Fourth National Communication of the Czech Republic on the UN Framework Convention on Climate Change

and

Demonstrable Progress Report on Implementation of the Kyoto Protocol

Ministry of the Environment of the Czech Republic

Czech Hydrometeorological Institute

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DEMONSTRABLE PROGRESS REPORT ON IMPLEMENTATION OF THE KYOTO PROTOCOL

Introduction

The Czech Republic (hereinafter "the CR") acceded to the UN Framework Convention on Climate Change (hereinafter the "Convention") on October 7, 1991 (Government Resolution No. 323/1993), signed the Kyoto Protocol (hereinafter the "Protocol") on November 23, 1998 (Government Resolution No. 669/1998) and completed the ratification process within the meaning of Art. 25 of the Protocol on November 25, 2001. It submitted the First National Communication to the Secretariat of the Convention in 1994 and this was subjected to an in-depth review in 1995 (document FCCC/IDR.1/CZE). The Second National Communication was submitted in 1997 and underwent an in-depth review in 1999 (document FCCC/IDR.2/CZE). The Third National Communication was submitted in 2001 and underwent an international expert audit review in 2002 (document FCCC/IDR.3/CZE).

While, in the period of preparation of the First and Second National Communications, the issue of global climate change in the CR was considered to be rather a narrow problem of interest only to professionals, manifestations and consequences of the "unusual" variations in the weather and the occurrence of ever more frequent extremes attracted increased interest in this issue from the lay public and subsequently also the political sphere. The greater frequency and consequences of dangerous anthropogenic interferences in the climate system have made it necessary to search for new, more efficient and economically more effective mechanisms for reducing detrimental consequences, both in an international context and at the national level.

Since the submission of the Second National Communication, there has been a significant breakthrough in international negotiations at the Third Conference of Parties to the Convention (COP-3) in Kyoto in December 1997. A Protocol was adopted with the main target of providing for and creating a legal basis for a gradual reduction of greenhouse gas emissions to a level that would reduce the risk of climate change in the future caused by interactions with the climate system. The Protocol defines the quantitative reduction targets and the means of achieving these targets. It requires that economically developed countries listed in Annex I to the Convention individually or jointly reduce total emissions of greenhouse gases by at least 5.2% compared to the 1990 levels by the first review period (2008 – 2012). This reduction is related to emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons and perfluorocarbons and sulphur fluoride, expressed as aggregate carbon dioxide emissions. The Protocol sets specific reduction targets for the individual countries in Annex B. The CR is required to reduce emissions by 8%.

The flexible mechanisms of the Protocol can also be employed to achieve reduction targets. These mechanisms consist in joint implementation (JI) projects pursuant to Art. 6 of the Protocol, international emission trading pursuant to Art. 17 of the Protocol and the Clean Development Mechanism (CDM) pursuant to Art. 12 of the Protocol. Thus, the Protocol in general extended the options of the Parties in selecting the means and instruments that are most suitable for meeting the reduction targets and simultaneously takes into account the specific circumstances in relation to the individual Parties. Nonetheless, emphasis is placed on reduction measures at a national level.

Following signing of the Protocol, work was commenced in 1998 on preparation of a national strategy for reducing greenhouse gas emissions and, in Resolution 480/1999, the Government of the CR approved the document "Strategy for Protection of the Climate System of the Earth in the Czech Republic", which included climate protection amongst top-priority environmental issues in the CR and simultaneously established the main tasks that the individual affected sectors must perform in the framework of achieving the quantitative targets of the Protocol. Simultaneously, the work of the Interministerial Commission on Climate Change was renewed; this body acts as a consulting body to the Minister of the Environment.

A number of years have passed since adoption of the Strategy for Protection of the Climate System of the Earth in the Czech Republic, during which substantial new professional information has been obtained, there have been a number of significant trends in international negotiations and, last but not least, the accession of the CR to the European Union also affects new requirements. Consequently, a National Program to Mitigate the Impacts of Climate Changes in the CR was prepared (hereinafter the "National Program") and was approved in 2004 by the Government of the CR in Resolution No. 187/2004. The National Program constitutes an updated document that reacts to changes in conditions. Its preparation followed from Act No. 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air), from the requirements following from Council Decision 99/296/EC and from the European Climate Change Program (ECCP), which the European Commission established in 2000 in the framework of identification of the main joint policies at the EU level and for the individual member states so as to ensure joint and individual meeting of the reduction targets of the Protocol. Through adoption of Resolution No. 187/2004 and formulation of the National Program, the Government of the CR newly defined its policy in the area of climate change, which is in accordance with the corresponding policy of the European Union. The National Program is concerned with defining the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the CR and to contribute to promotion of sustainable development. Its preparation was based on detailed analysis of national trends in emissions of greenhouse gases in the 1990 – 2001 period, on analysis of key emission sources, i.e. groups of sources that make the maximum contributions to the overall national balance, on updated projections of emission trends over the period to 2020, based on estimation of energy requirements and expected macroeconomic trends, on estimates of probable trends in further international negotiations on the Protocol in the immediate future, on consideration of the impact of the original Strategy on reducing emissions and on preliminary analysis of adaptation requirements at a national level in connection with the increased frequency of occurrence of extreme weather conditions in the territory of the CR in recent years. The National Program requires that its principles be reflected in specific forms in the conceptual materials of all the affected sectors (Ministry of the Environment, Ministry of Industry and Trade, Ministry of Transport, Ministry of Agriculture, Ministry for Regional Development, Ministry of Education, Youth and Sports, Ministry of Health, Ministry of Finance), including the

Strategy of Economic Growth of the CR, which can contribute in any manner whatsoever to reducing the risk of disturbing the climate system of the Earth or could be affected by such a risk.

The Fourth National Communication of the CR has been prepared pursuant to the requirements set forth in the document FCCC/CP/1999/7, Part II – *Guidelines for the Preparation of National Communications by Parties Included in Annex I to the Convention*. It analyzes current conditions in the area of climate change in the CR and documents the state of compliance with obligations following from the UN Framework Convention on Climate Change in the period from 2001, when the CR submitted the Third National Communication, to the year 2005.

As the Protocol came into effect on February 16, 2005, this communication is also the First National Communication of the CR on compliance with obligations following from the Protocol. The Annex "Communication of the Czech Republic on the Kyoto Protocol" to the Fourth National Communication describes compliance with these obligations in the structure required by the Secretariat of the Convention.

The Demonstrable Progress Report on Implementation of the Kyoto Protocol (hereinafter the "Report") in the sense of Article 3.2 of the Protocol and European Council and Parliament Decision No. 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementation the Kyoto Protocol, constitutes a separate part of this report. The CR, which is a Party to the Protocol and a Member State of the European Union, has prepared the Report in accordance with the requirements of the Protocol and Decision and according to the structure stipulated by the European Commission. The Report contains information related to the period between 1990 (base year for the Protocol) and 2005.

FOURTH NATIONAL COMMUNICATION OF THE CZECH REPUBLIC ON THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

Summary

This chapter contains a brief summary of the Fourth National Communication of the Czech Republic on compliance with obligations following form the UN Framework Convention on Climate Change (hereinafter the "Convention") and the Kyoto Protocol (hereinafter the "Protocol").

National Conditions

The Czech Republic was established on January 1, 1993 following the splitting of the Czech and Slovak Federative Republic (Czechoslovakia). The Constitution of 1992 established the basic profile of the structure of the State, and defines the position and role of the most important bodies of the state authority. On this basis, the Czech Republic can be considered to be a parliamentary democracy, with separate legislative, executive and judicial powers. The Government provides for executive power and generally consists of representatives of the strongest political parties according to the results of the most recent elections. In this election period, it consists of the Prime Minister, four deputy prime ministers and the individual ministers, responsible for the activities of 15 ministries. According to the Constitution, the Czech Republic is divided into regions, which gained a number of powers in 2001 that were formerly held by the Government. They constitute a self-governing intermediate level between the municipalities and cities and the Government. Their size corresponds to the larger territorial administrative units in the framework of the European Union. Integration relations can be considered to be amongst the most important external relations of the state at the present time. The Czech Republic became a member of OECD in December 1995; in March 1999 it became a member of NATO and in May 2004, a member of the European Union.

In 2004, a the Czech Republic had a population of 10.2 million inhabitants and was thus the 14th largest country in Europe in terms of the number of inhabitants. With an average population density of 129 inhabitants/km^2, it is one of the more densely populated countries of Europe. The nationality composition of the population is practically homogeneous (94% of the inhabitants are of Czech, Moravian or Silesian nationality, 1.9% constitute a Slovak minority and there are also Polish and German minorities). The originally high birth rate has stabilized over the last fifty years. From the beginning of the nineteen nineties, the Czech Republic has become a country that is beginning to accept a larger number of immigrants, especially from Southern and Eastern Europe and from some Asian countries.

Strategic environmental documents were adopted after 1990, including protection of the environment and the principles of sustainable development. The most important of these programs consists in the updated **State Environmental Policy 2004 – 2010,** which defines the protection of nature, the landscape and biological diversity, sustainable use of natural resources, material flow and waste management, protection of the climate system of the Earth and reduction of long-range transport of air pollution as a top-priority area from the standpoint of the environment. In the past decade, there has been a substantial reduction and stabilization in the level of air pollution in all the main indicators.

The weather of the country corresponds to the Atlantic-continental area of the temperate climate zone of the northern hemisphere. Air masses predominating at central latitudes predominate here. Penetration of air masses of tropical or arctic origin is relatively frequent. Their alternation leads to the frequent passage of atmospheric fronts throughout the year. The average annual temperature varies from 1.0 to 9.4 °C in dependence on geographic factors. The local temperature conditions depend substantially on the height above sea level, on the geographic position and on the local geomorphological conditions, especially on the exposure of the terrain. Atmospheric precipitation is amongst the most variable climatic features. Especially the geographic position of the country relative to air currents carrying moisture and the frequency of the occurrence of weather conditions with greater precipitation are decisive for precipitation conditions.

The transformation of the economy to the conditions of a market economy was commenced after 1989 and has now been completed. This was connected with the restitution and privatization processes, with fundamental changes in the economic structure of the state with the potential for input of foreign capital, with improved product quality, in an attempt to achieve competitiveness on the European and world markets, and with a concurrent improvement in the state of environmental conditions determined primarily by conduct in the economic sphere. The transformation has been completed in the area of services and banking and is continuing in the energy industry. Macro-economic analyses indicate that the Czech Republic returned to the GDP level of 1990 only in 2000. This level is affected by the increase in foreign investments; inflation is overall at an acceptable level.

The **State Energy Conception** that defines priorities and targets in the energy-production sector and describes specific implementation instruments of energy policy, was approved by the Government in March 2004. Similarly, a number of laws and documents dealing with energy treatment and management have also been adopted in recent years. Prior to 1989, the Czech Republic was a country that favoured the development of heavy industry with high energy consumption, based on domestic solid fossil fuels, where the energy from these fuels was frequently used in a very ineffective manner. This situation led to a number of serious environmental problems. The construction of two blocks of the Temelín nuclear power plant was completed in 2003.

Transport is based on a combination of railway and highway transport. The density of the railway network per unit area of the country is the greatest in the OECD countries. However, railway transport and its infrastructure require thorough modernization, which has already been commenced and has been

completed on some internationally important sections. The necessary modernization of the highway network and especially construction of superhighways frequently encounter various conflicts of interest, especially with environmental protection interests. The increase in the volume of passenger and freight transport and the transition from railway to highway and air transport is disturbing..

Industrial production has traditionally been the main feature of the economy of the Czech lands. After 1989, the emphasis on the individual industrial sectors gradually changed, with an increase in the share of the processing sector and construction and a decrease in heavy industry. The mining industry is currently characterized by a decrease in mining of black and brown coal and a related reduction in the production of briquettes and coke, which has tended to stabilize since 2000. Current conditions in the area of **wastes** can be characterized by a relatively large amount of generated waste materials. This rather unsatisfactory state of affairs is associated with the predominance of landfilling, especially of municipal waste, the constant low fraction of use as secondary raw materials and the low fraction of waste combustion. Only about 2.5% of total waste production is used for energy-production purposes. The decontamination and reclaiming of landfills, where operations have been terminated by law, constitutes a major financial problem. In contrast to the adequate capacity of landfills in the Czech Republic, there is a lack of a technical base for waste utilization and recycling, including greater use of its caloric value. The lower percentage of waste combustion is caused by the greater costs compared to landfilling and the unfavourable legislation. The fact that only technically safeguarded landfills have been operated since 1996 is a favourable aspect.

Agriculture has a typical Central European character, with production of foodstuffs typical for the temperate zone and the features of high intensity of cultivation of the land and also with the positive and negative consequences of large-capacity production of the collective type. The distribution of agricultural production has a zonal character, in which altitude above sea level is more important than latitude. Czech agriculture is capable of meeting domestic requirements for basic agricultural products. Agricultural land corresponds to 54.1 % of the total area of the land fund. Unfortunately, no framework policy has been adopted for the area of agriculture since 1990 and, at the present time, the policy of the sector is determined only by the EU Joint Agricultural Policy.

The area of **forest** land is constantly increasing at a slow rate and corresponds to 1/3 of the area of the state. More than ¾ of forest area consists of narrow-leaved forests and the rest consists of broad-leaved species. The total stand stocks of wood in forests are constantly increasing. In recent years, reforestation has been characterized by an attempt to increase the proportion of broad-leaved species at the expense of narrow-leaved species. From the standpoint of ownership relations, 60% of forest area belongs to the state, 15% to towns and municipalities and the remainder to private natural persons and other owners. In spite of the great reduction in emissions of pollutants into the air, the condition of forests has not improved substantially. This is a consequence of the prolonged accumulated degradation of forest land, which is a joint consequence of the effect of pollution levels and unsuitable and excessively intensive forest management; the high concentrations of tropospheric ozone also currently contribute to damage to forest stands.

Emission Inventories

Carbon dioxide (CO_2) is the most important greenhouse gas, contributing 86% to overall emissions, followed by methane (CH_4) with 7.1 %, nitrous oxide (N_2O) with 5.7 % and F-gases with 1.2 %. Over the last few years, the relative contributions of the individual greenhouse gases to total emissions have not changed much. The change in the values for the share of the *Energy* and *Industrial Processes* sectors is a result of a change in the methodology and temporary lack of consistency in the time series. However, the decrease of the share of the *Agriculture* sector in total emissions is tangible, caused by the reduction in CH_4 and N_2O emissions.

The rapid reduction in total emissions of greenhouse gas after 1990 was caused by the decrease in production and subsequently also the restructuring of the economy, as one of the consequences of the substantial changes in the political system. Conditions have been relatively stable since 1994 and the existing fluctuations can be attributed to various factors (e.g. different winter temperatures, inter-annual changes in GDP and the degree of adoption of measures to reduce greenhouse gas emissions, etc.). The uncertainty in determination of emissions in the individual years is also reflected in the inter-annual changes.

As total greenhouse gas emissions decreased by 24.6% to 2003 compared to 1990, it can be expected with high probability that the reduction commitment of the Protocol will be met for the first review period of 2008 – 2012. Nonetheless, in spite of this reduction of emissions since 1990, indicators relating aggregated emissions to one inhabitant or to GDP unit remain very unfavourable. Chapter 3 gives a detailed survey of the results.

Measures to Reduce Emissions

A number of measures are being implemented in the CR to reduce greenhouse gas emissions. The survey and classification were prepared in accordance with the methodical instructions for their analysis. These are measures narrowly concentrated on a certain subject area or sector, are framework measures or are measures of a predominantly adaptation character. However, the targets and impacts of many of the adopted measures are usually much broader, as it is primarily necessary to reduce the negative impacts on the environment as a whole for a number of these measures.

The key measures with the greatest expected benefit consist primarily in framework and conceptual measures related to several sectors and also measures of a legislative character. A number of program measures constitute practical implementation of framework, conceptual and legislative measures. The measures evaluated in the Fourth National Communication emphasize those that have come into force since 1995. This is considered to include the current state of utilization of the flexible mechanisms of the Protocol and participation in the system for trading in emission permits in the framework of the European Union.

The basis for policy in creation of measures consists in the National Program to Mitigate the Impacts of Climate Change in the Czech Republic, which was approved by the Government in 2004. It is concerned with defining the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the country and to contribute to promotion of sustainable

development. Its preparation was based on detailed analysis of national trends in greenhouse gas emissions in the period following 1990, analysis of key emission sources that contribute to a maximal degree to the overall national balance, and updated projections of emission trends in the time period to the year 2020. Account was also taken of analysis of preliminary adaptation measures in connection with the increased occurrence of extreme weather phenomena in recent years.

The National Program requires a substantial increase in the share of renewable energy sources in the consumption of primary energy sources and defines conditions for state participation in joint implementation projects, in international emission trading and in participation in trading in emission allowances for greenhouse gases. Prepared measures or measures that came into force in 2005 should contribute to meeting the national quantitative targets that, according to the program, consist in reduction of specific CO_2 emissions per inhabitant by 30% to 2020 compared to 2000, and reduction of total aggregated CO_2 emissions by 25% to 2020 compared to 2000 and provision for a continuation of this trend to 2030. The fraction of renewable energy sources in consumption of primary energy sources should increase to 6% by 2010 and to 20% in 2030, and there should be a reduction on the energy intensity of production, distribution and final consumption of energy to a level of 60-70% of current consumption by 2030 and an increase in the fraction of use of biofuels to 5.75% in 2010. According to the Program, the use of all alternative fuels in transport should reach a level of 20% in 2020.

The National Program is also concerned with the aspect of preparation of specific sectoral adaptation measures and places emphasis on their detailed economic evaluation, as a number of adaptation measures can be very interesting economically, especially from the long-term point of view, and can substantially contribute to mitigating the impacts of climate change on a national scale. This area also encompasses intensive support for scientific research on climate change, systematic observation and an improvement in forecasting and integrated warning systems.

The Program lays down specific tasks for the individual ministries that are responsible for the key activities of these sectors. Their tasks are also included in the State Energy Conception, approved by the Government in 2004, and the Transport Policy for 2005 – 2013, approved in 2005. Chapter 4 gives a detailed survey of the individual measures.

Emission Projections

In accordance with the recommended methodology for their preparation, projections were prepared for the scenario without measures, with measures and with additional measures, constituting complete fulfilment of the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources, the introduction of environmental tax reform, implementation of the Directive on buildings and implementation of the "Industry and Business" and "Infrastructure" operational programs. This methodology encompasses a series of steps that take into account the latest greenhouse gas inventory, choice of the initial and final year and cross-sectional years for projection, choice of the actual methodology and modelling instruments for preparation of the projection, selection and analysis of input data for the projection, establishment of the initial assumptions, definition of scenarios, their calculation and presentation of results and performance of sensitivity analysis under selected assumptions.

In the model calculation of the emission projection from energy-production processes, it was assumed that the Temelín nuclear power plant will be in normal operation throughout the monitored period, that the Dukovany nuclear power plant will be reconstructed in order to prolong its lifetime and will be in normal operations throughout the period of interest, that there will be no limits on petroleum, gas and black coal imports after 2004 and that exports would equal approx. 15 TWh annually to 2010, with a decrease to 10 TWh after 2010.

The results of the prepared projections indicate that a reduction in total greenhouse gas emissions by 26% can be expected in 2010 and by at least 38% in 2020, compared to the level in 1990. Chapter 5 gives a detailed description.

Estimates of Vulnerability, Impacts and Adaptation Measures

Estimates of the impacts of climate change were based on methods of impact evaluation using biophysical, empirical-statistical and process models. In addition, empirical analogue studies and expert estimates were employed. The models were validated and their sensitivity was analyzed; the climatic conditions in the 1961 – 1990 period were employed as starting conditions. New regional scenarios of climate change, which refine the results submitted in the previous national communication, were created in recent years for estimation of impacts. The scenarios are based on analysis of the properties of the global circulation models (GCM) available from the database of the Intergovernmental Panel on Climate Change ((IPCC), which best describe the present-day climate in the Czech Republic.

All the experiments indicate elevated average daily air temperatures in all the months of the year. The scenarios employed, based on SRES A2 and SRES B2, differ from previous estimates in a smaller change in the annual average temperature and smaller changes in monthly averages. With the exception of April, the temperature increase exceeds 1 °C; the greatest warming (about 3.5 °C) was found for September. According to the scenarios, precipitation will increase in the winter and spring by 5 to 20%, while summer precipitation will typically decrease by up to 30%. Substantial uncertainties are associated with the magnitude of changes in total precipitation connected with the choice of emission scenario.

The most important climatological variable for estimation of the impact of climate change on the hydrological regime consists in total precipitation; however, these values are accompanied by greater uncertainty than the other meteorological factors (especially air temperature, i.e. evaporation and transpiration). The climate change caused by an increase in the greenhouse effect leads to an impact on the hydrological cycle and it is highly probable that the yield of water sources in the Czech Republic will decrease, which would substantially worsen the currently relatively unfavourable hydrological conditions in some river basins.

A greater frequency of floods in the winter can be expected as a consequence of increased outflow in the colder season of the year. Warming of the water will lead to a reduction in the number of species, to acceleration of the processes of decomposition of organic substances, to influencing of the tem-

perature stratification in water bodies and to greater frequency of the occurrence of excessive growth of phytoplankton, with a number of detrimental consequences, and also to increased metabolism, which will simultaneously increase the toxicity of some substances.

The climatic conditions in the most fertile agricultural areas are dependent on the individual frequency of droughts, whose occurrence has increased in the last few decades. This is caused by increased evapotranspiration and also by a slight decrease in total precipitation, i.e. a reduction in the moisture balance values. The lack of precipitation in the vegetation period in dry years corresponds to over 200 mm. Droughts have the greatest impact on light, sandy soils. Studies have indicated that the susceptibility to impacts is increased particularly by increased variability in the weather and by the occurrence of extreme weather conditions (high temperatures and their duration, periods without precipitation and, on the other hand, more frequent occurrence of intense precipitation). A prolonging of the vegetation period, increase in the sum of active and effective temperatures, and an increased number of summer and tropical days and a decrease in the number of frosty or icy days can be expected. The beginning of the vegetation period in southern areas will shift to the beginning of March and the end of this period will move to the end of October or the beginning of November. Higher air temperatures will prolong the vegetation period and affect the growth and development of plants to allow earlier germination and onset of further phenophases so that, compared with current conditions, the time of ripening or harvesting could be put forward by at least 10 to 14 days. However, acceleration of vegetation in the spring can increase the danger of damage to plants by late frosts. Climate change will affect the landscape and ecosystems as a whole. It will substantially affect the conditions for the development and spread of agricultural pests and diseases. There will be a rise in infection pressure and increased incidence of species from warmer areas. Greater occurrence of viral diseases can be expected over larger areas, e.g. for potatoes. Similarly, greater damage from some fungal diseases is expected. From the standpoint of production of crops, there will be an increased need for chemical protection, leading to elevated costs. Insufficient chemical protection could, on the other hand, lead to reduced economic revenues from agricultural crops.

A change in the climatic conditions will undoubtedly have a substantial impact on the physiology of trees and on forest ecosystems. It is expected that the current unsatisfactory state of forest stands, caused particularly by burdening by air pollution, will be substantially worsened. There is a risk of potential decomposition of unstable young and adult spruce single-species forests in unsuitable sites and increased abiotic damage under extreme weather conditions. An overall increase in the temperature could lead to dangerous stress caused by drought. Further habitat factors, such as light, air temperature, availability of nutrients or environmental pollution could act synergically with soil moisture and affect tolerance to drought.

Chapter 6 also specifies the most important adaptation measures that could alleviate the risks of the impacts of climate change. A portfolio is contained in the National Program to Mitigate the Impacts of Climate Change in the Czech Republic and has been proposed for implementation by the Ministry of Agriculture, which directs activities in these affected sectors.

Financial Sources and Transfer of Technology

As the Czech Republic is not a country listed in Annex II of the Convention, it is not obliged in the sense of Article 12.3 of the Convention to adopt measures and fulfil obligations following from Articles 4.3, 4.4 and 4.5 of the Convention and especially to create further financial sources. Chapter 7 provides brief information on the total volume of finances that the state contributed to the individual funds. However, it is not possible to specify the part of these finances that is directed to the area of climate change.

Research and Systematic Observation

Research on the climate system is concentrated particularly in a number of institutions, which are listed in Chapter 8. Most of them are members of or are represented in the National Climate Program, which is an association of legal persons entrusted with performance of the tasks of the World Climate Research Programme of the World Meteorological Organization, creation of research teams of scientists in the area of the climate and publication of the results obtained. The research work is financed mainly from their budget; special published studies are financed mainly from the state budget through the grant agencies of the Czech Republic and the Academy of Sciences of the Czech Republic or the grant projects announced by the Ministry of the Environment and the Ministry of Agriculture. Some projects are carried out in the framework of international cooperation and shared financing with foreign partners. Systematic observation of the climate system is performed in a decisive degree by the Czech Hydrometeorological Institute, which acts as the state institute for the fields of protection of air quality, hydrology, water quality, climatology and meteorology with competence to establish and operate the state monitoring and observation network, including international exchange of data according to the WMO principles. Other institutions perform monitoring only for their own use, usually for the limited duration of a particular project.

In addition to participation in the activities of the World Meteorological Organization and UN Environmental program, the Czech Republic cooperates on a number of international projects concerned with the climate. Participation in the RC LACE (model ARPEGE-CLIMAT) project is most important in this respect. Recently, participation in international projects concerned with modelling the climate system and estimation of the impacts of climate change has expanded substantially. Assistance is regularly provided to developing countries in the area of training courses, assistance in installation and calibration of instruments (e.g. monitoring of the ozone layer, etc.).

In the framework of long-term basic tasks of research institutions and universities, research is carried out on the properties of observed and model series and fields of climatic variables, with emphasis on variability and the occurrence of extreme phenomena, changes in atmospheric circulation, interconnections between components of the climate system and estimates of climate changes. Research is concentrated primarily on the potential for modelling the climate on a regional scale, application of the methods of statistical downscaling and also the causes of climate change related particularly with solar activity.

Education and Public Awareness

The State Environmental Policy for 2004 – 2010, approved by the Government in 2004, which contains an analysis of current conditions and outlines the main directions of environmental protection in 2004 – 2010, is a basic strategic document for preparation of detailed programs for the individual components of the environment, including climate change, and for dealing with individual environmental problems. Amongst topical targets and measures, it emphasizes the creation and utilization of a program of an interconnected system of education and public awareness, concerned with the environment and permeating throughout all the sectors. The system includes state, public, private and civic institutions.

The Czech Republic is progressively implementing Agenda 21, whose Chapter 36 is one of the starting points for this program. The Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters, which was signed in 1998 and ratified in 2004, is another important basis for its creation. The Interministerial Agreement on cooperation in the area of environmental education and public awareness was concluded between the Ministry of the Environment and the Ministry of Education, Youth and Sports in 1999. Both ministries emphasize environmental education and public awareness as a multidisciplinary instrument providing information, facts, knowledge and skills and creating a basis for responsible relationship and conduct of individuals towards the environment. An Interministerial Agreement on cooperation in the area of environmental education and public awareness between the Ministry of the Environment and Ministry of Education, Youth and Sports has been signed at the level of the Ministers of these sectors.

A detailed description of the system of education, public information campaigns and the manner of participation of the public and NGOs is set forth in Chapter 9.

1 Introduction

The Fourth National Communication of the Czech Republic has been prepared pursuant to the requirements set forth in the document FCCC/CP/1999/7, Part II – *Guidelines for the Preparation of National Communications by Parties Included in Annex I to the Convention*. It analyzes current conditions in the area of climate change in the Czech Republic and documents the state of compliance with obligations following from the Convention in the period from 2001, when the CR submitted the Third National Communication, to the year 2005.

In 2002, new Act No. 86/2002 Coll., on protection of the air and amending some other Acts (Act on Protection of the Air), which contains a part related to protection of the climate system of the Earth, came into force. This Act also contains the obligation to prepare and submit a National Program on Mitigation of Climate Change of the Earth to the Government of the Czech Republic.

In 2004, the Government of the Czech Republic approved Resolution No. 187/2004 on the National Program to Mitigate the Impacts of Climate Change in the Czech Republic, which updated the original document with the name "Strategy for Protection of the Climate System of the Earth in the Czech Republic", approved in 1999 in Government Resolution No. 480/1999. The National Program establishes the national reduction targets for greenhouse gases in the period to 2020 and priorities for formulation of further measures to reduce greenhouse gas emissions and also adaptation measures (adaptation to climate changes that are already occurring), which must be incorporated in a specific form into the conceptual materials of all the sectors that could in any way contribute to reduction of the risk of disturbing the climate system of the Earth or could be affected by such a risk.

2 National Conditions

2.1 Structure of the State Administration

The Czech Republic was established on January 1, 1993 following the division of the Czech and Slovak Federative Republic (Czechoslovakia). The Constitution, which was adopted in 1992, established the basic profile of the structure of the State, which defines the positions and roles of the most important bodies of the state authority. On this basis, the Czech Republic can be considered to be a parliamentary democracy, with separate legislative, executive and judicial powers. The state is headed by the President, who is elected by the Parliament for a period of five years. The highest legislative body in the country is the Parliament, consisting of two chambers (Chamber of Deputies and Senate), which approve all the proposed laws and express consent or dissent with important international conventions, agreements, protocols, and various political and strategic documents in the areas of industry, the military, the environment, agriculture, etc. Executive power lies with the Government, which is drawn up on the basis of the results of elections to the Chamber of Deputies. Its members generally consist of the representatives of the strongest political parties in the last elections. In this election period, it consists of the Prime Minister, four deputy prime ministers and the individual ministers, responsible for the activity of 15 ministries. According to the Constitution, the Czech Republic is divided into higher self-governing units (regions), which obtained a number of powers in 2001 that were formerly held by the Government. Their size corresponds to the larger territorial administrative units in the framework of the European Union with a size of NUTS 3. They are headed by a chief executive officer. They constitute a self-governing intermediate stage between the municipalities and cities and the Government. They provide for selected functions and services to citizens in the framework of social-economic and other development (e.g. including the environment) on the basis of their own requirements, better knowledge of local and regional conditions and independent financial decision-making. At the present time, the municipalities constitute the only self-governing units directed by elected municipal and city representatives, headed by the mayor.

In the area of protection of the environment, the Ministry of the Environment is the highest executive body of the state administration; at the present time, it is divided into five professional sections (environmental economics, legislation and the state administration, protection of nature and the landscape, technical environmental protection and foreign relations). The Ministry establishes professional institutes (e.g. CENIA, the Czech Environmental Information Agency, the Czech Hydrometeorological Institute, the T.G. Masaryk Water Research Institute, the Agency for Protection of Nature and the

Landscape of the Czech Republic) and the State Environmental Fund of the Czech Republic and the Czech Environmental Inspection.

2.2 International Activities

The Czech Republic became a member of OECD in December 1995, a member of NATO in March 1999 and a member of the European Union in May 2004 and is a Party to most international environmental conventions and protocols. Its representatives participate in activities in the framework of international organizations (UN, OECD, Council of Europe). The state meets the main duties following for it from the adopted international obligations and also participates in a number of foreign projects, which assist in performing tasks accepted on the basis of international activities. In the area of foreign development assistance, assistance is provided primarily to less developed countries through their experts and in the form of assistance for international activities.

2.3 Population

In 2004, the Czech Republic had a total of 10.2 million inhabitants and was thus in 14th place in Europe in terms of population (See Tab. 2.2). With an average population density of 129 inhabitants/km^2, it is one of the more densely populated countries of Europe. As a consequence of natural and economic conditions, there is a higher population density in the northern part of the country and in areas with large urban agglomerates. The nationality composition of the population is currently practically homogeneous (94% of the inhabitants are of Czech, Moravian or Silesian nationality, 1.9% constitute a Slovak minority and there are also Polish and German minorities). The originally high birth rate has decreased over the last fifty years. From the beginning of the nineteen nineties, the Czech Republic has become a country that is beginning to accept a larger number of immigrants, especially from Southern and Eastern Europe and from some Asian countries.

2.4 Geographic Conditions

Its area (78 664 km^2) places the Czech Republic amongst medium-sized to smaller countries and, following the creation of a number of new European countries, it is the 21st largest state in Europe. Sněžka in Krkonoše (1603 m a.s.l.) is the highest mountain peak, while the lowest point is at Hřensko, where the Elbe crosses the border with Germany (115 m a.s.l.). From the standpoint of altitude distribution, 5.0% of the total area consists of lowlands or areas below 200 m a.s.l., 74.1% corresponds to 200 – 2500 m a.s.l., 19.3% lies at an altitude of 600 – 1000 m a.s.l. and 1.6% of the area of the country lies at an altitude of over 1000 m a.s.l. The average height above sea level is 450 m, which is higher than the average altitude of Europe as a whole (315 m); together with its position at the centre of the continent, this means that the main European water divide (North, Baltic and Black Seas) passes through the Czech Republic. This position on the main European divide is not favourable from the standpoint of water management, as most rivers have their source here. Thus, precipitation becomes the main source of water. The long-term average precipitation equals 693 nm and approximately 30% of this amount flows out of the country in watercourses. The river network in the Czech Republic has a density of 0.96 km/km^2. The vast majority of the territory of the Czech Republic is drained by the Elbe into the North Sea, the major part of Moravia is drained by the Morava River into the Danube and Black Seas and part of Moravia is drained by the Odra River into the Baltic Sea. The fan-shaped river network in the Odra watershed is characterized by the concentrated confluence of larger rivers in the Ostrava basin with an elevated risk of floods. Compared to the surrounding countries, there are only a very few lakes here (in the Šumava area). Artificial water reservoirs are far more frequent, with more than 24 000 located in the country, the vast majority of which are fishponds. Mineral springs are very common, occurring in about 350 locations.

The current conditions of the biosphere is the result of natural developments over the last several thousand years. The vegetation in valley floodplains and lowlands corresponds mainly to agricultural land. Lowland meadows cover large areas. Forests are the most important of all plant communities (about 1/3 of the area of the country), and form a microclimate and mezoclimate, absorb more solar radiation, reduce wind speed and affect outflow conditions. Most present-day forest stands were planted artificially and do not correspond to the original species composition of the forests. They consist mostly of single-species stands with a predominance of spruce and pine. The development of the contemporary landscape is affected primarily by secondary ecosystems. Original, natural ecosystems are scarce in the landscape. A large part of the country consists of fields, vineyards, orchards and gardens, used for food production, which are included amongst productive ecosystems.

Settlement structure consists of more than 15 000 predominantly small settlements, almost half of which have less than 100 inhabitants and 93% of which have less than 1000 inhabitants. Only five cities have more than 100 thousand inhabitants. Compared to the other countries of Central Europe, the Czech Republic has a smaller number of medium-sized and especially large cities. Territorial differences in the character of settlements are significantly affected by natural conditions. The areas of the uplands of central, southern and western Bohemia, which do not have very favourable conditions for agriculture, have a dense network of small settlements, while the more fertile lowlands of Bohemia and especially central and southern Moravia have larger rural settlements, frequently with 1-2 thousand inhabitants.

2.5 Protection of the Environment

A number of strategic environmental documents were adopted after 1990, encompassing protection of the environment and the principles of sustainable development. The updated State Environmental Policy 2004 – 2010 and the Strategy of Sustainable Development in the Czech Republic are the most important of these documents. The State Environmental Policy 2004 – 2010 defines the following priority areas:

- nature conservation, protection of the landscape and biological diversity;
- sustainable exploitation of natural resources, protection of waters and protection against floods, optimization of material flows and waste management;

- reducing the burden on the environment from human activities, improving environmental standards for the quality of human life;
- protection of the climate system of the Earth and prevention of long-range transport of air pollution and
- increasing public awareness of environmental issues.

In its environmental pillars, the strategy of sustainable development in the Czech Republic aims to minimize the conflict of interests between economic activities and protection of the environment and to gradually achieve separation of economic growth from an increase in detrimental impacts on the environment.

In the past decade there has been a substantial reduction and stabilization in the level of air pollution in all the main indicators (Tab. 2.1). The areas with the worst air quality include the agglomerations of the large cities (Prague, Plzeň and the Ostrava region) and locations with higher intensity of automobile transport. A reduction in the concentrations of arsenic, cadmium and lead can also be observed in the 1997 – 2003 period at most of the measuring stations. Tropospheric ozone is an exception, with a slight increase in the frequency of exceeding of pollution limit levels. The Czech Republic is a Party to the Convention on the Protection of the Ozone Layer (Vienna Convention) and its implementing Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) and the relevant amendments (London, Copenhagen, Montreal and Beijing); the basic obligations have been met, leading to a substantial reduction in the relevant substances.

Tab. 2.1 Comparison of emissions of pollutants into the air in 1990 and 2003 (thous. t. p.a.)

	particulate matter	SO_2	NO_X	CO	NMVOC	$CO_{2\ equiv.}$
1990	565	1 850	551	1 275	441	187 500
2003	76	226	330	569	198	143 400
% 1990	13.5	12.2	59.9	44.6	44.9	76.5

	Pb	Cd	Hg	PAH	PCB	PCDD/PCDF
1990[a)]	241.4	4.3	7.5	36.7	96.1	190.6
2003	48.9	2.8	2.9	25.7	86.6	178.3
% 1990 (2001)	20.3	65.1	38.7	70.0	90.1	93.5

**) data for 2001 for PAH, PCB, PCDD/PCDF*

Source: CSO, CHMI

Similarly as for the air, quite favourable progress has been made in reducing the pollution of surface waters. This is affected primarily by point sources (cities and municipalities, industrial plants and objects with concentrated farm animal production) and also extensive sources (agricultural management in the form of application of industrial fertilizers and chemical preparations, atmospheric depositions and erosion run-off).

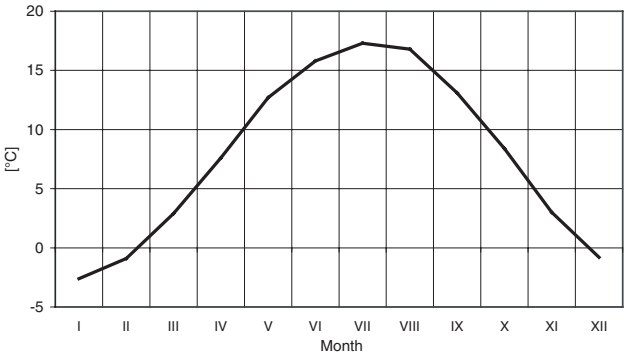
In 2003, 77.7% of the population of the Czech Republic was connected to public sewers, which is more than 15% more than the average for the European OECD countries. A total of 558.1 mil. m^3 of waste water was discharged into public sewer systems, 94.5 % of which was treated in waste water treatment plants. In the 1990 – 2003 period, there was a reduction in the discharged pollution BOD_5 value by 92%, in COD_5 by 85.3%, in the contents of insoluble substances by 89.2% and in dissolved inorganic substances by 13.6% for point sources of waste waters from industry.

Nature protection has a long tradition in the Czech Republic. For example, it contains the oldest European nature reserve, which was declared in the Novohradské hory in 1838 (the Žofín virgin forest). At the present time, the country has four national parks (Krkonoše, Šumava, Podyjí and České Švýcarsko) with a total area of 1190 km^2 and 24 protected landscape areas, covering 14.6% of the total area of the country. Internationally important protected areas are an important part of the natural complexes, including especially the biosphere reservations proclaimed by UNESCO.

2.6 The Climate

From a dynamic-synoptic point of view, the weather of the Czech Republic corresponds to the Atlantic-continental area of the temperate climate zone of the northern hemisphere. The average annual temperature varies from 1.0 to 9.4 °C in dependence on geographic factors. The lowest average temperatures occur in mountain areas on the northern, eastern and south-western borders of the country. The warmest areas lie at an altitude of about 200 m a.s.l. (lowlands in the southeast of the country and in the area along the Elbe). Temperatures of about 7-8 °C predominate in the average annual temperatures and in the average temperatures in the spring and autumn seasons; average summer temperatures are 16-17 °C and the average winter temperature is -1 °C. Prague is a specific area with a thermal island increasing the average annual temperature by about 1 to 2 °C above the values corresponding to its geographic position.

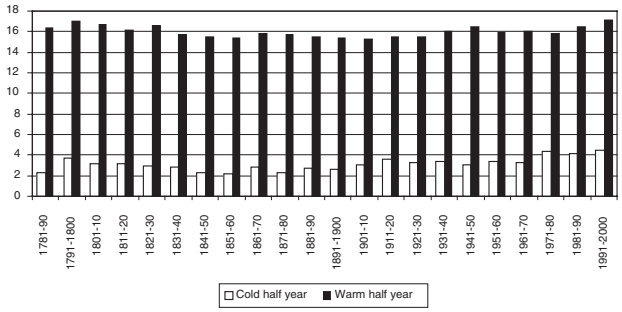
Fig. 2.1 Annual variation in the average air temperatures in the CR in the 1961 – 1990 period



Source: CHMI

The annual air temperature variation has the shape of a simple wave with a minimum in January and maximum in July (Fig. 21.). It follows from the temperature trends in 1961 – 1990 that most of the monitoring stations recorded an increase in the annual average temperatures in this period of 0.22 °C / 10 years; this increase can be considered statistically significant at 14% of these stations. The last three decades of the 20th century were associated with a substantial increase in the air temperature. The year 2000 was the warmest year of the 20th century and the 1991 – 2000 decade was the warmest in the whole series of measurements at the secular station of Prague Clementinum (Fig. 2.2). The warming is apparent in both the warmer and colder halves of the year, where the average temperatures outside of the winter period are more than 1 °C above the long-term average. This trend in gradual warming continued after 2000.

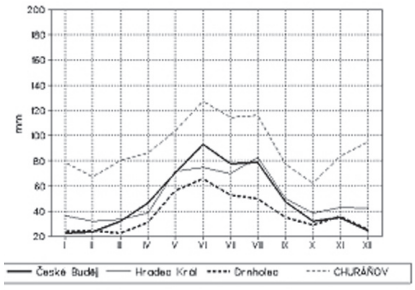
Fig. 2.2 Average winter and summer temperatures for decades for the 1781 – 2000 period at the Prague-Clementinum station

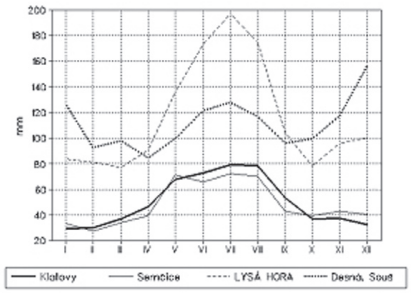


Source: CHMI

Atmospheric precipitation is amongst the most variable climatic elements. Especially the geographic position of the site relative to air currents carrying moisture and the frequency of the occurrence of weather conditions with greater precipitation are decisive for precipitation conditions. Heavy precipitation is connected especially with the occurrence of low pressure areas and fronts over Central Europe. Relatively longer periods without precipitation occur especially under the influence of high pressure areas from the Azores in the summer season.

Fig. 2.3 Annual variation in total monthly precipitation at selected stations in the CR



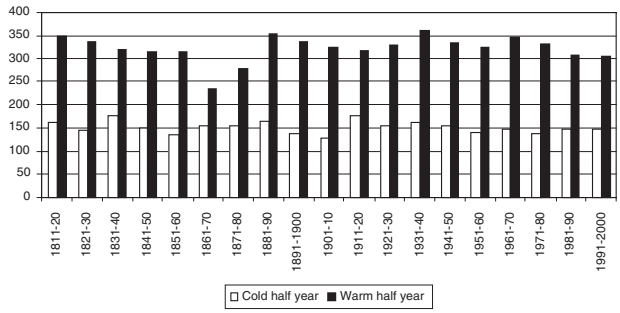


České Budějovice (388 m a. s. l.), Hradec Králové (278 m a. s. l.), Drnholec (179 m a. s. l.), Churáňov (1118 m a. s. l.), Klatovy (430 m a. s. l.), Semčice (234 m a. s. l.), Lysá hora (1324 m a. s. l.), Desná-Souš (772 m a. s. l.).

Source: CHMI

The lowest amount of precipitation occurs in the wind shadow of the Krušné hory (mountains), also in a strip along the Ohře river in north-western Bohemia and along the Dyje in southern Moravia, where the average annual total precipitation equals 450 mm. Maximum precipitation, with annual totals of over 1300 mm, occurs in the exposed sides of the Jizerské, Krkonoše and Beskydy mountains. The differences between the long-term minima and maxima indicate a substantial territorial variability in precipitation. The typical annual variation of precipitation, in the shape of a simple wave with maximum in July and minimum in February or January has practically not appeared in the average total precipitation curve in recent years. At the present time, the annual variation generally has one or two maxima in the summer month (June or August), frequently accompanied by a local maximum in November. Minimum total precipitation is most frequently recorded in February or January, or in October (See, e.g., Fig.2.3).

Fig. 2.4 Average winter and summer precipitation for decades for the 1811 – 2000 period at the Prague-Clementinum station



Source: CHMI

From the long-term standpoint, total precipitation has exhibited a decrease in the last few decades (Fig. 2.4), and this has been manifested most strongly in the warmest lowland areas of southern Moravia. Extreme total precipitation values occur more frequently, reflected in the repeated occurrence of floods, especially after 1995 (e.g. more extensive floods in 1997, 1998, 2002, 2004 and 2005).

An increase in the occurrence of extreme weather has been recorded especially in the last ten years.

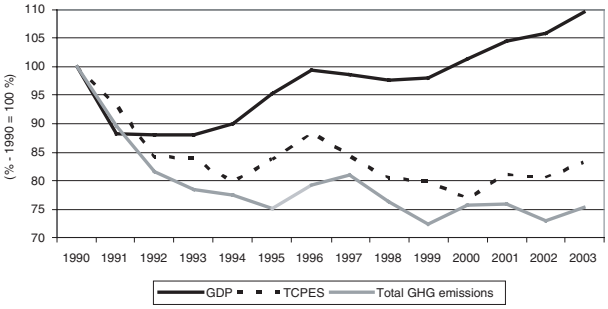
2.7 Economics

After 1989, the economy in the Czech Republic began to be transformed to the conditions of a market economy; at the present time, this transformation has been completed, especially in connection with accession to the European Union. This is connected with the restitution and privatization process, characterized mainly by a reduction in the influence of the state on the economy, with fundamental changes in the economic structure of the state with the possibility of input of foreign capital, with improved product quality, in an attempt to achieve competitiveness on the European and world markets, and with a concurrent improvement in the state of environmental conditions determined primarily by the conduct of the economic sphere. The transformation has been completed in the area of services and banking and is continuing in the energy industry. Tab. 2.2 gives a comprehensive survey of the relevant macroeconomic developments for the 1990 – 2003 period, related to the reference year of 1990. From this table, it follows, amongst other things, that the Czech Republic returned to the HDP level of 1990 only

in the year 2000. This level is affected by the increase in foreign investments; overall, inflation is at an acceptable level.

The branch structure of GDP in constant 1995 prices for the 1991 – 2003 period is given in Tab. 2.3. Following a rapid decrease in GDP in all the sectors of the economy by 20-30% in 1991 – 1993, growth was renewed in industry after 1993 and also in agriculture after 1997. Transport is the only sector exhibiting constant growth without reference to the GDP level. The index of trends in GDP, consumption of primary energy sources and selected sectors of the economy in the creation of GDP (in constant 1995 prices) is apparent from Tab. 2.4. Fig. 2.5 illustrates trends in greenhouse gas emissions and their relationship to the creation of the gross domestic product and domestic consumption of primary energy sources (DCPES). A favourable phenomenon occurred in 1992 – 1993 – independent trends in the curves of environmental burden (emissions) and of economic output (GDP).

Fig. 2.5 Trends in greenhouse gas emissions, total consumption of primary energy sources and gross domestic product in 1990 – 2003 in % of 1990



Source: CHMI, CSO

Tab. 2.2 Trends in the number of inhabitants and the main economic indicators in the 1990 – 2004 period

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of inhabitants [thous.]	10 363	10 331	10 315	10 304	10 295	10 283	10 273	10 224	10 201	10 202	10 207
GDP [bil. CZK], current prices	626.2	1 466.7	1 660.6	1 785.1	1 962.5	2 041.4	2 150.1	2 315.3	2 414.7	2 550.8	
GDP [bil. CZK], constant 1995 prices	1 449.4	1466.7	1527.7	1516.6	1499.2	1517.3	1576.3	1617.9	1642.0	1703.0	
GDP [bil. PPP][d)]	107.3	109.7	118.3	120.6	121.6	124.8	131.1	137.8	145.4	149.3	159.7
GDP/inhab. [thous. PPP][d)]	10.35	10.62	11.47	11.70	11.81	12.14	12.76	13.47	14.26	14.63	15.65
Nominal wage (CZK)	3 286	8 307	9 825	10 802	11 801	12 797	13 614	14 793	15 866	16 917	18 035
Level of inflation [%]	9.7	9.1	8.8	8.5	10.7	2.1	3.9	4.7	1.8	0.1	
Price index in the consumer sphere total[a)]	100.0	252.5	274.7	297.9	329.7	336.7	349.9	366.3	372.9	373.3	
Foreign investments into the CR [bil. CZK]	2.4	67.9	38.8	41.3	119.9	218.8	192.4	214.6	277.7	59.3	114.7
Foreign debts to the CR [bil. CZK]	287.7	457.3	578.9	748.7	726.9	822.5	817.1	811.3	813.3	894.3	
Exchange rate vs USD	18.56	26.54	27.14	31.70	32.28	34.57	38.59	38.04	32.74	28.23	
Unemployment level [%]	0.73	2.93	3.52	5.23	7.48	9.37	8.78	8.90	9.81	10.31	
Foreign trade balance [bil. CZK]	-13.7[c)]	-63.2	-99.0	-95.1	-22.1	-24.3	-66.3	-58.7	-49.5	-56.1	

[a)]1990 = 100%; [b)]data for the former Czechoslovakia; [c)]without Slovakia; [d)] parity purchasing power

Source: CSO

Tab. 2.3 Branch structure of GDP in constant 1995 prices for the 1991 – 2003 period

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
GDP in basic prices [bil. CZK]	1 180.7	1 183.7	1 197.9	1 227.4	1 326.4	1 371.8	1 346.0	1 335.4	1 360.0	1 419.9	1440.2	1470.8	1515.4
Agriculture, forestry, fishing [%]	5.4	4.3	6.4	5.2	4.8	4.6	4.5	5.1	5.2	5.3	4.8	4.8	4.7
Industry [%]	33.1	36.5	30.7	32.5	31.8	34.9	35.4	31.9	34.6	35.4	32.9	35.1	36.5
Construction [%]	9.3	8.7	8.6	7.5	9.5	8.0	7.2	7.5	5.5	5.3	4.6	4.6	4.1
Trade, repairs, restaurants, accommodation [%]	13.4	13.5	13.9	14.7	14.5	14.2	16.2	17.1	17.0	17.1	18.4	17.2	17.6
Transport, communications [%]	7.2	7.6	8.7	8.4	10.7	10.4	10.3	10.0	10.2	9.4	10.2	10.6	9.1
Financial mediation [%]	4.1	3.9	4.3	4.5	3.4	4.0	4.1	5.8	5.2	4.5	5.2	5.6	5.3
Commercial services [%]	8	7.3	7	6.6	13.2	11.8	11.4	12.6	12.4	13.1	14.2	12.7	13.3
Other services [%]	15.1	13.9	14.2	14.5	15.6	16.0	15.1	14.3	14.4	14.2	14.2	13.9	13.7

Source: CSO

Tab. 2.4 Index of trends in the gross domestic product in industry, agriculture, construction and transport in the 1990 – 2003 period [1990 = 100%]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
GDP [constant 1995 prices]	100.0	85.8	84.9	89.8	97.1	106.5	111.8	112.1	110.9	113.9	119.6	128.4	135.6	139.2
GDP [PPP]	100.0	85.8	84.9	89.8	97.1	102.3	107.8	101.9	100.8	102.7	105.0	105.1	105.6	102.6
DCPES[*)]	100.0	91.7	86.4	84.4	81.5	84.5	88.1	84.3	80.1	78.3	79.8	81.6	82.1	88.6
DCPES/GDP [CZK, c.p. 1995]	100.0	106.9	101.8	94.0	83.9	79.3	78.8	75.2	72.2	68.7	66.7	63.5	60.6	63.7
DCPES/GDP [USD, p.p.p.]	100.0	106.9	101.8	94.0	83.9	82.6	81.7	82.7	79.4	76.3	76.0	77.6	77.8	86.3
Industry	100.0	69.6	76.8	66.7	72.3	71.9	81.5	81.2	72.5	80.0	85.6	80.5	87.8	94.0
Agriculture	100.0	62.6	49.9	76.7	63.8	59.7	59.2	57.3	64.2	66.7	70.0	65.3	66.8	66.7
Construction	100.0	132.4	124.1	126.6	113.0	144.6	127.3	111.2	116.0	86.5	86.0	75.7	77.6	72.3

[*)]*DCPES = Domestic consumption of primary energy sources*

Source: CSO

2.8 Energy Production

The State Energy Conception was approved by the Government of the Czech Republic on March 10, 2004. The conception defines priorities and targets in the energy sector and describes specific implementation instruments in the energy policy of the state. Since February 5, 2001, the Czech Republic has been a member of the International Energy Agency and has been connected to the UCTE Western European electricity distribution network since 1996. The Energy Charter Treaty was ratified in the same year, simultaneously with accession to OECD. A number of laws and documents dealing with energy treatment and management have also been adopted in recent years and are described in detail in Chapter 4.

