly due to high proportion of material-intensive sectors in GPD (manufacturing). This is partially offset by below average domestic material consumption

Noise pollution

- significant problem from the long-term point of view, especially in cities
- **about 85% is caused by transportation** (all kinds… road, air, railway…)
- environmental impacts of transport are increasing in the CR
- although discussed in the EU for a long time, in the CR it was not a priority between 1990 and 1998 as the country had to deal with air and water pollution and waste disposal
- legal regulations for the noise pollution levels were passed in the Pre-Accession period, and regulations concerning noise pollution have been prepared since 2004.

Chart 2 → **Proportion of the population in the Czech Republic's agglomerations living in areas with exceeded limit values of noise indicators for day and night [%], 2012**



- people in many other cities and locations close to busy communications and traffic junctions (roads, airports) are also affected

C. INSTRUMENTS OF ENVIRONMENTAL PROTECTION in CR

Organization and Institutional Arrangement to Environmental Protection in the CR

- **Ministry of the Environment**
  - The foundation of the Ministry of the Environment on 1 January 1990 was a fundamental change in the environmental protection in CR.
  - professional organizations supporting public administration of the environmental protection:
    - Czech Environmental Information Agency (CENIA);
    - Czech Hydrometeorological Institute,
    - Water Research Institute of T.G. Masaryk,
    - Agency for Nature conservation and landscape protection of the CR,
    - Czech Geological Survey,…

Financing of environmental protection

- after 1989 the state of the environment could not have been improved without a significant increase in the funds spent; afterwards the amount of funds was reduced, as the most important environmental problems have improved substantially

Graph 5.1

The unusual height of investments in the 1990s was especially influenced by the legal deadline of the end of 1998, by which the operators of all the large and medium-size sources of air pollution had to achieve tighter emission limits. Within the scope of this all power plants and large heating plants were dusted off and desulphurised. Such high investments, concentrated in a couple of years, will never be repeated again. At the beginning of the current decade the Czech Republic got into a stage when all relatively „cheap" measures had been realised and every other improvement was markedly more expensive (the cost curves moved into a non-linear area).

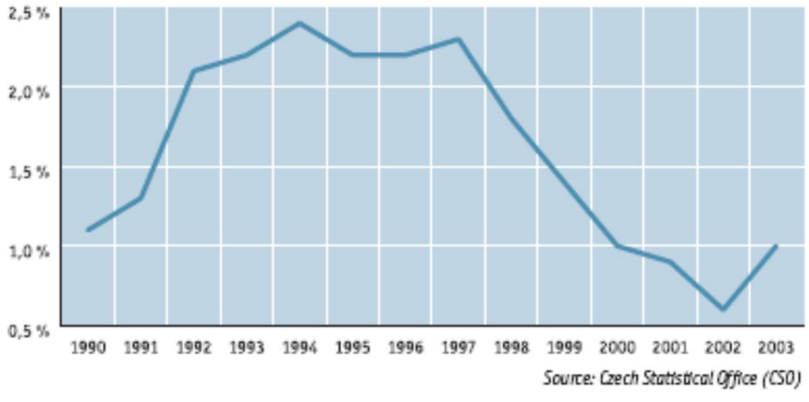


Chart 2 → **Investments and non-investment costs for environmental protection in the Czech Republic according to programme focus [CZK bil., current prices], 2003–2013**