Prior to 1989, the Czech Republic was a country that favoured the development of heavy industry (production of iron and steel) with high energy consumption, based on domestic solid fossil fuels, where the energy from these fuels was frequently used in a very ineffective manner. This situation led to a number of serious problems, especially in relation to the environment. Conditions gradually changed after 1989, with a transition to the use of cleaner fuels (petroleum and natural gas). The results of these changes are documented in Fig. 2.5. The construction of two blocks of the Temelín nuclear power plant was completed (test operation of the first block was commenced in June 2002 and, of the second block, in April 2003). Tab. 2.5 gives a survey of the shares of the individual kinds of fuels in the structure of domestic consumption of primary energy sources (DCPES). The fraction of renewable energy sources in total DCPES equalled 2.6% in 2002 and is expected to increase to 3-6% by 2010. In addition, energy is constantly being used more economically (there was an absolute decrease in DCPES in 1990 – 1999 by 22%, but there has again been a gradual increase since 2000). Tab. 2.6 gives a survey of the overall energy balance including domestic sources, imports, exports and losses.

Tab. 2.5 Fractions of the individual kinds of fuel in domestic consumption of primary energy sources in 1990 and in the 1994 – 2003 period [%]

	1990	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Solid fuels	65	58	58	55	56	53	51	53	51	49	47
Liquid fuels	17	17	19	19	17	19	20	19	19	19	19
Gaseous fuels	11	14	16	18	19	19	20	19	20	19	18
Other sources	7	11	7	8	8	9	9	9	10	13	16
Total	100	100	100	100	100	100	100	100	100	100	100

Source: CSO

Tab. 2.6 Total energy balance in 1990 and in the 1995 – 2003 period

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Domestic sources [PJ]	1 731	1 410	1 403	1 347	1 284	1 156	1 247	1 251	1 258	1 345
Imports [PJ]	592	726	803	779	780	744	728	774	785	846
% DCPES	28.5	41.5	44.0	44.6	47.0	45.9	44.0	45.7	46.1	46.0
Exports [PJ]	159	397	389	376	366	363	339	343	346	357
DCPES [PJ]	2 076	1 750	1 823	1 745	1 659	1 621	1 657	1 693	1 705	1 840
Losses [PJ]	689	595	602	605	581	562	610	596	673	644
% DCPES	33.2	40.0	33.0	34.6	35.0	34.6	36.8	35.2	39.5	35.0
Final consumption [PJ]	1 303	1 091	1 152	1 099	1 047	1 052	1 003	1 057	1 050	1 128

Source: CSO

The complicated price and tax relations in the area of energy production constitute an unresolved aspect. The prices of energy for the population continue to be subject to substantial subsidies, whose elimination and introduction of market conditions would constitute a serious social problem, which can be resolved only over a longer period of time.

Industry makes the greatest contribution to final energy consumption (41.6% in 2003, 52.8% in 1990). Although this value is constantly decreasing, it remains substantially higher than the average for the European OECD countries (30%). Energy consumption in the transport sector has increased from the original 8.7% in 1990 to almost 18% in 2003. The fraction of energy consumption in the residential and business sector has practically not changed and varies around 35%, amongst other things because of inadequate energy management.

2.9 Transport

The central position of the Czech Republic makes it an important crossroads of transport routes. Transport is based on a combination of railway and highway transport which, together provided for the transport of 15% of passengers and 96% of freight, based on transport output in 2003. Passenger automobile transport is a very important aspect and contributes just under 80% to total transport output for passengers. The density of the railway network per unit area of the country is the greatest in the OECD countries (more than 12 km of track per 100 km^2). However, railway transport and other infrastructure require thorough modernization, which has already been commenced and has been completed on some internationally important sections. The necessary modernization of the highway network (overall density of 70 km/km^2) and especially construction of throughways (density of 6.3 km/km^2) frequently encounters various conflicts of interest with environmental protection interests. The increase in the volume of passenger and freight transport and the transition from railway to highway and air transport is especially disturbing, see Tables 2.7 and 2.8.

Tab. 2.7 Transport outputs in passenger transport [bil. person km]

	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
IAT*)	39.9	44.3	49.0	51.7	54.5	57.9	59.0	59.7	62.4	63.9	63.4	65.2	67.3
Public highway	12.3	10.1	9.09	8.20	7.67	6.32	5.80	8.68	8.65	9.35	10.6	9.63	8.89
Total highway	52.2	54.4	58.1	59.0	62.2	64.2	64.8	68.4	71.0	73.3	74.0	74.9	76.2
Railway transport	13.4	11.8	8.6	8.5	8.0	8.1	7.7	7.0	7.0	7.3	7.3	6.6	6.5
Air transport	2.2	2.4	2.3	2.6	3.0	3.2	3.5	3.7	4.3	5.9	6.4	6.9	7.1
Water transport	0.003	0.005	0.006	0.003	0.010	0.010	0.010	0.008	0.008	0.008	0.008	0.008	0.008
Total	67.8	68.6	68.9	71.0	73.2	75.5	76.1	79.1	82.3	86.4	87.7	88.4	89.8

**) IAT – individual automobile transport*

Source: TRC

Tab. 2.8 Transport outputs in freight transport [bil. t.km]

	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total highway	16.82	20.25	25.26	29.81	32.50	34.55	40.64	33.91	36.96	39.03	40.26	45.06	46.56
Public highway	8.81	12.51	16.72	19.76	22.90	24.47	30.78	24.49	26.04	31.36	34.21	37.78	39.12
On own account	8.01	7.74	8.54	10.05	9.60	10.08	9.86	9.42	10.93	7.67	6.05	7.28	7.45
Railway	41.14	31.11	25.14	22.70	25.50	22.46	20.97	18.76	16.71	17.30	16.88	15.77	15.85
Air	0.06	0.08	0.03	0.03	0.03	0.03	0.05	0.06	0.03	0.04	0.03	0.03	0.04
Water	1.41	1.34	1.22	1.18	1.23	1.35	0.70	0.82	0.91	0.77	0.61	0.54	0.52
Total	59.43	52.78	51.65	53.72	59.26	58.39	62.36	53.55	54.62	57.14	57.78	61.4	62.98

Source: TRC

Tab. 2.9 Number of motor vehicles in the CR [thous. vehicles]

	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
One-track	1 172	1 175	1 151	912	915	918	930	927	800	749	755	760	752
Passenger and vans	2 411	2 580	2 747	2 924	3 043	3 193	3 392	3 493	3 440	3 439	3 530	3 619	3 702
Trucks	156	156	148	184	203	225	247	260	268	276	296	324	340
Buses	26	26	25	19	20	20	21	20	19	18	18	21	21
Total	3 765	3 937	4 071	4 039	4 181	4 356	4 590	4 700	4 527	4 482	4 599	4 724	4 815

Source: IRTAD, TRC

Tab. 2.9 gives a survey of the number of motor vehicles in the Czech Republic in the 1990 – 2003 period. While there were 23 passenger cars per 100 inhabitants in 1990, this number had increased to 36 by 2003. Fewer than 1% of vehicles were equipped with catalyzers in 1990, while this number has increased to 47.5% in 2003. In 2003, 18% of vehicles were driven by alternative means of propulsion. From the standpoint of the overall conception and strategy, the National Program to Mitigate the Impacts of Climate Change in the Czech Republic was approved in 2004 and the Transport Policy for the Czech Republic for 2005 – 2013 was approved in 2005. The transport policy deals with current basic conflicts in the area of transport, consisting particularly in the increasing volume of individual automobile transport and inadequate public transport, the discordance between modernization of transport networks and construction of capacities, especially in highway transport, inadequate harmonization of market conditions, reflected in sharp competition between railway and highway transport, failure to implement transformation of the railways, etc. (for more details, see Chapter 4).

2.10 Industry

Industrial production is traditionally the main component of the economy of the Czech Republic and, at the present time, when economic and market criteria of production are becoming a decisive factor, the further existence of industrial production is dependent on their competitiveness in the European and world markets. The emphasis on the individual industrial sectors has gradually changed, with an increase in the share of the processing sector and construction and a decrease in heavy industry. Following the reduction in the volume of industrial production in 1990 – 1993 to 66% of the level in 1990, a return to growth was recorded in 1994. The present-day mining industry is based on decreasing extraction of black and brown coal and a related reduction in production of briquettes, coke, etc. (since 1990, extraction of black coal has decreased to less than one half, brown coal by almost 40% and mining has remained almost constant since 2003). Simultaneously, the originally extensive mining of uranium ores and materials is now limited to two locations. Of mineral materials, primarily limestone, sand-gravels and natural sands, construction stone, clays and brick-making materials are extracted. The mining of metal ores has practically ceased and ores are imported mainly from the Ukraine, Russia and Poland. The production and distribution of electricity, gas and water contributed 4% to GDP in 2002, raw material mining contributed 1.4% and the processing industry, 25%.

2.11 Waste

Current conditions in the area of waste management can be characterized by a relatively large amount of generated waste material, corresponding to about 35.9 mil. tons in 2003, where the fraction of hazardous wastes in the total amount decreased to 4.5% in 2003, compared to 6.8% in 2000. The reported high production of wastes in this category is affected by the fact that, compared to the regulations of the European Communities, the national legislation has a broader definition for classification of waste in the "hazardous" category. Tab. 2.10 gives the amount of wastes generated from the standpoint of the systematic OECD classification for the 1996 – 2003 period.

Tab. 2.10 Waste production in the 1996 – 2003 period according to origin according to the OECD system [thous. t]

	Waste from agriculture and forestry	Waste from mining activities	Industrial waste	Waste from energy production*)	Municipal waste	Other waste	Total
1996	3 288	157	23 232	10 279	3 200	11 906	52 062
1997	4 412	1 890	14 083	13 306	3 289	31 538	68 508
1998	8 124	600	8 900	10 409	4 535	11 550	44 118
1999	7 175	2 351	8 867	4 941	4 200	7 935	35 469
2000	6 989	2 568	9 375	8 989	4 509	9 045	41 475
2001	5 935	2 285	9 040	6 491	4 243	10 700	38 694
2002	5 817	597	9 510	6 425	4 615	11 044	37 968
2003	5 281	689	7 525	6 501	4 639	11 304	35 939

*) *except radioactive waste*

Source: ME

The continuing unsatisfactory state of affairs in waste management is caused primarily by the prevalence of landfilling of waste (especially municipal waste) and the low fraction of re-use of waste (17.6%). Only about 2.5% of total waste production is used for energy-production purposes. The fact that only technically safeguarded landfills have been operated since 1996 is a favourable aspect. The decontamination and reclaiming of landfills, where operations have been terminated by law, constitutes a major financial problem. In comparison with the adequate capacity of landfills, the Czech Republic lacks a technical base for waste utilization and recycling, including utilization of its caloric value. In 2003, municipal waste was disposed in three municipal waste combustion units (Prague, Brno, Liberec) with a total capacity of 650 thous t. p.a., including the potential for use of waste heat. Together with other facilities for waste combustion, a total of 721 thous. tons was burned (including disposal of liquid wastes with high energy content in special combustion plants, medical wastes and waste disposal in hazardous waste incinerators). The total capacity of 67 industrial combustion plants equals 113 thous. tons p.a.. The lower percentage of waste combustion is caused by the greater costs compared to landfilling and legislative obstacles. Tab. 2.11 provides information on management of municipal wastes in 2003.

Tab. 2.11 Utilization of municipal waste in the Czech Republic in 2003

Manner of use	Amount [t] *)
Recovery of waste in a manner similar to fuels or in some other manner for energy production	219 581
Recovery/regeneration of solvents	2
Recovery/regeneration of organic substances that are not used as solvents (including composting and other biological processes)	153 293
Recycling/recovery of metals and metal compounds	4 236
Recycling/recovery of other inorganic materials	64 828
Regeneration of acids or bases	19
Recovery of components used for pollution abatement	489
Recovery of components from catalysts	-
Refining of used oil or some other manner of re-use of oils	199
Land treatment resulting in agriculture or ecological improvement	30 186
Recovery of waste generated by any of the operations numbered R1 to R 10**)	73 393
Preliminary treatment of waste for any of the operations numbered R1 to R 11**)	134 996
Use of wastes in reclaiming, landscaping, etc.	176 691
Transfer to some other authorized person (except a carrier, transporter) or other place of operations	2 777

*) *preliminary results*

**) *Code of the means of waste management*

Source: ME

The current national legislation dealing with the area of wastes came into effect in 2001. This consists particularly of Act No. 185/2001 Coll., on wastes, and Act No. 477/2001 Coll., on packaging, which fully implement the current legislation of the European Communities. Regulation of the Government of the Czech Republic No. 31/2999 Coll., valid from 2003, laid down a list of products and packaging that are subject to the take-back duty. These consist in waste oils, electric batteries, galvanic cells, discharge lamps and fluorescent lamps, tires and also refrigerators.

2.12 Agriculture

Agriculture has a typical Central European character with production of temperate-region foodstuffs and a high intensity of cultivation of the land. The distribution of agricultural production has a zonal character, in which altitude above sea level is more important than latitude. Czech agriculture is capable of meeting domestic requirements for basic agricultural products. Tab. 2.12 provides an overview of overall production (harvests) and hectare yields in the area of plant production in 1990 to 2003.

Tab. 2.12 Survey of production (harvests) and yields in the area of plant production in 1990 and 1995 to 2003

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Cereals total [thous. t]	8 947	6 602	6 644	6 983	6 669	6 928	6 454	7 338	6771	5762
Cereals total [t/ha]	5.46	4.19	4.2	4.14	3.97	4.35	3.91	4.52	4.33	3.95
Wheat total [thous. t]	4 624	3 823	3 727	3 640	3 845	4 028	4 084	4476	3867	2638
Wheat per ha [t/ha]	5.64	4.6	4.67	4.41	4.21	4.65	4.21	4.85	4.56	4.07
Rye total [thous. t]	558	262	204	259	261	202	150	149	119	159
Rye per ha [t/ha]	4.48	3.3	3.21	3.43	3.63	3.67	3.42	3.72	3.37	3.8
Barley total [thous. t]	3 157	2 141	2 262	2 485	2 093	2 137	1 629	1966	1793	2069
Barley per ha [t/ha]	5.69	3.84	3.77	3.84	3.62	3.94	3.29	3.97	3.67	3.76
Maize (grain) total [thous. t]	98	113	169	285	201	261	304	409	616	476
Maize (grain) per ha [t/ha]	3.19	4.28	5.09	6.92	6.09	6.6	6.43	6.6	8.73	5.58
Potatoes total [thous. t]	1 755	1 330	1 800	1 402	1 520	1 407	1 479	1131	901	683
Potatoes per ha [t/ha]	16.1	17.1	21	19.3	21.1	19.7	21.33	20.88	23.51	18.97
Sugar beets tech. total [thous. t]	4 026	3 712	4 316	3 722	3 479	2 691	2 809	3529	3833	3495
Sugar beets tech. per ha [t/ha]	34	39.9	41.6	40.3	42.7	45.6	45.8	45.4	49.5	45.2
Canola total [thous. t]	305	662	521	561	680	931	844	973	710	388
Canola per ha [t/ha]	2.9	2.62	2.3	2.47	2.57	2.67	2.61	2.84	2.27	1.55
Gross agric. production [bil. CZK]*)	-	99 454	114 149	111 407	106 551	95 307	101 188	110 102	102 290	93 671
of which, plant production [bil. CZK]*)		40 279	47 390	46 036	49 609	44 944	49 765	55 324	50 921	43 927

*) *current prices*

Source: MA

Of the total area of the land fund (7.9 mil. ha in 2003), 54.1% of this area consisted in agricultural land; this corresponded to 0.42 ha of agricultural land per inhabitant. The average level of application of industrial fertilizers remains low compared to the period prior to 1989 and is currently the lowest since the beginning of the 1960's. This is primarily a consequence of the high prices of these substances, and also of the significant trend towards environmentally sound agriculture, which was operated by 810 economic entities in 2003, on approximately 6% of cultivated land. Tab. 2.13 describes the trends in the consumption of nutrients and lime fertilizers since 1990. The total amount of applied nutrients remains well below the consumption per hectare in the advanced countries of the European Union, which is an advantage from an environmental standpoint.

Tab. 2.13 Trends in the consumption of NPK nutrients and lime fertilizers in the 1990 – 2003 period [kg/ha]

	1990	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
N	898	40	576	556	613	551	533	511	589	72	722	606
P_2O_5	568	13	103	146	118	117	126	86	108	123	123	117
K_2O	508	105	13	128	8	101	73	59	62	73	77	73
CaO	6169	479	54	754	75	769	742	782	759	922	922	726

Source: MA

In the area of animal production, Tab. 2.14 gives a survey of the total numbers of farm animals, the intensity of breeding and the production of some kinds of foodstuffs. Gross agricultural production is also listed, including both plant and animal production. Unfortunately, no framework policy has been adopted for the area of agriculture since 1990 and, at the present time, the policy of the sector is determined only by the European Union Joint Agricultural Policy.

Tab. 2.14 Survey of agricultural animal production and gross agricultural production in 1990 - 2003

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
cattle – total number [thous. head]	3 360	1 989	1 866	1 690	1 657	1 657	1 582	1520	1474	1428
cattle [head/km² agric. land]	794	465	436	395	387	367	37	355	345	335
milk production [mil. litres]	4 802	3 031	3 039	2 703	2 716	2 736	2 708	2 702	2 728	2 646
pigs – total number [thous. head]	4 569	4 016	4 080	4 013	4 001	3 688	3 594	3 441	3 363	3 127
pigs [head/km² agric. land]	1066	938	953	933	933	861	84	805	787	732
sheep – total number [thous. head]	430	134	121	94	86	86	90	96	103	116
sheep [head/km² agric. land]	102	31	28	22	2	2	21	22	24	27
horses – total number [thous. head]	25	19	19	20	23	24	26	21	20	20
horses [head/km² agric. land]	06	04	04	05	05	06	06	06	05	05
poultry – total number [thous. head]	33 278	27 875	27 573	29 010	30 222	30 222	32 043	29947	26873	25494
laying hens [mil. head]	3 682	3 047	2 948	3 322	3 615	3 307	3 064	3 190	1 829	1 859
Gross agric. production [bil. CZK]*)	-	99 454	114 149	111 407	106 551	95 307	101 188	110 102	102 290	93 671
- of which, animal production (%)	-	59 175	66 759	65 371	55 178	48 904	50 551	53 813	48 319	46 376

*) *current prices*

Source: MA

2.13 Forestry

The area of forest land has constantly increased slightly since 1990 (see Tab. 2.15) and equalled 2644 thous. ha in 2003, corresponding to about one third of the area of the Czech Republic; this corresponds to 0.26 ha per inhabitant. 78% of forest area consists of narrow-leaved tree species (spruce, pine, larch and fir) while the remaining 22% consists of broad-leaved species (oak, beech, birch). The information is given in a broader historical context corresponding to the dynamics of processes leading to assimilation of CO_2 in forest ecosystems. In recent years, reforestation has been characterized by an attempt to increase the fraction of broad-leaved species at the expense of narrow-leaved species. The total stand stocks of wood are constantly increasing and equalled 650 mil. m³ (see Tab. 2.16) in 2003.

Tab. 2.15 Trend in the area of forest land in 1920 – 2003 [thous. ha]

	1920	1930	1945	1950	1960	1970	1980	1990	2000	2003
Area	2 369	2 354	2 420	2 479	2 574	2 606	2 623	2 629	2 637	2 644

Source: MA

Tab. 21.6 Trend in the total stand stocks of wood in forests in 1930 – 2003 [mil. m³]

	1930	1950	1960	1970	1980	1990	1998	1999	2000	2001	2002	2003
Stand stocks	307	322	348	445	536	564	615	625	630	638	641	650

Source: MA

Tab. 2.17 Trends in some basic characteristics of the harvesting of wood in 1990 – 2003 [mil. m³ p.a.]

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total increment	163	165	165	166	166	168	168	168	168	170
Total harvesting	133	124	126	135	14	142	144	144	145	151
Ratio of harvesting and increment	082	075	076	081	084	085	087	086	086	089
Random harvesting	98	79	69	55	38	37	33	37	42	82
Random harvesting as % of total harvesting	737	637	548	407	271	261	229	240	250	482

Source: MA

Tab. 2.17 gives basic information on forest management. From the standpoint of ownership relations, 61.5 % of forests belong to the state, 15.0 % to towns and municipalities, 21.2% to private natural persons and 2.2% to other owners. Forests in the ownership of the state are managed by Lesy (Forests) CR s.p. or Vojenské lesy (Military Forests) s.p. and the national park administrations. On the basis of their function, economic (76%), protective (3%) and special purpose (21%) forests can be distinguished. Economic forests lie within the competence of the Ministry of Agriculture and forest units in National Parks and in Protected Landscape Areas lie within the competence of the Ministry of the Environment. In recent years, forest management has contributed between 0.8 and 1.0% to the creation of gross added value.

In the last few decades, forests have been substantially damaged, especially by industrial emissions. In spite of the substantial reduction in emissions of pollutants into the air (especially SO_2), the condition of forests is improving only very slowly. Current damage to forests is caused primarily by long-term accumulative degradation of forest soils as the joint effect of the action of pollution levels and unsuitable and excessively intense forest management. The high concentrations of tropospheric ozone currently also contribute to the damage to forest tree stands.

2.14 Trends in the Main Indicators

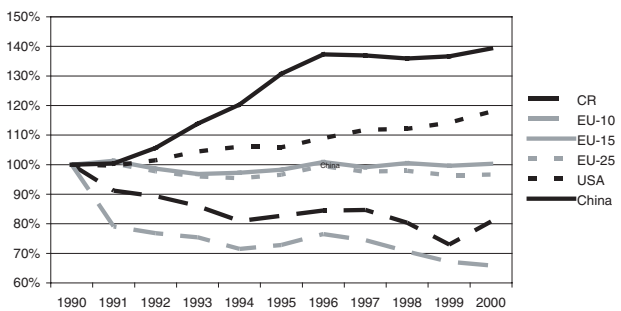
The absolute values of selected indicators (e.g. GDP, greenhouse gas emissions) are not easy to evaluate and compare with other countries. In international comparisons, it is very useful to employ standard indicators (the most frequently employed and the best known include, e.g., GDP/inhab. and the indices of trends in various parameters of the quality or damage to the environment (emissions/inhab., emissions/GDP, energy consumption/inhab., energy consumption/GDP, etc.).

The high dependence of the Czech Republic on solid fuels and uneconomical energy management are basic problems compared to other developed countries.

2.14.1 Index of Trends in CO_2

There has been a substantial reduction in CO_2 emissions; nonetheless, this reduction was the lowest of the post-communist countries (see Fig. 2.6).

Fig. 2.6 International comparison of CO_2 emission indices, 1990 - 2000



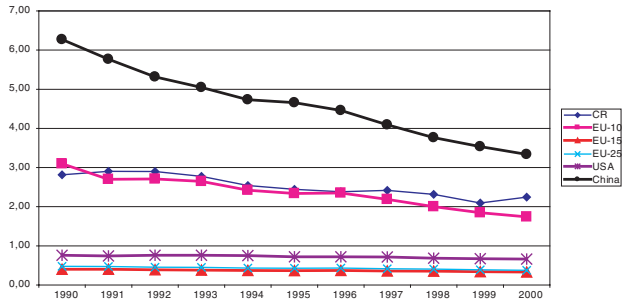
Zdroj: CAIT

2.14.2 CO_2 Emissions per GDP

A suitable method of determination of GDP is a fundamental aspect for international comparison. The values and trends in this indicator are similar for the post-communist

countries, comparable to economically developed countries, where there are no substantial differences in the framework of the countries in these two groups. In spite of the reduction in the value of this indicator in post-communist countries, it remains more than twice that in economically developed countries (see Fig. 2.7). The potential for decreasing these values lies not only in reduction of total emissions, but also particularly in an increase in economic output. The Czech Republic has been passed by Poland and Slovakia, which had a higher or the same value of this indicator at the beginning of the monitored period and now have the worst values in all of Europe.

Fig. 2.7 International comparison of trends in CO_2 emissions per unit GDP [t CO_2 / 1 000 USD constant 1995 prices], 1990 - 2000

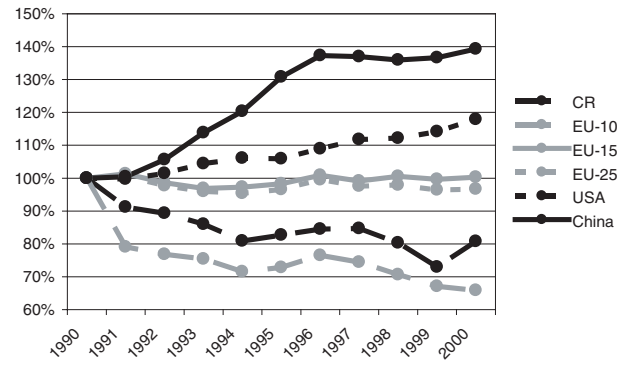


Source: CAIT

2.14.3 CO_2 Emissions per Inhabitant

International comparison is not favourable for the Czech Republic. Amongst the countries depicted in Fig. 2.8, it is in first place in the magnitude of this indicator, with the exception of the USA; in Europe, it is amongst the countries with the highest emissions per inhabitant. The high value of this indicator is caused not only by the composition of the primary energy sources (high fraction of solid fuels), but also the high exports of electrical energy.

Fig. 2.8 International comparison of trends in CO_2 emissions per inhabitant [t CO_2 / inhabitant], 1990 - 2000



Source: CAIT

3 Inventory of Greenhouse Gas Emissions

3.1 Preparation of Inventories

Inventories of greenhouse gases controlled by the UN Framework Convention on Climate Change monitor emissions and sinks for carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons and perfluorocarbons (HFCs, PFCs) and sulphur fluoride (SF_6) and also, as precursors, carbon monoxide (CO), nitrogen oxides (NO_X) and sulphur dioxide (SO_2). Emphasis is placed on accurate calculations of emissions of greenhouse gases with direct radiation absorption effect (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6). The total impact of emissions of these gases can be expressed as aggregated emissions, expressed as the equivalent amount of carbon dioxide taking into account the values of the GWP radiation absorption effects for a time period of 100 years according to the methodology of the Intergovernmental Panel on Climate Change (IPCC).

These inventories are prepared in accordance with the standard IPCC method. A detailed description of the methodology, emission factors employed and activity data is contained in the National Inventory Report, which is updated annually. The National Inventory Report and sets of data information on inventories for a particular year are available at www.chmi.cz/cc/.

3.2 Key Categories

Inventories of greenhouse gas emissions are based on a differentiated approach to important and less important emission categories. Important categories contributing more than 95% to overall aggregated emissions are denoted as key categories. This is related to the individual sectors or subsectors of the inventories and the individual greenhouse gases or groups (F-gases). The most important categories of emissions of greenhouse gases are listed in Tab. 3.1 together with their contributions to total emissions. The combustion of solid fuels is the most important key category, corresponding to more than 50% of total aggregate emissions.

Tab. 3.1 Key categories of greenhouse gas emissions in 2003

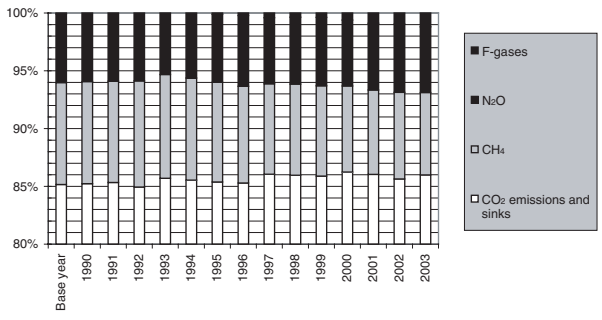
Sector/subsector	Gas	Emissions [Gg CO_2 equiv.]	Share of total emissions [%]	Accumulative share [%]
Energy: Stationary Combustion – Solid Fuels	CO_2	75 098	51.0	51.0
Energy: Stationary Combustion – Gaseous Fuels	CO_2	18 648	12.7	63.6
Energy: Road Transport	CO_2	12 727	8.6	72.3
Energy: Stationary Combustion – Liquid Fuels	CO_2	8 013	5.4	77.7
Industrial Processes: Production of Iron and Steel	CO_2	7 576	5.1	82.9
Energy: Fugitive Emissions - Coal Mining	CH_4	4 796	3.3	86.1
Agriculture: Direct N_2O emissions from Soils	N_2O	2 899	2.0	88.1
Industrial Processes: Mineral Products	CO_2	1 980	1.3	89.4
Agriculture: Indirect N_2O Emissions from Agriculture	N_2O	1 897	1.3	90.7
Waste: Landfiles	CH_4	1 752	1.2	91.9
Industrial processes: Use of F-gases	F-gases	1 712	1.2	93.1
Agriculture: Enteric Fermentation	CH_4	1 595	1.1	94.2
Energy: Transport in Agriculture, Forestry	CO_2	1 492	1.0	95.2

Source: CHMI

3.3 Inventories of Individual Greenhouse Gases

Fig. 3.1 depicts the shares and trends in the shares of the individual gases or their groups in total greenhouse gas emissions in the individual years. There are minimal differences between the individual years. A trend can be observed in the reduction in the fraction of methane as a consequence of a reduction in fugitive emissions and emissions from the agricultural sector, and an increase in the fraction of F-gases (HFCs, PFCs a SF_6) as a result of the process in which harmful freons depleting the ozone layer (regulated by the Montreal Protocol) have been replaced in the refrigeration industry and are employed in modern technologies. Carbon dioxide is the most important greenhouse gas, contributing 86% to overall emissions, followed by methane with 7.1 %, nitrous oxide with 5.7 % and F-gases with 1.2 % (figures for 2003).

Fig. 3.1 Trend in the fractions of the individual greenhouse gases in total emissions in 1990-2003[1] [%]



Source: CHMI

3.3.1 Carbon Dioxide

Carbon dioxide is the most important greenhouse gas in the national inventory and corresponds to the greatest fraction (86% in 2003) of total aggregate emissions. CO_2 emissions are derived particularly from the combustion of fossil fuels and from the decomposition of carbonates in the production of cement, lime, glass and sulphur removal; the values for CO_2 sinks were taken from the sector *Land-Use, Land-Use Change and Forestry*. Solid fuels make the greatest contributions to emissions of carbon dioxide from combustion processes; liquid and gaseous fuels make smaller contributions.

Tab. 3.3 gives the amount of carbon dioxide emissions produced by the individual activities. There was a decrease in these emissions between 1990 and 2003 by almost 24%, with major contributions especially from the *Combustion processes in Industry and Other Sources* subsector (heating and heating water in households, in the state and commercial sphere). The reduction in emissions in the *Combustion Processes in Industry* subsector at the beginning of the 1990's was caused by the cut-back and restructuring of some branches of industry; savings and the introduction of new technologies caused a reduction in emissions towards the end of this period. The reduction in emissions in the *Other Sources* subsector can be attributed to sounder utilization of energy (increased energy efficiency, insulation of buildings, etc.). The transport sector exhibits the opposite trend; emissions from this sector have increased almost two-fold since 1990 as a consequence of general trends in transport and especially in individual automobile transport and highway freight transport. The trend in the decreasing use of solid fuels and increase in the use of natural gas has had a favourable impact on emission trends. However, there has been a substantial increase in the price of gas in recent years, which could lead to a return to the use of solid fuels in the future.

According to the IPCC methodology, emissions of carbon dioxide from international air and marine transport are not reported as part of national emissions but are reported separately. Similarly, emissions from the combustion of biomass are not included in national emissions, because they would be included twice. These emissions are reported in the sector *Land-Use, Land-Use Change and Forestry (LULUCF)*.

3.3.2 Methane

Anthropogenic methane emissions are derived mainly from the mining, treatment and distribution of fuels and are classified among fugitive sources. The breeding of animals, landfilling of wastes and waste-water treatment are other important sources of methane emissions. In the breeding of animals, this gas is formed in digestive processes (especially in cattle) and in

[1] *The conversion of the original data for 1991 and 1993 in the CRF format was not completed by the time of preparation of this document.*

decomposition of excrements of animal origin. In landfilling of wastes, decomposition of organic substances under anaerobic conditions leads to the formation of methane and this substance is also formed in the anaerobic treatment of waste-waters.

The fraction of methane in total aggregated emissions decreased from 8.8% in 1990 to 7.1% in 2003. Tab. 3.4 gives the amount of methane emissions produced by the individual activities. Methane emissions decreased by almost 40% in the 1990 – 2003 period, caused mainly by a cut-back in coal mining and a reduction in the numbers of farm animals.

3.3.3 Nitrous Oxide

The greatest amounts of emissions of nitrous oxide are derived from agricultural activities, especially denitrification of nitrogen added to the soil in the form of artificial fertilizers or organic material. The production of nitric acid and combustion processes (fluid combustion, transport – automobiles with catalyzers) are also important sources.

The fraction of nitrous oxide emissions in total aggregated emissions has practically not changed and varies around 5.8%. Tab. 3.5 gives the amount of emissions of this greenhouse gas produced by the individual activities. Emissions of nitrous oxide decreased in the 1990 – 2003 period by almost 28%, especially as a consequence of a reduction in the use of artificial fertilizers in agriculture.

3.3.4 F-gases

The fraction of fluorinated gases in total aggregated emissions has increased since 1995, which was established as the reference year, from 169 to 1712 Gg CO_2 equiv. in 2003, with a similar increase in total aggregated emissions (0.1% in 1995 to 1.2% in 2003). These substances are not manufactured in the Czech Republic and their total consumption is covered by imports. The increase in emissions is caused by their use as a replacement for substances depleting the ozone layer (CFC, HCFC) with greater use in modern technologies. They are employed especially in refrigeration technology (esp. HFCs), in electrical technology (esp. SF_6) and in some other fields (e.g. as insulation between window panes, plasmatic etching, filling for fire extinguishers, propellants for aerosols and blowing agents, etc.). Tab. 3.2 gives the amounts of emissions of the individual F-gases in the 1995 – 2003 period.

Tab. 3.2 The results of inventories of F-gases [CO_2 equiv.]

	1995	1996	1997	1998	1999	2000	2001	2002	2003
HFCs	2	135	296	382	412	674	1045	1092	1344
PFCs	0	4	7	9	3	9	14	18	29
SF_6	167	183	323	132	111	206	223	212	339
F – gases (total)	169	322	626	523	525	890	1283	1322	1712

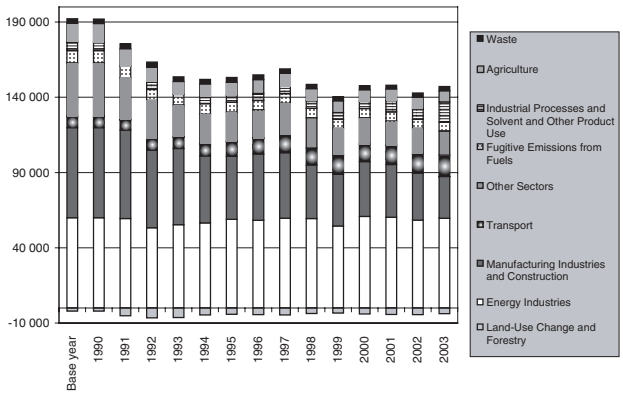
Source: CHMI

3.4 Results of Inventories

The trends in emissions and sinks in the main inventory categories are given in Tab. 3.6 and, for selected categories, in Fig. 3.2; the relative contributions of selected sectors are given in Tab. 3.7. Over the last few years, the relative contributions of the individual greenhouse gases to total emissions in the Czech Republic have not changed much. The change in the share of the sectors *Energy production* and *Industrial processes* is caused by a change in the methodology and temporary lack of consistency in the time series. However, the reduction of the share of the *Agriculture* sector in total emissions is tangible, caused particularly by the reduction in CH_4 and N_2O emissions.

The rapid decrease in total greenhouse gas emissions after 1990 was caused by the reduction in production and subsequently also the restructuring of the economy, as one of the consequences of the substantial change in the political system. Conditions have been relatively stable since 1994 and the existing fluctuations can be attributed to various factors (e.g. different winter temperatures, inter-annual changes in GDP and the degree of adoption of measures to reduce greenhouse gas emissions, etc.). The uncertainty in determination of emissions in the individual years is also reflected in the inter-annual changes. As total greenhouse gas emissions decreased by 24.6% to 2003 compared to 1990, it can be expected with high probability that the reduction obligation of the Kyoto Protocol will be met for the first review period of 2008 – 2012 (see also Chapter 5). Nonetheless, in spite of this reduction of emissions since 1990, indicators relating aggregated emissions to one inhabitant or GDP unit remain very unfavourable (see Chapter 2.14).

Fig. 3.2 Trends in greenhouse gas emissions in selected inventory categories[1] [Gg CO_2 equiv.]



Source: ČHMI

[1] *The conversion of the original data for 1991 and 1993 in the CRF format was not completed by the time of preparation of this document.*

Tab. 3.3 Inventory of carbon dioxide emissions 1990 – 2003[1] in the IPCC format [Gg]

Greenhouse Gas Source and Sink Categories	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1. Energy	**160 080**	**160 080**	**150 651**	**135 766**	**132 670**	**127 116**	**128 070**	**129 592**	**134 166**	**124 903**	**118 038**	**124 960**	**122 798**	**117 978**	**116 228**
A. Combustion Processes (Sectoral Approach)	160 080	160 080	150 651	135 766	132 670	127 116	128 070	129 516	133 925	124 486	117 501	124 420	122 246	117 426	115 668
1. Energy Industries	59 171	59 171	58 704	52 550	54 592	55 768	58 059	57 818	59 180	58 706	53 848	60 160	59 538	57 729	58 924
2. Manufacturing Industries and Construction	59 457	59 457	58 378	51 207	50 227	44 199	41 591	43 867	43 341	35 376	34 156	36 130	34 879	30 968	27 556
3. Transport	7 275	7 275	6 675	7 453	7 446	7 605	9 502	9 896	11 392	10 779	12 016	11 110	12 061	12 428	13 431
4. Other Sectors	34 177	34 177	26 894	24 555	20 406	19 544	18 918	17 936	20 013	19 624	17 481	17 019	15 769	16 301	15 757
5. Other	0														
B. Fugitive Emissions from Fuels	0	0	0	0	0	0	0	76	241	417	537	540	551	551	560
1. Solid Fuels	0	0	0	0	00	0	0	76	241	417	537	540	551	551	560
2. Oil and Natural Gas	0														
2. Industrial Processes	**3 380**	**3 380**	**2 894**	**3 210**	**2 782**	**2 772**	**2 609**	**2 479**	**2 498**	**2 661**	**2 362**	**2 251**	**4 524**	**4 407**	**10 262**
A. Mineral Products	3 380	3 380	2 894	3 210	2 782	2 772	2 609	2 479	2 498	2 661	2 362	2 251	2 000	1 793	1 980
B. Chemical Industry	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	706
C. Metal Production	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	2 524	2 614	7 576
3. Solvent and Other Product Use	**530**	**530**	**493**	**457**	**416**	**382**	**362**	**352**	**336**	**347**	**336**	**335**	**317**	**307**	**266**
4. Agriculture	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A. Enteric Fermentation	0														
B. Manure Management	0														
D. Agricultural Soils and other emissions of N_2O	0														
5. Land -Use, Land-Use Change and Forestry	**-2 128**	**-2 128**	**-5 201**	**-6 537**	**-6 336**	**-4 681**	**-4 250**	**-4 486**	**-4 639**	**-3 757**	**-3 401**	**-4 016**	**-4 363**	**-4 492**	**-3 848**
A. Changes in Forest and Other Woody Biomass Stocks	-2 128	-2 128	-5 201	-6 537	-6 336	-4 681	-4 250	-4 486	-4 639	-3 757	-3 401	-4 016	-4 363	-4 492	-3 848
E. Other	0														
6. Waste	**0**	**0**	**357**	**357**	**357**	**357**	**357**	**357**	**357**	**357**	**357**	**357**	**357**	**357**	**368**
A. Solid Waste Disposal on Land	0														
B. Waste-water Handling	0														
C. Waste Incineration	0	0	357	357	357	357	357	357	357	357	357	357	357	357	368
Total emissions and sinks (with LULUCF)	**161 862**	**161 862**	**149 194**	**133 252**	**129 890**	**125 945**	**127 148**	**128 294**	**132 718**	**124 511**	**117 692**	**123 886**	**123 633**	**118 556**	**123 276**
Total emissions (without LULUCF)	**163 990**	**163 990**	**154 396**	**139 789**	**136 225**	**130 626**	**131 398**	**132 780**	**137 357**	**128 268**	**121 093**	**127 902**	**127 996**	**123 048**	**127 124**
Note:															
International Bunkers	**617**	**617**	**555**	**476**	**373**	**283**	**371**	**459**	**407**	**225**	**539**	**343**	**439**	**497**	**597**
Aviation	617	617	555	476	373	283	371	459	407	225	539	343	439	497	597
Marine	0														

Note: IE – in the given year, the emissions are included in a different sector.

Source: CHMI

Tab. 3.4 Inventory of methane emissions 1990 – 2003[1] in the IPCC format [Gg]

Greenhouse Gas Source and Sink Categories	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total emissions	**798.26**	**798.26**	**729.16**	**685.25**	**648.56**	**619.44**	**612.15**	**599.72**	**575.50**	**543.83**	**509.10**	**510.21**	**499.30**	**493.97**	**486.18**
1. Energy	**453.38**	**453.38**	**412.15**	**385.83**	**375.79**	**354.48**	**346.80**	**334.63**	**329.72**	**303.75**	**278.68**	**287.18**	**282.07**	**275.24**	**266.13**
A. Combustion Processes (Sectoral Approach)	59.31	59.31	49.91	42.18	39.33	34.92	32.14	33.95	31.27	22.51	20.95	19.41	14.06	14.62	13.96
1. Energy Industries	7.10	7.10	5.20	7.01	6.83	6.72	5.13	2.57	2.26	2.24	1.66	1.27	0.68	0.66	0.73
2. Manufacturing Industries and Construction	1.23	1.23	3.40	1.70	2.34	1.50	2.41	1.03	1.51	1.21	1.28	1.16	0.89	0.79	1.10
3. Transport	3.07	3.07	0.82	1.25	1.65	1.02	1.34	3.51	4.29	1.86	1.90	1.92	2.04	2.21	2.32
4. Other Sectors	47.91	47.91	40.49	32.22	28.51	25.69	23.26	26.83	23.22	17.19	16.12	15.06	10.46	10.97	9.81
5. Other															
B. Fugitive Emissions from Fuels	394.07	394.07	362.23	343.65	336.45	319.56	314.66	300.68	298.45	281.23	257.73	267.77	268.00	260.62	252.17
1. Solid Fuels	361.90	361.90	320.98	305.97	298.00	281.99	276.61	268.42	263.47	253.05	228.96	239.00	244.74	237.48	228.40
2. Oil and Natural Gas	32.17	32.17	41.25	37.69	38.46	37.56	38.05	32.26	34.98	28.18	28.77	28.77	23.27	23.14	23.77
2. Industrial Processes	**5.60**	**5.60**	**4.78**	**4.78**	**4.78**	**3.93**	**3.83**	**4.90**	**3.91**	**4.02**	**3.92**	**3.40**	**3.40**	**3.40**	**3.40**
A. Mineral Products	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.16	0.01	0.00	0.00	0.01	0.01	0.01	0.01
B. Chemical Industry	0.40	0.40	0.40	0.40	0.40	0.39	0.40	0.39	0.39	0.39	0.40	0.39	0.39	0.39	0.39
C. Metal Production	5.20	5.20	4.37	4.37	4.37	3.53	3.41	4.34	3.51	3.63	3.52	3.00	3.00	3.00	3.00
3. Solvent and Other Product Use	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4. Agriculture	**204.19**	**204.19**	**178.99**	**162.44**	**142.41**	**133.97**	**133.83**	**133.83**	**129.11**	**121.13**	**120.50**	**113.76**	**112.92**	**105.38**	**105.91**
A. Enteric Fermentation	155.78	155.78	136.60	120.88	105.68	99.09	97.83	97.83	92.86	85.83	85.16	81.01	80.89	75.56	75.97
B. Manure Management	48.41	48.41	42.39	41.56	36.73	34.88	35.99	35.99	36.25	35.30	35.34	32.75	32.04	29.82	29.94
D. Agricultural Soils and other emissions of N_2O															
5. Land -Use, Land-Use Change and Forestry	**2.58**	**2.58**	**1.48**	**1.26**	**1.94**	**1.91**	**1.62**	**2.31**	**2.25**	**2.25**	**2.58**	**2.36**	**2.59**	**2.68**	**2.76**
A. Changes in Forest and Other Woody Biomass Stocks															
E. Other	2.58	2.58	1.48	1.26	1.94	1.91	1.62	2.31	2.25	2.25	2.58	2.36	2.59	2.68	2.76
6. Waste	**132.51**	**132.51**	**131.76**	**130.94**	**123.65**	**125.15**	**126.07**	**124.06**	**110.51**	**112.70**	**103.42**	**103.51**	**98.32**	**107.27**	**107.98**
A. Solid Waste Disposal on Land	93.20	93.20	93.89	95.98	92.00	92.67	94.91	95.04	80.87	81.93	75.98	75.98	73.48	80.63	83.41
B. Waste-water Handling	39.31	39.31	37.88	34.96	31.64	32.48	31.16	29.02	29.64	30.77	27.43	27.52	24.84	26.64	24.57
C. Waste Incineration															
Note:															
International Bunkers	**0.18**	**0.18**	**0.17**	**0.14**	**0.11**	**0.08**	**0.11**	**0.16**	**0.12**	**0.07**	**0.16**	**0.10**	**0.13**	**0.15**	**0.18**
Aviation	0.18	0.18	0.17	0.14	0.11	0.08	0.11	0.16	0.12	0.07	0.16	0.10	0.13	0.15	0.18
Marine															

Source: CHMI

Tab. 3.5 Inventory of nitrous oxide emissions 1990 – 2003[1] in the IPCC format [Gg]

Greenhouse Gas Source and Sink Categories	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total emissions	**36.34**	**36.34**	**33.31**	**29.76**	**25.99**	**26.69**	**28.24**	**29.71**	**28.42**	**27.07**	**26.17**	**26.37**	**26.75**	**26.29**	**26.31**
1. Energy	**4.57**	**4.57**	**4.37**	**4.14**	**4.05**	**3.93**	**4.30**	**4.16**	**4.31**	**4.47**	**4.46**	**4.78**	**4.98**	**4.98**	**5.10**
A. Combustion Processes (Sectoral Approach)	4.57	4.57	4.37	4.14	4.05	3.93	4.30	4.16	4.31	4.47	4.46	4.78	4.98	4.98	5.10
1. Energy Industries	2.08	2.08	1.93	1.92	1.96	2.00	2.16	1.34	1.29	2.06	1.95	2.16	2.21	2.14	2.14
2. Manufacturing Industries and Construction	1.27	1.27	1.16	1.13	0.96	0.90	0.88	0.44	0.43	0.63	0.60	0.65	0.77	0.67	0.71
3. Transport	0.26	0.26	0.37	0.39	0.47	0.56	0.83	1.77	1.94	1.41	1.58	1.66	1.75	1.92	2.01
4. Other Sectors	0.96	0.96	0.91	0.68	0.66	0.47	0.43	0.61	0.65	0.38	0.33	0.31	0.25	0.26	0.24
5. Other															
B. Fugitive Emissions from Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid Fuels															
2. Oil and Natural Gas															
2. Industrial Processes	**3.90**	**3.90**	**2.64**	**3.25**	**2.54**	**3.21**	**3.64**	**3.33**	**3.60**	**3.86**	**3.22**	**3.63**	**3.59**	**3.14**	**3.13**
A. Mineral Products															
B. Chemical Industry	3.90	3.90	2.64	3.25	2.54	3.21	3.64	3.33	3.60	3.86	3.22	3.63	3.59	3.14	3.13
C. Metal Production															
3. Solvent and Other Product Use	**0.66**	**0.66**	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**	**1.00**	**0.60**	**0.71**	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**
4. Agriculture	**26.56**	**26.56**	**24.96**	**21.04**	**18.05**	**18.21**	**18.95**	**20.57**	**19.26**	**17.39**	**17.14**	**16.62**	**16.84**	**16.83**	**16.73**
A. Enteric Fermentation															
B. Manure Management	2.14	2.14	1.98	1.84	1.62	1.53	1.55	1.55	1.52	1.44	1.44	1.36	1.35	1.25	1.26
D. Agricultural Soils and other emissions of N_2O	24.41	24.41	22.98	19.20	16.43	16.68	17.40	19.02	17.73	15.95	15.70	15.26	15.49	15.58	15.47
5. Land -Use, Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks															
E. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Waste	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	**0.64**	**0.64**	**0.66**
A. Solid Waste Disposal on Land															
B. Waste-water Handling	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.64	0.64
C. Waste Incineration															0.02
Note:															
International Bunkers	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.01**	**0.01**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.02**
Aviation	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02
Marine															

Source: CHMI

Tab. 3.6 Summary inventory of greenhouse gas emissions 1990 – 2003[1] in the IPCC format [Gg CO_2 equiv.]

Greenhouse Gas Source and Sink Categories	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1. Energy	**171 018**	**171 018**	**160 659**	**145 150**	**141 817**	**135 779**	**136 686**	**137 909**	**142 428**	**132 666**	**125 274**	**132 472**	**130 265**	**125 303**	**123 398**
A. Combustion Processes (Sectoral Approach)	162 742	162 742	153 052	137 934	134 751	129 069	130 078	131 519	135 919	126 343	119 325	126 310	124 086	119 278	117 542
1. Energy Industries	59 966	59 966	59 412	53 293	55 343	56 530	58 837	58 286	59 628	59 391	54 487	60 857	60 236	58 405	59 602
2. Manufacturing Industries and Construction	59 877	59 877	58 809	51 595	50 574	44 510	41 915	44 025	43 506	35 595	34 369	36 357	35 137	31 191	27 801
3. Transport	7 420	7 420	6 806	7 602	7 625	7 800	9 786	10 519	12 083	11 254	12 546	11 665	12 648	13 070	14 101
4. Other Sectors	35 480	35 480	28 025	25 443	21 209	20 228	19 540	18 688	20 702	20 103	17 923	17 431	16 065	16 613	16 039
5. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Fugitive Emissions from Fuels	8 275	8 275	7 607	7 217	7 066	6 711	6 608	6 390	6 508	6 323	5 949	6 163	6 179	6 024	5 856
1. Solid Fuels	7 600	7 600	6 741	6 425	6 258	5 922	5 809	5 713	5 774	5 731	5 345	5 559	5 691	5 538	5 356
2. Oil and Natural Gas	676	676	866	791	808	789	799	678	735	592	604	604	489	486	499
2. Industrial Processes	**4 708**	**4 708**	**3 813**	**4 316**	**3 671**	**3 849**	**3 819**	**3 614**	**3 697**	**3 942**	**3 443**	**3 447**	**5 708**	**5 452**	**11 305**
A. Mineral Products	3 380	3 380	2 895	3 210	2 782	2 772	2 609	2 482	2 498	2 661	2 362	2 251	2 001	1 793	1 980
B. Chemical Industry	1 219	1 219	826	1 014	797	1 002	1 138	1 040	1 125	1 204	1 007	1 133	1 121	982	1 686
C. Metal Production	109	109	92	92	92	74	72	91	74	76	74	63	2 587	2 677	7 639
Use of F-gases	169						169	322	626	523	525	890	1 283	1 322	1 712
3. Solvent and Other Product Use	**734**	**734**	**708**	**671**	**631**	**596**	**577**	**662**	**522**	**566**	**551**	**549**	**531**	**521**	**480**
4. Agriculture	**12 521**	**12 521**	**11 498**	**9 934**	**8 586**	**8 459**	**8 685**	**9 188**	**8 681**	**7 933**	**7 844**	**7 542**	**7 592**	**7 431**	**7 409**
A. Enteric Fermentation	3 271	3 271	2 869	2 538	2 219	2 081	2 055	2 055	1 950	1 802	1 788	1 701	1 699	1 587	1 595
B. Manure Management	1 681	1 681	1 505	1 442	1 273	1 208	1 236	1 236	1 234	1 187	1 188	1 109	1 091	1 014	1 019
D. Agricultural Soils and other emissions of N_2O	7 568	7 568	7 125	5 953	5 094	5 170	5 395	5 898	5 497	4 944	4 867	4 732	4 802	4 830	4 795
5. Land-Use, Land-Use Change and Forestry	**-2 073**	**-2 073**	**-5 170**	**-6 511**	**-6 295**	**-4 640**	**-4 216**	**-4 437**	**-4 591**	**-3 710**	**-3 346**	**-3 966**	**-4 308**	**-4 435**	**-3 790**
A. Changes in Forest and Other Woody Biomass Stocks	-2 128	-2 128	-5 201	-6 537	-6 336	-4 681	-4 250	-4 486	-4 639	-3 757	-3 401	-4 016	-4 363	-4 492	-3 848
E. Other	55	55	31	27	41	41	34	49	48	48	55	50	55	57	59
6. Waste	**2 983**	**2 983**	**3 325**	**3 307**	**3 155**	**3 186**	**3 205**	**3 163**	**2 878**	**2 924**	**2 729**	**2 731**	**2 621**	**2 808**	**2 839**
A. Solid Waste Disposal on Land	1 957	1 957	1 972	2 016	1 932	1 946	1 993	1 996	1 698	1 721	1 596	1 596	1 543	1 693	1 752
B. Waste-water Handling	1 026	1 026	996	935	866	883	855	810	823	847	777	779	721	758	715
C. Waste Incineration	0	0	357	357	357	357	357	357	357	357	357	357	357	357	373
Total emissions and sinks (with LULUCF)	**190 061**	**189 891**	**174 833**	**156 869**	**151 565**	**147 229**	**148 926**	**150 421**	**154 240**	**144 844**	**137 020**	**143 665**	**143 692**	**138 403**	**143 354**
Total emissions (without LULUCF)	**192 188**	**192 019**	**180 034**	**163 406**	**157 901**	**151 910**	**153 176**	**154 907**	**158 879**	**148 602**	**140 421**	**147 681**	**148 056**	**142 895**	**147 203**
Note:															
International Bunkers	**627**	**627**	**555**	**476**	**373**	**289**	**377**	**462**	**409**	**231**	**547**	**349**	**446**	**505**	**607**
Aviation	627	627	555	476	373	289	377	462	409	231	547	349	446	505	607
Marine															

Source: CHMI

Tab. 3.7 Shares of the basic sectors and subsectors in total greenhouse gas emissions in the 1990 – 2003[1] period in IPCC format [%]

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1. Energy	**90.0**	**90.1**	**91.4**	**92.3**	**92.9**	**92.2**	**91.8**	**91.7**	**92.3**	**91.6**	**91.4**	**92.2**	**90.7**	**90.5**	**86.1**
A. Combustion Processes (Sectoral Approach)	85.6	85.7	87.1	87.7	88.3	87.7	87.3	87.4	88.1	87.2	87.1	87.9	86.4	86.2	82.0
1. Energy Industries	31.6	31.6	33.8	33.9	36.3	38.4	39.5	38.7	38.7	41.0	39.8	42.4	41.9	42.2	41.6
2. Manufacturing Industries and Construction	31.5	31.5	33.5	32.8	33.1	30.2	28.1	29.3	28.2	24.6	25.1	25.3	24.5	22.5	19.4
3. Transport	3.9	3.9	3.9	4.8	5.0	5.3	6.6	7.0	7.8	7.8	9.2	8.1	8.8	9.4	9.8
4. Other Sectors	18.7	18.7	15.9	16.2	13.9	13.7	13.1	12.4	13.4	13.9	13.1	12.1	11.2	12.0	11.2
B. Fugitive Emissions from Fuels	4.4	4.4	4.3	4.6	4.6	4.6	4.4	4.2	4.2	4.4	4.3	4.3	4.3	4.4	4.1
2. Industrial Processes	**2.6**	**2.5**	**2.7**	**3.0**	**3.1**	**2.6**	**2.7**	**2.6**	**2.8**	**3.1**	**2.9**	**3.0**	**4.9**	**4.9**	**9.1**
3. Solvent and Other Product Use	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.3**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.3**
4. Agriculture	**6.6**	**6.6**	**6.5**	**6.3**	**5.6**	**5.7**	**5.8**	**6.1**	**5.6**	**5.5**	**5.7**	**5.2**	**5.3**	**5.4**	**5.2**
5. Land-Use, Land-Use Change and Forestry	**-1.1**	**-1.1**	**-2.9**	**-4.1**	**-4.1**	**-3.2**	**-2.8**	**-2.9**	**-3.0**	**-2.6**	**-2.4**	**-2.8**	**-3.0**	**-3.2**	**-2.6**
6. Waste	1.6	1.6	1.9	2.1	2.1	2.2	2.2	2.1	1.9	2.0	2.0	1.9	1.8	2.0	2.0

Source: CHMI

4 Measures to Reduce Greenhouse Gas Emissions

4.1 Survey and Classification of Measures

A number of measures are being implemented in the CR, intended to reduce greenhouse gas emissions. A survey and classification were prepared in accordance with the methodical instructions for their analysis[2]. These are both measures narrowly concentrated on a certain subject area or sector and also framework measures or measures of a predominantly adaptation character. However, the targets and impacts of many of the adopted measures are usually much broader, as it is primarily necessary to reduce the negative impacts on the environment as a whole for many of them.

The key measures with the greatest expected benefit consist primarily in **framework and conceptual measures** related to several sectors:

- The National Program to Mitigate the Impacts of Climate Change in the Czech Republic (Government Resolution No. 187/2004);
- The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources pursuant to Act No. 406/2000 Coll., on energy management.
- The State Environmental Policy 2004 -2010 (Government Resolution No. 257/2004);
- The State Energy Conception of the Czech Republic (Government Resolution No. 211/2004);
- The Strategy of Sustainable Development of the Czech Republic (Government Resolution No. 1242/2004);
- The Transport Policy of the Czech Republic for 2005 – 2013; and
- The Conception of Agrarian Policy of the Czech Republic 2004 – 2013.

Legislative measures are related mainly to the adoption or amendment of

- Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air), replacing Act No. 309/1991 Coll., on protection of the air, incorporating legislation on protection of the climate and including the National Program to Mitigate the Impacts of Climate Change in the Czech Republic;
- Act No. 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air), as amended by Act No. 521/2002 Coll., No. 92/2004 Coll. and No. 186/2004 Coll., No. 180/2005 Coll.;
- Act No. 521/2004 Coll., amending Act No. 76/2002 Coll., on integrated prevention;
- Act No. 359/2003 Coll., amending Act No. 406/2000 Coll., on energy management;
- Act No. 180/2005 Coll., on promotion of the production of energy from renewable energy sources;
- The Energy Act No. 458/2000 Coll. and the Act on energy management, No. 406/2000 Coll.; and
- The National Allocation Plan (Resolution of the Government No. 982/2005).

The **program measures** constitute practical implementation of framework, conceptual and legislative measures.

Measures included in the Fourth National Communication are classified as

a) implemented measures, i.e. measures that came into effect after 1995 and also

b) prepared measures, or measures that came into effect in 2005, consisting in

- full implementation of the National Program for Sound Energy Management and Use of Renewable and Secondary Energy Sources,
- introduction of environmental tax reforms;
- implementation of the Directive on Buildings; and
- introduction of the "Industry and Business" and "Infrastructure" operational programs.

In this chapter, the use of the flexible mechanisms of the Kyoto Protocol in the Czech Republic and participation of the state in the system of trading in CO_2 emission allowances for in the framework of the EU are also included as measures.

4.2 Framework Measures

4.2.1 National Program To Mitigate the Impacts of Climate Change

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic (hereinafter the "National Program"), as a document approved by the Government in 2004, forms the basis for the preparation of policies and measures to reduce greenhouse gas emissions.

4.2.1.1 Preparation of the National Program

In the past, protection of the climate was integrated particularly into the State Environmental Policy. In 1999, the Government of the Czech Republic approved a separate document entitled The Strategy for Protection of the Climate System of the Earth in the Czech Republic[3], which placed protection of the climate amongst top-priority environmental problems and set principal tasks for the individual sectors, which were intended to lead to meeting the quantitative obligations of the Protocol. The key emphasis was placed on a spectrum of measures related to energy savings and on an increased fraction of utilization of renewable energy sources.

In 2003, work was commenced on preparation for updating of this document in order to create better conditions for providing for meeting the national emission reduction targets in the sense of international agreements while retaining promotion of sustainable development and creating suitable preconditions for preparation for negotiations on the Protocol for the period after 2012. As the energy intensity of creation of GDP remains relatively high in the Czech Republic and there continues to be a large volume of greenhouse gas emissions per inhabitant, the updating was also required to define further measures to reduce greenhouse gas emissions that would lead to a gradual approach of these indicators to the values typical for the OECD and EU countries The National Program was adopted in Government Resolution No. 187/2004 of March 3, 2004.

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[2] *Guidelines for Preparation of National Communications by Parties Included in Annex I to the Convention (FCCC/CP/1997/7)*

[3] *Government Resolution No. 480/1999.*

4.2.1.2 Purpose and Targets of the National Program

The National Program is concerned with defining the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the Czech Republic and to contribute to promotion of sustainable development. Its preparation was based on detailed analysis of national trends in greenhouse gas emissions in the 1990 - 2001 period, analysis of key emission sources, i.e. groups of sources that make the maximum contributions to the overall national balance, on updated projections of emission trends over the period to 2020, on estimates of probable trends in further international negotiations on the Protocol in the immediate future, on consideration of the impact of the original Strategy on reducing emissions and on preliminary analysis of adaptation requirements at a national level in connection with the increased frequency of occurrence of extreme weather conditions in the territory of the CR in recent years.

The National Program declares a substantial increase in the share of renewable energy sources in the consumption of primary energy sources and defines conditions for state participation in joint implementation projects, in international emission trading and in participation in trading in emission allowances for greenhouse gases, in the sense of Act No. 695/2004 Coll., which simultaneously conforms with Directive No. 2003/87/EC. The prepared measures or measures that came into effect in 2005 should contribute to meeting the national quantitative targets which, according to the program, consist in

- reduction of specific CO_2 emissions per inhabitant to 2020 by 30% compared to the 2000 level;
- reduction of total aggregated CO_2 emissions to 2020 by 25 % compared to the 2000 level;
- ensuring continuing of this trend to the year 2030;
- increasing the fraction of renewable energy sources in consumption of primary energy sources to 6% by 2010 and to 20% by 2030;
- reduction of the energy intensity of production, distribution and final consumption of energy to a level of 60% to 70% of current consumption in 2030;
- increase in the fraction of use of biofuels to 5.75% in 2010; and
- achieving a fraction of 20% for the use of all alternative fuels in transport in 2020.

The National Program is also concerned with the aspect of preparation of specific sectoral adaptation measures and places emphasis on their detailed economic evaluation, as a number of adaptation measures can be very interesting economically, especially from the long-term point of view, and can substantially contribute to mitigating the impacts of climate change on a national scale. This area also encompasses intensive promotion of scientific research on climate change, systematic observation and an improvement in forecasting and integrated warning systems.

4.2.1.3 Tasks Set for the Sectors

In its Resolution, the Government required that the Ministers of the Environment, Industry and Trade, Transport, Agriculture, Regional Development, Education, Youth and Sports, and Health and the vice-Premier and Minister of Finance include key points of the National Program in the activities of the sectors from the standpoint of their economic capabilities and, within one year of its legal force, submit information on procedures in implementation of the prepared measures and, within four years from its legal force, submit a preliminary evaluation of the National Program from the standpoint of effects and economic potential of the adopted measures and, as appropriate, propose updating.

The roles and tasks of the individual sectors are as follows:

- The **Ministry of the Environment** coordinates and organizationally provides for implementation of the Convention and Protocol, implements and coordinates regular monitoring of greenhouse gas emissions and updates projections of emission trends, provides for the mechanism of trading in greenhouse gas emission allowances pursuant to Act No. 695/2004 Coll. and for implementation of the flexible mechanisms of the Protocol, proposes implementation of measures in the area of waste management, protection of waters and protection of the landscape and provides for inter-relationship of the National Program with the National and Regional Programs to abate emissions. It also coordinates scientific and research tasks related to monitoring the risk of climate changes and their impacts on the territory of the Czech Republic and prepares suitable adaptation measures and, through the State Environmental Fund of the Czech Republic, implements Part B of the State Program to Support Energy Savings and the Use of Renewable Energy Sources as part of the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources;
- The **Ministry of Industry and Trade** coordinates and, through the Czech Energy Agency, implements Part A of the State Program to Support Energy Savings and the Use of Renewable Energy Sources as part of the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources and, in accordance with the State Energy Conception, provides for assistance for the use of combined production of electricity and heat;
- The **Ministry of Transport** implements policy and measures in the transport sector and concentrates especially on the development and introduction of international standards in the area of environmental impacts, preference for environmentally sounder kinds of transport, introduction of savings measures in the area of energy consumption, reduction of the fraction of classical fossil fuels, especially diesel fuel and automobile petrols and modification of highway transport systems and development of alternative kinds of vehicle propulsion. It also implements the principles of the National Strategy for Development of Bicycle Transport, in the framework of which support is provided for financial participation of the State Transport Infrastructure Fund in related projects;
- The **Ministry of Agriculture** implements policies and measures in the area of agriculture and forestry, and implements Part C of the State Program to Support Energy Savings and the Use of Renewable Energy Sources as part of the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources. It is also concerned particularly with preparing adaptation measures in the sectors of agriculture, water management and forestry;
- Within its competence, the **Ministry for Regional Development** participates only indirectly in implementing

the National Program and, in the framework of land-use planning, respects the provisions of Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air) and incorporates it into land-use planning documents. In the framework of residential policy for development of the residential and apartment fund, emphasis is placed on less energy-intense projects for the construction and reconstruction of residential buildings;

- The **Ministry of Education, Youth and Sports** participates in the National Program particularly by increasing the level of education and public awareness in the framework of the State Program of Environmental Education and Public Awareness and related framework programs;
- The **Ministry of Health** is concerned only with implementation of adaptation measures following from health risks associated with climate changes;
- The **Ministry of Finance** cooperates in the National Program particularly in the creation of financial resources; in the immediate future this will consist in cooperation in implementation of Act No. 695/2004 Coll., on trading in greenhouse gas emission allowances.

4.2.2 The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources

The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources was prepared by the Ministry of Industry and Trade in agreement with the Ministry of the Environment in the sense of Title III of Act No. 406/2000 Coll., on energy management. The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources is proclaimed for a four-year period. In the sense of the Act, this is a document expressing targets in decreasing energy consumption and the use of renewable and secondary energy sources, in accordance with economic and social needs, sustainable development and protection of the environment.

The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources is concerned with the state administration and self-government, the business sphere, households and NGO's as target groups and is based particularly on the State Energy Conception (formerly the Energy Policy of the Czech Republic) and the State Environmental Policy.

The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources is based on results achieved in implementation of the individual years of the Program to Support Energy Savings and the Use of Renewable Energy Sources, implemented in 1991 to 1998, and the State Program to Support Energy Savings and the Use of Renewable Energy Sources in 1999 – 2001. The implemented years of the State Program provided a substantial benefit in the area of energy savings and the use of renewable and secondary energy sources. On the basis of this experience, the State Program of implementation of the individual targets of the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources is announced every year. It is evaluated at least once every two years and this evaluation is provided as information to the Government of the Czech Republic. Changes or modifications are proposed on the basis of the results obtained.

When this program was being prepared in 2001, it was assumed that 0.2% GDP would be available annually for implementation. Because of other priorities and limited financial resources, financing has not been provided in the past at the expected level, and thus benefits are substantially lower. Consequently, its proposal for full financing for the 2006 – 2009 period is also included in the category of prepared measures.

4.3 Conceptual Measures

4.3.1 The State Environmental Policy

The updated State Environmental Policy 2004 -2010 was adopted in Government Resolution No. 235/2004 which, amongst other things, requires that the Minister of the Environment provide for its regular evaluation for the 2004 to 2006 period by the middle of 2007, that a further updating be prepared by the end of 2010 and that further members of the Government be assigned priorities, tasks and targets following from this.

The top-priority areas of the updated State Environmental Policy 2004 – 2010 are compatible with the Sixth Environment Action Programme of the European Communities of 2002 and concentrate mainly on resolving on-going and newly emerging environmental problems in the areas:

- protection of nature, the landscape and biological diversity;
- sustainable exploitation of natural resources, protection of waters and protection against floods, optimisation of material flows and waste management;
- reducing the burden on the environment from human activities, improving environmental standards for the quality of human life;
- protection of the climate system of the Earth and prevention of long-range transport of air pollution and
- increasing public awareness of environmental issues.

The State Environmental Policy 2004 – 2010 is a fundamental reference document for the other sectoral and regional policies from the standpoint of the environment. Although this is a governmental document, its implementation requires extensive participation of the general public, partners in the business sector, NGOs, science and research and other groups. It should be an inspiration and instrument assisting in their strategic and every-day operative decision-making, so as to lead not only to creation of new economic, social and cultural values, but also to an improvement in the quality of life and quality of the environment.

The state policy in the area of the climate and its incorporation into the State Environmental Policy 2004 -2010 is based on the following important reasoning:

- Construction of the reduction commitment related to problem-free setting of international duties for the group of states of central and eastern Europe (including the Czech Republic) is greatly affected by the transformation process, leading to a decrease in production in some important sectors, although a number of measures implemented in the nineties must also be taken into account. The energy and carbon intensities of the economy remain high and place this group of countries above the average for contemporary developed Europe as a whole.

- With accession to the EU level, greater attention must be paid to the issue of climate change and the related energy intensity of the economy, and climate change will be a key subject in environmental policy in the coming years or decades. In the future, it can certainly be expected that there will be pressure for or at least discussion of setting further reduction targets in a relative sense, i.e. in terms of emissions per unit GDP or per inhabitant, where the CR could encounter difficulties.
- There continues to be limited experience in regulation of greenhouse gas emissions, related particularly to application of the flexible mechanisms of the Protocol.
- There is a lack of the necessary institutional structure and human resources. It will be necessary to prepare the administration and experts in this area in time.

The main targets of the State Environmental Policy 2004 – 2010 in relation to climate change consist in measures leading to

- reduction of aggregate greenhouse gas emissions and promotion of adaptation measures;
- achieving of national emission ceilings;
- reduction of emissions from combustion processes;
- preventing and reducing emissions of substances depleting the ozone layer;
- recovery of regulated substances in the area of servicing and disposal of old refrigeration equipment, including replacement and substitution of CFC substances in industrial refrigeration; and
- providing for collection of halons.

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic contains more detailed elaboration of the strategic approach to the aspect of climate change, including more detailed specification of targets, measures and mutual relationships.

4.3.2 State Energy Conception

The State Energy Conception of the Czech Republic was adopted in Government Resolution No. 211/2004 Coll. and is one of the basic components of the economic policy of the state. It is an expression of state responsibility for creation of conditions for reliable and long-term safe supplies of energy at an acceptable price and for creation of conditions for effective energy use, which will not endanger the environment and which will be in accordance with the principles of sustainable development. The state fulfils this legal obligation by establishing a legislative framework and rules for the operation and development of energy management.

The State Energy Conception contains four main targets concerned with fulfilling its vision and elaborating basic priorities in more specific form.

i) Maximizing of energy effectiveness. This target meets the high priorities of independence, safety and sustainable development. Summary expression of the increase in energy effectiveness will consist in the development of indicators for evaluation of consumption of primary energy sources or consumption of electricity in the creation of the gross domestic product. It is focused on maximizing the value obtained from energy, maximizing effectiveness in obtaining and conversion of energy sources and maximizing heat savings and the effectiveness of electrical appliances and distribution systems.

ii) The amount and structure of the consumption of primary energy sources. This target also corresponds to the priorities of independence, safety and sustainable development, in the framework of a sufficiently diversified and long-term safe structure of consumption of PES and production of electricity. It is concerned with promotion of the production of electricity and thermal energy from renewable energy sources, optimization of the use of domestic energy sources and optimization of the use of nuclear energy.

iii) Provision for maximum environmental soundness. This target also corresponds to the priorities of independence, safety and sustainable development from the standpoint of concentration on maximum environmental soundness, primarily based on an effective and environmentally sound structure of consumption of primary energy sources and on the means of production of electricity and thermal energy; individual targets will be concerned with a further reduction in the environmental impacts of energy-production processes. The emphasis of the targets is oriented towards minimizing emissions damaging the environment, minimizing greenhouse gas emissions and environmental burdens for future generations and remedying environmental burdens from the past.

iv) Completion of transformation and liberalization of energy management. This target also corresponds to the priorities of independence, safety and sustainable development from the standpoint of the requirements on provision for full adaptation of the state to a market model of energy management, developed in the framework of the EU, and also economic and social requirements. It is required that transformation measures be completed, the price levels for all kinds of energy be minimized and back-ups for energy sources be optimized.

Indicative targets of the State Energy Conception assume

- reduction in the energy intensity of creation of GDP by 25% to 2010 and by almost 50% to 2020 compared to 2000;
- reduction of CO_2 emissions from creation of energy by 13 % to 2010 and by 18 % to 2020 compared to 2000;
- reduction of NOX emissions from creation of energy by 30% to 2010;
- achieving a fraction of renewable energy sources of 11.3% in total consumption in 2010 and 12.9% in 2020 (this fraction equalled 2.7% in 2000);
- an increase in the use of biomass to 75% of total consumption of energy from secondary and renewable energy sources in 2010 (this fraction equalled 40% in 2000);
- an increase in the use of other renewable energy sources to twice the value in 2000 by 2010.

4.3.3. Transport Policy for 2005 - 2013

Government Resolution No. 882/2005 adopted the Transport Policy of the Czech Republic for 2005 – 2013, which follows the timetable for the programming period of the EU for the period following accession of the Czech Republic to the EU to 2013 and is based on analysis and evaluation of the Transport Policy of the Czech Republic of 1998. This was part of the strategy of the transport sector in the period prior to accession to the EU. In spite of the fact that this document was prepared prior to preparation of the European transport policy, it was able to predict the basic directions of developments in accordance with European trends and was capable of meeting the main targets, especially in the area of full approximation of the EC legislation

in the legislation of the Czech Republic, harmonization of transport systems and reform of public administration. Meeting targets in the area of development of the infrastructure seems less probable, as this is limited primarily by inadequate funding.

The Transport Policy is concerned with improving conditions for good-quality transport services to the regions and the entire area of the country, which should attempt to achieve equilibrium between the quality of public transport services and more rational use of passenger cars, the potential for affecting division of transport work and establishment of objective just charges for transport. The main subjects of concern in the Transport Policy in the framework of achieving its targets consist in harmonization of conditions on the transport market, modernization, development and revitalization of railway transport, improvement of the quality of road transport, reduction of the impact of transport on the environment and public health, promotion of multi-modal transport systems, development of urban, suburban and regional mass transport in the framework of integrated transport systems and concentration of research on safe, operationally reliable and environmentally sound transport.

Top-priority cross-sectional tasks concentrating on meeting environmental targets in transport consist especially in

- promotion of reduction of transport intensity, especially in freight transport;
- reduction of the environmental impact of transport and reduction of the impact on public health;
- reduction of noise levels caused by railway transport;
- introduction of measures to reduce the occurrence of congestion in road transport and creation of legal conditions for the potential for regulation of individual automobile transport (reduction of transport, charging fees for parking and entering selected areas, creation of low-traffic areas, etc.); and
- provision for a greater volumes of funding for research and development.

The transport policy assumes

- stabilization of greenhouse gas emissions derived from transport classified as fossil fuel sources and sources based on biomass to 2010 and reduction by 5% to 2013;
- reduction in emissions of sulphur dioxide from transport by 3% to 2010 and by 5% to 2013; and
- reduction in nitrogen oxide emissions from transport by at least 10% to 2010.

By 2013, the fraction of motor vehicles equipped with catalyzers should reach a level of 99% and the fraction of the population exposed to above-limit concentrations of tropospheric ozone should decrease by 10% by 2010 and by 20% to 2020. These quantitative targets should be achieved through legislative, economic and information instruments.

4.4 Legislative Measures

4.4.1 Act No. 86/2002 Coll., on Protection of the Air

The main reason for adoption of Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air), as amended, as follows from amendments introduced by Acts No. 521/2002 Coll., No. 92/2004 Coll., No.186/2004 Coll., No. 695/2004 Coll., No. 180/2005 Coll. and No. 385/2005 Coll., consisted in harmonization and transposition of the corresponding EU legislation. The existing framework legislation also includes the aspect of protection of the climate system of the Earth and takes into account especially the requirements of Council Decision 280/2004/EC.

In the area of protection of the climate, the National Program to Mitigate the Impacts of Climate Change is included in the legislation. In the sense of this law, the Ministry of the Environment, in cooperation with the relevant central administrative authorities, prepared the Regional Programs to reduce emissions, whose subsidiary targets are in accordance with the National Program to Mitigate the Impacts of Climate Change. In the territories of the Regions, the Regional Authorities prepared regional programs to reduce pollutant emissions, which also emphasize measures to reduce greenhouse gas emissions, as measures leading to a reduction in pollutant emissions also lead to a reduction in greenhouse gas emissions. Thus, the two National Programs are interconnected mutually and with the programs of the individual territorial units.

Aspects related to combustion sources, potential in production and electrical energy management and savings are the subject of territorial energy policies, which are intended to support the use of renewable and secondary energy sources and to contribute to sound management of energy and natural resources. At a national level, this subject is covered by the State Energy Conception, the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources and its subordinate State Program to Support Energy Savings and the Use of Renewable Energy Sources.

In order to achieve the targets in reducing greenhouse gas emissions in accordance with the targets set forth in the national and regional programs to reduce pollutant emissions, it is advisable to provide for implementation of the following targets in the area of air protection:

- reduction of energy intensity in the areas of production, distribution and final production of energy under the conditions of reduction of pollutant emissions;
- maximum utilization of central sources of heat and combined production of electrical energy and heat;
- the use of biofuels and energy-production use of biomass under the conditions of maintenance of air quality and with the target of further improvement;
- an increase in the production of electrical energy from renewable sources under the assumption of maintenance of air quality and with the target of further improvement;
- voluntary agreements with the operator above the framework of the requirements of the valid air protection legislation;
- use of the possibility of conversion to gas in areas with sufficient capacity;
- reduction of the combustion of certain kinds of fuels in small stationary sources of air pollution.

4.4.2 Act No. 458/2000 Coll. (the Energy Act)

Act No. 458/2000 Coll., on the conditions for operating a business and on performance of the state administration in the energy sector and amending some Acts (the Energy Act), establishes the right to preferential access to distribution networks for the operators of installations to utilise renewable energy sources and waste combustion and installations for combined production of electricity and heat. Provided that basic technical conditions are met, the operators of distribution networks are

obliged to purchase electricity and thermal energy derived from renewable sources and from combined production of heat and electricity.

4.4.3 Act No. 406/2000 Coll., on Energy Management

The Act on Energy Management No. 406/2000 Coll. includes the obligation for each region to prepare a territorial energy conception within five years, which will create conditions for sound energy management. These land-use conceptions were prepared in 2002 – 2004 together with the Regional Programs to reduce emissions pursuant to Act No. 186/2004 Coll., on protection of the air, which ensured interconnection of the territorial energy conceptions and the Regional Programs to reduce emissions and the relationship to greenhouse gases. This Act simultaneously forms a legislative base for the National Program of Sound Energy Management and Use of Renewable and Secondary Sources of Energy. It introduces compulsory measures for increasing the economy of energy use (e.g. requirements on minimal efficiency of production of electricity and heat for newly constructed sources, maximum losses for newly constructed installations for energy transfer and distribution, minimum technical requirements on specific consumption of heat for heating buildings and energy-consuming appliances), measures to support combined production of heat and electricity, the obligation to affix energy labels to selected energy-consuming appliances and the obligation of subjecting buildings and energy management to energy audits for entities in the public and private commercial sector of the tertiary and production sphere with energy consumption above a set value.

4.4.4 Act No. 180/2005 Coll., on Promotion of the Use of Renewable Energy Sources

Act No. 180/2005 Coll., on promotion of the production of electricity from renewable energy sources and amending some laws (Act on Promotion of the Use of Renewable Sources), as a new law, stipulates the manner and extent of promotion of the production of electricity from renewable energy sources, which should provide for achieving the national indicative targets, i.e. an increase in the fraction of electricity produced from renewable energy sources in gross energy consumption to a degree such that the fraction of renewable energy sources attains a value of 8% in 2010. Attaining of this value depends greatly on climatic factors, which substantially affect the level of use of water, solar and wind energy in the Czech Republic.

The Act, which is in accordance with Directive 2001/77/EC in the part related to promotion of the production of electricity from renewable energy sources, stipulates the manner of promotion of the production of thermal energy from renewable energy sources and delimits the performance of the state administration in this area, including fast and non-discriminatory administrative procedures, and stipulates the rights and obligations of natural and legal persons connected with this subject.

In particular, the Act should ensure an increased fraction of production of heat in facilities based on renewable energy sources and, through a corresponding reduction in greenhouse gas emissions, contribute to protection of the climate system and, through reduction of emissions of other pollutants, to protection of the environment. It should also contribute to improved care for the landscape (increased utilization of biomass), to a reduction in dependence on imports of energy-production materials, to an increase in diversification and decentralization of energy sources and thus to an increase in the safety of energy supplies, to an increase in the business security of investments in renewable energy sources, and to an increase in employment in the regions, and should also support the creation of institutional conditions for introduction of new technologies and for their penetration into both the domestic and the foreign market.

The system of support is based particularly on:

- maintaining the right of the producers of electricity from renewable sources to preferential connection of their source of electricity to the transmission system or distribution systems pursuant to this Act and to preferential transmission and distribution of electricity pursuant to the Energy Act, without respect to the status of opening up of the electricity market;
- obligatory purchase of all electricity produced from renewable energy sources by the operators of distribution systems;
- establishing of purchase prices for electricity produced from renewable energy sources and the prices of green bonuses differently for the individual kinds of facilities so that the consequent support is sufficiently motivating for investors and all kinds of renewable energy sources are used more for the production of electricity;
- providing guarantees to the investors and owners of installations, producing electricity from renewable sources who are subject to support pursuant to the Act, that the amount of revenue per unit of produced electricity from renewable sources acquired by the producers from the support will be maintained for a period of 15 years from bringing the installation into operation (or for a period of 15 years for installations that were brought into operation prior to the date of effect of the Act).

Wind generators located over an area of 1 km^2 with total installed output of 20 MW are excluded from promotion for the production of electricity from renewable energy sources. In case of production of electricity from biomass, promotion shall apply to the types and manners of use of biomass that are stipulated by an implementing regulation from the viewpoint of environmental protection.

4.4.5 Act No. 76/2002 Coll., on Integrated Prevention

Measures in the area of reduction of emissions of pollutants and greenhouse gases in industry are implemented and promoted in the framework of selected subprograms of the State Program to Promote Energy Savings and the Use of Renewable Energy Sources. The new energy legislation and especially implementation of the obligations following from the Act on Energy Management also contribute to a substantial increase in energy effectiveness and the consequent reduction in greenhouse gas emissions.

Act No. 76/2002 Coll., on integrated pollution prevention and control, the integrated pollution register and amending some laws (Act on Integrated Prevention) is the basic legislative document in the framework of integrated prevention. The Act implements the Directive on IPPC (96/61/EC) into Czech law. This Act has been amended several times. It was amended in 2002 by Act No. 521/2002 Coll., amending Act No. 76/2002 Coll., on integrated pollution prevention and control, on the integrated pollution register and amending some Acts (the Act on Integrated Prevention) and Act No. 86/2002 Coll., on protection of the air and amending some other Acts (Act on Protection of the Air). In 2004, it was amended by Act No. 437/2004

Coll., amending Act No. 50/1976, on land-use planning and the Construction Code (the Construction Code), as amended, Act No. 76/2002 Coll., on integrated pollution prevention and control, the integrated pollution register and amending some laws (Act on Integrated Prevention), as amended by Act No. 521/2002 Coll. and Act No. 40/2004 Coll., on public contracts, and Act No. 695/2004 Coll., on conditions for trading in allowances for emissions of greenhouse gases and amending some laws. Another amendment to Act No. 76/2002 Coll., on integrated prevention, was being prepared in 2004, but has not yet been approved.

Further legislation related to integrated prevention is set forth in Decree No. 554/2002 Coll., stipulating the form of an application for an integrated permit, and the extent and the manner of filling out thereof, in Government Regulation No. 63/2003 Coll., on the manner and extent of providing for a system of exchange of information on the integrated pollution register, and Decree No. 572/2004 Coll., stipulating the form and manner of keeping records of documents necessary for registration in the integrated pollution register.

The Act on Integrated Prevention specifies areas in which the region lays down the binding conditions for operation. These include (a) establishing of emission limits, (b) measures to prevent the risk of pollution of the environment, (c) conditions providing for the protection of human health and the environment in waste management and (d) conditions for sound use of materials and energy. Depending on the category of the installation, the Regional Authority also lays down binding conditions so that the requirements and targets of the law are fulfilled.

The IPPC regime applies to approximately 850 enterprises and 1400 installations (energy production 14%, metal production and processing 20%, mineral processing 7%, chemical industry 15%, waste management 7% and other installations 37%). At the end of 2002, the Ministry of the Environment, Federation of Industry and Transport and the Czech Business Council for Sustainable Development concluded an agreement on cooperation, which culminated in the Action Plan for 2000 – 2002. This plan encompasses the area of introduction of new legislation, implementation of the IPPC Directive, support for and promotion of further introduction of environmental management systems (EMS/EMAS) and other voluntary instruments in industrial enterprises, which are also favourably reflected in reduction of greenhouse gas emissions. However, exact calculation of the benefits in the area of reduction of greenhouse gas emissions is not currently possible for these activities.

4.4.6 Act on Wastes No. 185/2001 and Act on Packaging No. 477/2001 Coll.

These Acts harmonize the national legislation with the EU legislation in the area of waste management and packaging management.

Reduction of greenhouse gas emissions (CO_2, CH_4, N_2O) is a side effect of harmonization of the legislation, implementation of the principles contained in this legislation, with emphasis particularly on prevention of waste generation, reduction of the amount of wastes, separation according to kinds and environmental soundness of waste management. The targets and measures for waste management are further elaborated and stipulated in Government Regulation No. 187/2003 Coll., on the Waste Management Plan. New Act No. 185/2001 Coll., on wastes and amending some other laws, and Act No. 477/2001 Coll., on packaging and amending some laws (Act on Packaging), lay down the obligations of the operators carrying out treatment of waste electrical and electronic equipment to preferentially remove from this waste all substance and components stipulated in the implementing regulation and to store and process this waste in accordance with the technical regulations stipulated by the implementing regulation. The prepared regulation also includes freons and halons and amongst these substances stipulates that substances depleting the ozone layer contained in installations, e.g. thermal insulation foams, and in refrigeration circuits must be properly collected and treated in accordance with Regulation (EC) No. 2037/2000 of the European Parliament and Council on substances that deplete the ozone layer.

4.4.7 Amendment of Legislation in the Area of Energy Production

The State Energy Conception encompasses amendment or modification of the following legislation:

- Acts No. 458/2000 Coll. and No. 406/2000 Coll., which will assist in opening the market in electricity and gas and in harmonizing the rules of the market in these forms of energy with the EU rules, incl. conditions for inter-state trade in electricity, and in applying the provisions of Directive 2002/91/EC on the energy performance of buildings, and thus initiate both an improvement in their energy parameters and a reduction in energy consumption requirements.
- the Act on promotion of the production of electricity and thermal energy from renewable energy sources, which will be modified in accordance with Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market, so as to create conditions for meeting the indicative targets for the fraction of electricity produced from renewable energy sources in gross electricity production of 8% in 2010, and extends the competence of the Energy Regulation Authority in this area;
- the National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources for 2006 – 2009, with the goal of increasing funding for the program, provision for stabilization and long-term validity of measures stimulating energy savings and utilizing, for its implementation, possibilities provided in the EU in the framework of the 6th Action Program in energy production and the program pursuant to Decision No 1230/2003/EC of the European Parliament and of the Council;
- the Program for promotion of the use of combined production of electricity and heat for the purpose of retaining current forms of promotion and harmonization of the Czech legislation with Directive 2004/8/EC;
- rules for investment incentives pursuant to Act No. 72/2000 Coll., on investment incentives, and its amendment No. 453/2001 Coll. that, with simultaneous provision of investment incentives, would ensure more effective interconnection to the priorities of the State Energy Conception and attempt to extend the application of the Act to projects promoting the priorities of the Conception.

The State Energy Conception also envisages the preparation and publication of a long-term energy projection and provision for its indicative targets while affecting the development of energy management to 2030, preparation and publication of an indicative conception for the renewal and/or replacement of

end-of-life electricity production installations to 2030 and implementing their targets in influencing the development of the electrification system.

4.5 Program Measures

4.5.1 State Program to Promote Energy Savings and the Use of Renewable Sources of Energy

The intersectoral State Program to Promote Energy Savings and the Use of Renewable Sources of Energy has been in effect in amended form since 1999. It covers all the sectors of the national economy and is related to programs in previous years. Especially the programs of the Ministry of Industry and Trade implemented by the Czech Energy Agency (Part A) and programs of the Ministry of the Environment implemented by the State Environmental Fund (Part B) play a key role here. Nine other sectors, covering Part C, participated in the State Program for 2003.

4.5.1.1 Programs of the Czech Energy Agency

The programs are concerned with introduction of energy-saving measures in the area of production, distribution and consumption of energy, greater use of renewable and secondary energy sources and development of cogeneration production of heat and electricity. Emphasis is placed on introduction of greater efficiency in the use of energy, especially in industry, dissemination of modern technologies and procedures, support for projects with high efficiency of use of financial means, support for consulting, education, enlightenment and promotion of sound use of energy by the general public. In the framework of the program, support is provided especially in the form of nonreturnable financial subsidies for individual projects. Each year, subprograms are announced to promote implementation of energy-saving projects in residential buildings and family homes, education facilities, health care, public institutions and state buildings and projects for the use of renewable and secondary energy sources, development of combined production of heat and electricity, preparation of energy audits, financing of energy-saving projects, development and use of modern technologies and materials for measures to increase the efficiency of energy use, modernization of energy production and energy distribution installations, preparation of energy conceptions for cities and municipalities and optimisation of energy supply to residential units, energy savings in industry, transport and agriculture and also consulting, education and promotion of sound use of energy.

4.5.1.1.1 Structure

The program is concerned with the state administration and self-government, the business sphere, NGO's and households. It is supported particularly by the State Energy Conception and the State Environmental Policy.

The program consists of four subprograms, concerned with

- promotion of the preparation of territorial energy policies and energy audits;
- energy production and distribution installations;
- promotion of measures to increase the efficiency of energy use; and
- consulting, education and promotion of sound use of energy to improve the environment.

4.5.1.1.2 Economic and environmental factors

Economic and environmental factors of the State program in Part A for 1999 – 2004 are listed in the following table:

	1999	2000	2001	2002	2003	2004
Amount of subsidies provided [mil. CZK]	268.7	183.5	63.2	76.2	100.6	69.9
Fraction of subsidies in total investment costs [%]	10.4	12.2	10.1	8.2	8.7	13.5
Average costs of energy savings [thous. CZK/GJ]	1.4	2.2	1.9	1.4	1.7	3.2
Total CO_2 emission savings [thous. ton]	125	247	485	780	844	894

Source: Czech Energy Agency

In this subprogram in 2002 - 2004, support was also provided for preparation of territorial energy conceptions of cities and municipalities in the Czech Republic with at least 5 thousand inhabitants. The total costs for their preparation equalled CZK 12.5 mil. with an average of 28% subsidies. A total of CZK 83 mil. in total subsidies have been provided for preparation of energy audits of buildings and installations, allocated since 1999, corresponding to support corresponding to an average of 26% of total costs for one energy audit. The recipients of the audits are obliged to commence implementation of the variants of energy-saving measures recommended in the audit within five years of preparation of the energy audit (this is reduced to thee years for business entities). Compliance with this condition will lead to total investment costs of CZK 0.5 bil. in the future, with subsequently expected energy savings of 195 TJ p.a. The net payback period for measures implemented on the basis of recommendations of all the supported energy audits equals 15 years.

4.5.1.2 Programs of the State Environmental Fund of the Czech Republic

Part B of the State Program of energy savings and use of renewable energy sources consists in programs of the Ministry of the Environment implemented by State Environmental Fund of the CR. These programs are concerned with support for investments into the use of renewable energy sources and to support public awareness and education in the area of renewable energy sources. Support is allocated in dependence on the volume of budgetary means of the fund for the given year and is based particularly on the environmental effect primarily in areas that do not create sufficient internal sources of funds for implementation of the supported projects (e.g. local governments, budgetary organisations and the general population) through subsidies and soft loans.

Reduction of CO_2 emissions is only a side effect of support for all the program areas mentioned in this chapter and these values are relatively low in a number of cases.

4.5.1.2.1 Structure

The investment part of the program is concerned with support for savings in the following areas

- heating and hot water for apartments and family homes;
- energy supplies in municipalities and parts of municipalities;
- heating and hot water or production of energy in the commercial sphere;
- heating apartments and family homes using heat pumps;
- construction of small hydro-electric plants;
- construction of wind generators;
- joint production of electrical energy and heat from biomass and biogas; and
- the Sun into Schools program.

4.5.1.2.2 Economic and Environmental Factors

Economic and environmental factors of the State program in Part B for 2000 – 2004 are listed in the following table:

	2000	2001	2002	2003	2004
Loans from the state budget [CZK mil.]	0	0	0	0	0
Subsidies from public budgets [CZK mil.]	14.1	89	323.9	321.9	147.5
Subsidies from private sources [CZK mil.]	12.1	51.9	182.2	249.7	49.7
Fraction of subsidies in total investment costs [%]	51	48	53	52	56
Average costs of energy savings [thous. CZK/GJ]	4.5	5.6	6.4	6.1	7.9
Total CO_2 emission savings [thous. ton]	5	35	85	130	186

Source: State Environmental Fund of the CR

The greatest fraction of savings was achieved in programs concentrating on supplying energy to municipalities and parts of municipalities (48%) and on joint production of energy and heat from biomass and biogas (44%) and also on construction of wind generators (4%).

Programs concerned with supplying energy to municipalities and parts of municipalities consisted particularly in systems for supply of heat and hot water using biomass, where the support was also related to a system for distribution of the heat and to systems with combined production of heat and electrical energy, if this system was used for central supply of heat or hot water, where it was not preferable to utilize support in the framework of that program. Support was provided for both central and decentralized systems employing renewable energy sources or a combination of the two systems. The condition for obtaining support consisted in compliance with the criteria set forth in the outline of the energy audit, which must be prepared in several variants both for central sources and for combination with a decentralized heat source. Support for construction of central heat supply systems is related to a municipality or part thereof, if it is the owner of both the heat supply and the distribution networks. Support can also be provided in the framework of this program for island systems (one or several isolated small heating plants with distribution of heat to the nearest surrounding buildings). An island system is considered to consist in a source with minimal installed output of 100 kW, connected to at least 5 buildings. Support can be provided for island systems of heat supply in a municipality only if this system is recommended in an energy audit.

Support is provided in the program concerned with the joint production of electrical energy and biomass and biogas for the construction of cogeneration units, where the fuel is biomass or biogas formed by fermentation of agricultural wastes and biologically degradable separated wastes. This also includes systems with thermal gasification of wood, with steam boilers, steam turbines, etc. Provision of support is dependent on compliance with the criteria set forth in the outline of the energy audit. If the energy audit demonstrates the effectiveness of such an installation, the separate production of electrical energy can also be supported (e.g. island installations, back-up sources, etc.). The use of specially grown crops as fuel is taken into consideration.

Provision of support for the construction of wind generators is dependent on compliance with the criteria set forth in the outline of the energy audit; support is provided in dependence in the volume of disposable funds for the given year.

4.5.1.3 Energy Savings in the Transport Sector

This program has been implemented in the sector of the Ministry of Transport since 2004, when support was directed towards energy audits of buildings in the transport sector. In 2005, support was provided for these measures, concerned with

- transport infrastructure;
- organization of transport;
- support for the use of biofuels; and
- consulting, education and promotion of sound use of energy in the transport sector with emphasis on improvement of the environment.

In 2004, when the program began, only one subsidy was provided for an energy audit of the building of the Public Transport Authority in Hradec Králové in an amount of CZK 28 thous.

The amounts of savings of greenhouse gases for the period to 2020 is estimated as follows:

	2005	2010	2015	2020
carbon dioxide [thous. ton]	0	65	354	685
methane [tons]	260	290	380	480
nitrous oxide [tons]	0	0	0	0

Source: Ministry of Transport

4.5.1.3.1 Transport Infrastructure

The measure is intended to reduce energy consumption in the operation and maintenance of the transport infrastructure. Subsidies can be provided for implementation of measures leading to a reduction in energy consumption in the operation and maintenance of transport infrastructure and are intended for entities providing for the operation and maintenance of transport infrastructure. The subsidies may correspond to up to 50% of costs, and may equal a maximum of CZK 1 mil. per project.

4.5.1.3.2 Organization of Transport

This part is concerned with more effective use of energy achieved by organization of transport and an increase in the fraction of less energy-intensive kinds of transport. Subsidies can be provided for the introduction of energy management in transport, support for measures leading to reduction of con-

gestion in transport, support for integrated transport systems and interconnections in integrated transport systems – municipal mass transport (Park&Ride, Bike&Ride, etc.), support for measures to increase the fraction of unmotorized transport in transport volumes (bicycle, pedestrians, etc.). The subsidies may correspond to up to 30 % of costs, and may equal a maximum of CZK 1 mil. per project.

4.5.1.3.3 Consulting, Education and Promotion of Sound Use of Energy

The measures are concerned with public awareness, education, consulting and promotion for sound use of energy and renewable energy sources in the transport sector. Support is provided for organization of exhibitions, professional courses, workshops and conferences of a nonprofit character, preparation of studies, handbooks and information materials, video-presentations, television and radio programs, creation and development of information databases and computer systems. The supported projects should be concerned particularly with increased information for the public on the potential for sound use of energy in transport, affecting public opinion towards favourable acceptance of information on the necessity for the sound use of energy in transport and especially public opinion in the sense of reducing the consumption of non-renewable energy sources in transport.

4.5.2 Implementation of the Directive on Biofuels

The primary target of Directive 2003/30/EC of the European Parliament and of the Council, on the promotion of the use of biofuels or other renewable fuels for transport, is maintenance of agricultural land suitable for the production of food products in an active condition. As biofuels, similar to biomass, have a neutral carbon dioxide balance, their use contributes to reduction of CO_2 emissions from transport. The Directive stipulates the minimum fraction of biofuels in fuel consumption. The member states should provide for a minimum fraction of biofuels and other renewable fuels corresponding to 2% of the petrol and diesel fuel used for transport purposes by December 31, 2005. Following accession of the CR to the European Union in May 2004, support for the production of biodiesel fuel was stopped because of the lack of suitable legislation and thus practically no biodiesel fuel is produced or sold in this country at the present time. The entire national production MERO (methyl ester of rapeseed oil) is exported. However, it expected that the production of biofuels for transport will be renewed. Support for biofuels in transport is the subject of Article 3 (10) to (12) of Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air), as amended.

4.5.3 Further Measures in the Transport Sector

The vast majority of measures implemented in the transport sector and related to reduction of greenhouse gas emissions are implemented continuously; the National Program also contains the Transport policy of the Czech Republic for 2005 – 2013. Compared to previous years, there has been a slight increase in funding for implementing these measures.

Key measures in the area of transport consist in application of international standards for means of transport in the area of the environment and safety, support for gradual transfer of part of the volume of passenger and freight transport in highway and air transport to rail transport, railway, combined and water transport, support for creation of the relevant infrastructure for development of unmotorized kinds of transport, support for public mass transport, development of its infrastructure and introduction of integrated transport systems, support for improved organisation and regulation of highway transport and support for research, and the development and use of alternative kinds of vehicle propulsion.

4.5.3.1 Transport Corresponding to European Emission Standards

This program is concerned with the development and introduction of means of transport and automotive fuels for highway, railway, water and air transport that will correspond to European emission standards, and is targeted so that the emission parameters of vehicles and the composition of automotive fuels are in accordance with EU regulations. The measure will lead especially to a reduction in methane emissions and, to a lesser degree, of carbon dioxide emissions, as these vehicles have lower fuel consumption and better fuel economy. This measure tends to have a negative effect on nitrous oxide emissions, as newer vehicles equipped with effective catalytic converters (with spark ignition motors, three-way controlled catalytic converters) reduce the amount of hydrocarbons (including methane), carbon monoxide and nitrogen oxides (except nitrous oxide); however, the catalytic reduction of nitrogen oxide produces an increased amount of nitrous oxide.

The amount of support in the 2005 – 2008 period and the estimated savings of greenhouse gas emissions to 2020 are given in the following table:

	2000	2001	2002	2003	2004	2005
private sources [CZK mil.]	500	500	500	500	500	500

Source: Ministry of Transport

	2000	2005	2010	2015	2020
carbon dioxide [thous. ton]	0	0	172	944	1 826
methane (thous. t CO_2)	9.2	10.9	16.4	21.5	27.0

Source: Ministry of Transport

4.5.3.2 Program of Support for Renewal of the Vehicles of Urban Mass Transport and Public Transport

The program is intended to support renewal of the vehicle fleet of public line transport and urban mass transport to improve the conditions and quality of travel in public transport and thus provide a solution to traffic conditions on roadways, especially along main routes and in cities. In the framework of renewal of urban transport vehicles, priority is assigned to better accessibility of these vehicles for persons with health and mobility handicaps. Electrically propelled vehicles receive special support. The program is divided into two subprograms:

- Support for renewal of the vehicle fleet of public line transport; and
- Support for renewal of the vehicle fleet of urban mass transport.

In 2004, support was provided for this program in an amount of CZK 243.3 mil. from the state budget, CZK 520 mil. from public budgets and at least CZK 144 mil. from private sources.

Estimated savings in of greenhouse gas emissions to 2020 are given in the following table:

	2000	2005	2010	2015	2020
carbon dioxide [thous. ton]	0	0	65	354	685
methane (thous. t CO_2)	2.3	5.5	6.2	8.0	10.1

Source: Ministry of Transport

4.5.3.3 MARCO POLO Program

The *MARCO POLO* Program is a financial instrument that is intended to reduce congestion, improve protection of the environment in the framework of the transport system and thus contribute to an effective and sustainable transport system by the end of 2010. Towards the end of the program, the expected total annual increment in international freight transport (in ton-kilometres) should be transferred to railway and water transport or to a combination of the individual kinds of transport.