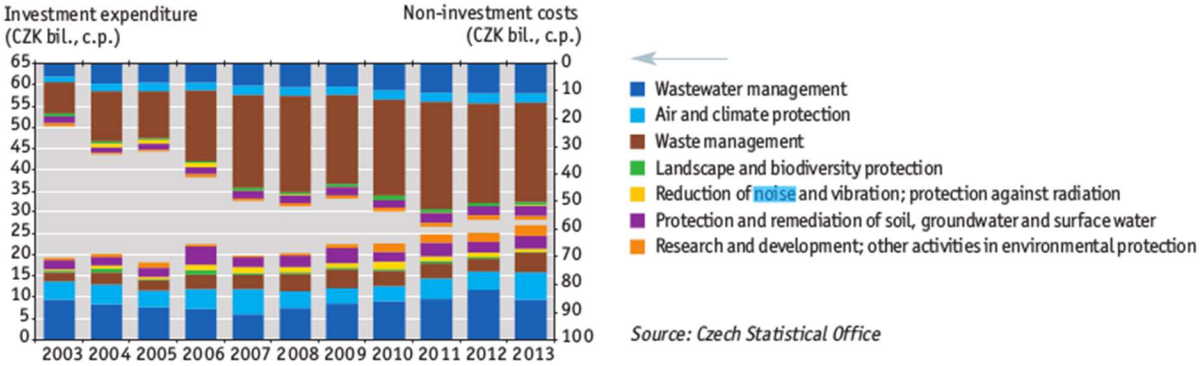


Table 5.1 Total investments in environmental protection in the Czech Republic (mil. CZK)

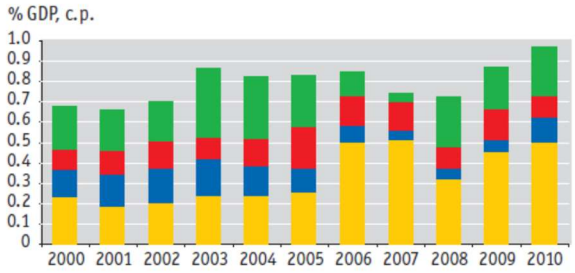
Projects	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
CR Total	3602	6048	9376	16954	19890	28272	32252	37036	40503	35160	28956	21399	19892	14919	19383
Waste water management	2271	3268	4626	7224	8715	10843	10246	10011	11275	8291	8839	8567	8815	7034	9523
Air and climate protection	692	1688	3187	5755	7876	13489	17886	21475	22323	20141	15762	8407	7057	4149	4179
Waste management	639	1092	1427	3115	2893	3127	2772	3449	4765	4698	2597	2270	1463	1236	2125
Reclamation of land			136	72	109	162	374								
Biodiversity and landscape protection								659	1081	1162	1091	1549	1437	511	405
Reduction of noise and vibrations (apart from workplace protection)				788	297	651	974	567	455	313	241	277	632	365	374
Protection and revitalisation of soil, ground and surface water								875	604	555	426	329	488	1027	2153
Protection against radiation														15	33
Environmental research and development														132	137
Other activities of environmental protection														450	454

Source: CSO

Sources of financing

- **State budget**: subsidies, refundable aids (free loans) and guarantees for commercial credits
- **State Environmental Fund of the CR**: its incomes consist of **charges** for pollution, use of natural resources and from **penalties** for breaching environmental law; in 1994–1997 SEF was funded by the National Property Fund in the amount of CZK 6.1 billion, which was a share of "small" privatization revenue addressed to the National Clean Air Program.
- The SEF has contributed to the implementation of many environmental protection measures in the form of **subsidies, loans and contributions**
- **National Property fund of the CR**: focuses on reclamation related to old ecological burdens in privatized companies (dissolved as of December 31 2005)
- **Local budgets** subsidies of municipalities or regions granted continuously (unlike the state program)
- **private investors**

Chart 1 → **Proportion of public environmental protection expenditure in GDP in the Czech Republic by source type [% GDP, current prices], 2000–2010**

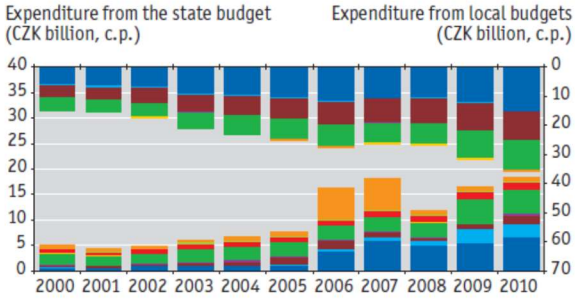


- Proportion of environmental protection expenditure by local budgets in GDP
- Proportion of environmental protection expenditure by the National Property Fund in GDP
- Proportion of environmental protection expenditure by state funds in GDP
- Proportion of environmental protection expenditure by the state budget in GDP

Source: Ministry of Finance

The National Property Fund was abolished as of 1 January 2006. Both its competences and its resources spent on the rehabilitation of old contaminated sites are now administered by the Ministry of Finance of the Czech Republic. The marked increase in state budget expenditure between 2005 and 2006 resulted from the involvement of funding by European funds. A portion of public environmental expenditure by local budgets is a duplication of expenditure from central sources.