Estimated savings in of greenhouse gas emissions to 2015 are given in the following table:

	2000	2005	2010	2015
carbon dioxide [thous. ton]	0	129	708	1369
methane (thous. t CO_2)	5.5	12.3	16.1	20.2

Source: Ministry of Transport

4.5.3.4 National Cycling Strategy in the Czech Republic

The National Cycling Strategy in the Czech Republic was approved in Government Resolution No. 678 of July 7, 2004. The strategy is intended to promote cycling as a form of environmentally sound transport and an alternative to other kinds of transport. Cycling is advantageous in that it produces no noise, has zero emissions and has low spatial and financial requirements.

4.5.4 Programs in the Area of Housing Infrastructure

4.5.4.1 Support for Repairs of Defects in Panel Apartment Buildings

The program is intended to assist the owners of apartment buildings constructed by panel technology in necessary repairs to ensure fitness for use of apartment buildings. Implementation in the framework of the program has been implemented in the framework of the activities of the Ministry for Regional Development since 1998 and no date has been set for termination.

The amount of financial support in since 2000 is given in the following table (savings of greenhouse gas emissions were not estimated):

	2000	2001	2002	2003	2004	2005	after 2005
state budget [CZK mil.]	533	220	285	287	230	220	220

Source: Ministry for Regional Development

4.5.4.2 Support for Regeneration of Panel Apartment Districts

The program is intended to create conditions for promotion of conversion of the existing mono-functional apartment districts to attractive poly-functional city wards. Support is provided, e.g., for preparation of a regulation plan for panel apartment districts, construction of transport infrastructure, including pedestrian routes, public greenery and cyclist routes, construction of sound barrier walls, conversion of apartment district heating plants to cleaner fuel, etc. The program has been implemented since 2001 and no date has been set for termination.

The amount of financial support in the period since 2001 is given in the following table (savings of greenhouse gas emissions were not estimated):

	2001	2002	2003	2004	2005	after 2005
state budget [CZK mil.]	150	0	80	110	100	100
state budget [CZK mil.]	81	0	161	100	100	100

Source: Ministry for Regional Development

4.5.4.3 Support for Construction of Rental Apartments and Technical Infrastructure

The program contains three subsidy titles, intended for

- support for the construction of rental apartments for specific-income groups of inhabitants;
- support for the creation of rental apartments in accordance with the principles of sustainable development of rural areas in unused buildings in the territory of rural municipalities; and
- support for the construction of technical infrastructure for subsequent apartment construction on properties owned by the municipality.

The program has been implemented since 1994 and differentiated subsidy levels according to the energy intensity of the building have been utilized since 2005.

The amount of financial support in the period since 2004 is given in the following table (savings of greenhouse gas emissions were not estimated):

	2004	2005	after 2005
state budget [CZK mil.]	483	500	500

Source: Ministry for Regional Development

4.5.4.4 Support for the Construction of Assisted Apartments

The program is intended to assist the construction of rental apartments in the ownership of municipalities for persons who are at a disadvantage in their access to housing, not only because of their income level, but also for other reasons, leading to special requirements in this area. The program facilitates the construction of three types of apartments – protected apartments, half-way apartments and re-entrance apartments. The program has been implemented since 1990 and differentiated subsidy levels according to the energy intensity of the building have been utilized since 2005.

The amount of financial support in since 2004 is given in the following table (savings of greenhouse gas emissions were not estimated):

	2004	2005	after 2005
state budget [CZK mil.]	201	500	500

Source: Ministry for Regional Development

4.5.5 Programs in the Agricultural Sector

4.5.5.1 Use of Renewable Energy Sources.

Measures in operational programs are intended to support the use of renewable energy sources:

- Increasing the diversification of agricultural activities, concerned with the production and processing of non-food agri-

cultural products and production and processing of biomass; and
- Diversification of agricultural activities and similar activities, concerned with support for alternative energy sources to 5 MW.

In the framework of the sector, the use of renewable energy sources is supported by Government Resolution No. 825/2004 on provision for the content of a minimal amount of biofuel or other fuel from renewable sources in the range of automotive petrols in connection with the Program to promote the production of bioethanol for mixing into petrols, for replacement of methanol in the production of the methyl ester of rapeseed oil (biodiesel fuel) and methyl tert-butyl ether and as an alternative fuel with promotion of its use on the domestic market. In cooperation with the Ministry of the Environment, the Ministry of Agriculture is preparing the introduction of mixed fuels through Act No. 186/2004 Coll., amending Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air). For the other types of renewable energy sources, the Ministry of Agriculture continues to support research and development in the area of production of biogas and cultivation of energy-production plants and wood. Support is directed towards the cultivation of energy-production wood species and plants and is concerned with the production of biodiesel fuel or the production of up to 1000 tons of bioethanol used as an alternative fuel, on the basis of processing crops from agricultural production produced in the Czech Republic.

Support was provided up to the amount of CZK 3 thous. per ton of methyl ester or to CZK 15 per litre of bioethanol and the estimated savings in greenhouse gas emissions to 2020 are as follows:

	2000	2005	2010	2015	2020
carbon dioxide [thous. ton]	124	122	120	100	90

Source: Ministry of Agriculture

4.5.5.2 Land-use Planning

Land-use planning creates conditions for rational management by property owners; properties are classified in terms of space and function and provision is made for access to them. An integral part of every land-use planning consists in a plan for joint facilities, consisting in measures for providing access to properties (particularly by field and forest roads), water management and anti-erosion measures (to protect the land fund and improve the water regime in the landscape) and measures to protect and create the environment and increase the ecological stability of the territory (territorial systems of ecological stability and further green areas).

In addition to the sphere of agriculture, land-use planning also contributes to implementing other specific aspects of the National Program, e.g. increasing the fraction of renewable energy sources in energy production. Land-use planning creates conditions for rational management by property owners and users, savings of automotive fuels for off-road vehicles and creation of better conditions for cultivation of fast-growing tree species and other advantageous energy crops.

Land-use planning also contributes to support for cyclist transport through the construction of cyclist routes and accompanying infrastructure (especially the construction of cyclist routes in the network of field and forest roads). Their network improves the accessibility of the agricultural landscape and facilitates better connections between municipalities and rural settlements.

4.5.5.3 Support for Afforestation of Unused Agricultural Areas

The adopted measures have an effect both in reduction of emissions of carbon dioxide, methane and nitrous oxide (in agriculture) and in increasing the level of sinks for carbon dioxide through absorption (in forest management). In the adopted National Program, the sector of the Ministry of Agriculture pledged to implement measures related to afforestation of unused agricultural areas, maintenance of permanent grasslands, and use and introduction of new land use technologies and cultivation methods. Support for the afforestation of unused agricultural areas and agricultural land unsuitable for agrosystems (sloped, stony, water-logged, shallow soils) was already mentioned in the Third National Communication. The Ministry of Agriculture provides nonreturnable financial assistance for afforestation of unused agricultural properties, including protection of established forest cultures. The area of forests increased by approximately 15 000 ha in 1990 – 2003. This increase is the consequence of two opposite processes – afforestation of non-forest land areas (including agricultural land) and withdrawal of properties from fulfilling the function of a forest, particularly for investment construction and extraction of raw materials.

4.5.5.4 Measures of an Adaptive Character

4.5.5.4.1 Non-ploughing Seeding Procedures

These procedures for growing crops do not require deeper tilling of the soil and thus enable maximum retention of the vegetative soil cover and also prevention of water and soil erosion with the greatest possible prevention of loss of soil moisture. A contribution can be obtained from the Agriculture operational program to purchase the necessary technology.

4.5.5.4.2 Construction of Irrigation Systems

The subsidy title "Support for the construction of drip irrigation in fruit orchards, hop gardens and vineyards" for 2004 contributed to extension of irrigation systems and simultaneously to effective use of irrigation water for production of special crops.

4.5.6 Favourable Purchase Prices for Electricity

Favourable tariffs for purchase of electricity produced from renewable energy sources constitute one of the decisive instruments employed in the Czech Republic to support renewable energy sources. This measure introduces a further advantage in these prices compared to current conditions and is intended to stimulate purchase of electricity produced from renewable sources and their increased use. It was already possible to provide these prices, but there was no guarantee of their continuation into the future. Act No. 180/2000 Coll. newly introduced a fifteen-year guarantee of minimum purchase prices from the date of bringing the installations into operation, as these measures seem feasible.

The effect of introduction of favourable tariffs was estimated using the EFOM/ENV model, which also took into consideration declaration of areas of *Natura 2000*, which substantially limits the potential for construction of wind generators in the territory of the country, and also the expected increase

in the prices of natural gas, which can be reflected in increased competitiveness, especially of sources burning waste biomass.

Estimation of the impacts of this measure is given in the following table:

	2005	2010	2015	2020
carbon dioxide [thous. ton]	1 057	985	1 350	1 705

Source: ENVIROS s.r.o.

These values are more than one half lower than the originally predicted in the draft law and estimates of the Ministry of Industry and Trade.

4.5.7 Use of Landfill Gas and Biogas from Waste Water Treatment Plants

The program is concerned with the use of methane formed in waste landfills and in decomposition of waste water treatment plant sludges. In Article 11, Decree No. 383/2001 Coll., on details of waste management, as amended, stipulates the technical requirements on waste landfills and the conditions for operation and closing of landfills. These conditions are considered to be fulfilled if they correspond to the technical standards specified in this Article. Technical standard CSN 83 8034, Waste Landfilling – Degasification of Landfills, stipulates the thresholds according to the mean methane concentration, above which it is necessary to utilize or remove landfill gases.

4.5.8 Implementation of the Directive on Cogeneration

The purpose of Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC is to increase energy-production efficiency and improve the safety of supply by creating a framework for promotion and development of highly effective combined production of heat and electricity on the basis of a demand for useful heat and savings in primary energy in the internal energy market, taking into account the specific circumstances in a particular country and especially climatic and economic conditions. The Directive has been only partly incorporated into the national legislation, i.e. in the Act on Energy Management, in minimum efficiencies and in the Energy Act in the obligation to purchase electricity from cogeneration and in minimum purchase prices; the manner of demonstrating the origin of energy is not yet included in the legislation.

4.5.9 The Integrated National Program to Reduce Emissions

The Integrated National Program to Reduce Emissions in the Czech Republic is based on Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air), and was approved in Government Resolution No. 454/2004. Its main goals are as follows:

- attaining of the national emission ceilings for sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia to 2010;
- reduction of emissions of pollutants that do exceed pollution limit levels (including emission of ozone precursors) in an attempt to attain the limit levels within set periods of time;
- maintenance of emissions of pollutants, for which exceeding of the pollution limit levels has not been determined, at a sufficient level so as to minimize the risk of exceeding the pollution limit levels in the future;
- and attaining the indicative target values for acidification, for human health and for vegetation by 2020.

It is fully in accordance with the State Environmental Policy, the State Energy Conception and the National Program to Mitigate the Impacts of Climate Change in the Czech Republic, as energy savings must currently be considered to be unambiguously the most important potential for reduction of emissions of both carbon dioxide and the main pollutants into the air. A substantial part of the measures to reduce pollutant emissions into the air will also lead to reduction of carbon dioxide emissions. Annual expenditures of CZK 581 mil from the state budget in the 2004 – 2006 period and CZK 4.4 bil. from private sources for the 2004 – 2008 period are expected for implementation of measures connected with the program.

The range of estimated reductions in pollutant emissions, which the program primarily emphasizes, to 2015 are given in the following table (savings of greenhouse gas were not estimated):

	2005	2010	2015
carbon monoxide [thous. ton]	561 to 660	572 to 676	587 to 701
nitrogen oxides [thous. ton]	322 to 336	323 to 337	298 to 310
sulphur oxides [thous. ton]	232 to 247	227 to 242	213 to 229

Source: Ministry of the Environment

4.5.10 Initiative for Energy-Saving Lighting

The initiative for energy-saving lighting was originally a three-year program prepared by the International Financial Corporation (IFC) and financed by the Global Environmental Facility (GEF) for the 2000 - 2003 period, which is continuing under the coordination of the local coordinator SEVEn. Its target consists in reduction of greenhouse gas emissions through accelerated introduction of energy-saving technology into newly forming markets. It is directed mainly towards the public sector, households and public street lighting. The budget of USD 1.25 thous. is employed to stimulate local private and public sources and the expected direct benefits are estimated as savings of about 390 kt CO_2 in 2002 - 2003 and as indirect benefits in subsequent years at the level of 425 kt CO_2 annually.

4.6 Prepared Measures

4.6.1 The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources for 2006 – 2009

The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources is a medium-term, four-year program document, which was prepared by the Ministry of Industry and Trade in cooperation with the Ministry of the Environment pursuant to Act No. 406/2000 Coll., on energy management. The National Program for 2006 – 2009 is based on the results and experience of the National Program for the 2002 – 2005 period and elaborates, for 2006 – 2009, the requirements and targets of the State Energy Conception and the State Environmental Policy of the Czech Republic for 2004 – 2010 and specifies a number of implementation instruments for its execution. It also corresponds to implementation of one of the additional measures set forth in the National Program to Mitigate the Impacts of Climate Change.

The National Program for 2006 – 2009 is compatible with the procedures of the European Union countries and promotes implementation of the requirements of the EU Directives, concerned with

- use of renewable energy sources (Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market);
- energy effectiveness (Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market and Regulation (EC) No 2422/2001 of the European Parliament and of the Council on a Community energy efficiency labelling programme for office equipment and the proposed Directive on energy efficiency and energy services); the use of alternative fuels in transport (Directive 2003/30/EC of the European Parliament and of the Council on the promotion of the use of biofuels or other renewable fuels for transport).

The Government promulgated this program in Resolution No. 884/2005 of July 13, 2005. The program is concerned with (a) the state administration and self-government, (b) the business sphere and (c) households and NGOs, as the three basic target groups.

The program for the 2006 – 2009 period is based on the basic indicators of energy effectiveness in 2000 – 2004 according to the following table:

	2000	2001	2002	2003	2004
energy intensity for primary energy sources [MJ/CZK thous. (1995 c.p.)]	1.050	1.047	1.038	1.064	1.033
inter-annual trend [%]	-	99.7	99.1	102.5	97.1
energy intensity per final energy consumption [MJ/CZK thous. (1995 c.p.)]	0.636	0.653	0.631	0.643	0.621
inter-annual trend [%]	-	102.7	96.6	101.9	96.6
electrical energy intensity [MWh/CZK mil (1995 c.p.)]	33.173	33.239	32.686	32.182	31.838
inter-annual trend [%]	-	100.2	98.3	98.5	98.9
ratio of final energy consumption / consumption of primary energy sources	0.616	0.624	0.608	0.604	0.601
inter-annual trend [%]	-	103.0	97.4	99.3	99.5

Source: Ministry of Industry and Trade, Czech Energy Agency

The priorities of the National Program for 2006 – 2009 are based on the State Energy Conception and the State Environmental Policy and consist in

- maximizing of energy and electrical energy effectiveness and utilization of energy savings in the energy transformation sector and in final energy consumption, especially in the processing industry, in households, in the tertiary sector and in transport;
- greater utilization of renewable and secondary energy sources, incl. energy use of wastes; and
- use of biogas and natural gas in transport.

The implementation of priorities appears in a reduction in the environmental burden and contributes to maintenance of the national emission ceiling for SO_2, NO_X, volatile organic compounds and CO_2 emissions.

The indicative targets of the priorities of the program for the period to 2009 are listed in the following table:

summary energy effectiveness (PES/GDP), energy savings	(a) average increase in effectiveness of at least 2.6%, (b) energy savings in the area of final consumption in an amount of approx. 11 PJ p.a. (inter-annual)
electrical energy effectiveness (electricity/GDP) and electricity savings	average increase in effectiveness of at least 2.1% (inter-annual)
fraction of renewable energy sources in consumption of primary energy sources	minimum of 5.6%
fraction of renewable energy sources in consumption of electricity	minimum of 7.5 %
greater energy utilization of municipal wastes	minimum of 1.5 – 2 PJ p.a.
fraction of biofuels in consumption of automotive fuels	minimum of 5.6% of the energy content
fraction of biofuels in consumption of automotive fuels	minimum of 1.8 % of the energy content

The targets of the program are concerned with

- utilization of the potential of renewable energy sources in production of electricity and heat and meeting the indicative targets of the program by 2009, i.e. 7.5% of gross electricity production and 5.6% of consumption of primary energy sources using adjustment of purchase prices for electricity from renewable energy sources, introduction of green bonuses, application of guarantees of returns on investments pursuant to Act No. 180/2005 Coll., on support for the production of electricity from renewable energy sources and creation of new instruments to promote production of heat from renewable energy sources; and
- creation of conditions for the utilization of the energy potential of solid municipal wastes of 15 PJ p.a. in 2015, employing support for long-term plans of the regions for the construction of installations for energy use of municipal wastes (preparation of feasibility studies, environmental impact assessment, public awareness campaigns), revision of the system of fees for waste management in order to create motivation for not landfilling wastes, creation of conditions for withdrawing finances from structural funds in the 2007 – 2013 period, support for selected pilot projects for installations for energy use of wastes and support for the production of electricity through surcharges on the market price (Act No. 458/2000 Coll.); and
- utilization of the potential for the use of alternative fuels in transport and implementation of the indicative targets of the program for 2006 of 5.6% biofuel and 1.8% natural gas in the energy content of automotive fuels, using promotion of the program for the production of bioethanol and MERO (methyl ester of rapeseed oil) and creation of tax and financial instruments of support.

The State Program to Promote Energy Savings and the Use of Renewable Sources of Energy, which has been in effect in amended form since 1999, is the chief instrument for imple-

mentation. The Draft State Program will be promulgated in a Resolution of the Government of the Czech Republic separately for each year and will be coordinated jointly by the Ministry of Industry and Trade and the Ministry of the Environment. The national program will be evaluated every two years and this evaluation will be submitted to the Government of the CR as information. Changes or modifications will be proposed on the basis of the evaluation.

The program encompasses the expenditures of CZK 8.055 bil. for the 2006 – 2009 period (of which about CZK 1.462 bil. from EU structural funds). It is expected that, in 2009, the consumption of at least 5.36 TWh of electricity will be covered by production from renewable energy sources and that renewable energy in primary energy sources will correspond to at least 108 PJ. Potential savings in final consumption (without time differentiation) are estimated at 400 PJ, of which 170 PJ is considered to be an economically promising potential. The proposal is based on annual savings in final consumption of 11 PJ. If the above energy from renewable energy sources and savings in final consumption are reflected in emissions (assuming unchanged structure of fuels and energy in primary sources and final consumption according to 2003), the total savings in carbon dioxide emissions for 2006 – 2010 can be estimated at the values in the following tables:

Savings in final consumption	2003		2006 – 2010	
	consumption [PJ]	CO_2 [thous. t]	consumption [PJ]	CO_2 [thous. t]
industry	474.77	17 765	14.80	554
agriculture	46.63	1 766	3.00	114
transport	186.10	13 431	21.10	1 523
services	126.38	4 420	6.30	220
households	270.97	9 571	0.40	14
Total	1 104.85	46 953	45.60	2 425

savings in production of heat and power	2003		2006 – 2010	
	production [PJ]	CO_2 [thous. t]	replacement by RES [PJ]	CO_2 [thous. t]
electricity	299.60	58 575	1.80	352
heat	188.32	15 325	34.56	2 812
Total	487.92	73 900	36.36	3 164

Savings in transport	2003		2006 – 2010	
	consumption [PJ]	CO_2 [thous. t]	replacement by RES + NG [PJ]	CO_2 [thous. t]
transport	186.10	13 430	10.30	743
Total	186.10	13 430	10.30	***743***

Source: Ministry of Industry and Trade, ENVIROS s.r.o.

If the program is fully implemented, its net effect should consist in the estimated reduction in CO_2 emissions as set forth in the National Program to Mitigate the Impacts of Climate Change, i.e. in an amount of about 6.3 mil. tons in the entire period to 2010.

4.6.2 Environmental Tax Reform

At the present time, the Conception of Environmental Tax Reform is being prepared and will form the basis for reform of the tax system in the Czech Republic. The conception is based on Directive 2003/96/EC of October 27, 2003, restructuring the Community framework for the taxation of energy products and electricity. This Directive stipulates minimum tariff rates of excise duties for fuel and electrical energy. In connection with implementation of the Directive into the national legislation, the Czech Republic has requested a transition period for the introduction of excise duties on solid fuels, electricity and natural gas for heating to the year 2007. New excise duties will be introduced as of January 1, 2008 at the latest to meet the EU requirements and the minimum tax rate for specified commodities or the subjects of duties will apply by the same date.

One of the targets of the prepared conception of environmental tax reform consists in support for environmentally sound fuels and means of producing electricity and, on the other hand, putting at a disadvantage fuels and means of producing electricity that are significant sources of emissions of greenhouse gases and other pollutants.

4.6.3 Industry and Business Operational Program

The Industry and Business Operational Program is a program for providing support from the Structural Funds. Measure 2.3 (Reduction of energy intensity and greater use of renewable energy sources) in the framework of priority 2 (Development of competitiveness of enterprises) is important for protection of the climate. Measure 2.3 includes two programs – Energy Savings and Renewable Energy Sources.

4.6.3.1 Energy Savings

It is the purpose of the program of the Ministry of Industry and Trade, implemented through the Czech Energy Agency for 2004 – 2008, to contribute to reduction of the energy intensity of Czech industry through financial support for energy-saving investment projects. Support in the framework of the operational program will be provided to projects concerned with

- new technologies of processing energy-production materials, to achieve a higher yield of the energy potential of raw materials;

- reduction of the energy intensity of processes connected with the production, conversion and distribution of energy;
- introduction of new installations for production of electricity and heat (modern structures equipped with new technologies for fuel treatment, addition of fuel and combustion);
- reduction of losses through modernization of installations employed for the production, distribution and transformation of energy-production media;
- utilization of waste heat and secondary energy sources and. energy use of wastes;
- introduction of combined production of electricity and heat (cogeneration);
- introduction of less energy-intense technologies of production and production equipment;
- modernization of energy management, improvement of procedures in logistics, improvement of thermal technical and energy properties of buildings, production and auxiliary operations and other buildings connected with production entities and use of low-energy products and materials, monitoring reductions in energy intensity, reduction of environmental burdens and achieving energy savings.

4.6.3.2 Renewable Energy Sources

It is the purpose of the program of the Ministry of Industry and Trade, implemented through the Czech Energy Agency for 2004 – 2008, to promote projects introducing production of electrical energy or heat from renewable energy sources (a renewable energy sources is a source defined in Decree No. 214/2001 Coll.). These projects contribute to increasing the fraction of renewable energy sources in total energy production and simultaneously contribute to a reduction in the consumption of primary, nonrenewable energy sources and thus to reduction in emissions from the production of electricity and heat.

Support will be provided in the framework of the operational program for

- projects of construction, renewal or reconstruction of installations for the use of renewable energy sources;
- projects for introduction of production technology and production installations with low energy intensity and minimum environmental impacts and utilizing equipment for production of energy from renewable energy sources;
- projects of combined production of electricity and heat using a renewable energy source for production.

4.6.4 Infrastructure Operational Program

The main target of this operational program consists in support for economic and social cohesion through reducing regional differences and participation in renewal and development of the regions. The amount of support will vary in the range 15 – 75% of total eligible costs for measures in dependence on the type of project. The purpose of this project is to protect and improve the state of the environment and to develop and improve the transport infrastructure, while respecting the principles of sustainable development, with emphasis on meeting the EC standards, and it is concerned especially with the use of low-energy combustion technologies, reduction of emissions of volatile organic compounds and use of renewable energy sources. The portfolio has a predominance of projects in the areas of water supply, sewer systems and waste water treatment plants; nonetheless, there are very few projects with direct impact on greenhouse gas emissions and thus it is rather difficult to estimate the benefits of the program and costs expended for reduction greenhouse gas emissions.

The Industry and Business and Infrastructure Operational Programs have been implemented since 2004. However, as a consequence of rather unfortunate definition of the rules, no projects were submitted in the key programs of "Energy Savings" and "Renewable Energy Sources" in 2004 and the funds have been reduced twice. Consequently, these operational programs are included amongst additional measures.

The EFOM/ENV model was employed to estimate the reduction in carbon dioxide emissions through implementation of the two operational programs as follows:

	2003	2005	2010	2015	2020
carbon dioxide [thous. ton]	0	0	2130	610	940

Source: ENVIROS s.r.o.

Because of the limited duration of the program, the maximum possible benefit of the program can be considered to consist in achieving a value of 2.13 Mt CO_2 in 2010.

4.6.5 Implementation of the Directive on Buildings

The Czech Republic has pledged to incorporate the intentions of Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings into the relevant Czech legislation; work on implementation of this Directive is progressing.

This Directive stipulates the requirements related to

- the general framework of the method of calculation of the energy performance of buildings;
- implementation of minimum requirements on the energy performance of new buildings;
- implementation of minimum requirements on the energy performance of large existing buildings, which are undergoing major renovation;
- energy certification of buildings; and
- regular inspection of heating and air-conditioning systems in buildings and evaluation of heating installations which are older than 15 years.

On the basis of information gained to date, the implementation of this Directive will not lead to a substantial increase in the potential for energy savings in buildings above the existing technical standards; however, its benefit will lie in accelerating the realization of this potential.

Estimated savings in of greenhouse gas emissions to 2020 are given in the following table:

	2003	2005	2010	2015	2020
carbon dioxide [thous. ton]	0	10	230	460	690

Source: Ministry for Regional Development. ENVIROS s.r.o.

4.7 Flexible Mechanisms of the Kyoto Protocol

4.7.1 Joint Implementation Projects According to Art. 6 of the Protocol

The Czech Republic has quite broad experience in implementing projects in the area of protection of the environment,

especially in connection with projects supported by the State Environmental Fund and the Czech Energy Agency. If joint implementation projects are implemented, it is assumed that these two institutions would participate in the process of their preparation, assessment and implementation right from the beginning.

4.7.1.1 Activities Implemented Jointly (AIJ)

In the framework of participation of the CR in the pilot phase of joint implementation projects as the testing phase, in which there will not be a shift of the achieved emission reduction to the investor, the National AIJ Reference Centre was established at the Ministry of the Environment in 1996 and prepared the basic general rules for their implementation. A total of 5 projects have been implemented, which were approved more or less on an individual basis. These are various types of projects: two projects for a change in the kind of fuel employed, two projects to increase energy efficiency in a given company and one project related to afforestation. A survey is given in the following table:

Central heating in Děčín	This project was approved in 1996 and the investor country was the USA. It was concerned with a change in heating medium from coal to gas, the use of cogeneration and increasing energy efficiency. The total costs of the project were approx. USD 8 mil., where the AIJ component consisted of approx. 7.5% of investment costs in the form of soft loans from a private company in the USA (USD 600,000). The installation was brought into operation in 1996 and the annual reduction in greenhouse gas emissions equals 24 kt CO_2.
Renewal of forest stands in the Šumava and Krkonoše National Parks	This project was approved in 1997 and the investor country was Holland. In the framework of the project, 14 thous. ha of land was afforested (9 thous. ha in Krkonoše and 5 thous. ha in Šumava), with total costs of USD 60.5 mil.; the AIJ component corresponded to 80% (USD 48 mil.) and the costs were covered by the FACE project. The annual reduction in greenhouse gas emissions equals 734 kt CO_2 and the life-time is estimated at 99 years.
Modernization of the Čížkovice cement plant	The project was approved in 1997, the investor country was France and the measures were concerned with aspects of energy efficiency. This project was carried out in the foreign branch in the framework of a single company, with total investments of about USD 6 mil. and achieved annual reduction in greenhouse gas emissions of about 33.6 kt CO_2.
Biomass heating plant in Hostětín	This was a comprehensive demonstration project for central heating using biomass together with the use of solar energy for heating hot utility water, supplemented by the construction of an information centre on renewable resources. Total costs were about USD 860 thous., of which the AIJ component was about USD 470 thous. The total annual reduction in greenhouse gas emissions equalled about 3350 t CO_2, which, with a lifetime of 15 years, corresponds to a total reduction of 50.25 kt CO_2
Installation of a new co-generation unit in Škoda Mladá Boleslav.	This project was implemented in the foreign branch of the same company and FRG was the investing country. The project involved modernisation and renovation of the cogeneration units where, together with an increase in energy efficiency, there was a change in heating medium from coal to gas. The total costs of the project equalled approx. USD 110 mil., mostly covered by a commercial loan. The annual reduction in emissions equals 272 kt CO_2, corresponding to a total of 5.4 mil. t CO_2 for a lifetime of twenty years.

In evaluation of the pilot phase of AIJ, it was pointed out that is systematic procedure is not available for accepting and evaluating AIJ projects, which were accepted and subsequently evaluated on an individual basis and the basic rules were very general. In this connection, it was found that one of the key aspects of implementation of similar projects lies in careful preparation of contracts.

4.7.1.2 Joint Implementation Projects (JI)

At the end of 2001, work was commenced on transfer of AIJ projects to the JI phase, i.e. with the assumed subsequent transfer of unit emission reductions to the foreign investor. The first step consisted in preparing institutional provision for this subject area at the Ministry of the Environment. A new task force was established, with the special task of selecting methodology for selection of JI projects, assessing the submitted proposals and making recommendations for implementation. The following have been named as top-priority areas for inclusion in JI projects

- use of renewable energy sources;
- energy savings in heating buildings (insulation, regulation) in the public sector;
- energy savings in heating buildings (insulation, regulation, low-energy buildings) in residential buildings;
- use of waste industrial heat in existing installations;
- construction of collection systems for landfill gases for old landfills and their energy-production use; and
- greening of public transport.

Nonetheless, projects outside of these priority areas can also be submitted as JI projects. Primarily for methodological reasons, the area of afforestation has temporarily been excluded.

Independent projects or groups of projects can be proposed as JI projects if they (i) are of an investment character, (ii) are in accordance with the generally binding regulations of the CR, (iii) do not lead to transfer of pollution between the individual components of the environment (e.g. air – water – soil) and (iv) are prepared for implementation; activities of a noninvestment character (technical assistance, consulting, expertise, education and public awareness, etc.) and also projects that have already been implemented or commenced cannot be recognised as projects in this sense. Draft projects are submitted to the Ministry of the Environment, which registers them and comprehensively evaluates the application. .

Proposals are evaluated particularly according to the overall and annual reduction in greenhouse gas emissions, the required number of emission credits, the price offered for unit emission reduction, the condition of additionality, accordance with the priorities of the State Environmental Policy and the priorities of the State Program to Promote Energy Savings and the Use of Renewable Energy Sources Similarly, the condition of the "best available technology" must be met in accordance with the adopted EC legislation, the project must provide a benefit for extending know-how and new domestic technology and the environmental and economic aspects of the project must be maintained. Projects that are concerned with complying with

the conditions laid down by the relevant generally binding national legislation are automatically excluded. The capacities of the State Environmental Fund, in the framework of which a separate methodical program was established, were employed to evaluate proposals. Following comprehensive evaluation of the project, it is discussed by a working group established within the Ministry of the Environment, which subsequently recommends it to the Minister of the Environment for approval.

4.7.1.3 Experience with AIJ and JI Projects

The Netherlands, Austria, Denmark, the Federal Republic of Germany and Japan have expressed active interest in cooperating on these projects. A number of other countries are also interested in closer specification of existing general cooperation in the future. Cooperation is usually based on the experience of both the investing and the host country. In a number of cases, there is potential for use of assistance from the investor countries, which is concentrated on dealing with certain specific and technical aspects.

Cooperation with the World Bank (also known as the International Bank for Reconstruction and Development IBRD) and the Prototype Carbon Fund (PCF), which was commenced in 2001, is also based on the JI principle. In accordance with the national methodology for JI projects, PCF supports projects concerned with energy savings through an increase in the energy efficiency in public buildings (hospitals, schools, etc.) with central heat supply and renewable energy sources in an extent suitable for industrial buildings. Participation of PCF is based on an agreement approved by the Government in 2003 and the projects are implemented through the Czech Energy Agency. The expected degree of participation of IBRD in joint implementation projects corresponds to USD 5-7 mil. in dependence on the amount of reduction of emissions through implementation of specific projects.

4.7.2 Trading in Greenhouse Gas Emissions According to Art. 17 of the Protocol

The potential for trading on the basis of this principle has not yet been the subject of detailed examination in the CR; however, possibilities have been indicated in relation to the use of revenue from emission sales, etc. Benefit from their sales could be recycled back into support for projects leading to a further reduction in greenhouse gas emissions, with similar emphasis to joint implementation projects. As these measures usually also resolve related problems (promotion of renewable energy sources, energy savings, etc.), which are amongst top priorities of environmental policy or other policies (e.g. employment, promotion of use of the landscape or agriculture for targeted cultivation of biomass), this approach will probably be optimal. Recycling of the benefit from the sale of emission units would be based on existing mechanisms of the State Environmental Fund, where a separate investment program would be created for this purpose, to distribute the purpose-bound revenues from the sale of emissions. This approach could be an alternative to joint implementation projects, which would eliminate their formal and procedural inadequacies.

4.8 National Allocation Plan as Implementation of Act No. 695/2004 Coll.

As an EU member state, the Czech Republic is obliged to implement a system of trading in greenhouse gas emissions, as defined by Directive 2003/87/EC. This Directive was transposed by Act No. 695/2004 Coll., on conditions for trading in greenhouse gas emission allowances and amending some laws, and Decree No. 6962004 Coll., stipulating the procedure for determining, reporting and verifying greenhouse gas emissions. The system is based on obligatory participation of installations emitting greenhouse gases (in the first phase, only CO_2), which belong in selected sector categories and meet the quantitative criteria for acceptance into the system. The trading takes place in a trading period; the first trading period is three years long (2005 – 2007) and the subsequent ones are five-year periods (2008 – 2012, etc.).

From the standpoint of reduction of greenhouse gas emissions, a key element in the system consists in the national allocation plan, which describes the manner and the amount of allocation of emission allowances to the individual companies (participants in the system) at the beginning of the relevant trading period. It contains not only a list of companies covered by the force of the Directive, together with the number of allocated emission allowances, but also a number of items of related information on implementation of policies in the area of reduction of emissions, relation to competitiveness and the single internal market, etc. The national allocation plan must be approved by the European Commission. Following approval by the European Commission, the allocation of allowances amongst the operators of the individual installations for the first trading period were accepted by the Government of the CR on July 20, 2005 and were promulgated in the form of a Government Regulation. The complete text of the National Allocation Plan of the CR for the 2005 – 2007 period, including methodical procedures, was approved by the Government on September 29, 2005. The allocation plan divides a total of 97.45 mil. allowances[4] annually amongst 426 installations.

4.9 Measures not Implemented

All the measures set forth in the Third National Communication continue to be implemented and the implementation of some measures (energy policies, energy audits, energy labelling) that are not explicitly mentioned here are mentioned in the legislation in the Act on energy management.

4.10 Summary of Measures

Tab. 4.1 gives a survey of measures, together with a list of the expected benefits in reducing greenhouse gas emissions to 2010.

[4] *One allowance correspond to the right to emit one ton of carbon dioxide.*

Tab. 4.1 Summary of measures with a list of expected benefits to 2010

Name of measure	Target of the measure	Affected greenhouse gases	Category of measure	State of the measure	Responsibility5	expected benefit6 [t CO_2 equiv.]	
						2005	2010
National Program to Mitigate the Impacts of Climate Change in the CR - Summary	provision for compliance with the obligations of the Kyoto Protocol	all	framework	implemented	Government of the CR and designated Ministry	n/a	n/a
The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources	harmonization with EU policy	all	framework	implemented / prepared	ME, MIT	6 332	6 332
The integrated national program to reduce emissions in the Czech Republic	achieving of the national emission ceilings and reduction of pollutant emissions	all	program	implemented	MIT, ME, MA, MT	n/a	n/a
Act on Protection of the Air	harmonization of the CR legislation with EU legislation	CO_2	legislative	implemented	ME and other state administrative bodies in the area of air protection	n/a	n/a
Energy Act	harmonization of the CR legislation with EU legislation	CO_2	legislative	implemented	MIT, ERA	n/a	n/a
Act on Energy Management	harmonisation of the CR legislation with EU legislation	CO_2	legislative	implemented	MIT	n/a	n/a
Infrastructure Operational Program	reduction of the amount of emitted pollutants, improving pollution levels in the affected locations, improvement of the state of health of the population and condition of vegetation, reduction of greenhouse gas emissions	all	program	commencing	ME, SEF, municipalities	n/a	2 130
Implementation of the Directive on the energy performance of buildings	reduction of the energy requirements of buildings in relation to the outdoor climate and local conditions, requirements on the indoor environment and effectiveness of expenditures	CO_2	legislative	prepared	investors, owners and operators of buildings	10	230
State Program to Promote Energy Savings and the Use of Renewable Sources of Energy, Part A – Czech Energy Agency Programs	reduction of the energy intensity of the economy, savings in energy materials and minimization of the environmental impact and reduction of greenhouse gas emissions	CO_2	legislative, program education	implemented	CEA	147	200
State Program to Promote Energy Savings and the Use of Renewable Sources of Energy, Part B - SEF Programs	reduction of the energy intensity of the economy, savings in energy materials and minimization of the environmental impact and reduction of greenhouse gas emissions	CO_2	legislative, program education	implemented	SEF	128	99
Support of the State Environmental Fund of the Czech Republic in air protection	reduction of emissions of pollutants into the air	CO_2	program	program	SEF	1 000	1 000
GEF Efficient Lighting Initiative	reduction of greenhouse gas emissions through accelerated introduction of energy-saving lighting technologies	CO_2	program, education	implemented	GEF, SEVEn	425	425
Program to Support Reconstruction and Restoration of Panel Buildings	repairs and reconstruction of panel apartment buildings	CO_2	program	program	MRD	n/a	n/a
Preferential purchase tariffs for electricity produced from renewable sources	fuel replacement in production of electricity	CO_2	legislative, program	prepared	ME, MIT, ERA	1 057	985
Environmental tax reform	fuel replacement in consumption of energy	CO_2	framework, legislation	prepared	ME, MIT, MF, ERA	0	900
Implementation of the Directive on cogeneration	increased efficiency of energy production and improved supply through the creation of a framework for support for and development of highly efficient combined production of heat and electricity	CO_2	legislative, program	implemented	MIT, ERA	n/a	n/a

Name of measure	Target of the measure	Affected greenhouse gases	Category of measure	State of the measure	Responsibility5	expected benefit6 [t CO_2 equiv.]	
						2005	2010
Set of measures in the transport sector	reduction of pollutant emissions reduction of greenhouse gas emissions	CO_2, CH_4, N_2O	framework, legislative, program	implemented	MT, ME, MA	2 797	3 917
Act on Integrated Prevention	harmonization of the CR legislation with EU legislation	CO_2, CH_4, N_2O	legislative	implemented	ME, MIT	n/a	n/a
National Allocation Plan	motivation of decisive industrial producers to reduce CO2 emissions harmonization of the CR legislation with EU legislation	CO_2	legislative, program	commencing	ME, MIT affected industrial enterprises	n/a	n/a
Industry and business operational program	increasing the energy efficiency of production and reducing energy consumption in industry and increasing the fraction of renewable energy sources	CO_2	program	prepared	MIT and affected industrial enterprises	0	2 130
Support for afforestation of unused agricultural areas	more rational use of agricultural land	CO_2	program	implemented	MA	84	84
Implementation of the Directive on biofuels	nonfoodstuff use of domestic agricultural production	CO_2	legislative, program	implemented	MA, ME	60	997
Use of landfill gas and biogas from waste water treatment plants	reduction of methane emissions from landfills and waste water treatment plants	CH_4	program	implemented	ME, operators of landfills and waste water treatment plants	n/a	n/a
Act on packaging and Act on wastes	harmonization of the CR legislation with EU legislation	CO_2, CH_4, N_2O	legislative	implemented	ME, MIT	n/a	n/a
AIJ project – Škoda Mladá Boleslav	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	Government of FRG in cooperation with Bavariawerk AG and RWE Energie	272	272
AIJ project – Hostětín	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	Government of the Kingdom of the Netherlands in cooperation with BTG Group	49	49
JI project – BTG Group	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	Government of the Kingdom of the Netherlands in cooperation with BTG Group	263	244
JI projects in the framework of PCF	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	CEA	0	1 300
Portfolio of projects	energy savings and use of renewable energy sources	CO_2, CH_4	voluntary activities	prepared	CEA	30	70

Explanation:
ME – Ministry of the Environment, MIT – Ministry of Industry and Trade, MA – Ministry of Agriculture, MT – Ministry of Transport, MRD – Ministry for Regional Development, MF – Ministry of Finance, ERA – Energy Regulation Authority, SEF – State Environmental Fund of the Czech Republic, CEA – Czech Energy Agency, PCF – Prototype Carbon Fund of the World Bank, GEF – Global Environment Facility, SEVEn – Centre for Effective Energy Use. n/a – data not available or estimate cannot currently be made
The benefits from AIJ and JI projects are not included in the overall benefit for the Czech Republic.

5 Projections of Greenhouse Gas Emissions

5.1 Emission Projections Scenarios

In accordance with the methodical instruction for preparation of projections[7], projections were prepared for the scenarios

- without measures;
- with measures, i.e. with implemented measures, which came into force in the 1995 – 2005 period; and
- with additional measures, i.e. with measures that are currently prepared or under preparation[8].

Additional measures included in preparation of projections are

- full implementation of the National Program for Sound Energy Management and Use of Renewable and Secondary Energy Sources;
- introduction of environmental tax reforms;
- implementation of the Directive on buildings; and
- introduction of the operational programs "Industry and Business" and "Infrastructure".

5.2 Methodology Employed

The methodology employed is in accordance with the methodology employed for preparation of projections for the Third National Communication which, amongst other things, permits them to be compared. It includes a set of the following steps: (i) greenhouse gas inventory, (ii) choice of the initial and final year and cross-sectional years for projection, (iii) choice of the actual methodology and modelling instruments for preparation of the projection, (iv) selection and analysis of input data for the projection, (v) establishment of the initial assumptions, (vi) definition of scenarios, (vii) their calculation and (viii) presentation of results and performance of sensitivity analysis under selected assumptions. The following text gives a brief description.

5.2.1 Inventory of Greenhouse Gas Emissions

Inventories of greenhouse gas emissions are prepared by the Czech Hydrometeorological Institute; the last summary inventory is available for 2003. Summary data from this inventory are given in Chapter 3 of this document.

Total national greenhouse gas emissions recalculated to CO_2 equiv. for 2003 equalled 143.4 Mt. The results of greenhouse gas emission inventories indicate that CO_2 emissions make the greatest contribution to greenhouse gas emissions; these emissions are produced practically only by the combustion of fossil fuels. The greatest fraction of total CO_2 emissions in 2003 came from the energy industry (47.8%), followed by the processing industry, including industrial energy production (30.7%), the population, agriculture and the tertiary sector (12.8%); transport currently makes the lowest contribution (19.9%).

5.2.2 Cross-cutting Period of the Projection

The choice of the right year for projected emission trends is very important for the quality of the projections. Usually, the initial year is a year for which official statistics are available for activities in the area of the economy and energy production and also an emission inventory has been performed. Annual data on macroeconomic developments in 2004, the energy balance for 2003, balance of sources and energy consumption for 2003 and the emission inventory for 2003 were available for work on the projections for the Fourth National Communication. The year 2003 was selected as the initial year for calibration of the model. The year 2020 was selected as the final year for projections of greenhouse gas emissions, in accordance with the required methodology for preparing this document. The years 2005, 2010, 2015 and 2020 were selected as cross-cutting years for preparing the projections.

5.2.3 Methodical Procedures Employed in the IPCC Sectors

In accordance with the IPCC methodology, projections of greenhouse gases were prepared through classification of greenhouse gas emissions into the following groups according to their origin: (i) Energy (IPCC sectors 1A and 1B), (ii) Industrial Processes (IPCC sector 2), (iii) Solvent Use (IPCC sector 3), (iv) Agriculture (IPCC sector 4), (v) Land-Use, Land-Use Change and Forestry (IPCC sector 5) and (vi) Waste (IPCC sector 6). Projections were prepared for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) in the above groups. Summary projections were made for emissions of hydrofluorocarbons and perfluorocarbons (HFCs, PFCs) and sulphur fluoride (SF_6) and also for NO_X, CO, NMVOC a SO_2. The methodical procedures and model instruments employed are listed below.

5.2.3.1 Energy

The EFOM/ENV energy production linear optimization model was used for projections of CO_2, CH_4 and N_2O emissions from combustion processes. The following activities were included in calculation of emission projections for the individual greenhouse gases:

- **carbon dioxide** - combustion of fuels in fuel conversion processes (public and factory energy production), combustion of fuels for final consumption (industrial processes, transport, households, agriculture and the sector of public and commercial services), fuel improvement processes (refineries, post-mining treatment of coal and coking) and removal of SO_2 from combustion products using limestone;
- **methane** – coal mining and its post-mining treatment; mining, storage, transport and distribution of natural gas and mining, storage, transport and refining of petroleum; and
- **nitrous oxide** – combustion of fuels ain stationary and mobile sources.

5.2.3.2 Industrial Processes

Trends in greenhouse gas emissions from industrial processes were projected using a combined procedure with the EFOM/ENV model and a table processor. The projection was concerned only with activities and emissions with a major contribution to greenhouse gas emissions. Other emissions and activities with a minor contribution to greenhouse gas emissions

[7] *Guidelines for Preparation of National Communications by Parties Included in Annex I to the Convention (FCCC/CP/1997/7)*
[8] *ECZ 5029, ENVIROS, s.r.o. July 2005*

were derived on the basis of an increase in GDP in the processing industry, amongst other things, because of the lack of information on potential future trends (e.g. production of nitric acid, etc.).

The main component of emissions from industrial processes, i.e. the metallurgy of ferrous metals, is dealt with directly in the EFOM/ENV optimization model. Consequently, in this part, projections were made only for carbon dioxide emissions from cement production, which constitute approx. 90% of emissions of this greenhouse gas from the sector of production of non-metallic materials. It is expected that the emissions from the production of glass, which is the second most important source of carbon dioxide emissions from this sector will remain in a constant ratio to those from cement production.

Cement production decreased constantly between 1990 and 2002 (Tab. 5.1) but increased in 2003 and this continued in 2004; the fraction of emissions from cement production in total emissions from non-metallic materials was almost constant throughout this entire period (approx. 90%). The emission factor taken from the IPCC methodology was employed in the projection, i.e. 0.4985 t CO_2/t cement.

Tab. 5.1 Projections of CO_2 emissions from production of non-metallic materials

	cement production [thous. t]	CO_2 emissions (kt)		
		cement	other	total
1999	4 241.3	2 114.0	248.1	2 362.1
2000	4 092.8	2 040.3	210.5	2 250.7
2001	3 590.7	1 790.0	210.5	2 000.4
2002	3 249.2	1 603.7	188.9	1 792.5
2003	3 575.0	1 782.0	198.2	1 980.2
2004	3 709.0	1 848.9	-	-
2005	3 960.0	1 974.1	219.3	2 193.4
2010	4 410.0	2 198.4	244.3	2 442.7
2015	4 410.0	2 198.4	244.3	2 442.7
2020	5 400.0	2 691.9	299.1	2 991.0

Source: CHMI, CSO, ENVIROS, s. r. o.

Emissions from the chemical industry were classified separately[9] for the first time in the emission inventory for 2003. Because of lack of information on future trends in the branch, projectionss of CO_2 emissions in the chemical industry were derived by indexation from the expected trends in GDP in the chemical industry (Tab. 5.2).

Tab. 5.2 Projections of CO_2 emissions from the chemical industry

	2003	2005	2010	2015	2020
CO_2 [kt]	706	712	727	750	778

Source: CHMI, CSO, ENVIROS, s. r. o.

5.2.3.3 Solvent Use

Emissions of greenhouse gases from solvents constitute only a negligible part of total emissions. The reduction to date was caused primarily by the transition to water-based coatings and adhesives. There is apparently no great scope for a further reduction in these emissions; because of the lack of information on future trends in this segment, emission values were left at the value for the initial year.

5.2.3.4 Agriculture

A simplified procedure using a table processor, based on projections of trends in the individual activities, was used to project greenhouse gas emissions from agricultural production. The calculation of projections of methane emissions took into account the effect of enteric fermentation and management of waste of animal origin (manure); projections of nitrous oxide emissions were based on direct emissions from agricultural soils and indirect emissions from agricultural activities. Projections of emissions from agricultural production are based on trends in the basic indicators, which were provided by the Ministry of Agriculture, i.e. on expected trends in the numbers of farm animals and trends in the soil balance according to the individual kinds. Trends in methane emissions from enteric fermentation and manure management after 2000 were affected by the substantial reduction in the numbers of farm animals (Tab. 5.3); an insignificant increase is expected after 2005.

Tab. 5.3 Trends in the numbers of farm animals [thous. head]

	2000	2005	2010	2015	2020
cattle	1 574	1 410	1 410	1 420	1 430
pigs	3 688	2 950	3 100	3 100	3 150
sheep	84	120	150	170	200
goats	32	11	14	17	20
poultry	30 784	25 000	23 000	23 500	24 000

Source: Ministry of Agriculture

Trends in nitrous oxide emissions were derived from the expected trends in the soil balance with the exception of non-agricultural land and water areas (Tab. 5.4). Because of the expected slight decrease or stagnation in trends in the area of agricultural land, it is also expected that nitrous oxide emissions will remain more-or-less constant at the level for the initial year.

Tab. 5.4 Trends in the soil balance [thous. ha]

		2000	2005	2010	2015	2020
total agricultural land		4282	4211	4161	4108	4065
of which	arable land	3096	3055	2987	2945	2898
	hop gardens	6	6	6	6	6
	vineyards	15	19	19	19	19
	permanent grasslands (meadows and pastures)	950	972	1003	1018	1030
total nonagricultural land						
of which	forest land	2637	2647	2657	2660	2665
	water areas	159	161	162	164	165
trends in indicators of total stocks of wood [mil. m^3]		630	648	655	674	683

Source: Ministry of Agriculture

[9] *In previous years, they were included in the energy production sector.*

5.2.3.5 Land-Use, Land-Use Change and Forestry

Projections of the overall balance of carbon dioxide emissions (including sinks) are based on the assumption that the production from wood harvesting will not increase significantly over the present level. There should be a slight increase in carbon dioxide sinks as a continuation of the trend in recent years. The projection is based on the indicator of the total wood stocks (Tab. 5.5).

Tab. 5.5 Rate of increase in the assimilated amount of CO_2

	2001 - 2005	2006 - 2010	2011 - 2015	2016 - 2020
Annual rate of increase [%]	0.57	0.22	0.57	0.27

Source: Ministry of Agriculture

Methane emissions from the combustion of wood in harvesting in forests correspond to only a small fraction of greenhouse gas emissions in the CR. No substantial changes are expected in these activities and, consequently, these emissions are left at the value for the initial year in the individual scenarios.

5.2.3.6 Waste

A simplified procedure using a table processor, based on projections of trends in the individual activities for these emissions and processes, was used to project greenhouse gas emissions from industrial production processes. The calculation of carbon dioxide emissions took into account waste combustion, the projections of methane emissions included waste landfilling and collection and treatment of municipal and industrial waste waters, and the projections of nitrous oxide emissions included collection and treatment of municipal and industrial waste waters. Management of solid municipal waste is one of the most important activities connected with greenhouse gas emissions. The combustion of municipal wastes (CO_2 emissions) and their landfilling (CH_4 emissions) constitute significant sources. The authors based calculations in projection emissions produced by these processes on the results of the PHARE project[10]. This project was concerned with future trends in waste management and especially the impact of adopting Directive 99/31/EC on waste landfills, which limits the amount of biologically decomposable waste deposited in landfills. In contrast to the above-mentioned project and because of public disapproval of the construction of new waste incinerators, no substantial increase in the amount of waste incinerated is expected (Tables 5.6 and 5.7).

Tab. Production and management of municipal wastes [tis. t]

	1998	1999	2000	2001
solid municipal waste, total	4 534.3	4 317.3	4 257.8	4 242.8
combustion	180.3	326.5	338.8	383.3
landfilling	2 062.1	2 633.8	2 566.6	2 611.9

*Source: **ISOH** – Waste Management Information System*

Tab. 5.7 Expected trends in the production of municipal wastes and emissions from waste management [tis. t]

	2003	2005	2010	2015	2020
incinerated and landfilled municipal waste [tis. t]	2 857.0	2 972.4	3 281.8	3 623.4	4 000.5
incineration	400.0	414.0	457.0	501.0	545.0
landfilling	2 457.0	2 558.4	2 824.8	3 122.4	3 455.5
biologically decomposable	1 105.7	1 151.3	1 271.2	1 405.1	1 555.0
used	0.0	0.0	225.2	708.1	1 067.0
not used	1 105.7	1 151.3	1 046.0	697.0	488.0
CO_2 emissions from combustion [kt p.a.]	368.3	381.2	420.8	461.3	501.8
N_2O emissions from combustion [kt p.a.]	0.015435	0.015975	0.017634	0.019332	0.021030
CH_4 emissions from landfilling of unused biological waste [kt p.a.]	83.4	86.9	76.5	51.0	35.7

Source: ENVIROS, s. r. o.

In relation to the validity of Directive 99/31/EC on the landfill of waste, which limits the deposition of biologically decomposable wastes on landfills in relation to the amount of waste deposited in 1995, it is expected that the amount of this waste deposited will decrease by approx. 56% by 2020 compared to 1999. This should correspond to reduction CH_4 emissions by up to 36 kt p.a.

Methane emissions from waste-water treatment are the last important source of greenhouse gas emissions from waste management. Projections of these emissions depend on a great many factors, such as trends in the amounts of water treated, including sewage and industrial waters, trends in treatment plant capacities, the contributions of the individual treatment technologies, etc. Because of the expected increase in industrial production, extension of the public sewer system and capacities of waste-water treatment plants, these emissions will gradually increase. On the basis of a qualified estimate, it is projection that these emissions will increase by 0.5% annually to 2020.

5.2.3.7 HFCs, PCFs and SF_6 Emissions

Because of the lack of reliable information on trends in these emissions, the projection was prepared only on the basis of an expert estimate that, in accordance with the latest IPCC results, predicts increases of 10%, 20% and 30% in 2010, 2015 and 2020, respectively, compared with the initial year.

5.2.3.8 CO, NO_X, SO_2 and NMVOC Emissions

For complex information on potential emission trends, Tab. 5.8 gives a framework projection of emissions of indirect greenhouse gases to 2020. The projections were calculated by the EFOM/ENV model (energy branches) with calculation using a table calculator (other branches). The projections reflect changes in the emission limits in the sense of the Act on Protection of the Air.

[10] *EC-PHARE Project CZ 9811-02-02 Implementation Investment Strategies for EC Waste Directives, SRCI, Prague 2000*

Tab. 5.8 Framework projections of indirect greenhouse gases [tis. t p.a.]

	2005	2010	2015	2020	emission ceiling for 2010 according to the Treaty on accession to EU
CO	605	550 – 554	430 – 437	333 – 352	-
NO_x	320	286	262 – 264	224 – 228	286
SO_2	225	213 – 226	179 – 190	136 – 143	265
NMVOC	205	199 – 201	178 – 182	162 – 168	220

Source: CHMI, ENVIROS, s. r. o.

It follows from model calculations for nitrous oxide emissions that the relevant emission ceiling of 286 kt can be achieved in 2010 only at the price of a radical replacement of the vehicle fleet in transport and agriculture; this cannot currently be considered realistic.

5.2.4 Collection and Analysis of Input Data

The following documents were employed as basic data sources for preparing projections of greenhouse gas emissions.

Statistical data

- Inventory of greenhouse gas emissions in the Czech Republic in 2003, Czech Hydrometeorological Institute, Prague, 2005;
- Energy balance of the Czech Republic in 2000, 2001, 2002 and 2003, Czech Statistical Office, Prague, 2005;
- Balance of energy-production processes for improved fuels in 2003, Czech Statistical Office, Prague, 2004;
- Annual national accounts 2001 – 2003; Czech Statistical Office, Prague, 2005; and
- Individual documents of the Ministry of Industry and Trade of the CR, Ministry of the Environment, Ministry of Transport, Ministry of Agriculture, Ministry of Education, Youth and Sports, Ministry of Culture, Czech Energy Agency, State Environmental Fund of the Czech Republic and the Czech Statistical Office

Projection data

- World Energy Outlook 2004, International Energy Agency, 2004;
- Draft Publication on "International Coal Trade - Contributing to Sustainable Energy Supply", International Energy Agency, 2004;
- Documents from the Ministry of Industry and Trade of the CR, Ministry of the Environment, Ministry of Transport, Ministry of Agriculture, Ministry of Education, Youth and Sports, Ministry of Culture, Czech Energy Agency and the State Environmental Fund, 2005;
- Documents from EGÚ Brno, a. s., VUPEK Economy, s. r. o., 2005.

A database on input data for work on the project was drawn up using these sources.

5.2.5 Initial Preconditions

Energy-production processes are the greatest sources of greenhouse gas emissions. Emission projections were mostly calculated using the EFOM/ENV comprehensive energy management model. This model requires a technological database as input information, including the emission coefficients for the individual technologies, and also a fuel and energy database (expenditures, prices, availability limits), as well as a database of demand for useful energy. The energy demand is based particularly on estimates of economic growth and the numbers of inhabitants. Potential probable combinations of availability and prices of fuel and energy, technological mix availability, economic growth and demographic developments form model scenarios that can be further investigated from the standpoint of the effects of various economic and legislative instruments. The following text summarizes the initial assumptions for creation of the scenarios.

5.2.5.1 Scenario of Demographic Trends

Predictions of the number of inhabitants are based on information from the Czech Statistical Office (CSO)[11]; the number of households, which is also required for calculation of energy demand, was estimated. CSO prepared population forecasts in three variants; the mean variant was used here.

Tab. 5.9 Demographic forecast [thous.]

	2002	2005	2010	2015	2020
population	10 203	10 236	10 283	10 302	10 283
households	3 824	3 861	3 978	4 150	4 311

Source: CSO, ENVIROS, s. r. o.

5.2.5.2 Scenario of Economic Development

The scenario of economic trends was prepared by the EGÚ Brno, a.s. company as a basis for calculation of the long-term balance of the electrification system and was also used to calculate the scenario for the energy policy of the state. It is apparent from Table 5.10 that the actual average annual rate of growth of GDP in the 2000 – 2005 period was 1% lower than predicted by the forecast used in the State Energy Conception of 2005. On the other hand, expectations for 2005 are higher than the predicted values of the scenario of the State Energy Conception 2005. There are apparently no reasons for modifying the rate of growth for the future, as a growth rate of about 4% can be expected for the coming years. Tab. 5.11 gives data on the average rates of growth of GDP in five-year cross-sections.

[11] *Population forecast for the CR to 2050, CSO, Prague 2004, publication 4025-04*

Tab. 5.10 Trends in GDP to 2005

	2000	2001	2002	2003	2004	2005	2005/2000
GDP (CZK mil.)	1 416 215	1 445 045	1 471 476	1 517 781	1 573 638	1 639 731	-
GDP growth rate [%]	-	2.04	1.83	3.15	3.68	4.20	2.97

Source: CSO

Tab. 5.11 Average inter-annual GDP growth rate

	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025	2025-2030
GDP growth rate [%]	3.55	3.99	3.73	3.65	3.22	3.33

Source: EGÚ Brno, a. s.

A similar course is expected for the sectoral structures of GDP to that recorded in the past in the developed countries of Europe - a decrease in the contribution of industry and agriculture and an increase in the sector of services. In connection with the faster rate of growth of GDP, it is also expected that there will be a higher rate of restructuring of industry, greater inflow of foreign investments, connected with a boom in the construction industry, and faster developments in the sector of services. The target consists in achieving the structure of the economy currently normal in the EU-15 countries by the year 2030. Tab. 5.12 depicts the resultant GDP structure.

Tab. 5.12 GDP structure according to the individual macroeconomic scenarios in 2030

	agriculture	industry and construction	transport	services
GDP structure [%]	3.3	29.9	7.3	59.5

Source: EGÚ Brno, a. s.

The structure of creation of GDP in the sectors of industry is characterised by a reduction in energy-intense sectors, especially metallurgy. Machinery production is expected to make a growing contribution, with increasing importance of products with higher added value. Forecasts of changes in creation of GDP are based, amongst other things, on analysis of the transformations and structural changes occurring in the former GDR following unification of Germany, where the structure of the economy was similar to that in the CR. A greater degree of restructuring of industry is expected in the scenarios with greater GDP growth (Tab. 5.13).

Tab. 5.13 Structure of creation of GDP in industry [%]

	2000	2005	2010	2015	2020	2025	2030
Energy production	15.11	12.86	12.63	12.39	12.14	11.90	11.80
Foodstuffs	11.74	10.96	10.73	10.50	10.25	10.20	10.10
Chemistry	7.59	7.82	8.00	8.19	8.39	8.50	8.60
Light industry	11.33	11.31	11.37	11.44	11.51	11.60	11.70
Machine industry	25.22	28.45	29.21	29.98	30.80	31.20	31.60
Metallurgy	11.16	11.15	10.71	10.28	9.81	9.60	9.20
Mineral materials and construction	17.83	17.45	17.35	17.22	17.10	17.00	17.00

Source: EGÚ Brno, a. s.

5.2.5.3 Scenario of Trends in Global Prices of Fuel and Energy

Petroleum, natural gas and black coal are commonly traded energy commodities on the global market. Price trend scenarios are also regularly prepared for these three basic energy commodities. Recently, electrical energy has been increasingly traded; however, because of the regional character of trade, no scenarios have been published for price trends. Tab. 5.14 and 5.15 give the basic scenarios of price rends, used as a basis for preparing the scenarios of long-term demand for energy sources.

The main assumptions employed in creation of the scenarios are as follows:

- there was a sudden increase in the trend in petroleum prices and the predictions of the long-term trends in the prices of petroleum and natural gas are very different;
- according to the study of Goldman Sachs, petroleum prices could reach 50 – 105 USD per barrel in coming years and, similarly, the price of gas could vary in the substantial range of 6 – 13 USD per MBtu;
- because of the ever-increasing demand (especially in the developing world), the price of natural gas will continue to be based on the price of petroleum (the range and rate of price changes will be lower than for petroleum prices);
- import prices of black coal are based on the optimistic assumption of a surplus on the European market (amongst other things, associated with difficulties in complying with the Kyoto Protocol);
- there is a certain risk of an increase in the price of black coal as a consequence of an increase in the demand in the rapidly developing countries of Asia;
- domestic black coal prices will be further increased by transport costs to the state borders (estimated at CZK 10 /GJ);
- at the present time, the import of cheap electrical energy is based particularly on the operation of old thermal power plants with lifetimes to 2010, where the price of electricity is based only on variable costs;
- new energy sources will have to meet strict environmental limits and the price of electrical energy will have to cover variable and fixed costs and will thus be substantially higher than the present value;
- after 2010, the increase in the price of imported electrical energy will be derived from the increase in the price of natural gas as a decisive new source of electrical energy in Europe.

Tab. 5.14 Basic scenario of trends in the prices of petroleum, natural gas and coal to 2020

	European import prices [CZK/GJ (30 CZK = 1 USD)]					
	1990	2000	2005	2010	2015	2020
Petroleum	137	137	197	157	181	181
Natural gas	76	76	95	110	126	126
Black coal	64.2	42.20	46.8	48.0	49.2	50.4

Source: OECD Economic Outlook No. 76 (petroleum), IEA World Energy Outlook 2004 (black coal), ENVIROS, s.r.o., 2005

Tab. 5.15 Basic scenario in trends in the import prices of electrical energy to 2035

	2000	**2005**	**2010**	**2015**	**2020**
CZK/GJ	221	340	360	370	390
CZK/kWh	0.80	1.22	1.30	1.33	1.40

Source: ENVIROS s.r.o.

5.2.5.4 Scenario of Trends in Domestic Prices and Availability of Fuel and Energy

The prices of imported primary energy sources will be based on the above average import prices into the EU. The prices of domestic energy sources is based on the costs of their acquisition and will also be affected by the position of the given fuel in the market compared to competitive energy sources. Solid fuel, especially brown coal, will continue to be a decisive domestic primary energy source. These sources will depend on the binding nature of territorial environmental limits on brown coal mining.

The purchase prices of electrical energy from renewable energy sources and from sources with combined production of electricity are currently stipulated by a Decree of the Energy Regulation Authority[12]. The current legislation[13] guarantees favourable purchase prices for a period of 15 years from bringing the source into operation. The Energy Regulation Authority can reduce these prices by up to 5% annually compared to the previous year. The projections assume maintenance of current purchase prices for the entire period.

The purchase prices of electricity from combined production of electricity and heat offered to producers for the individual production plants with total installed output of up to 1 MWe and supplied to the distribution system is suggested as CZK 1240/MWh and, for production plants with installed output of 1 to 5 MWe, as CZK 1170 MWh.

5.2.6 Political and Legal Environment

From the standpoint of the political and legal environment, the following basic assumptions are considered for energy trends:

- privatization in the energy industry, whose completion is not yet entirely clear but which, in general, need not have a detrimental impact on energy production and the economy of the state;
- opening of the market in energy, which will occur for all consumers in accordance with Act No. 458/2000 Coll. (the market in electricity will be opened completely as of January 1, 2006 and, in gas, as of January 1, 2007);
- protection of the environment, where the Czech Republic is bound by a number of international agreements (Second Protocol on Sulphur, Göteborg Protocol, Kyoto Protocol); and
- obligations following from membership in the EU (Directive 2001/80/EC of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from large combustion plants, Council Directive 96/61/EC concerning integrated pollution prevention and control, Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants, Council Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity and Directive 2003/30/EC of the European Parliament and of the Council on the promotion of the use of biofuels or other renewable fuels for transport).

5.2.7 Technical Developments

Substantial developments are expected in the development of technology for obtaining, converting, transport and use of energy sources. In the area of use of solid fuels for the production of electrical energy, use will be concentrated on sources with super-critical steam parameters and on fluid technologies, connected with much higher effectiveness and, in the area of combined production of electrical energy and heat, improvements will be made in technology permitting the construction of sources that are as close as possible to heat consumers. In the longer term, consideration is given to the potential increase in small sources based on microturbines and fuel cells.

In the sphere of the use of nuclear energy, it can be assumed that a new generation of flexible reactors based on the fission reaction will become available after 2020, and will be suitable for effective use in the energy systems of smaller countries. However, the plans of CEZ indicate that a new nuclear source will probably not be brought into operation before 2020. In the use of automotive fuels, in addition to a further decrease in specific consumption, the use of alternative fuels will be gradually promoted, facilitated, amongst other things, by the use of fuel cells in propulsion; in the area of the use of renewable energy sources, the main trend will lie in a further reduction of specific investment costs for all sources, which will improve their competitiveness compared to classical sources.

5.3 Construction of the Energy Scenario

The following initial assumptions were employed for model calculation of greenhouse gas emissions from energy-production processes:

- the Temelín nuclear power plant will remain in normal operation for the whole monitored period (2000 – 2020),
- the Dukovany nuclear power plant will be reconstructed in order to prolong its lifetime and will be in normal operation

[12] *ERA Price Decision No. 10/2004, stipulating the prices of electricity and related services*

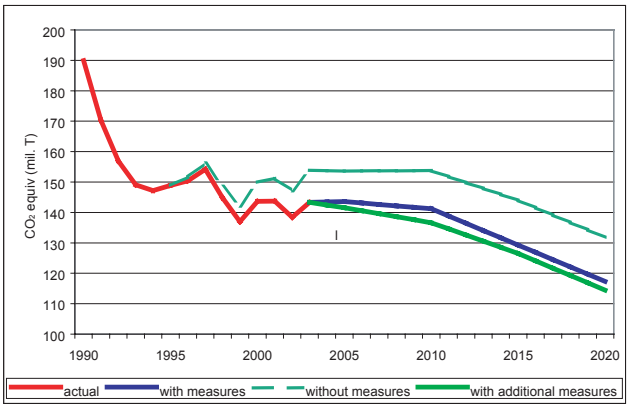
[13] *Act No. 180/2005 Coll., on the promotion of production of electricity and from renewable energy sources and on amendment to some laws (Act on Promotion of Use of Renewable Sources)*

throughout the monitored period (with expected termination of operations in 2025);
- since 2004, there have been no limits on imports of petroleum, gas and black coal;
- in 2000 – 2010, electricity exports are expected at a level of up to approx. 15 TWh annually for reasons of stability and regulation of the electrification system; it is expected that, after 2010, the annual balance of imports and exports of electricity will not exceed 10 TWh in either the positive or negative direction (attempts will be made not to increase the energy-import dependence through electricity imports and not to increase local emissions of pollutants and greenhouse gases through production of electricity for export).

5.4 Projections of Greenhouse Gas Emissions to 2020

The results of projections of greenhouse gas emissions for the scenarios without measures, with measures and with additional measures, which are defined in Chapter 5.1 and processed under the assumptions set forth in Chapters 5.2 and 5.3 are presented in Fig. 5.1.

Fig. 5.1. Projections of total greenhouse gas emissions



Source: ENVIROS, s.r.o., CHMI

The values of projections for 2005 to 2020, including the latest emission data according to the inventory of greenhouse gas emissions in 2003 are given for the individual greenhouse gases in Tab. 5.16, for the individual IPCC activity sectors in Tab. 5.17 and in the IPCC format in Tab. 5.19 to 5.21.

Tab. 5.16 Projections of emissions of the individual greenhouse gases [mil. t CO_2 equiv.]

	2003	2005	2010	2015	2020
scenario without measures					
CO_2	123.3	132.8	134.6	125.4	115.0
CH_4	10.2	10.5	8.6	8.0	6.3
N_2O	8.2	8.6	8.6	8.5	8.4
F-gases	1.7	1.7	1.9	2.1	2.2
Total	143.4	153.6	153.8	144.0	131.8
scenario with measures					
CO_2	123.3	123.4	122.9	111.9	101.2
CH_4	10.2	9.9	7.9	6.9	5.7
N_2O	8.2	8.5	8.5	8.4	8.2
F-gases	1.7	1.7	1.9	2.1	2.2
Total	143.4	143.6	141.2	129.3	**117.3**
scenario with additional measures					
CO_2	123.3	121.3	118.5	109.1	98.4
CH_4	10.2	10.0	7.7	7.0	5.6
N_2O	8.2	8.5	8.5	8.4	8.2
F-gases	1.7	1.7	1.9	2.1	2.2
Total	143.4	141.6	136.6	126.5	**114.4**

Source: ENVIROS, s.r.o., CHMI

Tab. 5.17 Projections of emissions of greenhouse gases in IPCC sectors [mil. t CO_2 equiv.]

	2003	2005	2010	2015	2020
scenario without measures					
Energy	123.4	133.2	133.0	123.4	110.8
Industrial Processes	13.0	13.3	13.9	14.3	15.1
Solvent Use	0.5	0.5	0.5	0.5	0.5
Agriculture	7.4	7.6	7.6	7.7	7.7
Land-use and Forestry	-3.8	-4.0	-4.0	-4.2	-4.2
Waste	2.8	2.9	2.8	2.3	2.0
Total	143.4	153.6	153.8	144.0	131.8
scenario with measures					
Energy	123.4	123.3	120.6	108.7	96.4
Industrial Processes	13.0	13.3	13.9	14.3	15.1
Solvent Use	0.5	0.5	0.5	0.5	0.5
Agriculture	7.4	7.6	7.6	7.7	7.7
Land-use and Forestry	-3.8	-4.1	-4.1	-4.2	-4.3
Waste	2.8	2.9	2.8	2.3	2.0
Total	143.4	143.6	141.2	129.3	117.3
scenario with additional measures					
Energy	123.4	121.3	116.0	106.0	93.5
Industrial Processes	13.0	13.3	13.9	14.3	15.1
Solvent Use	0.5	0.5	0.5	0.5	0.5
Agriculture	7.4	7.6	7.6	7.7	7.7
Land-use and Forestry	-3.8	-4.1	-4.1	-4.2	-4.3
Waste	2.8	2.9	2.8	2.3	2.0
Total	143.4	141.6	136.6	126.5	114.4

Source: ENVIROS, s.r.o., CHMI

The prepared projections indicate that a reduction of total greenhouse gas emissions by 26% can be expected in 2010 and by at least 38% in 2020 compared to the 1990 level.

Tab. 5.18 Projections of reduction in total greenhouse gas emissions compared to 1990 [%]

	2003	2005	2010	2015	2020
Scenario with measures	25	24	26	32	38
Scenario with additional measures	25	25	28	33	40

Source: ENVIROS, s.r.o., CHMI

Tab. 5.19 Projections of carbon dioxide emissions 2005 – 2003 in the IPCC format [Gg]

Greenhouse Gas Source and Sink Categories	Scenario with measures				Scenario with additional measures			
	2005	2010	2015	2020	2005	2010	2015	2020
Total emissions	**123 382**	**122 944**	**111 866**	**101 162**	**121 341**	**118 514**	**109 116**	**98 396**
1. Energy	**116 310**	**115 506**	**104 209**	**92 952**	**114 269**	**111 077**	**101 458**	**90 186**
A. Fuel Combustion (Sectoral Approach)	115 762	115 066	103 824	92 669	113 725	110 660	101 098	89 900
1. Energy Industries	60 810	60 212	56 008	43 977	58 680	57 571	54 935	42 989
2. Manufacturing Industries and Construction	25 012	25 015	19 672	21 583	25 293	23 691	18 369	20 701
3. Transport	13 751	14 096	13 846	14 373	13 755	14 095	13 859	14 379
4. Other Sectors	16 188	15 741	14 297	12 735	15 998	15 303	13 936	11 830
5. Other								
B. Fugitive Emissions from Fuels	548	441	385	283	544	417	361	286
1. Solid Fuels	548	441	385	283	544	417	361	286
2. Oil and Natural Gas	0	0	0	0	0	0	0	0
2. Industrial Processes	**10 557**	**10 927**	**11 228**	**11 797**	**10 557**	**10 927**	**11 228**	**11 797**
A. Mineral Products	2 193	2 443	2 443	2 991	2 193	2 443	2 443	2 991
B. Chemical Industry	712	646	668	702	712	646	668	702
C. Metal Production	7 651	7 839	8 117	8 105	7 651	7 839	8 117	8 105
3. Solvent and Other Product Use	**265**	**265**	**265**	**265**	**265**	**265**	**265**	**265**
4. Agriculture	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A. Enteric Fermentation								
B. Manure Management								
D. Agricultural Soils and other emissions of N_2O								
5. Land -Use, Land-Use Change and Forestry	**-4 131**	**-4 176**	**-4 297**	**-4 354**	**-4 131**	**-4 176**	**-4 297**	**-4 354**
A. Changes in Forest and Other Woody Biomass Stocks								
E. Other								
6. Waste	**381**	**421**	**461**	**502**	**381**	**421**	**461**	**502**
A. Solid Waste Disposal on Land								
B. Waste-water Handling								
C. Waste Incineration	381	421	461	502	381	421	461	502
Note:								
International Bunkers	**603**	**740**	**845**	**925**	**603**	**740**	**845**	**925**
Aviation	603	740	845	925	603	740	845	925
Marine								

Source: ENVIROS, s.r.o., CHMI

Tab. 5.20 Projections of methane emissions 2005 – 2003 in the IPCC format [Gg]

Greenhouse Gas Source and Sink Categories	Scenario with measures				Scenario with additional measures			
	2005	2010	2015	2020	2005	2010	2015	2020
Total emissions	**473.258**	**374.092**	**330.802**	**270.810**	**474.495**	**367.106**	**331.808**	**266.163**
1. Energy	**255.706**	**165.428**	**146.307**	**99.890**	**256.943**	**158.443**	**147.313**	**95.243**
A. Fuel Combustion (Sectoral Approach)	14.259	13.580	9.371	6.515	14.263	13.347	9.417	5.149
1. Energy Industries	0.729	0.739	0.698	0.559	0.725	0.730	0.695	0.558
2. Manufacturing Industries and Construction	1.052	1.072	0.928	0.970	1.059	1.063	0.912	0.961
3. Transport	2.380	2.258	2.164	2.235	2.381	2.258	2.164	2.235
4. Other Sectors	10.098	9.510	5.581	2.752	10.098	9.296	5.646	1.395
5. Other								
B. Fugitive Emissions from Fuels	241.448	151.849	136.936	93.375	242.680	145.095	137.896	90.093
1. Solid Fuels	217.817	127.930	110.843	65.927	219.098	121.297	112.496	63.359
2. Oil and Natural Gas	23.631	23.918	26.093	27.447	23.582	23.798	25.401	26.735
2. Industrial Processes	**3.400**	**3.400**	**3.400**	**3.400**	**3.400**	**3.400**	**3.400**	**3.400**
A. Mineral Products	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
B. Chemical Industry	0.390	0.390	0.390	0.390	0.390	0.390	0.390	0.390
C. Metal Production	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
3. Solvent and Other Product Use								
4. Agriculture	**99.716**	**100.555**	**101.268**	**102.319**	**99.716**	**100.555**	**101.268**	**102.319**
A. Enteric Fermentation	72.358	72.645	73.231	73.909	72.358	72.645	73.231	73.909
B. Manure Management	27.357	27.910	28.036	28.411	27.357	27.910	28.036	28.411
D. Agricultural Soils and other emissions of N_2O								
5. Land -Use, Land-Use Change and Forestry	**2.764**	**2.764**	**2.764**	**2.764**	**2.764**	**2.764**	**2.764**	**2.764**
A. Changes in Forest and Other Woody Biomass Stocks								
E. Other								
6. Waste	**111.672**	**101.945**	**77.063**	**62.437**	**111.672**	**101.945**	**77.063**	**62.437**
A. Solid Waste Disposal on Land	86.853	76.499	50.975	35.690	86.853	76.499	50.975	35.690
B. Waste-water Handling	24.819	25.446	26.088	26.747	24.819	25.446	26.088	26.747
C. Waste Incineration								
Note:								
International Bunkers	**0.179**	**0.220**	**0.251**	**0.274**	**0.179**	**0.220**	**0.251**	**0.274**
Aviation	0.179	0.220	0.251	0.274	0.179	0.220	0.251	0.274
Marine								

Source: ENVIROS, s.r.o., CHMI

Tab. 5.21 Projections of nitrous oxide emissions 2005 – 2003 in the IPCC format [Gg]

Greenhouse Gas Source and Sink Categories	Scenario with measures				Scenario with additional measures			
	2005	2010	2015	2020	2005	2010	2015	2020
Total emissions	**27.451**	**27.483**	**27.055**	**26.593**	**27.439**	**27.450**	**27.053**	**26.570**
1. Energy	**5.146**	**5.146**	**4.690**	**4.226**	**5.134**	**5.113**	**4.688**	**4.203**
A. Fuel Combustion (Sectoral Approach)	5.146	5.146	4.690	4.226	5.134	5.113	4.688	4.203
1. Energy Industries	2.162	2.240	2.102	1.623	2.148	2.210	2.091	1.624
2. Manufacturing Industries and Construction	0.678	0.725	0.579	0.594	0.679	0.728	0.586	0.599
3. Transport	2.055	1.950	1.868	1.929	2.056	1.950	1.868	1.929
4. Other Sectors	0.251	0.231	0.141	0.079	0.251	0.226	0.144	0.050
5. Other								
B. Fugitive Emissions from Fuels								
1. Solid Fuels								
2. Oil and Natural Gas								
2. Industrial Processes	**3.134**	**3.134**	**3.134**	**3.134**	**3.134**	**3.134**	**3.134**	**3.134**
A. Mineral Products								
B. Chemical Industry	3.134	3.134	3.134	3.134	3.134	3.134	3.134	3.134
C. Metal Production								
3. Solvent and Other Product Use	**0.692**	**0.692**	**0.692**	**0.692**	**0.692**	**0.692**	**0.692**	**0.692**
4. Agriculture	**17.819**	**17.850**	**17.876**	**17.876**	**17.819**	**17.850**	**17.876**	**17.876**
A. Enteric Fermentation								
B. Manure Management	1.162	1.180	1.190	1.209	1.162	1.180	1.190	1.209
D. Agricultural Soils and other emissions of N_2O	16.657	16.670	16.686	16.668	16.657	16.670	16.686	16.668
5. Land -Use, Land-Use Change and Forestry	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**
A. Changes in Forest and Other Woody Biomass Stocks								
E. Other								
6. Waste	**0.657**	**0.659**	**0.661**	**0.662**	**0.657**	**0.659**	**0.661**	**0.662**
A. Solid Waste Disposal on Land								
B. Waste-water Handling	0.641	0.641	0.641	0.641	0.641	0.641	0.641	0.641
C. Waste Incineration	0.016	0.018	0.019	0.021	0.016	0.018	0.019	0.021
Note:								
International Bunkers	**0.020**	**0.024**	**0.027**	**0.030**	**0.020**	**0.024**	**0.027**	**0.030**
Aviation	0.020	0.024	0.027	0.030	0.020	0.024	0.027	0.030
Marine								

Source: ENVIROS, s.r.o., CHMI

6 Estimates of Vulnerability, Impacts and Adaptation Measures

This chapter contains information on the expected impacts of climate change on the Czech Republic and gives a survey of activities performed in implementing Art. 4.1 of the Convention with emphasis on adaptation. The elaboration was based on the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations[14] and on the UNEP Handbook of Methods for Climate Change Impact Assessment and Adaptation Strategies[15]. The analyses performed so far have concentrated on the sectors of water resources, agriculture and forest management and, in selected cases on analysis on the impacts on human health.

Estimates of the impacts of climate change were based on methods of impact projection using biophysical, empirical-statistical and process models and, in some cases, also economic models. In addition, empirical analogue studies and expert estimates were employed. Attempts to employ integrated (intersectoral) models have so far not been successful, even though integration of impact assessments in all the analyzed sectors was performed by creation and utilization of the individual regional climate scenarios. Water and forest management also employed GIS. Validation and sensitivity analyses were also used for the models. The climatic conditions in the Czech Republic in 1961 – 1990 were employed as starting points.

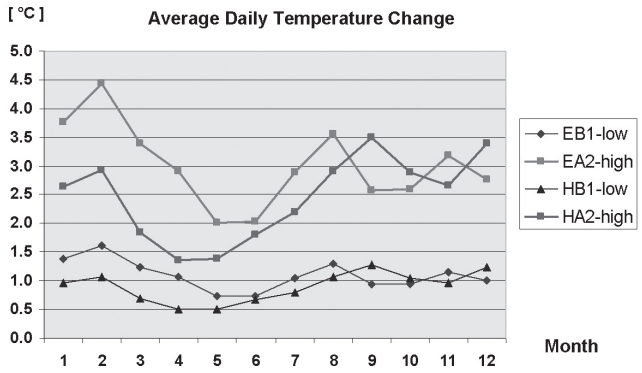
The scenario of climate change that is used most frequently in climate change impact assessments (scenario I) is based on the outputs of the HadCM2 a ECHAM4 global models[16],[17]. SRES A2 was used as the pessimistic variant and SRES B1 as the optimistic variant of trends in greenhouse gas emissions and particulate matter concentrations as emission scenarios. The scenarios of climate change were constructed for the selected combinations:

climatic model + emission scenario+ temperature sensitivity.

The timetable for the scenario extends to 2050 (thirty--year period centred in 2050). The "pattern scaling" method[18] is used to derive the upper and lower estimates of the change. The values 1.5 °C (low sensitivity) and 4.5 °C (high sensitivity) were chosen for the temperature sensitivity of global circulation models (GCM). For each model, the lower estimates of the changes are based on the variant following from low sensitivity GCM and SRES B1, while the upper estimates of changes are combined with high sensitivity GCM and SRES A2. The scenarios are related to the following elements: daily amplitude of air temperatures, average, maximum and minimum daily air temperatures, atmospheric precipitation, global radiation, air humidity and wind velocity. A stochastic generator was employed to simulate the daily data for the altered climate.

Changes in the average daily air temperatures (differences between thirty-year averages for the 2036 – 2065 and 1961 – 1990 periods) and atmospheric precipitation (in %) are given in Figs. 6.1 and 6.2.

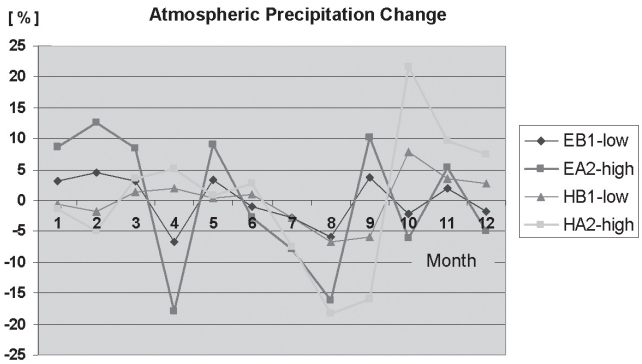
Fig. 6.1 Scenario of changes in the average daily air temperature for 2050 according to the ECHAM4 and HadCM2 models



Note: E - model ECHAM4, H - HadCM2, emission scenario B1 – SRES-B1, A2 – SRES-A2, low – low sensitivity, high – high sensitivity of the climate model.

Source: National Climate Program

Fig. 6.2 Changes in atmospheric precipitation



Note: E - model ECHAM4, H - HadCM2, emission scenario B1 – SRES-B1, A2 – SRES-A2, low – low sensitivity, high – high sensitivity of the climate model.

Source: National Climate Program

Another scenario of climate change (scenario II) was created on the basis of outputs from the HadCM3 model. Experiments based on four emission scenarios were available: IS95a GG (only an increase in greenhouse gases considered), IS95a AA (greenhouse gases and also the direct and indirect effect of sulphate species SO_4 and tropospheric ozone considered), SRES-A2 and SRES-B2. For the air temperatures, the differences between the average values for the 2036-2965 period and the reference period of 1961-1990 are given; for the

[14] *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations, University College London and Center for Global Environmental Research, London 1994*

[15] *Handbook of Methods for Climate Change Impact Assessment and Adaptation Strategies. Version 2.0. UNEP, 1998*

[16] *Kalvová, J., Kašpárek, L., Janouš, D., Žalud, Z., Kazmarová, H.: Scenarios of climate change in the territory of the Czech Republic and estimated impact of climate change on the hydrological regime, the sector of agriculture, the sector of forest management and human health in the CR, the National Climate Program of the CR, Prague 2003, 141 pp.*

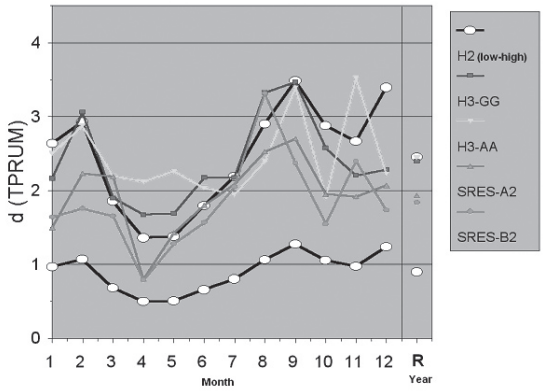
[17] *The impact of climate change on the amount and quantity of water sources and on hydrological conditions in the CR. Final report of the research task VaV/650/3/02 for 2003, T.G. Masaryk Water Research Institute, Prague 2003.*

[18] *Santer, B.D., Wigley, T.M.L., Schlesinge, M.E, Mitchell, J.F.B, 1990: Developing climate scenarios from equilibrium GCM results. Report No. 47, Max Planck Institute fur Meteorologie, Hamburg.*

other quantities (precipitation, global radiation), the fractions of the relevant values are given.

All the experiments with HadCM3 yield elevated average daily air temperatures in all the months of the year (Fig. 6.3). The scenarios employed, based on SRES A2 and SRES B2, differ from the IS95a scenarios in a smaller change in the annual average temperature and smaller changes in monthly averages. With the exception of April, the temperature increase exceeds 1 °C; the greatest warming (3.5 °C) was found in September for experiments GG and AA.

Fig. 6.3 Changes in the average air temperature (dTPRUM) between the 2036-2065 and the 1962-1990 periods *(HadCM3 model)*



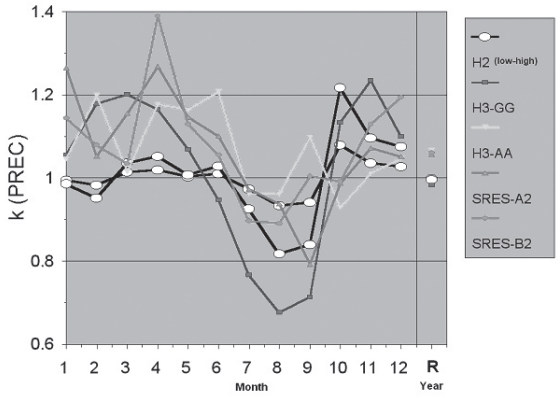
Note: R – change in the annual average, H3-GG and H3-AA – changes derived from the GG experiment (considering only an increase in greenhouse gas concentrations) and the AA experiment (considering the direct and indirect impact of SO_4 and tropospheric ozone, H2 (lower-upper) – curves of the lower and upper estimates of the version of scenario I according to HadCM2

Source: National Climate Program

Throughout most of the year, the scenario based on experiments with the HadCM3 model tends to be close to the upper estimate based on the HadCM2model. Changes in total precipitation (ratio of thirty-year monthly totals for the 2036 – 2065 period to the average totals for the reference period) are depicted in Fig. 6.4. Precipitation increases in the winter and spring by 5 to 20%, while summer precipitation typically decreases (by up to 30%). Substantial uncertainties are associated with the magnitude of changes in total precipitation connected with the choice of emission scenario.

The scenario[19] based on the outputs of seven GCM's available in the IPCC database at the beginning of 2001 was also recommended for estimation of the impacts of climate change on agriculture, forests and the hydrological regime in selected locations of the Czech Republic. The scenario contains changes in atmospheric precipitation, solar radiation, average daily air temperatures and daily amplitudes of air temperatures. This was again created by the "pattern scaling" technique using the MAGICC program[20] and is accompanied by analysis of uncertainties connected particularly with the choice of GCM, emission scenario and sensitivity of GCM to an increase in greenhouse gases.

Fig. 6.4 Changes in the total precipitation between the 2036-2065 and the 1962-1990 periods *(HadCM3 model)*



Note: The ratio of the values for the 2036-2065 and 1961-1990 periods is given. R – change in the annual average, H3-GG and H3-AA – changes derived from the GG experiment (considering only an increase in greenhouse gas concentrations) and the AA experiment (considering the direct and indirect impact of SO_4 and tropospheric ozone, H2 (lower-upper) – curves of the lower and upper estimates of the version of scenario I based on HadCM2

Source: National Climate Program

Another scenario of climate change was created on the basis of outputs from the HadCM3 model. Experiments based on four emission scenarios were available: IS95a GG, IS95a AA, SRES-A2, SRES-B2. This was intended primarily to determine the uncertainty in the estimated climate change from the standpoint of uncertainty connected with the emission scenario (with including or not including the radiation effect of sulphate particulate matter). The uncertainties connected with the choice of the beginning of the experiment on the time scale of the control course of GCM were investigated on the basis of group integration of the HadCM2 model. Once again, the time range of the scenarios extended to 2050. The uncertainty connected with the choice of the emission scenario corresponds to 0.6 °C for the annual average temperature. The summer months exhibit the smallest uncertainty (Fig. 6.5).

Analysis of the HadCM2 group integration model indicates that the range of changes yielded by the individual terms of the relevant group integration is considerable and exceeds the differences caused by choice of the emission scenario. The uncertainty is related to the magnitude of the change, but not to its sign.

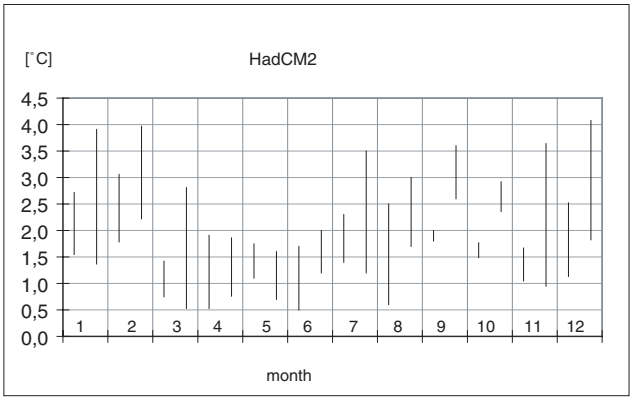
For atmospheric precipitation, the uncertainty connected with the choice of emission scenario also affects the sign of the change (Tab. 6.1). The HadCM2 group integration model also indicates a substantial uncertainty connected with choice of the beginning of the experiment. It is difficult to speak of a change in total precipitation in months for which one term of the group integration yields a decrease in precipitation and another term indicates an increase.

[19] *Dubrovský, M., Nemešová, I., Kalvová, J., 2005: Uncertainties in climate change scenarios for the Czech Republic. Climate Research, 29, 139-156*
[20] *Hulme, M., Wigley, T.M.L., Barrow, E.M., Raper, S.C.B., Centella, A, Smith, S., Chipanski, A.C., 2000: Using a climate scenario generator for vulnerability and adaptation assessments: MAGICC and SCENGEN Version 2.4 Workbook. Climatic research Unit, Norvich*

Fig. 6.5 Changes in the thirty-year averages of the average daily air temperature between the 2036–2065 and the 1962–1990 periods (HadCM3 model)

Note: The upper or lower end of the vertical lines indicates the largest or smallest value of the group integration and the horiztonal line indicates the average. For each month, the experiment including particulate matter is given on the left and the experiment without particulate matter is given on the right.

Source: National Climate Program



Tab. 6.1 Fraction of new total precipitation (to 2050) to total precipitation in the reference period 1961 - 1990

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Average[21]	1.13	1.13	1.10	1.25	1.13	1.08	0.90	0.87	0.90	1.01	1.11	1.10	1.04
Min	1.05	1.05	1.02	1.17	1.07	0.95	0.77	0.68	0.71	0.93	1.01	1.05	0.98
Max.	1.27	1.20	1.20	1.39	1.16	1.21	0.97	0.96	1.10	1.13	1.24	1.20	1.07

A set of scenarios based on outputs from seven GCM's22 available at the beginning of 2001 in the IPCC database were also recommended for assessment of the impacts of climate change at four selected locations in the Czech Republic (Central Bohemia, Southern Bohemia, Southern Moravia, Beskydy Mts.). The expected increase in GHG emissions was based on the IS92a scenario or on a 1% annual increase. A combination of the outputs from three GCMs (CSIRO or NCAR, ECHAM, HadCM) and three temperature sensitivities (low, medium and high) was recommended for the individual variants of the scenario. Simultaneously, two uncertainty groups were analyzed:

- the uncertainty in deriving the standardized scenario (range of outputs from various GCMs), internal variability in a specific GCM model (estimated from the HadCM group simulation model, choice of site in the Czech Republic, for which the scenario is formed); and
- the uncertainty in the change in the annual global average air temperature (choice of emission scenario, climate sensitivity).

A stochastic model was used to estimate the combined effect of the three sources of uncertainty (choice of GCM, error in estimating the standardized scenario and uncertainty in forecasting global temperature changes). While the main sources of uncertainty in estimating temperature changes are the intermodel variability (uncertainty following from the differences between the individual GCMs) and the uncertainty in the estimate of the global temperature change, the main source of uncertainty in estimating changes in precipitation consists in the intermodel variability.

Further scenarios and uncertainty estimates will be obtained in work on tasks in on-going EU projects, especially the ENSEMBLES project.

6.1 Water Resources

The production and consumption of drinking water has consistently decreased over the past decade[23]; produced drinking water from public water mains decreased by 32% between 1992 and 1999 and invoiced drinking water decreased by 33% over the same period. Trends in the production and consumption of drinking water in the future will depend on both natural and social-economic and political conditions. A conception has not been prepared for long-term trends in the sector of the national economy; consequently, demands on water resources in the coming decades can be derived only by an expert estimate. If requirements on water for agricultural irrigation are not taken into account, it can be expected that there will be a tendency towards a reduction in the consumption of drinking water as a consequence of the population decrease. Increased requirements for irrigation water will depend substantially on political and economic conditions in agriculture, which are difficult to predict in relation to membership in the EU.

6.1.1 Expected Impacts

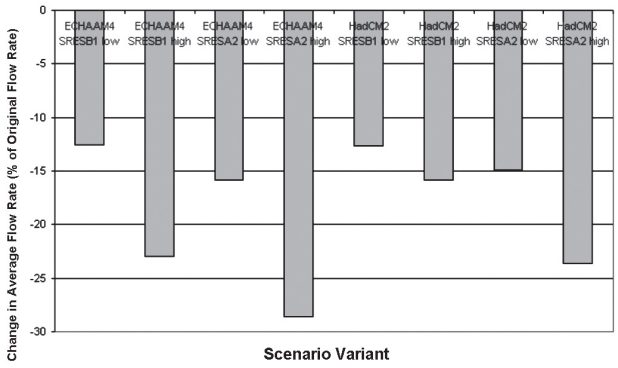
Total precipitation is the most important climatic variable for assessing the impact of climate change on the hydrological regime. However, these values in projections of climate change are usually accompanied by a greater uncertainty than the other meteorological parameters (especially air temperature and thus evaporation and transpiration). A climate change caused by

[21] *average for four variants of the scenario; max. and min. refers to the greatest and smallest change*
[22] *Dubrovsky M. et al, 2005: Uncertainties in climate change scenarios for the Czech Republic. Climate Research, 29, 139-156*
[23] *Statistical Environmental Yearbook of the Czech Republic, ME CR, CSO, Prague 1997, 1998, 1999 and 2000.*
[24] *Summary technical report on the preparatory phase of regular monitoring of climate changes and their impacts. National Climate Program, Prague 1999*

an increase in the greenhouse effect leads to an impact on the hydrological cycle[24] and it is highly probable that the yield of water sources will decrease, which would substantially worsen the currently relatively unfavourable hydrological conditions in some river basins.

The BILAN (CR), CLIRUN (Poland) and SAC-SMA (USA) models were used in a territorial study of climate change in the Czech Republic[25] to determine the sensitivity and assess impacts in parts of the river basins of the Labe (Elbe), Želivka and Úpa Rivers. Emphasis was placed on the scenario with an increase. Most of the results identically indicated a decrease in surface and underground outflow. The results of a subsequent study[27] indicated that the reduction in outflow will be greater than indicated in previous works and that there will be a significant impact on water resources. The relatively extensive assessment of regional variability in the impact of climate change (calculations performed for 50 river basins) indicated that, in the Czech Republic, the impact of climate change varies in a relatively broad range in dependence on climatic and hydrological conditions.

Fig. 6.6 Decrease in the long-term average flow rates in percentages according to eight variants of scenarios of climate change of 2000 (Elbe in Brandýs n. Labem)

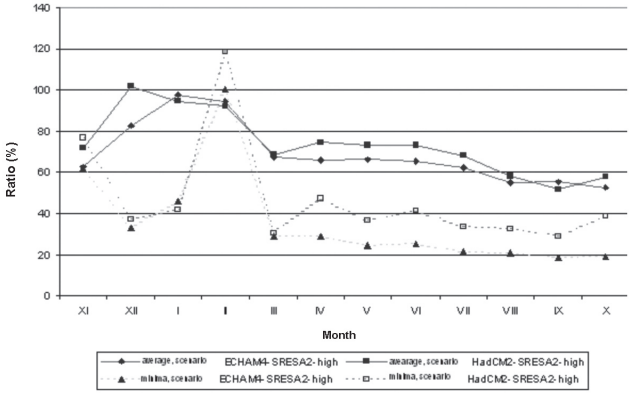


Source: National Climate Program

In the period following 1995, a number of forecasts were based on cooperation in the Territorial Studies of Climate Change in the Czech Republic. Scenarios of climate change from several global circulation models were used for sensitivity analysis of tens of river basins; these models were provided in the framework of European cooperation (EU-supported project). Although various simulations yield different results, the determined trends are identical. The basic information obtained by sensitivity analysis can be summarized as follows:

- The change in the outflow is highly dependent on changes in the amount of precipitation and their annual variations[26]. Relatively small changes in long-term average atmospheric precipitation increase (or suppress) the effects of relatively large changes in long-term average air temperatures. In general, it can be stated that a reduction in average outflow, caused by an increase in the average annual air temperature by 2 °C, can be compensated by an increase in precipitation by 5%. If the long-term average total precipitation does not change, then an increase in the air temperature by 2 °C would cause a reduction on the average flow rate in most river basins by 10 – 15% and an increase in air temperature by 4 °C would cause a reduction of 20 – 25%. Fig. 6.5 depicts the percentage decreases in the long-term average flow rates of the Elbe in Brandýs nad Labem for the eight variant scenarios of 2000.
- Under the conditions of climate change, there would be a very substantial change in the distribution of outflow in the annual cycle in that there would be a reduction in accumulation of water stored in the form of snow. Outflow would increase substantially in the winter months, that from the spring thaw would be smaller and flow rates would be reduced in the late summer and autumn. The reduction in the monthly average flow rates in the autumn months in a period of hydrological drought would be substantially greater than the reduction in the average flow rate – reduction to half of current values would not be exceptional. This is especially true for a change in precipitation in the range of -5% to +5%. Even if the change in precipitation were in the range of +5% to +10%, outflows would not return to the present values in the summer and autumn. Fig. 6.6 depicts the monthly changes in the amounts of outflows (Labe, Brandýs n. Labem) for the pessimistic variants of the climate change scenario of 2000. The amounts of outflow are expressed in percentages of the modelled original state.
- On a regional scale, the flow rates in the mountain river basins of Northern Bohemia would be relatively less sensitive to a change in climatic conditions. River basins where there is less precipitation and in which there are no larger accumulation areas would be particularly characterized by a reduction in flow rates.
- The basic outflow, which can be considered to be an indicator of outflow from underground waters, generally changes similarly to total outflow. The winter and spring replenishment of groundwater stocks would end up to two months sooner than at the present time.

Fig. 6.7 Average monthly outflow heights and minimum monthly outflow heights according to the scenario of 2000 in percentages of the modelled original state (Elbe in Brandýs n. Labem)



Source: National Climate Program

The impact of climate change on the hydrodynamics and selected water quality parameters in reservoirs were studied using the CE-QUAL-W2 model for the conditions of the

[25] *Moldan, B., Sobíšek, B.: Territorial study of climate change in the Czech Republic. National Climate Program – Vol. 22, Prague 1996*

[26] *Research on the impacts of climate change caused by an increase in the greenhouse effect in the Czech Republic. Task 02 of project VaV/740/00. National Climate Program, Prague 2000*

ECHAM4 ($2xCO_2$) scenario. The inflow into the reservoir was simulated using the SAC-SMA model. The results indicate the following changes compared to current conditions:

- a greater reduction in water levels in the summer and autumn;
- shortening of the winter period of stratification and the interval of coverage of reservoirs by ice;
- an increase in the surface temperature of water in the summer;
- a reduction in the concentration of dissolved organic matter in the lake part of reservoirs;
- an increase in the trophic gradient between the inflow and lake part of reservoirs, i.e. the nutrient-rich inflow into the reservoir and the mesotrophic conditions at the dam;
- shift of phytoplankton groups towards groups with a higher optimum temperature (e.g. cyanobacteria), which constitute a substantial risk for the production of drinking water.

A methodology has been prepared for the scenario study of water quality in reservoirs under various conditions and has been applied to the Římov, Lipno and Švihov reservoirs.

6.1.2 Vulnerability Estimates

A greater frequency of floods in the winter can be expected as a consequence of increased outflow in the colder season of the year[27]. Simulations of the precipitation-outflow process have also indicated that heavier rain occurring in connection with summer storms will constitute a greater risk of flash floods even if the long-term total precipitation does not change. The consequences of climate change very substantially affect the size of the storage space in the reservoir that would be necessary to preserve the existing level of water withdrawals. Simultaneously, relatively large reservoirs are less sensitive to climate changes than smaller reservoirs with predominantly a seasonal cycle of filling and emptying. Even a relatively insignificant reduction in precipitation, combined with warming, can lead to a substantial reduction in guaranteed water withdrawals.

The amount of water in the water course significantly affects the biotope environment. The effect of minimal flow rates and of their expected extreme fluctuations are decisive for the structure and functioning of the ecosystem. The magnitude of minimal flow rates affects the production potential of the ecosystem. Increased frequency of floods leads to a change in recovery of a particular section of the water course. There is a change in the physical characteristics of the biotope through a shift of sediments from higher areas, fish are washed downstream and partly destroyed by the volume of particles borne in the water. In addition, run-off from the watershed brings a number of undesirable substances into the system – inorganic and organic pollutants, nutrients, insoluble substances, etc.