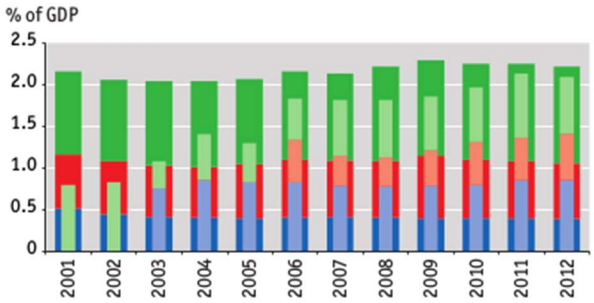
Chart 2 → **Public environmental protection expenditure from the state budget and local budgets in the Czech Republic by programming orientation [CZK billion, current prices], 2000–2010**



- Water protection
- Air protection
- Waste management
- Soil and groundwater protection
- Landscape and biodiversity conservation
- Reduction of the impact of physical factors
- Administration in environmental protection
- Environmental research
- Other activities in ecology

Source: Ministry of Finance

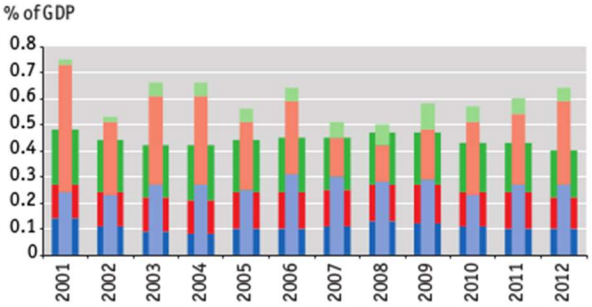
Chart 1 → **Total environmental protection expenditure by the main sectors in the Czech Republic and in the EU28 [% of GDP], 2001–2012**



- EU28 Total expenditure – specialised companies (*)
- EU28 Total expenditure – public sector (*)
- EU28 Total expenditure – industry sector (*)
- Czech Republic Total expenditure – industry sector
- Czech Republic Total expenditure – public sector
- Czech Republic Total expenditure – specialised companies

Source: Eurostat

Chart 2 → **Investment in environmental protection by the main sectors in the Czech Republic and EU28 [% of GDP], 2001–2012**



- EU28 Total expenditure – specialised companies (*)
- EU28 Total expenditure – public sector (*)
- EU28 Total expenditure – industry sector (*)
- Czech Republic Total expenditure – industry sector
- Czech Republic Total expenditure – public sector
- Czech Republic Total expenditure – specialised companies