Warming of the water leads to

- a reduction in the number of species in the community, with the greatest effect on groups with high oxygen requirements;
- accelerated processes of decomposition of organic substances, which further increases the oxygen deficit, especially in polluted water courses, with all the negative consequences;
- affecting of the temperature stratification of the reservoir and higher frequency of cases of excessive multiplication of phytoplankton with a number of negative consequences; and
- accelerated metabolism, which simultaneously increases the toxicity of some substances. As the temperature increases, more pollutants are accumulated in the biomass of organisms, increasing their toxicity – for both metals and pesticides.

In 2001 – 2002, a team of hydrological specialists examined the application of newly developed methods of assessing the impacts of climate change on water sources in the Czech Republic. This will lead to an improved proposal for adaptation measures, to be submitted to the Ministry of the Environment and Ministry of Agriculture.

6.1.3 Adaptation Measures

The adaptation measures proposed in the T.G. Masaryk Water Research Institute are the result of analyses and comparison of changes in water management and the capacities of water sources with the current conception of developmental policy, with the state water management structure and with the state of the environment in the Czech Republic. Input data for each region in the competence of the Povodí state enterprises will consist in the prepared inventory of requirements, which will include particularly

- assessment of the technical condition of the individual water structures and the potential for further intensification;
- revision of the manipulation regulations for water structures as a consequence of changes in requirements on water use after 1990;
- estimation of the free capacities of sources and proposal of a means of their use on the basis of re-evaluation of the proposed parameters of water works;
- determination of the present state of demands on sources as the starting state prior to climate change;
- determination of the future requirements for the individual kinds of water use in the region and any relevant priorities.

In addition to these measures, measures adopted in the past[28] are still in place, i.e.

- promotion of a further reduction in water consumption in industry, energy production, agriculture and households;
- reduction of water losses through repair to and reconstruction of pipeline systems;
- promotion of programs of more effective use of withdrawn water;
- trading in water and its transfers; and
- controlled management of surface and underground waters.

The measures can be divided into two groups. The first group contains measures that are currently defined as part of the environmental policy of the Czech Republic. They are con-

[27] *Research on the impacts of climate change caused by an increase in the greenhouse effect in the Czech Republic. Task 02 of project VaV/740/00. National Climate Program, Prague 2000*

[28] *Second Communication of the CR on compliance with obligations following from accession to the UN Framework Convention on Climate Change, ME, Prague 1997*

cerned with providing for sustainable development and are necessary irregardless of any expected climate change. The second group contains adaptation measures that supplement the first group in that they constitute modifications taking into account a change in climatic conditions in the Czech Republic.

6.2 Agriculture

Basically, Czech agriculture is still undergoing transformation, based in recent years from accession to the European Union, which has added increased competition[29] to previous changes. Following the original changes in ownership relations, reduction of production, etc., these changes lie mainly in the area of trade – in foreign competition and, according to farmers, in an inadequate subsidy system.

- In spite of a reduction in the intensive use of the landscape, the technology of extensive cultivation with minimum intervention is expanding.
- Extensive farming technologies, especially in complicated terrain, lead to increased intensity of water and wind erosion and damage to land through loss of the upper layer of the soil and, on the other hand, layers of soil and debris washed to lower areas.
- Anti-erosion measures are employed in normal farming. The financial situation in agricultural enterprises and the overproduction of cereals have led over the years to a slight reduction in cultivated area and also to a slight increase in the area of grasslands.
- Changes have occurred over the years in foodstuff consumption, with a decrease in consumption of meat, especially beef, so that there has been a substantial reduction in the number of farm animals. This has also led to a reduction in the production of barnyard fertilizers, which has also been reflected in a change in cultivation technologies.
- There has been a substantial reduction in the areas set aside for fodder crops, especially potatoes and beets. There has also been a reduction in the area of sugar beets, but an increase in the area of oil crops. The example of canola reflects the effect of subsidy policy on cultivation areas.
- In recent years, difficulties have been encountered in selling domestic fruit. The composition of varieties is not suited to the current market demand. The problem of the age structure of orchards, with a predominance of orchards that have outlived optimum production, is resolved through subsidy titles.

Climatic conditions in the most fertile agricultural areas in the Czech Republic can lead to the occurrence of drought. However, droughts have become more frequent in the last few decades. This is caused by increased evapotranspiration and also a slight decrease in total precipitation, i.e. a reduction in the moisture balance values. Thus the lack of precipitation in the vegetation period in dry years corresponds to over 200 mm. Droughts have the greatest impact on light, sandy soils. The potential for dealing with lack of water through irrigation depends on the farm profit margin. The high costs for more demanding crops, such as vegetables, have led to a substantial reduction in the area of cultivation. At the present time, the use of irrigation can be recommended only for intensive cultivation of fruit and vegetables. In dry years, it will be difficult to obtain a sufficient amount of good-quality irrigation water.

Problems associated with the water regime are connected, amongst other things, with lack of organic matter. The current reduction in the production of barnyard fertilizers is not compensated by incorporation of organic matter into the soil, so that the carbon balance in the soil is unsatisfactory even with expansion of the technology of minimal cultivation of the soil and the greatest possible incorporation of plant residues in the soil. Land-use measures will permit a comprehensive approach to protection and improvement of the condition of the land. In this connection, conditions should be created for implementation of improvements in the landscape, including protective measures, such as grassing over areas endangered by erosion and planting of vegetation.

6.2.1 Expected Impacts

It is not possible to unambiguously determine climate changes on the basis of current knowledge and forecasts are always affected by our level of knowledge and thus practically by the scenario employed. From this point of view, the expected impacts gradually change with the appearance of new scenarios. The following joint predictions follow from all the available studies:

- The weather will become increasingly variable, there will be an increase in the occurrence of extreme weather conditions, especially high temperatures and their duration, and periods without precipitation; On the other hand, there can be an increase in the occurrence of intense precipitation;
- The increased air temperature will lead to prolonging of the vegetation period and to an increase in the sum of active and effective temperatures. On an average, there will be an increase in the number of summer and tropical days and a decrease in the number of frosty and icy days.
- The beginning of the vegetation period in southern areas will shift to the beginning of March and the end to the end of October to early November. Higher air temperatures will prolong the vegetation period and affect the growth and development of plants to allow earlier germination and the onset of further phenophases so that, compared with current conditions, the time of ripening or harvesting could be put forward by at least 10 to 14 days. On the other hand, there will be an increase in the occurrence of black frosts and frosty days in the individual years. However, acceleration of vegetation in the spring can increase the danger of damage to plants by late frosts.
- The expected increase in temperatures should create sufficient temperature security for growing thermophilic species (e.g. semi-early varieties of corn for grain, early varieties of grapes). On the other hand, there is a serious danger of thermal stress connected with more frequent occurrence of extremely high temperatures. It follows from the estimated humidity index values, without a significant increase in precipitation and with the expected increase in evapotranspiration, that a substantial part of central and southern Moravia, central and north-western Bohemia, and the regions around the lower and central parts of the Labe (Elbe) and Vltava will be in increased danger of drought, which could have a detri-

[29] *Research on the impacts of climate change caused by an increase in the greenhouse effect in the Czech Republic. Task 02 of project VaV/740/00. National Climate Program, Prague 2000*

mental effect on harvest yields in the most productive areas of the country.

- At high temperatures, the yield of agricultural crops will be affected primarily by adequate soil moisture, i.e. the total amount and the occurrence of precipitation in the vegetation period.
- An increased air temperature will subsequently increase the values of potential evaporation and evapotranspiration. The $2xCO_2$ scenario indicates an increase in the evapotranspiration values by more than 200 mm in the vegetation period. However, there is also an apparent increase for the winter season so that, especially following winters with less snow cover, the soil profile will not be saturated and there will be a smaller store of soil moisture, which has been typical for the beginning of spring in the past.
- In contrast, there will be a reduction in the moisture balance values, the difference between precipitation and evapotranspiration, and thus a substantial increase in the dryness of the climate in the Czech Republic. In the summer season, the moisture deficit in warm years will attain values of more than 300 mm in the summer season alone and over 500 mm over the whole the vegetation period.
- The simulation results also indicate a change in the composition of total precipitation, with an increase in the probability of the occurrence of erosion-effective rain, especially in May, June and September.
- The climate change will lead to lower productivity in some areas, but higher in other areas. The most highly productive areas will probably become less productive and higher temperatures and evapotranspiration will lead to a reduction in the amount of moisture available for plants, especially in the summertime, and there will be an overall increase in the moisture deficit. Under the warmest conditions and on extremely light soils, it can be expected that locations will appear that are not suitable for economic production. Higher areas, where agricultural production is currently limited by low temperatures, should gain in productivity under the expected changes in climatic conditions, as they will probably not be so greatly affected by the lack of precipitation. The increase in temperatures will enable expansion of the crop composition to include more thermophilic varieties. However, in many cases, cultivation of some crops could be limited by unsuitable soil and terrain conditions (topsoil depth, soil skeleton, slope) and, potentially, also by the absence of a processing industry.
- An increase in the air temperature and changes in the temperature dynamics in the presence of other climatic features will affect the landscape and the processes occurring in it. Many landscape-forming processes will become more intense (erosion, weathering or decomposition of organic substances).
- Agro-ecosystems will also change. Increased temperature, prolonging of periods without precipitation and increased numbers of dry periods will create more favourable conditions for the development and multiplication of agricultural pests and diseases. There will be an increase in the number of generations, e.g. of greenfly, potato beetles, etc. Conditions will improve for the occurrence of pests in the more southerly, i.e. warmer areas.
- Similar as for pests, there will be an increase in infection pressure of diseases and the occurrence of species from warmer areas. Greater occurrence of viral diseases can be expected over larger areas, e.g. for potatoes. Similarly, the occurrence of fungal diseases can be expected to increase, e.g. potato fungus and hop fungus.
- The elevated occurrence of diseases and pests will require increased chemical protection, which will lead to higher costs for their protection and a potential increase in the environmental burden for the environment as inadequate chemical protection would, on the other hand, lead to a reduction in the economic revenues from agricultural crops.
- The soil will be substantially affected by climate change. There will be a change in the dynamics of soil moisture, more frequent occurrences of low-moisture states will affect microbial activity in the soil, the decomposition of biomass, etc. There will be an increase in the areas requiring irrigation

6.2.2 Adaptation Measures

In addition to its productive function, agriculture fulfils an important role in creation of the landscape. Recommended adaptation measures are based on knowledge to date and analysis of natural conditions. However, it appears that these measures will also have to include financial and socio-economical aspects in order to create a comprehensive structure of adaptation measures in the landscape. Individual adaptation measures for the agricultural landscape from the standpoint of production must become part of the broader concept. The following measures appear to be necessary and feasible for agriculture:

- Prepare a new land assessment for ecological land units for an alternative that takes into account a change in the climate and evaluate the production potential of the units.
- Provide for protection of the soil against erosion and other negative effects caused by cultivation, e.g. by compacting, reduction of fertilization with organic fertilizers.
- Accelerate the completion of land-use measures so as to define areas for land-improvement and measures in the landscape.
- Concentrate subsidy titles in agriculture on support for protective measures in the landscape and expansion of environmentally sound farming.
- Increase the variety of the landscape and, in this sense, select the composition of cultivated species of agricultural crops and farm animals. Introduce some other crops and improvement procedures for improving the adaptability of selected species to expected changes in climatic conditions.
- Change the structure of agricultural crops in a targeted manner to create a compromise between habitat and economic conditions, to fulfil the requirements for a certain degree of variety in the agroecosystem and avoid unsuitable, long-term, single-species crops. In dry areas, concentrate on crops with a shorter vegetation period and lower moisture requirements.
- Select agrotechnical procedures that minimize the loss of soil moisture. It will be useful to more extensively employ the method of minimal soil tilling. Simultaneously, the lower amounts of barnyard fertilizer will have to be replaced by other organic matter, greater emphasis will have to be placed on technologies employing mulches and organic material, the fact must be taken into account that ploughing-in straw

increases the soil moisture deficit and preventative measures should be emphasized in reducing weed infestation.
- Cultivation procedures should be chosen to reduce the risk of erosion processes as a consequence of flash storms and of strong winds.
- Irrigation should be carefully considered from the water--management, production and economic standpoints. On the basis of experience to date, micro-irrigation can be considered.
- The risk of infectious diseases and pests can be combated through choice of times for spraying, base don the assumption of the creation of conditions for the development of several generations of pests during a single vegetation season.

6.3 Forest Management

Forest properties cover approximately one third of the territory of the Czech Republic (33.5%), of which 98% correspond to areas intended for growing forests. The area of forest properties is increasing slowly but constantly; over the past 5 years, it has increased by approx. 0.3%. Narrow-leaved species greatly predominate in the species composition, consisting mostly of spruce (53.2%) and pine (17.3%), although there has been a slight decrease; the fraction of spruce has decreased by 0.9% and that of pine has decreased by 0.3% over the past five years. Of broad-leaved species, there are the largest areas of beech (6.5%) and oak (6.5%), with an increased of 0.5% for beech and 0.1% for oak. The vast majority of forests are state-owned, followed by privately owned forests (23.1%) and municipal forests (15.4%). There has been a decrease in state ownership over the past 5 years by 3.1% in favour of municipal and private ownership. In 2004, overall harvesting in forests equalled 15.6 mil. m^3, while the overall current growth equalled 220.3 mil. m^3. Harvesting of wood per inhabitant increased by 8.5% over the past 5 years and equalled 1.53 mil. m^3. Calculated per ha of forest land, harvesting equalled 5.90 m^3, which is an increase of 7.7% over the given period. A qualitatively new inventory of the forests of the Czech Republic was performed in 2001 – 2004, indicating substantially higher stocks of wood (335 m^3/ha) than the formerly determined data based on forest management plans. The area of forest fires increased in the dry period of 2003 to approx. 5 times the previous summer average; 0.5% of the area of forests was affected by forest fires in 2003.

6.3.1 Expected Impacts

The vast majority of forests in the Czech Republic are subject to measures in forest management. For several centuries, Czech forestry has been oriented towards the production of wood material. This corresponds to the current state and structure of forest stands, with a predominance of spruce single-species forests at the expense of forests of mixed species and ages. There has been a substantial increase in pressure for polyfunctional use of forest stands in the past few decades, leading to a gradual introduction of stands with a greater variety of species.

A change in bioclimatic conditions can have serious consequences for forest management. Climate change will be manifested in two ways. Forest ecosystems must resist short-term climatic temperature and precipitation extremes, whose frequency will clearly increase. The climate change will gradually affect forests especially through the increasing temperatures and increasing CO_2 concentrations. In addition, specifically under the conditions in Central Europe, it is necessary to add, to the changes in the environment, a strong anthropogenic effect, i.e. especially prolonged burdening of ecosystems by industrial emissions of sulphur and nitrogen.

6.3.2 Vulnerability Estimates

As has already been mentioned above, single-species spruce forests predominate in the Czech Republic, rather than more stable forests of mixed age and species. Consequently, changing bioclimatic conditions will increase the degree of risk, especially for single-species spruce forests, particularly in zones outside of the ecological optimum for spruce. This is especially true of lower altitudes where broad-leaved species should occur naturally. There will particularly be an elevated forest health risk from the increased presence of pathogens, leading to potential decomposition of maturing and mature stands of unsuitable single-species spruce trees. Spruce stands at higher altitudes on mountain ridges will also be endangered as high pollutant deposition occurs in these areas and the soil is substantially affected by long-term acidification and nutrition degradation. These weakened stands are less resistant to the detrimental effects of extreme climatic conditions (dry periods, extreme temperatures, wind, wet snow, etc.).

At lower altitudes, spruce stands are exposed to increased occurrence of honey fungus (*Armillaria mellea*). Together with higher summer temperatures and increased precipitation deficit, this can lead to destabilization and decomposition of spruce stands. Vascular tissue pathogens, the commonest causes of vascular mycosis, can also be expected to have a fundamental impact on the condition of forests. The deterioration in the state of health, together with favourable conditions for insect populations, exacerbates the risk of an increase in the occurrence of bark insects, especially spruce bark beetles. In addition, "overheating" of trees in combination with summer growth increments can also be expected to be a detrimental factor at lower altitudes.

6.3.3 Adaptation Measures

The range of uncertainty remains high in making decisions on expenditure of funds for implementing the proposed adaptation measures. Consequently, funds are expended preferentially for measures that follow from the current condition of forest management and that can simultaneously act as protective measures against the expected impacts of climate change. Of the other potential approaches, less expensive measures can be expected to be implemented.

Attempts are being made to gradually change the current species composition of forest stands through a greater proportion of broad-leaved species (especially stabilization and improvement species) in renewing and establishing stands. It is necessary that the natural requirements of forest tree species and the overall stability of the ecosystem under the local ecological conditions be taken into consideration. There is a gradual reduction in the number of spruce trees and an increase in the fraction of oak and beech; however, the rate and extent of these changes is not adequate.

Activities should concentrate primarily on adoption of effective economic and legislative instruments for achieving the generally formulated targets, such as better means of management, sounder technologies, application of the principles

of integrated forest protection and control of the spreading of detrimental factors from warmer more southerly areas (stricter quarantine regulations and measures), an increase in the environmental functions of forests, etc. It will also be necessary to improve awareness amongst minor forest owners.

For example. a change in the composition of tree species can be expected to reduce forest revenues, with the relevant problems for owners and greater demands on state intervention in forest management. For example, the 2004 Annual Report of Forests of the Czech Republic emphasizes the importance of forests as a sink for CO_2 from the air as a means of preventing the detrimental consequences of global climate change; on the other hand, however, it admits that the current forest legislation does not permit inclusion of these forests in the individual categories of special purpose forests[30].

7 Financial Sources and Transfer of Technology

As the Czech Republic is not a country listed in Annex II of the Convention, it is not obliged in the sense of Article 12.3 of the Convention to adopt measures and fulfil obligations following from Articles 4.3, 4.4 and 4.5 of the convention and especially to create further financial sources.

Brief information will be given in this chapter on the overall amounts of finances that the CR contributes to the individual funds and on the medium-term outlook for financing foreign developmental assistance by the Czech Republic. However, in most cases it is not possible to specify the part of these finances that was directed to the area covered by the Convention.

Pursuant to Government Resolution No. 248/2003 on the "Medium-term prospects for financing foreign development assistance by the Czech Republic", which substantially amended the "Principles for provision of foreign development assistance", approved in 1995, foreign developmental assistance is subject to an annual program that, together with the draft budget, is submitted by the Minister of Foreign Affairs for the following budgetary year. A draft program and prospective budget for the following two years are also submitted to the Government, creating a basis for financing developmental projects on a multi-annual basis.

Government Resolution No. 302/2004 newly adopted the "Principles of foreign developmental cooperation after accession of the Czech Republic to the EU", according to which the Minister of Foreign Affairs, as the coordinator of foreign assistance, submits a plan of foreign developmental cooperation for the following year together with the prospective budget for the following two years.

This material also introduced a uniform method for calculation and reporting Czech foreign developmental cooperation. Development assistance is reported on an international scale using the indicator of the fraction of the volume of assistance to developing countries (*Official Development Assistance*) in the GDP.

The foreign development assistance of the Czech Republic has exhibited a constant increase in recent years that is in accordance with the role of this country as an emerging donor and new EU member. This increase is a consequence of both the increasing volume of funds designated for development assistance and the better statistical reporting of the Ministry of Foreign Affairs. On an international scale, reporting is collected at the OECD Development Assistance Committee, whose members are all developed donors and whose methodology is generally accepted. The Czech Republic has had the statute of an observer on this committee since 1996.

The medium-term perspective of financing of foreign developmental cooperation reflects the necessity to gradually increase the payments of the Czech Republic for foreign development assistance, particularly in relation to membership in the EU. According to the Decision of the Council of Europe in Barcelona on March 14, 2003, the member states pledged to increase the financial means intended for foreign developmental assistance to a minimum of 0.33% ODA/GDP so that the average for the EU countries reaches a level of 0.39% ODA/GDP in 2006.

The total amount of finances provided for ODA in 2003 equalled CZK 2.55 bil. and, in 2004, CZK 2.81 bil., where the fraction of the contributions for bilateral development assistance predominated (56%) over multilateral contributions (44%). A gradual increase to as much as CZK 3.79 bil. by 2008 is proposed, so that the Czech Republic would achieve a fraction of 0.112% ODA/GDP.

The Barcelona obligation has been included in the *soft acquis* for the EU member states. At the present time, proposals of the European Commission are being discussed and should also be binding for the new member states; specifically, these countries should attain a fraction of 0.33% GDP by 2015 (a level of 0.17% should be achieved by 2010). Tab. 7.1 lists the volumes of finances expended for foreign development assistance in 2003 – 2004 and prospects to 2008. It cannot be expected in any way that maintenance of this trend on the part of the Czech Republic would lead to meeting the requirement of the European Commission that the new member states achieve a fraction of 0.17 % ODA/GDP in 2010. In absolute numbers, however, the budget for foreign development assistance will increase between 2004 and 2008 by almost one billion CZK, which will have to be accompanied by changes in institutional provision for foreign development assistance in order to ensure truly purposeful use of the allocated funds.

Tab. 7.1 Volumes of finances expended for foreign development assistance in 2003 – 2004 and prospects to 2008

	2003	2004	2005	2006	2007	2008
ODA (mil. CZK)	2556	2814	3051	3302	3423	3779
GDP (mil. CZK)	2532400	2611500	277000	2957000	3157000	3381000
ODA/GDP (%)	0.10	0.11	0.11	0.11	0.11	0.11

Bilateral development assistance is an important feature of Czech foreign development assistance. Up to 2005, inclusive, this assistance was usually provided individually through separate, unconnected projects in more than 40 countries. From 2006, they will be centred around multi-annual projects in top-

[30] *Report on the state of forests and forest management in the Czech Republic in 2004, MA CR, Prague 2005*

priority countries and in high-priority sectors, in the framework of which it will be possible to better concentrate the Czech contribution, Czech expertise and also Czech interests. This will be supplemented by individual projects in other countries (of lower priority), if they correspond to the targets, principles and criteria for Czech foreign development assistance and especially reflect demand on the part of the receiving country.

The Czech Republic considers multilateral development assistance to be an important form of foreign development assistance, both in the form of cooperation through the UN international organizations or the Brettonwood institutions, and also through a contribution to the EU. After including the financial contributions of the relevant international institutions and especially in relation to the compulsory contributions to the EU budget in future years, the fraction of multilateral assistance in the coming years will attain about 60% of total Czech foreign development assistance.

In addition to mandatory contributions, following from membership in international organizations (e.g. in the framework of the UN system, the World Bank group and the International Monetary Fund, etc.), the CR also provides contributions on a voluntary basis through various bodies, particularly as special-purpose contributions.

In 2003 – 2001, a total of CZK 150 mil. was expended from the state budget for payments to the UN and other international organizations, which are included in ODA according to the OECD methodology. This sum equalled CZK 210 mil. in 2004 and a sum of CZK 220 mil. was planned for 2005. These payments are expected to increase slightly in the 2006 – 2008 period, as it is expected that part of the volume of finances will be deposited in trust funds, which enable the use of Czech expertise. Similarly, these amounts will also include payments for development projects implemented through international organizations, i.e. multilateral projects. These will be only new projects in 2006; from 2007, this will include all multilateral projects, including on-going projects.

In 2003, payments were made to international financial organizations accountable as ODA in an amount of CZK 232 mil.; these payments equalled CZK 91 mil. in 2004 and the amount of CZK 92 mil. was included in the state budget for 2005. The above expected payments for 2005 – 2006 are set on the basis of the obligations of the Czech Republic following from membership in these international financial organizations.

Payments to the EU budget constitute another important component of multilateral developmental assistance, with the necessity and potential for a substantial increase in the coming years. The Czech Republic can calculate 4.68% of its contribution to the budget of the European Commission as Official Development Assistance (ODA). In addition, the Czech Republic, as an EU member state, has been requested to make regular payments to EDF (*European Development Fund*) and it will contribute regularly to EDF to the year 2008, irregardless of whether this fund remains outside of the EU budget or is incorporated into this budget.

Financing of foreign developmental assistance will have a slightly increasing trend in absolute numbers. However, the ODA/GDP ratio will most probably remain unchanged to 2008.

8 Research and Systematic Observation

This chapter summarizes scientific-technical and socio-economic research on the climate system in the Czech Republic, systematic observations and archiving of climatological data. This research is intended particularly to improve knowledge of the causes, effects, magnitudes and temporal factors of climate changes and their economic and social consequences. Attention is also paid to international cooperation and exchange of scientific and technological and socio-economic information (according to Art. 4.1 (g) and (h) of the Convention). Information is also given on the organization of research in the area of the climate system and also on international cooperation in this area, including support for developing countries (according to Article 5 of the Convention).

8.1 Organization and Financing

Research on the climate system is concentrated particularly in the following institutions: the National Climate program of the CR (NCP), the National Committee for IGBP, the Committee on the Environment of the Academy of Sciences of the Czech Republic, the National Forest Committee, Institutes of the Academy of Sciences of the Czech Republic (Institute of Physics of the Atmosphere, Geophysical Institute, Institute for Hydrodynamics, Institute of Landscape Ecology, Geological Institute), university departments (Department of Meteorology and Environmental Protection of the Faculty of Mathematics and Physics of Charles University in Prague, the Department of Geography at the Faculty of Science of Masaryk University in Brno, the Faculty of Science of Charles University in Prague, Southern Bohemian University in České Budějovice, the Landscape Ecology Institute of the Agricultural Faculty of the Mendel Agricultural and Forestry University in Brno) and institutes in the sectors (Czech Hydrometeorological Institute, T.G. Masaryk Water Research Institute). Most of these institutes are members of or are represented in NCP, which is an association of legal persons entrusted, amongst other things, with performance in the CR of the tasks of the World Climate Research Programme of the World Meteorological Organization, creation of research teams of scientists in the area of the climate change in the Czech Republic and publication of the results obtained.

Research that forms part of the basic tasks of the individual institutes is financed from their budgets. Requested special studies are financed mainly from the state budget through the grant agencies of the Czech Republic and the Academy of Sciences of the Czech Republic or the grant projects announced by the Ministry of the Environment and the Ministry of Agriculture. Some projects are carried out in the framework of international cooperation and shared financing with foreign partners.

Systematic observation of the climate system is performed in a decisive degree by the Czech Hydrometeorological Institute, which acts as the state institute for the fields of protection of air quality, hydrology, water quality, climatology and meteorology with competence to establish and operate the state monitoring and observation network, including international exchange of data according to the principles of the World Meteorological Organization. Other institutions perform monitoring only for

their own use, usually for the limited duration of a particular project.

Exchange of scientific and technical information between Czech and foreign institutions is not regulated in any way and occurs quite freely. The Czech Hydrometeorological Institute mostly provides only basic observation data for a fee.

In addition to participation in the activities of the World Meteorological Organization and UN Environmental Program (UNEP), the Czech Republic cooperates on a number of international projects concerned with the climate. Participation in the RC LACE (model ARPEGE-CLIMAT) project is most important in this respect. Recently, participation of the Czech Republic in international projects concerned with modelling the climate system and estimation of the impacts of climate change has expanded substantially. The Czech Republic regularly provides assistance to developing countries in the area of training courses, assistance in installation and calibration of instruments (e.g. monitoring of the ozone layer, etc.).

8.2 Research on Climatic Processes and Study of the Climate System

In the framework of long-term basic tasks of research institutions and universities, the following are investigated[31]:

- the properties of observation and model series and fields of climatic variables with emphasis on variability and the occurrence of extreme phenomena;
- changes in atmospheric circulation;
- interconnections between the components of the climate system and estimates of climate changes;
- the potential for modelling the climate on a regional scale;
- the methods of statistical downscaling;
- the causes of climate change related particularly to solar activity.

In addition, reconstruction of the climate is performed on the basis of historical observations and underground boring. Work was carried out on a number of grant projects[32] in 2002 – 2005, with emphasis on the above subject areas. There has also been a substantial increase in participation of national institutions in international projects concerned with modelling the climate, determination of the uncertainty of climate changes and estimation of the impacts of climate changes. In particular the following projects were involved:

- PRUDENCE 2001 – 2004, EU FP5 Prediction of regional scenarios and uncertainties for defining European climate change risks and effects [33];
- SOLICE 2000 – 2003, EU FP5 Project on Solar Impacts on Climate and the Environment [34];
- MAGMA 2003 – 2005, EU FP5 Projects of the Prague Centre of Mathematical Geophysics, Meteorology and their Applications [35];
- QUANTIFY 2005-2010, EU FP6 Integrated Project Quantifying the Climate Impact of Global and European Transport Systems [36], with participation by the Department of Meteorology and Environmental Protection of the Faculty of Mathematics and Physics of Charles University, and the project
- ENSEMBLES 2004 – 2009, EU FP6 Integrated Project ENSEMBLE-based Predictions of Climate Changes and their Impacts [37],

with participation by the Department of Meteorology and Environmental Protection of the Faculty of Mathematics and Physics of Charles University and the Institute of Physics of the Atmosphere of the Academy of Sciences of the Czech Republic and the Czech Hydrometeorological Institute.

International workshops and conferences were held in the CR on the subject of modelling and climate change:

- Workshop on Regional Climate Modelling and Mini-Symposium on Climate Change in Europe, Prague, Nov. 29 – Dec. 3, 2004; and
- Workshop on Global Change in 20th Century and Seasonal and Interannual Climate Prediction, June 4 – 6, 2005.

8.3 Estimates of Trends, Changes in the Variability and Frequency of the Occurrence of Extreme Phenomena

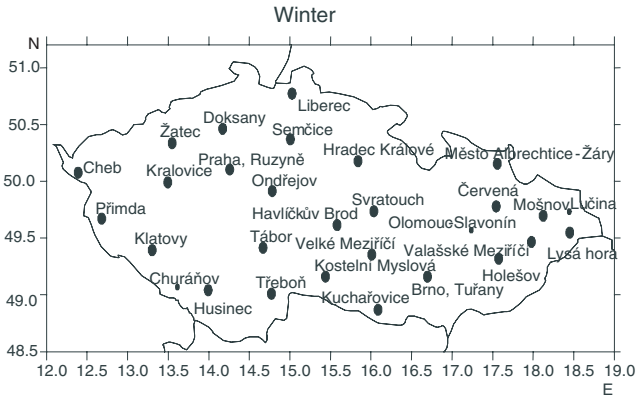
The results of analyses of time series of daily maxima (TMAX) and daily minima (TMIN) air temperatures at more than 20 stations in the Czech Republic have confirmed[38],[39] that there has been a temperature increase in the 1961 – 2000 period and that especially the last decade was very warm. A statistically significant increase in seasonal TMAX and TMIN averages has been demonstrated, with the exception of the autumn. The temperature increase was most marked in the winter. The number of hours of sunshine increased, except in the autumn.

At all the stations, the average number of summer days in the 1991 – 2000 period was greater than for any earlier decade and there was also an increase in the number of tropical days in the 1990's. Compared to the first decade, the number of days with TMAX above 20 °C and average annual sums of TMAX over 15, 20 and 25 °C was also higher. Fewer frosty and icy days were recorded, especially at higher altitudes.

In studying the frequency of the occurrence of extreme phenomena, attention was concentrated primarily on the tailing of the statistical distribution and continuous periods when the air temperature to total atmospheric precipitation exceeded the set values. The number of very warm days (days with TMAX greater than the 90% percentile) increased most markedly in the winter (Fig. 8.1), while the number of cold extremes (TMIN less than 10% percentile) was reduced primarily in the summer[40].

[31] *Report on the state of forests and forest management in the Czech Republic in 2004, MA CR, Prague 2005*
[32] *A list of projects supported in 2002, 2003, 2004 and 2005 can be found at http://www.vlada.cz/1250/rvv/cep/cepfind.sqw*
[33] *http://prudence.dmi.dk*
[34] *http://www.metoffice.com/research/stratosphere/processes/solice.html*
[35] *http://geo.mff.cuni.cz/magma/*
[36] *www.pa.op.dlr.de/quantify/*
[37] *http://www.ensembles-eu.org/*
[38] *project VaV/740/1/00*
[39] *Huth, R., Pokorná, L., 2004: Trends in eleven climatic factors in the 1961-1998 period in the Czech Republic. Meteorologické zprávy, 57, 168-178.*
[40] *Chládová Z., Kalvová, J., 2005: Changes in selected temperature quantiles in the 1961-2000 period. Meteorologické zprávy, 58, 85 – 92.*

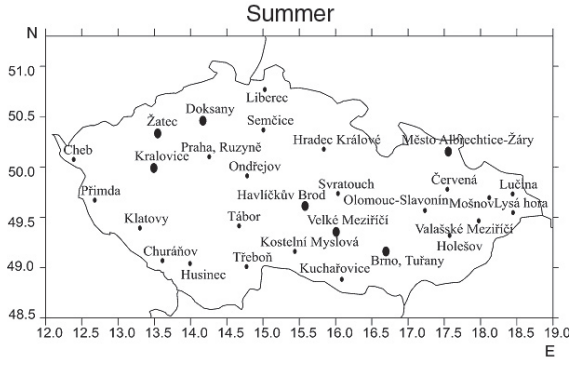
Fig. 8.1 Linear trends in the 90% quantiles of daily maximum temperatures in the winter in the 1961 – 2000 period



Note: The large circles denote statistically significant positive trends and the small correspond to statistically insignificant trends.

Source: National Climate Program

Fig. 8.2 Linear trends in the 10 % quantiles of daily maximum temperatures in the winter in the 1961 – 2000 period



Note: The large circles denote statistically significant positive trends and the small correspond to statistically insignificant trends.

Source: National Climate Program

The maximum occurrence of hot waves in the 1961 – 2000 period was in the 1990's and the minimum occurrence was recorded at the end of the 1970's and beginning of the 1980's. The longest hot wave occurred in July and August of 1994 and lasted more than one month in many areas of the Czech Republic, in spite of the fact that hot waves usually last about 4 – 7 days.

The variability of the air temperature was investigated using wavelet analysis[41],[42], which provides both information on the occurrence of frequencies (episodes) and information in which time periods these frequencies occurred and, on the other hand, which periods are relatively stable without greater fluctuations. This analysis indicated that the Czech temperature series do not contain episodes that would be characteristic for the entire monitored period. There was a substantial reduction in climatic variability in the 1850 – 1930 period. Wavelet analysis also confirmed a temperature increase from approximately 1850.

The horizontal resolution of GCM (global circulation models) is too low for estimation of the impacts of climate change in an area as small as the Czech Republic. Consequently, research has recently been intensified in the area of the possibility of statistical downscaling and work has been commenced on the development of a regional climate model.

Statistical downscaling

Work on statistical downscaling began to develop in the Czech Republic in the second half of the 1990's. First a stochastic weather generator was introduced into the scenario. In addition to direct modification of the data employed, a two-step stochastic generator was employed to construct daily series of meteorological elements for the future climate in scenario I; in this generator, series of monthly global radiation averages (totals) (SRAD – solar radiation), TMAX, TMIN and atmospheric precipitation (PREC) are generated in the first step and the actual daily values are generated in the second step. A supplement to this generator enables addition of further, e.g., humidity characteristics and the wind direction and speed to these generated series.

Statistical downscaling is based on the fact that GCM simulate large fields of quantities in the open atmosphere better than local ground-level variables. This usually consists in a search for statistical relationships between quantities that GCM simulate more reliably, i.e. usually large fields in the free atmosphere (predictors) and local quantities that are required for study of the impacts of climate change (predictands). Initially, studies in the CR concentrated mainly on methodical aspects (Huth, 2002). The effect of various meteorological variables were investigated in the role of predictors, together with the effect of the area from which the predictor values were collected (horizontal resolution, position and size of the area), the sensitivity of the results to the statistical procedure employed (multiple regression analysis, canonical correlation analysis, preprocessing of the field using main component analysis, etc.). Initially, the predictands were the temperature and precipitation characteristics and downscaling of other variables (humidity variable, wind direction and speed) is currently being studied. Part of the study was competed after the scenario[43].

The time series of TMAX and TMIN with a daily step for 5 areas in the CR were obtained for the time period to the year 2050 from HadCM3 using the linear downscaling model, and were supplemented by sensitivity estimates for the statistical method of solving the multiple linear regression model (classical least squares method, ridge regression, partial least squares method, etc.) and for the time step of the input data sets (daily data, monthly averages). In addition to linear methods, nonlinear downscaling procedures are also studied using various kinds of neuron networks (RBF network, multilevel perceptron) and local models in reconstructed phase space[44]. It has been found that nonlinear procedures mostly yield somewhat better agreement between the time series obtained by statistical downscaling and measured series. Nonetheless, for temperature characteristics of the average monthly temperature type, the results of the linear and nonlinear procedures differed only slightly.

[41] *Pišoft, P., Kalvová, J., Brázdil, R., 2004: Cycles and trends in the Czech temperature series using wavelet transforms. Theoretical and Applied Climatology, 13, 1661-1670*

[42] *project VaV/740/1/01*

[43] *Huth, R., Pokorná, L., 2004: Trends in eleven climatic factors in the 1961-1998 period in the Czech Republic. Meteorologické zprávy, 57, 168-178.*

[44] *VaV/740/2/03*

Dynamic downscaling

In 2001, work was begun on development of the regional climate model (RCM) Aladin-Climat[45]. The Aladin regional forecasting model was adapted for modelling the climate and experiments were carried out on optimization of the RCM integration area, network density and frequency of connection to GCM employing boundary conditions[46]. A technical line was created, connecting RCM to the Arpege-Climat global climate model (GCM). Experiments with various choice of parameters (especially radiation fluxes) were evaluated and compared with real data. The RegCM3 regional model was also used as a verification and testing instrument, using which complete forty-year simulation controlled by reanalyses by the National Centre for Environmental Forecasts (NCEF) was performed in the 1961 – 2000 period. The parameters of statistical distribution of selected climatic characteristics simulated by RegCM3 and real data were compared. Attention was concentrated primarily on characteristics that are related to the occurrence of extreme phenomena47. The participation of the CR institutions in the EU FP6 ENSEMBLES project reflects the progress achieved in the area of regional climate modelling.

8.4 Systematic Observation

In the framework of the Global Climate Observing System (GCOS), the Czech Republic participates in meteorological atmospheric observations: in the network of GSN ground-level stations at the Milešovka observatory, in the GAW network at the Hradec Králové Solar and Ozone Laboratory and at the observatory for monitoring the quality of the natural environment on a regional level, located in Košetice[48]. All three laboratories follow the climate monitoring principles set forth in GCOS/GOOS/GTOS. Table 8.1 gives more detailed information on observatories.

Tab. 8.1 Survey of observatories

	GSN	GUAN	GAW	others
Number of stations expected	1		2	
Number of stations in operation	1		2	
Number of stations according to GCOS standards	1		2	
Expected number of stations in 2005	1		2	
Number of supported data international centres			4	

Source: CHMI

9 Education, Enlightenment and Awareness

9.1 General Policy

The State Environmental Policy is the basic, strategic, cross-cutting document for preparation of detailed programs in the individual components of the environment, including climate change, and for dealing with individual environmental issues. Its updated version, approved by the Government of the Czech Republic on March 17, 2004 under No. 235, includes an analysis of current conditions and quite specifically elaborates the main directions for environmental protection. Its topical targets and measures include the creation and use of an interconnected system of environmental education, enlightenment and awareness (EEEA) implemented in all the sectors, including state, public, private and civic institutions and organizations and utilizing the relationships between them on the basis of democratic principles whilst recognising regional differences, potentials and needs.

New Act No. 561 of September 24, 2004 on preschool, elementary, secondary, higher vocational and other education (the Act on Schools) mentions environmental education in the preamble, and thus EEEA must be seen as a priority reflected throughout the law. Some specific articles are concerned with EEEA. The Act on Schools was approved at the end of 2004 and came into effect on January 1, 2005. Directives and documents emphasizing the implementation of EEEA in the education system are connected (or will be connected) to the law. Simultaneously, Act No. 562 of September 24, 2004 was also approved; this law amends some laws in connection with the adoption of the Act on Schools (amending law) and came into effect on January 1, 2005.

Act No. 123/1998 Coll., as amended by Act No. 132/2000 Coll. and Act No. 6/2005 Coll., on the right to information on the environment, mentions the subject of environmental education, enlightenment and awareness (Article 13). In Resolution of the Government of the Czech Republic No. 1048/2000, the Government approved the State Program of Environmental Education, Enlightenment and Awareness in the Czech Republic, established at the initiative of the Ministry of the Environment. The draft program was created jointly by an inter-sector working group established for this purpose at the Ministry of the Environment. A key target of the program lies in increasing the consciousness and knowledge of the population about the environment, education in sustainable development and public participation in environmental issues. The EEEA Action Plan for 2004 – 2006 was adopted in Government Resolution No. 991 of October 8, 2003.

The Czech Republic is progressively implementing Agenda 21, whose Chapter 36 is one of the starting points for this program. The Aarhus Convention on access to information, public participation in decision-making and access to justice

[45] *SF/740/7/01 and GA CR 205/01/0804 projects*

[46] *Halenka, T. et al., On the development of a regional climate model for the Central Europe. In: Proceedings AMS Annual Meeting, ed. K. Heideman, AMS, Seattle, 2004, 1-13*

[47] *project GA CR 205/03/Z024*

[48] *Annual Report of the Czech Hydrometeorological Institute 1999, CHMI, Prague 2000*

in environmental matters, which the Czech Republic signed in 1998 and ratified in 2004, is another important basis for its creation. The Intersectoral Agreement on cooperation in the area of environmental education and public awareness was concluded between the Ministry of the Environment and the Ministry of Education, Youth and Sports in 1999. Both ministries emphasize environmental education and public awareness as a multidisciplinary instrument providing information, facts, knowledge and skills and creating a responsible relationship and conduct of individuals towards the environment. In 2004, the Ministry of the Environment and the Ministry of Education, Youth and Sports updated and signed, at the level of the Ministers, an Intersectoral Agreement on cooperation in the area of environmental education and public awareness between the Ministry of the Environment and Ministry of Education, Youth and Sports.

The **Government Council for Sustainable Development** (hereinafter the Council) was established in the Government Resolution of July 30, 2003 as a permanent consulting, initiative and coordinating body of the Government of the Czech Republic for the area of sustainable development and strategic management. The Statute of the Council was approved in the Government Resolution of August 6, 2003. The members of the Council consist in representatives of the central bodies of the state administration, local governments, social partners, academic communities and the nonprofit sector. In its activities, the Council initiates, conceives, coordinates, monitors, evaluates and promotes the strategic dimension in governing the country. It proposes measures to harmonize long-term plans and targets with medium-term and short-term targets and programs in accordance with the principles of sustainable development. It monitors and evaluates global phenomena and developmental opportunities and proposes timely and suitable reactions of the state to these phenomena. The council prepares, coordinates and monitors implementation of the principles of sustainable development in achieving dynamic equilibrium of its economic, social and environment components. On December 8, 2004, the Government approved the Draft Strategy of Sustainable Development in the Czech Republic, where environmental education, enlightenment and awareness is perceived as a cross-cutting instrument. On June 14, 2005, the Government Council for Sustainable Development further approved the Framework of Programs of Sustainable Consumption and Production in the Czech Republic.

In the framework of the UN Decade for Education for Sustainable Development, the UN ECE member states signed the Strategy of Education for Sustainable Development in March 2005. The Ministry of the Environment will participate in preparation of the National Strategy of Education for Sustainable Development, which should be completed in 2007. A working group has been established at the Government Council for Sustainable Development for preparation of this national strategy. The Strategy for Protection of Biological Diversity in the Czech Republic was approved in Government Resolution No. 620 of May 25, 2005; this document also emphasizes the importance of environmental education and enlightenment.

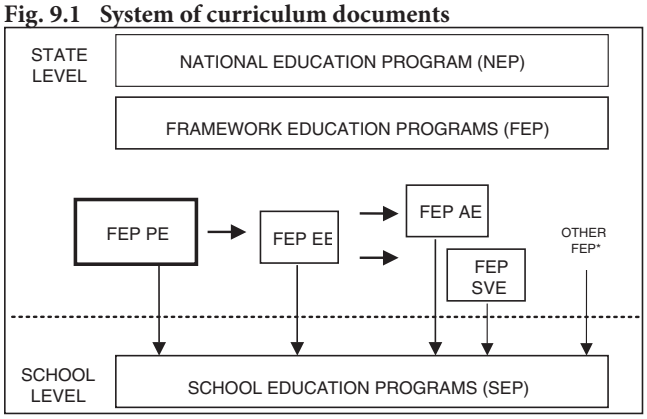
9.2 The Education System

Environmental scientific policy is part of the White Book – the National Program of Development of Education in the Czech Republic. One of the targets of the program consists in education in environmental protection in the sense of providing for sustainable development in society. The Act of September 24, 2004 on preschool, elementary, secondary, higher vocational and other education, which came into effect on January 1, 2005, states that one of the components of a general education consists in gaining knowledge of the environment and its protection, based on the principles of sustainable development.

9.2.1 Definition of Framework Education Programs

In accordance with the new principles of curriculum policy, formulated in the National Program of Development of Education in the Czech Republic (the White Book) and stipulated in the Act on preschool, elementary, secondary, higher vocational and other education, the new system of curriculum documents is introduced into the education system for education of students from 3 to 19 years. Curriculum documents are created at two levels – state and school. The National Education Program and the Framework Education Programs correspond to the state level of the system of curriculum documents. While the National Education program formulates requirements on education that apply to early education as a whole, the Framework Education programs define a binding framework for education in its individual stages (for preschool, elementary and secondary education). The school level corresponds to school education programs, according to which education is provided at the individual schools. Each school creates its school education program according to the principles stipulated in the relevant Framework Education program. Framework and school education programs are public documents available for the pedagogical and general public.

Fig. 9.1 System of curriculum documents



Legend:
FEP PE – Framework education program for preschool education; FEP EE - Framework education program for elementary education; RVP AE - Framework education program for academic secondary school education; RVP SVE – Framework education program(s) for secondary vocational education.
** Other RVP – framework education programs that, in addition to the above, are defined by the Act on Schools - Framework education program for basic artistic education, Framework education program for language education, and others, as appropriate.*

Framework education programs are cross-cutting issues that are concerned with education and training of students in selected socially important and topical areas. This aspect should be reflected in the school education program as a whole and also in other school activities. These consist in the following aspects: Man and the World of Work, **Man and the Environment**,

Information and Communication Technology and The Citizen in a Democratic Society. The Methodical instruction for environmental education, enlightenment and awareness in schools and educational facilities of December 2001 remains in place.

9.2.2 Preschool Education

The Framework Education Program for Preschool Education 2004 came into effect on March 1, 2005 through Measure of the Minister of Education of March 1, 2005. This document became binding for preschool education and replaced the formerly recommended Framework Program for Preschool Education 2001. Kindergartens are obliged to create or elaborate their own Educational Programs and to work according to this from September 1, 2007. The methodical web site (http://www.rvp.cz/) is being gradually extended to include sections on elementary and academic secondary school education. The web site supports and develops the competence of pedagogues in creating and implementing school and class education programs.

9.2.3 Elementary Education

On December 13, 2004, with validity from February 1, 2005, the Ministry of Education, Youth and Sports issued a Framework Education Program for Elementary Education through a Measure of the Minister of Education, Youth and Sports. This document was prepared in the framework of cooperation between the Ministry of Education, Youth and Sports and the Pedagogical Research Institute in Prague and underwent public discussion. In its final form, this will become an important document directing education at all types of schools that provide elementary education. Environmental education is part of the overall conception and is not a separate subject. This Framework Education program will form the basis for school education programs, which are prepared by the schools themselves.

9.2.4 Secondary Education

At the present time, there are 8 fields of study at secondary schools, with emphasis on protection of the environment, protection of the landscape and industrial ecology, at 26 secondary schools.

9.2.5 University Education

There are 26 universities preparing future teachers in the Czech Republic. The study programs of these schools include sustainable development and environmental education. Over 100 fields of study at universities are concerned with ecology and protection of the environment. The study program also includes doctoral study in these university subjects.

9.2.6 Forum of University Teachers

Education for a sustainable future was constituted in the basis of an initiative of the Environment Centre of Charles University in Prague (http://cozp.cuni.cz/) and in connection with the UNDP project as a free organization of members with a joint interest in university education in the fields of the environment and sustainable development. The Forum is intended to permanently contribute to clarification and creation of the content, extent and methods of education for sustainable development. In the long term, this body should also provide for mutual information on the activities of the individual members, and increase cooperation in the preparation of courses, lectures and textbooks and also in research work and projects. It would also be useful if the Forum could support international contacts.

The Ministry of the Environment also supports a competition for the best thesis in the area of protection of the environment and, in cooperation with the Envioptimum Foundation, announced the 12th year of this competition in 2005. In recent years, the CR has employed EU programs, such as SOKRATES, LEONARDO etc., for education of students and workers in public administration.

9.2.7 Post-graduate Education of Pedagogues

The Ministry of Education, Youth and Sports is responsible for integration of the elements of environmental education, enlightenment and awareness into post-graduate education of pedagogues. The Methodical Instruction of the Ministry of Education, Youth and Sports on the developmental program of further education of pedagogical workers deals with further education of pedagogical workers. Standards for further education of pedagogical workers in environmental education, enlightenment and awareness (EEEA) according to Decree of MEYS No. 317/2005 Coll., on further education of pedagogical workers, certification commissions and the carrier system of pedagogical workers, were approved in the middle of 2005.

9.3 Public Information Campaign

The work of the Ministry of the Environment includes publishing, film and promotional activities that, amongst other things, are related to global environmental issues, including climate change. The Ministry publishes a number of publications and periodicals, both its own and on request from other entities. The Newsletter and Bulletin, which are issued regularly and contain the official wording of all important documents, are the basic periodicals of the Ministry of the Environment. Electronic means are also employed to inform the public. The Ministry has its own web site http://www.env.cz and the web site Cenia is gradually being created for access to information on EEEA (http://www.ceu.cz/edu/evvo/evvo.htm). In addition, any questions in the area of the environment can be sent through the internet to info@env.cz; in the sense of Act No. 123/1998 Coll., on free access to information on the environment, and Act No. 106/1999 Coll., on free access to information, the Ministry will provide qualified answers to such questions. Statistically, approx. 50 questions are received per month. Press conferences of the Ministry serve to provide information to journalists and other media.

The Ministry of the Environment participates in providing for the progress of celebrations of important days concerned with the environment, provides for awarding of the Prize of the Minister, promotion of environmentally sound products, issuing of promotional printed material (posters, brochures, pamphlets), etc. The Ministry holds its own exhibitions or has presentations at national and international exhibitions and expositions held by other entities (e.g. Pragotherm, Ekostyl, ENVI Brno and others) and announces the EKOFILM film festivals (international film festival on the environment, natural and cultural heritage) and It Affects You Too (IAFT) film festivals. The videotheque, which it has created since its formation, provides a generally acclaimed service. Films and video programs are most

frequently presented to the public with the assistance of NGOs, Czech television and some professional institutions or individual professionals concerned with environmental education. These materials are also available through a network of video outlets and can be ordered according to an updated catalogue.

9.4 Educational Programs

The Ministry of the Environment is one of the first state institutions to provide information on its educational programs on its web site in accordance with the relevant laws. Educational courses are intended primarily for the employees of the sectors; programs for the general public are being prepared for the future. Interested persons can apply directly if they comply with certain conditions. Training of employees of the state administration on the subject of environmental education, enlightenment and awareness is carried out primarily through the form of regular workshops and printed information (methodical instructions, aids). In training the employees of other organizations, professionals of the Ministry act as instructors for the Institute for Local Administration in Benešov (national training centre, where examinations of the professional qualifications of employees of the state administration are also held) and for the Office of the Government. Similar training is also provided by NGOs, such as the Czech Environmental Managerial Centre, Centre for Innovation and Development, Koniklec, etc. Training is related to legislation, EMAS, ISO standards, cleaner production, voluntary agreements, waste management, packaging technology, chemical and hazardous substances, monitoring, modern technologies, foreign and domestic experience, work with the public, codices and charters in this sphere, etc. CENIA, the Czech Environmental Information Agency is also authorized to act as the National Cleaner Production Centre.

9.5 Information Centres and Consulting Centres

Czech National Council Act No. 173/1989 Coll. requires that the Ministry of the Environment create an information system on the environment, an integral part of which consists in public information services coordinated by the Ministry. These include services provided to the professional and general public by general, professional and other specialized public libraries, scientific, technical and economic information centres, archives and other processing or mediating workplaces. These activities are effectively supplemented by printed outputs and presentation of information on the internet. The web site also contains an Environmental Library, containing important and interesting publications published or financially supported by the Ministry of the Environment. Some of these are available in English or German or, less frequently, in French. In 2005, work was commenced on the project of transformation of the Czech Environmental Institute (CEU) to CENIA, the Czech Environmental Information Agency. This agency will operate the Uniform Environmental Information System and the www.cenia.cz web site provides access to information, databases and applications.

The national network of environmental education centres is supported annually through public contracts in an amount of CZK 5 mil. (http://www.pavucina-sev.cz/).

STEP – the Network of Environmental Consulting Centres in the CR – is a member of the EcoCounselling Europe European association of environmental consultants. Its work is supported by the Ministry of the Environment through public contracts in a volume of approx. CZK 2 mil.

9.6 Participation of the Public and NGO's

Institutes of the state administration in the area of the environment (Ministry of the Environment, Regional Authorities, Administrations of Protected Landscape Areas and National Parks, CENIA, the Czech Environmental Information Agency, the Nature Protection Agency) and some other institutions, such as universities and institutes of technology, professional scientific institutes, medical or enlightenment and cultural educational facilities, some tourist centres, the STEP Network of Environmental Consulting Centres, etc. participate in environmental education of the general public.

NGO's also play an important role, especially civic associations or specialized professional federations and societies and their environment, agricultural or medical consulting facilities. The work of nonprofit organizations (nongovernmental and contributory), especially environmental education centres providing services for the public, schools and educational facilities in the area of environmental education and enlightenment, and other services in the area of extra-curricular education, work with parents and children or education and awareness of the public, is very beneficial. Environmental education, enlightenment and awareness are also supported by important foundations, e.g. the Foundation for Development of a Civic Society, the Partnership Foundation, the Via Foundation, the Open Society Fund and the Sluníčko Foundation.

At the present time, great emphasis is placed on public participation in decision-making in environmental matters and community cooperation. The basic units of some NGO's concerned, amongst other things, with environmental consulting, and NGO's established, amongst other things, as environmental consulting centres (e.g. Veronika, Rosa, Kosenka, Ostrava Green point, etc.) are concerned with support for civic participation in environmental issues. The public is invited to participate in the creation of some important documents, which are placed on the web site of the Ministry in the preparatory stages for public discussion and comments (e.g. the State Program of Environmental Education, Enlightenment and Awareness in the CR, etc.). The Green Circle, as an umbrella and service organization, associating over 20 member organizations, is the contact point for comments on draft documents submitted by the Ministry of the Environment.

Civic associations and generally beneficial societies can also obtain support for their work as NGO's from the state through the central bodies of the state administration. The Ministry has contributed to dissemination of information in this area for several years and annually publishes the results of tender procedures for the individual year, with a brief survey of the outputs of projects, on its web site (http://www.env.cz).

The Program of Development of Human Resources, supported from European social funds, has been a significant source of support since 2004. In the framework of the grant scheme of the Network of environmental information and

consulting centres, support can be provided for their formation and activities in the individual regions.

Greenpeace (www.greenpeac), the DUHA Movement (www.hnutiduha.cz), Brontosauří ekocentrum Zelený klub (Brontosaurus Green Club Ecocentre) on the Ekolist web site (www.ekolist.cz), the CZ Biom Association (http://czbiom.ecn.cz/), Ekowat (www.ekowatt.cz), SEVEn o.p.s. (http://www.svn.cz) and other organizations are systematically concerned with the issue of climate change.

Tab. 9.1 Structure of expenditures from state funds for environmental protection, 1998 - 2003

	1998	1999	2000	2001	2002	2003
environmental education and awareness [CZK thous.]	10 497	5 263	3 180	13 571	42 475	81 648
Measures to reduce the production of greenhouse gases [CZK thous.]	871	8 574	52 895	265 331	349 673	395 494

Source: Ministry of the Environment

Support of SEF for the Sunshine into Schools program is important for education and awareness. This program entails the installation of low-power photovoltaic or photothermal equipment in educational facilities. This program is intended primarily for demonstration of the potential for obtaining energy from solar radiation to the students of elementary and secondary schools as part of the enlightenment and educational process. Universities and religious special-purpose facilities also participate in this program.

9.7 Related Legislation

Act No. 106/1999 Coll., on free access to information, outlines the conditions of the right to free access to information by the public and establishes the basic conditions under which this information is provided. For the purposes of this law, an applicant is any natural or legal person who requests information.

Act No. 123/1998 Coll., on free access to information on the environment, as amended by Act No. 6/2005 Coll., stipulates the right of the public to timely and comprehensive information on the state of the environment and natural resources that is available to the state administrative bodies, territorial self-governing bodies and legal persons established, directed or authorized by them. Amongst other things, the amendment to the Act reformulated Article 13, which deals with environmental education and awareness and also newly defined consulting.

Act No. 561 of September 24, 2004 on preschool, elementary, secondary, higher vocational and other education, came into effect on January 1, 2005.

9.8 International Activities

The Czech Republic participates in a number of international projects concerned with environmental education, enlightenment and awareness. These activities are supported methodically and financially directly by the Ministry of the Environment and Ministry of Education, Youth and Sports.

The Blue from the Sky program is the national part of the original pan-European educational program called Air Pollution, concerned with monitoring air quality. It has four separate parts. In the Ozone project, children and students study the effect of tropospheric ozone on plants in the springtime. The occurrence of lichens is studied year-round in the Lichens project. During four weeks in the autumn, children measure the acidity of precipitation in the Acid Rain project. Together with children from eight other European countries, they perform measurements and implement measures in the winter and spring, leading to energy savings in their schools, in the Energy project. The GLOBE program is a global program, which the CR joined together with other countries in 1995. For the GLOBE program, scientists prepared a system of demonstration measurements that were simultaneously easy for students to perform, permitting monitoring of trends in global environmental issues. In the framework of the network of participants in the GLOBE program, students perform measurements and observations of the quality of the environment in the areas of meteorology, hydrology, biometry, phenology, pedology and remote sensing of the Earth. They send their observations through the Internet to the NASA centre in the USA.

Clean Up the World is an international environmental program providing inspiration and opportunities for people and societies throughout the world to clean up and care for the environment. The project is coordinated by the Czech Union for Nature Conservation in the Czech Republic.

In recent years, a wide range of activities has evolved in the framework of global education (http://sweb.cz/jiri_hruska/). The Association of Friends of Committed Teaching (www.pau.cz) are dedicated to further education of pedagogues. The Ministry of Education, Youth and Sports participated in dissemination of the Green Pack of teaching aids, which was prepared in the Czech mutation by the Regional Environmental Centre for central Europe (http://www.reccr.cz/greenpack.html).

The Ministry of the Environment participated in the creation of the International Visegrad Fund with official seat in Bratislava in the Slovak Republic, which also announced subjects in the category of Education in the first year of its existence in 2001.

ANNEX
COMMUNICATION OF THE CZECH REPUBLIC ON THE KYOTO PROTOCOL

Summary

The Communication of the Czech Republic on the Kyoto Protocol (hereinafter the "Protocol") contains information on:

- The national inventory system pursuant to Article 5.1 of the Protocol,
- The national registers pursuant to Article 7.4 of the Protocol,
- Flexible mechanisms pursuant to Articles 6, 12 and 17 of the Protocol,
- Domestic policies and measures pursuant to Article 2 of the Protocol,
- Domestic and regional programs,
- Information pursuant to Article 10 of the Protocol,
- Financial resources.

The National Inventory System

The Czech Hydrometeorological Institute has performed inventories of greenhouse gas emissions since 1995 and has submitted them to the Secretariat of the Convention through the national contact person for the UN Framework Convention on Climate Change (hereinafter the "Convention").

Pursuant to Decision 20/CP.7, it is necessary to create a fully functional national system to provide for regular annual inventories of greenhouse gas emissions according to the internationally binding methodology by January 1, 2007. As the body of the state administration responsible for meeting international commitments, in 2005 the Ministry of the Environment prepared establishment of this system.

National Registries

The Czech Republic expects that, for the purpose of the Protocol, the national registry will be established and operated in cooperation with the system of registries that was established in the Czech Republic in the framework of implementation of the system of trading in greenhouse gas emission allowances.

Flexible Mechanisms of the Protocol

In relation to the expected level of emissions in the review period of the Protocol, the Czech Republic has actively participated in implementation of the Joint Implementation project only in the position of a host country. In the future, consideration will be given to participation in the international emission trading mechanism pursuant to Article 17 of the Protocol, participation in the clean development mechanism (CDM) is not expected in the next few years from the position of the CR as a state.

Domestic Policies and Measures

A number of measures are being implemented in the CR to reduce greenhouse gas emissions. These are measures narrowly concentrating on a certain subject area or sector, are framework measures or are measures of an adaptation character. However, the targets and impacts of many of the adopted measures are usually much broader, as it is primarily necessary to reduce the negative impacts on the environment as a whole for many of these measures.

Domestic and Regional Programs

The key measures with the greatest expected benefit in the Czech Republic consist primarily in framework and conceptual measures (programs, concepts and policies) related to several sectors. There are a number of programs in the Czech Republic that constitute practical implementation of framework, conceptual and legislative measures.

Information Pursuant to Article 10 of the Protocol

At a national level, institutions of the state administration in the area of the environment and some other institutions, such as universities and institutes of technology, professional scientific institutes, medical or enlightenment and cultural educational facilities, some tourist centres, the STEP network of environmental consulting centres, etc. contribute towards environmental enlightenment of the general public. NGO's also play an important role.

The Czech Republic also participates in a number of international projects concerned with environmental education, enlightenment and awareness.

The Czech Republic also attempts to create capacities in the area of climate change in developing countries and in other countries through a number of projects.

Financial Resources

The Czech Republic is not a country of Annex II of the Convention. Thus, it is not obliged, in the sense of Art. 11 of the Protocol, to adopt measures and fulfil duties following from Articles 4.3, 4.5 and 4.5 of the Convention and especially to create further financial resources. Nonetheless, brief information will be given on the total volume of finances that the Czech Republic contributes to the individual funds. However, it is not possible to specify the part of these finances that was directed to the area covered by the Protocol.

1 The National Inventory System

The Czech Hydrometeorological Institute has performed inventories of greenhouse gas emissions since 1995 and submits them to the Secretariat of the Convention through the national contact person. This activity has been performed to date in the Czech Republic on the basis of projects or through *"ad hoc"* authorization of the Czech Hydrometeorological Institute. The inventory was prepared for the 1990 – 2003

period; since 1998 data have been provided in the CRF format. Recalculation of the emission time series from 1990 has been partly completed and submitted to the Secretariat of the Convention and the remaining gaps are regularly filled and shortcomings are remedied. Measures are implemented to ensure that consistent time series of emission data are available for 1990 – 2004 by April 15, 2006, including calculation for the *Land-Use, Land-Use Change and Forestry (LULUCF)* sector according to the new GPG LULUCF 2003 methodology. Work on application of the new methodology is progressing with full intensity; nonetheless, it is not yet known when all the data necessary for its application will be available in the CR. The entire emission time series for the LULUCF sector will be submitted to the Secretariat of the Convention by April 15, 2006.

In preparing the inventories, the Czech Hydrometeorological Institute has long worked with a quite stable team of sectoral workers, consisting in research, academic and private workplaces specializing in energy production, transport, forestry, agriculture and wastes.

Pursuant to Decision 20/CP.7, it is necessary to create a fully functional national system to provide for regular annual inventories of greenhouse gas emissions according to the internationally binding methodology by January 1, 2007. The greatest emphasis will be placed on the inventory for the year 1990, as the reference year for the Protocol, and also on all the years to the present time. In the interest of simplifying control and ensuring transparency of the inventory, it must be supplemented by sets of auxiliary information, that will facilitate control of the results (basic statistical indicators, emission factors, parameters used for the calculation, etc.). As the body of the state administration responsible for meeting international commitments, in 2005 the Ministry of the Environment prepared establishment of this system. In this position, it names the institution responsible for the quality and timeliness of submission of the results of inventories and also provides suitable personnel and financial capacity for its activities, including conditions for cooperation with the Czech Statistical Office, concerned ministries, etc. with other cooperating entities, especially in relation to provision for regular availability of the necessary statistical data. This task will be implemented systematically so that the approved national inventory system can be operated without substantial changes for a sufficiently long period of time.

In March 2005, the Ministry of the Environment approved a proposal that respected the requirements on the creation of a fully functional national system according to Decision 20/CP.7. In June 2005, its operation was entrusted to the Czech Hydrometeorological Institute, which has prolonged experience in preparation and coordination of inventories and two of whose employees have participated for several years in international control inventories as experts or heads of international expert teams and as authors in the preparation of a new methodology for the Intergovernmental Panel on Climate Change, which will come into effect in 2007. This authorization is valid for the 2006 – 2008 period. It is expected that, following evaluation of experience in operation of the system in 2006 and 2007, the authorized institution will be confirmed in 2008 for work on the national inventory system for the period following 2008, or that the relevant changes will be implemented in organizational and financial matters.

2 National Registries

The Czech Republic expects that, for the purpose of the Protocol, the national registry will be established and operated as a consolidated system with the system of registries that was established in the Czech Republic in the framework of implementation of the system of trading in greenhouse gas emission allowances. Pursuant to Act No. 695/2004 Coll., on conditions for trading in greenhouse gas emission allowances and amending some laws, this registry is operated by the Operator of the market in electricity, which employs the French Seringas system, developed for this purpose. It is assumed that, following clarification of the technical and functional specifications for operation of the national Kyoto registry, the two systems will be operated using identical software and hardware, particularly to save costs. Experts in the Czech Republic monitor preparation of specifications for the registries at the UN FCCC level and participate in the relevant professional meetings.

3 Flexible Mechanisms of the Kyoto Protocol

From the standpoint of the use of flexible mechanisms, the Czech Republic has so far actively participated in implementation of Joint Implementation (JI) projects pursuant to Article 6 of the Protocol in the position of a host country. Following initial experience with AIJ (Activities Implemented Jointly) projects, a methodology was prepared for preparation, assessment and approval of JI projects. By October 2005, the Ministry of the Environment had registered 78 project plans, whose total emission savings could attain a level of approx. 1 mil. tons of CO2 equiv. annually. Detailed evaluation was performed for 34 projects, which were approved by the Ministry of the Environment as projects complying with the JI criteria.

The experience gained in the implementation of JI projects indicates that the potential of these projects has been greatly reduced in connection with the accession of the Czech Republic to the European Union and especially with the start-up of the system of trading in greenhouse gas emission allowances. Together with the increase in administrative costs for administration of the projects, this is also reflected in a decreasing interest of foreign investors in investments into projects with limited reduction capacities. The situation is also complicated by interconnection of the system of trading in allowances to greenhouse gas emissions, which allows companies included in the trading system to be investors and recipients of ERU and CER units. The necessity to prevent double counting of emission reductions further limits the potential for implementation of projects in the Czech Republic. In this connection, it will be necessary in the immediate future to resolve the aspect of the national approach to JI and CDM projects from the position of investor. So far, the Czech Republic has not considered the possibility of purchasing of units using flexible mechanisms; nonetheless, in the sense of the above-mentioned interconnection of trading systems, Czech companies included in the trading system can express an interest in such purchases. The Czech Republic will continue to analyze the situation in the area of JI and will search for solutions to difficulties encountered in practical implementation. The chief interest of the Czech Republic

lies in meeting the relevant criteria for implementation of JI projects in the Track I regime as soon as possible.

In relation to expected emission conditions, the Czech Republic has also expressed interest in trading in emission units in the framework of the International Emission Trading mechanism, as outlined in Article 17 of the Protocol. At the present time, an approach is being discussed that will enable use of financial revenues obtained through the sale of units in this mechanism to support measures in the area of the environment or measures leading to a further reduction of greenhouse gas emissions. It is expected that this mechanism could be a suitable supplement to the JI mechanism.

In connection with the Protocol coming into effect, the Czech Republic expects that the area of flexible mechanisms will be analyzed in detail in the near future in an attempt to find an optimal approach, based primarily on experience gained in implementation to date and expected developments on an international level.

4 Domestic Policies and Measures

Since adoption of the Protocol in 1998, a number of measures have been and are being implemented in the CR to reduce greenhouse gas emissions. These measures are narrowly focused on a particular aspect or sector. However, their targets and impacts are usually much broader, as it is necessary to reduce the negative impacts on the environment as a whole in many cases.

In 1998, the Czech Republic began to prepare its national strategy in the area of climate change in order to ensure meeting of the national quantitative targets and gradually meeting other commitments contained in the Protocol. In 1999, the Government adopted the document "Strategy for Protection of the Climate System of the Earth in the Czech Republic", which included this subject amongst priority environmental issues and simultaneously outlined the main tasks for the effected sectors.

This Strategy was revised in 2003 to take into account the upcoming membership of the Czech Republic in the European Union. The newly prepared document took into account, amongst other things, the European Climate Change Program (ECCP).

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic, which the Government approved in 2004, newly defined the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the Czech Republic and to contribute to promotion of sustainable development. Its preparation was based on detailed analysis of national trends in greenhouse gas emissions in the 1990 to 2001 period, analysis of key emission sources, i.e. groups of sources that contribute to a maximal degree to the total national balance, and up-dated projections of emission trends in the time period to the year 2000, based on estimates of energy requirements and expected macroeconomic development. The National Program specifies new additional measures that, together with existing measures, should lead to an overall reduction in greenhouse gas emissions by 28% at the end of the Protocol review period, compared to 1990.

The highest benefits from the standpoint of reduction of greenhouse gases in the Czech Republic are expected primarily from framework and conceptual measures, which are mostly related to several sectors. Legislative measures support framework and conceptual measures and program measures constitute practical implementation of all the framework, conceptual and legislative measures.

Table 4.1 in Chap. 4 of the Fourth National Communication of the Czech Republic gives a detailed description of the individual measures and a general overview of framework, program, legislative, educational and voluntary measures, the state of their implementation and the expected benefits to 2010. The Report on Progress Achieved in Compliance with the Kyoto Protocol also contains a description of measures.

5 Domestic and Regional Programs/ Legislative Measures, Effectiveness and Administrative Procedures

5.1 Framework and Conceptual Measures

The **National Program to Mitigate the Impacts of Climate Change in the Czech Republic,** as a document approved by the Government in 2004, forms the basis for the preparation of policies and measures to reduce greenhouse gas emissions. It is concerned with defining the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the Czech Republic and to contribute to promotion of sustainable development. The National Program declares a substantial increase in the share of renewable energy sources in the consumption of primary energy sources and defines conditions for state participation in joint implementation projects, in international emission trading and in participation in trading in emission allowances for greenhouse gases, in the sense of Act No. 695/2004 Coll., which conforms with Directive No. 2003/87/EC.

Prepared measures or measures that came into force in 2005 should contribute to meeting national quantitative targets, consisting in reduction of specific CO_2 emissions by 30% to 2020 compared to 2000, reduction of aggregate CO_2 emissions by 25% to 2020 compared to 2000, increasing the fraction of renewable energy sources in the consumption of primary energy sources to 6% in 2010 and to 20% in 2030, reduction of the energy intensity of production, distribution and final consumption of energy to a level of 60 – 70% of current consumption in 2030, an increase in the fraction of the use of biofuels to 5.75% in 2010 and achieving of a fraction of 20% of use of all alternative fuels in transport in 2020.

In this document, the Government required that the Ministers of the Environment, Industry and Trade, Transportation, Agriculture, for Regional Development, Education, Youth and Sports, and Health and the Vice-Premier and Minister of Finance include the key points of the National Program in the activities of the sectors from the standpoint of their economic capabilities and, within one year of its legal for-

ce, submit information on procedures in implementation of the prepared measures and, within four years from its legal force, submit a preliminary evaluation of the National Program from the standpoint of the effects and economic potential of the adopted measures and, as appropriate, propose updating.

The **National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources** was prepared by the Ministry of Industry and Trade in agreement with the Ministry of the Environment in the sense of Title III of Act No. 406/2000 Coll., on energy management, and has been announced for a four-year period. It is concerned particularly with reducing energy consumption, use of renewable and secondary energy sources and its target groups consist in the state administration and local government, the business sphere, households and NGOs.

When it was being prepared in 2001, it was assumed that 0.2% GDP would be available annually for implementation. Because of other priorities and limited financial resources, financing was not provided in the past at the expected level, and thus benefits are substantially lower. Consequently, a proposal for full financing for the 2006 – 2009 period is also included in the category of prepared measures.

The updated **State Environmental Policy** 2004 – 2010 was adopted in 2004. The set priorities are compatible with the Sixth Environment Action Programme of the European Communities of 2002 and, in addition to addressing on-going and newly emerging environmental issues in the area of protection of nature, the landscape and biological diversity, sustainable use of natural resources, water protection, waste management, etc., also emphasize protection of the climate system of the Earth.

This is a fundamental reference document for the other sectoral and regional policies from the viewpoint of the environment. The main targets of the State Environmental Policy in relation to protection of the climate consist in measures leading to reduction of aggregated emissions of greenhouse gases and support for adaptation measures, achieving of the national emission ceilings, reduction of emissions from combustion processes and eliminating or reduction of emissions of substances depleting the ozone layer.

In 2004, the Government adopted the **State Energy Conception**, which is one of the fundamental components of the economic policy of the state. It is an expression of state responsibility for creation of conditions for reliable and long-term safe supplies of energy at an acceptable price and for creation of conditions for its effective use, which will not endanger the environment and will be in accordance with the principles of sustainable development. Its basic targets, concerned with fulfilling its objective, consist in maximizing energy effectiveness, determining the level and structure of consumption of primary energy sources, providing for maximum environmental soundness and completion of the transformation and liberalization of energy management.

The indicative targets of the State Energy Conception assume reduction of the energy intensity of creation of GDP by 25% to 2010 and by almost 50% to 2020 compared to 2000, reduction of CO_2 emissions from energy production by 13% to 2010 and by 18% to 2020 compared to 2000, reduction of NO_x emissions from energy production by 30% to 2010, achieving a fraction of renewable energy sources in total consumption of 11.3% in 2010 and 12.9% in 2020 (the fraction in 2000 equalled 2.7%) and that the use of biomass in total consumption of energy from secondary and renewable energy sources will increase to 75% in 2010 (equal to 40% in 2000) and the use of other renewable energy sources will double compared to 2000.

The **Transport Policy** for 2005 – 2013 was adopted in 2005 and sets forth principal targets primarily in the areas of harmonization of the transport system and public administration reform. Meeting targets in the area of development of the infrastructure seems less probable, as this is limited primarily by inadequate funding. Its main subjects consist in harmonization of conditions on the transport market, modernization, development and revitalization of railway transportation, improvement of the quality of road transportation, reduction of the impact of transportation on the environment and public health, support for multi-modal transportation systems, development of urban, suburban and regional mass transport in the framework of integrated transportation systems and concentration of research on safe, operationally reliable and environmentally sound transportation.

Priority cross-cutting tasks concerned with meeting environmental targets in transport consist particularly in support for reduction of transport intensity, especially in freight transport, reduction of the environmental impact of transport and reduction of its impact on public health, introduction of measures to reduce the occurrence of congestion in road transportation and creation of legal conditions to enable regulation of individual automobile transportation (reduction of transportation, charging fees for parking and entering selected areas, creation of low-traffic areas, etc.).

The Transport Policy envisages stabilization of greenhouse gases emissions from transport classified as to fossil fuel sources and biomass sources by 2010 and a reduction by 5% in 2013, a reduction of sulphur dioxide emissions from transport by 3% to 2010 and by 5% to 2013 and a reduction of nitrogen oxide emissions from transport by at least 10% to 2010. By 2013, 99% of motor vehicles should be equipped with catalyzers and the fraction of the population exposed to above-limit concentrations of tropospheric ozone should decrease by 10% to 2010 and by 20% to 2020.

5.2 Legislative Measures

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic has its legislative basis in **Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air)**. In the sense of this law, the Ministry of the Environment, in cooperation with the relevant central administrative authorities, prepared the Regional Programs to Reduce Emissions, whose subsidiary targets are in accordance with the National Program to Mitigate the Impacts of Climate Change. In the territories of the Regions, the Regional Authorities prepared regional programs to reduce pollutant emissions, which also emphasize measures to reduce greenhouse gas emissions, as measures leading to a reduction in pollutant emissions also lead to a reduction in greenhouse gas emissions. Thus the two National Programs are interconnected mutually and are connected with the programs of the individual territorial units.

Act No. 458/2000 Coll., on the conditions for operating a business and on performance of the state administration in the energy sector and amending some Acts (the Energy

Act), establishes the right to preferential access to distribution networks for the operators of installations utilizing renewable energy sources and waste combustion and of installations for combined production of electricity and heat. Provided that basic technical conditions are met, the operators of distribution networks are obliged to purchase electricity and thermal energy derived from renewable sources and from combined production of heat and electricity.

Act No. 406/2000 Coll. on energy management includes the obligation for each region to prepare a territorial energy conception, which will create conditions for sound energy management. These land-use conceptions were prepared together with the Regional Programs to reduce emissions pursuant to the Act on Protection of the Air, which ensured interconnection of the territorial energy conceptions and the Regional Programs to reduce emissions in relation to greenhouse gases. This Act simultaneously forms a legislative basis for the National Program of Sound Energy Management and Use of Renewable and Secondary Sources of Energy. It introduces compulsory measures for increasing the economy of use of energy (e.g. requirements on minimal efficiency of production of electricity and heat for newly constructed sources, maximum losses for newly constructed installations for energy transfer and distribution, minimum technical requirements on specific consumption of heat for heating buildings and energy-consuming appliances), measures to support combined production of heat and electricity, the obligation to affix energy labels on selected energy-consuming appliances and the obligation of subjecting buildings and energy management to energy audits for entities in the public and private commercial sector of the tertiary and production sphere with energy consumption above a set value.

Act No. 180/2005 Coll., on support for the production of electricity from renewable energy sources and amending some laws (Act on Support for Use of Renewable Sources) stipulates the manner and extent of support for the production of electricity from renewable energy sources, which should provide for achieving the national indicative targets, i.e. an increase in the fraction of electricity produced from renewable energy sources in gross energy consumption to a degree such that the fraction of renewable energy sources attains a level of 8% in 2010. Attaining of this value depends greatly on climatic factors, which substantially affect the potential for the use of water, solar and wind energy in the Czech Republic. The Act is compatible with Directive 2001/77/EC in the part related to support for the production of electricity from renewable energy sources. Wind generators located over an area of 1 km^2 with total installed output of 20 MW are excluded from support for the production of electricity from renewable energy sources. In case of production of electricity from biomass, promotion applies to the types and manners of use of biomass that are stipulated by an implementing regulation from the viewpoint of environmental protection.

Measures in the area of reduction of emissions of pollutants and greenhouse gases in industry are implemented and promoted in the framework of selected subprograms of the State Program to Promote Energy Savings and the Use of Renewable Energy Sources. The new energy legislation and especially implementation of the obligations following from the Act on Energy Management also contribute to a substantial increase in energy effectiveness and the consequent reduction in greenhouse gas emissions. **Act No. 76/2002 Coll., on integrated prevention**, which specifies some binding operating conditions, is a basic legislative document. These conditions include determination of emission limits, measures to eliminate the risk of environmental pollution and provisions for economical use of materials and energy.

Reduction of greenhouse gas emissions is a side effect of implementation of the principles contained in **Acts No. 185/2001 Coll., on wastes** and **No. 477/2001 Coll., on packaging,** particularly in relation to prevention of waste generation, reduction of its amount, separation according to kinds and the environmental soundness of waste management. The prepared regulation includes amongst these substances also freons and halons and also stipulates that substances depleting the ozone layer contained in installations, e.g. in foams, and in refrigeration circuits must be properly collected and processed in accordance with the binding regulations.

5.3 Program Measures

The program measures constitute practical implementation of framework, conceptual and legislative measures and encompass especially the State Program to Promote Energy Savings and the Use of Renewable Energy Sources, consisting of the programs of the Czech Energy Agency and State Environmental Fund, the Program of Energy Savings in the Transport Sector, implementation of the Directives on biofuels and cogeneration, the program of support for renewal of mass urban transport and public transport vehicles, programs in the area of housing infrastructure, introduction of advantageous purchase prices for electricity produced from renewable energy sources, the use of landfill gases and biogases from waste water treatment plants and implementation of the Integrated National Program to Reduce Emissions.

6 Information pursuant to Article 10 of the Kyoto Protocol

6.1 Emission Inventory

The Czech Hydrometeorological Institute has performed inventories of greenhouse gas emissions since 1995 and sends them to the Secretariat of the Convention through the national contact person. This activity has been performed to date in the Czech Republic on the basis of projects or on the basis of *"ad hoc"* authorization of the Czech Hydrometeorological Institute. The inventory is prepared for the 1990 – 2003 period; since 1998 data have been provided in the CRF format. Recalculation of the emission time series from 1990 has been partly completed and submitted to the UN FCCC Secretariat and the remaining gaps are regularly filled and shortcomings are remedied. Measures are implemented to ensure that consistent time series of emission data are available for the 1990 – 2004 period by April 15, 2006, including calculation for the *Land-Use, Land-Use Change and Forestry (LULUCF)* sector according to the new GPG LULUCF 2003 methodology. Work on application of the new methodology is progressing with full intensity; nonetheless, it is not yet known when all the data necessary for its application will be

available in the Czech Republic. The entire emission time series for the LULUCF sector will be submitted to the Secretariat of the Convention by April 15, 2006.

6.2 Adaptation Measures

Adaptation measures must be employed to reduce the negative and increase the positive impacts of climate change, but cannot be employed to prevent all impacts. The ability to adapt depends primarily on the availability of financial resources, technologies, levels of education, available information, suitable planning and the overall infrastructure.

The importance of adaptation measures in the Czech Republic is emphasized, amongst other things, by the increased frequency of the occurrence of extreme weather conditions in its territory in recent years and the ever increasing damage caused by extreme weather conditions. Consequently, it is necessary to plan the attitude of the state in the area of adaptation measures strategically and simultaneously sufficiently far in advance.

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic elaborates specific sector adaptation measures and places them at a similar level of importance as measures connected with reducing emissions.

6.3 Access to Technologies and their Use

Cooperation with member states of the European Union in the area of use of technologies with low production of greenhouse gas emissions, with specific emphasis on the fastest possible utilization in the state and private sector, is a strategic priority. The Integrated National Program to Reduce Emissions plays an important role here and is concerned, amongst other things, with reducing the emissions of basic pollutants (particulate matter, sulphur dioxide, nitrogen oxides, etc.), which are regulated by the Czech legislation at a higher level than at the individual air pollution sources through announcement of emission ceilings or air-pollution limit levels. The program is conceived as part of the air protection system and is accompanied by the National Program to reduce emissions of particulate matter, sulphur dioxide and nitrogen oxides from existing especially large combustion sources of air pollution. Its goal consists in achieving the emission limit values for each existing source by January 1, 2008 at the latest. In the framework of this national program and the subsequent regional programs and concepts, proposals were also prepared in 2003 – 2004 for reduction of greenhouse gas emissions, especially in the energy sector. Implementation of new technologies is frequently confronted by problems of an economic character (especially in the state sphere) and low awareness levels (particularly the private sector).

6.4 Scientific and Technical Development

In the framework of long-term tasks of research institutions and universities in the CR, research is carried out on the properties of observed and model series and fields of climatic variables, with emphasis on variability and the occurrence of extreme phenomena, changes in atmospheric circulation, interconnections between components of the climate system and estimates of climate changes, the potential for modelling the climate on a regional scale, methods of statistical downscaling and the causes of climate changes, especially in relation to solar activity. In addition, reconstruction of the climate is performed on the basis of historical observations and underground boring. Work was carried out on a number of grant projects in 2002 – 2005, with emphasis on the above subject areas.

6.5 Provision for Capacities in the Area of Climate Change

In the Czech Republic, the Ministry of the Environment is responsible for implementation of the Protocol and is simultaneously the supreme control body of the state administration in the area of protection of the environment. The climate change agenda is the responsibility of the Climate Change Department, which also includes the national contact person for the Convention in the Czech Republic. Because of the cross-cutting character of the issue of climate change, which affects a number of professional entities, the sector encompasses the Working Group for Climate Change of the Ministry of the Environment, which acts as a consulting body for the Minister of the Environment and whose members include representatives of the substantively competent departments. The Interministerial Commission on Climate Change also acts as a consulting body for the Minister of the Environment in providing for implementation of the Convention and Protocol. According to the character of the measures, the corresponding sectors (of the environment, industry, transport, agriculture, finances, etc.) are responsible for preparation and implementation of specific measures to reduce greenhouse gas emissions and adaptation measures.

Environmental education, enlightenment and public awareness is also related to creation of personnel capacity. At a national level, institutions of the state administration in the area of the environment and some other institutions, such as universities and institutes of technology, professional scientific institutes, medical or enlightenment and cultural educational facilities, some tourist centres, the STEP network of environmental consulting centres, etc. participate in environmental enlightenment of the general public. NGO's also play an important role.

On the other hand, it is necessary to constantly exert efforts to increase capacities in the area of climate change as, in relation the growing agenda in this area and the increasing general importance of this subject in the medium and long term, provision for these areas on the basis of the existing capacities is probably unsustainable.

The Czech Republic also participates in the creation of capacities in developing countries and other countries. The table below gives a survey of projects of foreign developmental assistance in the responsibility of the Ministry of the Environment in 2004, which are also related to climate change.

Project name	Partner country	Implementer in the CR	Withdrawn to date (CZK thous.)	2004 budget (CZK thous.)	2005 budget (CZK thous.)	2006 budget (CZK thous.)	Total project budget (CZK thous.)	Project duration	Characteristics of the project
Implementation of Czech environmental technology and know-how	India	Innovation and development centre	4 000	1 500	0	0	5 500	2001-2004	Support for technical cooperation between Czech and Indian industry in the area of cleaner technology
Survey of water resources in Ethiopia with focus on drought–affected areas	Ethiopia	0	5 800	1 900	1 900	0	9 600	2001-2005	Participation of the CR in implementation of the national program of Ethiopia for water resource development through training of local experts for evaluation of the volume of groundwater sources and hydrological mapping of the territory
Geological work in Mongolia – hydrogeological work, combating desertification in the Dorngobi region	Mongolia	Geomin Jihlava	1 700	3 000	3 000	1 300	9 000	2003-2006	Creation of hydrogeological documents and a regional water management plan in the south-eastern part of Mongolia affected by drought
Application of preventative procedures in selected enterprises, connected with transfer of Czech technology and know-how	Kazakhstan	Innovation and development centre	1 750	1 625	1 625	0	5 000	2003-2005	Projects of industrial prevention concerned with reducing the environmental burden and related transfer of Czech technology
Drinking water supply for the region of the city of Valjevo / „Rovni“ regional water supply system	Serbia and Montenegro, Republic of Serbia	VHS Brno, a.s.	6 200	2 400	1 200	0	9 800	2003-2005	Technical assistance in planning and implementation of construction of waterworks
Construction of high-quality drinking water resources in South-Eastern areas of Ethiopia	Ethiopia	Člověk v tísni, o.p.s. (People in Need)	2 890	2 900	0	0	5 790	2003-2004	Providing access to high-quality drinking water for approx. 12,000 thous. people, securing long-term reliable administration of new water resources; training in the area of basic hygiene rules.
Program of management and renewal of water courses in the Kali Progo/Sapi and Tondano watershed	Indonesia	Mott Macdonald, T.G. Masaryk Water research institute	800	590	590	0	1 980	2003-2005	Preparation of a land-use plan and reclaiming of land in the watershed of the Sapi and Kali Progo rivers in the southern province of central Java
Improving the environment in the watershed of the Bregalnice river	Macedonia (FYROM)	Hydroprojekt CZ,a.s.		1 345	2 230	2 174	5 750	2004-2006	Strategic concept of environmental protection in the watershed of the Bregalnice river. Technical proposals and technical-economic evaluation
Creation of the modern CLIDATA climatology database	Serbia and Montenegro, Mongolia, Ethiopia, Nicaragua	Czech Hydrometeorological Institute		1 700	3 400	1 800	6 900	2004-2006	The target consists in providing the recipient country with applications of CLIDATA – software for administration of climatology data
Solar energy for schools in Kenya	Africa / Kenya	Narovinu humanitarian centre / Humanitarian movement		1 363	3 328	2 000	6 691	2004-2006	Support for improved education levels in schools and hope centres in Kenya by equipping approx. 20 elementary schools with photovoltaic systems for lighting and powering computers and other teaching aids
Monitoring alpine glacial lakes and protection of the population against the catastrophic consequences of floods	Kyrgyzstan	GEOMIN cooperative		2 000	3 350	3 400	8 750	2004-2006	Assistance in introducing monitoring of dangerous glacial lakes and a warning system against the danger of catastrophes occurring through bursting of moraine dams
Reducing pollution of surface and ground waters in Sri Lanka through transfer of Czech technology	Sri Lanka	Ircon, s.r.o.		800	2 500	2 700	6 000	2004-2006	Technical cooperation with enterprises and municipalities in Sri Lanka in order to introduce Czech technology and protection / saving of water, establishing pf production branches.

7 Financial Resources

The Czech Republic is not a country listed in Annex II of the Convention and thus the duty to adopt measures and fulfil obligations following from Articles 4.3, 4.4 and 4.5 of the convention and especially to create further financial sources does not follow for it from Article 12.3 of the Convention.

The foreign developmental cooperation of the Czech Republic has exhibited a constant increase in recent years that is in accordance with the role of this country as an emerging donor and new EU member. This increase is a consequence of both the increasing volume of funds designated for developmental assistance and also the better statistical reporting of the Ministry of Foreign Affairs. The Barcelona obligation has been included in the *soft acquis* for the European Union member states. At the present time, discussions are being carried out on a proposal by the European Commission that the new member states should approach a level of 0.17% by 2010 and should attain a fraction of 0.33% GDP by 2015. However, it cannot be expected that these targets could be achieved on the part of the CR if the current trends are preserved; at the present time this value corresponds to a level of 0.10 – 0.11%. However, in most cases, it is not possible to specify the part of these finances that is directed to the area of climate change.

DEMONSTRABLE PROGRESS REPORT ON IMPLEMENTATION OF THE KYOTO PROTOCOL

Summary

The Demonstrable Progress Report on Implementation of the Kyoto Protocol (hereinafter the "Report") was prepared in accordance with Art. 3.2 of the Kyoto Protocol (hereinafter the "Protocol") and Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, according to the structure approved for the Climate Change Committee of the European Commission.

The Report is divided into six chapters (where the first chapter is the Introduction), each of which contains a description of and the level of compliance with the relevant requirements of the Protocol. Chapter 2 describes the approach of the state to the introduction of measures to reduce greenhouse gas emissions, a brief history of adoption of measures and also the structure and description of the individual measures since 1998, when the Czech Republic signed the Protocol, to the present time. Chapter 3 describes trends in greenhouse gas emissions between 1990 (reference year for the Protocol) and 2003 (last officially prepared National Inventory Report) and projections for trends in these emissions for the individual gases and sectors to the year 2020. Chapter 4 gives an estimate of the impact of measures to reduce greenhouse gas emissions as prepared by the Enviros s.r.o. company. Chapter 5 contains a description of meeting the other commitments of the Protocol (progress in preparing inventories of greenhouse gas emissions, in introducing adaptation measures, in access to technologies and their introduction, in scientific and technical development, in providing for capacities in the area of climate change and in assistance to developing countries). Chapter 6 – Conclusions summarizes the degree of achieving the individual targets set by the Protocol, and states shortcomings and ways of overcoming them.

1 Introduction

The Czech Republic signed the Protocol on November 23, 1998 and completed the ratification process in the sense of Art. 25 of the Protocol on November 15, 2001.

According to Art. 3.2 of the Protocol, every party to the Protocol is obliged to submit a Report on Progress Achieved in Compliance with the Protocol to the Secretariat of the UN Framework Convention on Climate Change (hereinafter the "Convention") by December 31, 2005. On the basis of Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, the European Commission as a whole and also each Member State of the European Union must also submit an analogous Report to the Secretariat of the convention by December 31, 2005. For this purpose, the European Commission has established a uniform structure of the Report, which is in accordance with the requirements of the Secretariat of the Convention.

The Czech Republic, which is a Party to the Protocol and a member state of the European Union, has prepared the Report in accordance with the requirements of the Protocol and Decision No 280/2004/EC, according to the structure stipulated by the European Commission. The Report contains information related to the period between 1990 (reference year for the Protocol) and 2005.

2 Measures to Reduce Greenhouse Gas Emissions

2.1 Strategic Approach of the State

In the Czech Republic, the Ministry of the Environment is responsible for implementation of the Protocol and is simultaneously the supreme control body of the state administration in the area of protection of the environment.

According to the character of the measures, the corresponding sectors (of the environment, industry and trade, transport, agriculture, finances, etc.) are responsible for preparation and implementation of specific measures to reduce greenhouse gas emissions and adaptation measures.

After adopting the Protocol in 1998, the Czech Republic began to prepare its first national strategy in the area of climate change in order to ensure meeting of the national quantitative targets and gradually meeting other commitments contained in the Protocol. In 1999, the Government of the Czech Republic adopted the document "Strategy for Protection of the Climate System of the Earth in the Czech Republic", which included this subject amongst priority environmental issues and simultaneously outlined the main tasks for the effected sectors. As a consequence of the proposed and gradually introduced measures, emission trends stabilized following a rapid decrease in 1990 – 1994 as a consequence of the transformation process in the national economy. Following 1995, the overall annual trend in reductions of total greenhouse gas emissions equalled 0.9% and, in the 1995 – 2003 period, total emissions, not including the Land-Use, Land-Use Change and Forestry (LULUCF) sector, decreased by 3.9%.

The original document was revised in 2003 to take into account the upcoming membership of the Czech Republic in the European Union. The newly prepared document took into consideration, amongst other things, also the European Climate Change Programme (ECCP), established in 2000 by the European Commission in the framework of identification of the main joint policies at the level of the EU and the individual Member States, so as to ensure joint and individual meeting of the reduction targets of the Protocol.

The National Program to Mitigate the Impacts of Climate Change, which the Government of the Czech Republic approved in 2004, newly defined the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the Czech Republic and to contribute to promotion of sustainable development. Its preparation was based on detailed analysis of national trends in greenhouse gas emissions in the 1990 to 2001 period, analysis of key emission sources, i.e. groups of sources that contribute to a maximal degree to the total national balance, and up-dated projections of emission trends in the time period to the year 2000, based on estimates of energy requirements and expected macroeconomic development. The National Program specifies new additional measures that, together with existing measures, should lead to an overall reduction in greenhouse gas emissions by 28% at the end of the Protocol review period, compared to 1990.

2.2 Structure of Measures and a Brief Description

Measures leading to a reduction in greenhouse gas emissions are closely related to a certain aspect or sector. However, their targets and impacts are usually much broader, as it is necessary to reduce the negative impacts on the environment as a whole in many cases.

The greatest expected benefit consists primarily in framework and conceptual measures, which are mostly related to several sectors. Legislative measures support framework and conceptual measures and program measures constitute practical implementation of all the framework, conceptual and legislative measures.

2.2.1 Framework and Conceptual Measures

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic (hereinafter the "National Program"), as a document approved by the Government in 2004, forms the basis for the preparation of policies and measures to reduce greenhouse gas emissions. It is concerned with defining the main targets and measures in the area of climate change at a national level, so as to ensure meeting of the reduction emission targets to the maximum possible degree in the sense of international agreements, to reflect contemporary and future social and economic conditions in the Czech Republic and to contribute to promotion of sustainable development. Its preparation was based on detailed analysis of national trends in greenhouse gas emissions in the 1990 to 2001 period, analysis of key emission sources, i.e. groups of sources that contribute to a maximal degree to the total national balance, and up-dated projections of emission trends in the time period to the year 2020.

The National Program declares a substantial increase in the share of renewable energy sources in the consumption of primary energy sources, defines conditions for state participation in joint implementation projects, in international emission trading and in participation in trading in emission allowances for greenhouse gases, in the sense of Act No. 695/2004 Coll., which conforms with Directive No. 2003/87/EC.

Prepared measures or measures that came into force in 2005 should contribute to meeting national quantitative targets, consisting in reduction of specific CO_2 emissions by 30% to 2020 compared to 2000, reduction of aggregate CO_2 emissions by 25% to 2020 compared to 2000, increasing the fraction of renewable energy sources in the consumption of primary energy sources to 6% in 2010 and to 20% in 2030, reduction of the energy intensity of production, distribution and final consumption of energy to a level of 60 – 70% of current consumption in 2030, an increase in the fraction of the use of biofuels to 5.75% in 2010 and achieving of a fraction of 20% of use of all alternative fuels in transport in 2020.

In this document, the Government required that the Ministers of the Environment, Industry and Trade, Transportation, Agriculture, for Regional Development, Education, Youth and Sports, and Health and the Vice-Premier and Minister of Finance include the key points of the National Program in the activities of the sectors from the standpoint of their economic capabilities and, within one year of its legal force, submit information on procedures in implementation of the prepared measures and, within four years from its legal force, submit a preliminary evaluation of the National Program from the standpoint of the effects and economic potential of the adopted measures and, as appropriate, propose updating.

The **National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources** was prepared by the Ministry of Industry and Trade in agreement with the Ministry of the Environment in the sense of Title III of Act No. 406/2000 Coll., on energy management, and has been announced for a four-year period. It is concerned particularly with reducing energy consumption and the use of renewable and secondary energy sources and its target groups consist in the state administration and local government, the business sphere, households and NGOs.

When it was being prepared in 2001, it was assumed that 0.2% GDP would be available annually for implementation. Because of other priorities and limited financial resources, financing was not provided in the past at the expected level, and thus benefits are substantially lower. Consequently, its proposal for full financing for the 2006 – 2009 period is also included in the category of prepared measures.

The updated **State Environmental Policy** 2004 – 2010 was adopted in 2004. The set priorities are compatible with the Sixth Environment Action Programme of the European Communities of 2002 and, in addition to addressing on-going and newly emerging environmental issues in the area of protection of nature, the landscape and biological diversity, sustainable use of natural resources, water protection, waste management, etc., also emphasize protection of the climate system of the Earth.

This is a fundamental reference document for the other sectoral and regional policies from the standpoint of the environment. The main targets of the State Environmental Policy in relation to protection of the climate consist in measures leading to reduction of aggregated emissions of greenhouse gases and support for adaptation measures, achieving of the national emission ceilings, reduction of emissions from combustion processes and eliminating or reducing emissions of substances depleting the ozone layer.

In 2004, the Government adopted the **State Energy Conception**, which is one of the fundamental components of the economic policy of the state. It is an expression of state responsibility for creation of conditions for reliable and long-term

safe supplies of energy at an acceptable price and for creation of conditions for effective energy use, which will not endanger the environment and will be in accordance with the principles of sustainable development. Its basic targets, concerned with fulfilling its objectives, consist in maximizing energy effectiveness, determining the level and structure of consumption of primary energy sources, providing for maximum environmental soundness and completion of the transformation and liberalization of energy management.

The indicative targets of the State Energy Conception assume reduction of the energy intensity of creation of GDP by 25% to 2010 and by almost 50% to 2020 compared to 2000, reduction of CO_2 emissions from energy production by 13% to 2010 and by 18% to 2020 compared to 2000, reduction of NO_x emissions from energy production by 30% to 2010, achieving a fraction of renewable energy sources in total consumption of 11.3% in 2010 and 12.9% in 2020 (the fraction in 2000 equalled 2.7%) and that the use of biomass in total consumption of energy from secondary and renewable energy sources will increase to 75% in 2010 (equal to 40% in 2000) and the use of other renewable energy sources will double compared to 2000.

The **Transport Policy** for 2005 – 2013 was adopted in 2005 and sets forth principal targets primarily in the areas of harmonization of the transport system and public administration reform. Meeting targets in the area of development of the infrastructure seems less probable, as this is limited primarily by inadequate funding. Its main subjects consist in harmonization of conditions on the transport market, modernization, development and revitalization of railway transportation, improvement of the quality of road transportation, reduction of the impact of transportation on the environment and public health, support for multi-modal transportation systems, development of urban, suburban and regional mass transport in the framework of integrated transportation systems and concentration of research on safe, operationally reliable and environmentally sound transportation.

Priority cross-cutting tasks concerned with meeting environmental targets in transport consist particularly in support for reduction of transport intensity, especially in freight transport, reduction of the environmental impact of transport and reduction of its impact on public health, introduction of measures to reduce the occurrence of congestion in road transportation and creation of legal conditions for the potential for regulation of individual automobile transportation (reduction of the volume of transportation, charging fees for parking and entering selected areas, creation of low-traffic areas, etc.).

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2.2.2 Legislative Measures

The National Program to Mitigate the Impacts of Climate Change in the Czech Republic has its legislative basis in **Act No 86/2002 Coll., on protection of the air and amending some other laws (Act on Protection of the Air)**. In the sense of this law, the Ministry of the Environment, in cooperation with the relevant central administrative authorities, prepared the Regional Programs to Reduce Emissions, whose subsidiary targets are in accordance with the National Program to Mitigate the Impacts of Climate Change. In the territories of the Regions, the Regional Authorities prepared regional programs to reduce pollutant emissions, which also emphasize measures to reduce greenhouse gas emissions, as measures leading to a reduction in pollutant emissions also lead to a reduction in greenhouse gas emissions. Thus the two National Programs are interconnected mutually and with the programs of the individual territorial units.

In order to reduce greenhouse gas emissions in accordance with the targets set forth in the national and regional programs to reduce pollutant emissions, it is necessary to provide for a reduction in energy intensity in the area of production, distribution and final consumption of energy under conditions reducing pollutant emissions, maximum use of central heat sources and combined production of electrical energy and heat, greater utilization of biofuels and energy-production use of biomass, an increased fraction of production of electrical energy from renewable energy sources, voluntary agreements with operators over and above the framework of the requirements of the valid air-protection legislation, utilization of the potential for conversion to gas in areas with adequate capacity and reduction of combustion of certain kinds of fuel in small stationary sources of air pollution.

Act No. 458/2000 Coll., on the conditions for operating a business and on performance of the state administration in the energy sector and amending some Acts (the Energy Act), establishes the right to preferential access to distribution networks for the operators of installations utilizing renewable energy sources and waste combustion and of installations for combined production of electricity and heat. Provided that basic technical conditions are met, the operators of distribution networks are obliged to purchase electricity and thermal energy derived from renewable sources and from combined production of heat and electricity.

Act No. 406/2000 Coll., on energy management, includes the obligation for each region to prepare a territorial energy conception, which will create conditions for sound energy management. These land-use conceptions were prepared together with the Regional Programs to reduce emissions pursuant to the Act on Protection of the Air, which ensured interconnection of the territorial energy conceptions and the Regional Programs to reduce emissions in relationship to greenhouse gases. This Act simultaneously forms a legislative basis for the National Program of Sound Energy Management and Use of Renewable and Secondary Sources of Energy. It introduces compulsory measures for increasing the economy of use of energy (e.g. requirements on minimal efficiency of production of electricity and heat for newly constructed sources, maximum losses for newly constructed installations for energy transfer and distribution, minimum technical requirements on specific consumption of heat for heating buildings and energy-consuming appliances), measures to support combined production of heat and electricity, the obligation to affix energy labels to selected energy-consuming appliances and the obligation of subjecting buildings and energy management to energy audits for entities in the public and private commercial sector of the terti-

ary and production spheres with energy consumption above a set value.