Source: Eurostat

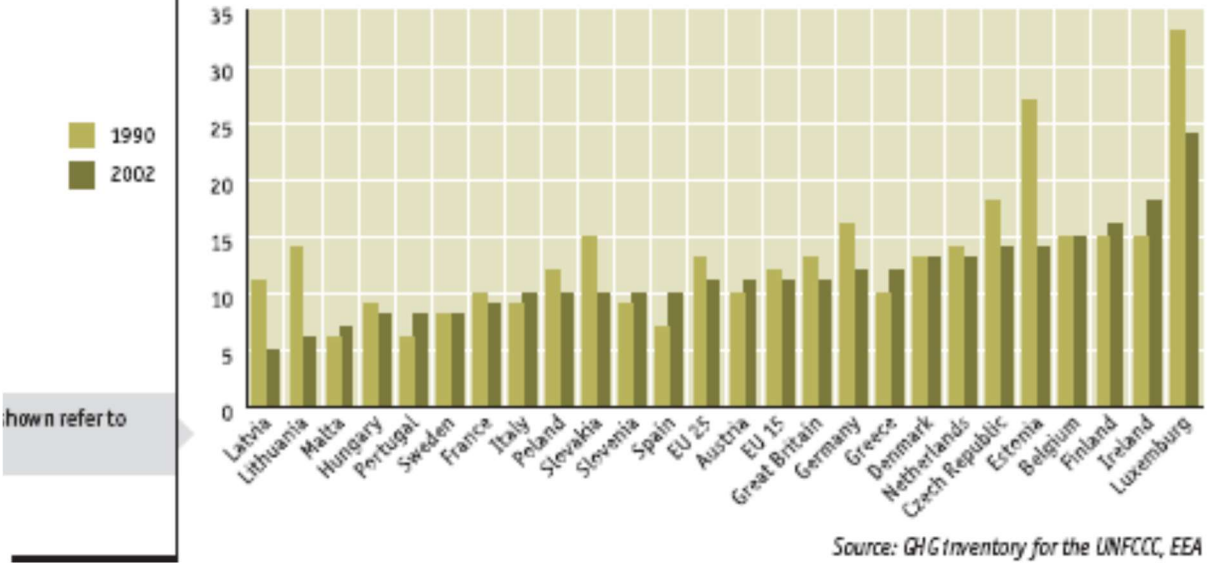
International context

- At the end of the 20th century environmental protection became an inseparable component of international relations in the political and economical sphere influencing social and cultural issues.

- The development of the state of the environment in the monitored time period has been positively influenced by the **EU-approximation process** of the Czech Republic and by the development of multilateral cooperation within international organizations, especially the UN Economic Commission for Europe (UN ECE), the UN Environmental Program (UNEP), the UN Educational, Scientific and Cultural Organization (UNESCO), and the Organization for Economic Cooperation and Development (OECD).
- **The Czech Republic became a contracting party to most of important global and regional multilateral agreements** and established an effective system of bilateral cooperation with European as well as developing countries.

Graph 4.1

Greenhouse gas emissions in equivalents of CO_2 per capita of the EU15 Member States for 1990 and 2002 (t/capita)

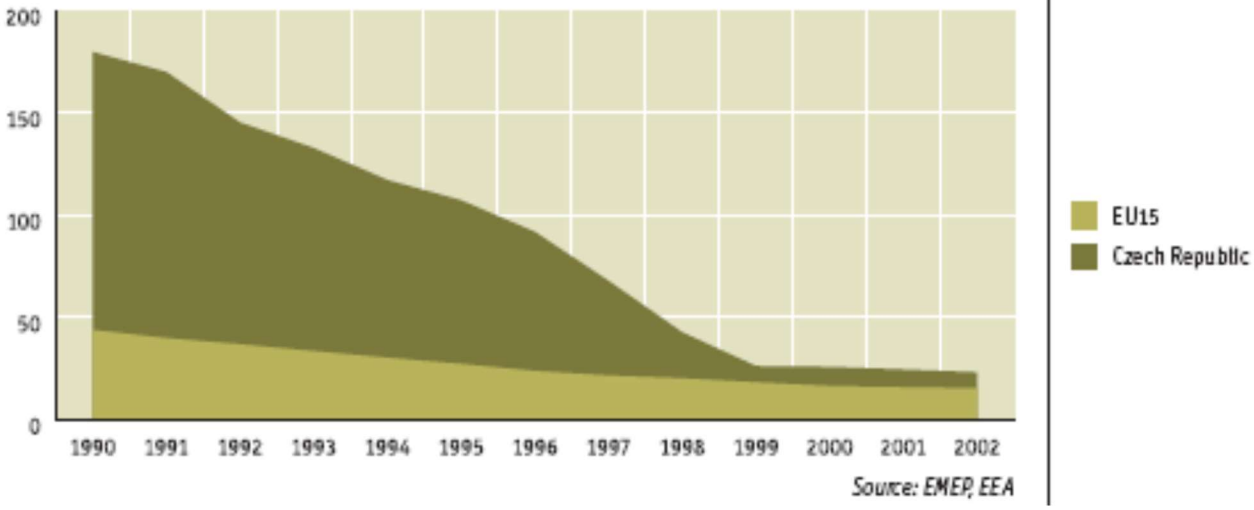


hown refer to

Source: GHG Inventory for the UNFCCC, EEA

Graph 4.3

The EU15 and the Czech Republic's emission trends for SO_2 between 1990 and 2002 (kg/capita.year)



Source: EMEP, EEA

Economic instruments of environmental protection in CR

The protection of nature and the landscape in the Czech Republic uses, above all, the following economic instruments:

- **non-market ("financial") instruments**
  - **positively stimulating**
    - financial subsidies => national subsidy programs + European subsidy programs
    - grants
    - loans
    - tax reliefs
  - **compensatory instruments**
    - financial compensation for losses resulting from the declaration of a provisionally protected area,
    - compensation for aggravating conditions for farming and forestry
    - compensation for some damages caused by selected specially protected animals.
  - **negatively stimulating**
    - fees (e.g. entry fees for cars in national parks)
    - taxes and charges for environmental impacts (e.g. cutting down trees) – "**polluter pays principle**" = inclusion of negative externalities in the costs of the polluter
    - penalties for non-compliance with environmental regulations
- **market ("financial") instruments**
  - trade in greenhouse gas emission allowances (Kyoto protocol)
- **voluntary instruments**
  - eco-labeling
  - responsible care
  - voluntary agreements…
- **access to environmental information**
  - integrated pollution register

Tax relief due environmental protection

- In the early 1990s environmental tax reliefs were only exceptional. The whole system of taxation was rather **unclear,** especially because of the sales tax. This tax consisted of hundreds of rates and was used instead of the VAT and concise taxes (high sales tax imposed on the sale of passenger vehicles and fuels)

- since 1993 exemptions from the road tax for some modes of transport;
- concise tax on fuels
    - rates of the sales tax and concise tax on fuels grew only a little between 1989 and 2004 in comparison with consumer price inflation
    - international water transportation and environmentally demanding international air transportation exempted from any concise taxes on fuels based on international agreements; domestic air transportation exempted from the concise tax on fuels since 2001 and domestic water transportation since 2004
    - lower sales tax rate was applied between 1991 and 1992 and a lower concise tax rate on unleaded petrol between 1993 and 1995; the tax advantage of unleaded petrol was cancelled from 1996 and since 2001 it has not been possible to sell leaded petrol.
    - a zero concise tax on biodiesel was applied until 2000.
    - a lower concise tax rate has been applied to LPG (liquefied gasses) used as a fuel for vehicles
    - until 2003 there was a zero concise tax on CNG (compressed gasses) used as a vehicle fuel; a relatively high concise tax on CNG and substantially increased concise tax on LPG and diesel oil were applied in 2004, and the concise tax on petrol has been increased too.
    - economic advantages of more environmentally-friendly fuels in the form of lower concise taxes dropped in 2004 to ca ½.
- exemption from the property tax in case of real estates that were found important for environmental protection;
- reduced VAT (5 %) rate on some environmentally-friendly products (renewable fuels and energy sources and biodiesel), since 2004, all products under lower VAT rate transferred to the basic VAT rate of 21%.

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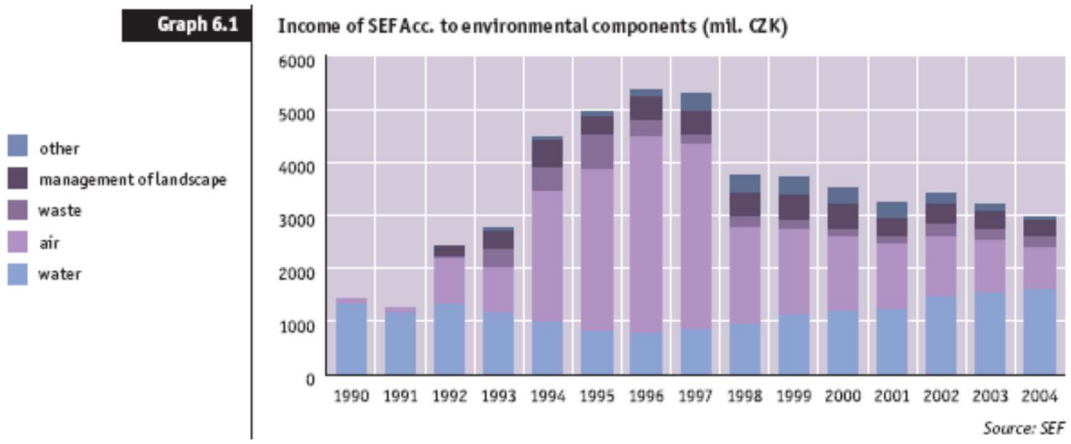
Payments for environmental impacts (“charges”)

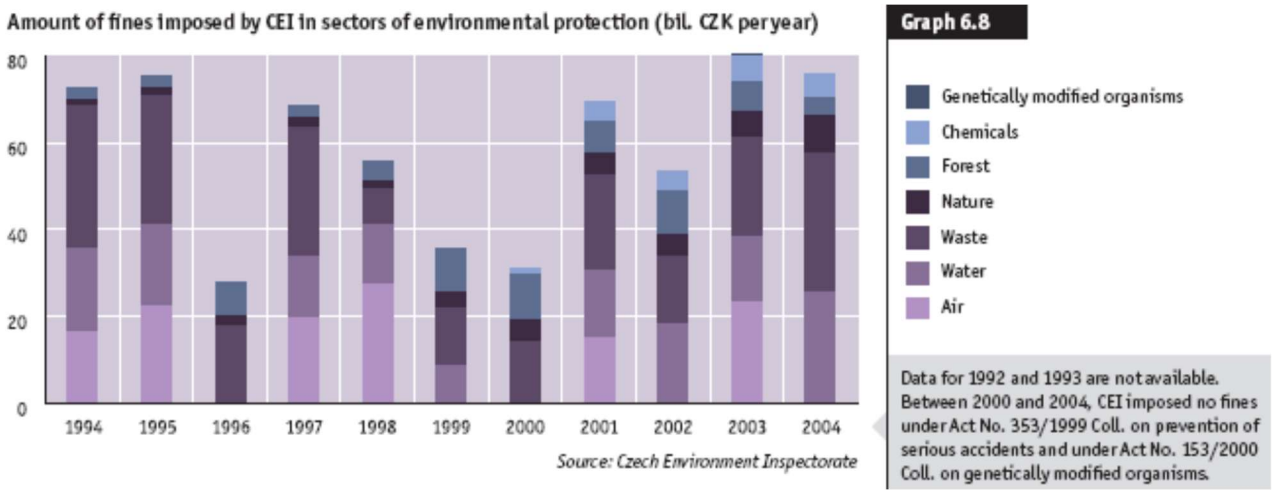
- various payments for pollution and utilization of the natural resources.
- the payments have been utilized since the mid 1960s, they include charges for **air pollution**, charges **for discharge of waste water** into surface water, charges for **consumption of surface and ground water**, as well as charges for the **use of agriculture land resources**,
- in the 1990s, new charges were introduced – especially **for waste dumping**, **extraction of mineral resources** and **forestland exclusion**
- the payment of the charges is controlled mainly by the Czech Environmental Inspectorate or regional authorities, most of the charges are collected by tax offices and the financial revenue is received by the State Environmental Fund of the Czech Republic or municipalities.
- the majority of the collected charges are used to support activities dedicated to environmental protection



As of 2004, **16 types of charges** (payments) were paid in the CR. They include charges:

- for **air pollution** – operators of extra large to small stationary sources,
- for **production and import of regulated substances** and products containing them (**Freon**) (they in fact, but not de jure, ceased as of 1 May 2004 after the accession of CR in EU),
- for **discharging wastewater into surface water**,
- for permitted **discharging of wastewater into groundwater**,
- for **surface water consumption** in order to pay for the river basin management,
- for **groundwater consumption**,
- for **waste dumping on a landfill**
- for selected **car wrecks**
- a fee for **municipal waste disposal**,
- for registration and annual recording in a list of authorized entities under the Act on **packaging** (reg. packaging and their recycling),
- for a **mined area** and for a volume of **extracted minerals**,
- for the **agricultural land use exclusion** (permanent and temporary),
- for **forestland use exclusion**

A special category of payments includes fines – sanctions for not observing limits or duties defined by the State.



*"The range of economic instruments available for environmental protection applied in the Czech Republic is **one of the largest in Europe** and probably in the world (Slovakia and Poland have a similar, though less numerous range of charges). However, environmental charges have **not always been introduced and modified systematically and ideally**. Therefore, there are cases when charging is ineffective (e.g. with regard to administration or transaction expenses). For this reason, the existing system of charges, its improvement and gradual coordination with other tools of environmental policy, should be explored."*

Voluntary Programs

- The first voluntary regulatory instruments (i.e. instruments reducing the negative impact on the environment) to be implemented in our country were:
    - ecol-labeling (1993),
    - Responsible Care (1994)
    - Cleaner Production (1994).
- These were followed by
    - voluntary agreements between industry and state administration (1995),
    - implementation of ISO standards of the 14 000 series (1997)
    - EMAS (EC's Eco-Management and Audit Scheme) (1998)

National Program for Labeling Environmentally Friendly Products (EFP)

- the Czech National Program for Labeling EFPs was started in April 1994.
- criteria were set for evaluation of thermal insulating materials from scrap paper, lubricating oils for chain saws, detergents for textiles and water-based painting and coating materials.
- in 2005, the National Program encompasses 41 evaluated product categories, ca 300 labeled products and 75 companies – eco-label holders.
- The Ministry of the Environment is the guarantor of the program, which is administered by the Czech Environmental Information Agency (CENIA).
- **the Czech Republic was the first post-communist country to develop a successful national eco-labeling program.**

- In 2000, the Czech Eco-labeling Program became part of the Global Eco-labeling Network (GEN), an organization currently (2005) associating more than 35 most significant world eco-labeling programs.
- In the Czech Republic, the National Program is being implemented in parallel with the EU Eco-label Scheme and the eco-label “Environmentally Friendly Product“ is awarded together with the EU eco-label “The Flower“.

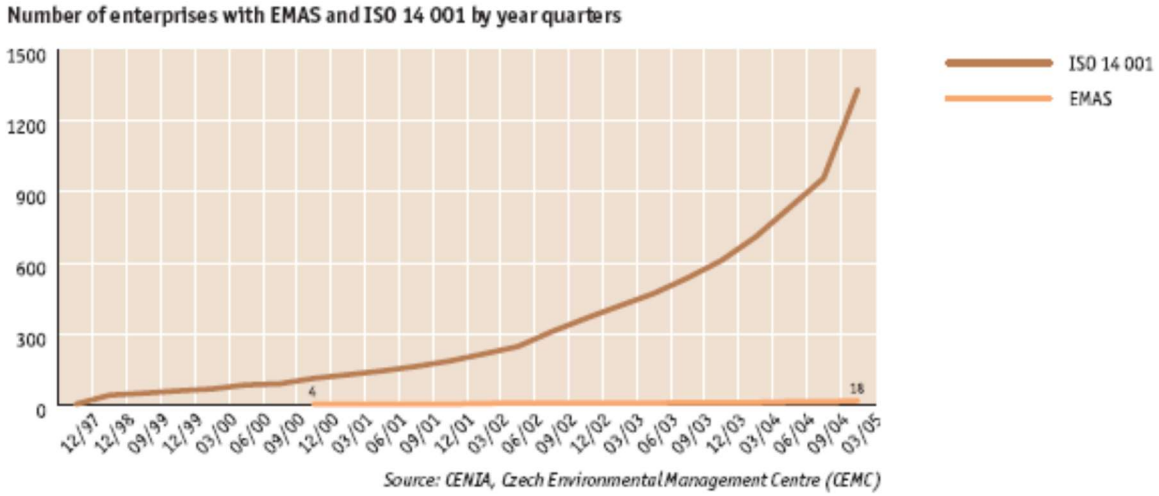
Logo of the Czech ecolabel and the logo of the EU´s “The Flower”

Cleaner Production

- voluntary program, preemptive measures to increase efficiency of utilization of inputs (raw materials), elimination of toxic and dangerous materials from production, prevention of waste…
- During the 12-year history of Cleaner Production in the Czech Republic, 118 projects were implemented in businesses from the fields of light and heavy industry, transportation, chemical and textile industry, health care, food industry, costume jewellery production, agricultural primary production, bakeries, brewing as well as forestry. 32 % of these projects resulted in financial savings. In the year following the Cleaner Production implementation, 37 businesses saved a total of CZK 177 million.

National EMAS Program, ISO 14001

- EMAS = Eco-Management and Audit Scheme
- The EMAS system entered into force in April 1995 and it was opened mainly to businesses from the industrial sphere.
- updated in 2002, the main purpose was to extend the applicability from the field of industry to all economic sectors and to strengthen the compatibility between EMAS and ISO 14 001 and to encourage the participation of small and medium enterprises in the program.
- ISO 14 001 surpasses EMAS as regards the number of certified businesses mainly for economic reasons: ISO is the less demanding option, valid worldwide and its implementation is currently seen as a full market factor.
- This trend is apparent all over Europe, despite the pressure from EU authorities to implement EMAS.
- The Czech Republic ranks seventh among the European Union Members concerning the number of ISO 14 001 certificates (2004/2005).
- Among enterprises with EMS (ISO 14 001 + EMAS) manufacturing enterprises prevail, by which accepting environmental system is caused by competitive pressure.



Responsible Care

- at present 29 companies are entitled to use the label Responsible Care.
- *"Responsible Care® is the chemical industry's global voluntary initiative under which companies, through their national associations, work together to continuously improve their health, safety and environmental performance, and to communicate with stakeholders about their products and processes."* http://www.responsiblecare.org/page.asp?p=6341&l=1

(2-side) Voluntary Agreements

- contracts between a public law entity on one side and one or more subjects on the other side
- The content of voluntary environmental agreements varies significantly.
- By the end of mid-2005, there were 7 voluntary agreements concluded in the Czech Republic.
- e.g. Agreement on Gradual Reduction in Environmental Impact of Detergents, Agreement on Packaging, Agreement on Cooperation with the Czech Business Council for Sustainable Development and Confederation of Industry of the Czech Republic, Agreement on Portable Batteries Collection, Voluntary Agreement on Reduction in Mercury Load from Dental Medical Institutions…

Environmental Managerial Accounting

- environmental managerial accounting system collects, records, evaluates and transfers to the user the information on material and energy flows, flows of all types of waste and waste management, as well as information on costs, savings and revenues relating to all activities with potential impact on the environment.
- environmental reporting at company level

Right of Access to environmental information

- demand for environmental information during the 1990s was so significant that a law on right to access to environmental information was passed (1998) before adoption of a general law on free access to information (1999)
- Act No. 123/1998 Coll. ensures access to information on the comprehensive state of the environment, environmental pressures and impacts, exploitation of natural resources, impacts of construction, human activities and industrial technologies, and to information on the environment protection measures

Environmental Education and the role of NGOs

- Environmental education leading to responsible behavior not only with respect to society, but also towards nature, has been involved in the Rainbow Program from 1990.
- Non-governmental non-profit organizations dealing with environmental protection were started from “scratch” after 1989. Only few conservationist organizations, e.g. Czech Union for Nature Conservation or the famous Brontosaurus movement, survived the previous regime.
- At the moment there are more than 420 non-governmental environmental organizations in the Czech Republic.

Public opinions