Act No. 180/2005 Coll., on support for the production of electricity from renewable energy sources and amending some laws (Act on Support for Use of Renewable Sources) stipulates the manner and level of support for the production of electricity from renewable energy sources, which should provide for achieving the national indicative targets, i.e. an increase in the fraction of electricity produced from renewable energy sources in gross energy consumption to a degree such that the fraction of renewable energy sources attains a value of 8% in 2010. Attaining of this value depends greatly on climatic factors, which substantially affect the level of use of water, solar and wind energy in the Czech Republic. In the part related to support for the production of electricity from renewable energy sources, the Act is compatible with Directive 2001/77/EC. Wind generators located over an area of 1 km^2 with total installed output of 20 MW are excluded from support for the production of electricity from renewable energy sources. In case of production of electricity from biomass, promotion shall apply to the types and manners of use of biomass that are stipulated by an implementing regulation from the viewpoint of environmental protection.

Measures in the area of reduction of emissions of pollutants and greenhouse gases in industry are implemented and promoted in the framework of selected subprograms of the State Program to Promote Energy Savings and the Use of Renewable Energy Sources. The new energy legislation and especially implementation of the obligations following from the Act on Energy Management also contribute to a substantial increase in energy effectiveness and the consequent reduction in greenhouse gas emissions. **Act No. 76/2002 Coll., on integrated prevention**, which specifies some binding operating conditions, is a basic legislative document. These conditions include determination of emission limits, measures to eliminate the risk of environmental pollution and provisions for economical use of materials and energy.

Reduction of greenhouse gas emissions is a side effect of implementation of the principles contained in **Acts No. 185/2001 Coll., on wastes** and **No. 477/2001 Coll., on packaging**, particularly in relation to prevention of waste generation, reduction of its amount, separation according to kinds and environmental soundness of waste management The prepared regulation includes freons and halons amongst these substances and also stipulates that substances depleting the ozone layer contained in installations, e.g. in foams, and in refrigeration circuits must be properly collected and processed in accordance with the binding regulations.

2.2.3 Program Measures

The program measures constitute practical implementation of framework, conceptual and legislative measures and encompass especially the State Program to Promote Energy Savings and the Use of Renewable Energy Sources, consisting of the programs of the Czech Energy Agency and State Environmental Fund, the Program of Energy Savings in the Transport Sector, implementation of the Directives on biofuels and cogeneration, program of support for renewal of mass urban transport and public transport vehicles, programs in the area of housing infrastructure, introduction of advantageous purchase prices for electricity produced from renewable energy sources, use of landfill gases and biogases from waste water treatment plants and implementation of the Integrated National Program to Reduce Emissions. The individual measures and their effects are summarized in Tab. 2.1.

Tab. 2.1 Summary of measures with a list of expected benefits to 2010

Name of measure	Target of the measure	Affected greenhouse gases	Category of the measure	State of the measure	Responsibility[49]	Expected benefit[50] [t CO_2 equiv.]	
						2005	2010
National Program to Mitigate the Impacts of Climate Change in CR - Summary	provision for compliance with the obligations of the Kyoto Protocol	all	framework	implemented	Government of CR and designated Ministry	n/a	n/a
The National Program of Sound Energy Management and Use of Renewable and Secondary Energy Sources	harmonization with EU policy	more	framework	implemented / prepared	ME, MIT	6 332	6 332
The integrated national program to reduce emissions in the Czech Republic	achieving of the national emission ceilings and reduction of pollutant emissions	more	program	implemented	MIT, ME, MA, MT	n/a	n/a
Act on Protection of the Air	harmonization of CR legislation with EU legislation	CO_2	legislative	implemented	ME and other state administrative bodies in the area of air protection	n/a	n/a
Energy Act	harmonization of CR legislation with EU legislation	CO_2	legislative	implemented	MIT, ERA	n/a	n/a
Act on Energy Management	harmonisation of CR legislation with EU legislation	CO_2	legislative	implemented	MPO	n/a	n/a
Infrastructure Operational Program	reduction of the amount of emitted pollutants, improving pollution levels in the affected locations, improvement of the state of health of the population and condition of vegetation, reduction of greenhouse gas emissions	all	program	commencing	ME, SEF, municipalities	n/a	2 130
Implementation of the Directive on the energy performance of buildings	reduction of the energy requirements of buildings in relation to the outdoor climate and local conditions, requirements on the indoor environment and effectiveness of expenditures	CO_2	legislative	prepared	investors, owners and operators of buildings	10	230
State Program to Promote Energy Savings and the Use of Renewable Sources of Energy, Part A – Czech Energy Agency Programs	reduction of the energy intensity of the economy, savings in energy materials and minimization of the environmental impact and reduction of greenhouse gas emissions	CO_2	legislative, program education	implemented	CEA	147	200
State Program to Promote Energy Savings and the Use of Renewable Sources of Energy, Part B - SEF Programs	reduction of the energy intensity of the economy, savings in energy materials and minimization of the environmental impact and reduction of greenhouse gas emissions	CO_2	legislative program education	implemented	SEF	128	99
Support of the State Environmental Fund of the Czech Republic in air protection	reduction of emissions of pollutants into the air	CO_2	program	program	SEF	1 000	1 000
GEF Efficient lighting initiative	reduction of greenhouse gas emissions through accelerated introduction of energy-saving lighting technologies	CO_2	program education	implemented	GEF, SEVEn	425	425
Program to Support Reconstruction and Restoration of Panel Buildings	repairs and reconstruction of panel apartment buildings	CO_2	program	program	MRD	n/a	n/a
Preferential purchase tariffs for electricity produced from renewable sources	fuel replacement in production of electricity	CO_2	legislative program	prepared	ME, MIT, ERA	1 057	985
Environmental tax reform	fuel replacement in consumption of energy	CO_2	framework legislative	prepared	ME, MF, MIT, ERA	0	900

[49] *see the explanations*
[50] *nonaccumulated values*

Name of measure	Target of the measure	Affected greenhouse gases	Category of the measure	State of the measure	Responsibility[49]	Expected benefit[50] [t CO_2 equiv.]	
						2005	2010
Implementation of the Directive on cogeneration	increased efficiency of energy production and improved supply through the creation of a framework for support for and development of highly efficient combined production of heat and electricity	CO_2	legislative program	implemented	MIT, ERA	n/a	n/a
Set of measures in the transport sector	reduction of pollutant emissions reduction of greenhouse gas emissions	CO_2, CH_4, N_2O	framework legislative program	implemented	MT, ME, MA	2 797	3 917
The Act on Integrated Prevention	harmonization of CR legislation with EU legislation	CO_2, CH_4, N_2O	legislative	implemented	ME, MIT	n/a	n/a
National Allocation Plan	motivation of decisive industrial producers to reduce CO_2 emissions harmonization of CR legislation with EU legislation	CO_2	legislative program	commencing	ME, MIT affected industrial enterprises	n/a	n/a
Industry and business operational program	increasing the energy efficiency of production and of energy consumption in industry and an increased fraction of renewable energy sources	CO_2	program	prepared	MIT and affected industrial enterprises	0	2 130
Support for afforestation of unused agricultural areas	more rational use of agricultural land	CO_2	program	implemented	MA	84	84
Implementation of the Directive on biofuels	nonfoodstuff use of domestic agricultural production	CO_2	legislative, program	implemented	MA, ME	60	997
Use of landfill gas and biogas from waste water treatment plants	reduction of methane emissions from landfills and waste water treatment plants	CH_4	program	implemented	ME, operators of landfills and waste water treatment plants	n/a	n/a
Act on packaging and Act on wastes	harmonization of CR legislation with EU legislation	CO_2, CH_4, N_2O	legislative	implemented	ME, MIT	n/a	n/a
AIJ project - Škoda Mladá Boleslav	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	Government of FRG in cooperation with Bavariawerk AG and RWE Energie	272	272
AIJ project – Hostětín	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	Government of the Kingdom of the Netherlands in cooperation with BTG Group	49	49
JI project – BTG Group	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	Government of the Kingdom of the Netherlands in cooperation with BTG Group	263	244
JI projects in the framework of PCF	energy savings and reduction of emissions in the framework of an AIJ project	CO_2	voluntary activities	implemented	CEA	0	1 300
Portfolio of projects	energy savings and use of renewable energy sources	CO_2, CH_4	voluntary activities	prepared	CEA	30	70

Explanation:
ME - Ministry of the Environment, MIT - Ministry of Industry and Trade, MA - Ministry of Agriculture, MT - Ministry of Transport, MRD - Ministry for Regional Development, MF - Ministry of Finance, ERA – Energy Regulation Authority, SEF - State Environmental Fund of the Czech Republic, CEA - Czech Energy Agency, PCF – Prototype Carbon Fund of the World Bank, GEF - Global Environment Facility, SEVEn – Centre for Effective Energy Use.
n/a - data not available or estimate cannot currently be made
The benefits from AIJ and JI projects are not included in the overall benefit for the Czech Republic.

3 Trends and Projections of Greenhouse Gas Emissions

Inventories of greenhouse gases controlled by the Convention monitor emissions and sinks of CO_2, CH_4, N_2O, HFCs, PFCs and SF6 and also of the precursors CO, NO_X and SO_2. The total impact of emissions of these gases is expressed as the aggregated emissions, i.e. the equivalent amount of carbon dioxide, taking into account the values of the radiation absorption effects of the global warming potential (GWP) for a time period of 100 years. It is prepared in accordance with the standard methodology of the Intergovernmental Panel on Climate Change (IPCC), a description of which and the manner of use in the CR, including emission factors and activity data, are contained in the National Inventory Report, which is updated annually (www.chmi.cz/cc/).

Following 1990, there was a substantial reduction in emissions as a consequence of restructuring of industry in the framework of transformation to a market economy. In subsequent years, a number of measures were implemented, leading to reduction of greenhouse gas emissions and thus, in spite of an increase in economic activity, there was no increase in greenhouse gas emissions. The measures are primarily oriented towards reducing the consumption of fuel and energy, as a consequence of which the production of greenhouse gas emissions is also reduced.

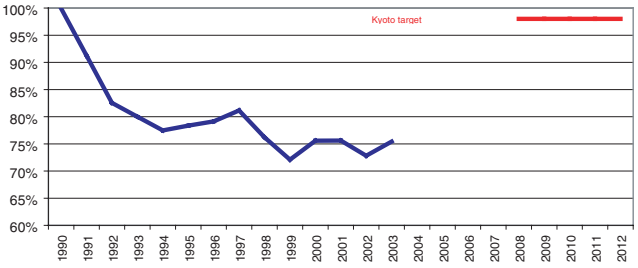
3.1 Trends in Emissions According to Gases

There was a reduction in total greenhouse gas emissions by almost 25% in the 1990 – 2003 period (Fig. 31.). It can be expected that this reduction will continue in the future, although at a slower rate. The greatest reductions occurred in CH_4 emissions by almost 40%, N_2O by 28% and CO_2 by 24%. Emissions of F-gases increased in the 1995 – 2003 period to 1.7 mil. t CO_2 equiv, which led to a change in the mutual ratio between the individual gases – the fraction of CH_4 decreased, that of F-gases increased and the fractions CO_2 and N_2O of remained more or less constant. CH_4 emissions decreased as a consequence of a reduction in brown coal mining and a reduction in the number of head of farm animals, especially cattle. The increase in emissions of F-gases is caused by increased use in the refrigeration industry to replace freons, which are prohibited by the Montreal Protocol.

Trends in aggregated emissions are depicted in Fig. 3.2; Tab. 3.1 gives the changes in emissions between the years 1990, 1995, 2000 and 2003. Emissions of F-gases have been monitored since 1995, which was also set as the base year for these substances; they have exhibited a strongly increasing trend since that time. The amount of HFCs employed has increased almost six-fold since that time, PFCs have increased eighty-fold and the use of SF_6 has doubled. In 2003, CO_2 emissions corresponded to 86% of total greenhouse gas emissions, methane to 7.1%, N_2O to 5.7% and F-gases to 1.2%.

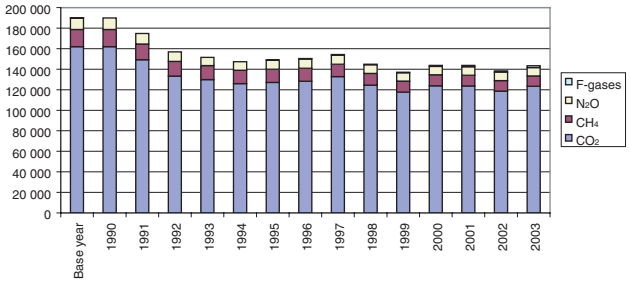
Detailed results for inventories of greenhouse gas emissions for the Czech Republic are given in the Fourth National Communication of the Czech Republic to the UN Framework Convention on Climate Change.

Fig. 3.1 Index of trends in greenhouse gas emissions 1990 - 2003



Source: CHMI

Fig. 3.2 Trend in the fractions of the individual greenhouse gases in total emissions in 1990-200351 [%]



Source: CHMI

Table 3.1 Trends in greenhouse gas emissions according to type in 1990, 1995 and 2003

	1990	1995	2000	2003	decrease 1990-2003	fraction of total change		
	[Gg CO_2 equiv.]					1990-95	1995-2000	2000-03
Total emisisns and sinks of CO_2	161 862	127 148	123 886	123 276	-23.8 %	0.90	0.08	0.02
CO_2 (without LULUCF)	163 990	131 398	127 902	127 124	-22.5 %	0.88	0.09	0.02
CH_4	16 763	12 855	10 714	10 210	-39.1 %	0.60	0.33	0.08
N_2O	11 266	8 754	8 175	8 157	-27.6 %	0.81	0.19	0.01
HFCs	0	2	674	1 344	608-krát		0.50	0.50
PFCs	0	0	9	29	82-krát		0.32	0.68
SF_6	0	167	206	339	103.4 %		0.23	0.77
Total emissions and sinks	189 891	148 926	143 665	143 354	-24.5 %	0.88	0.11	0.01
Total emissions (without CO_2 from LULUCF)	192 019	153 176	147 681	147 203	-23.3 %	0.87	0.12	0.01

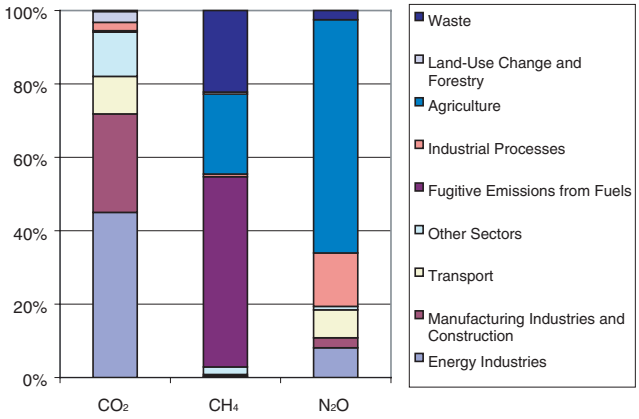
Source: CHMI

[51] *At the time of preparation of the document, not all the original data for 1991 and 1993 had not been converted to the CRF format*

3.2 Trends in Emissions According to Sectors

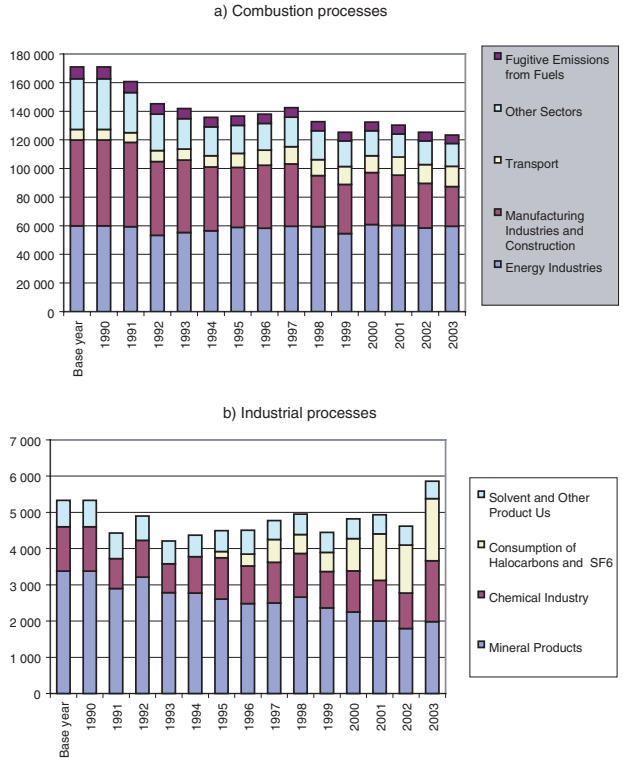
Between 1990 and 2003, there was a reduction in emissions in the *Combustion Processes* and *Agriculture* sectors, the emission values remained more or less constant in the *Industrial Processes* and *Waste* sectors, while there was an increase in emission sinks in the *Land-Use, Land-Use Change and Forestry* sector. Fig. 3.3 depicts the contributions of the sectors to emissions of the individual greenhouse gases and Fig. 3.4 a) to d) depicts the trends in total emissions in the individual sectors.

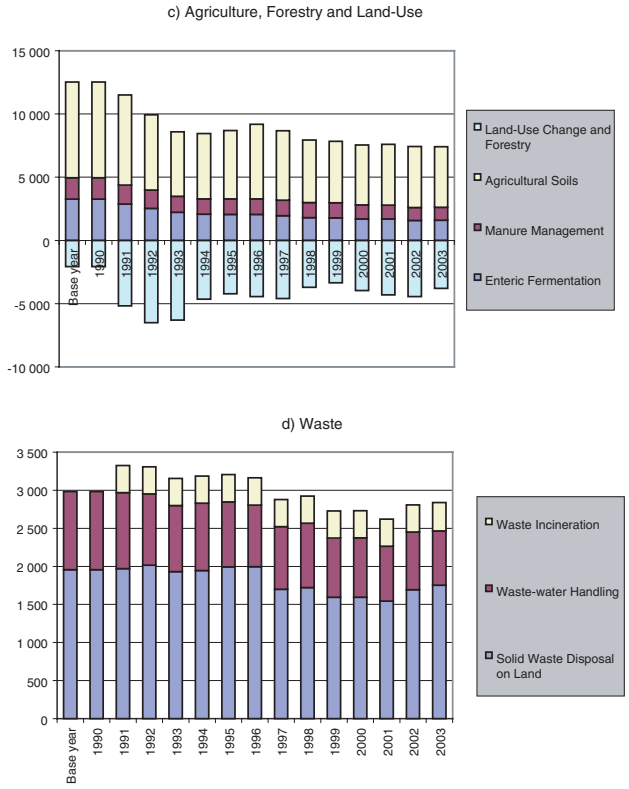
Fig. 3.3 Contributions of the sectors to emissions of the main greenhouse gases



Source: CHMI

Fig. 3.4 a) to d) Trends in greenhouse gas emissions in selected inventory categories [Gg CO_2 equiv.]





Source: CHMI

3.2.1 Combustion Processes

There was a very substantial decrease in total emissions in this sector, caused particularly by restructuring of industry after 1990 and also implementation of a number of measures leading to energy savings. Between 1990 and 2003, the consumption of fossil fuels decreased from 1841 to 1449 PJ, with a substantial increase in the fractions of liquid and gaseous fuels from 18 to 22% and from 13 to 23%, respectively. In spite of the increase in emissions from transport, there was an overall reduction in emissions in the *Manufacturing Industries and Construction* and *Other sectors* (households, institutions) while there was no substantial reduction in the *Energy* sector, as there was a substantial increase in exports of electrical energy. The cut-back in coal mining led to a reduction in fugitive methane emissions. The trend in aggregated emissions in this sector is depicted in Fig. 3.4 a).

3.2.2 Industrial Processes and Solvent Use

Emissions from this sector are more-or-less stable; the initial reduction in emissions from cement production was compensated by an increase in emissions of F-gases, which are used to replace prohibited freons. An increase in emissions can be expected in this sector in the future. The use of solvents makes a negligible contribution to this sector (0.3%). There was a reduction in emissions in this area as a consequence of replacement of solvent-based coatings by water-based coatings.

3.2.3 Agriculture

The reduction of emissions in this sector was caused by the transformation of agriculture after 1990, with a reduction in the number of head of farm animals and reduction in the use of

artificial fertilizers. The reduction in emissions is slow and prolonged compared to the other sectors. The results of emission inventories in this sector are given in Fig. 3.4 c).

3.2.4 Land-Use, Land-Use Change and Forestry

The determination of emissions and sinks in this sector follows from the balance of the increment in wood mass in forests and implemented harvesting. During the monitored years, the increment was always greater than harvesting and thus this sector exhibits an increase in CO_2 sinks (Fig. 3.4 c)). This is a slow, prolonged trend corresponding to the increase in the area of forest stands and their age structure.

3.2.5 Waste Management

Trends in emissions in this sector follow primarily from the amounts of landfilled and incinerated wastes and the amounts of waste waters, which do not change substantially, and thus emissions in this sector remain at a level of about 3 mil. t CO_2 equiv. The trend in aggregated emissions in this sector is depicted in Fig. 3.4 d).

3.3 Emission Projections

In accordance with the methodical instruction for preparation of projections, projections were prepared for the scenario without measures, with measures, i.e. with implemented measures, that came into effect in the 1995 – 2005 period, and with additional measures, i.e. with measures that are currently being prepared or have been prepared. Additional measures included in preparation of projections correspond to full implementation of the National Program of economic energy management and use of renewable and secondary energy sources, the introduction of environmental tax reform, implementation of the Directive on buildings and implementation of the "Industry and Business" and "Infrastructure" operational programs.

The projection was calculated in accordance with the recommended methodology and is based on the existing inventory of greenhouse gas emissions, collection and analysis of input data, establishing of initial assumptions, defining of scenarios and their calculation and performance of sensitivity analyses under selected assumptions.

The results of the projections of greenhouse gas emissions for all the processed scenarios are depicted in Fig. 3.5 and elaborated in Table 3.2 which, in addition to the values of projection emissions for 2005 to 2020, also gives the results of the latest available inventory of greenhouse gas emissions for 2003 classified for the individual IPCC activity sectors. The results of the updated projections indicate that a reduction of total greenhouse gas emissions by 26% can be expected to 2010 and by at least 38% to 2020, compared to the level in 1990.

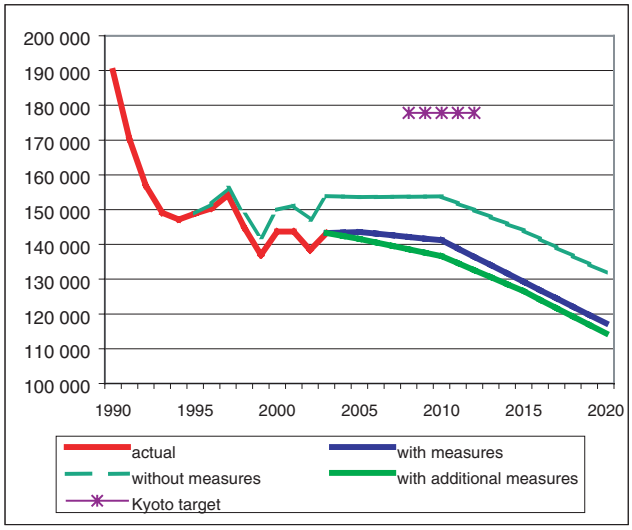
Detailed results for projections of greenhouse gas emissions for the Czech Republic are given in the Fourth National Communication of the Czech Republic to the UN Framework Convention on Climate Change.

Tab. 3.2 Projections of emissions of greenhouse gases in IPCC sectors [mil. t CO_2 equiv.]

	2003	2005	2010	2015	2020
Scenario without measures					
Energy	123.4	133.2	133.0	123.4	110.8
Industrial Processes	13.0	13.3	13.9	14.3	15.1
Solvent Use	0.5	0.5	0.5	0.5	0.5
Agriculture	7.4	7.6	7.6	7.7	7.7
Land-use and Forestry	-3.8	-4.0	-4.0	-4.2	-4.2
Waste	2.8	2.9	2.8	2.3	2.0
Total	143.4	153.6	153.8	144.0	131.8
Scenario with measures					
Energy	123.4	123.3	120.6	108.7	96.4
Industrial Processes	13.0	13.3	13.9	14.3	15.1
Solvent Use	0.5	0.5	0.5	0.5	0.5
Agriculture	7.4	7.6	7.6	7.7	7.7
Land-use and Forestry	-3.8	-4.1	-4.1	-4.2	-4.3
Waste	2.8	2.9	2.8	2.3	2.0
Total	143.4	143.6	141.2	129.3	117.3
Scenario with additional measures					
Energy	123.4	121.3	116.0	106.0	93.5
Industrial Processes	13.0	13.3	13.9	14.3	15.1
Solvent Use	0.5	0.5	0.5	0.5	0.5
Agriculture	7.4	7.6	7.6	7.7	7.7
Land-use and Forestry	-3.8	-4.1	-4.1	-4.2	-4.3
Waste	2.8	2.9	2.8	2.3	2.0
Total	143.4	141.6	136.6	126.5	114.4

Source: ENVIROS, s.r.o., CHMI

Fig. 3.5 Projections of total emissions of greenhouse gas [Gg CO_2 equiv.]



Source: ENVIROS, s.r.o., CHMI

3.4 Meeting Emission Commitments

As follows from the previous text of this part, meeting of the emission commitments of the Czech Republic following from ratification of the Protocol is not endangered. The reduction in total emissions and the increase in sinks between 1990

and 2003 equalled 23.8% and emission projections indicate a reduction in emissions and increase in sinks in the 2005 – 2010 period by a further 2.4 and 5%, respectively. Consequently, it is clear that the Czech Republic will meet its quantitative commitments pursuant to Article 3 of the Protocol.

3.5 Reporting for the Kyoto Mechanisms

At the present time, the Czech Republic is preparing information required for meeting the requirements of the Convention and Protocol related to the number of assigned amount units (AAU) and the compulsory national Commitment Period Reserve according to the Protocol. Work is progressing primarily in connection with preparation of the national inventories and reporting in the sector of Land-Use, Land-Use Change and Forestry. Records of the numbers of AAU and other units transferred in the framework of use of the Kyoto mechanisms will progress in the framework of the national registry. This registry is expected to be established and brought into operation in connection with technical and functional specifications based on experience gained in operation of the index of emission allowances pursuant to Act No. 695/2004 Coll., on conditions for trading in greenhouse gas emission allowances and amending some laws.

3.6 Reporting for the Sector of Land-Use, Land-Use Change and Forestry

The Czech Republic as a party to the Convention and Protocol must prepare the emission inventory methodology in the sector including agricultural land in the categories according to Land-Use, Land-Use Change and Forestry (LULUCF) according to the newly approved Good Practice Guidance of the Intergovernmental Panel on Climate Change (GPG LULUCF, IPCC 2003). The 2003 IPCC GPG-LULUCF methodology is recommended for greenhouse gas emission inventories submitted after 2005. It is expected to be fully implemented in national inventories by the end of 2006. Decisions must be made to the end of 2006 on a number of aspects related to reporting the emission balance in this sector, which will be important for the first and next review periods of the Protocol.

The current state of the methodology employed in the Czech Republic corresponds roughly to former requirements on emission inventories in the LUCF/LULUCF sector for the emission inventory in the framework of commitments for the Convention. The conclusions of the control process for the Convention on the greenhouse gas emission inventory for 2001, which took place in the autumn of 2003, outline the shortcomings of this methodology. Together with the implementation of 2003 IPCC GPG-LULUCF, it is necessary to review and extend the inventory to include further information, especially in relation to supplementary data from the LULUCF sector in the framework of the requirements of the Protocol and Marrakesh agreements. The current method of preparing the inventory for the LUCF sector is drawn up in the framework of the emission balance of the state. Its preparation has been coordinated by CHMI since 1995. The current methodology was prepared in 1997 on the basis of a study prepared by the Forest Management Institute (Henžlík et al. 1994). From the standpoint of the 2003 IPCC GPG-LULUCF criteria, the procedures can be described as a second-level methodology, because they employ nationally-specific recalculation coefficients and take into account broad-leaved and narrow-leaved species, the individual components of tree biomass, etc. From the standpoint of reporting land categories, only the category of land containing forests or woody biomass stocks have so far been quantified, i.e. category 5A of the original 1996 IPCC GL methodology. No reporting was performed for the other land categories in the Czech Republic. The current calculation for land category 5A is based on the principle of determination of the degree of absorption and losses of carbon for the area of the given category of land use. Absorption is determined on the basis of the quantified wood increment based on information in the forest management plans (FMP) while losses are derived on the basis of recorded data on performed harvesting; the area of the stand land is determined on the basis of recorded data in the FMP and forest management schemes (FMS). These data are administered by the Forest Management Institute. Basic information for calculation of changes in carbon stocks in forest ecosystems for use in the emission balance consist in 1) the area of the land category and 2) information in increments and losses in biomass. These fundamental data are based on information from FMP and FMS. The program of the National Forest Inventory of the Czech Republic (NFI) constitutes a qualitatively new means of determining the state of forests; in contrast to FMP/FMS data, it provides objectively determined (measured) information on forests. From the standpoint of the requirements of the Convention and Protocol, the use of NFI data will provide a substantial benefit and qualitative shift in reporting information.

In relation to the state of fundamental data that can be employed for preparing the national emission inventory in the LULUCF sector and in relation to the set deadlines for recommended implementation of 2003 IPCC GPG-LULUCF in the national inventory system, pragmatic strategy consists in the following steps:

1. review and supplement the current procedure in emission balance inventories in the LULUCF sector, i.e. the first general IPCC method based on FMP/FMS.
2. prepare an reviewed method on the basis of repeated NFI studies to permit application of the second general IPCC method.

The change in the methodical procedure according to 2003 IPCC GPG-LULUCF should also reflect the conclusions of the last international control of the CR emission inventory for 2001, which was performed in 2003.

4 Estimation of the Impact of Measures to Reduce Greenhouse Gas Emissions

The targets and impacts of most of the adopted measures are usually much broader, as it is necessary to reduce the negative impacts on the environment as a whole.

The vast majority of measures are concerned with the energy sector, as this sector currently contributes 86.1% to total greenhouse gas emissions, of which 82.0% are emitted by combustion processes; the energy industry contributes 41.6%, the processing industry 19.4% and transport 9.8%, etc. In choice of measures, emphasis is placed in reduction of carbon dioxide emissions, which correspond to 86% of total emissions.

Frequently, it is very difficult to estimate the contributions of the individual activities, especially less important activities, with sufficient accuracy. Overall estimation of the impact of measures to reduce greenhouse gas emissions is based on preparation of projections of greenhouse gas emissions for the period to 2020, where projections were made in accordance with the methodical instructions for scenarios without measures, with measures (those which came into force in the 1995 – 2005 period) and additional measures (those which are currently prepared or being prepared).

The measures included are given in Chapter 2 and summarized in Tab. 2.1; additional measures correspond to full implementation of the National Program of economic energy management and use of renewable and secondary energy sources, the introduction of environmental tax reform, implementation of the Directive on buildings and implementation of the "Industry and Business" and "Infrastructure" operational programs.

The overall effect of measures already adopted to reduce greenhouse gas emissions for 2010, 2015 and 2020, given in Tab. 4.1, follow from the differences between the results for the individual scenarios.

Tab. 4.1 Overall estimate of the impact of measures to reduce greenhouse gas emissions in 2010 – 2020 [mil. t CO_2 equiv.]

	2010	2015	2020
Energy	12.4	14.7	14.4
Industrial Processes	0.0	0.0	0.0
Solvent Use	0.0	0.0	0.0
Agriculture	0.0	0.0	0.0
Land-Use and Forestry	0.1	0.0	0.1
Waste	0.0	0.0	0.0
Total	12.6	14.7	14.5

Source: ENVIROS, s.r.o., CHMI

Tab. 4.2 gives an estimate of the overall impact of additional measures on reducing greenhouse gas emissions to 2010, 2015 and 2020, beyond the framework of the impact of measures already adopted.

Tab. 4.2 Overall estimate of the impact of additional measures to reduce greenhouse gas emissions in 2010 – 2020 [mil. t CO_2 equiv.]

	2010	2015	2020
Energy	4.6	2.7	2.9
Industrial Processes	0.0	0.0	0.0
Solvent Use	0.0	0.0	0.0
Agriculture	0.0	0.0	0.0
Land-Use and Forestry	0.0	0.0	0.0
Waste	0.0	0.0	0.0
Total	4.6	2.7	2.9

Source: ENVIROS, s.r.o., CHMI

It is difficult to evaluate the impacts in Tab. 4.1 and 4.2 for the sectors outside of the Energy sector, or their effects are less than the rounded-off value given.

It also follows from the prepared projections that a reduction of total greenhouse gas emissions by 26% can be expected to 2010 and by at least 38% to 2020 compared to the level in 1990 (see also Tab. 4.3).

Tab. 4.3 Projection reductions in total greenhouse gas emissions compared to 1990 [%]

	2010	2015	2020
Scenario with measures	26	32	38
Scenario with additional measures	28	33	40

Source: ENVIROS, s.r.o., CHMI

5 Progress in Meeting other Commitments

5.1 Emission Inventory

The Czech Hydrometeorological Institute has performed inventories of greenhouse gas emissions since 1995 and submits them to the Secretariat of the Convention through the national contact person. This activity has been performed to date in the Czech Republic on the basis of projects or through *"ad hoc"* authorization of the Czech Hydrometeorological Institute. The inventory is prepared for the 1990 – 2003 period; since 1998 data have been provided in the CRF format. Recalculation of the emission time series from 1990 has been partly completed and submitted to the Secretariat of the Convention and the remaining gaps are regularly filled and shortcomings are remedied. Measures are implemented to ensure that consistent time series of emission data are available for 1990 – 2004 by April 15, 2006, including calculation for the *Land-Use, Land-Use Change and Forestry (LULUCF)* sector according to the new GPG LULUCF 2003 methodology. Work on application of the new methodology is progressing with full intensity; nonetheless, it is not yet known when all the data necessary for its application will be

available in the Czech Republic. The entire emission time series for the LULUCF sector will be submitted to the Secretariat of the Convention by April 15, 2006.

In preparing the inventories, the Czech Hydrometeorological Institute has long worked with a quite stable team of sectoral workers, consisting in research, academic and private workplaces specializing in energy production, transport, forestry, agriculture and wastes.

Pursuant to Decision 20/CP.7, it is necessary to create a fully functional national system to provide for regular annual inventories of greenhouse gas emissions according to the internationally binding methodology by January 1, 2007. The greatest emphasis will be placed on the inventory for the year 1990, as the reference year for the Protocol, and also on all years to the present time. In the interest of simplifying control and ensuring transparency of the inventory, it must be supplemented by sets of auxiliary information, which will facilitate control of the results (basic statistical indicators, emission factors, parameters used for the calculation, etc.). As the body of the state administration responsible for meeting international commitments, in 2005 the Ministry of the Environment prepared establishment of this system. In this position, it names the institution responsible for the quality and timeliness of submission of the results of inventories and also provides suitable financial and personnel capacity for its activities, including conditions for cooperation with the Czech Statistical Office, concerned ministries, etc. with other cooperating entities, especially in relation to provision for regular availability of the necessary statistical data. This task will be implemented systematically so that the approved national inventory system can be operated without substantial changes for a sufficiently long period of time.

In March 2005, the Ministry of the Environment approved a proposal that fully respected the requirements on the creation of a highly functional national system according to Decision 20/CP.7. In June 2005, its operation was entrusted to the Czech Hydrometeorological Institute, which has prolonged experience in preparation and coordination of inventories and two of whose employees have participated for several years in international control inventories as experts or heads of international expert teams and as authors in the preparation of a new methodology for the Intergovernmental Panel on Climate Change, which will come into effect in 2007. This authorization is valid for the 2006 – 2008 period. It is expected that, following evaluation of experience gained in operation of the system in 2006 and 2007, the authorized institution will be confirmed in 2008 for work on the national inventory system for the period following 2008, or that the relevant changes will be implemented in organizational and financial matters.

5.2 Adaptation Measures

Adaptation measures must be employed to reduce the negative and increase the positive impacts of climate change, but cannot be employed to prevent all impacts. The ability to adapt depends primarily on the availability of financial resources, technologies, levels of education, available information, suitable planning and the overall infrastructure.

Foreign experience has indicated that formulation of suitable adaptation measures is highly acceptable in a number of cases, especially over the longer term. This area also encompasses support for scientific research on climate change, an improvement in the observation system and an improvement in forecasting and integrated warning systems on a national scale. The importance of adaptation measures in the Czech Republic is emphasized, amongst other things, by the increased frequency of the occurrence of extreme weather conditions in the territory of the Czech Republic in recent years and the ever increasing damage caused by extreme weather conditions. Consequently, it is necessary to plan the attitude of the state in the area of adaptation measures strategically and simultaneously sufficiently far in advance.

The National Program elaborates specific sector adaptation measures and attributes to them the same level of importance as that of measures related to reduction of emissions.

The **water management sector** is clearly most sensitive to climate change under the conditions in the Czech Republic. Adaptation measures for this sector are concerned mainly with implementation of measures leading to an increase in the water retention properties of the landscape, restoration of individual systems, reduction of affecting of water quality by contamination, the safety of water works against overflowing, a change in the controllable retention space, an increase in the capacity of safety overflows, an increase in the effectiveness of management of water works under nonstationary conditions and the decision-making process in dangerous and uncertain situations. Suitably selected measures, respecting the technical and natural conditions in the individual water works, can reduce the risk following from flood situations.

Further measures can be directed towards achieving greater flexibility and effectiveness of water management systems and comprehensive and integrated use of water sources, which will be favourably manifested especially under extreme conditions, i.e. in long periods without precipitation, similar to prolonged precipitation with subsequent floods. The regular provision for safe passage of major floods through the affected territory and continuous increasing of the water retention ability of the landscape are also important adaptation measures. In recent years and especially following the experience with the extensive floods in 1997, 1998 and 2002, there has been a considerable improvement in the level of transfer of information and of the activities in the entire Integrated Rescue System.

The **agricultural sector** is the second most vulnerable sector in the Czech Republic. Agricultural activities will undoubtedly be affected by climate change; nonetheless, in contrast to other sectors, the impacts can be relatively easily affected by changing the species composition and farming methods. This sector is unusual in that, in addition to detrimental effects, a number of favourable effects may occur (prolonging of the frost-free period, prolonging of the vegetation period, favourable changes in other phenophases and earlier ripening or harvesting, increased rate of photosynthesis, etc.). Adaptation measures are oriented towards changes in the cultivated varieties of agricultural crops and farm animals, the use of new agrotechnical methods especially to reduce losses of soil moistures, provision for reproduction of soil fertility, increasing the stability of the land from the standpoint of the danger of erosion, and improvement and expansion of the use of irrigation for growing special crops, etc. The most complex task will apparently consist in finding suitable ways of resisting increased pressure from infectious diseases, caused by fungi and insects, and the increased competitive pressure from the growth of weeds.

The impacts on **forest ecosystems** will differ considerably from region to region and thus adaptation measures must be the result of long-term planning, taking into consideration the specific features of the individual forest areas and local predictions of potential danger. In general, the most important measure consists in increasing the adaptation potential of forests through species, genetic and age diversification of tree stands. The most drastic adaptation measure consists in an enforced change in the species composition of stands and a change in the clear-cutting management method for undergrowth methods. Similarly as in the agricultural sector, measures will also have to be directed towards elimination of the risk of increased populations of insect pests, vascular mycosis and especially root rot.

The National Program to Mitigate the Impacts of Climate Change specifies the individual orientation of the adaptation measures in greater detail and, in this sense, requires especially the Ministry of Agriculture to cooperate with the Ministry of the Environment in work on specification and gradual implementation of these measures. From this point of view, it is also necessary that the Ministry of Agriculture, similarly to the manner in which it is concerned with measures in the water management sector, be likewise concerned with preparation of measures in agriculture and forestry. A significant shortcoming of all the so-far prepared and introduced adaptation measures lies in the fact that insufficient attention has been paid to the aspect of their economic analysis.

5.3 Access to Technologies and their Use

Cooperation with member states of the EU in the area of use of technologies with low production of greenhouse gas emissions, with specific emphasis on the fastest possible utilization in the state and private sector, is a strategic priority. The Integrated National Program to Reduce Emissions plays an important role here and is concerned, amongst other things, with reducing the emissions of basic pollutants (particulate matter, sulphur dioxide, nitrogen oxides, etc.), which are regulated by the Czech legislation at a higher level than at the individual air pollution sources through announcement of emission ceilings or air-pollution limit levels. The program is conceived as part of the air protection system and is accompanied by the National Program to reduce emissions of particulate matter, sulphur dioxide and nitrogen oxides from existing especially large combustion sources of air pollution. It is concerned to achieve the emission limit values for each existing source by January 1, 2008 at the latest. In the framework of this national program and the subsequent regional programs and concepts, proposals were also prepared in 2003 – 2004 for reduction of greenhouse gas emissions, especially in the energy sector. Implementation of new technologies is frequently confronted by problems of an economic character (especially in the state sphere) and low awareness levels (particularly in the private sector).

5.4 Scientific and Technical Development

In the framework of long-term tasks of research institutions and universities, research is carried out on the properties of observed and model series and fields of climatic variables, with emphasis on variability and the occurrence of extreme phenomena, changes in atmospheric circulation, interconnections between components of the climate system and estimates of climate changes, the potential for modelling the climate on a regional scale, methods of statistical downscaling and the causes of climate changes, especially in relation to solar activity. In addition, reconstruction of the climate is performed on the basis of historical observations and underground boring. Work was carried out on a number of grant projects in 2002 – 2005, with emphasis on the above subject areas.

Research in the Czech Republic is concentrated mainly in the National Climate Program of the Czech Republic, which works as an association of legal persons (currently 14 scientific and research workplaces) entrusted in the Czech Republic with performance of the tasks of the World Climate Research Programme of the World Meteorological Organization, assistance in creation of research teams of scientists in the area of the climate and publication of the results obtained. In recent years, there has also been a substantial increase in participation of institutions in the Czech Republic in international projects concerned with modelling the climate, determination of the uncertainty of climate changes and estimation of the impacts of climate changes. This work is concentrated particularly in the PRUDENCE 2001 – 2004, SOLICE 2000 – 2003, MAGMA 2003-2005, QUANTIFY 2005-2010 and ENSEMBLES 2004-2009 projects.

Cooperation is also implemented in preparation and reviewing the chapters of the Fourth IPCC Assessment Report and on the review process for special or technical IPCC reports; one worker was selected by the IPCC Secretariat for the position of the head of the review team. The lack of financial funds set aside in general in the Czech Republic for science and research, the limited personnel capacities oriented towards this aspect and the complete lack of financial means allocated from the state budget to support IPCC activities prevent more extensive scientific research in the area of climate change.

The international workshops and conferences *Workshop on Regional Climate Modelling and Mini-Symposium on Climate Change in Europe, Prague (2004)* and *Workshop on Global Change in 20th Century and Seasonal and Interannual Climate Prediction, Prague (2004)* were held in the Czech Republic on the subject of modelling and climate change.

5.5 Provision for Capacities in the Area of Climate Change

5.5.1 National Activities

In the Czech Republic, the Ministry of the Environment is responsible for implementation of the Protocol and is simultaneously the supreme control body of the state administration in the area of protection of the environment. The relevant duties follow particularly from signing of the Convention and Protocol, from Decision No 280/2004/EC and from Government Resolution No. 187/2004, in which the Government approved the National Program to Mitigate the Impacts of Climate Change in the Czech Republic. Further duties follow from the related documents adopted at the Conference of Parties of the Convention and adopted and prepared Directives of the European Union (EU) related to the area of climate change.

The aspect of climate change is the responsibility of the Climate Change Department, which is part of the Foreign Relations Section of the Ministry of the Environment. The National Focal Point for the Convention in the Czech Republic is also part of the Climate Change Department. Because of the cross-cutting character of the issue of climate change, which affects a number of professional entities, the sector encompasses the Working Group for Climate Change of the Ministry of the Environment, which acts as a consulting body for the Minister of the Environment and whose members include representatives of the substantively competent departments. The Interministerial Commission on Climate Change also acts as a consulting body for the Minister of the Environment in providing for implementation of the Convention and Protocol. The Deputy Minister – Director of the Foreign Relations Department of the Ministry of the Environment is the chair of the commission; the members consist in representatives of the professional sections of the Ministry of the Environment, other ministries, the Senate of the Parliament of the Czech Republic and the Chamber of Deputies of the Parliament of the Czech Republic. The main tasks of this Commission consist in discussion of materials and approaches of an intersectoral nature, where it is necessary to resolve the individual aspects of the given issue in cooperation with the affected sectors.

According to the character of the measures, the corresponding sectors (of the environment, industry, transport, agriculture, finances, etc.) are responsible for preparation and implementation of specific measures to reduce greenhouse gas emissions and adaptation measures.

In connection with the increasing volume of the agenda and with attempts to effectively implement all the requirements of the Protocol, it will be necessary in the future to further increase personnel capacity in the area of climate change as provision is not made at an acceptable level for all the requirements following from the Protocol.

5.5.2 International Activities

The Czech Republic also participates in the creation of capacities in developing countries and other countries. A survey of projects of foreign developmental assistance under the responsibility of the Ministry of the Environment in 2004, which are also related to climate change, is given in Chapter 6.5 of the Communication of the Czech Republic on the Kyoto Protocol (Annex to the Fourth National Communication of the Czech Republic on the UN Framework Convention on Climate Change).

5.6 Assistance to Developing Countries

The Czech Republic is not a country listed in Annex II of the Convention and thus the duty to adopt measures and fulfil obligations following from Articles 4.3, 4.4 and 4.5 of the convention and especially to create further financial sources does not follow for it from Article 12.3 of the Convention.

The foreign developmental cooperation of the Czech Republic has exhibited a constant increase in recent years that is in accordance with the role of this country as an emerging donor and new EU member. This increase is a consequence of both the increasing volume of funds designated for developmental assistance and also of the better statistical reporting of the Ministry of Foreign Affairs. The Barcelona commitment has been included in the *soft acquis* for the EU member states. At the present time, discussions are being carried out on a proposal by the European Commission that the new member states should approach a foreign aid level of 0.17% by 2010 and should attain a fraction of 0.33% GDP by 2015. However, it cannot be expected that these targets could be achieved on the part of the CR if the current trends are preserved; at the present time this value corresponds to a level of 0.10 – 0.11%. However, in most cases, it is not possible to specify the part of these finances that is directed to the area of climate change.

6 Conclusions

6.1 Meeting Targets

On the basis of the information contained in this Report, it can be stated that the Czech Republic has achieved demonstrable progress in reducing overall greenhouse gas emissions since 1990 (reference year for the Protocol). The rapid decrease in total emissions of greenhouse gases after 1990 was caused by the cut-back in production and subsequently also the restructuring of the economy, as one of the fundamental consequences of the fundamental changes in the political system. However, a number of measures implemented after 1990 also contributed to the reduction in emissions. These consist in both framework measures and measures concentrating on a certain aspect or sector. In recent years, attention has also begun to be paid to measures to mitigate the impacts of climate change (adaptation measures). However, the targets and impacts of most of the adopted measures are usually much broader, as it is necessary to reduce the negative impacts on the environment as a whole.

It follows from the updated projections of greenhouse gas emissions to the year 2020 that the Czech Republic will most probably not have difficulties in meeting the reduction targets set by the Protocol for the first review period, i.e. reduction of aggregate greenhouse gas emissions by the 2008 - 2012 period by 8% compared to 1990. On the other hand, the Czech Republic continues to have a relatively high energy intensity for creation of GDP and a high volume of emissions of greenhouse gases when calculated per inhabitant. The Czech Republic will attempting to bring these values closer to those for the European Union countries in the foreseeable future. This is the main motivation for establishing further measures to reduce greenhouse gas emissions contained in the National Program to Mitigate the Impacts of Climate Change, which was approved by the Government of the Czech Republic in March 2004.

Inventories of greenhouse gas emissions are prepared in accordance with the standard methodology of the Intergovernmental Panel on Climate Change (IPCC). A detailed description of the methodology, emission factors employed and activity data are contained in the National Inventory Report, which is updated annually. Work was commenced at the beginning of 2005 on creation of the National Inventory System according to Art. 5 of the Protocol.

In connection with flexible mechanisms, the Czech Republic has made considerable progress in relation to joint implementation (JI) projects pursuant to Art. 6 of the Protocol. A methodology has been created for submitting and assessing

JI projects and priority areas have been established for these projects. However, it will be necessary to update this area and elaborate it in more detail in some aspects.

The Czech Republic also supports science and research in the area of climate change. Scientific research projects in this area are especially connected with the National Climate Program (NCP), which is an association of legal persons established on January 1, 1994. At the present time, NCP provides for tasks following from the World Climate Program, coordinated by the World Meteorological Organization. This work consists particularly in obtaining climatological data and monitoring the climate, processing climatological data, estimation of the impacts of climate change on human lives and activities and estimation of the impacts of human activities on the climate, investigation of the interconnections between the components of the climate system and estimates of climate changes. The Czech Republic cooperates in a number of international projects in this area and also supports projects in developing countries (e.g. training courses, installation and calibration of instruments, creation of a climatological database).

6.2 Remediation of Shortcomings

Because of the continuing relatively high energy intensity of creation of GDP and the large volume of greenhouse gas emissions per inhabitant in the Czech Republic, priorities in this country must continue to emphasize particularly the preparation and implementation of further effective measures to reduce greenhouse gas emissions. Priorities must also include adaptation measures, the flexible mechanisms of the Protocol (related to the aspect of registers), and provision for operation of the National Inventory System according to Art. 5 of the Protocol. It is also necessary to increase the effectiveness of the work of the state administration (cooperation of the individual sectors, communication with the private sector and with NGO's). Last but not least, it is necessary to exert efforts to increase capacities in the area of climate change as, in relation the growing agenda in this area and the increasing general importance of this subject in the medium and long term, provision for these areas on the basis of the existing capacities is probably unsustainable. It is very important to continue to create and extend capacities in developing countries in the area of climate change.

Abbreviations

Abbreviation	Meaning
AAU	Assigned Amount Units
AIJ	activities implemented jointly
CAIT	Climate Analysis Indicators Tool
CDM	Clean Development Mechanism
CENIA	Czech Environmental Information Agency
CEZ	Czech Power Company
CHMI	Czech Hydrometeorological Institute
CSO	Czech Statistical Office
CEA	Czech Energy Agency
CFC	chlorofluorocarbons
COP	Conference of Parties to the Convention
DCPES	domestic consumption of primary energy sources
ECCP	European Climate Change Program
EDF	European Development Fund
EEEA	environmental education, enlightenment and awareness
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
ERA	Energy Regulation Authority
FMP	forest management plan
FMS	forest management scheme
GAW	Global Atmosphere Watch
GCM	global circulation models
GCOS	Global Climate Observing System
GDP	gross domestic product
GEF	Global Environmental Facility
GHG	greenhouse gas(es)
GPG	Good Practice Guidance
GWP	global warming potential
HFCs	hydrofluorocarbons
HCFC	hydrochlorofluorocarbons
IBRD	International Bank for Reconstruction and Development /World Bank
IFC	International Financial Corporation
IPCC	Intergovernmental Panel on Climate Change
IPPC	integrated pollution prevention and control
JI	joint implementation
KP	Kyoto Protocol
LUCF	Land-Use Change and Forestry
LULUCF	Land-Use, Land-Use Change and Forestry
MA	Ministry of Agriculture
ME	Ministry of the Environment
MERO	methyl ester of rapeseed oil
MEYS	Ministry of Education, Youth and Sports
MH	Ministry of Health
MIT	Ministry of Industry and Trade
MP	Montreal Protocol
MRD	Ministry for Regional Development
MT	Ministry of Transport
NCEF	National Centre for Environmental Forecasts
NCP	National Climate Program
NFI	National Forest Inventory
NMVOC	nonmethane volatile organic compounds
ODA	Official Developmental Assistance
OECD	Organization for Economic Cooperation and Development
PCF	Prototype Carbon Fund
PES	primary energy sources
PFCs	perfluorocarbons
PREC	atmospheric precipitation
RES	renewable energy sources
SEVEn	Centre for Effective Energy Use
SEF	State Environmental Fund
SRAD	solar radiation
TCPES	total consumption of primary energy sources
TMAX	daily maximum temperature
TMIN	daily minimum temperature
TRC	Transport Research Centre
UCTE	Union for Coordination of Transmission of Electricity
UN FCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization