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Content

List of Abbreviations

AAU	Assigned amount unit
AS CR	Academy of Sciences of the Czech Republic
B30	Alternative fuel for diesel engines, diesel fuel blended with 30% of the fatty acid methyl esters of rapeseed oil
B100	Hundred percent biodiesel
BaP	Benzo(and)pyrene
BAT	Best Available Techniques
BDMW	biologically degradable municipal waste
BR1	1st Biennial Report of the Czech Republic
BREF	Best Available Techniques Reference Documents
CDA	Czech Development Agency
CDM	Clean Development Mechanism
CEI	Czech Environmental Inspectorate
CEMC	Czech Environmental Management Centre
CENIA	CENIA, Czech Environmental Information Agency
CER	Certified emission reduction
CF4	Tetrafluoromethane
CFC	Chlorofluorocarbons
CGS	Czech Geological Survey
CH_4	Methane
CHMI	Czech Hydrometeorological Institute
CNCS	Czech Nature Conservation Society
CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	Carbon dioxide
COSMC	Czech Office for Surveying, Mapping and Cadastre
CRF	Common Reporting Format

CSEUR	Consolidated System of EU Registries
CTF	Common Tabular Format
CzSO	Czech Statistical Office
DES	Data Exchange Standards
E85	Alternative fuel - a blend of 85 percent bioethanol produced from agricultural raw materials and 15 percent gasoline
EC	European Community
EC	European Commission
ECCP	European Climate Change Programme
ECOP	Education for Competitiveness Operational Programme
EEA	European Environment Agency
EEA	European Economic Area
EE&A	Environmental education and public awareness
EMAS	Eco-Management and Audit Scheme
ERO	Energy Regulatory Office
ERU	Emission reduction unit
EUA	European Union Allowances
EUAA	European Union Aviation Allowances
EU ETS	European Union Emission Trading System
EUTL	European Union Transaction Log
FACCE	Food security, Agriculture and Climate Change
FDC	Foreign development cooperation
FEP	Framework educational programmes
FMI	Forest Management Institute
FSF	fast start finance
GAECs	Good Agricultural and Environmental Conditions
GAV	Gross added value
GCM	Global climate models
GDP	Gross domestic product
GEF	Global Environment Facility

GEO	Group on Earth Observations
GEOSS	Global Earth Observations System of Systems
GHGs	Greenhouse gases
GIS	Green Investment Savings (Programme) (Czech Green Investment Scheme)
GIS	Geographical Information System
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbons
HFC, HFCs	Hydrofluorocarbons
IBRD	International Bank for Reconstruciton and Development
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
JI	Joint Implementation
KP	Kyoto Protocol
LA	level assessment
lCER	Long-term certified emission reduction
LCV	light commercial vehicle
LHP	large hydropower plant
LPG	Liquified petroleum gas (Propane-butane)
LULUCF	Land Use, Land Use Change and Forestry
MEAs	Multilateral Environmental Agreements
MERO	Methyl ester of rapeseed oil
MEYS	Ministry of Education, Youth and Sports
MFA	Ministry of Foreign Affairs
MIT	Ministry of Industry and Trade
MoA	Ministry of Agriculture
MoE	Ministry of the Environment
MoT	Ministry of Transport
MRD	Ministry of Regional Development

MU Brno	Masaryk University Brno
N	Nitrogen
N_2O	Nitrous oxide, dinitrogen oxide
NA	not applicable
NAP	National Allocation Plan
NC6	6th National Communicaiton of the Czech Republic under the UNFCCC
NE	not estimated
NER	New Entrant Reserve
NGO	nongovernmental nonprofit organization
NIR	National Inventory Report
NIS	National Inventory System (greenhouse gases)
NMVOC	Non-methane volatile organic compounds
NO	not occuring
NO	Nitrogen oxide
NOx	Nitrogen oxides
NPP	nuclear power plant
NSRF	National Strategic Reference Framework
ODA	Official Development Assistance
ODS	ozone depleting substances
OPE	Operational Programme Environment
OPEI	Operational Programme Enterprise and Innovations
OPT	Operational Programme Transport
OSCE	Organisation for Security and Co-operation in Europe
PAH	Polycyclic aromatic hydrocarbons
PCF	Prototype carbon fund
PES	primary energy sources
PFC, PFCs	Perfluorocarbons
(S)PM10	Suspended particulate matter under 10 microns in size
(S)PM2.5	Suspended particulate matter under 2.5 microns in size
PPP	Purchasing power parity

PPS	Purchasing power standard
QA	Quality assessment
QC	Quality control
RES	renewable energy sources
RCM	Regional climate models
R&D	research and development
RMU	Removal unit
SDS	Sustainable Development Strategy
SEA	Strategic Environmental Assessment
SEF	Stadard Electronic Format
SEF CR	State Environmental Fund of the Czech Republic
SEP	State Environmental Policy
SEPs	school education programmes
SF_6	Sulphur fluoride
SFSD	Strategic Framework for Sustainable Development
SHMI	Slovak Hydrometeorological Institute
SHP	small hydropower plant
SMW	solid municipal waste
SO_2	Sulphur dioxide
SOx	Sulphur oxides
SPA	specially protected areas
STS	solid pollutaning substances
TA	trend assessment
tCER	Temporary certified emission reduction
T.G.M. W.R.I.	T. G. Masaryk Water Research Institute
TMA	maximum temperature
TMI	minimum temperature
TRC	Transport Research Centre
TSES	Territorial System of Ecological Stability
UNFCC	United Nations Framework Convention on Climate Change

VOC	Volatile organic compounds
WAM	with additional measures
WEM	with existing measures
WHO	World Health Organisation
WHRU	waste heat recovery unit
WMO	World Meteorological Organisation
WMP	Waste Management Plan
WTO	World Trade Organisation
WWTP	waste water treatment plant

1 SUMMARY

Introduction

The Czech Republic, as a Party to the United Nations Framework Convention on Climate Change (Convention/UNFCCC), acceded to the Kyoto Protocol (Protocol/KP) on 15 November 2001. The Czech Government subsequently set the 2005 national emission target, corresponding to reduction of greenhouse gas emissions by 20% taking 1990 as the reference year by its Resolution No. 38/2001. The State Environmental Policy 2012-2020 set subsequent emission target per capita to be achieved by 2020 at the average EU-27 value valid as of 2005 (10.5 t CO_2/capita).

The Czech Republic is further committed, on the basis of the joint EU commitment (December 2008) to reduce greenhouse gas emissions by at least 20% by 2020 in comparison with 1990 levels or, if new international agreement is reached, by 30%. The EU climate and energy package further imposes on the Czech Republic the commitment to reduce emissions by 21% (by 2020 with 2005 as reference year) in sectors covered by EU ETS and in sectors outside EU ETS not to increase emissions by more than 9% during identical period.

National conditions

The Czech Republic is a parliamentary democracy; the supreme legislative body is a two-chamber Parliament. Executive power rests with the Government that is formed based on results of general elections into the lower house of Parliament – Chamber of Deputies. The Czech Republic is a member of UN, EU, NATO, OECD, WTO, IMF and many other notable international organizations.

Czech population reached 10 512 922 on 30 June 2013; 75% of population lives in urban areas. Demographic projections indicate slight growth in population by 2020 (by approximately 5%). Large number of scattered municipalities is characteristic feature of the country (as of 1. 1. 2012 there were 6 252 municipalities). As of 1. 1. 2013, 5 cities had population exceeding 100 000 (Prague, Brno, Ostrava, Pilsen and Liberec).

With 78 867 km^2 of territory the Czech Republic belongs among middle-sized European countries. Average elevation above sea level is 450 m, which exceeds the average European elevation of 315 m. The main European watershed traverses the country between the North, Baltic and the Black Sea. Long-term precipitation is 693 mm and approximately 30% of this volume is drained in the form of surface water. Alluvial plains and lowlands are mostly cultivated – cropland and meadows. Woods cover 1/3 of the territory and significantly influence micro- and mezzo-climate. Most of the woodland (economically exploited monocultures with prevalence of spruce and pine populations) has been artificially planted and does not correspond to natural species compositions.

The state of the environment considerably improved in the last 20 years, especially the ambient air quality and with respect to water protection and waste management. Significant levels of polycyclic aromatic hydrocarbons (PAHs) and particulate matter (PM) emissions however persist, generated by household coal-fired heating boilers and internal combustion

engines. After 1990 the Government adopted key environmental legislation, which is continuously being improved upon in line with EU legislation. A number of strategic environmental documents were drafted in recent years addressing principles of sustainability. The most important document in this domain is *Strategic Framework for Sustainable Development* of the Czech Republic (SFSD), adopted by the Czech Government on 11 January 2010. SFSD determines long-term objectives for three basic pillars of modern society development (economic, social and environmental).

Climate

The Czech Republic lies within the Atlantic-continental area of the moderate climate zone of the northern hemisphere. Average annual temperature fluctuates in relation to geographic factors between 1.1 and 9.7 °C. Average spring and fall season temperature reaches 7 to 8 °C, during the summer the temperature rises to 16 or 17 °C; in winter the average is -1 °C. Changes in average annual temperature over the last 150 years indicate incremental rise in temperature; between 1861 and 1910 the average annual temperature reached 7.4 °C, between 1911 and 1960 also 7.4 °C while between 1961 and 2010 the average temperature rose to 7.7 °C.

Regardless of considerable year-to-year fluctuations, there is an apparent trend of gradual rise in average annual temperature amounting to approximately 0.3 °C over 10 years. Average number of days with extreme weather / temperature and their changes over decades demonstrate that over the last two decades there has been a marked increase of average number of days with high temperatures and reduction in the number of days with low temperature. Number of summer days during the year increased on average by 12 days, tropical days by 6 and conversely, number of freezing days dropped by 6.

Similar trends in precipitation development are not apparent. During the last two decades, there has been an indistinctive rise in annual precipitation amount. Decreases in the spring precipitation are balanced out by summer precipitation mainly in the form of rainstorms. Average annual precipitation between 1991 and 2010 was approximately 5% higher than between 1961 and 1990. Year-on-year variability in precipitation amount is high; for instance in 2002 we have recorded the third highest precipitation amount, but in the following year – 2003 – the annual precipitation was the second lowest in 207 years of observations. Rainstorms became more numerous over the last two decades as well.

Economy and greenhouse gas emissions

Between 2000 and 2008 the Czech Republic achieved more than double the growth levels of GDP in comparison with EU-27, EU-15 and OECD annual averages. Between 2005 and 2007 the Czech Republic joined the group of countries with the highest dynamic GDP growth in Europe. In 2009, the impact of the global economic crisis fully manifested itself and the Czech economy entered into recession triggered by a downturn in foreign demand. After partial resurgence between 2010 and 2011, which had been triggered by increased exports, the recession resumed from the end of 2011.

Long-term structural imbalance of the public finance negatively manifested itself during 2008–2012, as well as strong dependency on automobile manufacturing sector and overly complex and costly tax and legal system. The Czech educational sector deficit also made itself felt by turning out insufficient numbers of qualified graduates not corresponding to the labour

market demands. Another characteristic feature of the Czech economy is its relatively low material and energy efficiency, which is given by its industrial structure.

Energy intensity of the economy has been steadily declining thanks to modernization of available technology and energy savings. In international comparisons the Czech Republic remains among the countries with high-energy consumption per GDP unit.

Electricity generation between 2000 and 2012 grew by 19% while the exports grew faster than domestic consumption. The highest share of electricity generated goes to coal-fired steam power stations. Their share declined from 78.3% (in 2000) to 59% in 2012 primarily due to higher production of nuclear power and renewable sources. Share of nuclear-generated power (NPP Dukovany and NPP Temelín) currently stands at 32.5%. Renewable sources contributed in 2011 by 8.5% of the total (rising from 6.9% in 2010). Renewable power share estimates for 2012 reach 9.2%.

Exploitable coal deposits are low and the operational life of existing mines is estimated from 10 to 50 years. Black coal deposits in the Czech Republic are estimated to be depleted by 2030. Therefore, the sustainable development needs depend especially on the proliferation of renewable and nuclear sources and energy savings.

Total imports of primary energy sources (PES) hover at about 60% and grow with gas replacing coal; since 2000, the PES imports grew from 58 to 64.5% in 2011. Dependence on oil, gas and nuclear fuel imports is practically complete. PES consumption and total energy consumption has been growing slightly in recent years. Demand for sources is somewhat dampened by decline in energy intensity. Anticipated convergence of national macro-economic indicators with European average indicate further decline in energy intensity. Relatively large losses during energy transformation and distribution need to be reduced; in 2000 these losses amounted to 40.3% and in 2011 to 40.9%.

Total achievable potential of renewable energy sources (RES) sources in the Czech Republic has been estimated at approximately 190 PJ, while PES consumption reaches almost 1 900 PJ. Assuming that PES consumption will remain flat and the RES potential will be achieved by 2020, the share of RES on primary consumption will reach 10% in 2020. Higher share of RES on total generation / consumption is achievable only if the total PES consumption declines further (via energy efficiency and savings). The largest potential is in the energy sector, households, service sector and industry and especially in transport sector. Total achievable savings between 2015 and 2020 range between 300 – 400 PJ. Due to the growing demand for biomass use in energy sector and transport sector (as fuel compound) as well as in the form of renewable raw material in industrial sector it will be necessary to increase biomass production in short-term and medium-term time frame, while respecting sustainable use of cropland.

The Czech Republic is one of the countries with the densest transportation infrastructure in the EU, however, during economic crisis there has been a marked drop in investment into the development of this network. The transport sector primarily uses road and railway network. There is a continuous trend in declining railway use, both in terms of passengers and cargo. Railways serviced nearly 70% of all cargo transports in 1990, by 2012 this figure dropped to 22%. Road freight transportation has been steadily growing as well as passenger transportation - individual car transport accounted for 70% in 2012 of all passenger travel while in 1990 it was only 59%. From the perspective of transportation output, there has been a significant decrease since 2009 in individual automobile transport caused by consumption tax and fuel prices growth. The economic recession (2008-2012) triggered only a temporary decline in cargo transport during 2009, but it bounced back and the 2010-2012 levels correspond roughly to 2006-2008 levels.

If the transport sector emissions in 1990 represented 6.35% of the total national carbon dioxide emissions, in 2011 this share reached 12.92%. Number of cars almost doubled in the last 20 years and reached 4.71 million vehicles in 2012, which corresponds to 45 per 100 inhabitants (in 1990 it was 23). Continuously improved condition and composition of the vehicle fleet with respect to the EURO standard reduced catalyser-free vehicles from 93% in 1993 to 16% in 2011. Average age of vehicles however remains high (13.9 years, in 2012). It is however presumed that use of new vehicles is higher than use of older cars. Alternative fuel vehicles represented 2.1% of the total in 2011.

The Czech Republic is traditionally an industrial country and industry represents approximately a third of the Czech GDP, while in the EU it is approximately one fifth. Year-on-year revenue of the industrial sector grew by approximately 2.7% annually with GDP per head growing by approximately 18% (between 2007 and 2012), while work productivity grew by approximately 4.8% year-on-year and the energy intensity gradually declined. One of the three Czech employees works in industrial sector. More than half the capacity of the Czech industry works for export. Industrial production reacted to the global economic crisis by increased volatility of its sales and change in product range. Long-term export trends enjoy faster growth of value added per unit than export of simple materials. Share of technologically balanced products, such as machinery, electronics and vehicles continues to grow. In the second half of 2008 there had been a decline in industrial production triggered by downturn in the Czech automobile exports. Industrial production index decreased to 86.8% in the last quarter of 2008 in comparison with 2007; automobile production reached the minimum in the first quarter of 2011, when it dropped by 31.3% (compared to 2007).

Total waste generation in the Czech Republic reached 30.023 million tons in 2012, which is 20.9% less than in 2002 (37.969 million tons). Total production of municipal waste in the Czech Republic reached approximately 5.19 million tons, i.e. about 494 kg per inhabitant. Between 2010 and 2012 the growth in material recovery of municipal waste has been apparent, growing from 24.3% to 30.3%, nevertheless, there is still a large volume of waste that is being landfilled. In 2012 a total of 53.7% of municipal waste was landfilled. Mixed municipal waste represents the largest share of waste that is landfilled. From the total municipal waste produced in 2012 only 30.3% had been materially recovered, energy recovery processed only 11.8% of waste.

Crop land represented 53.6% of the total area of the country (approximately 7.9 million ha) in 2011 (in 2003 the figure was 54.1%). Consumption of mineral fertilizers and calcic substances stagnates; declining numbers of cattle also result in declining consumption of farm fertiliser. Wheat remains the predominant crop. Production of rapeseed grew in the recent years (due to its use as a component in motor fuel).

In 2007, the mandatory mixing of bio components into fuel has been introduced. Bio components include rapeseed oil methyl-ester (MERO – FAME) and bio ethanol produced mainly from sugar beet. Agriculture contributed to the total amount of greenhouse gas emissions in 2011 by about 6.4% (incl. the LULUCF sector). N_2O emissions from agriculture amounted to 70% of the total national emissions of this particular gas in 2011.

Woodland area has been steadily growing, especially as a result of afforestation of infertile cropland (in recent years the annual gain was approximately 2 000 ha). The total area of woodland in 2012 reached 2 662 thousand ha, which represent approximately one third of the Czech territory (33.75% of the entire state territory) and slightly exceeds European average.

National Greenhouse Gas Inventory System and emissions trends

Emission inventory is being maintained in line with the standard IPCC methodology. Emission factors and activity data that were used are included in the annual National Inventory Report[1]. National Inventory System (NIS) has been launched in 2005. The body responsible for its administration is the Ministry of the Environment, which delegated these powers to the Czech Hydrometeorological Institute (CHMI) as the organization responsible for coordination of emission inventory preparation and elaboration of the required data and text outputs.

CHMI has been tasked especially with the following:

- Management of sectoral data sources,
- Determination of uncertainties using the Tier 2 Monte Carlo methods,
- QA/QC review procedures,
- Reporting of data in the prescribed CRF format (Common Reporting Format),
- Elaboration of the National Inventory Report (NIR),
- Maintenance of the inventory archiving and documentary system.

Official greenhouse gas inventory outputs (CRF, NIR) are completed by the CHMI and submitted to the Ministry of the Environment for approval. The Ministry of the Environment cooperates further with other departments and state organizations, especially with the Czech Statistical Office (CzSO). Besides that, the Ministry of the Environment communicates with the European Commission and the UNFCCC Secretariat.

In 2013, the inventory team completed preparations for designation of key categories using the Tier 2 method, i.e. including uncertainties. This method will be implemented in the coming years.

QA processes include control activities and review undertaken by third party, which is not involved in national inventory preparation. CHMI cooperated on QA processes with Slovak experts, who are involved in preparing the Slovak national inventory. The Ministry of the Environment, to whom CHMI submits national inventory results for evaluation and approval, also carries out reviews.

Results of the greenhouse gas inventories between 1990 and 2011 were provided in basic sectoral categories in and separate Annex 1 (CTF Tables 1a, 1b, 1c) and Annex 2. Total greenhouse gas emissions incl. LULUCF decreased in the Czech Republic from 192.42 million tons CO_2 equivalent to 1990 to 125.54 million tons CO_2 equivalent in 2011. Emissions excluding LULUCF decreased from 196.04 million tons to 133.49 million tons CO_2 equivalent, which means that in terms of 1990 figures there has been a reduction in national emissions by 31.91%. Emission inventory also included HFC, PFC and SF_6 (the so-called F-gases) emissions. Individual gas shares on the total greenhouse gas emissions (excl. LULUCF) reached in 2011 the following amounts: 85.6% for CO_2, 7.7% for CH_4, 5.8% for N_2O and 0.9% for F-gases.

The emission reduction trend has been permanent since 1994 and potential fluctuation are caused for instance by different temperatures during winter, year-on-year changes in GDP or

[1] National Inventory Report and inventory data sets for each year are available at http://www.chmi.cz/files/portal/docs/uoco/oez/nis/nis_uv_cz.html

by the degree of implementation of adopted measures. A noticeable decrease is apparent in the Energy sector (stationary combustion) and in Agriculture sector; on the contrary, emissions produced by Transport sector have been steadily rising over long term. Additional reduction of emission is apparent in the manufacturing sector and in other sectors (housing, institutions and services), while in the energy sector there has been no such decrease. Given the fact that the total greenhouse gas emissions have decreased by 2011 in comparison with 1990 by 34.76% (incl. LULUCF), respectively by 31.91% (excl. LULUCF), there is a high probability of successful achievement of the national emission target for the first commitment period under the Kyoto protocol (2008 – 2012).

Manufacturing sector and construction sector, as well as households and public institutions and services sectors have all contributed to the reduced emissions between 1990 and 2011. Trends indicating reduced use of solid fuels and increase in natural gas use have had positive impact. Positive impact may also be assigned to energy savings (new production technologies, modern equipment and household appliances, heating insulation of buildings etc.). Rapid emission growth between 1990 and 2007 is apparent in the Transport sector, where emission grew more than twofold since 1990, which is a result of rapidly developing individual automobile and road freight transport. However, between 2007 and 2011, emissions in this sector have slightly dropped (by 10.3%).

F-gases emissions increased since 1995 (reference year) from 76 to 1 194 Gg CO_2 equivalent in 2011 and relative share of F-gases on total emissions grew similarly (0.1% in 1995 to 1% in 2011). These substances are not being manufactured in the Czech Republic and their entire consumption is met by imports. Increase in these emissions is caused by substituting ozone depleting substances but also by increased application of F-gases in new technology, especially in cooling equipment (HFCs), electronics (SF_6) and in some specialized manufacturing processes (low-energy windows, fire extinguishers, propellants for aerosols and expanding agents and so on).

National emission trading registry

The Czech greenhouse gas emissions trading registry has been administered since 2005 by OTE a.s. under authorization from the Ministry of the Environment. In June of 2012, the single Union Registry has become active. Registry allows access only to duly authorized representatives of the account holders. All entities operating equipment discharging greenhouse gas emissions into ambient air pursuant to a permit issued by Ministry of the Environment, have the obligation, pursuant to Act No. 383/2012 Coll., on conditions of trading with greenhouse gas emission allowances, to open an account with the Registry. Since 2012, that same obligation is imposed on aircraft operators who fall, pursuant to Act. 383/2012 Coll., into the European Union Emissions Trading System (EU ETS).

The Registry information system had been reviewed, in terms of DES, by the UNFCCC Secretariat within the framework of the initiation procedure prior to integration with EUTL[2] and further by using and set of testing scenarios. The Registry has undergone all these tests successfully and received the necessary certifications on 1 July 2012.

[2] European Union Transaction Log

Policies and measures leading to emissions reduction

In the Czech Republic, there are several levels of measures used to reduce greenhouse gas emissions (strategic, legislative and programming). Since 2000, the Czech Republic has been implementing a system of strategic and operational planning, which is being continuously modified in line with the Czech international commitment arising from post-2012 process and EU policies and legislation. Legislative framework determines institutional responsibilities for coordination and implementation of programmes as well as imposing regular review of their impacts.

The set of strategic instruments includes especially the following measures:

- Strategic Framework for Sustainable Development (SFSD, adopted by the Czech Government in 2010),
- National Strategic Reference Framework for 2007 - 2013,
- National Reform Programme (which is updated annually, last update in 2013),
- Strategy of the Regional Development for 2007 – 2013 and for 2014 – 2020 (approved by the Government in July 2013).

Programming documents with direct or demonstrable indirect impact on greenhouse gas emissions include:

- National Programme To Abate the Climate Change Impacts in the Czech Republic
- State Environmental Policy 2012-2020 (SEP)
- National Emission Reduction Programme

At present time (fall 2013), the medium-term Strategy for Improving Ambient Air Quality (by 2020), which also includes the National Emission Reduction Programme, is being revised. Scenario involving additional measures within this programme anticipates implementation of the following measures: reducing the share of solid fuels in the energy mix, increased efficiency of energy production and distribution, considerable investments into household heating, support focusing on savings to be achieved in buildings etc.

Additionally, the following legislation has been adopted or amended in recent years, having direct impact on greenhouse gas emissions:

- Act No. 383/2012 Coll., on conditions of trading with greenhouse gas emission allowances,
- Act No. 201/2012 Coll., on protection of ambient air,
- Act No. 73/2012 Coll., on substances damaging ozone layer and on fluoride greenhouse gases,
- Act No. 76/2002 Coll., on integrated prevention and limiting pollution and on integrated pollution register, as amended,
- Act No. 406/2000 Coll. on energy management, as amended,
- Act No. 458/2000 Coll., on business conditions and public administration in the energy sectors (Energy Act), as amended,
- Act No. 310/2013 Coll. on supported energy sources, as amended.

Emission projections scenarios

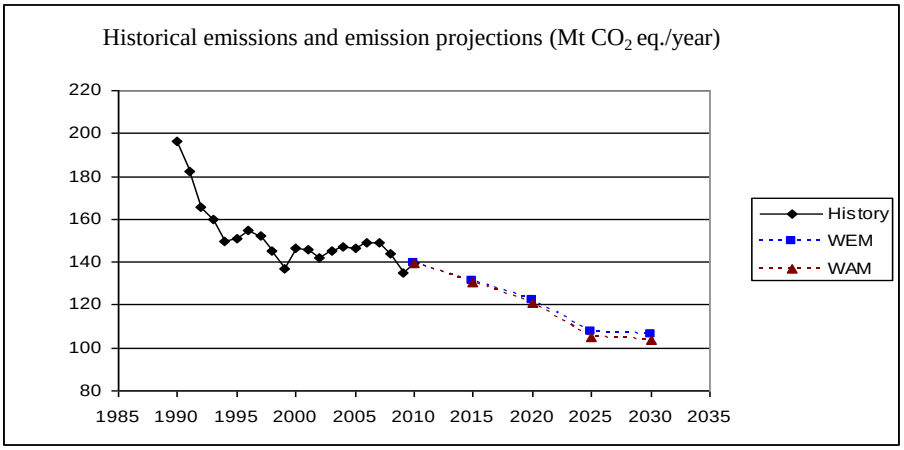
Projections have been revised in line with Guidelines,[3] Decision 280/2004/EC and Decision 2005/166/ES for the following scenarios:

- With existing measures (WEM), i.e. implemented measures which came into force before the projection preparation period (June, 2012);
- With additional measures (WAM), i.e. with existing measures and measures, which are to be implemented shortly or which are being planned.

Additional measures included in projections are especially:

- Transposition of requirements set forth by Directive 2010/31/EU on the energy performance of buildings into Czech legislation,
- Proposal of EU regulation on CO_2 emissions from new light commercial vehicles,
- Support provided in connection with voluntary energy savings commitments in industrial sector.

The methodology for preparing emission projections has been already used in preparation of the Third and the Fifth National Communication, which enables their mutual comparison. Scenarios used in creating projections are based on the above-mentioned strategic and programming documents. Historical emissions along with both projections (WEM and WAM) are given in graph below.



Mechanisms according to Art. 6, 12 and 17 of the Kyoto Protocol

The Czech Government approved the Framework agreement on cooperation in implementing projects seeking reduction of greenhouse gas emissions with the International Bank for Reconstruction and Development (IBRD) and other investor countries by its Resolution No. 648 dated 30. 6. 2003. In 2012, there were 85 Joint Implementation (JI) projects approved. During the first commitment period of the Protocol (2008 – 2012) there have been issued approximately 0.883 million ERUs annually. Implementation of all JI projects during 2002-2012 generated approximately 7.446 million AAUs, and from this amount the issued ERUs reached 4.413 million. Act No. 383/2012 Coll., on conditions of trading with greenhouse gas emission allowances allows use of free AAUs to support project according to Art. 6 of the

[3] UNFCCC *Reporting Guidelines on National Communication*, FCCC/CP/1999/7, part II

Protocol. From the perspective of the total reduction of emissions between 2008 and 2012 (please refer to Annex 1 (CTF Tables 1a, 1b, 1c and Annex 2), the JI projects contribution to total reduction is estimated at 3.5 – 4% and the share of the GIS programme ("Green Savings" programme) at 2.5 – 3%. The Czech Government also supported selected specific private sector projects within the Clean Development Mechanism (CDM) in developing countries.

Estimated vulnerabilities, climate change impacts and adaptation measures

Integration of the regional climate model (RCM) ALADIN–CLIMATE/CZ with A1B emission scenario for 1961 – 2050 with horizontal resolution of 25 km has been completed in 2008. In intermediate horizon (midpoint in 2030), the average annual temperature in the Czech Republic will increase approximately by 1 °C; temperature rise in the summer and winter will be slightly lower than during spring and autumn. Simulations also indicate that some of the related temperature characteristics will also change. During the summer months, it is anticipated that the number of summer and tropical days or tropical nights will also increase, and in the winter the number of frost, ice and arctic days will decrease.

Situation is more complicated with regard to precipitation amount. Most nodal points in the model simulate decrease in future precipitation in the winter amounting locally up to 20%, and in the spring increasing by 2 - 16%. In the summer and especially in the autumn the situation differs for different locations in the CR (locally there may be a slight decrease by several percentage points or increase up to 20 – 26%), in the summer there is and slight decrease, locally however there might be sporadic increase up to 10%. In the period between beginning of the autumn and beginning of the summer, the anticipated increase in precipitation is accompanied by corresponding increase in surface evapotranspiration caused by rising temperatures. In the summer, there is a decrease in precipitation and due to a drop in water reserves in the soil, this will probably not lead to a significant increase in territorial evapotranspiration. A significant finding is the shift in the snow cover thaw at higher altitudes due to higher temperatures from April to January–February.

In medium-term horizon (midpoint in 2050) the simulated warming is more accentuated, the highest rise in air temperature is in the summer (by 2.7 °C), and lowest in the winter (by 1.8 °C). In medium-term horizon the fall in winter precipitation up to 20% and their increase in the autumn become apparent. In the summer months the drop in precipitation begins to be a dominant factor, becoming even more accentuated over long term horizon, while the precipitation decline in winter will be slower in comparison with preceding periods.

More frequent occurrences of extreme weather events already affect water levels, agriculture and forestry as well as affecting population health. In medium-term horizon (around 2030, see scenarios for 2010 –2039) we anticipate further increases in negative impacts on the individual segments of the environment and as a new development, we must take into account impacts on the energy sector, recreation opportunities and tourism and the overall living comfort of population especially in larger cities.

Water management

In medium-term horizon, we can anticipate that the average flow through many river basins will decrease by 15 – 20% ("optimistic" scenarios) or even by 25 – 40% ("pessimistic" scenarios) leading to changes in the overall hydrological regime. Drop in flow rate will manifest itself in the change of the surface water quality due to higher water temperature and its subsequent eutrophication. Water deficits will grow in the summer and autumn months even in relatively wet regions and there will be an increased risk of spring flooding. Intensive

precipitation episodes taking place during summer storms will represent increased risk of rainstorm flooding even during relatively stable long-term precipitation amounts.

Agriculture

Adaptation of agriculture to climate change pertains mostly to production of foodstuffs and food security, potentially with biomass production. Climate change will affect genetic diversity in agriculture, soil fertility, quality and availability of water for irrigation. Changes in the current precipitation amount and more frequent occurrences of rainstorms may increase soil water erosion risks, which currently affect more than half of the agriculture area.

Changes in vegetative seasons may affect plant composition, especially those, which find it harder to adapt to changing conditions. Climate change will change conditions for disease and pest proliferation.

Forestry

Anticipated increase in average temperatures will manifest itself by a gradual shift in presence of various types of timber species in higher altitudes. For instance, a rise in average annual temperature by 1 – 2 °C may lead to shift in the tree line by 100 or 200 m in altitude.

From the perspective of climate change, heat and drought are the most significant factors increasing the risk of forest fires and affecting health and stability of spruce monocultures in low and medium altitude locations, i.e. in locations which are pivotal for timber production in the Czech Republic. At the same time, they contribute to more frequent occurrences of abiotic calamities during sudden climatic episodes (destructive gusty winds, wet snow, landslides triggered by extreme rainfall, forest fires etc.).

Biodiversity

From climate change perspective, the most vulnerable ecosystems in the Czech Republic are mountain ecosystems and ecosystems comprising of residues of indigenous grass growth. Changes will manifest itself the strongest in ecosystems above the shifting upper reaches of tree line, where the vulnerability will be compounded by their relatively small area. Approximately one tenth of monitored plant species are at risk of extinction by the end of this century, while only one fifth of the plant species will be able to adapt easily to climate change. Climate change will also bolster proliferation of invasive alien species, whose intentional planting or unintentional import and subsequent expansion may put biodiversity, biotopes and entire ecosystems at risk.

Urbanized landscape

Changes in temperature and precipitation amounts toward extremes will lead, especially in larger cities, to significant impacts on quality of life also in relation to availability and quality of water. Climate change will influence internal environment of buildings, constructions and construction work in general. Weather extremes have negative impact on buildings envelopes and degrade value of buildings and their lifetime, which brings about increased repair costs.

Transport

Extreme weather fluctuations may significantly impact road, rail, water-borne and air traffic. We may anticipate a more frequent impassibility of road / railways due to flooding, damage or destruction, blockages by landslides, fallen trees etc. Landslides are especially capable of disrupting entire sections of transport infrastructure.

Health and hygiene

Climate change may negatively influence health of the population by a broad spectrum of direct and indirect factors. Direct influence on human health results from increased frequency and intensity of extreme weather events. Indirect influence is leveraged by changing environment and living conditions, as they respond to climate change, for instance by increased favourable conditions for spreading of contagious diseases.

Aggravated climatic conditions may trigger increased migration of population from worst affected areas. This may lead to higher demand for humanitarian aid and healthcare for the migrants into the Czech Republic, potentially leading to the need to increase capacity of its healthcare system and pharmaceuticals consumptions.

Industry and energy sector

Climate change will affect the energy sectors by leveraging imbalances between the supply and demand for energy. Climate change will also influence distribution of precipitation during the year thus affecting electricity generation from water sources. Climate change will negatively affect distribution and transmission networks, which will be influenced by increased demand for cooling during hot summer periods, but also by windstorms and flooding.

Lack of precipitation may also affect production of biomass for energy use but also manufacturing sectors with high water use intensity (such as paper mills, chemical plants and so on). On the opposite, strong precipitation / flooding may disrupt electricity distribution and other product distribution systems or limit supply via railroads or on roads as well as shutting down production, mainly hydro-power stations or cause release of hazardous substances.

Adaptation measures

The Strategy on adaptation to climate change in the Czech Republic (Strategy) is currently (autumn 2013) updated and complemented and once adopted by the Czech Government (2014) it will create a framework for coordination of adaptation measures for a number of sectors.

Water management

Water retention in the landscape achieved by optimising its structure and by utilization of effective and close-to-nature technical preventive measures forms a fundamental basis for protection against extreme hydrological events. To these ends the following measures are being implemented:

- River basin plans pursuant to the EU Water Directive,
- Adaptation measures supported by Operational Programme Environment in the area of Limiting risk of flood and Optimising the landscape water regime,
- Programme for restoration of natural landscape functions, focusing on water, forest and non-forest ecosystems.

This includes revised River Basin Management Plans integrating Flood risk management plans, implementation of restoration and flood prevention measures that are close-to-nature on watercourses and floodplains within the next programming period of OPE in 2014-2020 and Rural Development Programme for 2014-2020.

Agriculture

Sustainable use of cropland (incl. protection against erosion and soil degradation, increased water retention in soil, maintaining soil fertility etc.) is the key precondition for adapting to climate change. Solutions should be based on the principles promoting sustainable farming and good agricultural practices.

Forest management

Adaptation measures will be implemented within the framework of the National Forestry Programme II as approved by the Czech Government Resolution No. 1221/2008. This mainly involves ensuring species, age and spatial diversity of forests, prioritizing natural recovery and stabilisation of carbon bound in forest ecosystem.

Biodiversity

The most important implemented or planned measures include:

- protection and restoration of interconnectedness and migration permeability of landscape (implemented via Territorial System of Ecological Stability (TSES), fish sluices, eco-ducts, restoration of backbone migration corridors),
- protection and improvement of protected and endangered species populations and key biotopes (protection and management of specially protected areas (SPA) and NATURA 2000, revitalization of landscape elements, measures supporting nesting / breeding of bird populations, bio-corridors, protection and implementation of TSES etc.),
- increasing ecosystem capacity necessary for ensuring key services (such as revitalization of major landscape elements, support focusing on frugal management in forests and on crop land),
- measures leading to protection, restoration and improvement of ecosystems and natural areas (protection and management of urban vegetation, revitalization of ecosystems and natural elements in open landscape),
- analysis of future impacts of climate change to individual species, ecosystem and biotopes and SPAs,
- measures preventing and limiting dispersion of invasive alien species of plants and animals and their potential eradication.

Urbanized landscape

Adaptive measures in urbanized landscape are implemented in connection to and following onto water management measures. Additional measures are being supported especially via Spatial Development Policy of the Czech Republic (2008), which defines territorial planning priorities in order to ensure sustainable development of the territory and via OPE (2007 – 2013), which supports restoration of close-to-nature vegetation within urban areas.

Health and hygiene

Policies and measures in the healthcare sector include:

- monitoring of pathogens and distribution of information to clinical and laboratory experts,

- research into zoonotic contagion cycles with emphasis on changes in vector and reservoir animal ecology,
- identification of risk areas, seasonal changes and groups of population which is especially vulnerable to risk factors, whether of contagious or non-contagious nature and preparation of early-warning system,
- raising awareness about healthcare within the public.

Crisis situations, protection of population and the environment

Measures in this particular sector include:

- development and further strengthening of Integrated rescue system (IRS), which ensures coordinated actions of all its units (Fire Rescue and fire protection units, Police and emergency services),
- protection of critical infrastructure, being a part of the Strategy and sectoral Operational programmes under preparation (protection of information and energy infrastructure, crisis management),
- environmental security, including crisis management for drought, flood, forest fire situations, improved meteorological and hydro-meteorological services,
- monitoring and crisis management in areas at risk of landslides, or taking landslides into account in spatial planning.

Tourism, Transport. Industry and Energy sector

So far, there is no set of adaptation measures for these sectors. These will be identified and included in the Strategy.

Financial resources and technology transfers

The key strategic documents in this field are: Development Cooperation Strategy of the Czech Republic 2010 – 2017 and Multilateral Development Cooperation Strategy of the Czech Republic 2013 – 2017. The total amount of funding provided to international development cooperation in 2012 reached 1.3 billion CZK. In 2012, the share of the ODA on GDP amounted to 0.124%.

Although the Czech Republic is not a Party to Annex II of the Convention, it has committed itself at the COP 15 (December 2009, Copenhagen) to support measures reducing greenhouse gas emissions (mitigation) in 2010 – 2012, as well as the adjustment measures to climate change (adaptation) in the context of capacity building and technology transfer in developing countries (the so-called *fast start finance* - FSF). The total amount of support to developing countries in 2010 – 2012 amounts to 30 billion USD. The Czech Republic has voluntarily committed to provide for these purposes 12 million EUR via its bilateral and multilateral official cooperation in selected developing countries. In the given period, the Czech Republic spent 12.62 million EUR on projects focused on greenhouse gas emissions reduction, such as upgrades of energy facilities and alternative / renewable energy systems (FSF projects). Almost 65% of the funds were directed to financing adaptation measures, mostly in water management sector and agriculture. Recipients of this support have been countries such as Afghanistan, Angola, Ethiopia, Yemen, Cambodia and Palestine (in total 14 countries).

Research and systematic observation

The objective of the research is to contribute to the knowledge of the causes and effects, size and time of climate change factors and their sectoral, economic and social impacts. Attention is also given to international cooperation, respectively exchange of scientific, technical and socio-economic information. Research into current state and development of the global climate system as well as regional climate is focused especially in the following institutions:

- Environmental Committee of the Academy of Sciences of the Czech Republic,
- National forestry committee,
- Research institutes of Academy of Sciences of the Czech Republic, universities and other state research organizations.

Systematic observation of the climate system is undertaken in required extent by the CHMI, which acts as the responsible state body in the air protection sector, hydrology, water quality, climatology and meteorology with competences to establish and manage state monitoring and observation networks, including international data / information exchanges according to the WMO principles.

During the period described in this national communication there were 63 projects involved in research, development and innovations which were connected with climate change. Projects were focused on development of climate scenarios for the Czech Republic, evaluation of water management vulnerabilities, including supply of drinking water, statistical assessments of the probabilities of climate extremes, variability of agricultural production, food security and development of new low-carbon technologies.

CHMI establishes and operates national monitoring and observation systems which record the quantitative and qualitative states of atmosphere and hydrosphere and causes leading to their pollution and damage; it processes the results, measurements and monitoring in compliance with EU legislation, creates and administers databases and provides information on the state of atmosphere and hydrosphere, including forecasts and alerts to dangerous hydro-meteorological events.

Environmental education and public awareness

National policy relating to environmental education and public awareness (EE&A) is based mostly on Chapter 36 Agenda 21 of Aarhus Convention on Access to Information, participation of the public on decision-making and access to legal protection of the environment, which the Czech Republic ratified in 2004 and the Regional Strategy (UNECE) for education for sustainable development, adopted in 2005. The obligation to develop EE&A has been imposed by Act No. 123/1998 Coll. on the right to environmental information and Act No. 561/2004 Coll. School Education Act. The fundamental strategic and cross-section document for the elaboration of detailed programmes for individual segments of the environment, including climate change, is the State Environmental Policy 2012 – 2020 (SEP).

2 NATIONAL CONDITIONS

2.1 Structure of the State administration

The fundamental constitutional arrangement, defining positions and tasks of the major state institutions, is laid down by the Constitution of the Czech Republic, which was adopted in 1992. The Czech Republic is a parliamentary democracy with division of powers between the legislative, executive and judicial branches of Government. President is the head of the State, elected directly by the electorate for a term of five years. The supreme legislative body of the land is the two-chamber Parliament, comprising of the Chamber of Deputies (lower house) and the Senate, which adopts all proposed bills, approves international treaties, conventions, protocols and other important political strategic documents in the industrial, military, environmental, agricultural and other sectors. The executive powers rest with the Government, which is formed on the basis of elections into the Chamber of Deputies. Its members usually come from the political parties, which obtained the strongest mandate from the electorate.

Since 1 January 2000, constitutional Act No. 347/1997 Coll., established 14 higher territorial self-governing units – Regions – whose size corresponds to similar administrative units in the EU defined as NUTS 3. Regional Authorities act as the local bodies exercising delegated powers of the state Government; a Director General heads Regional Authority. The head of each Region is a hejtman; in Prague the head is the Mayor.

Regions represent a self-governing level between the Government and local municipalities, be it cities, towns or smaller units. Regions ensure selected functions and services to citizens within the framework of socio-economic and other development (incl. environmental services) based on their specific regional needs, better local knowledge and independent financial governance. Municipalities are currently the only self-governing units managed by the locally elected municipal and city boards of representatives headed by mayors.

In the environmental sector, the highest executive body is the Ministry of the Environment established on 19 December 1989 by Act No. 173/1989 Coll. as of 1 January 1990 to function as the central body of State administration and supreme supervising body in all matters related to the environment.

The Ministry of the Environment acts as the central executive body of the State administration in the following areas:

- protection of natural accumulation of water
- protection of water sources and protection of subsurface and surface water quality
- protection of air
- protection of climate system
- protection of nature and landscape
- protection of agricultural land fund
- performance of state geological service
- protection of mineral deposits, incl. protection of natural resources and underground water

- geological work and ecological supervision of mining
- waste management
- evaluation of environmental impact assessment and their impact on the environment, incl. cross-border impacts
- game-keeping, fishery and forestry in national parks
- state environmental policy.

In order to exercise control activities of the Czech Government, the Ministry of the Environment coordinates activities of all other ministries and other central State administration bodies in all matters relating to the environment.

At present time (2013), the Ministry of the Environment is divided into four expert sections (Directorate of EU Funds, Economics and Environmental Policies, Directorate of State Administration, Directorate of Protection of Nature and the Landscape and Directorate of Technical Protection of Environment). The Department dealing with internal audits and financial control and security and crisis management department are subject to ministerial control directly.

The Ministry of the Environment is also the founding body of expert institutions such as the Czech Hydrometeorological Institute, the T.G. Masaryk Water Research Institute, the Agency for Nature Conservation and Landscape Protection of the Czech Republic, CENIA – Czech Environmental Information Agency, the State Environmental Fund of the Czech Republic, the Czech Geological Survey, the Silva Tarouca Research Institute for Landscape and Ornamental Gardening.

The Czech Environmental Inspectorate (CEI) is an independent organizational unit of the Ministry of the Environment. CEI is an expert body of State administration charged with supervision and enforcement of compliance with environmental standards in the Czech Republic. It also supervises compliance with binding decision issued by other state bodies in the environmental sector. CEI was established in 1991 by Act No. 282/1991 Coll. on the Czech Environmental Inspectorate.

2.2 International activities

The Czech Republic is a member of the UN, EU, NATO, OECD, WTO, WHO, IMF, World Bank, Council of Europe, OSCE; it is a part of the Schengen area, member of the Visegrad Group and other notable international structures. The Czech representatives take active role in environmental activities and sustainable development of all these organizations, with emphasis being placed on cooperation within the framework of the EU, OECD and UN (especially the UN environmental program – the UNEP). The Czech Republic has been actively involved in the preparation of the UN conference on sustainable development – Rio + 20 (June 2012), which was the watershed event in the international environmental protection in recent years.

The Czech Republic is a party to 46 multilateral environmental agreements (MEAs), whose list is provided in Table 2.1 below. The Czech Republic is further bound by 45 bilateral or multilateral agreements on cooperation in the environmental area. The state complies with all its fundamental obligations arising from these international commitments and is involved in a

number of projects abroad, which seek to fulfil tasks imposed by broader international commitments. In the area of foreign development cooperation, the Czech Republic provides aid especially to the less developed countries, by providing expert assistance and supporting international development programs (OECD, UNDP etc.). The Czech Republic has become on 14 May 2013 a member of DAC OECD, which attests to the quality of the Czech foreign development cooperation activities abroad.

Table 2.1: Multilateral agreements in the environmental sector, which the Czech Republic is a Party to (list of the most important MEAs)

Area	Name / Title
Climate change	The United Nations Framework Convention on Climate Change (UNFCCC) Kyoto Protocol
Protection of nature and the landscape	The Convention on Biological Diversity (CBD) and The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD) International Framework Agreement for the Sustainable Management of Carpathian Forests (Carpathian Convention) The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) The Convention on Wetlands of International Importance, especially as Waterfowl Habitats (Ramsar Convention) The European Landscape Convention
Protection of species	Convention on International Trade in Endangered Species of Wild Fauna and Flora, (CITES) African-Asian Migratory Water Bird Agreement (AEWA) Convention on the Conservation of European Wildlife and Natural Habitats (Bern convention) Agreement on the Conservation of European Bats (EUROBATS) The Great Bustard Memorandum of Understanding International Convention for the Regulation of Whaling
Biological security	The Cartagena Protocol on Biosafety (CPB)
Air protection	Convention on Long-range Transboundary Air Pollution (CLRTAP)
Protection of the ozone layer	Vienna Convention for the Protection of the Ozone Layer Montreal Protocol on Substances that Deplete the Ozone Layer
Water protection	Convention on the Protection and Use of Transboundary Watercourses and International Lakes
Chemical substances	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade Stockholm Convention on Persistent Organic Pollutants (POPs)
Waste	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
Industrial accidents	Convention on the Transboundary Effects of Industrial Accidents
Public access to information on the environmental	Convention on Access to Information, Public Participation in Decision–Making and Access to Justice in Environmental Matters (Aarhus Convention) Protocol on Pollutant Release and Transfer Registers (the PRTR Protocol)
Environmental Impact Assessment	Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) Protocol on Strategic Environmental Assessment (SEA Protocol)

Source: MoE

2.3 Population

The Czech Republic had population of 10 512 922[4] as of 30 June 2013, which places it at the 15th place in Europe.

Average population density of 132 inhabitants per km^2 makes the Czech Republic one of relatively densely populated countries in Europe. High population density and high urban dwellers ratio (75%) means that a large number of inhabitants live in areas with disrupted environment, especially due to emissions from intensive traffic, household heating using solid fuels mostly in smaller municipalities and other local negative impacts.

In 2009 the Czech Statistical Office projections related to demographic development in the Czech Republic indicate that the future trends are nearly identical to the EU-15 trends: the Czech population will slightly grow until 2020, reaching 10.8 million. This demographic projection also anticipates that the share of inhabitants over 65 will be higher by approximately 5% in 2020 in comparison with the existing numbers (20.5% against currently approximately 15%).

From the perspective of demographics, one of the issues with principal importance is the change in education structure. According to the study published by the Faculty of Economics, the University of Economics, Prague,[5] it is anticipated that by 2020, the number of inhabitants with completed university education will grow. Given that emphasis is put on the increased environmental awareness from the lowest levels of school education, it is anticipated that the population's awareness of importance of prevention and resolution of environmental issues will also grow.

2.4 Geographic conditions

With area of 78 867 km^2, the Czech Republic is one of the small to mid-sized countries and currently ranks at the 21st place in Europe by size. The highest mountain is Sněžka in the Giant Mountains (1 603m above sea level), lowest point in the country is located near Hřensko, in place where the River Elbe crosses into Germany (115m above sea level). From the perspective of altitude, the lowlands and territory generally under 200m above sea level take up 5.0%, areas between 200 – 500m above sea level take up 74.1%, areas 600 – 1 000m above sea level take up 19.3% and areas with altitude exceeding 1 000m above sea level take up 1.6% of the territory. Average altitude is 450 m, which is higher than the average altitude in Europe (315 m).

The divide among the main watersheds of Europe passes through the Czech Republic (the North, Baltic and Black Seas). This position on the main European divide is not favorable 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 mm 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 Bohemia 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

[4] http://www.czso.cz/csu/redakce.nsf/i/obyvatelstvo_lide

[5] http://kdem.vse.cz/resources/relik09/Prispevky_PDF/Fiala_Langhamrova_Hulik.pdf, p 10

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 numerous, 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 condition 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.

The Czech Republic is characterized by scattered settlement structure, based historically on the large number of municipalities (there were 6,249 municipalities as of January 1, 2008) – only a small fraction of these municipalities can be called towns by international standards. Five cities have more than 100 thousand inhabitants (Prague, Brno, Ostrava, Plzeň and Liberec). 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 favorable 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

2.5.1 Development of legislation and strategic documents

The state of the environment has markedly improved over the course of the last twenty years, especially with regard to air quality, water protection and waste management. On the other hand, the environment remains in several aspects unsatisfactory (for instance the dust particle emission levels) and represents, in the affected areas, a risk to both human health and the ecosystems.

A number of key component legislation was adopted after 1990, and this is being continuously updated to comply with EU legislation, especially in the areas of protection of air, water, waste management and protection of nature and the landscape. The following norms belong among the most important legislation:

- Act No. 201/2012 Coll., on Air Protection (hereinafter "new Air Protection Act") came into effect on 1. 9. 2012 and determines primarily rights and obligations of pollution source operators, instruments reducing the amount of substances which pollute the air, competence of administrative bodies and measures leading to remedies and sanctions. Additionally, an Act was adopted last year regulating ozone depleting substances and fluorinated greenhouse gases;
- Act No. 254/2001 Coll. regulates Protection of Waters, their use and associated rights;

- Act No. 185/2001 Coll. on Waste management defined fundamental principles of waste management, objectives and measures leading to their fulfilment as defined in the Waste Management Plan of the Czech Republic 2003-2013;
- Act No. 114/1992 Coll. on Protection of nature and the landscape defines what constitutes general protection of territories and species;
- Act No. 100/2001 Coll., on Environmental Impact Assessment;
- Act No. 76/2002 Coll., on Integrated prevention and limiting pollution and integrated pollution register;
- Act No. 289/1995 Coll., on Forests.

In addition, a number of strategic environmental documents covering protection of the environment incl. principles of sustainable development were adopted. The most important of these are: the State Environmental Policy (SEP), updated in 2012, the Strategy for Sustainable Development of the Czech Republic (2004) and subsequent **Strategic Framework for Sustainable Development of the Czech Republic (SFSD)**, adopted by the Czech Government on 11 January 2010. The SFSD determines the long-term objectives in three basic areas of modern social development – economic, social and environmental. This document is structured into 5 priority axes:

- Society, man and health;
- Economy and innovations;
- Territorial development;
- Landscape, ecosystems and biodiversity;
- Stable and secure society.

The Czech Government approved the State Environmental Policy in 2013; the Policy defines main priorities for the protection of the environment for 2012 – 2020 taking into account the condition and development of the environment; it focuses, in line with the Czech international commitments, on the 4 key areas:

- Protection and sustainable use of resources including protection of natural resources, ensuring protection of water and improvement of its condition / quality, preventing waste generation, ensuring maximum waste recovery and limiting its negative influence on the environment, protection and sustainable use of soil and mineral deposits / environment.
- Climate protection and improvement of air quality aiming to reduce greenhouse gas emissions, limiting negative impact of climate change in the Czech Republic, reducing the levels of air pollution and support to efficient and environmental-friendly use of renewable sources of energy and achieving energy savings.
- Protection of nature and the landscape focusing on protection and strengthening of ecologic functions of the landscape, maintenance of natural and landscape values and improvement of urban environment quality.
- Safe environment including prevention of natural disasters / risks (floods, droughts, landslides, erosion etc.), and prevention of anthropogenic risks.

The SEP contains a detailed implementation section outlining the individual objectives, measures, responsibilities and deadlines. In the area of greenhouse gas emissions, the SEP emphasizes simultaneous and synergic resolution of air emissions posing greatest health risks (primarily PAH, PM 2.5, PM10, PM1, SPS).

2.5.2 Air condition development

Solid polluting substances (STS) represent the main air pollutant in the Czech Republic, primarily $PM_{2.5}$ and PM_{10}, SO_2, NO_x, VOC, PAH and NH_3. Current significant sources of these emissions include generation of electricity and heating (from the perspective of SO_2 and NO_x production), transportation (producing NO_x, STS and VOC), household heating (STS and PAH) and metallurgy industry, including coking plants (STS, PAH, NO_x and SO_2). Agriculture is one of the main sources of NH_3, sectors using solvents are the main producers of VOC.

Between 1990–2011 there has been a decrease in ground layer ozone precursors (VOC, NO_x, CO and CH_4) by 62%. Between 2007 and 2011 the NO_x emissions dropped by 26%, SO_2 emissions by 28%. Positive development in terms of lowered emission burden was caused primarily by reduced emissions generated by transportation due to upgrades of the vehicle pool and emissions generated by stationary sources (energy sector). At present, the Czech Republic complies with valid national emission ceilings. Despite reduced emissions there has been very little improvement in air quality in the Czech Republic since 2000, which is mostly due to emissions, besides meteorological factors, that continue to be generated by transportation and probably also by increased emissions from low-emission sources, which are mostly represented by household heating appliances, where there has been a return to solid fuels, while the technical level of these combustion appliances remains very low.

Currently, the imission limits for PM_{10}, $PM_{2.5,}$ NO_x and benzo(and)pyrene (BaP) are being exceeded.

Production of SO_2 emissions is caused mostly by coal use in generating electricity and heat. From the perspective of SO_2 volumes, the largest group of sources consist of public and industrial energy sector sources, which provide for approximately 85% of emissions; in this sector, it is anticipated that there will be a significant drop in these emission in the future due to lowered emissions limits. Almost the entire remainder of these emissions (nearly 15%) is generated by local household heating appliances, where there has been only a very slight step away from burning solid fuels.

NO_x compounds are being discharged into air mostly by industrial sources (Energy sector) and transportation (according to 2009 emission data, their share is nearly equal, approximately 48%). Emissions of NO_x from other sources are negligible.

VOC emissions are generated mostly by smaller sources (mostly in relation to heavy solvent use) and transportation – together they generated almost 90% of emissions. Ammoniac is produced in connection with farming; industrial sources represent a smaller share. Transport and small sources have little influence on NH_3 emissions.

2.5.3 Water condition development

Similarly to air, pollution of surface water is decreasing, and there has been positive improvement in its quality. Quality is affected mostly by point sources (cities and municipalities, industrial plants and industrial cattle farming facilities), as well as area sources (farming and application of mineral fertilisers and barnyard manure and other chemical compounds, atmospheric depositions and erosion runoffs).

The number of inhabitants connected to drinking water supply systems is increasing steadily, with 93% of the population having access to high quality drinking water.

In long-term perspective, there has been a steady improvement in sewerage infrastructure and waste water treatment plants (WWTP). Between 2000 and 2011, the size of the sewerage network doubled, the numbers of people connected to sewerage increased from 75% to 83% and the number of people connected to sewerage terminated in a WWTP rose from 64% to 78%; the ratio of treated waste water has increased slightly from 95% to 97%.

2.5.4 Urbanized landscape

Settlements in the Czech Republic are characteristically rather dispersed, there are 6 251 municipalities, mostly small with population not exceeding 500 and that makes it considerably different from other EU Member States.

During historical development, the original natural landscape has been more or less modified on the majority of the Czech territory and the natural ecosystems became artificial. In 2011, the agricultural land took up 53.6% of the Czech territory, and its area has been steadily decreasing. Forests take up 33.7% and their area has been gradually increasing. The remainder of the territory are water surfaces, wetlands, built-up areas and other surfaces.

Changes commencing in 1989 are characterised primarily by the suburbanization processes. The most significant changes in the last two decades are therefore very intensive changes in functional use of suburban and urban landscapes; extensive development of commercial zones and residential districts with increased transportation demands connected with daily commuting to places of work. Suburbanization processes, and other real estate developments, take up quality crop land, limit natural diffusion of floods on floodplains and fragmentation of the landscape generally.

2.5.5 Nature

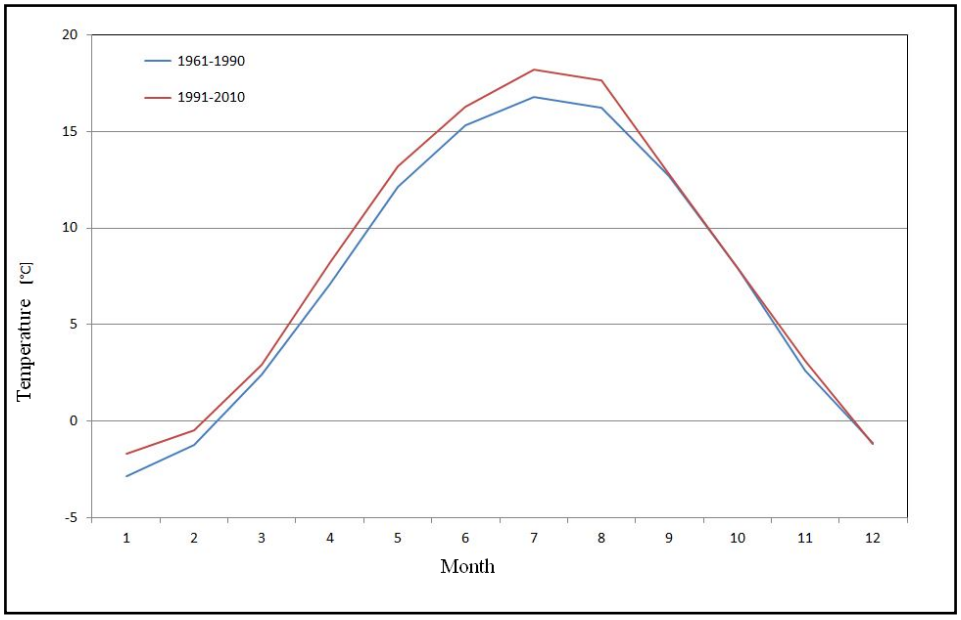
There are currently four national parks (Krkonoše (Giant Mountains), Šumava, Podyjí and České Švýcarsko (Czech Switzerland)) taking up 1 195 km2 and 25 smaller protected landscape areas (10 867 km2), which represent about 15.3% of the territory of the Czech Republic. Upon accession to the EU, the Czech Republic created the corresponding network of European system of sites of Community importance and bird areas – the so-called Natura 2000 system (comprising of 41 bird habitats and 1082 sites with European significance). The total area of the Natura 2000 network exceeds 11 072 km2, i.e. 14% of the entire Czech territory (EU average is 17.5%). Most of the naturally significant sites are protected by a special regime pursuant to Act No. 114/1992 Coll., on protection of nature and the landscape, as amended.

2.6 Climate

The Czech Republic lies within the Atlantic-continental area of the moderate climate zone of the northern hemisphere. Average annual temperature fluctuates in dependence on geographic factors between 1.1 to 9.7 °C. The lowest temperature averages are recorded in mountainous regions along the northern, eastern and south-western borders of the territory. The warmest regions lie in altitudes not exceeding 200 m (lowlands in southeast and along the Elbe River). Average spring and autumn temperature oscillates around 7 or 8 °C, during the summer months the temperature rises to 16 and 17 °C on average, in winter the temperature

drops to about -1 °C on average. Prague represents a specific region, as within its heat island[6] the average annual temperature is higher by approximately 1 to 2 °C above the value normal for its geographic location.

Figure 2.1: Annual course of average air temperature in the Czech Republic in the 1961 – 1990 and 1991 – 2010 periods



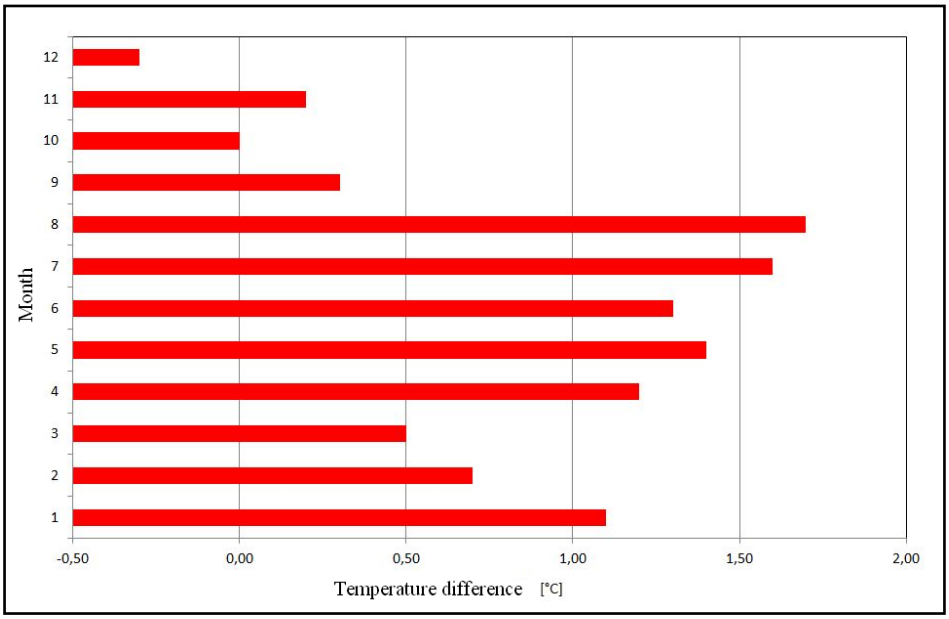
Source: CHMI

The annual course of average air temperature assumes the shape of a simple wave with the minimum in January and the maximum in June (Figure 2.1). Comparing temperature trends in 1961 – 1990 and 1991 –2010 (Figure 2.2) indicates that the average annual temperature between these two periods increased by 0.8 °C, with highest increase in August (by 1.7 °C); in December there has been a decrease by 0.3 °C.

During the summer months the fluctuations of average temperature are more significant; in the autumn and winter they are lower. Table 2.2 gives values of these fluctuations from average temperature (°C) supplemented with changes in precipitation levels between 1961–1990 and 1991–2010. A slight gradual increase of annual precipitation amount may be discerned over the last two decades. Increased precipitation in the summer, mostly attributed to storm rainfall, alleviates spring shortfall. Average precipitation in 1991–2010 is approximately 5% higher than during 1961–1990.

[6] Beranová, R., Huth, R. (2003): Prague heat island during different synoptic conditions. Meteorological Bulletin, 56, no. 5, pp 137-142, ISSN 0026-1173.

Figure 2.2: Average monthly temperature deviations between the 1961-1990 and 1991-2010 periods



Source: CHMI

Table 2.2: Changes in average temperature (°C) and precipitation amounts between the 1961–1990 and 1991–2010 periods

	I	II	III	IV	In	VI	VII	VIII	IX	X	XI	XII	year
Temperature °C)	1.1	0.7	0.5	1.2	1.4	1.3	1.6	1.7	0.3	0.0	0.2	-0.3	0.8
Precipitation (ratio)	1.03	1.02	1.31	0.87	0.94	0.97	1.19	1.02	1.14	1.09	1.03	1.04	1.05
Precipitation (%)	+3	+2	+31	-13	-6	-3	+19	+2	+14	+9	+3	+4	+5

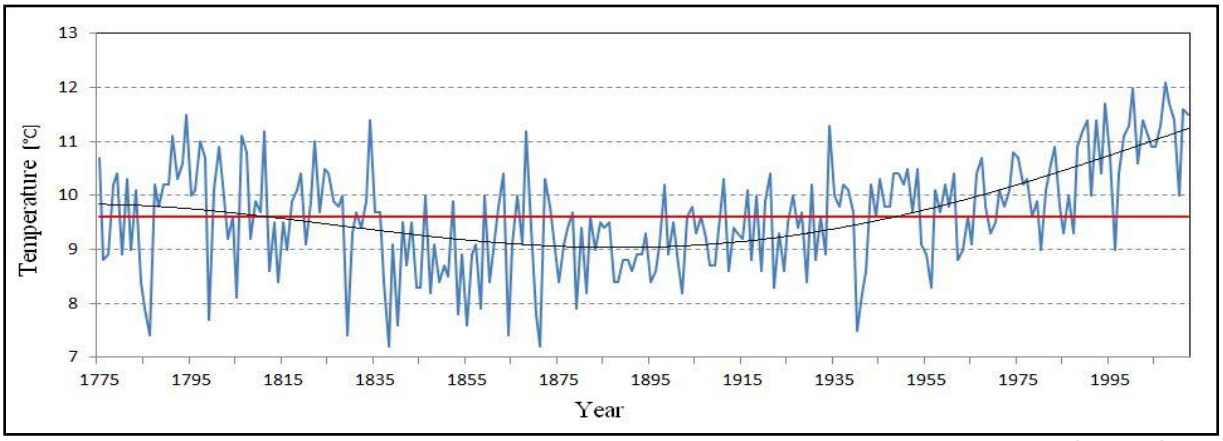
Source: CHMI

Records kept at the Prague-Klementinum[7] meteorological station, which keeps temperature records since 1775 and precipitation since 1805 (Figure 2.3 and 2.4), may be used to illustrate, for orientation, the long-term development of the temperature and precipitation regime in the Czech Republic. It is apparent that the end of the 18th century had been warmer and that the first half of the 19th century had been colder. From the second half of the 19th century the temperature gradually rose, the rise steadied in the mid-20th century, but temperature began rising steadily and markedly since the 80s of the 20th century again. Similar trends apply to seasonal cycles.

Year-on-year fluctuations of precipitation amounts are very high; for instance, for 2002 we record the third highest annual precipitation amount, while for 2003 the annual precipitation was second lowest in the 207 years of records. Despite that, there is an indistinctive trend of decreasing precipitation since the thirties of 20th century.

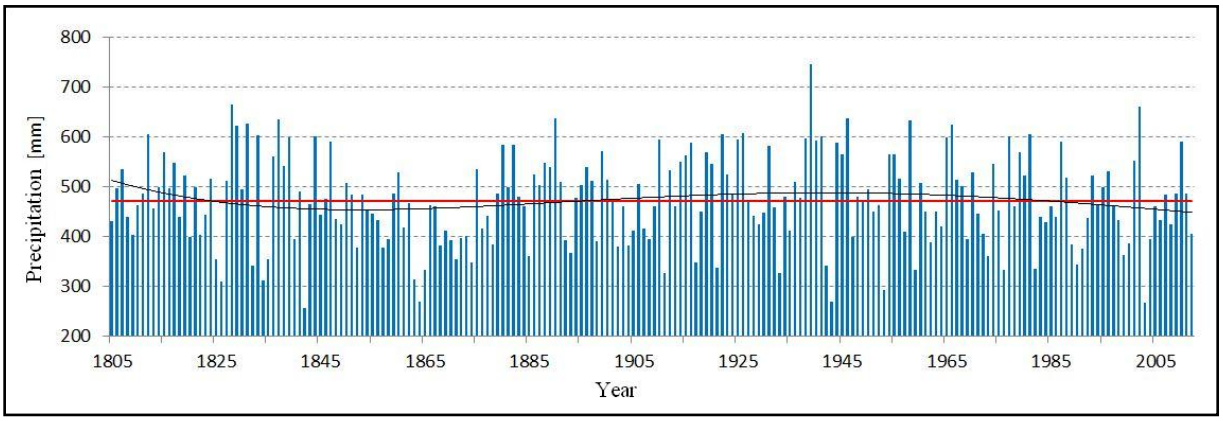
[7] Temperature progression can be used for an entirely demonstrable manner of detection of temperature change due to climate change only with difficulty because the station is very specific urban-type station and measured values are affected by the so-called heat island within city, which is a value proportional to the degree of urbanization and urban development. It is clear that in the period 1775-2012, the city gradually increased urbanization from a completely unknown value to the present level of around 2.0 to 2.4 ° C and in no case can be this anthropogenic heat contribution filtered from the measured temperature curve. For precipitation progression, the influence of the station position in the centre of the city may be only negligible.

Figure 2.3: Average annual air temperatures (°C) between 1775 and 2012, Prague-Klementinum



Source: CHMI

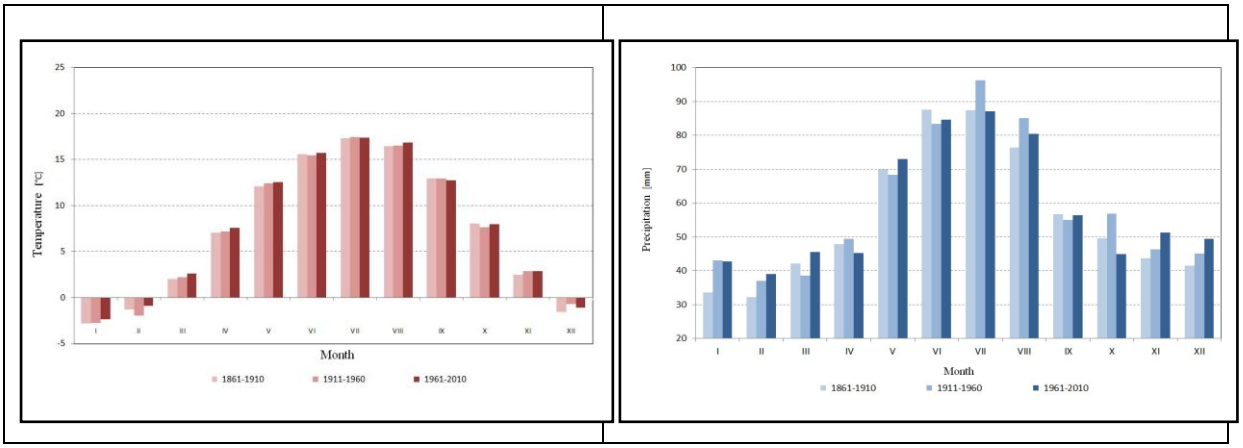
Figure 2.4: Average annual precipitation (mm) between 1805 and 2012, Prague-Klementinum



Source: CHMI

Fluctuation of average annual temperature over the last 150 years in the Czech Republic indicates that there is an incremental growth of the temperatures; between 1861 and 1910 the average annual temperature in the Czech Republic was 7.4 °C, between 1911 and 1960 also 7.4 °C and between 1961 and 2010 it was 7.7 °C. Similar change in the development of precipitation cannot be discerned, however the basic rhythm of precipitation remains the same – maximum precipitation happens in the summer, minimum in winter (Figure 2.5).

Figure 2.5: Development of average annual temperature (left) and average annual precipitation (right) in the last 150 years

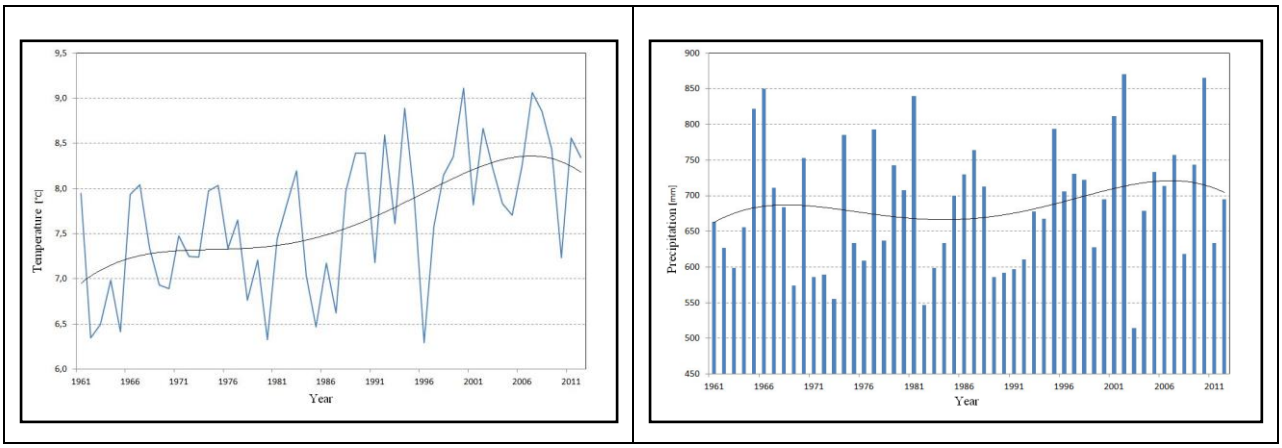


Source: CHMI

The two fundamental indicators of climate (temperature and precipitation) and their development may be described in a more precise manner using time series of territorial temperatures, respectively territorial precipitation, which are available since 1961. Territorial temperatures represent average air temperature reduced to medium altitude, considering results from the entire station network run by the CHMI, and illustrate the character of temperature regime development in the Czech Republic over the last 50 years; territorial precipitation models are construed in similar way.

Despite significant year-on-year changes, Figure 2.6 makes the trend of gradually increasing annual average air temperature apparent – see growth by approximately 0.3 °C/10 years. With the exception of the autumn, the differences between other 3 seasons of the year are not marked – higher growth trends are apparent in the summer; in the autumn, the average temperature growth trend is, in comparison with other seasons, approximately one third. In the summer, Moravia heats up quicker, in the winter and in the spring Bohemia warms up quicker. The differences between Bohemia and Moravia do not exceed temperature change of more than 0.05 °C/10 years and remain almost the same in the autumn. Considering the substantial year-on-year fluctuation of precipitation amounts, similar changes are statistically entirely negligible. For instance, in 2002 precipitation levels were the highest in the entire run of records, while in 2003 the annual precipitation was the lowest over the same period.

Figure 2.6: Average annual territorial temperature (left) and precipitation (right) in the Czech Republic in 1961–2012



Source: CHMI

The number of days when maximum (TMA) or minimum (TMI) air temperature exceeded or failed to reach the determined threshold limit is a climatological characteristic used to describe thermal regime of a monitored location or territory. In order to describe the course and externalities of the warm part of the year, we use the number of summer days (TMA ≥ 25 °C), and tropical days (TMA ≥ 30 °C) and tropical nights (TMI ≥ 20 °C). The course and externalities of the cold part of the year is characterised by and number of frost days (TMI < 0 °C), and ice days (TMA < 0 °C) and arctic days (TMA ≤ -10 °C). In order to get bearings on the potential development of the so-called "heat waves" these statistics are being supplemented by analysis of the number of days when the TMA ≥ 35 °C.

Average numbers of days with extreme temperatures and their change between two periods of time (Table 2.3, values are rounded up to whole days) show that in the last two decades there has been an increase in average number of days with high temperature and decrease in days with low temperature in the Czech Republic, which complements the gradual growth of temperatures and growing temperature extremality. Number of summer days has increased by

12 on average, number of tropical days by 6, and conversely the number of frost days dropped by 6 on average and ice days by 1. Similar trend has been recorded with respect to tropical nights and arctic days, however, statistically significant changes are not being recorded. Numbers of days with temperatures exceeding ≥ 35 °C occur, depending on actual weather, so far only exceptionally and their changes are also statistically negligible.

Table 2.3: Changes in average number of days with extreme temperatures in 1961–1990 and 1991–2010

		I	II	III	IV	In	VI	VII	VIII	IX	X	XI	XII	year
Summer days TMA ≥ 25 °C	1961–1990	0	0	0	1	4	9	14	13	4	0	0	0	45
	1991–2010	0	0	0	1	6	11	17	17	4	0	0	0	57
	change	**0**	**0**	**0**	**0**	**2**	**2**	**4**	**4**	**0**	**0**	**0**	**0**	**12**
Tropical days TMA ≥ 30 °C	1961–1990	0	0	0	0	0	1	3	3	0	0	0	0	8
	1991–2010	0	0	0	0	0	2	6	5	0	0	0	0	14
	change	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**2**	**0**	**0**	**0**	**0**	**6**
Frost days TMI < 0 °C	1961–1990	25	21	17	7	1	0	0	0	1	5	13	22	112
	1991–2010	23	21	16	7	1	0	0	0	0	5	12	22	106
	change	**-2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**	**-1**	**-6**
Ice days TMA < 0 °C	1961–1990	12	6	2	0	0	0	0	0	0	0	2	9	30
	1991–2010	11	6	1	0	0	0	0	0	0	0	2	9	28
	change	**-1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**

Source: CHMI

Numbers of days with precipitation level above a certain threshold are an important characteristic illustrating precipitation amounts in a territory generally. Precipitation days with precipitation amount exceeding ≥ 5 mm and ≥ 10 mm occur in the Czech Republic during the entire course of the year and their monthly numbers correspond to the annual course of precipitation – there is more precipitation in the summer, less in the winter. Days with precipitation exceeding ≥ 20 mm occur almost exclusively in the warm parts of the year, occurrence in the cold period is extraordinary.

Table 2.4, giving average numbers of days with precipitation exceeding certain threshold and their changes between the two monitored period show, that there has not been any statistically significant change in the last 50 years. Primary cause of this results is that significant precipitation events with strong (often rainstorm-level) precipitation are considerably inhomogeneous due to terrain topography over time and area and cannot be always recorded within the framework of existing weather stations. Radar data however confirm that the frequency of rainstorms have grown over the last two decades.

Table 2.4: Change in average number of days with threshold precipitation amounts in 1961–1990 and 1991–2010

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	year
≥ 5 mm	1961–1990	2	2	2	3	4	5	5	5	3	2	2	2	35
	1991–2010	2	2	2	3	5	5	5	4	4	2	3	2	37
	change	**0**	**-1**	**0**	**1**	**1**	**0**	**1**	**-1**	**1**	**0**	**1**	**0**	**2**
≥ 10 mm	1961–1990	0	0	1	1	2	2	2	2	1	1	1	1	14
	1991–2010	0	1	1	1	2	3	3	2	2	1	1	1	17
	change	**0**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**3**
≥ 20 mm	1961–1990	0	0	0	0	1	1	1	1	0	0	0	0	4
	1991–2010	0	0	0	0	1	1	1	1	1	0	0	0	5
	change	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**

Source: CHMI

Relative humidity, cloud amount, sunshine, snow cover and duration trends remain mutually consistent and correspond to temperature trends and their amplitudes. Winter, spring and summer are characterised by extended sunshine, lower cloud amount and lower relative humidity. Conversely, in the autumn, when temperature and daily amplitude drops, we record the opposite. Average number of days with snow cover in altitudes below 600m above sea level has dropped by approximately 15% in the last two decades in comparison with the usual number of days in the second half of the 20th century (the winter season is shorter by 12 days); in higher altitudes, the drop was approximately half that rate. Snow cover maxima have decreased in lowlands by 25%, in uplands by up to 30%. Similar trends are also recorded for overall new snow total precipitation.

2.7 Economy

The Czech Republic achieved two or three times the GDP growth between 2000 and 2008 in comparison with EU-27, EU-15 and OECD averages. Between 2005 and 2007, the Czech Republic had the fastest GDP growth dynamic exceeding 6% annually. Similar situation existed on the demand side of the GDP in areas such as investment, household consumption and exports, as well as at the supply side of the economy, in areas such as industry and services. Along with quick economic growth, the purchasing power parity (PPP) has also grown, from 71% of the EU-27 average in 2000 to 83% in 2007. The impact of global economic crisis made itself fully felt in 2009 and the Czech economy rapidly dropped primarily due to lack of foreign demand. After a frail recovery in 2010-2011, which had been stimulated exclusively by exports, the economy went into recession in 2011. In comparison with neighbouring countries, the Czech Republic had been in the worst situation due to both falling exports and the slump in household consumption triggered by uncertainty regarding future economic development. Consolidation of public budgets had been taking place also in the neighbouring countries, which managed to avoid another bout of lengthy recession. This caused the relative level of GDP per person, recalculated in PPP, to decrease to 79% of the EU-27 average in 2012.

The Czech economy continued to open up following accession to the EU in 2004 and utilizes the advantages of the common market based on an inflow of foreign investment and know-how. Global competition represented mostly by Asian emerging markets, China, India and by

strengthened exchange rate of the Czech koruna against global currencies (USD and EUR) disadvantages cheap consumer goods, products with low added value and semi-products.

The main supportive forces for economic growth in the Czech Republic in 2004 – 2007 included accession to the EU customs-free zone, high input of direct foreign investments providing for inflow of capital, know-how and entrance into the sales network of multinational companies. Low and stable inflation, together with low interest rates, stability in the financial sector and an increase in employment rates played an important role in promoting growth, where the economic policy, both monetary and fiscal, was not as restrictive as it had been throughout much of the 1990's. Economic development in 2008 – 2012 uncovered the vulnerabilities of the Czech economy and its protracted structural problems. This involved primarily long-term structural imbalance of public finance and subsequent insufficient fiscal support of the economy in recession, strong dependency of the economy on automobile industry, which had been systemically supported by system of investment incentives and the overly complex and costly tax and legal system. Lack of qualified graduates has also manifested the stealthy deficit of the Czech education system, which failed to produce sufficient numbers of professionals in the structure and quality, which the labour market demanded.

The Czech economy continues to be materially and energy intensive due to the predominantly industrial nature of the economy as a whole.

Anticipated development

Macroeconomic predictions published by the Ministry of Finance indicate that the economy should start to gradually revive in the second half of 2013, which is confirmed by preliminary estimates of GDP for 2nd quarter of 2013, which indicate end of recession by strong quarter-on-quarter growth achieving 0.7% GDP. Foreign demand should remain the main driver of the growth in the nearest future and the domestic demand should kick in at later stages. Higher utilization of production capacities is directly linked to a very gradual creation of gross fixed capital. The Ministry of Finance anticipates real GDP growth in 2014 to reach 1.3%. Prospects of a strong and stable economic growth remain uncertain and currently it cannot be ruled out that in extreme the recession may return.

When consolidation strategies were being drawn up it was anticipated that the economy will be gradually picking up and the public expenditure will be replaced by private investment and consumption supported by decreasing interest rates. In the meantime the situation in the Eurozone has become more complicated again which backfired in the form of halting exports. The Czech Government anticipates that the deficit of the public finance will again comply with Maastricht 3% criteria in 2013.

Table 2.5: Development in population growth and main economic indicators in 1995 - 2012

Year	1995	2008	2009	2010	2011	2012
Number of inhabitants (thousand)	10 331	10 430	10 491	10 517	10 497	10 509
GDP (billion CZK)	1 533.7	3 848.4	3 759.0	3 790.9	3 823.4	3 830.5
GDP (PPS[a]) per capita	11 232	20 227	19 405	19 491	20 144	20 215
Average gross monthly wage of employees in the national economy (CZK)	8 010	22 592	23 344	23 864	24 455	25 112

Year	1995	2008	2009	2010	2011	2012
Inflation rate (%)	9.1	6.3	1.0	1.5	1.9	3.3
Price indexes in the consumer sphere, total (2005=100)	64.5	112.1	113.3	114.9	117.1	121.0
Foreign investments in the Czech Republic (billion CZK)	723.1	3 919.8	4 046.4	4 253.4	4 357.2	4 575.9
Foreign debt of the Czech Republic (billion CZK)	457.3	1 629.5	1 639.2	1 766.7	1 877.5	1 940.9
Average annual exchange rate CZK vsEUR (ECU)	34.31	24.94	26.45	25.29	24.59	25.14
Average annual exchange rate CZK vsUSD	26.54	17.04	19.06	19.11	17.69	19.58
Unemployment level (%)	4.0	4.4	6.7	7.3	6.7	7.0
Balance of foreign investment (billion CZK)	58.9	-1 545.0	-1 727.8	-1 830.4	-1 817.6	-1 903.6

a) PPS (Purchasing Power Standard); average purchasing power 1 PPS corresponds to average purchase power of 1 EUR in EU-27;

Source: CzSO

Table 2.6: Sources of GDP in current prices in 1995 – 2012 period, in million CZK (Part 1)

Year / Sector	Agriculture, forestry, fishery	Mineral resources – mining	Manufacturing industry	Generation and distribution of electricity, gas and water	Construction sector	Commerce, automobile repairs and consumer goods	Hotel industry / accommodation	Transport, warehouses, post and telecoms
1995	62 219	31 339	321 803	76 282	107 128	149 819	47 419	137 284
2002	68 853	28 221	576 324	105 385	152 522	290 633	62 935	278 437
2003	67 129	26 792	586 401	105 030	163 552	297 492	68 272	301 537
2004	72 820	32 672	667 761	120 290	182 301	308 376	71 849	309 110
2005	71 691	35 783	716 877	124 791	189 292	338 185	65 053	324 957
2006	74 434	40 695	776 768	144 495	199 158	375 453	64 781	357 851
2007	79 068	44 342	848 243	154 826	224 875	394 329	73 088	392 008
2008	80 293	50 355	846 306	188 842	235 658	403 884	72 011	403 174
2009	65 122	42 997	764 613	211 037	242 216	362 557	65 802	391 700
2010	56 659	43 974	785 507	185 974	250 786	379 241	64 712	393 848
2011	79 814	46 269	825 344	178 602	233 937	386 053	64 914	384 524
2012	71 452	39 655	847 622	175 835	217 497	400 581	64 370	385 521

Source: CzSO

Table 2.7: Sources of GDP in current prices in 1995 – 2012 period, in million CZK (Part 2)

Year / Sector	Financial sector / insurance	Real estate, enterprise services, R&D	Public administration; defence; social security	Education	Healthcare, veterinary and social services	Other public, social and personal services	Households employing staff	Gross added value in basic prices
1995	44 646	177 082	93 986	58 112	49 158	36 893	210	**1 393 380**
2002	65 754	295 601	172 839	93 405	94 195	58 585	323	**2 344 012**
2003	81 710	307 068	181 569	103 189	99 724	64 621	371	**2 454 457**
2004	86 664	325 585	186 259	108 871	105 403	66 081	423	**2 644 465**
2005	81 532	362 883	197 389	117 110	114 901	66 942	435	**2 807 821**
2006	91 324	386 529	207 035	123 949	118 937	75 301	494	**3 037 204**
2007	113 313	424 549	219 522	132 644	123 259	79 842	440	**3 304 348**
2008	139 269	479 482	229 095	138 031	135 482	77 611	429	**3 479 922**
2009	150 280	487 417	238 398	142 506	145 333	79 764	489	**3 390 231**
2010	157 934	491 851	238 379	142 545	145 203	83 195	490	**3 420 298**
2011	167 696	468 905	227 327	146 238	150 495	83 842	505	**3 444 465**
2012	149 967	477 511	229 469	151 419	152 649	81 723	511	**3 435 608**

Source: CzSO

2.8 Energy and energy intensity of economy

The energy intensity of the Czech economy has been decreasing over the long term, among other also due to use of technologies that are less energy intensive, heat insulation of buildings and savings achieved by households. The Czech Republic however remains one of the countries with high energy intensity per GDP unit in international comparison.

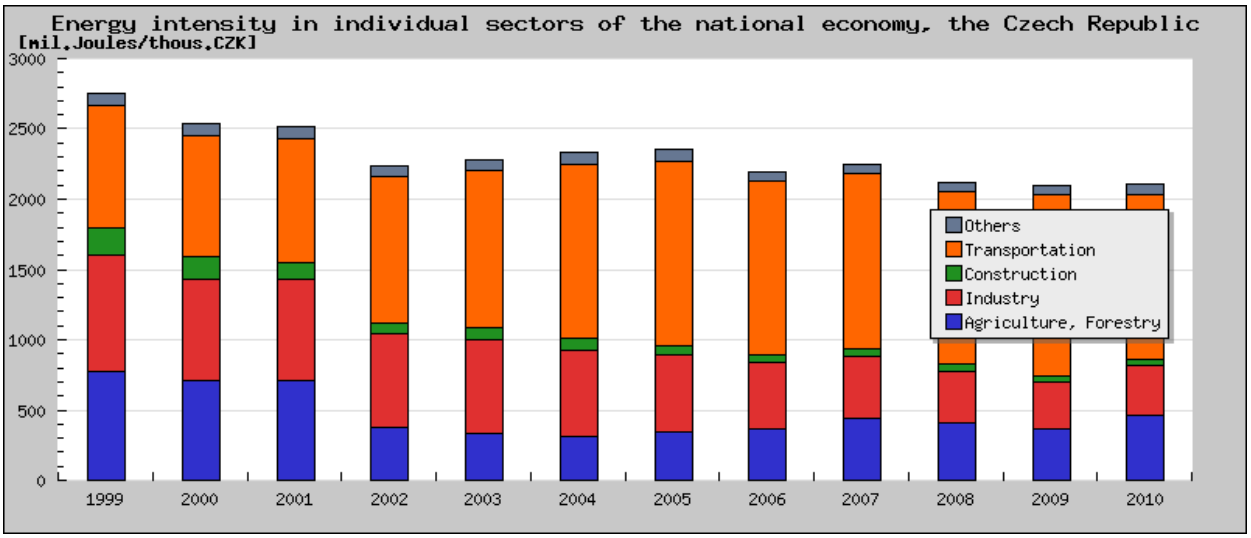
Year-on-year tempo of **energy intensity decrease** has been very unstable and fluctuated during 2000-2003, however the situation has been improving since 2004 and energy intensity decreased considerably. Besides economic growth, this situation has been also influenced to a large degree by implementation of measures contained in the State Energy Policy, which was adopted in March 2004. Domestic consumption of energy per GDP unit has been steadily falling up to 2008. In 2009, as a result of financial and economic crisis, there has been a decrease in consumption of primary energy sources but also decrease of GDP, which has considerably influenced the resulting energy intensity of the economy, which temporarily grew again.

The Czech economy began growing again in 2010. This situation influenced consumption of primary energy sources (PES), which grew (by 5.3%), and GDP, which also grew (by 2.3%). Both these values subsequently influenced the total energy intensity economy, which has, after temporary growth caused by economic crisis in 2010, grown further, by 2.9%. **In long-term perspective** however, there continues to be an apparent decrease, in comparison with 2000, whereby the energy intensity of the Czech economy decreased by 19.0%.

This situation turned around entirely in 2011 when an absolute decoupling between GDP and PES consumption has been achieved – GDP grew while PES consumption continued to decrease. Energy intensity of the economy reached 505.6 GJ/thousand CZK (s.c.r. 2005) which represents a year-on-year decrease by 3.3%. In the long-term perspective, since 2000 (when this value was 661.8 GJ/thousand CZK), there has been an overall decrease of energy intensity by 23.6%.

The largest shares on energy intensity in **sectoral structure** (refer to Figure 2.7) are contributed by transportation, industry and agriculture.

Figure 2.7: Energy intensity – sector structure Czech Republic [MJ / thousand CZK]

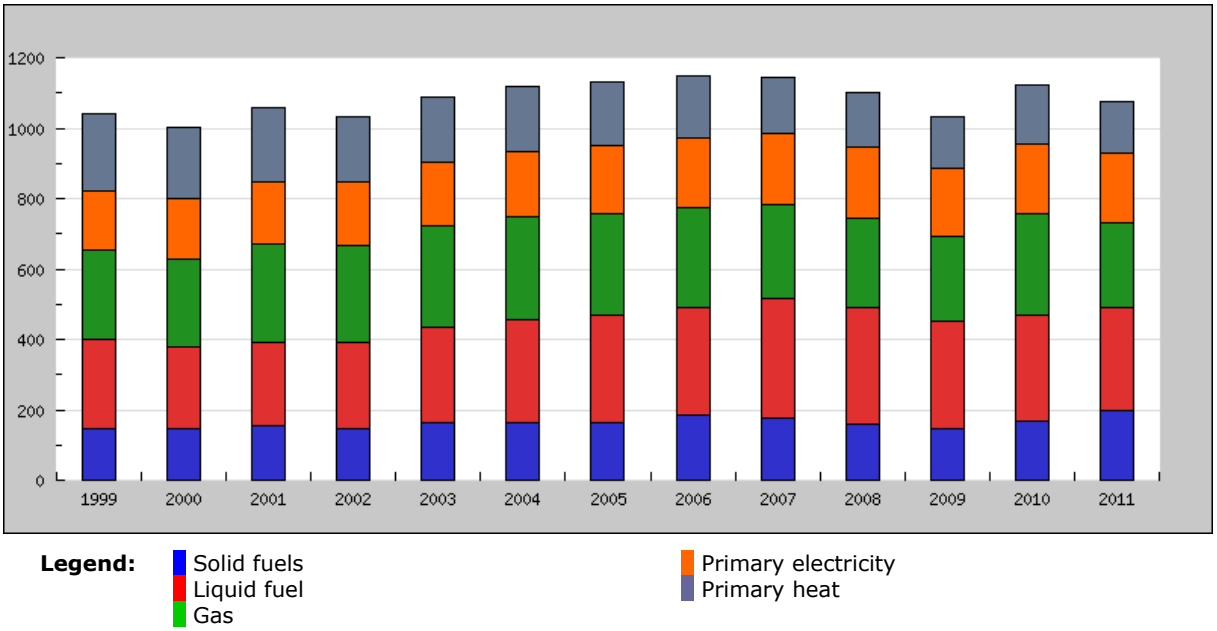


Source: CzSO

Development of energy consumption

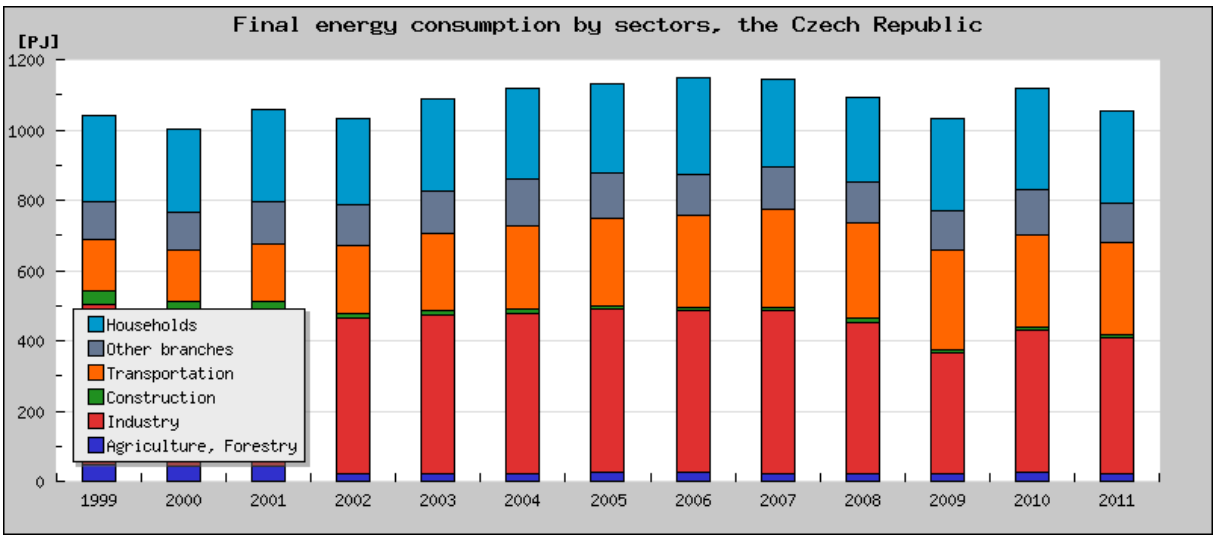
Growing total end-user energy consumption (refer to Figure 2.8) in 1999–2011, during which consumption grew by 14%, ended in 2007, when the situation turned around and a slight decrease of total consumption has been recorded in the following years (by 0.36% in 2007, by 3.6% in 2008 and by 7.76% in 2009). Year-on-year decrease in consumption had been recorded for the first time for all forms of energy in 2009. Causes of this decrease include, besides savings, also various impacts of the economic crisis as energy consumption in the Czech Republic is by largest degree influenced by the industrial sector, which lost its output. In 2010, consumption began growing again, triggered by increased industrial production and national economy overall, however 2011 marked again a year-on-year decrease, by 4.0%.

Figure 2.8: Total end-user energy consumption according to energy sources, Czech Republic [PJ]



Source: CzSO

Figure 2.9: Total end-user energy consumption according to sectors, Czech Republic [PJ]



Source: CzSO

From the viewpoint of the total end-user energy consumption according to sector, the industrial sector is the most energy intensive (35.8% in 2011). Energy consumption in this sector has fluctuated but since 2006, and thanks to restructuring of the sector and efforts to introduce less energy intensive technologies, there has been steady annual decrease. Energy savings are being implemented both in the energy transformation area (replacement of less efficient technology in steam-driven power plants and heating plants, which are near the end of their useful life) as well as in the area of consumption – by application of the best available technologies, use of energy-saving appliances, construction of energy-saving buildings, use of high-quality insulation, use of energy audits, labelling of appliances, increased efficiency of

energy cycles, obligation to combine electricity generation with heat generation and host of other measures.

Massive year-on-year fall in consumption began in 2009 as a consequence of the economic crisis, which has affected this sector especially sharply. In 2010, the consumption was spurred by economic growth and year-on-year consumption in the industrial sector grew again. In comparison with consumption levels in the sector prior to the crisis, the slowly decreasing trend however continues. The most energy intensive areas in the manufacturing industry include metallurgy, production of non-metal mineral products, chemical and oil-manufacturing industry.

Other significant contributors to total energy consumption in the Czech Republic are households (consuming 24.1% of total energy in 2011). Heating takes up most of the household energy consumption.

Transportation sector contributed to total consumption in 2011 by 24.3%. This sector is the only sector steadily growing in the past, and in recent years its consumption is marked by fluctuations.

Electricity generation structure

Composition of pollutants and greenhouses gases, which are being discharged from energy-generating sources, is closely linked to the composition and share of individual sources energy. Dependence on domestically available fossil fuels as a source ensuring energy security leads to landscape damage and related reduced attractiveness of the territory. A number of energy source sites also take up large areas of the territory, influence microclimate in the location and damages the aesthetic and recreational function of the landscape.

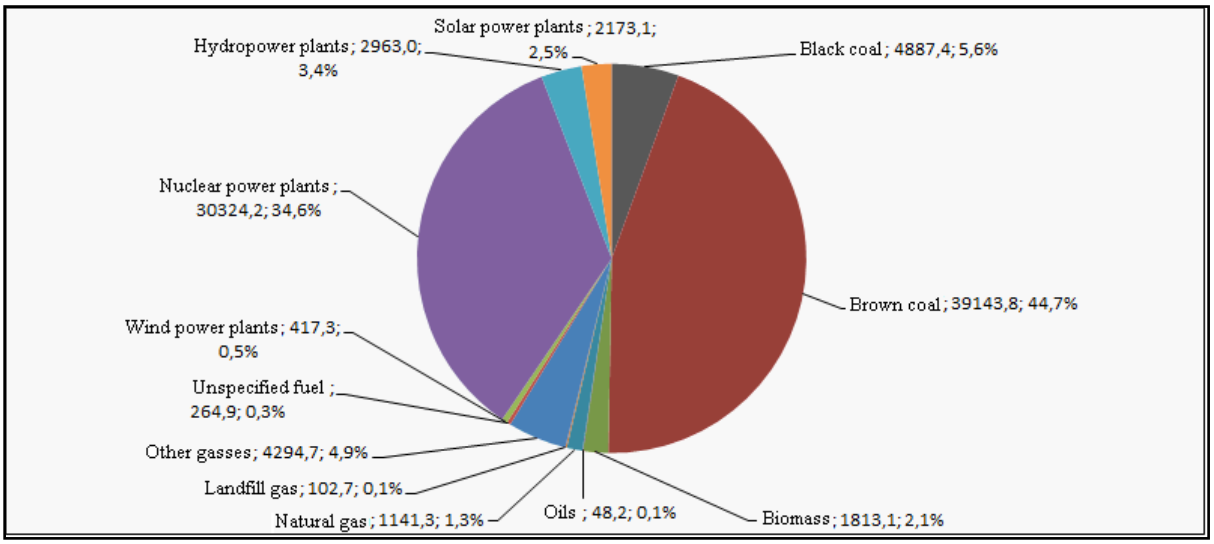
The Czech Republic generates electricity predominantly in coal-driven sources. Brown coal (lignite) accounted for production of 44.7% (39 144 GWh) of electricity in 2012 while black coal accounted for 5.6% (4887 GWh) of the total volume generated. Generation of electricity in coal-fired plants have been stagnating in recent years or slightly decreasing.

Another significant source are nuclear power plants (Dukovany and Temelín), which accounted for 34.3% (30 324 GWh) of all electricity generated in 2012.

The share of electricity generated in nuclear power plants has been growing; energy generation in nuclear power plants remains a widely discussed topic. On one hand, it represents an almost emission-free technology, which is very beneficial to the environment, especially air and climate; on the other hand it produces waste in the form of spent nuclear fuel and its safe and final disposal or recovery has not been resolved yet.

Structure of electricity generation according to fuel type used is given in Figure 2.10.

Figure 2.10: Structure of electricity generation according to fuel type, Czech Republic, 2012 [GWh, %]



Source: ERO, MIT

Total production of electricity in 2000–2011 fluctuates, but the overall trend is growing. In comparison with 2000, there was 19.2% more electricity generated in 2011; the year-on-year increase (2010/2011) reached 1.9%.

The Czech Republic generates sufficient volume of electricity to cover all of its domestic demand and therefore it is able to export a considerable portion abroad. The Czech Republic exported in 2011 a total of 27.5 TWh of electricity, i.e. almost 31.4% of the total produced, and imported only 10.5 TWh. The balance between imports and exports is 17.0 TWh, which amounts to 19.5% of the total electricity generated in the Czech Republic (87 561 GWh). The Czech Republic thus belongs among the largest European electricity exporters. At the same time, the Czech Republic is facing the key decision regarding its future energy strategy, taking into account the limited available deposits of coal and other minor energy sources.

Heat production structure

The Czech Republic produces heat mostly in power plants and heating plants (70.9%) and in district heating plants (22.8%). Other sources contribute only single-digit percentage points.

Overall, the volume of produced heat is falling, which demonstrates economic and prudent use of heat and efforts leading to lowering of heat consumption in the industrial and public sector. Net heat production in 2011 reached 182 718 TJ, which marks a year-on-year decrease by 9.4%. In 2012, the net production reached 185 589 TJ, which is a slight (1.5%) year-on-year increase. The Czech Republic is one of the countries with a very high utilization of centralized heating systems.

Energy and renewable energy sources

The significance of renewable energy sources (RES) in the Czech energy sector has been steadily growing. The volume of produced energy has been growing annually (see Figure 2.11) as well as its share in the total electricity generation. Before 2011, the largest sources of RES energy in the Czech Republic were hydropower plants, but these were overtaken in 2011 by photovoltaic power plants due to rapid increase in solar production compounded by lower production from hydro sources caused by lower precipitation that year. Estimates for 2012

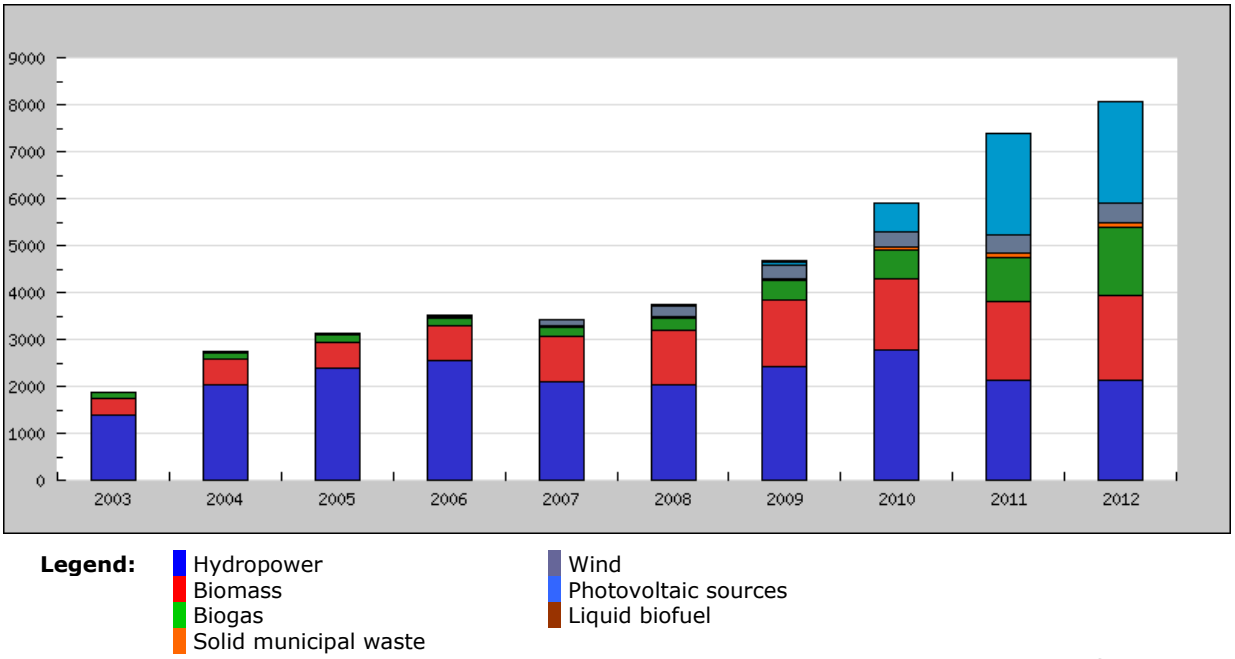
(data are not yet complete) place production from solar and hydro sources at almost equal footing. A considerable increase has been recorded for electricity generation using biogas, where production rose year-on-year by 543 GWh.

Structure of electricity generation from RES in 2012 (estimate) was as follows: photovoltaic sources (26.7%), hydropower (26.4%), biomass (22.4%), biogas (18.3%), wind (5.2%) and energy produced by incineration of solid municipal waste (1.1%).[8]

In 2011, RES produced 7 245 GWh of electricity, 2012 estimates amount to 8 056 GWh, which represents the anticipated year-on-year increase of 11.2%. Estimated RES production in 2012 represents 9.2% of the total generated electricity in the Czech Republic (in 2011 this share was 8.5 %).

This increase is a result of development in biogas production, where electricity generation rose year-on-year by 58.5%. Estimates for 2012 indicate that hydropower will generate 8.4% more than year before, biomass 7% more and wind 4.8% more. The same estimate indicates a decrease in photovoltaic generation (-1.5%) and municipal waste recovery (-3.5%).

Figure 2.11: Electricity generation from RES and waste in the Czech Republic [GWh] between 2003 and 2012



Source: MIT

Considerable financial support provided toward RES-driven electricity generation causes increases in the price of electricity. This is a problematic issue, especially for large customers, such as the metallurgy sector, chemical plants, paper mills or the glass-making industry. Increasing prices may jeopardize their ability to compete or even their very existence.

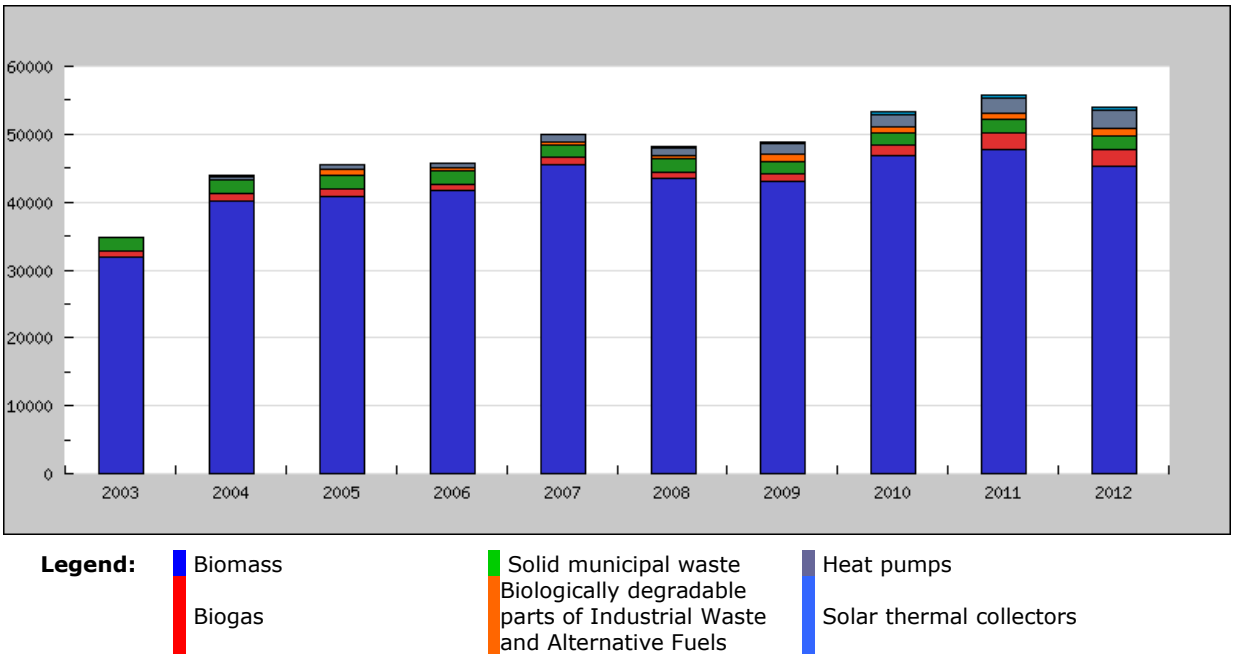
Volume of heat generated using RES has been steadily growing over the long-term; the 2012 estimates anticipate year-on-year increase by 1.8% (see Figure 2.12). In 2011, RES accounted for 8% of the heat produced. The largest volume is produced from biomass (83.8%), where

[8] *Note: rounding up the figures results in the sum totalling 100.1 %.*

the decisive factor is use of wood in household sources. Year-on-year estimates for 2012 indicate a decrease in biomass heat production by 0.5%. Other sources contribute far less (waste 5.7%, biogas 4.6%, heat pumps 4.9%, solar thermal collectors 1%). A more considerable year-on-year increase has been recorded in estimates for biogas heat production, by 30.8%, where the production rose from 1910 TJ in 2011 to anticipated 2500 TJ in 2012. Rapid growth will also affect production using heat pumps and solar thermal collectors.

The Czech Republic committed itself, in line with the EU targets, to achieve and 13% share of RES in the final consumption of energy sources by 2020. This target includes gross consumption of electricity, final consumption of heat energy and cooling and final consumption of energy in transportation. The Czech Republic achieved approximately 10% of RES in the final consumption of energy sources already in 2011.

Figure 2.12: Heat production using RES and waste in the Czech Republic [GJ] in 2003 – 2012



Source: MIT

Composition of fuel used in generating energy from RES increases diversification, which assists in improved security of energy supplies and reduces CO_2 emissions. Production of energy from RES is currently costlier, in the majority of cases, than use of conventional fuel, but this difference has been gradually falling – especially when the related external costs related to production of greenhouse gas emissions and air pollutants are factored in.

In comparison with other EU Member States, the Czech Republic is among countries with lower RES utilization in terms of electricity consumption. The reason lies in low usable potential of certain RES sources in the Czech Republic, as there does not exist large potential for hydropower such as in Norway or Austria, or wind turbines such as in Germany. Biomass potential is comparable with other countries in Central Europe.

Table 2.8: Electricity balance (GWh)

GWh	2007	2008	2009	2010	2011	2012*)
Gross production	88 198	83 518	82 250	85 910	87 454	87 574
Own consumption	6 786	6 433	6 260	6 446	6 533	..
Net consumption	81 412	77 085	75 990	79 464	80 921	..
Imports	10 204	8 520	8 586	6 642	10 457	11 587
Exports	26 357	19 989	22 230	21 590	27 501	28 707
Overdraft reserve	592	477	747	795	944	..
Transmission losses	4 915	4 662	4 487	4 466	4 405	..
Energy sector consumption	2 512	2 437	2 199	2 043	1 875	..
Final consumption	57 240	58 040	54 913	57 212	56 653	

*) estimate

Source: IEA

Table 2.9: Gross electricity production from renewable energy sources (GWh)

	2008	2009	2010	2011	2012 *)
Hydropower	**2 024.3**	**2 429.6**	**2 789.5**	**1 963.2**	**2 129.0**
SHP < 1 MW	442.4	469.9	554.8	397.0	-
SHP 1 up to < 10 MW	477.8	484.9	603.8	497.6	-
LHP ≥ 10 MW	1 104.1	1 474.8	1 630.9	1 068.5	-
Biomass total	**1 170.5**	**1 396.3**	**1 492.2**	**1 684.6**	**1 803.0**
Wood chips etc.	603	650.1	641.8	820.0	-
Cellulose	458.5	500.5	514.7	526.2	-
Plant materials	23.1	72.9	74.2	111.0	-
Pellets and patent fuel	84.5	164.2	241.2	218.0	-
Other biomass	1.4	8.6	20.2	0.0	-
Liquid biofuel	0	0.0	0.1	9.3	-
Biogas total	**266.9**	**441.3**	**634.7**	**928.7**	**1 472.0**
Municipal WWTP	74	79.2	85.0	88.3	-
Industrial WWTP	4	3.6	5.0	6.9	-
Biogas stations	91.6	262.6	447.4	724.8	-
Landfill gas	97.2	95.8	97.3	108.7	-
Biologically degradable parts of Solid Municipal Waste	**11.7**	**10.9**	**35.6**	**90.2**	**87.0**
Biologically degradable parts of Industrial Waste and Alternative Fuels	**0**	0.0	0.0	0.0	0.0
Wind	**244.7**	**288.1**	**335.5**	**397.0**	**416.0**
Photovoltaic plants	**12.9**	**88.8**	**615.7**	**2 182.0**	**2 149.0**
Total	**3 731**	**4 655.0**	**5 903.2**	**7 245.7**	**8 056.0**

*) estimate

Source: CzSO

Table 2.10: Heat production from renewable energy sources (TJ)

	2008	2009	2010	2011	2012 *)
Biomass total	**43 399.9**	**43 007.2**	**46 736.3**	**45 436.7**	**45 206.0**
Biomass outside households	**15 462.6**	**15 497.7**	**16 065.8**	**16 132.6**	**-**
Firewood	355.8	318.6	379.9	360.1	-
Wood chips etc.	8 297.8	7 929.6	8 147.7	8 415.7	-
Cellulose	6 339.2	6 455.2	6 739.7	6 609.3	-
Plant materials	258.5	432.3	483.3	429.3	-
Pellets and patent fuel	211.3	360.8	311.2	316.1	-
Other biomass	0.0	1.2	4.1	0.0	-
Liquid biofuel	0.1	0.0	0.0	2.1	-
Biomass – households	**27 937.4**	**27 509.5**	**30 670.5**	**29 304.1**	**-**
Biogas total	**1 065.4**	**1 211.0**	**1 610.4**	**1 910.6**	**2 500.0**
Municipal WWTP	690.3	678.1	714.7	745.9	-
Industrial WWTP	62.2	58.7	62.8	71.5	-
Biogas stations	226.5	397.6	752.4	1 015.8	-
Landfill gas	86.5	76.5	80.5	77.5	-
Biologically degradable parts of Solid Municipal Waste	**1 848.2**	**1 646.0**	**1 777.1**	**2 074.9**	**2 137.0**
Biologically degradable parts of Industrial Waste and Alternative Fuels	**1 100.2**	**1 140.0**	**969.2**	**929.9**	**927.0**
Heat pumps	**1 159.6**	**1 445.3**	**1 775.7**	**2 193.4**	**2 655.0**
Solar thermal collectors	**203.9**	**265.5**	**366.5**	**478.3**	**535.0**
Total	**48 777.2**	**48 715.0**	**53 235.1**	**53 023.8**	**53 960.0**

*) estimate

Source: CzSO

2.9 Resources management

The Czech Republic does not have large deposits of mineral resources; most are imported. Available supply of certain mineral resources, located in the Czech Republic, has been depleted to a large degree. Economic reasons lead to suppression of black coal mining. Lignite mining in open strip mines has considerable negative environmental impacts. The supply of energy coal has been estimated to last for another 10 – 50 years. From the perspective of sustainable development, the increased use of renewable energy sources and energy savings are well justified. Recycling of industrial and consumer waste and its energy recovery is an important factor. Secondary raw materials market (aluminium, steel, glass, plastics etc.) reacts sharply to the prices of primary raw materials and fossil fuels.

Mineral resources

Mineral resource mining reached approximately 1.3% on the total GDP in 2010. The Czech economy depends on imports of a number of mineral resources, as the available supply of several types of mineral resources is already nearly depleted in the Czech Republic. At present time, the Czech Republic does not have significant deposit of ore and only limited own supply of fossil fuels. The country has sufficient supply of certain non-ore and construction raw materials, with deposits sufficient for tens up to hundreds of years. The Czech Republic has raw material basis especially for development of traditional industrial sectors – glass-making (sand), ceramics and porcelain (wide variety of ceramic clays, china, kaolin) and paper-making (paper kaolin). Technical quality of cement production, lime and

plaster are comparable with production in the highly developed EU countries. Mined out deposits of natural gas and oil may be used in the future, given suitable geological conditions are present, for underground storage of natural gas.

At present time, the Czech Republic mines the following mineral resources: lignite, black coal, oil, natural gas, uranium, kaolin, clays, bentonite, spar, fuse basalt, diatomite, quartz, sand for glass-making and casting, lime and cement, dolomites, gypsum, and wide variety of decorative stones, construction stone, gravel sand and brick-clay. In terms of volume, the most important is lignite mining in strip mines, which fluctuates between 40-45 million tons annually. Black coal mining is also significant (10-12 million tons annually) as well as production of construction materials (especially exclusive construction stone and gravel stone).

2.10 Transport

The Czech Republic's central location within Europe makes it a crossroad for all kinds of transportation; at the same time, the country has one of the densest transportation infrastructures within the EU. The fundamental pillar is combination of road and railway transportation. In terms of transportation output in personal transportation there has been a considerable decrease in 2010, which may have been caused by a rapid growth of consumption tax and fuel in this period.

Another factor contributing to decrease of personal transportation output, but also freight, is the 2008 economic crisis. Individual automobile transportation reached 70% in 2012, while in 1990 it was a mere 59%. Between these dates it fluctuated between 73-74%, but in the last three years there has been and decrease due to high prices of fuel in the Czech Republic. At the same time, biking became more popular especially in smaller cities and towns, which had been greatly assisted by development of safe infrastructure. In towns with 5000 up to 50 000 inhabitants, biking-related transportation reaches 2 up to 25% of transportation to and from work.

The decrease in personal use of automobiles is to certain degree a positive development, especially with regard to the environment, even though cars continue to contribute to the worsening the air quality in highly urbanized areas. Decreasing use, whether personal or in terms of freight, of railways is also a worrying trend. Railway transportation in 1990 processed almost 70% of the total freight transportation, while today it is only approximately 22%. The vast majority of freight in the Czech Republic is transported by road. The data below giving figures for air transportation represent domestic carriers on domestic and international commercial routes as well as charter flights (persons and freight) (Tables 2.11, 2.12, 2.13. and 2.14).

Railway network density is comparatively high (12.1 km of railways per 100 km^2), the railway infrastructure however requires substantial upgrade, which has in part been already commenced and even already completed especially on internationally significant routes. Road network also requires modernization (in 2012 the road density was 70 km/100 km^2) and there is a need for continued construction of motorways (in 2012 the density reached 0.95 km/100 km^2); the roads continue to be technically neglected especially in terms of transportation defects, insufficient capacity, quality and unsatisfactory parameters.

Table 2.11: Personal transportation output in 1990 – 2012 (million vehicle-kilometres)

	1990	1995	2000	2005	2006	2007	2008	2009	20101)	2011	2012
Personal	21 884	26 597	30 701	34 945	35 934	37 282	38 463	39 675	34 230	35 086	34 594
Personal-petrol	20 428	24 766	27 216	28 551	28 850	29 394	29 658	29 779	25 014	24 976	23 647
Personal-diesel	1 390	1 755	3 421	6 338	7 036	7 842	8 760	9 853	9 180	10 074	10 897
LCV	146	543	1 279	2 231	2 416	2 602	2 788	2 974	3 159	3 345	3 531
Heavy trucks		5 480	7 525	9 063					8 128		
Buses		790	665	639					472		
Total	**25 999**	**33 740**	**40 480**	**47 169**	**48 505**	**50 324**	**51 918**	**53 555**	**46 381**	**47 541**	**46 875**

1) change in methodology *Source: TRC*

Table 2.12: Personal transportation output in 1990 – 2012 (billion person-kilometres)

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Road – on own account	39.90	54.50	63.94	68.64	69.63	71.54	72.38	72.29	63.57	65.49	64.26
Road – public	12.34	7.67	9.35	8.61	9.50	9.52	9.22	9.49	10.34	9.27	9.02
Road – total	52.24	62.17	73.29	77.25	79.13	81.06	81.60	81.78	73.91	74.76	73.28
Railway transportation	13.36	8.01	7.30	6.67	6.92	6.90	6.80	6.50	6.59	6.71	7.27
Air transportation	2.18	3.03	5.86	9.74	10.23	10.48	10.75	11.33	10.90	11.59	10.61
Water-borne transportation	0.00	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.02
Total	67.78	73.22	86.46	93.67	96.30	98.45	99.16	99.63	91.41	93.07	91.17

Source: TRC

Table 2.13: Transport output – freight 1990 – 2012 (billion tkm)

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Road – on own account	8.01	9.60	7.67	5.33	5.28	4.87	4.82	3.84	3.87	4.92	4.88
Road – public	8.81	22.90	31.36	38.12	45.09	43.27	46.06	41.12	47.97	49.91	46.35
Road – total	16.82	32.50	39.04	43.45	50.37	48.14	50.88	44.96	51.84	54.83	51.23
Railway	41.14	25.50	17.50	14.87	15.78	16.30	15.44	12.79	13.77	14.32	14.27
Air transportation	0.06	0.03	0.04	0.04	0.05	0.04	0.04	0.03	0.02	0.02	0.02
Water transportation	1.41	1.23	0.77	0.78	0.82	0.90	0.86	0.64	0.68	0.70	0.67
Total	59.43	59.26	57.34	59.14	67.01	65.38	67.21	58.42	66.31	69.86	66.18

Source: TRC

Table 2.14: Air transportation 2000 – 2012

Indicator	2000	2004	2005	2006	2007	2008	2009	2010	2011	2012[1)]
Total number of flights	53 040	82 591	95 310	95 184	100 839	105 083	101 153	95 617	87 334	-
Total number of km flown (thousand)	61 554	87 824	96 833	98 796	104 626	111 024	110 729	105 926	105 372	-
Total number of persons transported (thousand)[2)]	3 483	5 750	6 330	6 710	6 977	7 158	7 354	7 466	7 525	6 420

1) Preliminary data *2) Only Czech commercial operators* *Source: CzSO*

In 1990, the transportation-generated emissions amounted to mere 6.35% of total CO_2 emissions in the Czech Republic. In 2009, this value rose to its maximum of 16.49%. This is a very adverse trend, despite the fact that it still remains below EU-15 average. After 2009, emissions in this sector have started to fall for the first time in history, but that trend might have well been caused by the 2008 economic crisis.

Table 2.15 gives an overview of the number of vehicles in the Czech Republic between 1990 and 2012. Vehicle numbers nearly doubled over the last 20 years and reached a total of 4.71 million in 2012 – which is 45 vehicles per 100 inhabitants in 2012 (in 1990 this number was 23).

Table 2.15: Number of motor vehicles in the Czech Republic 1990 – 2012 (in thousands)

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012[1)]
Single-track	1 172	915	749	794	823	860	893	903	924	944	977
Personal cars	2 411	3 043	3 439	3 959	4 109	4 280	4 423	4 435	4 496	4 581	4 706
Trucks	156	203	276	415	468	534	590	587	585	586	595
Buses	26	20	18	20	20	20	20	20	20	20	20
Total	3 765	4 181	4 482	5 188	5 420	5 694	5 926	5 945	6 025	6 131	6 298

[1)] Data valid as of 1. 7. 2013 – due to changes in the vehicle registration system triggered by the EU legislation the data for 31. 12. 2012 are not available.

Source: TRC

Despite continuous improvements in the structure of vehicle pool (number of cars complying with EURO standard has been growing, and the number of cars without catalyser dropped from 93% in 1993 to 16% in 2011) the average age of vehicles in the Czech Republic remains high (13.9 for personal cars in 2012) and its structure is not yet close to the structure in the EU generally. Alternative propulsion systems amounted to 2.1% in 2011.

Table 2.16 gives data on static structure of personal cars according to vehicle age. Table shows cars that are registered, but not those, which are actually operated on roads, and therefore the share of newer cars looks rather pessimistic. Data on dynamic structure, which are collected every five years, indicate significantly higher use of newer cars compared to older cars, which improves real environmental parameters of the vehicle pool as a whole. In 2010, distribution of personal cars according to age was the following: 31.10% of cars fell within 0-5 years of age; 30.14% of vehicles were 6-10 years old and 38.76% of cars were 10 years old or older. Collection of these data is parallel to collection of national transportation data, but unlike the national census, it concerns only several areas in the Czech Republic, and therefore may be relatively uncertain.

Table 2.16: Share of personal cars registered in the Czech Republic according to their age (%)

	2005	2006	2007	2008	2009	2010	2011	2012[1)]
0-5 years	18.07	17.53	16.95	16.71	17.55	17.81	18.09	19.71
6-10 years	27.55	26.96	25.10	24.36	23.15	22.17	21.51	21.31
10 years or older	54.37	55.51	57.95	58.92	59.31	60.02	60.40	58.98

[1)] Data as of 1. 7. 2013 - due to changes in the vehicle registration system triggered by the EU legislation the data for 31. 12. 2012 are not available.

Source: TRC, http://www.autosap.cz

Table 2.17 gives fuel consumption in individual transport sectors. Table 2.18 gives overview of fuel price development. Table 2.19 demonstrates that there has been a favourable development in petrol station infrastructure in terms of the number of stations where alternative fuels may be purchased.

Table 2.17: Fuel consumption by sector (thousands of tons)

	1990	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012[1)]**
road - petrol	1 069	1 637	1 845	2 039	1 994	2 081	2 001	1 936	1 755	1 684	1 579
road - diesel	904	1 252	1 741	3 228	3 370	3 558	3 561	3 445	3 301	3 318	3 343
road - LPG		12	62	70	72	77	78	80	76	74	71
road - CNG		2	2	3	3	4	5	6	7	8	8
road - biodiesel			70	3	19	34	85	154	196	271	247
road - bio ethanol					2	0	54	91	90	94	87
railway - diesel	208	106	104	92	96	95	105	95	92	90	87
water-borne - diesel	18	18	5	5	6	5	4	5	4	3	5
air - AVGAS	45	4	3	2	2	2	2	2	2	1	2
air - kerosene	169	180	192	318	326	342	362	331	310	307	286

[1)] Preliminary data *Source: CzSO*

Table 2.18: Fuel price development (CZK/l)

	1990	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	***2012[1)]***
Petrol 91 oct. – Special	16.00	19.08	28.33	28.02	29.06	29.05	29.85	26.69	31.28	33.75	*36.26*
Petrol 95 oct.- Natural	12.40	19.29	28.71	28.48	29.59	29.54	30.32	27.15	31.74	34.58	*36.68*
Diesel - cars	9.80	15.65	24.70	27.87	28.97	28.67	31.74	26.10	30.57	34.25	*36.46*
LPG				26.15	28.02	26.54	29.43	23.52	26.98	31.74	*32.87*
CNG				20.13	22.27	19.53	22.10	22.51	23.03	23.79	*24.81*

[1)] Preliminary data *Source: TRC*

Table 2.19: Available infrastructure – alternative fuel

	2007	**2008**	**2009**	**2010**	**2011**	**2012**
Total	6 360	6 424	6 499	6 591	6 690	6 790
Public	3 610	3 578	3 615	3 672	3 717	3 728
LPG	685	708	796	812	819	822
CNG	16	17	18	21	27	28
B30			125	93	111	209
B100			111	33	43	58
E85			2	37	53	118

Source: TRC

Financial crisis after 2008 has been and principal event having influence on the decrease of industrial output as well as considerable decrease in transportation output (freight) in 2009 (see Table 2.20).

Table 2.20: GDP development and development of transportation output / freight

	1990	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
GDP (billion CZK)	632.7	1 533	2 269	3 116	3 352	3 662	3 848	3 759	3 790	3 823	3 830
Transportation output / freight (million tkm)	59.42	59.26	57.34	59.13	67.01	65.38	67.21	58.42	66.31	69.86	66.18

Source: MoT and TRC, https://www.sydos.cz/cs/rocenka-2012/rocenka/htm_cz/cz12_807000.html

Financial crisis also caused reduction in investment directed into development of transportation network in the Czech Republic. The largest investment was directed to transportation in 2008, amounting to nearly 83 billion CZK in regular prices, which is more than double the amount in 2012. The volume of investment in infrastructure in 2012 has been the lowest in the last 10 years and amounted to approximately 33 billion CZK (see Table 2.21) and since 2008 it has been falling each year.

Tab 2.21: Total investment into transportation infrastructure (millions CZK)

Type of infrastructure	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Railway	13 200	14 428	13 178	17 003	22 954	19 593	14 245	10 987	9 594
Road[1)]	10 988	42 137	42 268	41 461	50 962	52 524	43 494	31 799	22 036
National water courses	402	303	527	390	538	1 557	1 462	549	433
Air transportation	993	7 045	2 014	2 137	8 108	2 441	2 059	983	1 187
Pipelines	399	164	710	801	433	210	231	135	149
Total	**25 983**	**64 078**	**58 695**	**61 791**	**82 996**	**76 325**	**61 490**	**44 454**	**33 400**

1) Data given for road infrastructure include motorway costs as well as I., II. and III. class roads

Source: MoT, CzSO, sourced from https://www.sydos.cz/cs/rocenky.htm

The Ministry of Transport completed in 2013 its proposal for 2nd phase of Transport Sectoral Strategy, which outlines medium-term of transportation infrastructure development with long-term outlook. This document represents the fundamental departmental concept formulating priorities and objectives for transportation development and transportation infrastructure over medium-term horizons until 2020 and framework for development up to 2050. This strategy anticipates growth in transportation intensity on roads by 11% in terms of personal transportation and by 22% for freight, as shown in Table below (calculated using arithmetic averages of proposed intensities in the entire set of road clusters). A positive aspect is anticipated in connection with reconfiguration of territorial distribution of road intensity on existing roads, which are currently overloaded and locally significantly impact air quality.

Table 2.22: Theoretically anticipated change in daily transportation intensity if all contemplated measures within the Transport Sectoral Strategy are implemented by 2050

Possibilities of transportation infrastructure development in the Czech Republic	Modelled transportation intensity (thousand vehicles/day) Arithmetic average of modelled intensities in the entire set of road clusters	
	personal	freight
Starting position on existing infrastructure in 2050	9 238	2 584
Target on complete set of proposed measures in 2050	10 232	3 145
Target intensity on complete set of proposed measures in 2050 / starting intensity on existing infrastructure in 2050	111%	122%

Source: MoT and Integra Consulting, sourced from Evaluation of impacts of Transport sectoral strategy 2nd phase pursuant to Ac No. 100/2001

In 2013, the National Strategy for Development of Bicycle Transportation of the Czech Republic 2013–2020 has been also adopted, updating the previous strategy for 2004–2011. The main objective of the strategy is to support cycling so that it becomes a fully-fledged form of transportation supplementing other forms of transportation. This strategy aims to increase the contribution of cycling on the total transportation output to 10% by 2020 (on average for the entire Czech Republic).

The Czech Republic is a member of International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO). Regarding ICAO, measures to limit or reduce emissions of greenhouse gases from aviation bunker fuels are implemented within the EU ETS system (for more details refer to Chapter 4.4.1). As regard the IMO, the Czech Republic doesn´t have any emissions of greenhouse gases from marine bunker fuels. However, the EU and its member states are currently discussing and preparing the monitoring, reporting and verification system of marine emissions.

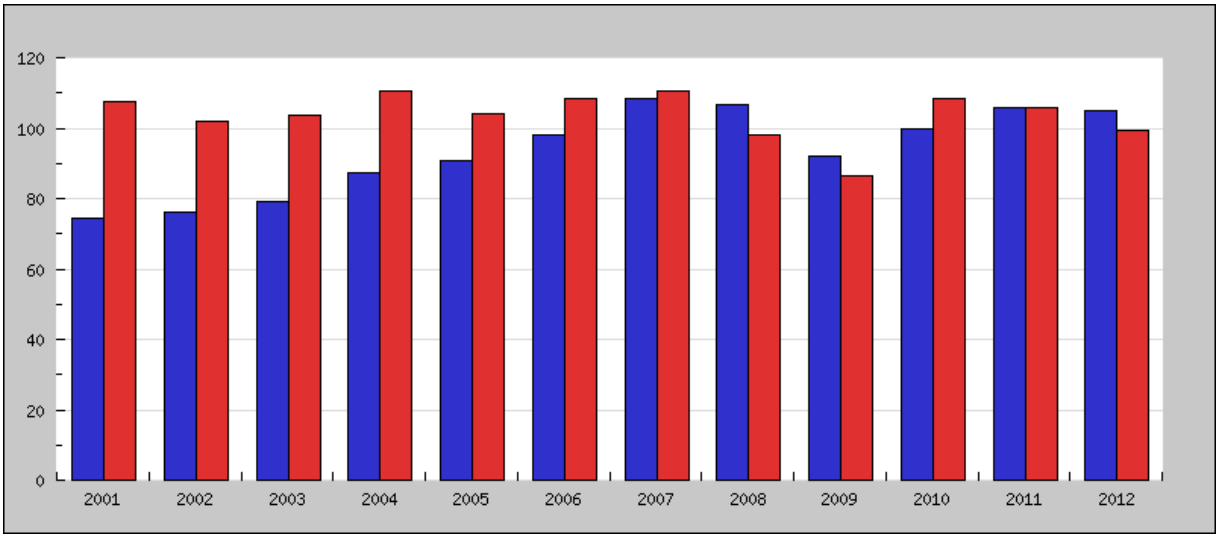
The EU is active within both ICAO and IMO and strives to reach an agreement on the establishment of a market-based measure to limit or reduce emissions of greenhouse gases from aviation and marine bunker fuels.

2.11 Industrial production

Industry in the Czech Republic generates approximately 30% of the GDP and therefore it is one of the decisive sources of economy**.** In environmental terms, it is also a considerable producer of a wide spectrum of pollutants and waste as well as consuming non-renewable sources of energy and raw materials. This sector has a huge impact on environment, especially in areas where large industrial complexes are concentrated emitting large volumes of pollutants (Moravian-Silesian Region, Usti and Central Bohemian Regions). Relation between industry and the environment is best demonstrated by development in industrial production (according to its indexes) with development of energy intensity of industry, pollutant emissions and emission of greenhouse gases, waste and expenses directed to ecologization of production. The objective is environmental stability, which means ensuring satisfactory quality of the environment in the Czech Republic as well as limiting negative impact outside its borders.

Regardless of slight fluctuations in industrial production, the trend since 2000 has been growing (in comparison with the 1990s in the 20th century when many energy- and raw material-intensive productions had been wound down - see Figure 2.13). So far, industrial production in the Czech Republic has grown far faster in comparison with EU-25, respectively EU-27. Only since 2008 it had begun to stagnate and decrease in connection with global economic crisis, which had only became fully apparent year later.

Figure 2.13: Index of industrial production (year-on-year and basal), Czech Republic [%]



Legend: Basal index of industrial production (2005=100 %) Year-on-year index of industrial production (previous year=100 %)

Source: CzSO

In 2009 the industry, including manufacturing industry, showed largest year-on-year change (decrease) since 2001. Industrial production dropped by 13.6% year-on-year. The decrease in industrial production had been caused the most by machinery and equipment production (decrease of the entire sector by 27.2%), production of metal constructions and metal products (decrease by 21.8%), automobile industry has been also significantly affected, i.e. sector, whose production represents approximately two-thirds of production that is exported (decrease by 10.2%), which in turn affected related sectors (rubber industry, plastics etc.). The only production that grew was food industry (which grew by 5.3%).

Year 2010 marked a turn in terms of economic recovery with increased industrial production**,** which was reflected in a considerable year-on-year growth by 10.3%. The growing of the German economy upon which the national economy depends to a large extent triggered this development. Growth in industrial production has been mostly driven by foreign demand, along with domestic demand. Medium technologically intensive production contributed the most to the year-on-year growth, i.e. automobile industry, machinery and computer production. High increase in production has been also apparent in metallurgy. In 2010, the economic crisis finally hit construction sector. The sector dropped by 7.8% year-on-year. Savings measures put in place by the Government and falling consumer and corporate demand also affected the sector.

In 2011, the Czech economy overcame the crisis and returned to the pre-crisis values. Year-on-year industrial production had grown by 6.5%, total revenue generated by sales of products and services amounted to 4 408 billion CZK. Growth of the domestic economy was driven

mainly by foreign trade while domestic demand fell. Automobile industry, machinery, electronic and plastics and rubber industry have responded favourably.

In 2012, the growth of industrial production slowed down. While in the first half of the year the industrial production continued to grow, in the second it began falling. After two years of growth, there was and year-on-year decrease in 2012, amounting to 0.8%. This development was influenced by weaker industrial production in the Eurozone, which in turn affected industrial production in the Czech Republic. Another factor that weakened growth was weak domestic demand in a situation where households begun to lower its consumption.

In terms of industry's impact on the environment, there is an apparent connection between structural changes in industry, changes in production technologies and the condition of the environment generally. In the manufacturing industry, there had been large structural changes between 2000 and 2008, resulting in "lighter" production structure, i.e. growth in sectors producing technologically more demanding products with higher added value using less energy and producing fewer emissions (cars, electronics, computer technologies). Practically all sectors underwent technological innovation, especially car production, electronics, optics as well as restructured metallurgy. Drop in industrial production following 2008 economic crisis and beyond had positive impact on emissions of pollutants and on the environment, as the industrial sector produced fever emissions.

The emission production is not evenly distributed among individual sectors; the most intensive sectors are steel and metal works, refineries, cement and lime production. In a number of sectors, notably in paper and cellulose manufacture, glass-making, ceramics and chemical production and industrial energy generation (production of technological steam and electricity for own consumption) there has been a stabilization of emissions or even reduction. Industrial technologies, emitting large volumes of greenhouse gases, are covered by EU ETS.

Emissions generated by the industry may be divided into 2 groups – emissions from industrial energy generation involve mostly NO_x and SO_2 as well as CO, where steel works in Ostrava and Třinec produce vast majority thereof. Industrial processes without combustion are specific according to production types and have varying emission levels burdening the environment. In 2008–2009, emissions were favourably affected by economic crisis and therefore there had been a temporary drop in all types of emissions. In 2010, the recovery of the industry affected emissions in this sector, and some emissions increased. In 2011, the total emissions from industrial sector have decreased along with the falling curve of industrial production, for most of the monitored pollutants. The sole exceptions were CO emissions, where there was a year-on-year increase of 2.4%. All other monitored compounds demonstrated considerable decrease: $PM_{2.5}$ by 23.3%, PM_{10} by 18.9%, NO_x by 14.1%, SO_2 by 12.5% and VOC by 7.2% *(Source: Cenia).*

Energy intensity of the industry has been falling considerably. While in 2000 the energy intensity of the industrial sector reached 699 MJ/thousand CZK, in 2011 this value was only 327 MJ/thousand CZK (calculated using ratio of final consumption of energy in industry and gross added value (GAV) of a sector). This trend is favourable for the environment, as higher energy consumption means increased burden on the environment during its production. In 2011, there was a slight year-on-year growth of GAV in industrial sector; however, there has been a decrease in energy consumption (by 6.2%). Energy intensity of the industry decreased in total by 12.2%. Introduction of new technologies, BAT and measures leading to energy savings drove for the decrease of energy intensity in industry.

From the perspective of investment in the industrial sector, most of the investment went to protection of the environment in the manufacturing industry. In 2011, the investment into the protection of the environment reached 4.5 billion CZK, which is an increase by 19% in

comparison with 2010. The dampening of economic crisis, which in previous years caused decrease in investment, has caused increased investment in this sector. Processing industry is in the third place in terms of investment into the protection of the environment (18% share on all investment into the protection environment), after public administration (38%) and activities related to water supply (19%). Most of the funds within the manufacturing industry went to the protection of air and climate and to waste water management.

Table 2.23: Index of industrial production according to sectors (year-on-year index)

Sectors	Index industrial production [1, 2)]					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
Industry total	**110.6**	**98.2**	**86.4**	**110.3**	**106.5**	**98.8**
Mining	**98.9**	**97.0**	**99.0**	**99.7**	**101.7**	**95.0**
Manufacturing industry	**112.4**	**98.5**	**84.7**	**111.5**	**107.7**	**98.9**
Paper and paper products	107.5	95.0	92.5	105.1	101.2	99.0
Coke, nuclear fuel, oil processing in refineries	95.7	114.8	89.7	103.5	90.7	102.9
Chemical products and substances	98.6	105.3	87.2	109.7	96.4	105.3
Rubber and plastic products	118.8	97.6	89.0	105.7	107.0	96.4
Basic metals, metallurgical and metal-working products	90.1	104.5	72.5	121.8	105.9	91.0
Machinery and equipment repairs	115.7	106.5	71.7	115.3	111.2	102.4
Electronic and optical instruments and equipments	113.7	101.2	84.0	117.6	110.8	105.8
Means of transport and transport equipment	116.7	99.1	89.1	122.7	121.2	102.2
Other manufacturing industry	104.3	102.5	80.6	103.4	103.2	96.1
Generation and distribution of electricity, gas and water	**101.6**	**95.4**	**96.1**	**105.2**	**97.4**	**99.9**

[1)] *average month in 2005 = 100* *Source: CzSO*

Research, development and innovations

Situation in the research and development sector (R&D) can be characterized by relatively low total expenditures on R&D on the total GDP. The long-term trend with respect to R&D expenditures in the Czech Republic, as calculated in regular prices, has been growing (with the exception of 2008, which demonstrated a slight decrease due to fall in private investment). Despite this trend, the total R&D expenditures in the Czech Republic remains below the usual R&D levels in the developed EU countries, which contribute about 2 – 3 % of their GDP to research and development.

Table 2.24: Overall expenditures for research and development in the Czech Republic

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Share on GDP (%)	1.17	1.16	1.15	1.2	1.2	1.35	1.49	1.48	1.41	1.48	1.56	1.86
billion CZK	26.5	28.3	29.6	32.2	35.1	42.2	49.9	54.3	54.1	55.3	59.0	70.7

Source: CzSO 2012, Annual statistical survey - Research and development VTR 5-01

The main sources of R&D expenditures in 2010 and 2011 have been the increase of investment from domestic private commercial sources and investment from public foreign sources, and furthermore in 2011, there has been a considerable increase in the support from the EU structural funds on R&D financing.

In 2011, 54% of total research and development expenditures came from private (domestic and foreign) sources. The contributions coming from foreign private sources have been growing, from 5% in 2005 – 2007 to 12-15% in recent years.

Another significant trend is strengthening of university research, where the share on total R&D expenditures gradually rose to 22% and public research, which rose to 55% in 2011.

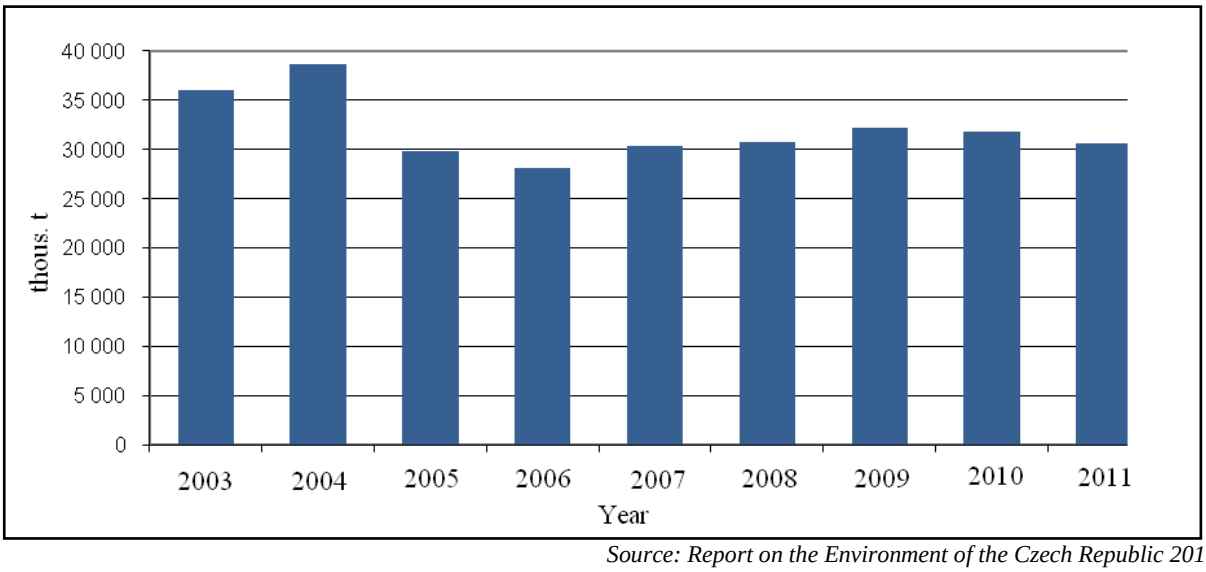
A low level of cooperation between private and public research institutions remains an issue.

2.12 Waste

The fundamental rules for waste management are defined by Act No. 185/2001 Coll., on Waste, as amended, and its implementing regulation, and Act No. 477/2001 Coll. on Packaging, as amended. Targets for waste management and measures for their achievement have been determined by the Waste Management of the Czech Republic 2003-2013, which had been promulgated in line with the Act on Waste in the form of Government Resolution. All Regional Waste Management Plans and waste management plans of individual producers must be in compliance with the objectives specified in the national plan.

Total production of all waste in the Czech Republic reached approximately 30.023 million tons in 2012. In 2012, the total production of waste decreased by 16.8% in comparison with 2003, when it reached almost 36.087 million tons. Total production of hazardous waste in 2012 reached 1.64 million tons.

Figure 2.14: Total production of waste in the Czech Republic [thousands of tons], 2003–2011



Source: Report on the Environment of the Czech Republic 2011

Table 2.25 Total production of municipal waste in the Czech Republic, 2003 - 2012

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total production of municipal waste (1000 t/year)	4 603	4 652	4 439	3 979	4 234	3 832	5 125	5 224	5 388	5 188

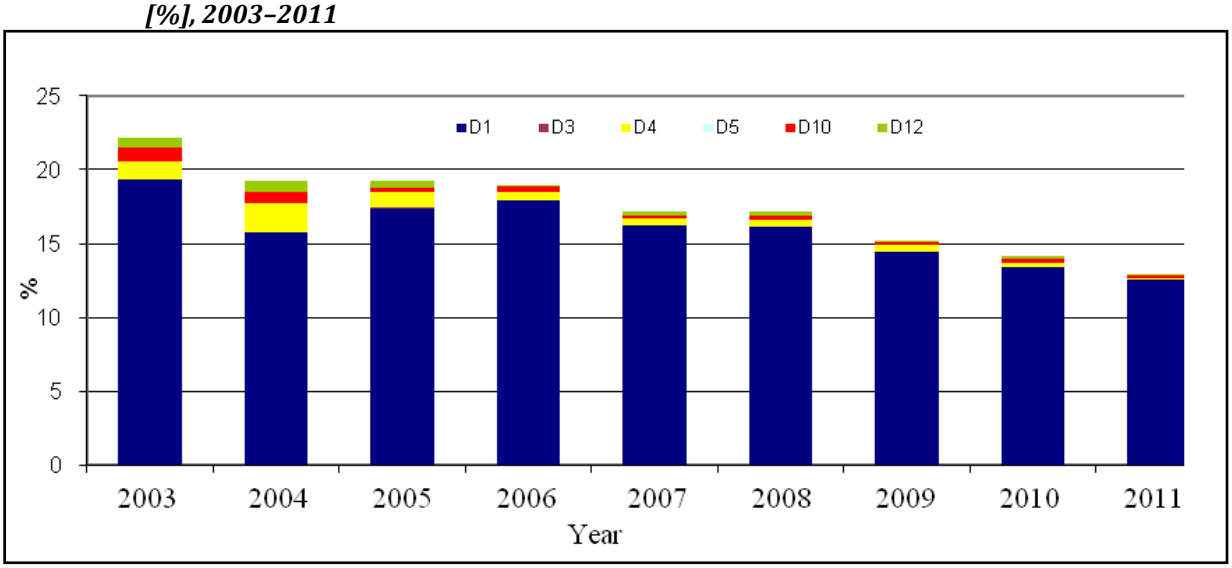
Source: Waste Management Plan Indicators

Waste statistics indicate that the total volume of waste, which is being recycled or recovered, has been steadily growing. Total production of municipal waste in the Czech Republic in 2012 reached approximately 5.19 million tons, i.e. about 494 kg per person a year. The share of municipal waste that was materially recovered from total production increased between 2010 and 2012 by 6% (from 24.3% to 30.3%).

While the volume of recovered waste has been growing, there are still large volumes which continue to be landfilled, which remains the most frequent form of management especially with municipal waste. In 2012, from total municipal waste production 53.7% was removed by landfilling (below or on the terrain level). Mixed municipal waste represents the largest share of the landfilled municipal waste. From the total production of municipal waste in 2012, 30.3% of waste had been materially recovered and 11.8% energy-recovered.

Energy recovery represents only a small portion. In 2012, energy recovery processed a total 1.050 million t waste, which is only 3.5% of the total waste production. In contrast, material recovery processes processed 22 744 million tons waste, which is 75.8% of all waste production. In the Czech Republic there are presently 28 incinerators of hazardous waste in operation and three facilities for energy recovery of municipal waste: WHRU (Prague, Brno and Liberec). Besides WHRU facilities, waste is also being energy-processed in 4 cement plants.

Figure 2.15: Share of selected methods of waste removal on total production in the Czech Republic [%], 2003–2011



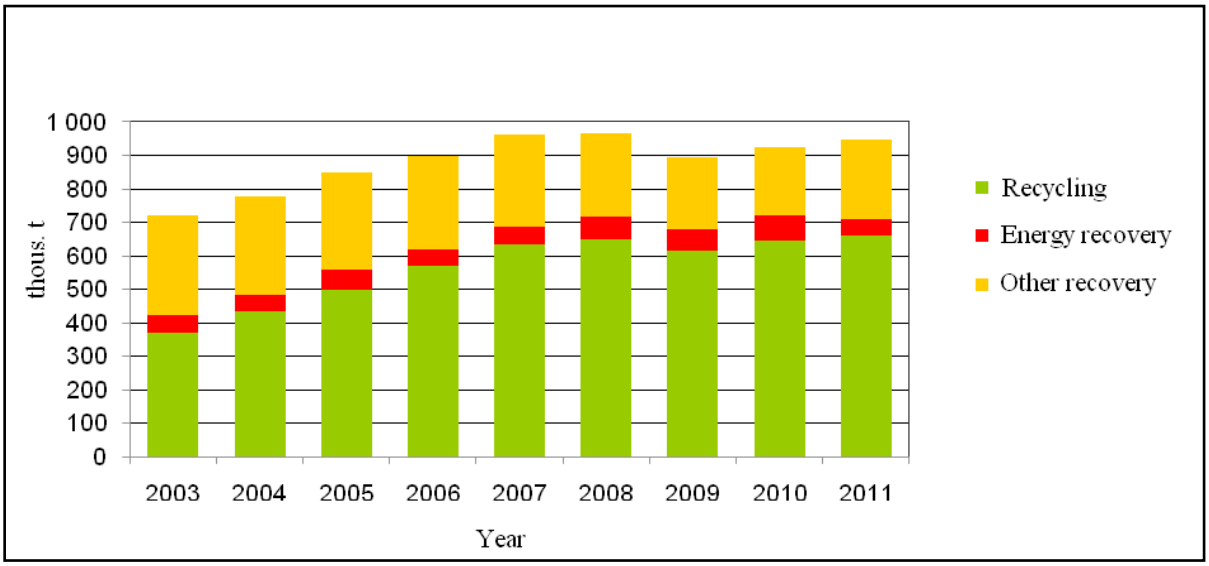
The graph shows the most often used waste removal processes. Codes follow regulation 383/2001 Coll., on details of waste management, as amended:
D1 – landfilling on or below terrain line (landfilling), D3 – depth grouting, D4 – storage in surface tanks, D5 – storage at specially technically equipped landfills, D10 – incineration on land, D12 – final or permanent storage.
Data follow valid methodology for each specific year – according to mathematic expression of calculation "waste management indicator set." For 2011, the data was determined according to 2010 methodology. T.G.M. W.R.I., – CeHO, CENIA (ISOH)

Source: Report on the Environment of the Czech Republic 2011

Recovery of hazardous waste has been growing since 2002; in 2005 recovery reached 36.1% and in 2006, 40.5% of total hazardous waste production. Similarly, the ratio of materially recovered hazardous waste has been also growing. In 2012, only 2.1% of hazardous waste was landfilled, 4.3% incinerated and 2.5% energy-recovered. A continuous problem is large volumes of hazardous waste, which is being deposited in hazardous waste storage facilities.

The main priority of waste management is to ensure compliance with waste management hierarchy, in line with the Czech legislation and the EU commitments, but also with practical requirements arising from the present condition of the waste management sector. The waste management hierarchy is primarily defined by the Waste Framework Directive (98/2008/EC), which lays down waste management rules and generally represents the best overall choice from the environmental point of view: 1) prevention, 2) preparation for re-use, 3) recycling, 4) other recovery (energy recovery) and 5) disposal.

Figure 2.16: Use of packaging waste in the Czech Republic [thousand t], 2003–2011



Source: Report on the Environment of the Czech Republic 2011

Secondary raw materials and waste

The requirements of the manufacturing industry in the Czech Republic are covered by 15 up to 20% by domestic or imported secondary raw materials. Some processes use up to 60% of secondary materials on input (for instance certain non-ferrous metals). Recycling of ferrous and non-ferrous metals is a considerable activity and the Czech metallurgy depends to a degree on recycling. Exports and imports of the most important commodity from the secondary materials group i.e. scrap iron, fluctuates depending on the demand of metallurgic operators.

Waste Management Plan of the Czech Republic (WMP CR)

The Waste Management Plan of the Czech Republic determines what are the specific objectives and targets as well as measures for waste management in the Czech Republic. The binding part of the WMP was promulgated in the form of Government Regulation No. 197/2003 Coll. and it is valid for ten years, i.e. covering the period 2003 – 2013. The targets defined in the Waste Management Plan are directed especially toward support of material recovery of waste and limiting of its negative impact on human health and the environment. The WMP includes waste management objectives set forth by the binding Czech and EU regulation.

The current Waste Management Plan includes, for instance, the following objectives:

- Increase of re-use of waste primarily by recycling to 55% of all produced waste by 2012 and increase material recovery of municipal waste to 50% by 2010 in comparison with 2000;

- Lower weight of the waste being landfilled by 20% by 2010 in comparison with 2000 and with perspective of further reduction;
- Lower the maximum of biologically degradable municipal waste (BDMW) that is landfilled so that by 2010 this particular type totals no more than 75% of the weight, in 2013 no more than 50% of the weight and by 2020 no more 35% of the weight of total BDMW produced in 1995 by
    - supporting creation of regional municipal waste management facilities so that the volumes of biologically degradable municipal waste that is landfilled is gradually limited; when creating this regional network precedence should be given to building composting facilities, facilities for anaerobic degradation and mechanical-biological treatment of waste;
    - preferring composting and anaerobic degradation of degradable waste (except of paper and carton) and using the resulting product in agriculture, recultivation, vegetation management; waste, which cannot be used in this way, should be used for fuel or energy-recovered;
    - determining instruments for supporting increased material recovery of waste preferring re-use, if ecologically and economically viable.

Currently, the WMP is in the process of being updated for the following decade. The effectiveness of the current Waste Management Plan has been extended by the Government Regulation dated 19. 6. 2013 No. 181/2013 Coll. to the end of 2014.

The main priorities of the new WMP will include prevention measures and reduction of hazardous properties of waste, maximum use of waste in material and energy recovery in connection with particular industrial segments and regions; reducing the scope of landfilling, especially of mixed municipal waste by 2025. At the same time, the new WMP will address management of biologically degradable municipal waste and biologically degradable waste optimising all activities in the waste management area and ensuring long-term stability and sustainability of waste management policies in regions and in the entire Czech Republic.

The new Waste Management Plan shall define the following targets for particular waste flows:

- determine municipal waste targets for sorted collection for paper, glass, plastic and metals by 2015,
- by 2020, increase to at least 50% of the weight the overall preparedness for re-use and recycling of waste from paper, plastic, metals, glass produced by households and potentially waste from other sources, if similar to household-type of produced waste,
- lower the maximum of landfilled biologically degradable municipal waste so that by 2020 it does not represent more than 35% of the weight of the BDMW totals produced in 1995.

A number of programmes will support implementation of these targets. Operational Programme Environment 2007-2013 is one of the most important, specifically its priority Axis 4 – Waste management and rehabilitation of existing ecological burdens with a budget exceeding **776 mil EUR** from the Cohesion Fund involving projects aiming to reduce greenhouse gas emissions with the following focus: integrated waste management systems, regional systems for re-using bio waste or mechanical and biological removal of municipal waste, separate collection systems, storage and waste management, sorting and collection of waste, systems for sorting of hazardous municipal waste and hospital waste, waste

management facilities, sorting and recycling, sorting lines, composting facilities and biogas facilities processing biologic waste, etc.

2.13 Agriculture

Agriculture has typical central European character with predominance of food production and high share of arable land (71.3%). Zonal character of agriculture is driven by altitude rather than latitude. Agricultural production is sufficient to cover domestic demand in terms of basic products. Crop production prevails over animal production. Yield converted to area is lower than in neighbouring countries. Contribution of agriculture to GDP is about average in the EU.

Cropland in the Czech Republic, same as in other EU Member States, suffers from real estate development; despite that the Czech Republic remains one of the countries with the largest shares of crop land / total area in the EU. Then main crop is grain, especially wheat. Wheat fields have been growing in recent years to the detriment of forage crops. Five-year averages indicate that wheat harvests increase. The largest area is taken up by wheat and barley fields, corn (mass and seeds), sugar beet and oat fields. Yields from these main crops have been growing, but regardless of that the Czech Republic is among the medium successful wheat producers. Traditionally, potatoes do well as well as rapeseed.

During the last fifteen years, there has been a marked drop in the number in livestock, despite that fact that livestock numbers grew in certain neighbouring countries. This is apparent in international comparison, where livestock numbers are below average even within the framework of the EU. Animal production corresponds to livestock numbers, and within the EU the meat production is also below average. Milk production has been falling despite the increased milk yield per cow, which is not sufficient to compensate for falling numbers of cows.

Crop production in the Czech Republic amounted to 52.2 billion CZK in constant prices in 2012 and represented 52.9% of total agricultural production. Animal production amounted to 43.1 billion CZK (respectively 43.7%). Since 2001 the plant production exceeded the animal production. Table 2.26 gives overview of overall agricultural production between 1998 and 2012.

Table 2.26: Production in agricultural sector in constant prices (2000) for 1998 – 2012 (million CZK)

	Total	Crop production	Animal production	Agricultural services	Additional activities (inseparable)
1998	102 623	47 479	53 244	1 900	
1999	105 214	51 471	52 549	1 194	
2000	101 188	49 765	50 550	873	
2001	104 460	53 640	49 896	924	
2002	102 616	49 913	49 697	783	2 223
2003	97 219	44 032	49 830	1 184	2 173
2004	111 286	59 587	47 937	1 184	2 578
2005	107 853	55 493	47 731	1 150	3 479
2006	101 468	49 489	47 350	1 261	3 368

	Total	Crop production	Animal production	Agricultural services	Additional activities (inseparable)
2007	105 121	52 747	49 063	1 257	2 054
2008	110 670	57 472	49 605	1 395	2 198
2009	106 099	55 960	46 849	1 312	1 978
2010	97 939	50 716	43 858	1 357	2 008
2011	106 344	59 186	43 541	1 330	2 287
2012	98 593	52 182	43 123	1 285	2 003

Source: CzSO, MoA

From the total territory of the state (approximately 7.9 million ha) the agricultural / farming land took up 53.6% in 2011 (in 2003 it was 54.1%), which represents approximately 0.4 ha per inhabitant. Consumption of mineral fertilizer and calcic substances has been stagnating in recent years (Table 2.27), along with decrease of livestock, where production fell along with consumption barnyard manure.

Development of organic farming is a positive trend. The number of organic farms has been steadily growing but in the recent years, probably in relation to economic crisis and its impacts and also to the termination of support within the framework of the Rural Development Programme for 2007 – 2013, the number of these farms has been consolidating (the number of those withdrawing from the system increases but the overall increase remains very slight). Numbers of distributors and producers of bio food are also growing.

Table 2.27: Development of organic farms and area of cropland in the organic farming system in the Czech Republic

Year	Total number of enterprises	Area in ha	Percentage share on agricultural land fund
1990	3	480	-
1991	132	17 507	0.41
1992	135	15 371	0.36
1993	141	15 667	0.37
1994	187	15 818	0.37
1995	181	14 982	0.35
1996	182	17 022	0.40
1997	211	20 239	0.47
1998	348	71 621	1.67
1999	473	110 756	2.58
2000	563	165 699	3.86
2001	654	217 869	5.09
2002	721	235 136	5.50
2003	810	254 995	5.97
2004	836	263 299	6.16
2005	829	254 982	5.98
2006	963	281 535	6.61

Year	Total number of enterprises	Area in ha	Percentage share on agricultural land fund
2007	1318	312 890	7.35
2008	1 946	341 632	8.04
2009	2 689	398 407	9.38
2010	3 517	448 202	10.55
2011	3 920	482 927	11.40
2012	3 934	488 658	11.46

Source: MoA

The number of registered enterprises and area of cropland involved in integrated production has also risen. In 2007, the state introduced mandatory mixing of bio-compounds into fuels; this measure continues to apply. Bio compounds involved include rapeseed methyl-ester (MERO – FAME) and bio-ethanol, produced mostly from sugar beet. This measure resulted in growing area dedicated to growing rapeseed. Agriculture contributed in 2011 to production of all greenhouse gases in the Czech Republic by 6.4 % (incl. LULUCF sector). In 2011, the CH_4, N_2O and CO_2 emissions reached the total of 8064.84 Gg (kt) CO_2 eq. N_2O emissions in agricultural sector represented in 2011 70% of total N_2O emissions in the Czech Republic[9].

After 1990, when agriculture sector transformed, there has been a considerable decrease in the use of mineral fertiliser and calcic substances due to savings in funding. In 1994 the application of mineral fertiliser and calcic substances rose again and since then it has been fluctuating slightly. At present time, the fertiliser application in the Czech Republic in comparison with the EU average is, more often than not, lower.

Table 2.28: Development of mineral fertiliser use 1999 – 2011 (kg/ha)

Fertiliser type	Economic year									
	1999/ 2000	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011
Total	**88.4**	**89.7**	**99.8**	**97.0**	**98.9**	**104.6**	**110.5**	**98.0**	**99.8**	**108.1**
In that:										
Nitric	67.4	65.2	73.7	71.7	74.1	77.6	82.2	78.1	80.2	84.9
Phosphate	12.6	14.1	15.6	15.0	14.9	16.3	16.9	12.4	12.4	14.2
Potassium	8.4	10.4	10.5	10.3	9.9	10.7	11.4	7.5	7.2	9.0

Note: In the Czech Republic, the figures for phosphate and nitric fertiliser give values for the amount of relevant oxides, while in number of countries the value means directly the amounts of phosphorus or nitrate.

Source: MoA

2.14 Forestry

The Czech Republic is one of countries with high forest coverage. The area of forests has been growing since the second half of the 20th century, mostly due to long-term trend of afforestation of infertile cropland (in recent years the annual gain is approximately 2 000 ha). Total area of forestland in 2012 reached 2 662 thousand ha, which is approximately one third

[9] National Inventory Report (NIR), CHMI, 2011

of the Czech territory (33.75% of the total territory). This is slightly more than the average in Europe (32.2% in 2010).

During afforestation, there has been recent effort to increase the share of broadleaved species at the expense of conifers. In 2012, more than 73.2% of forests were coniferous forests (76.5% in 2000) and 25.6% broadleaved (22.3% in 2000). Total wood supply in the Czech Republic has been growing and in 2012 it reached 686 million m^3 (Table 2.30).

Table 2.29: Trends in the area of forest land in 1920 – 2012 (thousand ha)

	1920	1930	1945	1950	1960	1970	1980	1990	2000	2005	2010	2011	2012
Area	2 369	2 354	2 420	2 479	2 574	2 606	2 623	2 629	2 637	2 647	2 657	2 660	2 662

Source: MoA, COSMC

Table 2.30: Trends in the total standing stock of wood in forests in 1930 – 2012 (million m^3)

	1930	1950	1960	1970	1980	1990	1998	1999	2000	2005	2010	2011	2012
Standing stock	307	322	348	445	536	564	615	625	630	663	681	683	686

Source: MoA

Table 2.31: Trends in some basic characteristics of forest management in1990 – 2012 (million m^3/year)

	1990	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**
Total harvesting	13.3	12.4	14.4	15.5	16.7	15.4	15.1
Salvage logging	9.8	7.9	3.3	4.5	6.1	3.8	3.2
Salvage logging in % from total harvesting	74%	64%	23%	29%	36%	25%	22%
Total increment	17.0	18.0	19.8	20.5	21.2	21.4	21.6
Ratio of increment and harvesting	78%	69%	73%	76%	79%	72%	70%

Source: MoA, FMI, CzSO

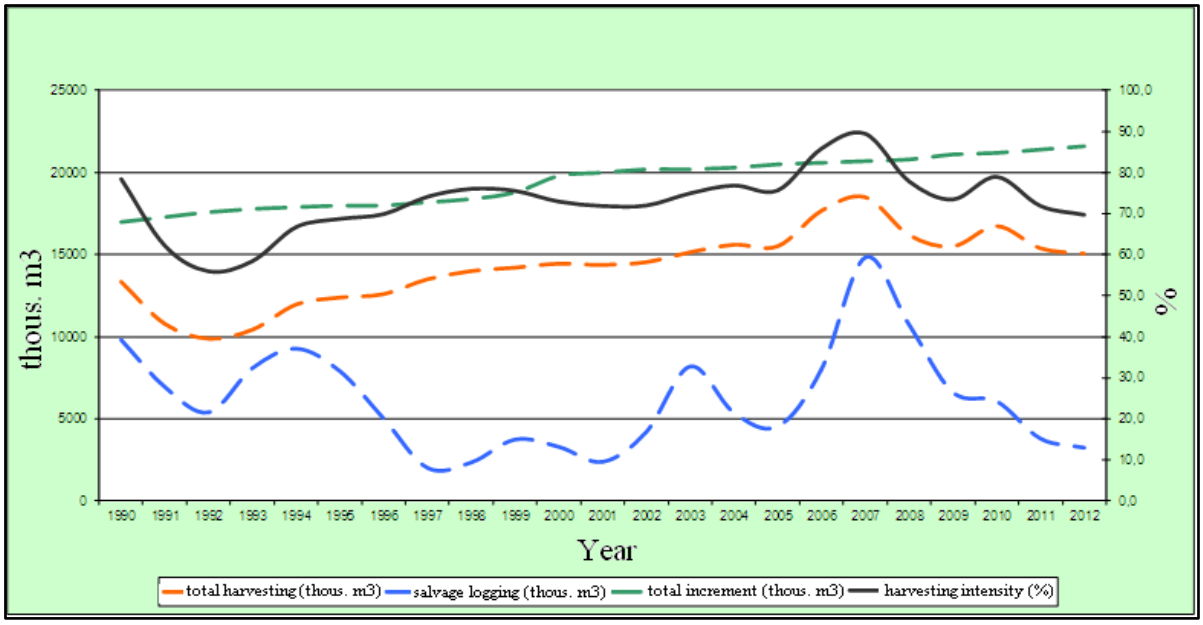
The basic information on the forest economy is given in Table 2.31. and Figure 2.17. Historically, salvage logging following the Kyrill windstorm in January 2007 caused the record-breaking logging yield in 2007.

With regard to the ownership, 59.80% of the forests is owned by the state, 16.79% by cities and municipalities, 19.31% by private persons, 2.87% by legal entities and 1.23% by other owners (2012 data). Lesy CR s.p. (Czech Forests, a state enterprise), respectively Vojenske lesy s.p. (Army Forests, a state enterprise) and National Park Administrations manage forests owned by the state. With regard to the function of forests, there are economic forests (74.62%), protective forests (2.53%) and special-use forests (22.84%). Economically driven forests growths are administered by the Ministry of Agriculture. Forests in national parks and in their protective zones are administered by the Ministry of the Environment. Forests in national parks are the so-called special-use forests. The share of forestry sector in the creation of gross value added fluctuates between 0.5 and 0.8% in recent years (in normal prices).

Forests have been severely damaged in previous decades by industrial exhalations. Despite dramatic decrease in pollutant emissions into air (especially SO_2) the health of the forests is improving only very slowly. The cause of the current damage to forests lies especially in the long-term cumulative degradation of forest soil due to pollutants burden and inappropriate and overly intensive forest exploitation. Forests are also being damaged by high concentrations of tropospheric ozone.

The area of forestland in the Czech Republic has been steadily slightly growing. Between 2011 and 2012 this area grew by 2 thousand ha. This increase has been caused by afforestation of infertile cropland.

Figure 2.17 Comparison of total increment with harvesting [million m^3]



Source: FMI

Broadleaved species have been gaining at the expense of conifers in terms of forest composition, which is becoming more mixed, spruce and pine is on the retreat, being replaced by beech, oak, ash and maple tree. This is a result of a long-term effort to achieve a more balanced and natural composition of the forests in the Czech Republic and partially of a specific financial support of the state focusing on ensuring the necessary ratio of ameliorative and reinforcing woody species during restoration of the forests.

Air pollution has a great effect on the forest health and pollution weakens growth. Forest health condition is characterized mainly by the degree of defoliation. Significant reduction of immission burden in recent years has undoubtedly influenced the condition of forests, where the impact is apparent with some delay. Forests however continue to demonstrate large degree of defoliation, which is among the highest in comparison with other European countries and in the long-term, despite certain fluctuations, it continues to slightly grow. High defoliation is caused by continuing effects of immission, even if at lower rates, but also by the fact that stability of forest ecosystems has been disrupted in the long term due to ruinous immission levels in the past. Defoliation is also caused by other negative factors of biotic and abiotic nature, some of which have been growing in significance over the recent years (climatic extremes, insect living under bark).

The **Land Use, Land-Use Change and Forestry** (**LULUCF**) sector closely relates to agriculture and forestry. The most important land category in LULUCF sector in the Czech Republic with regard to greenhouse gases emission balance are forested areas. Forestry in the Czech Republic is regulated by the Forest Act (Act No. 289/1995 Coll., on Forests, as amended), which forms the fundamental legislative instrument. While this Act does not directly determine the specific targets for forest carbon stocks, its provisions regulate carbon stocks and reduction of greenhouse gas emissions in many respects indirectly. The purpose of this Act is to determine conditions for the preservation, tending and regeneration of forests as

national riches to enable the fulfillment of all their functions and to support sustainable forestry.

In general, the area of clear felling must not exceed one hectare and a cleared area of forest land must be afforested within two years. The most important instrument are the Forest Management Plans (or Guidelines for areas under 50 ha) which include binding provisions for maximum fellings and minimal share of soil-improving and reinforcing species and other provisions and recommendations.

In any event, a strong emphasis has been placed on issues related to carbon stocks and emissions from the forestry sector during negotiation and elaboration of the National Forestry Programme II. This programme has been approved by the Government Resolution No. 1221/2008 and should lead to a draft forestry bill, which will contain specific measures preventing climate change and promoting adaptation to climate change in the forestry sector. The National Forestry Programme contains "Key Action 6" – aiming to "Reduce impacts of anticipated global climate change and extreme meteorological events", which is itself based on 12 specific measures. These measures are generally focusing on creating more resilient forest ecosystems by supporting diversified growth with the highest possible use of natural processes, diverse wood plant composition, natural capacity for restoration and variability of afforestation methods.

Together with Principles of State Forest Policy (Decree No. 854 of 21 November 2012) which include also enhancing biodiversity in forest ecosystems, their integrity and ecological stability as one of the main principles, the above mentioned documents form a framework which ensures that the implementation of activities under Article 3.3 and 3.4 contribute to conservation of biodiversity and sustainable use of natural resources.

In 2011, the net LULUCF sink reduced total greenhouse gas emissions of the Czech Republic by 7.96 million tons of CO_2 eq. (Table 2.33), which is almost 6% of all discharged emissions. Currently, the LULUCF contribution to the total emission balance corresponds, approximately, to emissions of greenhouse gases generated by agriculture, the total volume of the sink remains, year-on-year, variable.

Table 2.32: Area according to category IPCC [thousand ha]

Territorial category	1990	2010	2011
Forest Land	2 629.5	2 657.4	2 659.8
Grassland	878.2	1 031.5	1 035.0
Cropland	3 455.0	3 247.6	3 239.9
Wetlands	157.5	163.1	163.1
Settlements	658.9	679.6	681.3
Other	107.2	107.2	107.2

Source: CHMI

Table 2.33: Emissions (+) and sink (-) from LULUCF in 2011 [Gg CO_2 eq.]

Emissions (+) and sink (-) [Gg CO_2 eq.]	CO_2	CH_4	N_2O	Total
LULUCF	**-8 026.31**	**55.11**	**11.99**	**-7 959.22**
Forest Land	-7 964.19	55.11	5.59	-7 903.49
Cropland	147.70	-	6.39	154.09
Grassland	-328.93	-	-	-328.93
Wetlands / moorland	31.62	-	-	31.62
Settlements	87.48	-	-	87.48
Other	-	-	-	-

Source: CHMI

LULUCF contribution to the fulfilment of reduction commitment of the Czech Republic will be accounted for, in accordance with rules set forth by Kyoto Protocol (KP), at the end of the first Kyoto commitment period. The Czech Republic has also elected accounting of forest management activities pursuant to KP Art. 3.4 for the first Kyoto commitment period. This category remains most significant from the perspective of LULUCF sector emissions stocks (Tab 2.34). However contribution of forest management toward the Kyoto target will be considerably limited by the specific cap for this activity which is defined as 0.32 Mt C/year (i.e. -1,173 t CO_2).

Table 2.34: Additional information on emissions (+) and sink (-) from KP activities 2008 – 2011 [Gg CO_2 eq.]

Year	Activities as defined in KP Art. 3.3		Activities as defined in KP Art. 3.4
	Afforestation and reforestation	**Deforestation**	**Forest management**
2008	-271.99	160.20	-4 403.99
2009	-294.68	170.19	-6 441.15
2010	-322.26	206.87	-5 096.22
2011	-356.88	163.70	-7 568.71

Source: CHMI

It may be anticipated that forest management sinks will be decreasing in the coming years. The main reason is the age structure of forests in the Czech Republic. The temporary fall in sinks will be also contributed to by the planned increase in the share of broadleaved species. This measure is however a significant adaptation measure, which aims to ensure long-term stability of forest stands and therefore also carbon accumulation over long-term horizon. In the future, we also expect a more extensive use of biomass for energy purposes and larger volumes of carbon accumulated in harvested wood products.

3 INVENTORIES OF GREENHOUSE GAS EMISSIONS INCLUDING INFORMATION ON THE NATIONAL INVENTORY SYSTEM AND NATIONAL REGISTER FOR TRADING ALLOWANCES

3.1 Summary tables and inventory results

This chapter describes greenhouse gas emissions (GHGs) trends over time, covering period between 1990 and 2011. The Czech Republic is obliged to report on GHGs to the European Commission on the basis of the Regulation (EU) No. 525/2013 and to the Secretariat of the United Nations Framework Convention on Climate Change.

GHG Inventory results for 1990 - 2011 are provided, in sector-by-sector composition, in separate Annex 1 and Annex 2. These results come from the National Inventory Report (NIR), which was submitted to UNFCCC in April 2013. Annex 1 provides trend tables (CTF Tables 1a, 1b, 1c) that refer to the main gases CO_2, CH_4 and N_2O. Annex 2 refers to total (aggregate) GHGs expressed in CO_2 equivalents. This Table also gives figures for F-gases emissions, here discussed in detail in sub-chapter 3.2.

Tables in Annex 1 and Annex 2 provide, in line with the Convention requirements, data giving emission aggregate sums including emissions and sinks from Land Use, Land Use Change and Forestry (LULUCF), and without including this sector. Total greenhouse gas emissions including sinks from LULUCF, expressed in CO_2 eq., indicate decrease in the Czech Republic from 192.4 million tons to 125.5 million tons in 2011. Emissions (excl. LULUCF) decreased from 195.8 million tons in 1990 to 133.6 million tons, i.e. in comparison with reference year 1990 the emissions including LULUCF decreased by 34.8%. The inventory also includes emissions HFC, PFC and SF_6 (substances containing Fluor, the so-called F-gases), which are also covered by the Kyoto Protocol. Their present share on total GHGs amounted in 2011 to 0.9%. CO_2 emissions amounted to 84.7% of the total emissions (excl. LULUCF) in 2011; CH_4 share amounted to 8.2% and N_2O to 6.2%. Development of total emissions with reference to individual gases over years is provided in Table 3.1.

Figure 3.1 and 3.2 illustrate development of emissions and sinks in main inventory categories. Rapid decrease of total GHGs after 1990 was caused by decrease in production and subsequent restructuring of the economy, which was triggered by the change in the political system. Situation remains rather stable after 1994; potential fluctuations are caused by a variety of effects (varying temperature during winters, year-on-year change in GDP and impacts of adopted measures aiming to reduce GHGs etc.). Year-on-year changes also reflect a certain amount of uncertainty in determining the exact level of emissions in individual years. Substantial decrease is apparent in the Energy sector (stationary combustion technology) and in Agriculture sector, while emissions generated by Transport continue to grow. Figure 3.3 shows development of emissions from stationary sources also in finer sub-sector detail. The Figure makes it apparent that GHG decrease occurred in Manufacturing industry and Other sectors (housing, institutions and services), while there is no decrease in Energy sector.

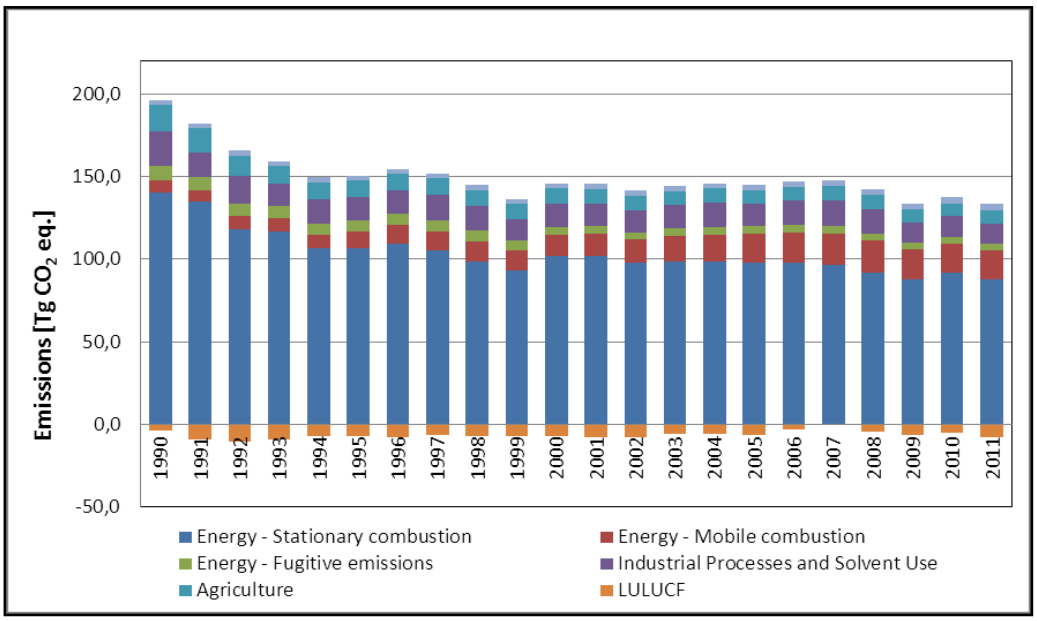
Table 3.1: Trends in greenhouse gas emissions in the 1990 -2011period [Gg CO_2 eq.]

Year	CO_2 (excl. LULUCF)	CH_4 incl. LULUCF)	N_2O (incl. LULUCF)	HFCs	PFCs	SF_6	Total emissions	
							incl. LULUCF	excl. LULUCF
1990	164 812.75	17 915.09	13 364.89			77.68	192 421.08	196 039.02
1991	154 306.92	16 277.58	11 587.58			77.32	173 109.33	182 146.60
1992	139 954.47	15 339.56	10 344.24	NO	NO	76.96	154 822.06	165 608.99
1993	135 893.77	14 420.96	9 163.61			76.60	150 003.81	159 436.67
1994	126 908.55	13 575.80	9 007.81			76.24	142 307.75	149 448.82
1995	128 037.89	13 395.62	9 278.46	0.73	0.12	75.20	143 466.34	150 676.45
1996	132 486.96	13 274.42	8 875.16	101.31	4.11	77.52	147 059.10	154 679.74
1997	129 595.98	13 018.90	8 955.67	244.81	0.89	95.48	145 103.09	151 763.94
1998	123 216.89	12 571.32	8 760.40	316.56	0.89	64.19	137 800.88	144 798.83
1999	115 636.37	11 975.71	8 593.51	267.47	2.55	76.98	129 276.37	136 431.41
2000	125 711.08	11 176.34	8 697.13	262.50	8.81	141.92	138 361.80	145 886.05
2001	125 466.64	10 886.27	8 859.36	393.37	12.35	168.73	137 793.77	145 671.68
2002	122 126.15	10 501.16	8 561.65	391.29	13.72	67.72	133 906.79	141 539.32
2003	125 510.87	10 445.75	8 060.21	590.14	24.53	101.25	138 839.78	144 582.43
2004	126 509.64	10 155.47	8 753.05	600.30	17.33	51.89	139 766.55	145 949.52
2005	125 744.39	10 513.46	8 443.31	594.21	10.08	85.88	138 573.86	145 259.37
2006	127 127.71	10 816.51	8 277.19	872.35	22.56	83.07	143 573.44	147 038.10
2007	127 346.27	10 470.03	8 313.75	1 605.85	20.16	75.85	146 897.96	147 624.79
2008	122 004.67	10 532.74	8 436.79	1 262.45	27.48	47.04	137 373.51	142 146.37
2009	114 427.74	10 205.50	7 896.25	1 020.25	27.14	49.61	126 623.08	133 486.19
2010	118 005.01	10 412.56	7 639.11	1 467.85	29.43	16.22	131 934.11	137 422.56
2011	114 296.49	10 288.77	7 782.94	1 130.42	2.43	34.55	125 536.29	133 495.50
%*	-30.65	-42.57	-41.77	x	x	-55.52	-34.76	-31.90

**) Percentual change in the last year in comparison with 1990 as reference year* *Source: CHMI*

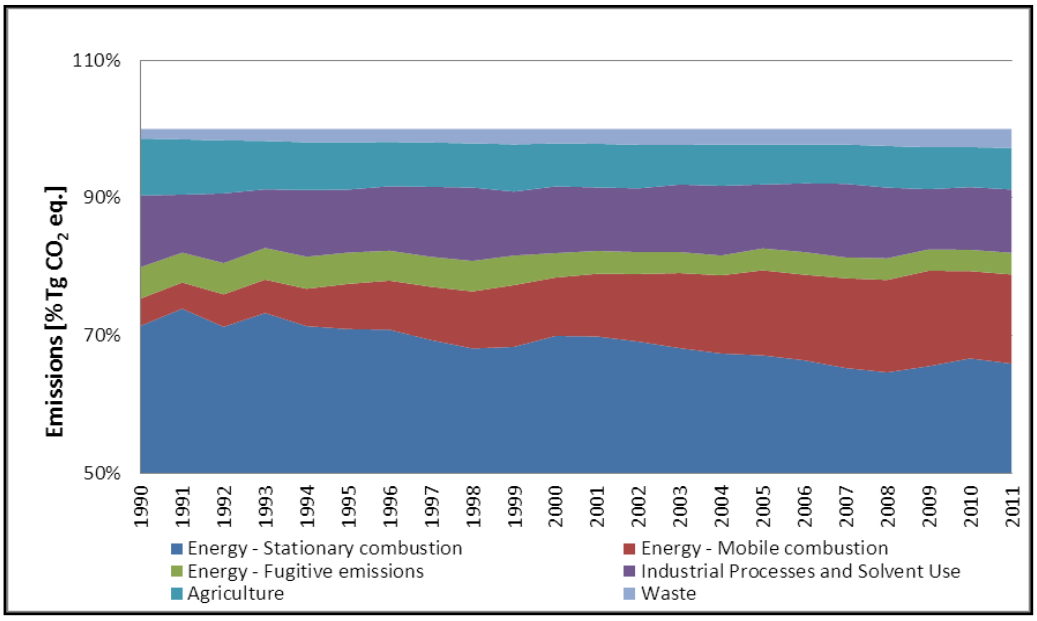
With regard to the fact that by 2011 the total GHGs decreased by 34.8% in comparison with reference year 1990 (incl. LULUCF), respectively by 31.9% (excl. LULUCF), the fulfilment of the commitment under the first commitment period of the Kyoto Protocol 2008 – 2012 can be anticipated with high probability (see Chapter 5).

Figure 3.1: Trends in greenhouse gas emissions in the 1990 – 2011 period by sectors (Tg CO_2 eq.)



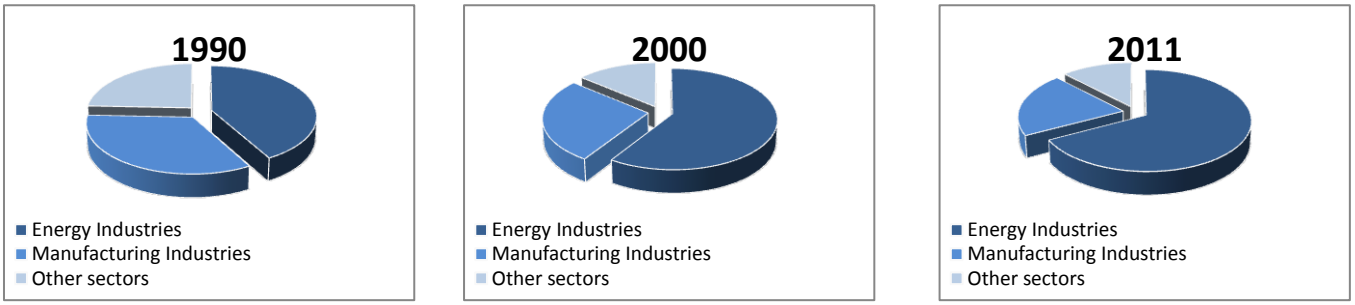
Source: CHMI

Figure 3.2: Share of individual sectors on total GHGs in the 1990 – 2011 period



Source: CHMI

Figure 3.3: Trends of GHG shares from stationary combustion sources



Source: CHMI

3.2 Inventories of greenhouse gases

3.2.1 Introduction

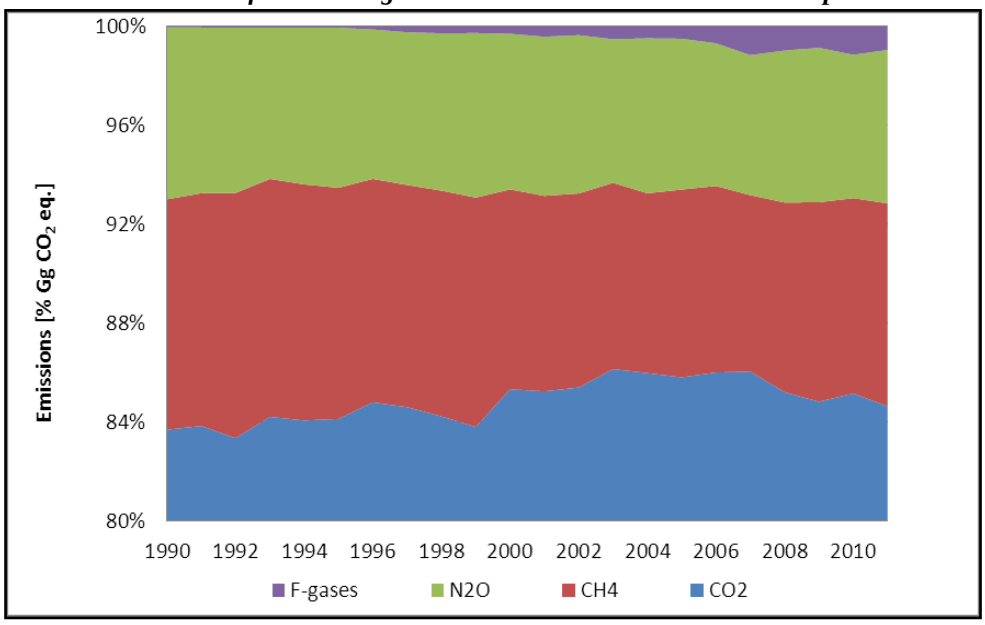
Inventories of greenhouse gases for the purposes of the UN Framework Convention on Climate Change monitor emissions and sinks of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and partially of HFCs, PFCs and SF_6. Besides these substances, the inventory also takes stock of precursors: volatile organic compounds (NMVOC), 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 is given as the aggregated emissions, expressed as the equivalent amount of carbon dioxide, taking into account the global warming potential values GWP for a time period of 100 years.

Greenhouse gas 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[10].

3.2.2 Emissions of individual greenhouse gases

Figure 3.4 provides overview of shares and development of individual gases or their groups in the total greenhouse gases emissions (GHGs) over individual years. Changes are minimal year to year. There is a decreasing trend for methane due to decrease of fugitive emissions and Agriculture sector emissions and increase in share of F-gases (HFC, PFC and SF_6), which is a result of the process of replacing ozone depleting chlorofluorocarbons (freons, regulated by the Montreal Protocol), in cooling and their application in modern technologies. The most important greenhouse gas is carbon dioxide, which amounts to 84.7% of total emissions, followed by methane with 8.2%, N_2O with 6.2% and F-gases 0.9% (data 2011, emissions including LULUCF).

Figure 3.4: Shares and trends of individual gases on total emissions in the Czech Republic



Source: CHMI

[10] National Inventory Report and data sets for each year are available at www.chmi.cz

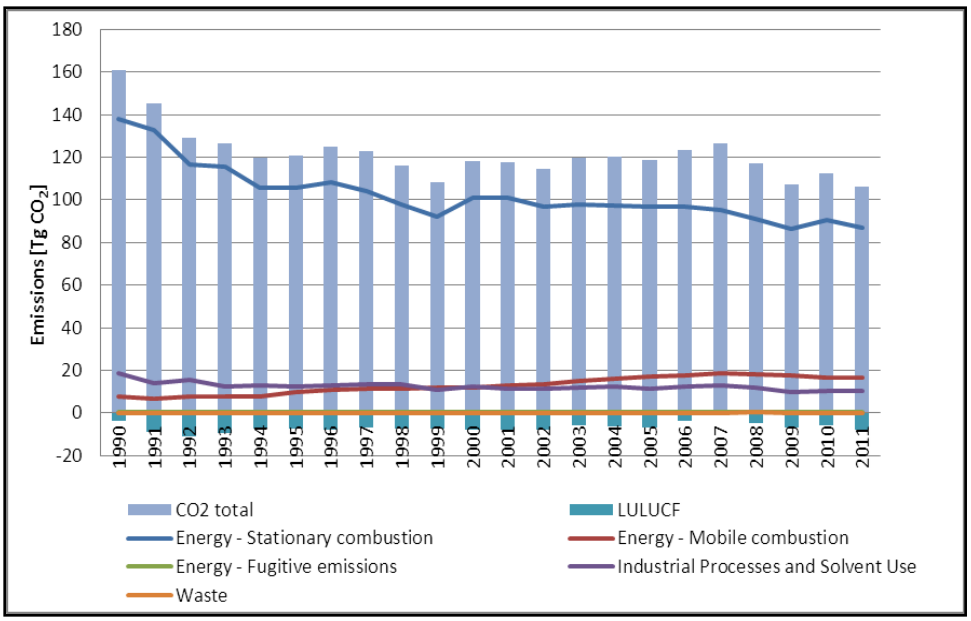
3.2.2.1 Carbon dioxide

Carbon dioxide is the most significant anthropogenic greenhouse gas. In most developed countries it has the largest share on the national total aggregated emissions. In the Czech Republic, its share amounted to 84.7% (including LULUCF) in 2011. CO_2 emissions are generated primarily by fossil fuels combustion, carbonate breakdowns during cement, lime and glass production, scrubbing and in metallurgic and chemical processes; CO_2 emissions and sinks (total sector balance indicates predominance of sinks) are apparent in the Land Use, Land Use Change and Forestry (LULUCF) sector. In the Czech Republic, the CO_2 emissions are coming from combustion of solid fuels, to a smaller degree by combustion of liquid and gaseous fuels.

Amounts of CO_2 produced by individual activities are given in the Annex 1 (CTF Table 1a). Between 1990 and 2011 there has been a decrease by 34% driven by Manufacturing industry, construction and Other sectors (households, institutions and services) falling within the Energy sector. Decrease of emissions generated by fuel combustion in the Manufacturing industry sector and construction sector at the beginning of the 90s was triggered by winding down and restructuring of certain industrial sectors, while at the end of the period the decrease was caused by implementation of new technologies. Reduced emissions in other sectors may be accounted to energy savings (improved energy efficiency, heat insulation etc.). Adverse trends are apparent in the Transport sector, which recorded more than double increase (2.5) since 1990, driven by transportation development, especially in personal automobile use and road freight transportation. Increasing share of natural gas over solid fuel use has positive impact on the development of emissions. In recent years, however, the price of natural gas increased, which triggered re-use of solid fuels in certain regions.

In line with the IPCC methodology, the CO_2 emissions produced by international air and sea transportation are not counted as part of national emissions, but they are reported separately. Similarly, emissions generated by biomass incineration are not included in national figures, as that would mean double counting. These emissions are included in the LULUCF sector. Figure 3.5 shows shares of individual sectors in total CO_2 emissions in the Czech Republic.

Figure 3.5: Trends of CO_2 emissions and shares of individual sector in the Czech Republic 1990 – 2011



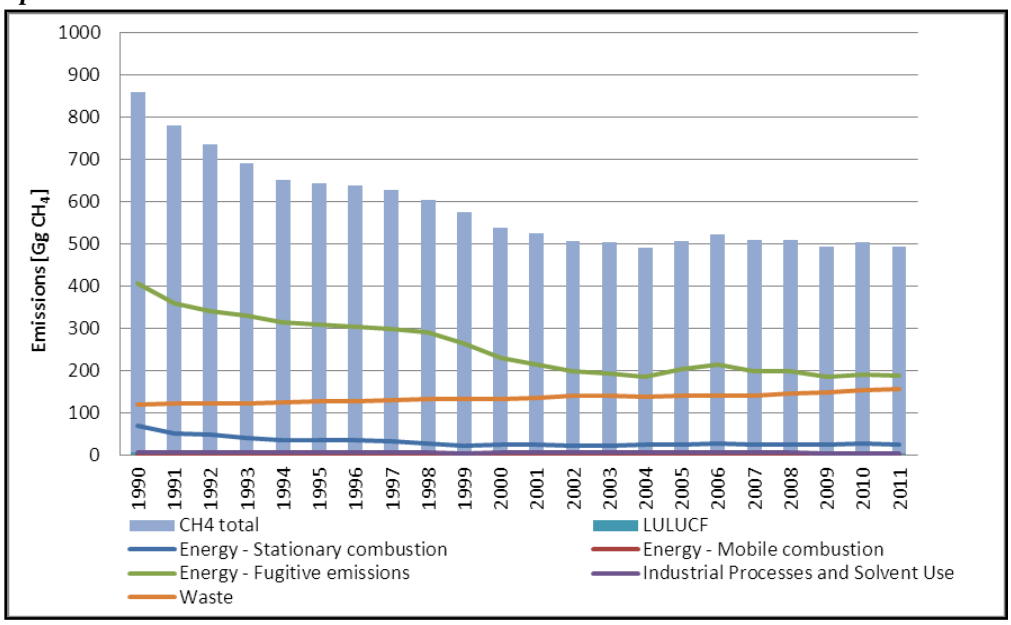
Source: CHMI

3.2.2.2 Methane

Anthropogenic emissions of methane are generated mostly by mining, fuel treatment and distribution; this type of source is designated as fugitive. Other significant sources of methane emissions are livestock, landfilling waste and treatment of wastewater. Livestock generates methane in digestive processes and during excrement decomposition. Landfilling produces methane during degradation of organic substances in anaerobic conditions; similar processes are present during anaerobic treatment of wastewater.

Share of methane on total aggregated greenhouse gases decreased from 9.3% in 1990 to 8.2% in 2011. Amounts of methane produced by individual activities are given in the Annex 1 (CTF Table 1b). In 1990 – 2011 methane emissions fell by 42.6% due to decrease in coal mining and decrease in livestock numbers. Figure 3.6 shows shares of individual sectors in total emissions of CH_4 in the Czech Republic.

Figure 3.6: Trends of CH_4 emissions and shares of individual sector in the Czech Republic in the 1990 – 2011 period



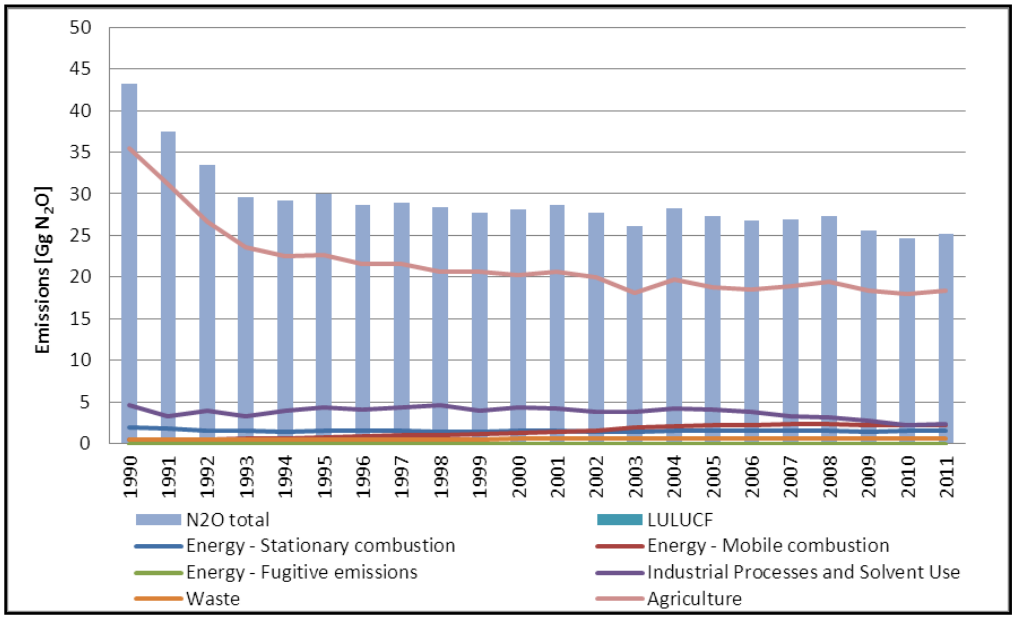
Source: CHMI

3.2.2.3 Nitrous oxide

The largest amounts of nitrous oxide (N_2O) emissions are produced in agriculture, especially by denitrification of nitrogen added to soil in the form of mineral fertiliser or organic materials. Other significant sources are production of nitric acid and Transport sector (automobiles with catalysers).

N_2O emissions share in the total aggregated emissions of greenhouse gases decreased from 6.9% in 1990 to 6.2% in 2011. Figure 3.7 provides overview of individual sectors' contribution to total N_2O emissions. Data on N_2O emissions classified by activity is provided in the Annex 1 (CTF Table 1c). In 1990 – 2011 there has been a decrease in N_2O emissions by 41.8%, primarily due to reduced use of artificial fertiliser in agriculture and decrease in livestock numbers, compounded by use of new technologies in removing N_2O emissions during production of nitric acid.

Figure 3.7: Trends of N_2O emissions and shares of individual sector in the Czech Republic in the 1990 – 2011 period

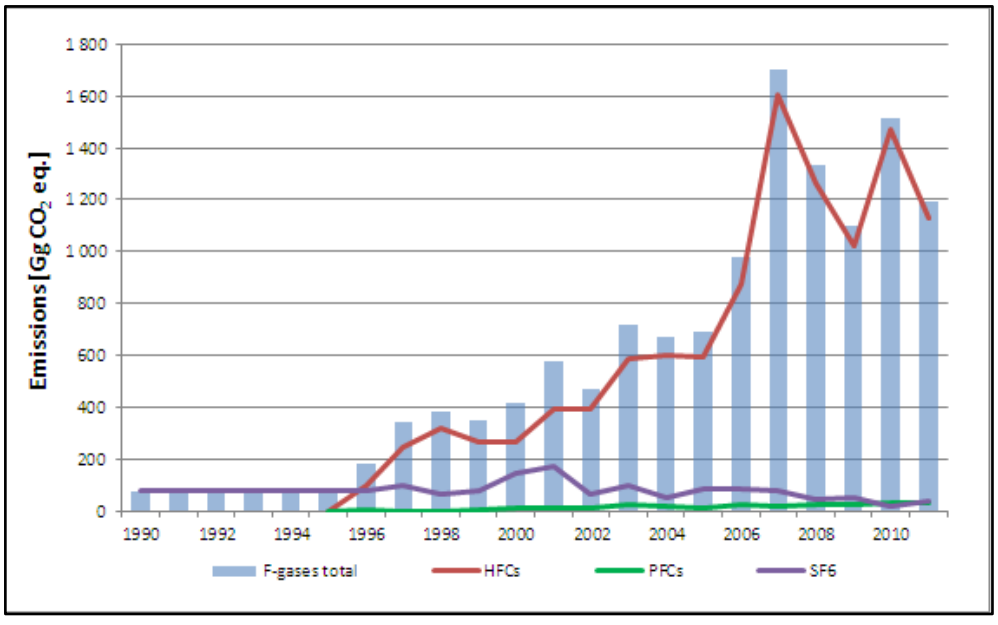


Source: CHMI

3.2.2.4 F-gases

Emissions of fluorinated gases since 1995, which is the reference year defined by the Kyoto Protocol (KP), increased from 76 to 1 194 Gg CO_2 eq in 2011 and their share in total aggregated emissions increased from 0.1% in 1995 to 1% in 2011. These substances are not produced in the Czech Republic and the entire consumption is imported. Increase in these emissions is caused by replacing CFC and HCFC (ozone depleting substances) in cooling and by extended application of F-gases in modern technologies. This concerns especially HFCs in cooling sector, SF_6 in electronics and in other areas (for instance window insulation, plasma etching, fire extinguisher content, aerosol propulsion gases and expanding agents etc.). Figure 3.8 provides information on individual F-gases emissions in 1990 – 2011.

Figure 3.8: F-gases inventories in the 1990 – 2011 period (CO_2 eq.)



Source: CHMI

3.3 National greenhouse gases inventory system

3.3.1 Introduction

Article 5 of the Kyoto Protocol (KP) obliges Parties to build a fully functional national greenhouse gas inventory system (NIS) by the end of 2006, in line with rules promulgated at the 7th Conference of the Parties to the UNFCCC (Resolution 20/CP.7). The EU Member States are additionally committed by Regulation No. 280/2004/EC as replaced by Decision No. 525/2013 of 21 May 2013 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change.

The National Inventory System in the Czech Republic was launched in line with international treaties in 2005 and since then it's been in operation without any interruption.

The objective of NIS is to ensure high-quality national inventory of GHGs so that it complies with all requirements whether imposed by relevant Decision or IPCC methodology. From practical point of view this means achieving required quality of national inventories, so that these pass regular international reviews. These reviews include especially annual UNFCCC inspection. Since 2011, the internal inspection carried out by the EC in cooperation with EEA has been growing in significance.

The main NIS functions include putting in place and operation of an institutional, legislative and procedural system that is necessary to fulfil all required activities included in the process of greenhouse gases inventory preparation. The Ministry of the Environment (national entity) is the body responsible for correct functioning of the NIS in the Czech Republic, and it administers the system via the Czech Hydrometeorological Institute (CHMI), which is the organization responsible for coordination of inventory preparation and required data and text outputs.

3.3.2 Institutional Arrangements

Person responsible for international reporting on greenhouse gases:
Pavel Zámyslický, Head of Energy and Climate Protection Dept., Ministry of the Environment
pavel.zamyslicky@mzp.cz

Person responsible for compilation of the inventory:
Ondřej Miňovský, NIS Coordinator, Czech Hydrometeorological Institute
ondrej.minovsky@chmi.cz

One of the main pillars of NIS is allocation of responsibilities to institutions involved in inventory in individual sectors. The NIS Coordinator (CHMI) is primarily responsible for:

- Management (coordination of cooperation among individual sector agents)
- General and cross-section issues including determining the uncertainties
- QA/QC control procedures
- Data reporting in prescribed format - CRF (*Common Reporting Format*)
- Preparation of *National Inventory Report* (NIR)
- Cooperation with relevant UNFCCC and EU bodies
- Operation of complete archiving and documentation management system for the inventory.

Specialised institutions – sector compilers, elaborate sector-specific inventories:

- KONEKO marketing, (a private limited liability company),
- Transport Research Centre, public research institution,
- IFER - Forest ecosystem research institute s.r.o. (a private limited liability company),
- Charles University in Prague, Environment Center;
- CHMI is the sector compiler for two sectors: 2 - Industrial processes and 3 – Product use.

3.3.3 Official inventory result approval process

Official greenhouse gases inventory results (CRF, NIR) are compiled by CHMI and submitted to the Ministry of the Environment for approval. The Ministry of the Environment liaises with other involved Ministries and state authorities, especially with the Czech Statistical Office (CzSO). Besides that it is in charge of communication with the EC and the UNFCCC Secretariat.

3.3.4 Methodical aspects

National inventory of greenhouse gases is based on the IPCC methodology and principles of good practice (*Revised 1996 IPCC Guidelines, 1997, Good Practice Guidance, 2000* and *Good Practice Guidance for LULUCF, 2003*). In 2011-2012 the inventory team undertook an extensive preparation to transfer to the "new" IPCC 2006 Guidelines.

Inventory of greenhouse gas emissions is a multi-level process including data collection, estimating emission sources and sinks, controls and verification, determining uncertainties and reporting. The main phases of inventory are:

Data collection: Data collection is the most significant stage and in many cases it is the most difficult phase, directly affecting accuracy of emission determination. Methodological instructions require assessment as to the appropriateness of existing data sources, and potentially undertaking own emission measurements, or searching for new and more exact data sources.

Data collection process utilizes expertise and methods in place at data providers. Various data sources, from official national data to international statistics, to authorized collecting at operators or sectoral associations, are relevant. Regular communication and consulting takes place throughout the process (from data collection until final completion).

Determining uncertainties: This process provides valuable information for inventory compilers and for inventory users. Uncertainties must be defined for each separate category of sources, as well as for total emissions and their trends. Determination of uncertainties is one of the important principles of good practice as it helps inventory compilers to better focus on those categories, which considerably contribute to larger uncertainty in emission estimates (including allocation of funding) and by that to gradual improvement of quality.

Identification of key categories: Good practice requires that key categories be identified. Key categories are important for use of development diagrams during selection of appropriate method, and the inventory coordinator seeks to apply more sophisticated higher tiers methods of inventory to these key categories.

QA/QC control procedures: Application of QA/QC processes represents an important phase in compiling NIR. QA/QC processes include planning, undertaking the controls themselves and reviewing relevant documentation, verification of data and their review by independent

providers. Correct application of QA/QC processes is also one of good practice principles, allowing removal of potential mistakes and discrepancies.

Reporting inventory results: Reporting to UNFCCC bodies takes place annually on April 15. Documents submitted include:

- *National Inventory Report*
- Database of the reporting software – in mdf format
- Export of complete data inventory – in xml format
- CRF tables (*Common Reporting Format*)
- SEF tables (*Standard Electronic Format*)

Reporting to the EU takes place in two stages, first as of 15 January and final version as of 15 March, reporting for the EU matches the extent and quality of the report for UNFCCC.

Good Practice Guidance represents a set of instructions, recommendations and advice prepared by the IPCC, whose aim is to achieve the required quality of the result, and ensure that the inventory is not under- or over-estimated.

Text below specifies some other tools ensuring the required quality of reporting:

Tier approach: *Tiers* are level of methodological complexity. Usually there are three tiers. *Tier* 1 represents the basic method, using standard recommended *default* emission factors, directly tabulated in manuals (IPCC, 2000, 2003 and 2006); *Tier* 2 requires territorial (national) specific information (such as territory-specific emission factors, or other parameters necessary to estimate emissions). *Tier* 3 represents the most complex and sophisticated methods emissions estimates are often based on modelling. *Tier* 2 and *Tier* 3 are called *higher tiers* and their use is required for those categories of sources, which have significant impact on total national greenhouse gases emissions or which could contribute to uncertainties (these are the so-called "key categories," see below).

Key categories: The key categories concept lies in identification of categories, which have significant impact on total national greenhouse gases emissions or which could contribute to uncertainties (trends) since 1990. Key categories contribute to total uncertainty of emission estimate in actual year or determining its trends. Key categories enjoy special attention in compiling the national inventory, demanding more complex methods and thorough application of QA/QC processes, and undergoing more rigorous methods in planning the inventory improvement. Prioritization of funding allocation is directly tied to the output of key categories' analyses.

Adherence to good practice principles leads to achieving all required quality criteria, which include: transparency, completeness, consistency, comparability and accuracy.

Transparency: Transparency means transparent and clear documenting of applied processes, allowing understanding how the inventory was compiled and whether all relevant principles of good practice were observed.

Completeness: National inventory must include all categories of sources and sinks of greenhouse gas emissions. Any missing categories must be clearly identified and appropriate justification provided why they could not be included in the inventory or what steps are being taken for their future inclusion.

Consistency: Ensuring consistency of time series is important for demonstrating credibility of trends. Methodological manual describes ways of ensuring this consistency. Inventory

emissions in the entire period must be determined using identical methods and same or similar data sources. Time series should encompass development of emissions over time and not potential changes in methods applied during the monitored period.

Comparability: National inventory of greenhouse gases shall be complied in a manner allowing comparison with inventories taken in other countries. This may be achieved by application of unified IPCC methods, including identical classification of sources and sinks, identification of key sources, prescribed manner of reporting etc.

Accuracy: National inventory should not be over or under-estimated. It is therefore necessary to avoid systematic mistakes in estimating emissions.

Following the IPCC methodology (*Good Practice Guidance, 2000* and *Good Practice Guidance for LULUCF, 2003*) recalculations in estimating emissions and sinks are undertaken also in those cases when new and more credible data are obtained, or when there is a change in methodology leading to more accurate result. Having in mind the principle of consistency, these recalculations are undertaken for the entire time series. Most recalculations of an important nature were undertaken prior to submitting the Initial Report for the Czech Republic to the Kyoto Protocol. In recent years, recalculations in the Czech national inventory are undertaken mainly in connection with international reviews organized by the UNFCCC. These recalculations usually only slightly amend the previously estimated figures. For more detailed description of recalculations see Chapter 10 of the National Inventory Report submitted in April 2013. For quantified effect of the recalculations see individual sectoral chapters of the NIR.

3.3.5 Key categories

Inventory of greenhouse gas emissions is based on differentiated approach to significant and less significant emission categories. Significant categories, which contribute to total aggregated emissions by more than 95%, are designated as key categories. They relate to individual sectors or sub-sectors of the inventory and to individual greenhouse gases, or groups (F-gases). Identification of key categories has been undertaken in accordance with *"Tier 1"* methodology on the basis of *level assessment* (LA) and *trend assessment* (TA). In total 25 key categories were identified of which 19 complied criteria for evaluation according to standard.

Table 3.2 gives a list of key categories, evaluated on the basis of emitted volume i.e. according to "emission level" (*Level Assessment*, LA), and Table 3.3 demonstrates uncertainties in trends (*Trend Assessment*, TA). The list is drawn up using 2011 data, trends account for results from 1990, which is the reference year according to the Convention. Most of the key categories were already evaluated on the basis of level assessment (emissions are determined using CO_2 eq.), and six more categories of sources were added on the basis of trend assessment (see below), as the trend from 1990 is significantly different from total greenhouse gas emission trend.

Table 3.2: List of key categories on the basis of emission level (LA)

Key categories of sources	Gas	Share %	Cumulative %
Energy - Stationary combustion – Solid Fuels	CO_2	45.80	45.80
Energy - Mobile combustion – Road Transportation	CO_2	11.34	57.15
Energy - Stationary combustion – Gaseous Fuels	CO_2	10.68	67.83

Key categories of sources	Gas	Share %	Cumulative %
LULUCF: Forest Land remaining Forest Land	CO_2	5.37	73.20
Industrial Processes: Iron and Steel Production	CO_2	3.96	77.16
Energy - Stationary combustion – Liquid Fuels	CO_2	3.49	80.65
Energy - Fugitive emissions – Coal mining and Handling	CH_4	2.31	82.96
Agriculture: Direct N_2O emissions	N_2O	2.10	85.06
Waste: Solid Waste Disposal Sites	CH_4	1.93	86.99
Agriculture: Enteric Fermentation	CH_4	1.41	88.40
Agriculture: Indirect N_2O emissions	N_2O	1.25	89.65
Industrial Processes: Cement Production	CO_2	1.17	90.82
Industrial Processes: Limestone and Dolomite Use (except Cement and Lime production)	CO_2	0.81	91.63
Industrial Processes: HFC, PFC Use as ODS substitutes	F-gas	0.80	92.43
Energy - Mobile sources in Agriculture and Forestry	CO_2	0.77	93.20
Industrial Processes: Lime Production	CO_2	0.49	93.68
Energy - Fugitive emissions – Oil and Natural Gas	CH_4	0.47	94.15
Agriculture: Manure Management	N_2O	0.47	94.62
Energy - Mobile combustion – Road Transportation	N_2O	0.46	95.08

Source: CHMI

Table 3.3: List of key categories on the basis of trend level (TA) not included in table 3.2

Key categories of sources	Gas	Share %	Trend %	Part %	Cumulative %
Energy - Stationary combustion – Solid Fuels	CH_4	0.11	1.35	1.4	91.47
LULUCF: Cropland remaining Cropland	CO_2	0.04	1.22	1.3	92.69
Energy - Stationary combustion – Other Fuels	N_2O	0.27	0.66	0.8	93.35
Industrial Processes: Nitric Acid Production	CO_2	0.29	0.64	0.6	93.99
Agriculture: Manure Management	CH_4	0.27	0.56	0.6	94.55
Energy - Stationary combustion – Biomass	CH_4	0.24	0.53	0.5	95.08

Source: CHMI

In 2013, the inventory team undertook preparation for determination of key categories using *Tier 2* methods, i.e. including uncertainties. This method will be implemented in the coming years.

3.3.6 Inventory uncertainties

Determination of uncertainties is one of the most important principles of good practice in the emission inventory. Analysis of uncertainties characterizes extent (i.e. possible interval) of results of the entire national inventory, as well as of its individual components. Knowledge of partial and overall uncertainties allows compilers to better understand the inventory process, which includes collecting of appropriate input data and their evaluation. Analysis of uncertainties assists in identifying those categories of emission sources and shares, which contribute the most to total uncertainties and determining priorities for further improvement of quality.

Analysis of uncertainties is based on partial uncertainties of activity data for individual categories of sources and their shares, as well as on uncertainties corresponding to emission factors and other parameters required for calculation. These partial uncertainties are expressed in the form of statistical characteristics, or on the basis of an expert assessment (if there is a lack of data for determining statistical characteristics). Resulting values are then uncertainties of total greenhouse gas emissions and their trend. To this end, one can use the method of error propagation based on mathematical-statistical relations for calculation of sum variations or product from corresponding variations of its individual terms. IPCC methodological manuals (IPCC, 2000, 2003 and 2006) provide a solid ground for this calculation, which is also being used for the Czech national inventory of greenhouse gases. The recommended more robust method for determining uncertainties (Tier 2), which better works with partially dependent values (which is also the case in national inventory) and asymmetric interval of reliability is based on stochastic modelling using the Monte Carlo method. Preparation for use of this more sophisticated method has already been completed by the Czech team in 2013 and in the coming years it will be implemented.

Numerically, uncertainties on all levels are expressed using reliability interval at 95 per cent level of probability. In practice uncertainty is usually expressed by relative value expressed in per cent.

Total uncertainty inventory according to volume of emissions	3.62%
Total uncertainty inventory according to emissions trends	2.30%

3.3.7 QA/QC control procedures

QA/QC processes are carried out annually pursuant to updated plan. Plan preparation reflect institutional arrangement: each institution prepares its own QA/QC procedures, including authorization of responsible QA/QC expert for each sector. Sector QA/QC plan is an integral part of the entire QA/QC plan, which is drafted by NIS coordinator. National inventory of greenhouse gases is a part of client processes at CHMI, which follow the ISO 9001 quality standard (CHMI obtained certification in 2007). Processes relating to national inventory are elaborated in the form of development diagrams and include all main principles that need to be adhered to during compilation of the inventory including QA/QC processes.

QC processes include routine technical inspections of inventory quality so as to ensure consistency, integrity, accuracy and completeness of the data and to reveal and remove any error and omissions. QC processes are applied to all fundamental processes carried out during inventory: data collection, selection of appropriate method and emission factors, and calculations of emissions and processes documentation. These QC procedures are carried out in line with IPCC methodology, primarily with *Good Practice Guidance, 2000*. Sector compilers undertake parts of these processes; the remainder is carried out by NIS coordinator. Sector compilers focus primarily on activity data control, emission factors and applied sector-specific methods, NIS coordinator reviews appropriateness of method selection, analyses trends and compares data from several possible sources. Sector compilers and NIS coordinator use control tools available in CRF *Reporter*.

QA processes include control activities and review by third parties not directly involved in national inventory compilation, but who are competent in the given field. CHMI cooperates on QA processes with Slovak experts from SHMI, who are involved in compilation of the Slovak national inventory. Active control role is obviously assumed by the Ministry of the Environment, which reviews all drafts at least two weeks before the official submission of national results.

Regular international inspections undertaken by the UNFCCC play a large role in increasing the quality of national inventory. Inspections identify shortcomings and provide recommendations that are thoroughly analysed by the Czech NIS team; inspection conclusions are then used in order to improve quality of the Czech national inventory.

More detailed description of the quality assurance and quality control plan and its implementation is provided in Chapter 1.5 “Information on the QA/QC Plan” of the National Inventory Report submitted in April 2013.

3.3.8 Systematic improvement of inventory quality

Plan for improvement of inventory quality also constitutes one of the good practice tools besides being one of the fundamental provisions of the Kyoto Protocol (KP) (Art.10, para a-f). The National inventory system has drafted and annually updates improvement plan for the existing inventory system. One of the basic tools for this planning is, among other, analysis of key categories.

The national inventory team drafted an extensive project in 2011-2012, funded by the State Environmental Fund, with the title "Development of the system for monitoring and projection of greenhouse gas emissions in the Czech Republic" which directly focuses on evaluation of workable improvement of individual NIS parts; some of these improvements identified by the project were already implemented, for example, a detailed analysis of natural gas composition and derivations for national emission factors, or update of uncertainties for all monitored categories of sources/shares of all monitored greenhouse gases.

NIS team continues in improvements by implementing national emission factors for liquid fuels. The improvement plan includes all sectors and categories, but having in mind the limited budget the allocation of funds must be done prudently and sometimes it is necessary to apply compromise solutions such as deferrals of planned improvement. Updated improvement plan is always submitted to UNFCCC.

3.3.9 Systematic Minimization of adverse impacts and effects under articles 3.14 and 2.3 of the Kyoto Protocol / Information on assessment of consequences of response measures

For information on Minimization of Adverse Impact see Chapter 15 of the National Inventory report submitted in April 2013. More information on the EU-wide assessment procedures is available in section 4.10 of the EU 1st Biennial Report.

3.4 National emission trading registry

The European Union Emissions Trading Scheme (EU ETS) has been established by Directive 2003/87/EC, as amended. The EU ETS has been a part of the Kyoto Protocol (KP) since 2008. According to the Commission Regulation (EU) No. 920/2010 of 7 October 2010 for a standardized and secured system of registries pursuant to Directive 2003/87/EC, as amended, each Member State is obliged to use the single EU registry which functions as KP registry.

The national registry has been operated since 2005 by OTE a.s. company on the basis of authorization issued by the Ministry of the Environment. The single EU registry was fully

implemented in June 2012. Only duly authorized representatives of account holders can access the registry.

The registry serves to provide accurate evidence of issuance, holding, transfers and cancellations of allowances. Allowances and Kyoto units are recorded in individual accounts of the parties, operators' accounts, aircraft operators' accounts or personal accounts. According to Act No. 383/2012 Coll. on conditions of trading with greenhouse gas emission allowances, as amended, all facility operators holding Ministry of the Environment permit to discharge greenhouse gases into air, have the obligation to establish an account in the registry. Since January 2012, the same obligation is imposed on aircraft operators with operating license issued in the Czech Republic or who fall under the Czech administration pursuant to the list of aircraft operators issued by the EC. Personal account may be opened by any natural or legal entity including facility of aircraft operators, who already have operator's account.

OTE a.s. company as the administrator of the Registry operates an internet emission trading portal at https://www.povolenky.cz/.

Contact information:
Operátor trhu s elektřinou, a.s. (OTE) (Czech electricity and gas market operator)
Sokolovská 192/79, 186 00 Prague 8 – Karlín
Telephone: +420 296 579 166
Fax: +420 296 579 180
e-mail: ote@ote-cr.cz

The EU Member States, who are also Parties to KP, including also Iceland, Lichtenstein and Norway have decided to operate national registry in consolidated form in line with all relevant decisions applicable to Parties' registries – namely Decision 13/CMP.1 and 24/CP.8. Consolidated platform implementing national registries (including EU registries) is called CSEUR - Consolidated System of EU Registries)

In 2012, the EU registry underwent fundamental change / development in line with new requirements laid down by Commission Regulation 920/2010 and Commission Regulation 1193/2011 and in line with CSEUR implementation. Transfer to the Consolidated System of EU Registries initiated changes in security system and control systems and in minimizing of discrepancies during manipulation with individual unit types (ERU, CER, tCER, lCER, AAU, RMU).

The registry information system conforms to DES. The UNFCCC Secretariat has verified DES compatibility during initiation procedure prior to connection into EUTL and by a set of testing scenarios. The registry successfully completed all these tests and obtained required certificates on 1 June 2012, please refer to Figure 3.9.

Complete description of functionalities and technical details of consolidated registries have been provided to UNFCCC within the framework of common/specific readiness documentation of EU national registries and all consolidated national registries. The overview of security measures, list of publicly accessible information and description of disaster recovery plan is provided in Chapter 14.2 of the National Inventory Report (NIR), which was submitted to the secretariat of the UN Framework Convention on Climate Change in April 2013, and separate annexes referenced in Chapter 14.2 which were submitted together with NIR.

Figure 3.9: UNFCCC certificate

United Nations
Framework Convention on
Climate Change

Recertification Certificate

Party	***Czech Republic***
Issue Date	**01-06-2012**

This certificate confirms that the national registry of *Czech Republic* has successfully passed all recertification tests pursuant to the release of the change of the consolidation of European national registries:

Test Item	Date Passed
Common readiness documentation review	15/12/2011
Specific readiness documentation	31/05/2012
Connectivity reliability test	30/05/2012
Distinctness test	9/12/2011
Interoperability test	30/05/2012

As a result of the execution of the abovementioned tests, the following comments/remarks shall be taken into account:

Item	Comment
SEF	Support of the standard electronic format (SEF) shall be tested and implemented by September 2012

Jörg Kirschbaum

for the ITL Administrator

4 POLICIES AND MEASURES, LEGISLATION AND PROGRAMMES WITH IMPACT ON GREENHOUSE GAS EMISSIONS REDUCTION

4.1 System of climate policies and legislation

4.1.1 Climate policy development

The Ministry of the Environment is responsible for the compliance with the Convention and the Protocol in the Czech Republic; the Ministry of the Environment is also the supreme State administration body in the area of environmental protection. The climate change agenda is addressed primarily within the Department of Energy and Climate Protection; which also includes the national focal point for the Convention and the Protocol in the Czech Republic. Having in mind the cross-sectoral nature of climate change issues, which affects many other departments, the Ministry of the Environment is responsible primarily for the drafting of national policies in areas of mitigation and adaptation. Individual State departments (Ministries), such as Ministry of the Environment, Ministry of Industry and Trade, Ministry of Transport, Ministry of Agriculture, Ministry of Regional Development etc. are then responsible for drafting and implementation of sector-specific policies and measures aiming to reduce emissions of greenhouse gases and adapt to climate change impacts , according to the nature of measure.

4.1.2 National and regional programmes, legislative tools and administrative procedures

With regard to the size of the Czech Republic, arrangement of its State administration and division of powers between central and regional bodies pursuant to Act No. 129/2000 Coll., on Regions, as amended, the Regions do not have a direct competence in the area of protection of global climate system. Nevertheless, the Regional bodies remain responsible, pursuant to Section 1 and 14 of Act No. 129/2000 Coll., on Regions, as amended, for overall development of its territory and for addressing the needs of its population in general terms. This is the foundation of the regional role of responsible bodies in creation of Regional development concepts and plans including water management plans for river basins and flood prevention measures, principles of territorial development including use of renewable energy sources (RES). Regional bodies are also involved in implementation of the below specified energy savings programmes and use of RES, restoration of housing fund (central heating supply systems, revitalization of housing estates) and improvement of transportation infrastructure. Regions also play a large role in preparation of waste management plans and in actual waste management (operation of landfills, composting facilities, facilities involved in energy and material recovery of waste etc.).

Measures of a legislative nature play an important role in the Czech Republic, not only imposing a number of obligations on the state administration and also natural and legal persons, but also providing for the preparation and revision of important strategic documents and programmes.

Since 2000, an integrated and complex system of strategic and operational planning has gradually been created, which is further modified in line with international commitment of the Czech Republic whether assumed pursuant to post-Kyoto processes or EU policies and legislation. Legislative measures also lay down rules for institutional responsibilities for coordination and implementation of various programmes and impose obligations for their regular evaluation.

Wider strategic framework is created primarily by the following documents:

- Sustainable Development Strategy (2004),
- Strategic Framework for Sustainable Development (adopted by Government in 2010),
- National Strategic Reference Framework (2007 – 2013),
- Economic Growth Strategy (2005),
- National Reform Programme (updated annually, last in 2013),
- Strategy of the Regional Development 2007 – 2013 and 2014 – 2020 (adopted in June 2013).

The most important strategic documents with direct or demonstrable indirect effect on greenhouse gas emissions:

- National Programme To Abate the Climate Change Impacts in the Czech Republic – see Chapter 4.3
- State Environmental Policy 2012-2020 – see Chapter 2.5
- National Emission Reduction Programme – see Chapter 4.3
- Climate Protection Policy – in preparation – see Chapter 4.3
- Strategy on Adaptation to climate Change in the Czech Republic - in preparation – see Chapter 6.3
- Update of State Energy Policy – in preparation – see Chapter 4.3

Annex 4 gives an overview of all measures (direct and indirect) according to sectors and gases. This overview is based on the recommended methodology for preparation of the National Communication.

4.2 Legislative instruments

This chapter gives an overview of the key legislation especially in the area of air protection, industrial emissions, emission trading system, energy sector and waste.

4.2.1 Act No. 383/2012 Coll., - on Conditions of Trading with Greenhouse Gas Emission Allowances

This Act transposes Directive 2003/87/EC as amended by Directive 2009/29/EC and simultaneously introduces a host of changes to EU ETS (European Union Emissions Trading Scheme) for the third trading period 2013-2020. This Act defines the rights and obligations of the parties that participate in this system.

Besides Directive 2009/29/EC, the functioning of the EU ETS is also regulated by other EU legislation. The Act implements this regulation, respectively adapts the directly applicable EU

regulation (Regulation 1031/2010/EU on auctioning, Regulation 601/2012/EU on monitoring and reporting, Regulation 600/2012/EU on accreditation and verification, Regulation1193/2011/EU on registries, Commission Decision 278/2011/EU on benchmarks, Commission Decision 2010/2/EU on vulnerable sectors).

The EU ETS gradually moves, within the framework of third trading period, from free allocation of allowances to the system of auctions, and the share of allowances sold at auctions will gradually increase.

Directive 2009/29/EC imposes obligation on Member States to use at least 50% of revenue generated from auctions for pre-defined purposes, which primarily involve reduction of greenhouse gas emissions and adaptation to negative effects of climate change. Act No. 383/2012 Coll. implements these obligations so that 50% of auction revenues will be used to decrease energy intensity of buildings, support innovations and clean technology in industry, compliance with the Czech Republic's international commitment in the area of climate protection and to cover administrative costs associated with ETS operation.

The Directive also lays down the principle that from 2013 no more free allowances will be issued to electricity producers. The Czech Republic however used its exemption clause and will allocate a portion of its free allowances to electricity producers nevertheless in order to support investment into modernization. Power and heating plants operators generating electricity in the Czech Republic will therefore be able to obtain up to 70% of the allowances for free in 2013. The volume of free allowances will gradually decrease between 2013 and 2020 to 0% in 2020. This exemption is subject to fulfilment of several requirements.

The Ministry of the Environment submitted to the EC, in the autumn 2011, the so-called National investment plan for equipment and modernization of infrastructure and clean technologies. This plan forms the groundwork for partial free allocation of allowances to electricity producers (also for co-generation of heat and electricity) and consists of individual investments to be implemented by facility operators, whose investment must correspond at least to the total value of freely allocated allowances.

Facility operators, who will be temporarily able to obtain free allowances for purposes of electricity generation, must undertake to invest at least the minimum market value of free allowances into equipment and modernization of infrastructure and into clean technologies.

Other industrial sectors and heat producers will also be entitled to a certain amount of free allowances pursuant to the Directive. These sectors may be principally divided into the following two groups:

- Sectors affected by carbon leakage – 100% of free allocation for the entire term of the third trading period based on benchmarking. Beneficiaries will be cement and lime producers, iron and steel works and chemical industry (list of exposed Sectors is provided in the Annex to the Commission Decision 2010/2/EU).
- Other – these are sectors not exposed to carbon leakage and heating producers, who may obtain up to 80% of free allowances in 2013 with gradual decrease to 30% in 2020. By 2027 they should not be able to obtain any free allowances at all. This group includes heating plants and industrial sectors, which were not identified as affected by loss of competitiveness (for instance automobile producers).

The new law further regulates conditions, following onto EU regulation, for issuance of permit to emit greenhouse gases, conditions applicable to emission estimates, fundamental obligations in relation to determining, reporting and verification of reported emissions and

AAUs management. These activities are modified so that they become harmonized with the EU from 2013.

Air transportation has been a part of EU ETS since 2012.

4.2.2 Act No. 201/2012 Coll., on Air Protection

Act No. 201/2012 Coll., on Air Protection replaced Act No. 86/2002 Coll., and its objective is to achieve targets of air quality and further decrease of pollutants discharged into the air. The Act transposes a number of EU Directives in the area of air protection (such as Directive 2010/75/EU, 2008/50/ES, 2001/81/ES etc.); it regulates obligations of source operators, defines emission limits and other operational conditions for stationary source operators. It introduces additional mechanisms for improvement of air quality (such as compensation measures for sources located in location already suffering from polluted air), restricts emission limits for a number of sources, introduces new measures in transportation sector (by establishing the so-called low-emission zones); a significant priority is also the area of household heating – solid fuels, where it prescribes fundamental change in existing sources with perspective to 2022 aiming to lower primary particle emissions generated by combustion processes, i.e. also the "black carbon" fraction. The new law also anticipates a more flexible approach of the permitting bodies, which are able to modify conditions for sources with more regard to local condition and quality of air.

4.2.3 Act No. 73/2012 Coll., on ozone depleting substances and fluorinated greenhouse gases

This Act regulates the rights and obligations of persons and competence of administrative bodies in the field of ozone layer protection and climate system protection against negative effects of regulated substances and fluorinated greenhouse gases. The implementing regulation to Act No. 73/2012 Coll. is regulation No. 257/2012 Coll., on emission prevention of substances damaging ozone layer and fluorinated greenhouse gases.

With regard to ozone layer protection, the fundamental regulation is Regulation (EC) No.1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer, as amended, and Regulation (EC) No. 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases.

4.2.4 Act No. 76/2002 Coll., on integrated pollution prevention and control, on the integrated pollution register (Integrated Prevention Act), as amended

The Integrated Prevention Act, as amended, transposes EU legislation, especially Directive 96/61/EC (later replaced by codified wording under No. 2008/1/EC) on Integrated Pollution Prevention and Control (IPPC). The new Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) have been transposed into national legislation in 2013 by amending the Act via regulation 288/2013 Coll.

The main objective of integrated prevention is protection of the environment as a whole against industry and agriculture pollution by regulation of operations of selected facilities listed in Annex No. 1 of the Act. Issuance of integrated permit replaces several other administrative acts according to corresponding legislation.

Prevention of pollution by implementing the so-called BAT (best available techniques) represents a higher degree of protection of the environment.

In the area of greenhouse gas emissions, which are generated by production and use of heat and electricity, the Act allows the regulator to apply the BAT concept, which should lead to increased energy efficiency of production. BAT includes technologies used as well as the manner in which the facility is designed, built, operated, maintained and decommissioned. This Act also allows application of emission limits or equivalent technical parameters, which are based on advanced technologies used in affected industrial sectors. Nevertheless, the possibility of imposing emission limits directly with respect to greenhouse gas emissions remains limited by law on integrated prevention only in cases where it is required, in order to prevent serious pollution at the site.

The manner and scope of ensuring information exchange by BAT is defined in Act No.76/2002 Coll., on integrated prevention, as amended. The set of BAT is specified in reference documents (BREF). For permitting purposes the most important information is provided in the so-called conclusions on BAT.

4.2.5 Act No. 185/2001 Coll., on Waste, as amended, and its implementing regulation and Act No. 477/2001 Coll. on Packaging

Basic waste management rules are set forth in Act No. 185/2001 Coll., on Waste, as amended, and in its implementing regulation and by Act No. 477/2001 Coll. on Packaging, as amended. Waste management objectives and measures for their achievement are defined in Waste Management Plan of the Czech Republic 2003-2013, which had been promulgated by Regulation of the Government as required by law.

4.2.6 Act No. 406/2000 Coll. on Energy Management, as amended

This act transposes relevant EU legislation including: Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Directive 2009/125/EC establishing a framework to set mandatory ecological requirements for energy-using and energy-related products, Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources on energy-related products, Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings and Directive 2012/27/EU of the European Parliament and the Council of 25 October 2012 on energy efficiency.

This Act, which had been amended several times since 2000 (original wording) sets forth, among other, the following:

a) Certain measures for improved energy management and related obligations of persons in energy management area,

b) Rules for development of State Energy Policy, territorial energy policies and State Programme to Promote Energy Savings and the Use of Renewable and Secondary Sources of Energy,

c) Requirements for eco-design of products,

d) Requirements for providing information on energy consumption on energy labels,

e) Requirements for information and education in the area of energy savings and use of renewable and secondary sources.

4.2.7 Act No. 458/2000 Coll., on Business Conditions and Public Administration in the Energy Sectors and on amending certain acts, as amended (Energy Act)

Act No. 458/2000 Coll. transposes Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC, Regulation (EC) No. 714/2009 laying down rules providing a framework for cross-border exchanges in electricity in order to alleviate these difficulties, Regulation (EC) No. 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No. 1775/2005 and Regulation (EC) No. 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators.

This Act regulates conditions for business activities, exercise of state administration and non-discriminatory regulation in energy sectors such as electro-energy sector, gas and heating, as well as the related rights and obligations of natural persons and legal entities. It concerns organization of business activities in energy sector while maintain economic competition, meeting the needs of consumers, interest of license holders and ensuring safe, secure and stable supply of electricity, gas and heating for acceptable prices.

4.2.8 Act No. 310/2013 Coll., on supported sources of energy

This Act amends Act No. 165/2012 Coll., on supported of energy sources, as amended by Act No. 407/2012 Coll., and other laws. The amendment cancels support provided to new electricity generating facilities from renewable sources from 2014, with one-year transition, allowing completion of projects in progress. It also defines the maximum fee levied for the support of renewable sources, which will be collected from customers within the regulated price of electricity and introduces levy on electricity generated from solar radiation effective as of 1. 1. 2014 for facilities put into operation in 2010.

Act transposes Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

This Act regulates:

a) Support provided to generation of electricity, heating and bio-methane from renewable sources of energy (RES), secondary energy sources ("secondary source"), highly efficient combined production of electricity and heat and decentralized electricity generation, exercise of state administration and related rights and obligations of persons involved,

b) Contents and creation of the National Action Plan of the Czech Republic pro energy from RES ("National Action Plan"),

c) Conditions for issue, record-keeping and acknowledging guarantees of energy originating from RES,

d) Conditions for certification on origins of electricity generated from highly efficient combined production of electricity and heat or from secondary sources,

e) Financing of the support of electricity generated from supported sources, heat from RES, decentralized electricity production, bio-methane and provision of subsidy to market operator to cover these expenses,

f) Levies on electricity generated from solar radiation,

g) The purpose of this Act is to protect climate and the environment,

h) Support provided to use of RES, secondary sources, highly efficient combined generation of electricity and heat, bio-methane and decentralized of electricity production,

i) Increase of the share of RES on consumption of primary energy sources,

j) Contribute to efficient use of natural sources and permanently sustainable social development,

k) Creation of conditions for the fulfilment of binding share of energy from RES on the gross final consumption of energy in the Czech Republic while simultaneously reflecting interests of the customers on minimising the impacts on energy prices in the Czech Republic.

4.2.9 Act No. 55/2012 Coll., on Public Procurement

The Public Procurement Act specifies, in connection with procurement of vehicles, that contracting authorities must define technical specification, including consumption, emissions of CO_2, NO_x, hydrocarbons and particles.

4.3 Programming tools

4.3.1 National Programme To Abate the Climate Change Impacts in the Czech Republic

Objective: update of the "Strategy of Protection of the Climate System of the Earth in the Czech Republic" and adoption of new reduction targets by 2020, i.e. reduce by 2020 in comparison with 2000:

a) Emissions of CO_2 per inhabitant by 30%,
b) Aggregated emissions by 25%.

Characteristics: Cross-section and framework strategic document on national level (coordination by the Ministry of the Environment).

Implementation period: 2004 – continues, programme update underway.

Timeframe: 2020

Sector: Cross-section.

In March 2004, Czech Government adopted (in the form of its Resolution No. 187 dated 3. 3. 2004) the revised wording of its "Strategy of Protection of the Climate System of the Earth in the Czech Republic," which defined new tasks for individual sectors. The National Programme To Abate the Climate Change Impacts in the Czech Republic (National Programme) replaced the Strategy of Protection of the Climate System of the Earth in the Czech Republic (adopted by Government Resolution No. 480 in May 1999), whose objective was to ensure fulfilment of the Czech international commitment under the United Nations

Framework Convention oc Climate Change (UNFCCC) and the Kyoto Protocol (KP). This document has not yet anticipated future membership of the Czech Republic in the EU and the necessity to harmonize its national policies and measures with the EU strategic and legislative framework.

The National Programme represents strategic Government document coordinating sectoral and cross-sectoral policies at national level and acknowledges requirements defined in the European Climate Change Programme (ECCP), which became a binding document for the Czech Republic upon its accession to the EU in 2004. Individual Ministries implement the national Programme according to their competences.

The National Programme, drafted in line with requirements set forth by Council Decision 99/296/EC, outlines specific reduction (mitigation) measures for reduction of greenhouse gas emissions, as well as adaptation measures allowing the society and eco-systems to adapt to climate change. National Programme emphasizes that emissions reduction will in general build on respective international treaties with regard to the sustainable development in the Czech Republic.

The Government Resolution No. 395 dated 6. 4. 2005 triggered an evaluation of the National Programme from the perspective of environmental effects and economic impact of adopted measures in 2007, i.e. comparison of the original starting position and achieved reduction on greenhouse gas emissions since the National Programme came into force.

At present time, a new document entitled "Climate Protection Policy" is being drafted, which should replace the National Programme; drafting process should be completed in 2014.

4.3.2 National Emissions Reduction Programme

Objective: Objective of this programme is defined as achievement of emission ceilings and reduction of atmospheric discharge as well as ensuring corresponding air quality. The Czech Republic is adhering to the currently valid 2010 ceilings. For the future period, the emission ceilings were defined by the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) to the Convention on Long-range Transboundary Air Pollution (CLRTAP) for 2020 for SO_2, NOx, VOC, NH_3 and $PM_{2.5}$.

Characteristics: The National Emissions Reduction Programme represents the fundamental programming tool for policies concerned with air protection.

National emission ceilings:

Current national pollutant emission projections to 2020 are provided in document entitled "Potential for reduction of pollutants in the Czech Republic by 2020".

Table 4.1: Outlook for national emission ceilings for SO_2 emissions by 2020

Emissions SO_2 [kt]	**2005**	**2010**	**2020**
1.A.1. Public Energy sector	148.34	122.71	68.60
1.A.2. Industrial Energy sector	31.51	15.16	15.83
1.A.3.b. Road transportation	0.98	0.11	0.11
1.A.4.b. Heating of households	32.46	30.08	10.00
2. Production processes excl. combustion	3.17	3.56	4.48
Other sectors	1.84	1.47	1.49
Total	**218.30**	**173.09**	**100.51**
Sector	**2005**		**2020**
1.A.1. Public Energy sector	135.2		73.7
1.A.2. Industrial Energy sector	36.1		20.4
1.A.3.b. Road transportation	1.0		0.1

1.A.4.b. Heating of households	33.5		23.3
2. Production processes excl. combustion	1.4		2.4
Other sectors	0.7		0.1
Total	**208.0**		**120.0**

Source: MoE

Table 4.2: Outlook for national emission ceilings for NOx emissions by 2020

Emissions NOx [kt]	**2005**	**2010**	**2020**
1.A.1. Public Energy sector	112.63	56.36	46.67
1.A.2. Industrial Energy sector	43.39	38.65	32.80
1.A.3.b. Road transportation	96.38	83.60	32.28
1.A.4.b. Heating of households	15.93	15.24	13.20
2. Production processes excl. combustion	1.42	1.76	2.47
Other sectors	21.19	22.48	12.49
Total	**290.94**	**218.09**	**139.91**
Sector	**2005**		**2020**
1.A.1. Public Energy sector	111.5		53.9
1.A.2. Industrial Energy sector	28.1		30.0
1.A.3.b. Road transportation	95.7		55.1
1.A.4.b. Heating of households	15.1		12.5
2. Production processes excl. combustion	1.4		2.47
Other sectors	34.5		18.3
Total	**286.2**		**172.3**

Source: MoE

Table 4.3: Outlook for national emission ceilings for VOC emissions by 2020

Sector	**2005**		**2020**
1.A.1. Public Energy sector	6.2		5.7
1.A.2. Industrial Energy sector	1.6		1.9
1.A.3.b. Road transportation	67.0		25.1
1.A.4.b. Heating of households	18.5		19.1
2. Production processes excl. combustion	7.0		8.0
3. Use of paint and solvents, production and processin chemical products, printing	103.2		81.7
Other sectors	9.8		6.3
Total	**214.2**		**147.88**
Emissions VOC [kt]	**2005**	**2010**	**2020**
1.A.1. Public Energy sector	5.39	4.96	4.10
1.A.2. Industrial Energy sector	5.70	5.95	5.00
1.A.3.b. Road transportation	42.21	31.89	12.61
1.A.4.b. Heating of households	23.15	20.40	15.06
2. Production processes excl. combustion	11.76	11.76	11.98
3. Use of paint and solvents, production and processing o chemical products, printing	93.40	82.70	71.86
Other sectors	16.57	15.47	12.16
Total	**198.20**	**173.10**	**132.80**

Source: MoE

Table 4.4: Outlook for national emission ceilings for NH_3 emissions by 2020

Sector	**2005**		**2020**
1.A.1. Public Energy sector	0.2		0.6
1.A.2. Industrial Energy sector	0.1		0.2
1.A.3.b. Road transportation	2.0		1.2
4.B. Manure management	56.5		50.5
Mineral fertiliser application	17.8		20.5
Other sectors	2.5		2.4
Total	**79.0**		**75.3**
Emissions NH_3 [kt]	**2005**	**2010**	**2020**
1.A.1. Public Energy sector	0.06	0.67	0.3
1.A.2. Industrial Energy sector	0.1	0.21	0.2

1.A.3.b. Road transportation	1.08	0.78	0.44
4.B. Manure management	57.02	52.57	42.76
Other sectors	21.67	23.63	24.25
Total	**79.93**	**77.86**	**67.95**

Source: MoE

Table 4.5: Outlook for national emission ceilings for $PM_{2.5}$ emissions by 2020

Sector	**2005**		**2020**
1.A.1. Public Energy sector	2.8		2.0
1.A.2. Industrial Energy sector	1.1		0.8
1.A.3.b. Road transportation	5.6		2.8
1.A.4.b. Heating of households	16.7		15.1
2. Production processes excl. combustion	3.4		3.3
Other sectors	6.1		4.4
Total	**35.5**		**28.4**
Emissions $PM_{2.5}$ [kt]	**2005**	**2010**	**2020**
1.A.1. Public Energy sector	2.93	2.23	1.92
1.A.2. Industrial Energy sector	1.79	1.33	0.68
1.A.3.b. Road transportation	4.43	4.56	2.01
1.A.4.b. Heating of households	15.66	11.58	6.92
2. Production processes excl. combustion	2.55	2.71	2.76
Other sectors	6.86	7.1	4.82
Total	**34.22**	**29.51**	**19.11**

Source: MoE

Based on the above projections and having in mind the uncertainties contained in these projections, the Czech Republic committed itself to reduce emissions by 2020 as follows:

Table 4.6: National emission ceilings in the form of relative reduction by 2020 with regard to 2005 levels, Annex II to the revised Gothenburg Protocol

Pollutant	**SO_2**	**NO_x**	**VOC**	**NH_3**	**$PM_{2.5}$**
Ceiling in Annex II to the revised Gothenburg Protocol (%)	45	35	18	7	17

Source: MoE

At present time (autumn 2013), the Medium-term Strategy (by 2020) for improvement of the air quality is being drafted; this document is also a part of the National Emissions Reduction Programme, and will contain new analyses of emissions projections with regard to anticipated publishing of revised National Emission Ceilings Directive and also a new measure aiming to reduce emissions by 2020 with outlook to 2030. Scenario containing sufficient measures in this respect counts on implementation of the following measures: reducing the share of solid fuels in energy mix, increasing energy production and distribution efficiency, implementing considerable investment in the area of household heating, supporting savings in buildings etc.

The cost of implementation of these measures have been estimated, using GAINS model, to reach approximately 45 – 60 billion CZK annually in the present period; a significant part of these costs represents restoration of the vehicle pool. After the specific measures within the National Emissions Reduction Programme will have been detailed, the total cost will be reviewed.

4.3.3 State Energy Policy

Objective: State Energy Policy represents a strategic document with outlook for 30 years expressing objectives in the area of energy management in line with requirements of sustainable development.

Characteristics: Cross-sectional and framework strategic document on national level.

Implementation period: From 2004 onwards, evaluation takes place every 5 years.

The proposal for the SEP is drafted by the Ministry of Industry and Trade after which is it submitted for approval to the Government. The Ministry of Industry and Trade evaluates the implementation of the State Energy Policy at least once every 5 years and informs the Government of the results.

The currently valid SEP has been approved in 2004 and currently it is undergoing an update.

4.3.4 State Programme to Promote Energy Savings and the Use of Renewable Sources of Energy

Objective: Promoting energy savings, increasing energy efficiency and use renewable sources energy.

Characteristics: Programme involves State administration and local governments, private sector, households and non-profit organizations.

Implementation period: 2004 - 2006 MIT + 10 other Ministries, since 2007 it is in place in the form of the EFEKT programme implemented only by the Ministry of Industry and Trade (MIT).

Timeframe: Annual evaluations and definitions of subject matter and budget of individual parts of the program (funded from the state budget).

The State Programme to Promote Energy Savings and the Use of Renewable Sources of Energy was adopted by Government Resolution No. 1105/2004. Its scope and funding is defined in Act No. 406/2000 Coll., on energy management (as amended by Act No. 61/2009 Coll.).

This programme represents implementation tool for the State Energy Policy and Czech commitments toward the EU in the area of energy efficiency. It is supplemental programme to energy programmes financed from the EU Structural Funds.

The State Programme to Promote Energy Savings and the Use of Renewable Sources of Energy focuses on reducing energy consumption, use of renewable and secondary energy sources in line with economic and social needs, sustainable development and protection of the environment. Besides that it focuses on education, energy planning, small-scale investment actions and pilot projects. The most significant emission reductions have been achieved in the energy sector, protection of the environment area, renewable sources energy (RES) and energy savings in industry and in housing sector.

Programme has been implemented during its initial run (from 2005) not only by MIT (which coordinates the entire programme), but also by 10 ministries, especially MoD, McRD, MoA and MoE. Since 2007, the programme has been renamed Programme EFEKT, and as such it has been fully implemented only by MIT. The Programme EFEKT has provided support for various projects during the 2007-2013 period.

4.3.5 European Structural Funds Programmes

Reductions of greenhouse gas emissions achieved thanks to the implementation of the Operational programmes remain, due to the scope of objectives of individual programmes, mostly unquantified. These programmes (2004 – 2013) seek to achieve the objectives defined in the Lisbon Strategy for economic development and should contribute to the economic convergence of the Czech Republic with the EU-15.

Operational Programme Transport (2007 – 2013)

Characteristics: Operational Programme Transport (OPT) has a budget of **5.82 billion EUR,** which represents approximately **22%** of all funding allocated from EU funds to the Czech Republic for 2007-2013. The Czech public sources co-finance additional 1.03 billion EUR.

OPT is divided into **Priority Axes** forming logical sections, and these are further detailed by setting up the so-called Areas of Intervention, which defined what types of projects may be supported within the framework of corresponding Priority Axis:

1. Upgrades of railway network TEN-T,
2. Construction and upgrades of motorway and road network TEN-T,
3. Upgrades railway network outside TEN-T,
4. Upgrades of 1st class roads outside TEN-T,
5. Upgrades and development of Prague Metro and traffic management systems in Prague,
6. Support of multi-modal freight transportation and development of domestic water-borne transportation.

All projects implemented within individual Priority Axes favour mass transportation, aim to increase flow of road transportation and support ecological alternatives to road automobile transportation (water-borne and railway transportation) and thus have indirect positive effect on CO_2, NO_x and solid particle emissions. On the second hand, they increase the volume of transit traffic between the West and Eastern Europe, which in turn increases transportation-generated emissions.

Operational Programme Environment (2007 – 2013)

Characteristics: Operational Programme Environment (OPE) is, in financial terms, the second largest Czech Operational programme. Between 2007 and 2013 it allocated 5 billion EUR, which represents approximately 18.4% of all EU funding in the Czech Republic. Two of the eight Priority Axes of OPE are directly designated to reduce CO_2 emissions. These are:

- **Priority Axis 2 – Improving air quality and reduction of emissions:** Axis focuses on improvement of ambient air quality and reducing of emissions. It supports renovations and acquisition of combustion sources with lower consumption and limited emissions, acquisition of equipment meeting definition of an ecologically efficient product, reduction of heat loss in housing, measures leading to decreased emissions of volatile organic compounds (VOC) to air by favouring water-solvable paints, installation of catalytic and thermo-oxidation units etc.
- **Priority Axis 3 – Sustainable use of energy sources:** Axis focuses on use of energy sources in a sustainable manner, use of renewable sources energy for electricity and heat generation and effective use of waste heat, thermal insulation, construction

and renovations of central and block heating plants, installations of renewable energy sources specially for heating of and preparation of hot water, solar systems, biomass boilers, wind power plants, heat pumps etc.

Estimated results of the OPE show that energy savings in 2010 reached 155 TJ. Installed capacity of RES in 2010 is 3.81 MW and reduction of CO_2 emissions reached 19 144 t in 2009 and 12 742 t in 2010.

Operational Programme Enterprise and Innovations

Characteristics: Operational Programme Enterprise and Innovations (OPEI) focuses on support of development of the enterprise sector by transferring results from research and development into business practice. It is the third largest Czech Operational programme: EU funding allocation reached 3.04 billion EUR. The Czech public sources provide additional financing of 0.54 billion EUR. OPEI is divided into 7 Priority Axes, which are further subdivided into individual Areas of Intervention.

Direct impact on effective energy management and use of renewable sources is apparent for Priority Axis 3 (construction and renovations of facilities involved in production and distribution of electric and heat energy produced from renewable sources, introduction and upgrades of metering and regulation systems, renovation, modernisation and reduction of losses in distribution networks etc.), and Priority Axis 6 (development, consulting in the area of eco-technologies and environmental management systems). Other Axes support development of production with higher added value and thus have effect on de-carbonization of the Czech industry.

Implementation period: 2007 - 2013, in progress.

Timeframe: Annual evaluation and budgeting.

Energy savings from projects completed before the end of 2012 reached 840 TJ and anticipated total savings from all approved projects up to 2012 reach 6 309 TJ. Production of electricity from renewable sources in projects completed before the end of 2012 reached 205.7 GWh and production of heat 126 TJ. The anticipated annual electricity production from RES in projects approved before end of 2012 is 822.9 GWh and anticipated annual heat production from RES is 1700 TJ.

Integrated Operational Programme

Characteristics: Integrated Operational Programme (IOP) contains Area of Intervention **5.2 Improvement of the environment at problem housing estates,** which contributes to the improvement of quality of life in housing and focuses on renovation of residential housing, including measures aiming to reduce energy intensity of residential housing.

Implementation: 2007-2013

Implementation is limited to 41 problematic housing estates, with population of 20 thousand, which have approved Integrated plan for town development. Since commencement of the programme on 31 December 2012, there were 984 applications with total volume of 4 046 mil CZK and 763 projects were financed to the tune of 2 411.7 million CZK. Total allocation for programming period 2007-2013 reaches 226 556 849 EUR.

4.4 Other measures

4.4.1 Emission trading (EU ETS)

Characteristics: The EU ETS is one of the most important economic tools seeking to reduce CO_2 emissions. Administrative framework for the EU ETS is based on Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, which is transposed by Act No. 383/2012 Coll., on conditions of trading with greenhouse gas emission allowances.

Implementation period: 2005 – continues;

Timeframe: In the second trading period 2008-2012, allowances are again allocated free-of-charge, similar as during the first trading period 2005-2007. In the third trading period 2013-2020, allowances will be allocated on the basis of harmonized rules and a growing share of allowances will be sold at auctions.

Sector: Energy sector (public and industrial), industrial technologies (refineries, chemical sector, metallurgy, coking plants, lime production, cement, glass-making, ceramics, paper and cellulose).

In the Czech Republic, the EU ETS is run via Act No. 383/2012 Coll., on conditions of trading with greenhouse gas emission allowances. This Act defines what facilities are subject to the system and the rights and obligations of operators. Operators monitor their emissions, report to the Ministry of the Environment and receive allowances. Part of the allowances is free, the remainder may be bought at the marketplace or in auction. Allowances exist and move between allowance accounts within the registry, which is administered by OTE, a.s.

In 2013, approximately 350 facilities participated in the system. Volume of emissions included in the trading system in the Czech Republic represented approximately 60% of total greenhouse gas emissions in the Czech Republic in 2011. Monitored greenhouse gases include CO_2 and N_2O.

Allocation plan represented the required premise before initiation of allowance trading in the first two trading periods. National allocation plan (NAP) determines the quantity of allowances, which are to be distributed during the trading period to individual facility operators. The Ministry of the Environment has prepared NAP in cooperation with the Ministry of Industry and Trade. NAP2 (2008 – 2012) – allocation plans cover the first Kyoto Protocol commitment period –and directly follows NAP1 (2005 – 2007) created for the first trading period. When calculating the allocated volume of allowances, the Ministry of the Environment based its estimates on historical, only partially verifiable emissions between 2000 and 2004 (which means that the quality and availability of data for the preparation of NAP1 was limited) and on fully verified emissions for the period covering 2005 and 2006 (for NAP2). The third trading period 2013 – 2020 uses National Allocation Tables instead of NAP, and these tables determine allocation per facility for each year according to benchmarks.

In case of NAP2 (2008 – 2012), the total level of allocation in the Czech Republic was decided on 26 March 2007 by the European Commission, which allocated 86.8 million allowances annually to the Czech Republic. This allocated volume includes reserve for new entrants in the amount of 1.29 million allowances and a reserve for joint implementation (JI) projects amounting to 99 389 allowances.

The existing Czech facilities received allocation amounting to 86.8 million emission allowances in average annually between 2008 and 2012.

In 2008, facilities covered by the EU ETS emitted 80,399 million t CO_2. In comparison with 2007, there has been a reduction of emissions by 8.5%, which is 7,435 million t CO_2. Table below shows differences between allocated allowances and verified emissions in completed trading periods.

Table 4.7: Allocated allowances vs. verified emissions [10^3 t CO_2]

Sector	Information	2005	2006	2007	2008	2009	2010	2011
Combustion facilities	EUA allocated free-of-charge	83 335	83 335	83 335	75 578	75 943	76 089	76 139
	Verified emissions	71 457	72 041	75 484	70 444	64 464	67 365	65 468
	Difference	**11 878**	**11 293**	**7 851**	**5 134**	**11 479**	**8 724**	**10 671**
Refineries of mineral oils	EUA allocated free-of-charge	1 370	1 370	1 370	1 088	1 088	1 088	1 088
	Verified emissions	997	1 105	1 095	1 087	980	1 054	988
	Difference	**374**	**265**	**276**	**1**	**109**	**35**	**100**
Raw iron or steel	EUA allocated free-of-charge	5 770	5 770	5 770	3 052	3 052	3 079	3 378
	Verified emissions	4 681	4 931	5 247	3 203	3 944	2 864	3 077
	Difference	**1 089**	**839**	**523**	**-150**	**-892**	**214**	**301**
Cement or lime	EUA allocated free-of-charge	4 388	4 388	4 388	3 836	3 836	3 836	3 836
	Verified emissions	3 561	3 826	4 336	4 057	3 212	3 144	3 510
	Difference	**827**	**562**	**53**	**-221**	**624**	**692**	**326**
Glass	EUA allocated free-of-charge	801	801	801	972	1 009	1 006	1 006
	Verified emissions	769	770	764	823	618	663	631
	Difference	**32**	**31**	**37**	**149**	**391**	**344**	**375**
Ceramic products	EUA allocated free-of-charge	830	830	830	823	829	832	819
	Verified emissions	724	689	742	652	477	406	443
	Difference	**106**	**141**	**88**	**170**	**353**	**426**	**376**
Paper, cellulose, carton	EUA allocated free-of-charge	425	425	425	210	210	210	210
	Verified emissions	265	261	167	134	90	84	68
	Difference	**160**	**164**	**258**	**76**	**120**	**127**	**142**
Total	EUA allocated free-of-charge	96 920	96 920	96 920	85 559	85 968	86 140	86 476
	Verified emissions	82 455	83 625	87 835	80 400	73 785	75 580	74 186
	Difference	**14 465**	**13 295**	**9 085**	**5 159**	**12 183**	**10 561**	**12 291**

Source: EUTL

It remains difficult to quantify the EU ETS effect on the development of emissions due to the fact that besides the EU ETS companies are influenced also by developments in fuel prices or electricity and general economic development.

Table 4.7 suggests that in the first trading period there had been a large over-allocation and therefore the reduction of emissions was nearly negligible. The second trading period was strongly influenced by economic crisis, and emissions had been far lower in most of the sector than originally anticipated.

Sector: Civil aviation.

Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC included aviation activities in the scheme for greenhouse gas emission allowance trading within the Community. Act No. 383/2012 Coll. transposed the Directive into the Czech legal system.

The EU ETS includes aircraft operators whose planes land or depart from airport in the EU Member States, Norway, Iceland and Lichtenstein. Two trading periods are set for the aviation sector. The first period was the year 2012. The second trading period is already harmonized with the third trading period for stationary sources (2013 – 2020). The volume of emission allowances EUAA in the 1st trading period was determined at 97% of historic emissions (average emissions in the EU between 2004 and 2006). In the 2nd trading period this volume has been reduced to 95% of historic emissions. From this amount, 15% of allowances will be auctioned and the remaining allowances will be allocated free-of-charge. In the second trading period, there is a reserve of 3% for new and fast-developing operators. Allocation of emission allowances free-of-charge to individual operators is determined on the basis of multiplication of a benchmark[11] and volume of verified tonne-kilometres in 2010.

An Aircraft operator included in the EU ETS is obliged to annually monitor and report CO_2 emissions produced during the calendar year. Tonne-kilometre data are monitored and reported only for the purposes of applying for free allocation of emission allowances for trading periods or for allocation of free emission allowances from special reserve.

Each aircraft operator included in the EU ETS falls within one administrative country, which is determined by the European Commission. In 2012, the Czech Republic administered 14 aircraft operators (4 Czech, 10 foreign). These operators received in 2012 a total of 798 821 free emission allowances, and verified emissions in 2012 reached 907 820 tonnes of CO_2.

4.4.2 Green Investment Savings Programme (GIS)

Characteristics: Project activities based on Art. 17 of the KP coordinated by the Ministry of the Environment.

Implementation period: 2009 – 2012, for public sector buildings – 2014*

** Note: part of the State Environmental Fund's own reserves (from the total amount of 1.5 billion CZK) and additional 400 million CZK from Government budget reserve (NER surplus) has been allocated to energy savings in public sector buildings. The amount of own resources of the SEF allocated to support the public sector buildings will be based on actual implementation of the measure.*

The Czech Republic had in 2008 – 2012 (under Kyoto Protocol regime) anticipated emission surplus of about 150 million t CO_2 eq., which corresponds to identical number of AAUs (Assigned Amount Units,an equivalent of one tonne of CO_2), and from that number approximately 130 million AAU could be sold within the framework of international emission trading. The legal ground for GIS programme in the Czech Republic is Section 12a of Act No. 695/2004 Coll., as amended by Act No. 212/2006 Coll. and Act No. 315/2008 Coll., governing AAU management.

[11] Benchmark was determined by the European Commission by Decision No. 2011/638/EU

These AAUs are the property of the Czech Republic, managed by the Ministry of the Environment. AAUs, which the Czech Republic have not used toward fulfilment of its KP commitments, can be traded by the Ministry of the Environment on international market according to Art. 17 of the KP or used to support projects within the framework of joint implementation mechanism under Art. 6 of the KP. Funds obtained from sale of AAUs are revenue of the State Environmental Fund (SEF) of the Czech Republic. These revenues may be used only to support activities and projects leading to reduction of greenhouse gas emissions.

Cumulative resource of the GIS programme reached approximately **22 billion** CZK (resources obtained by the sales of AAUs incl. interest, and additional 400 million CZK from Government budget reserve – NER surplus – and own resources of the SEF up to the amount up of 1.5 billion CZK. Support focused on family homes, residential houses and in 2013 the programme begun administering applications for public sector buildings submitted in 2010. Beneficiaries included owners of family homes, residential houses (municipalities, housing co-ops and other), public sector building owners (such as municipalities, hospitals, schools, civic associations and others).

GIS programme focused on reduction of energy intensity and CO_2 emissions in the housing sector. In 2011, the households consumption reached 258,9 PJ (i.e. 71,9 GWh). This includes not only consumption for heating (including losses), but also hot water and general household running. Average energy intensity in 2011 reached 228 kWh/m^2 per year.

Households contribute to energy consumption by almost a quarter (23.9% in 2006) and the housing sector belongs, along with industry and transportation, among the worst emitters of GHGs. Consumption of energy for heating and hot water remains the most significant item in energy balance of households, respectively residential houses. Most of these houses do not comply with existing energy standards, which manifests itself by high energy intensity and CO_2 emissions per unit of residential area. As a consequence, use of small heaters and stoves running on solid fuels (especially brown coal containing sulphur) family houses represent a significant source of local air pollution by emitting dust particles (PM_{10}).

GIS programme was officially announced on 22. 4. 2009 (Earth Day).

GIS programme was divided into three areas of intervention:

A. Heating energy savings, via

A.1. Complex insulation aiming to achieve low-energy standard,

A.2. High-quality thermal insulation of selected parts of houses (partial insulation).

B. Support provided to new buildings complying with passive energy standards

C. Use of renewable sources of energy for heating and hot water

C.1. Replacement of sources running on solid and liquid fossil fuels or electric heating for low-emission sources running on biomass and efficient heat pumps,

C.2. Installations of low-emission sources running on biomass and efficient heat pumps in new buildings,

C.3. Installations of solar thermal collectors.

D. Subsidy bonus for select measure combinations – some combinations are favoured in the form of a bonus

Support was provided nation-wide. In August 2010, the Ministry of the Environment stopped accepting applications for panel housing estate segment and on 29 October 2010 it stopped

application for family houses and non-panel residential houses. The reason for stoppage was exhaustion of financial resources available for the GIS program. The anticipated energy savings achieved thanks to GIS are estimated to reach 1100 TJ in 2010 and 8700 TJ in 2013.

After all measures within GIS will be implemented, the programme will contribute approximately 1 350 GWh/year in savings besides supporting heat generation from RES in total output amounting to 467 GWh/year while contributing to reduced emissions to the tune of 12.4 million tons of CO_2 over 15 years.

4.4.3 Programme "New GIS 2013"

Programme "New GIS 2013" (GIS 2013) opened on 13 June 2013 by the Ministry of the Environment announcing the first Call to submit applications. On 12. 8. 2013, the Ministry of the Environment opened the family houses segment. Resources provided by the State Environmental Fund, with allocation 1 billion CZK cover the Call. The objective of the programme is to lower greenhouse gas emissions by implementing measures leading to lower energy intensity of the family houses, supporting construction of family houses with low energy footprint and supporting efficient use of energy sources.

Support is being provided in the following areas:

- Support area A – Reducing energy footprint of existing housing
- Support area B – Construction of family houses with very low energy intensity
- Support area C – Efficient use of energy sources
- Support area D – Support dedicated to preparation and ensuring implementation of supported measures
- Support area E – Bonus for combinations of selected measures.

4.4.4 Programme New GIS

The objective of this programme is support provided to implementation of measures leading to lower energy intensity of buildings (energy savings, reduced greenhouse gas emissions and pollutant into ambient air, improvement of culture of housing and other).

Funding of the programme in 2013 – 2020 will be covered by the EAU revenues plus additional public and other sources. The anticipated revenue from EUA auctioning could range, according to Act No. 383/2012 Coll. in 2013 – 2020 between 12 – 20 billion CZK.

Under the New GIS programme, 70% of the funding will be directed into the housing sector, i.e. family and residential houses, public buildings will represent 30% of supported renovations (division of total allocation: family homes – 49%, housing coops - 21% and public sector buildings - 30%). Family homeowners will not be able to apply for support from other subsidy programmes. The amount of support will be linked to the achieved energy savings, type of implemented measure, cost, execution and other parameters.

Programme benefits – pro-growth measure with positive impact on the Czech economy (directly on State budget, enterprise development in construction sector, machinery etc.), creation and maintenance of dozens of thousands jobs.

Programme is construed so as to achieve high leverage effect by high degree of mobilization of private sector's own sources.

4.4.5 Programme PANEL / NEW PANEL / PANEL 2013 +

Characteristic: Programme PANEL (NEW PANEL since 2009, PANEL 2013 + since 2013) supports complex renovation and upgrades of residential houses improving their value, lowering their energy intensity and fundamentally extending their lifetime.

Implementation period: since 2001, temporarily suspended in 2010, continues in 2013, **will continue in the future**

Timeframe: Annual evaluation and budgeting exercise.

Programme was established in 2012 by Government Resolution No. 299/2001 Coll. Support may be provided to:

- Natural persons or legal entities owning or co-owning a building;
- Natural persons or legal entities owning or co-owning flats or non-residential premises in a building;
- Flat-owners associations.

Support was provided in 2006 for specific types of repairs or upgrades in panel housing built using standardized construction systems. This support was later extended to all residential houses regardless of their construction system.

Support was provided in the form of:

- Guarantee for loan provided,
- Subsidy toward partial interest from loans.

Since 2013, this programme has been implemented pursuant to Government Resolution No. 468/2012. Support takes the form of a low-interest loan in the programme PANEL 2013 +.

The Ministry of Industry and trade evaluation of the State Programme to Promote Energy Savings and the Use of Renewable Sources of Energy in 2010 demonstrated that energy savings in all so far renovated apartments receiving PANEL or New Panel support amounted to approximately 5 852 304 GJ.

4.4.6 Support to housing fund modernization using building saving

Characteristics: State-subsidized savings scheme offering loans (or bridging loans) at favourable rates to satisfy housing needs of natural persons.

Time frame: since 1995, **continuing**

Building savings are the most popular manner of financing new homes. Loans are state-subsidized and may be used to build or modernize family homes or apartments.

4.4.7 Support of Voluntary Commitments to Energy Savings

Characteristics: Potential tax exemptions or possibility to use grants for end users of energies, who commit themselves to achieve certain improvement in energy savings (or absolute reduction on energy consumptions or CO_2 emissions).

Implementation period: Planned from 2011. Anticipated energy savings in 2015 should reach 2225 TJ and about 6400 TJ in 2020.

4.4.8 Organic farming

Organic farming (ecological agriculture) is an integral part of agricultural policies in the Czech Republic. Its importance lies not only in production of high-quality bio products but also in other non-production functions including increase in long-term sequestration of carbon in the form of organic soil.

Organic farmers are not allowed to use industrial nitro-based fertilisers, which produce large amounts of CO_2 and whose application causes NO_x emissions from the soil. Similarly, any pesticides are banned on organic farming as well as growth regulators, whose production also increased CO_2 emissions.

- Action plan for development of organic farming 2011 – 2015 (including scenarios with additional measures – WAM) adopted by the Government on 14. 12. 2010 describes strategy for the development of organic farming in the Czech Republic by 2015. As of 31. 12. 2012 eco-farms farmed about 488 658 ha, which is 11.46% of the total cropland. In this respect, the Czech Republic is high above the EU average. The Action plan seeks to extend this area to 15% and increase the share of organic products on the market to 3%. Approximately 80% of area farmed by eco-farmers is taken up by grassland, which plays an important role in sequestering carbon.

- Government Regulation No. 79/2007 Coll., regulates implementation of agro-environmental measures.

- Act No. 242/2000 Coll., on organic farming and on amendment of Act No. 368/1992 Coll., on administrative fees, as amended, and modified by Act No. 320/2002 Coll. and Act No. 553/2005 Coll., including Decree of Ministry of Agriculture No. 16/2006 Coll., implementing certain provision of Act No. 242/2999 above sets forth conditions for eco-farming and activities of agro-environment programmes (introduction of new technologies, methods in protected areas, landscape management etc.). This Act implemented EU Directives No. 834/2007 and 889/2008 into national law.

4.4.9 Joint implementation projects (JI)

Characteristics: Project activities pursuant to Art. 6. KP coordinated by the Ministry of the Environment.

Implementation period: 2002 – 2012 *(in 2013 there was last issue of emission reduction units and the final reports are being drafted etc.)*

Sectors: Industry, Energy sector (including RES), Waste.

Act No. 383/2012 Coll. on conditions of trading with greenhouse gas emission allowances allows use of free AAUs to support projects pursuant to joint implementation mechanism (Art. 6 of the KP).

The Czech Government approved by its Resolution No. 648 dated 30. 6. 2003 conclusion of a Framework cooperation agreement for implementation of projects aiming to reduce greenhouse gas emissions between the Czech Republic and the International Bank for Reconstruction and Development – IBRD and other investor countries.

So far, 85 JI projects (Table 4.9) were implemented in the Czech Republic. From the perspective of the KP these emission reductions are applied for the 2008 – 2012 period in the form of Emission Reduction Units (ERUs).

One of the projects aimed to reduce N_2O emissions produced during manufacture of nitric acid, achieved an average annual reduction of approximately 427 thousand t CO_2 eq. During the first commitment period of the KP (2008 – 2012), approximately 0.883 million ERUs have been issued (see Table 4.8). Implementation of all JI projects in 2002-2012 used up approximately 7.446 million AAUs, from that issued ERUs 4.413 million.

Table 4.8: JI projects overview

Project type	Number	ERU (thousand/year)
Small hydropower plant	17	48
Replacing fossil fuels with biomass	18	106
Nitrous oxide breakdown	1	427
Coal to gas conversion[1]	2	1
Energy recovery of landfill gas	47	301
Total	85	883

[1] *1 coal to gas conversion project including use of heat pumps, only AAUs were issued.* *Source: MoE*

4.5 Measures in preparation

4.5.1 Climate Protection Policy

The objective of the drafted Climate Protection Policy is to reduce targeted emissions in short-term (by 2020) respectively medium- and long-term (2030/2050) horizon and implementation of the EU Climate and Energy package.

The purpose is to supplement and coordinate already existing sectoral policies and measures from the perspective of achieving national climate protection objectives. The timeframe (year 2020 - 2050) is determined by technical-economical and legislative framework (especially by the EU Climate and Energy package) and its anticipated continued existence. The drafted Policy will also serve as the Low carbon development strategy of the Czech Republic.

Revised draft of the Climate Protection Policy should be submitted in 2014.

4.5.2 Programming documents for use of EU funds in 2014-2020

Partnership agreement for programming period 2014-2020

The Czech Republic have been in the process of completing preparation for the Partnership agreement for programming period 2014-2020 during 2013; this agreement defines priorities and measures for efficient and effective use of EU funding in 2014-2020 in order to meet objectives of the Europe 2020 Strategy. All relevant Ministries coordinated by Ministry of Regional Development (MRD) share in the preparation of this fundamental development document. The draft agreement contains a number of mitigation and adaptation measures; the most important measures are defined as follows:

<u>Support of conversion to low-carbon economy in all sectors</u>

- Increasing the share of production/consumption of renewable energy sources (RES),
- Reduced energy intensity of buildings (incl. housing sector, public and commercial buildings),

- Reduced energy intensity respectively increased energy efficiency of production and technology processes especially in industry but also in agriculture and aquaculture,
- Modernisation of energy transmission and distribution networks with emphasis on electricity network including support of smart grids development,
- Increased share of alternative energy use in transportation,
- Increased carbon sequestration in agriculture and forestry.

Support of climate adaptation, prevention of and risk management

- Removal and inventory of ecological burden
- Reduction of environmental risks and development of risk management measures

Protection of the environment by supporting efficient use of resources

- Ensuring flood protection based on increased retention capacity of the landscape and slower draining away of water from landscape in agriculture and aquaculture sectors as this issue is one of the key factors in flood occurrences, implementation of additional flood-prevention measures including technical.
- More efficient waste management in line with waste management hierarchy as set forth by the Framework Directive, with emphasis on reduced landfilling of waste,
- Increase protection of nature and landscape by strengthening of its ecological stability by strengthening biodiversity, reduction of landscape fragmentation and implementation of appropriate measures in the area of agriculture and aquaculture,
- Increase soil protection, especially cropland, against erosion and degradation.

Detailed measures and financial allocations for these objectives are presently being negotiated and will be elaborated further during negotiation and preparation of individual Operational programmes.

5 GREENHOUSE GAS EMISSIONS PROJECTIONS

5.1 Emission projection scenarios

The following projections have been prepared in line with methodological guidelines for projection compilation[12] and in line with Decision No. 280/2004/EC and Decision No. 2005/166/EC:

- With existing measures, i.e. with measures implemented and effective as of the date when preparation of projections began (June, 2012);
- With additional measures, i.e. with existing measures and with measures, which are to be implemented in near future or which are planned. Additional measures included in projections preparation include, for instance:
    - Transposition of Directive 2010/31/EU on the Energy Performance of Buildings into Czech legislation,
    - Draft EU Directive on CO_2 produced by light commercial vehicles,
    - Support of voluntary commitment to achieve energy savings in industrial sector.

Table below provides overview of projection results.

Table 5.1: Overview of projection results - emissions [Mt CO_2 eq, respectively % reduction in comparison with 1990]

Scenario	1990	1995	2000	2005	2010	2015	2020	2025	2030	1990 - 2010	1990 - 2015	1990 - 2020	1990 - 2025	1990 - 2030
WEM	196.3	151.0	146.2	146.7	139.5	130.8	122.3	107.3	106.5	-28.9 %	-33.4 %	-37.7 %	-45.4 %	-45.8 %
WAM	196.3	151.0	146.2	146.7	139.5	130.3	120.9	104.7	103.9	-28.9 %	-33.6 %	-38.4 %	-46.6 %	-47.1 %

Source: CHMI

5.2 Sectoral projections

During preparation of projections for greenhouse gases the greenhouse gas emissions were divided, in line with IPCC Guidelines, according to their origin into the following groups:

(i) Greenhouse gas emissions from combustion processes and fugitive emissions (Sector 1A and 1B)

(ii) Greenhouse gas emissions from industrial processes (Sector 2)

(iii) Emissions from solvent use (Sector 3)

(iv) Emissions from agriculture (Sector 4)

[12] UNFCCC *Reporting Guidelines on National Communication*, FCCC/CP/1999/7, part II

(v) Forest management (Sector 5)

(vi) Waste (Sector 6)

Projections were then calculated according to the above groups (CO_2, N_2O and CH_4, HFC, PCF and SF_6). Methodological operations and modelling tools are described in the text below.

5.2.1 Greenhouse gas emissions from combustion processes and fugitive emissions (Sector 1A and 1B)

For projection of CO_2, CH_4 and N_2O emissions from combustion processes – use of fuels, we have used the EFOM/ENV model. Calculation includes the following processes for individual gases:

CO_2 emissions

- fuel combustion in fuel conversion processes (public and industrial energy sector),
- fuel combustion in final consumption (industrial processes, transportation, households, agriculture and sector of public and commercial services),
- fuel refinement processes (refineries, coal treatment and coking),
- SO_2 removal processes using lime.

CH_4 emissions

- mining and post-mining treatment of coal,
- mining, storage, transit and distribution of natural gas,
- mining, storage, transportation and refining of oil.

N_2O emissions

- fuel combustion (in stationary or mobile sources).

Parameters of energy sector development are the result of calculations using the EFOM/ENV model. Balance is valid for scenario with measures.

Table 5.2: Domestic consumption of primary energy sources – WEM scenario

(PJ)	2010	2015	2020	2025	2030
Brown coal	555	466	440	346	326
Black coal and coke	203	197	189	172	156
Oil	335	346	346	336	298
Gas	47	41	31	32	50
Electricity	-54	-34	-40	-36	-18
Nuclear	296	254	291	432	426
RES	176	186	210	217	222
Total	1 558	1 457	1 467	1 499	1 460

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

Table 5.3: Structure of electricity production – scenario WEM

(TWh)	2010	2015	2020	2025	2030
Brown coal	40.9	36.7	33.2	25.9	24.4
Black coal	5.7	6.1	5.1	3.7	2.6
Oil	0.4	0.2	0.1	0.1	0.1

(TWh)	2010	2015	2020	2025	2030
Gas	4.2	7.6	13.8	11.4	11.7
Nuclear	28.0	24.0	26.7	40.5	40.0
RES	6.6	8.7	10.5	11.0	11.2
Total	**85.9**	**83.4**	**89.4**	**92.5**	**90.0**

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

Table 5.4: Final consumption of fuel and energy – scenario WEM

(PJ)	2010	2015	2020	2025	2030
Brown coal	23.7	19.0	15.7	5.1	4.3
Black coal	63.3	64.9	61.2	59.4	58.4
Oil	286.3	293.2	292.4	286.0	276.6
Gas	293.9	281.2	266.8	275.6	294.2
Electricity	200.1	209.7	222.5	236.2	244.0
Heat	146.1	130.7	124.8	123.3	121.2
RES	105.3	118.0	123.3	127.7	130.9
Total	**1 118.7**	**1 116.8**	**1 106.7**	**1 113.4**	**1 129.5**

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

Table 5.5: Final consumption of electricity – scenario WEM

(TWh)	2010	2015	2020	2025	2030
Households	15.0	14.2	14.5	15.2	15.4
Transport	2.2	3.3	4.0	4.8	5.2
Industry	22.5	25.0	27.0	28.5	29.3
Services	14.8	14.7	15.2	16.2	16.9
Agriculture	1.0	1.0	1.1	1.0	1.0
Total	**55.6**	**58.3**	**61.8**	**65.6**	**67.8**

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

For heating we have used the average value according to EUROSTAT of 3 570 day-degrees. For building cooling there does not yet exist a uniform methodology for calculation or day-degree unit. Scenarios with additional measures, respectively excl. measures were calculated by adding, respectively subtracting emissions from partial measures.

Table 5.6 provides projections of total greenhouse gas emissions from the Energy sector for scenarios with existing measures and with additional measures.

Table 5.6: Projections of total greenhouse gas emissions from the Energy sector (in Mt $CO_{2\ eq}$)

	2010	2015	2020	2025	2030
With existing measures	115.4	106.8	98.4	86.3	85.7
With additional measures	115.4	106.2	96.9	84.2	83.6

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

5.2.2 Greenhouse gas emissions from industrial processes (Sector 2)

For projections of greenhouse gases from industrial processes we have used a combination of EFOM/ENV model and model based on table processor. Projections focused on activities with main contribution toward greenhouse gas emissions. Projections for smaller sources of emissions were calculated on the basis of GDP development in industrial sectors.

Emission coefficients are adapted from National emission inventory for 2010.

Emissions from combustion processes in industry were calculated using the EFOM/ENV model, based on demand deduced from sectoral GDP projections. Table 5.7 gives final fuel consumption in industry for the WEM scenario.

Table 5.7: Final consumption of fuel and energy in industrial sector – WEM scenario

(PJ)	2010	2015	2020	2025	2030
Brown coal	3.4	5.0	4.7	3.4	4.3
Black coal	10.3	9.9	7.2	5.4	5.0
Coke	49.4	51.7	51.5	51.4	51.4
Other solid fuels	0.0	0.0	0.0	0.0	0.0
Motor fuels	5.8	5.9	6.1	6.3	6.4
Heating oil	7.4	12.0	14.9	11.4	16.5
Other liquid fuels	17.6	25.7	20.9	26.9	23.1
Natural gas	110.3	113.3	106.8	105.9	97.1
Other gaseous fuels	17.7	19.0	16.7	17.9	17.9
Electricity	81.0	90.0	97.2	102.4	105.3
Heat	83.0	70.9	69.8	68.5	67.0
Biomass	14.6	16.5	15.4	14.9	18.3
Black lye	8.3	4.0	3.2	3.5	4.5
Biogas	0.6	1.0	0.8	0.8	0.7
Waste	0.0	0.0	0.0	0.0	0.0
Secondary heat	9.6	10.3	10.3	10.3	10.3
Total	**418.9**	**435.1**	**425.4**	**429.1**	**428.2**

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

Emissions from industrial processes were determined from projections of energy intensive materials and products, on the basis of information obtained from industry associations. Overview of projections on industrial production and use of produced material is given in Table 5.8. Table 5.9 provides emission projections for WEM and WAM scenarios.

Table 5.8: Projections of active data for selected energy intensive materials (thousand t)

Material	2010	2015	2020	2025	2030
Production – cinder	2 748	2 800	3 000	3 200	3 200
Production – lime	915	1 000	1 000	1 000	1 000
Lime use	2 344	2 009	1 846	1 468	1 333
Production – glass	1 023	1 100	1 200	1 200	1 200
Production – bricks and ceramics	1 117	1 200	1 300	1 400	1 400
Production – ammoniac	257	260	260	260	260
Production – nitric acid	442	450	450	450	450
Production – ethylene	455	460	460	460	460
Production – dichloride-ethylene	136	140	140	140	140
Production – styrene	170	170	170	170	170
Production – steel	5 274	5 400	5 400	5 400	5 400
Production – raw iron	3 987	4 100	4 100	4 100	4 100
Production – agglomerate	4 628	4 800	4 800	4 800	4 800
Production – metallurgic coke	2 548	2 682	2 682	2 548	2 548

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

Table 5.9: Projections of total greenhouse gas emissions from Industrial Processes (in Mt $CO_{2\ eq}$)

	2010	2015	2020	2025	2030
With existing measures	12.1	12.2	12.3	12.3	12.2
With additional measures	12.1	12.2	12.3	12.3	12.2

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

5.2.3 Emissions from use and production of solvents and select chemicals (Sector 3)

There have been two significant changes in processing and use of solvents – increase in chemical industry and decrease in use of paints due to conversion to water-soluble paint. The only predictable tendency is a slight decrease of emissions from paint.

Table 5.10: Projections of active data for production and use of solvents and paint

Thousand tonnes	2010	2015	2020	2025	2030
A. Paint application	35.9	34.0	32.5	32.5	32.5
B. Scouring and chemical cleaning	14.8	14.7	14.5	14.4	14.2
C. Chemicals, production and processes	13.6	14.0	14.0	14.0	14.0
D. Other					
1. Use of N_2O as an anaesthetic	0.60	0.60	0.60	0.60	0.60
2. N_2O from fire extinguishers					
3. N_2O from aerosols	0.15	0.15	0.15	0.15	0.15
4. Other N_2O use					
Other solvent use (SNAP 0604)	22.77	22.54	22.31	22.09	21.87

Source: CRF tables 2010, ENVIROS, s. r. o.

Table 5.11: Projections of total greenhouse gas emissions from Solvent and Other Product Use (in Mt $CO_{2\ eq}$)

	2010	2015	2020	2025	2030
With existing measures	0.5	0.5	0.5	0.5	0.5
With additional measures	0.5	0.5	0.5	0.5	0.5

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

5.2.4 Emissions from agricultural production (Sector 4)

Projections of greenhouse gases emissions includes the following activities:

CH_4 emissions

- enteric fermentation,
- manure management.

N_2O emissions

- direct emissions from agricultural land,
- indirect emissions from agricultural activities.

Emissions from combustion processes in agriculture were determined using the EFOM/ENV model, based on the following projections for final energy consumption in agriculture sector.

Table 5.12: Projections of final energy consumption in agriculture – WEM scenario

(PJ)	2010	2015	2020	2025	2030
Brown coal	0.4	0.3	0.3	0.3	0.0
Black coal	0.1	0.1	0.1	0.1	0.0
Coke	0.1	0.0	0.0	0.1	0.0
Motor fuel	13.4	12.2	12.1	12.3	12.3
Heating oil	1.1	0.6	0.6	0.2	0.0
Other liquid fuel	0.0	0.0	0.0	0.0	0.0
Natural gas	2.0	2.7	2.5	3.0	3.7
Other gaseous fuel	0.0	0.0	0.0	0.0	0.0

Electricity	3.7	3.7	3.8	3.6	3.6
Heat	1.5	1.0	1.0	1.0	1.0
Biomass	0.5	0.5	0.5	0.5	0.6
Biofuel in transportation	0.1	1.7	2.4	2.7	3.0
Geothermal energy	0.0	0.0	0.0	0.0	0.0
Secondary heat	0.0	0.0	0.0	0.0	0.0
Solar heat	0.0	0.0	0.0	0.0	0.1
Total	**22.8**	**22.8**	**23.3**	**23.8**	**24.5**

Source: ENVIROS, s. r. o.

CH_4 and N_2O emissions generated by plant and animal production were calculated from projections on livestock numbers and use of cropland, as shown in Table 5.13 and 5.14. Emission coefficients used in the National emission inventory for 2010 were used in the process.

Table 5.13: Projections of livestock stock (thousands)

	1990	**2010**	**2015**	**2020**	**2025**	**2030**
Cattle	3 532	1 349	1 340	1 350	1 400	1 400
Pigs	4 790	1 909	1 720	1 600	1 500	1 500
Sheep	430	197	210	215	225	225
Goats	41	22	24	27	30	30
Horses	27	30	32	34	35	35
Poultry	31 971	24 838	23 600	23 000	22 500	22 500

Source: MoA, CzSO

Table 5.14: Projections of data for land management (kt)

Input data	**1990**	**2010**	**2015**	**2020**	**2025**	**2030**
Application of nitric fertiliser	418	226	239	244	250	250
Production of potatoes	1 755	665	700	720	750	750
Production of sugar beet	4 026	3 065	3 050	3 000	2 800	2 800
Production of clover	1 344	338	350	400	440	450
Production of alfalfa	1 088	527	500	550	600	650
Production cereal	8 947	6 878	7 800	8 100	8 000	8 300
Production legume	152	58	65	62	67	70
Production soya	2	16	18	20	22	22

Source: IFER, s.r.o.

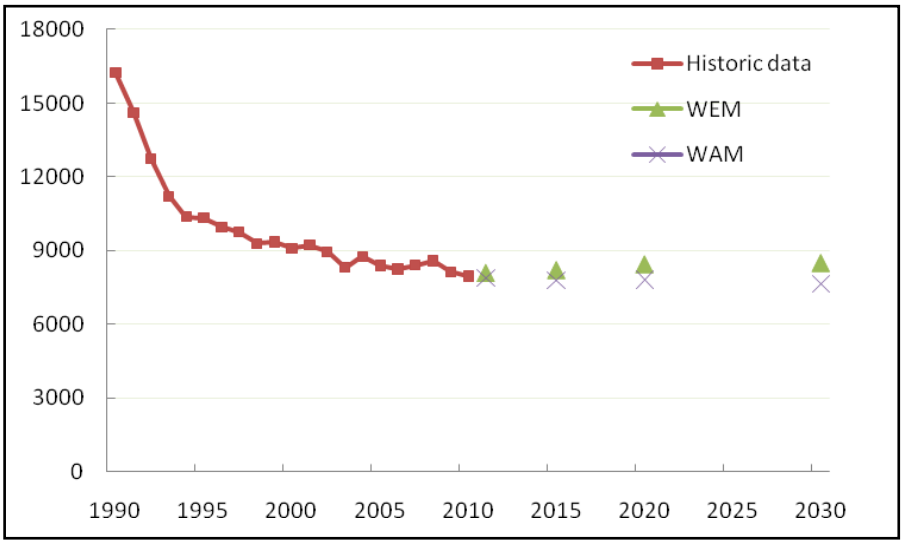
Measures aiming to reduce amount of greenhouse gases in agriculture focus primarily on lower application of nitric fertiliser, catch crops use, development of organic farming (eco-farming), introduction of modern technologies, controlled fermentation of plant waste etc. Lower application of fertiliser and reduced field runoffs form one of the declared objectives in existing policies. Slight increase in emissions by 2030 for scenario with measures is caused by anticipated growth in the number of livestock required to meet domestic demand and exports of animal-related commodities (see Table 5.15 and Figure 5.1).

Table 5.15: Projections of total emissions from agriculture (in Gg CO_2 eq.)

	2010	**2015**	**2020**	**2025**	**2030**
With existing measures	7 965	8 090	8 209	8 439	8 496
With additional measures	7 965	7 888	7 799	7 806	7 646

Source: IFER, s.r.o.

Figure 5.1: Historic and projected greenhouse gas emissions (kt CO_2 eq.) in Agriculture according to scenario with existing measures (WEM) and scenario with additional measures (WAM)



Source: IFER, s.r.o.

5.2.5 Land Use, Land-Use Change and Forestry (Sector 5)

The most important category for land use, from the perspective of carbon stock balance, within the framework of the LULUCF sector is forestland. Forests in the Czech Republic are mostly economically managed and with the exception of entirely negligible area, none of the forest is the so-called primary forest. Pursuant to "Good Practice Guidance" (2003, Chapter 3), forests in the Czech Republic are categorized as "temperate zone forest, economically managed." Pursuant to Marrakesh Accords, forest is defined as is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. Definition does not include permanent unstocked areas, which are recorded in the cadastre as forest (these fall within other categories of land).

Definition of forest land thus corresponds to provisions of Act No. 289/1995 Coll., on Forest, as amended, respectively the Ministry of Agriculture Regulation No. 84/1996 Coll., on Forestry and economic planning.

Another important document regulation forests, is the National Forestry Programme II 2013, which is the fundamental document ensuring sustainable forest management. Government Resolution No. 1221/2008 makes this regulation binding.

National emission inventory reports on six basic IPCC categories. Development of these categories is shown in Table 5.16. No significant change to these data is anticipated. Area of forest land, grassland and wetlands will increase slightly, while cropland will slightly decrease from 2030 on.

Table 5.16: Projections of land use

Land use categories (thousand ha)	2010	2015	2020	2025	2030
Forest land	2 604	2 612	2 615	2 617	2 618
Cropland	3 248	3 226	3 214	3 207	3 203
Grassland	1 085	1 089	1 095	1 099	1 103
Wetlands	163	165	166	166	166
Settlements	680	688	690	690	690
Other land	107	107	107	107	107

Source: CRF tables 2010, IFER, s.r.o.

When calculating emissions development in LULUCF sector, we put strong emphasis on forest land, which is the key category for the Czech emission inventory. For this reasons, all forest-related projections were prepared using the European Forest Information Scenario Model (EFISCEN). Greenhouse gas projections for other categories were prepared using simple correlation according to emission level I reference year on the basis of change in land use.

Scenario with existing measures (WEM) includes development of land use (see Table 5.16). For forestland, the scenario based on EFISCEN model is based on existing implementation of forest management pursuant to the Act on Forests.

Scenario with additional measures (WAM) is similar to the WEM scenario. It differs in in application of EFISCEN model scenario for forestland and CO_2 emissions. It includes proposed shift from dominant spruce forests to mixed forest with higher share of hardwood, such as oak or beech. Support provided toward development of these diversified and more resilient tree covers forms a part of requirements pursuant to the National Forest Program II.

Projections for WEM and WAM scenarios are provided in Table 5.17. Results demonstrate that if tree logging stays on the same level as in 2006 - 2010, the LULUCF sector will have rather small impact on emissions/sinks of greenhouse gas.

WAM scenario gives slightly higher values than WEM scenario. Possible explanation may be the secondary effect of a created stable and permanently sustainable forest cover (WAM measure), which may have lower capacity to remove CO_2 emissions that that of a classical spruce monoculture cover.

Table 5.17: Projections of greenhouse gas emissions for LULUCF sector (Mt CO_2 eq)

Scenario	2010	2015	2020	2025	2030
With existing measures	-5.52	0.92	-0.54	-1.91	-2.13
With additional measures	-5.52	1.18	-0.24	-1.60	-1.60

Source: CRF tables 2010, IFER, s.r.o.

5.2.6 Emissions generated from waste (Sector 6)

Projections include the following activities:

CO_2 emissions

- waste incineration

CH_4 emissions

- waste landfilling
- collection and treatment of municipal and industrial waste waters

N_2O emissions

- collection and treatment of municipal and industrial waste waters

Two scenarios were prepared – WEM and WAM, using demographic and sectoral projections of GDP. Additional measures within the WAM scenario are being drafted into the amendment

of the Waste Act, which is in force since October 2013. Adopted measures include period from June 2012 (when work on projections began), when measures defined in a number of EU Directives were implemented (landfills, waste incinerators, recycling, packaging and packaging waste, bio degradable waste, WWTPs) and included in the WEM scenario. Furthermore, technological development was accounted for. We have used active data as recommended by methodologies and recommendations suggested by IPCC Guidelines. A new Waste Management Plant of the Czech Republic (WMP CR) should be completed in 2014 covering the period 2013 – 2022.

Emission development in Waste sector

GHGs have been increasing in the Waste sector since 1990. The main drivers of this increase in emissions are: organic carbon accumulated in landfills, increasing volumes of mixed municipal waste and high content of biologically degradable substances in municipal waste. Currently, there is a stagnating trend in the amount of emissions produced from landfills (key category for Czech inventory) thanks to technologies capturing landfill gases. Waste incineration influences emissions primarily in terms of industrial waste. Policies and measure in the Waste sector are primarily focusing on reducing the amount of produced waste, reducing the amounts of biologically degradable waste that is landfilled, incineration of waste that cannot be recycled, use of landfill gas and on improvement in waste water treatment in sparsely settled regions.

Waste management technologies

Most of the waste in the Czech Republic is being landfilled. However, when comparing year-on-year developments, there is a positive trend to this. While in 2007, 86% of all solid municipal waste was landfilled, by 2011 this figure dropped to 55% (CENIA, Czech environmental information agency, 2013). This percentage should fall further and measure being adopted (incineration, composting) should have a considerable impact on the total amount of emissions.

Waste content

Overall composition of solid municipal waste (SMW) is very important factor. Biologically degradable part of the SMW influences the amount of methane produced from SMW landfills. On the other hand, fossil carbon increased the amount of CO_2 produced by SMW incineration. Measures seeking to modify used technology interact with measures changing SMW waste composition (lower volume of biodegradable waste, sorted collection etc.). When waste contains large amounts of biologically degradable waste, the emissions from landfills will remain high. If there is high amount of fossil carbon, landfill emissions levels will be lower, but emissions from waste incineration will be high.

Technologies limiting emissions

Methane that is being produced does not need to act as a greenhouse gas. Methane can be removed from landfills and from wastewater treatment processes and used in energy processes or burned off by bio-oxidization. In case of wastewater, the same assumptions of specified in the National emission inventory remains valid and are based on existing technical standards (anaerobic part of the processes removes methane, aerobic does not). With respect to gas removal systems of landfills, it remains difficult to define their efficiency. When quantifying the present emission levels (year 2010) we base our calculations on data provided by the Ministry of Industry and Trade, which determine that gas removal from landfills amounts approximately to 14% of overall methane production.

In considering future development, we assume that the efficiency and use of collection equipment at landfills will be considerably higher. Oonk and Boom (1993) and Scheehle and Kruger (2006) evaluated technologies installed at landfills and compared it to the removed methane. Their findings indicated that installed capacity was 30 – 70% efficient.

Projections of emissions

The waste sector comprises of three sub-sectors – emissions produced from landfills (CH_4), wastewater treatment (CH_4, N_2O) and incineration of waste (CO_2). In order to estimate emissions from landfills, we have used the first order decay model. In the two other sub-sectors the emissions are calculated according to IPCC methodology (tier 1). The main active data clusters are GDP projections and population (source: CzSO). Other important data include data on waste being incinerated and landfill gas emissions being eliminated.

Emissions in the Waste sector change slowly even after implementation of respective measures. The cause is the sheer volume of waste, which is currently being landfilled and which will influence the volume of emissions released in the coming decades.

5.2.6.1 Scenario with existing measures (WEM)

In this scenario, the production of waste does not grow in comparison with the reference year. Dematerialization, waste separation, existing economic tools and legislation compensate further increase of mixed municipal waste. New landfills are equipped by landfill gas capture technologies. Composition of municipal waste gradually changes. Share of plastics decreases as well as biologically degradable substances, which positively influences the volume of emissions released from landfills and waste incinerators. Municipal wastewater is treated with aerobic and anaerobic technologies. The number of inhabitants who are connected to WWTPs increases.

Production of industrial wastewater is directly linked to GDP growth. Volume of N_2O emissions depends on the amount of proteins in food and the size of the population. Projections are based on constant protein levels in food and on slightly growing population.

Greenhouse gas emissions in this scenario will fall. The main driver will be the implementation of the Waste Directive (31/99/EC) and simultaneous support of renewable sources (Act No. 180/2005 Coll. on the promotion of electricity production from renewable energy sources), which includes capture of landfill gases. Existing measures also include the 2003 Waste Management Plan of the Czech Republic.

5.2.6.2 Scenario with additional measures (WAM)

According to the WAM scenario, we anticipate decrease production waste. Most of the city-produced municipal waste will remain to be landfilled. New landfills will be equipped with highly efficient gas capture technologies.

The main reason for the anticipated decrease of emissions is support provided to renewable sources. Act No. 310/2013 Coll. on the supported energy sources, amending Act No. 165/2012 Coll. includes requirements defined in Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

Intermediate objectives for individual years and individual types of RES renewable are already included in the National Action Plan of the Czech Republic for Renewable Energy Sources (MIT, July 2010).

Amendment of the Act on Waste (169/2013 Coll.) will be in force from October 2013 and amends the underlying Waste Act (185/2001 Coll.) the important document for reduction of

emissions in this particular sector will also be the new waste Management Plan covering the period 2014 – 2022, which will be adopted by the end of 2014.

Calculations of partial and overall emission levels linked to the above-described scenarios are provided in Tables 5.18 and 5.19. For aggregations and conversion to CO_2 eq we have used global warming potential (GWP) values recommend by IPCC (21 for methane, 310 for N_2O).

Table 5.18: Total emissions for WEM scenario, Gg CO_2 eq

	2010	2015	2020	2025	2030
Landfilling	2 708	2 604	2 625	2 604	2 583
Municipal wastewater	399	437	388	338	288
Industrial wastewater	256	313	326	336	349
Other wastewater	66	66			
Incineration	183	406	400	394	389
Total	3 612	3 760	3 739	3 672	3 608

Source: ENVIROS, s.r.o.

Table 5.19: Total emissions for WAM scenario, Gg CO_2 eq.

	2010	2015	2020	2025	2030
Landfilling	2 708	2 331	2 205	2 058	1 890
Municipal wastewater	399	437	384	335	275
Industrial wastewater	256	313	309	307	302
Other wastewater	66	66			
Incineration	183	424	430	435	441
Total	3 612	3 505	3 328	3 134	2 909

Source: ENVIROS, s.r.o.

5.2.7 HFC, PCF and SF_6 emissions

Emissions of fluorinated gases are tied to their utilization. None of these gases are produced in the Czech Republic; the following trends in terms of their use are anticipated:

- Lower use of certain products due to their prohibition by EU legislation (for instance SF_6 in windows);
- replacement of gases with higher GWP with gases with lower GWP;
- stagnation of their use in fire extinguishers, foam blowing agents and semiconductor manufacture;
- increase of use in car air-conditioning systems, in households and in tertiary sector.

Table 5.20 gives projections for use of fluorinated gases and Table 5.21 indicates emissions from use these gases.

Table 5.20: Projections of the use of fluorinated gases (t)

	Use	2010	2015	2020	2025	2030
HFC-23	Cooling and air-conditioning equipment	0.30	0.30	0.30	0.30	0.30
HFC-23	Semiconductor production	0.00	0.00	0.00	0.00	0.00
HFC-32	Cooling and air-conditioning equipment	43.30	40.00	40.00	40.00	40.00
HFC-125	Cooling and air-conditioning equipment	138.10	138.00	138.00	138.00	138.00

	Use	2010	2015	2020	2025	2030
HFC-134a	Cooling and air-conditioning equipment	335.10	335.00	335.00	335.00	335.00
HFC-134a	Aerosols/inhalators	2.13	2.20	2.20	2.20	2.20
HFC-134a	Foam blowing agent	21.20	21.00	21.00	21.00	21.00
HFC-134a	Solvents	0.00	0.00	0.00	0.00	0.00
HFC-152a	Cooling and air-conditioning equipment	0.035	0.035	0.039	0.042	0.047
HFC-152a	Solvents	0.00	0.00	0.00	0.00	0.00
HFC-143a	Cooling and air-conditioning equipment	141.50	145.80	150.10	154.60	159.30
HFC-227ea	Cooling and air-conditioning equipment	0.15	0.15	0.15	0.15	0.15
HFC-227ea	Foam blowing agent	0.034	0.034	0.034	0.034	0.034
HFC-227ea	Fire extinguishers	16.53	17.00	17.00	17.00	17.00
HFC-236fa	Fire extinguishers	5.14	5.14	5.14	5.14	5.14
HFC-245ca	Cooling and air-conditioning equipment	0.00	0.00	0.00	0.00	0.00
HFC-245ca	Foam blowing agent	0.017	0.017	0.017	0.017	0.017
HFC-245ca	Solvents	0.90	0.00	0.00	0.00	0.00
CF4	Semiconductor production	0.00	0.00	0.00	0.00	0.00
C2F6	Cooling and air-conditioning equipment	0.00	0.00	0.00	0.00	0.00
C2F6	Semiconductor production	3.20	3.20	3.20	3.20	3.20
C3F8	Cooling and air-conditioning equipment	0.00	0.00	0.00	0.00	0.00
C3F8	Fire extinguishers	0.00	0.00	0.00	0.00	0.00
C6F14	Cooling and air-conditioning equipment	0.00	0.00	0.00	0.00	0.00
SF_6	Semiconductor production	0.00	0.50	0.50	0.50	0.50
SF_6	Electrical equipment	0.53	0.53	0.53	0.53	0.53
SF_6	SF_6 - laboratories	0.00	0.00	0.00	0.00	0.00
SF_6	SF_6 – noise-proof windows	0.15	0.00	0.00	0.00	0.00

Source: CRF tables 2010, ENVIROS, s. r. o.

Table 5.21: Projections of total greenhouse gas emissions from fluorinated gases (in Mt $CO_{2\ eq}$)

	2010	2015	2020	2025	2030
With existing measures	1.5	1.6	1.6	1.6	1.6
With additional measures	1.5	1.6	1.6	1.6	1.6

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

5.2.8 Transport

Emissions in transportation sector are also calculated using the EFOM/ENV model. Calculation is based on the following projection of transportation performances in the transportation sector (Table 5.22).

Table 5.22: Expected transport performances for personal and freight transportation

	2010	2015	2020	2025	2030
Personal transportation (million person-km)	107 029	123 236	140 001	152 823	162 090
Personal automobiles (million vehicle-km)	63 570	70 420	78 150	81 940	83 300
Freight transportation (million t-km)	68 495	76 402	87 349	93 189	95 636

Source: MoT, TRC, ENVIROS, s. r. o.

Model calculation determined the following projections of final consumption of energy in transportation sector for the WEM scenario (Table 5.23).

Table 5.23: Projections of final fuel and energy consumption in transportation – scenario WEM (PJ)

	2010	2015	2020	2025	2030
Bio fuels	9.7	24.6	32.1	33.8	36.1
Electricity	7.8	11.9	14.5	17.2	18.9
Petrol	77.5	73.8	72.6	65.0	54.8
Gas – diesel	144.3	140.3	139.6	136.0	133.8
Aviation gasoline	14.3	18.3	20.9	22.8	24.2
LPG	3.2	3.8	4.1	4.3	4.7
Natural gas	2.9	8.1	14.4	21.5	31.6
Hydrogen	0.0	0.0	0.0	0.0	0.0
Total	**259.6**	**280.8**	**298.1**	**300.6**	**304.0**

Source: ENVIROS, s. r. o.

5.2.9 Buildings

Emission projections for residential houses are based on the final energy consumption in residential sector (Table 5.24).

Table 5.24: Projections of final energy consumption in residential sector

Final energy consumption in residential sector (PJ)	2010	2015	2020	2025	2030
Brown coal	18.9	13.3	10.5	1.0	0.0
Black coal	2.6	2.2	1.5	1.8	1.2
Coke	0.7	0.7	0.6	0.6	0.6
Oil-based products	0.2	0.2	0.2	0.2	0.2
Natural gas	100.5	80.4	69.9	68.7	80.1
Electricity	54.1	51.0	52.2	54.7	55.3
Heat	50.3	47.9	42.5	41.4	40.5
RES	59.0	55.6	54.7	56.7	52.1
Total	**286.4**	**251.2**	**232.0**	**225.0**	**230.0**

Source: CzSO, EGÚ Brno, ENVIROS, s. r. o.

For service sector, the final energy consumption is shown in Table 5.25.

Table 5.25: Projections of final energy consumption in services sector

Final energy consumption in services sector (PJ)	2010	2015	2020	2025	2030
Brown coal	0.9	0.4	0.3	0.3	0.0
Black coal	0.0	0.1	0.1	0.1	0.1
Coke	0.1	0.2	0.1	0.1	0.0
Oil-based products	1.6	0.5	0.6	0.7	0.7
Natural gas	60.5	57.7	56.5	58.7	63.8
Electricity	53.5	53.1	54.9	58.3	60.9
Heat	11.4	11.0	11.6	12.5	12.7
RES	3.0	3.9	4.0	4.3	4.7
Total	**131.0**	**126.8**	**128.0**	**134.9**	**142.9**

Source: CzSO, EGÚ Brno, ENVIROS, s. r. o.

5.3 Total projections

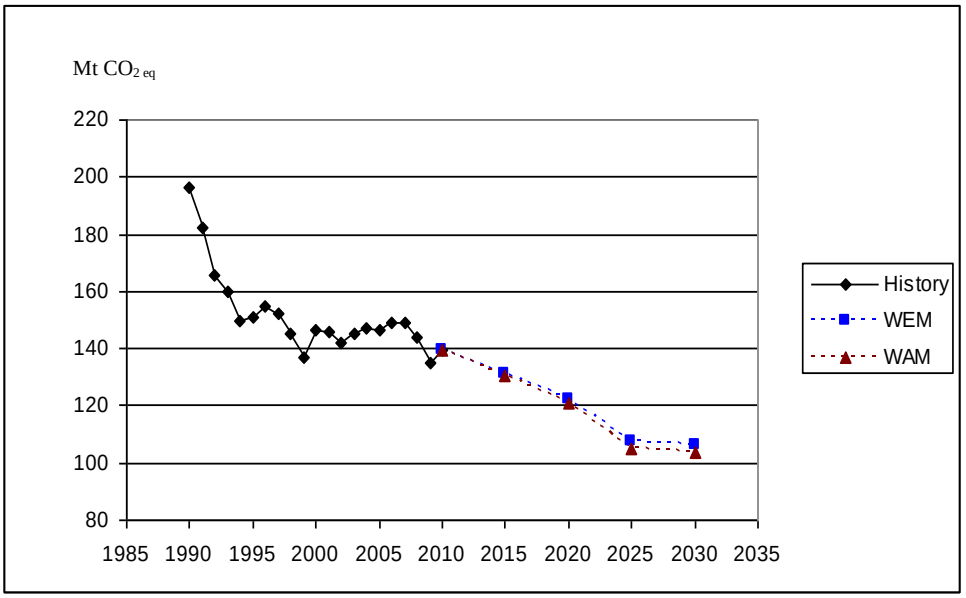
Figure 5.2 indicates development of greenhouse gas emissions in 1990 – 2030. For period covering years 1990 – 2010 we have used values from national greenhouse gas inventories and for 2015 – 2030 our own projections:

(i) Projections for WEM (with existing measures),

(ii) Projections for WAM (with additional measures).

These projections differ in a number of measures seeking reduction of greenhouse gas emissions and degree of their implementation.

Figure 5.2: Historic emissions and projections of greenhouse gas emissions in CO_2 eq. for WEM and WAM scenarios (excl. LULUCF)



Source: ENVIROS, s.r.o.

Tables 5.26 and 5.27 show more detailed results for calculations of the said two projections.

Table 5.26: Calculation of projections of greenhouse gas emissions (excl. sector LULUCF) – projections with existing measures

Gas (Mt CO_2 eq)	2010	2015	2020	2025	2030
CO_2	120.0	112.3	104.2	92.7	92.6
CH_4	10.3	9.3	8.9	5.7	5.1
N_2O	7.6	7.7	7.6	7.3	7.2
HFCs	1.5	1.5	1.5	1.6	1.6
PFCs	0.0	0.0	0.0	0.0	0.0
SF_6	0.0	0.0	0.0	0.0	0.0
Total (CO_2 eq)	139.5	130.8	122.3	107.3	106.5

Source: ENVIROS, s.r.o.

Table 5.27: Calculation of projections of greenhouse gas emissions (excl. sector LULUCF) – projections with additional measures

Gas (Mt CO_2 eq)	2010	2015	2020	2025	2030
CO_2	120.0	111.8	102.8	90.3	90.1
CH_4	10.3	9.3	8.9	5.6	5.1
N_2O	7.6	7.6	7.6	7.3	7.1
HFCs	1.5	1.5	1.5	1.6	1.6
PFCs	0.0	0.0	0.0	0.0	0.0
SF_6	0.0	0.0	0.0	0.0	0.0
Total (CO_2 eq)	139.5	130.3	120.9	104.7	103.9

Source: ENVIROS, s.r.o.

Total effects of policies and measures for the WEM and WAM scenarios, agreggated and for each sector, are given in table 5.28.

Table 5.28: Total effect of policies and measures in 2015 and 2020

Total Effect of Policies and Measures	Expected benefit in reducing greenhouse gas emissions (in kt CO_2 eq/year)	
	2015	2020
WEM Scenario		
Energy supply	7134	7682
Transport	1676	2603
Industrial Processes	1365	2012
Agriculture	370	475
Waste	50	136
Cross-cutting	1669	6039
Total Effect WEM	**12264**	**18147**
WAM Scenario		
Energy supply	364	868
Transport	147	486
Industrial Processes	0	0
Agriculture	210	250
Waste	154	388
Cross-cutting	0	0
Total Effect WAM	**875**	**1992**
Total Aggregate Effect (WEM+ WAM)	**13139**	**20139**

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

5.3.1 Sensitivity analysis to a change in economic growth

Economic development remains the dominant factor affecting the results of projections.

With regard to the dominant share of combustion processes on total greenhouse gas emission levels in the Czech Republic, the sensitivity analyses focused on this decisive portion of projections.

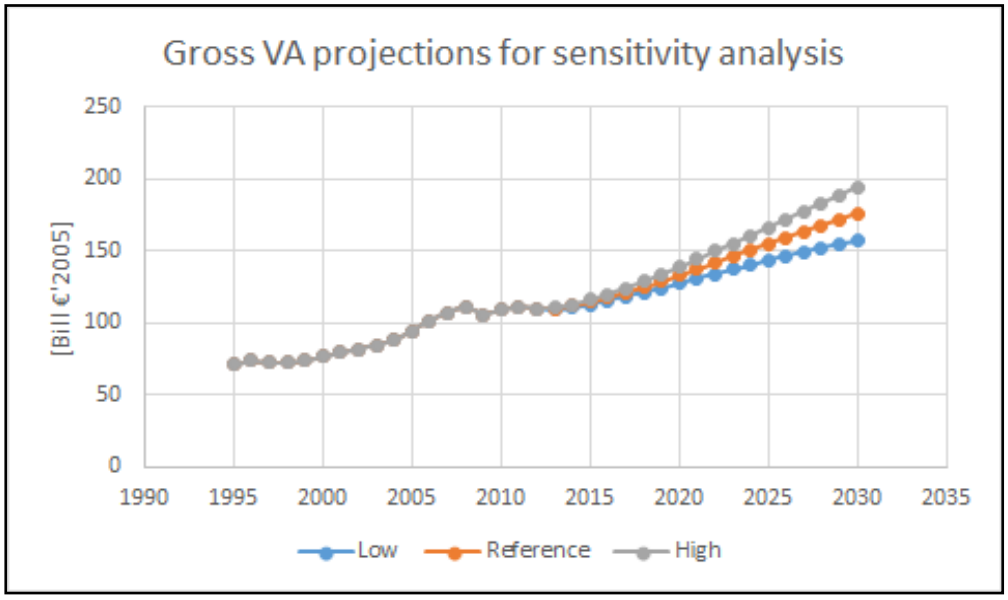
Emission projections are based on scenarios where GDP achieves average year-on-year growth of 4.1%. For uncertainties study (GHGs) we have prepared two alternative scenarios with average annual growth reaching 3.2% and 4.98% (see Figure 5.3).

Parallel with the GDP scenarios we have calculated scenarios with varying population development. These scenarios were compiled by the Czech Statistical Office (CzSO) and are presented below in Figure 5.4.

The results of calculations for individual emission scenarios within the uncertainties analysis were achieved using the EFOM/ENV model and are presented in Table 5.29.

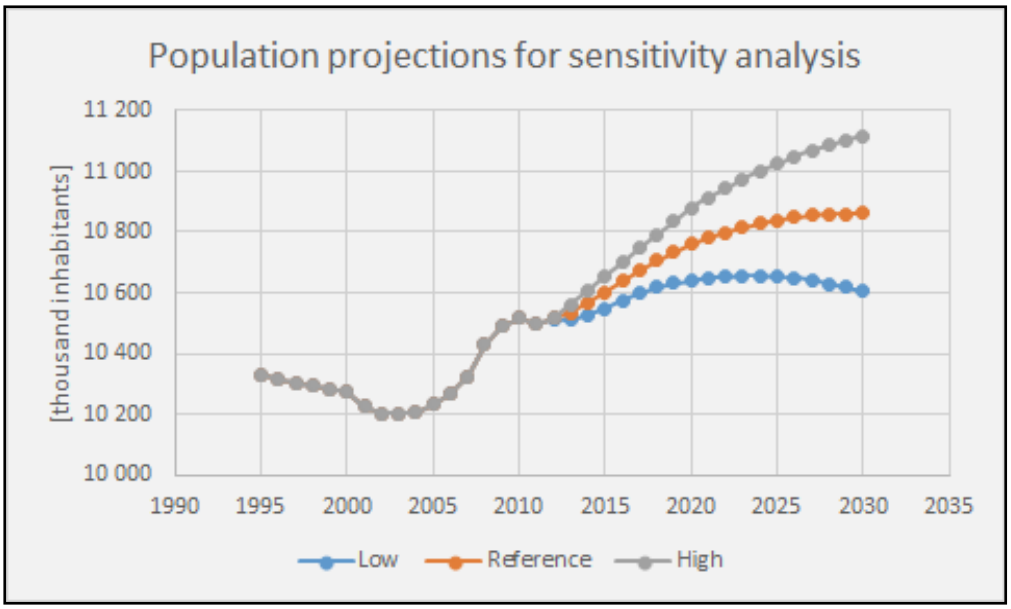
It is apparent that the differences between emissions in individual scenarios are considerably lower than differences between independent input data. Differences between high and basic scenarios are lower than variations between basic and low scenario. That means that higher growth of emissions with high scenario, that is contingent of fast economic growth, is partially compensated by improved energy efficiency. Improved energy efficiency in the high scenario may be explained by growth in investment in more favourable economic conditions.

Figure 5.3: Projections of GDP for the analysis of uncertainty



Source: ENVIROS, s.r.o.

Figure 5.4: Projections of population growth for the analysis of uncertainty



Source: ENVIROS, s.r.o.

Table 5.29: Analysis of uncertainty for greenhouse gases from combustion processes depending on economic growth

(Mt CO_2)	2010	2015	2020	2025	2030
Low scenario	116.9	105.1	97.0	85.2	84.7
Basic scenario	116.9	109.0	100.7	89.3	89.2
High scenario	116.9	109.7	102.1	90.5	91.4

Source: ENVIROS, s.r.o.

5.4 Mechanisms pursuant to Art 6, 12 and 17 of the Kyoto Protocol

Act No. 383/2012 Coll., on conditions of trading with greenhouse gas emission allowances allows use of free AAUs to support project in accordance with joint implementation mechanism (Art. 6 KP).

The Czech Government approved conclusion of the Framework agreement on cooperation in implementing projects seeking reduction of greenhouse gas emissions with the IBRD and other investor countries by its Resolution No. 648 dated 30. 6. 2003.

There were 85 joint implementation (JI) projects approved. From the perspective of the KP, these emission reductions will be exercised in 2008 – 2012, when the Emission Reduction Unit (ERU) can be transferred.

One of the implemented projects seeking to reduce N_2O emissions from production of nitric acid achieved average annual reduction of approximately 427 thousand t CO_2 eq. During the Kyoto Protocol control period (2008 – 2012) there have been issued approximately 0.883 million ERUs annually (see Table 4.4). Implementation of all JI projects during 2002-2012 generated approximately 7.446 million AAUs, and from that the issued ERUs reached 4.413 million. From the perspective of the total reduction of emissions between 2008 and 2012 (please refer to Annex 1), the JI projects contribution to total GHG reduction is estimated at 3.5 – 4% and the share of the GIS programme ("Green Investment Savings" programme) at 2.5 – 3%. The above makes it apparent that the Czech Republic utilizes flexible mechanisms only as supplemental measures to trading in the EU ETS. With regard to the fact that allocation of emission allowances took place pursuant to the National Allocation Plan, this instrument is considered to be a national instrument.

The Czech Government supported, within the Clean Development Mechanism (CDM), implementation of six hydropower plants in North Korea. Topič Energo s.r.o. company have been the partner in all six projects. Large Czech businesses can participate on these projects from their own initiative. For instance, ČEZ, the largest Czech electricity producer, invests into the development of renewable energy sources, energy savings or projects implemented in Central or Eastern Europe, or in the Balkans. Besides that ČEZ actively search for projects in China and South-East Asia. ČEZ concluded contracts for purchases of emission credits (CER) with Chinese developers of wind and hydropower plants in the Hebei and Sechuan provinces and with the company distributing mine methane for cooking into 50 000 households in Fengcheng in the south of China.

5.5 Used methodology

Methodology used in preparation of emission projections is in line with methodology used for compilation of the Third, Fourth and the Fifth National Communication, which enables their mutual comparability. Methodology includes a set of the following actions:

(i) Inventory of greenhouse gases,

(ii) Selection of the starting and the end year and cross-sectional years for projection,

(iii) Selection of own methodology and modelling tools for projections,

(iv) Collection and analysis of input data,

(v) Determination of initial assumptions,

(vi) Definition of scenarios,

(vii) Calculation of scenarios and results presentation,

(viii) Sensitivity analysis of selected assumptions.

Results of these actions are described below.

5.5.1 Inventory of greenhouse gas emissions

The Czech Hydrometeorological Institute compiled the inventory; the last available summary inventory used in preparation of projections is dated 2010. Summary data from this inventory are given in Chapter 3 here above. Total greenhouse gas emissions converted to CO_2 eq. for 2010 amounted to 134 005 thousand t (including shares).

5.5.2 Starting year and cross-section periods

2010 is the starting year; for projections purposes, the following data were available for this year: macro-economic development, energy balance, sources balance and energy consumption, national emission inventory. To calibrate models we have also used the 2005 data. End year for projection of greenhouse gas emissions was 2030, which is in line with the required methodology for compilation of this document. Year 2010, 2015, 2020, 2025 and 2030 were selected to be the cross-section years.

5.5.3 Modelling tools and methods

For projections of CO_2, CH_4 and N_2O emissions from fuel combustion processes we have use the EFOM/ENV model. Following activities were included in projections for individual gases:

- **Carbon dioxide (CO_2)** - fuel combustion in fuel conversion processes (public and industrial energy sector), fuel combustion in final consumption (industrial processes, transportation, households, agriculture and public and commercial services sector), fuel refining processes (refineries, coal treatment and coking) and SO_2 removal from flue gases using lime;
- **Methane (CH_4)** - coal mining and post-mining treatment of coal; mining, storage, transit and distribution of natural gas and mining, storage, transportation and refining of oil;

- **Nitrous oxide (N_2O)** - fuel combustion in stationary and mobile sources.

For projections of greenhouse gases development from industrial processes, we have used the combined approach of using the EFOM/ENV model and table processor. Projections focused on activities and emissions with majority share on GHGs. Other emissions and activities with minority share on emissions were derived from GDP growth in manufacturing industry, also with respect to lack of data on its development in the future (for instance, steel, coke, polymers, nitric acid production etc.).

The main component of emissions produced from industrial processes, i.e. metallurgy, has been solved directly by the EFOM/ENV model. Projections for the sector of non-ferrous production were performed only for CO_2 emissions from cement production, which put together approximately 90% of emissions. For glass-making, which is the second most significant source of CO_2 emissions, we assume constant pro rata development to cement-produced emissions. For cement projections we have used the emission factor used in the IPPC methodology, i.e. 0.4985 t CO_2/t of cement.

5.5.4 Collection and analysis of input data

The basic sources of data for compilation of greenhouse gases projections were the following documents:

Statistical data:

1. Greenhouse gas emissions inventory in the Czech Republic 2010, CHMI, Prague, April 2012
2. Energy Balance in the Czech Republic 2005- 2010, CzSO, Prague, 2012
3. Annual Report of the Operational Programme Enterprise and Innovation 2011, CzechInvest, Prague, June 2012
4. 2nd National Energy Efficiency Action Plan of the Czech Republic– NEEAP II, MIT-commissioned study prepared by ENVIROS, s. r. o. and SEVEn, Prague, 2010
5. Annual Report of the Operational Programme Environment 2011, MoE, SEF, Prague, June 2012
6. Documents provided by the Ministry of Industry and Trade, 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, Czech Statistical Office and CzechInvest.

Prognostic data:

1. European Commission Communication COM (2008) 744 "Second Strategic Energy Review – AN EU Security and Solidarity Action Plan – Europe's current and future energy position – Demand – resources – investments" dated 13. 11. 2008
2. European Commission Communication COM (2009) 519 "Investing in the Development of Low Carbon Technologies (SET-Plan)" dated 7. 10. 2009
3. Documents provided by Ministry of Industry and Trade, 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.
4. Documents provided by EGÚ Brno, a. s., VUPEK-ECONOMY, spol. s. r. o.

The above-mentioned sources were used in creating databases for prognoses input data.

5.5.5 Initial assumptions and scenarios

Political and legal environment

From political and legal perspective these following conditions have been taken into consideration with regard to the development of energy sector and industrial processes emitting GHGs:

- By acceding to the EU, the Czech Republic committed itself in terms of protection of the environment and climate, which form a part of the Acquis communautaire, such as Directive No. 80/2001/EC, Directive No. 96/61/EC (to be replaced by Directive 2010/75/EU in 2014), Directive No. 81/2001/EC (revision presently underway), Directive No. 96/2003/EC (as added to by Directives 2004/74/EC and 2004/75/EC) and Directive No. 2003/30/EC (replaced by Directive 2009/28/ES).
- The ETS system is in operation in the Czech Republic as a part of the EU ETS. This system is developing especially in terms of allowance allocations, when the so-called grandfathering is being gradually abandoned and auctions will be the main source of allowances (from 2013).
- The Czech Republic is bound by a number of international climate and environmental protection treaties (Kyoto Protocol, Second Sulphur Protocol, Gothenburg Protocol).
- Energy market is open to all comers pursuant to Act No. 458/2000 Coll. (electricity from 1. 1. 2006, gas 1. 1. 2007) and coal, gas and electricity prices are converging with European market prices.

Technological development

In the period between 2010 and 2030, we anticipate significant developments in technologies for acquisition, conversion, transportation and use of energy sources. In the area of solid fuel used in electricity generation, the use will lead to sources with supercritical steam parameters and fluid technologies, which will considerably increase efficiency; in the area of combined electricity and heat production the improvement of technologies will allow construction of sources as close as possible to its consumers. Later on, we anticipate possible coming of small sources based on micro turbine and fuel cell technologies.

In the nuclear sector, we anticipate construction of two new nuclear blocks around 2025.

In terms of motor fuel, we anticipate, besides further decreasing consumption, a higher use of alternative fuels, which will be possible also by use of renewable energy sources (biofuel). Main trend will be not only further decrease in measurable investment costs, but also criteria affecting protection of soil and biodiversity, respectively demonstrable contribution to reducing greenhouse gas emissions.

Demographic development scenario

Population growth prognosis is based on the Czech Statistical Office (CzSO) data[13]; numbers of households, which are also necessary to calculate energy-related demand, were estimated. CzSO prepared three separate population projections; we have used the middle projection.

[13] Population prognosis up to 2065, CzSO, Prague 2009, published w-4020-09

Table 5.30: Demographic prognosis (thousand)

	2010	2015	2020	2025	2030
Population	10 517	10 635	10 761	10 839	10 861
Households	4 614	4 803	4 975	5 095	5 173

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

Economic development scenario

There is no official prognosis of long-term (2030) GDP development in the Czech Republic. Besides that, it is very difficult to estimate development of national economy or its individual sectors during economic crisis. Scenarios for GDP development used in this projection are based on forecasts prepared by EGÚ Brno, a.s. for OTE, a.s. in April 2012. These projections are prepared semi-annually and are approved by a team of experts commissioned by OTE, a.s. company.

Table 5.31: Gross added value development prognosis (2005 constant prices[14]) in billion EUR

Sector	2010	2015	2020	2025	2030
Industry	33.24	41.00	49.93	57.02	62.89
Construction sector	4.53	5.17	5.91	6.58	7.25
Agriculture	2.65	2.92	3.22	3.53	3.76
Transport	9.74	11.62	13.87	16.02	18.10
Services	42.98	49.43	60.54	73.07	86.27
Total	93.15	110.14	133.48	156.21	178.27

Source: ENVIROS, s. r. o.

Development of global fuel and energy prices

Globally traded commodities include oil, natural gas and black coal. Price development scenarios are being regularly prepared for these commodities. In recent years, electricity is being traded in a still increasing degree, but with regard to its regional nature, there does not exist any published price development scenarios.

Fuel prices on the global market were taken from EU documents[15] dated 12. 8. 2013. Data correspond with a "moderate" price development scenario.

Table 5.32: Global fuel prices development prognosis (2008 constant prices[16])

$ (2010)/boe	2015	2020	2025	2030
Oil	86.0	88.5	89.2	93.1
Natural gas	53.8	61.5	58.9	64.5
Black coal	22.0	22.6	23.7	24.0

Source: EU 120813 Recommendations for reporting on projections in 2013

The main assumptions used in outlining the scenarios include:

- There has been a jump in oil / gas prices and long-term prognoses for its development vary considerably;
- With regard to ever-growing demand (especially in the developing world) natural gas prices will continue to be tied to oil prices (extent and speed in price change will be lower than for oil);

[14] Exchange rate of 29.78 CZK/€ – 2005 average

[15] EU 120813 Recommendations for reporting on projections in 2013

[16] Exchange rate 0.64 $/€ –2008 average

- Price on import for black coal is based on the optimistic assumption of its surplus on European market;
- There exists a certain risk of black coal prices rising due to growing demand in fast-growing Asian countries;
- Domestic price of black coal will be burdened with additional transportation costs at state border (estimate 10 CZK/GJ);
- New energy sources will need to comply with strict ecologic limits and electricity prices will need to cover variable and constant costs, and therefore the price will be considerably higher than current prices;
- After 2010 the increases in electricity price is derived from increase of natural gas prices, as a new decisive source of fuel for generation of electricity in Europe.

Development of domestic prices and fuel and energy availability

Prices of imported primary energy sources will derive from above mentioned average prices on import into EU. Prices of domestic energy sources will be based on the cost of their acquisition and simultaneously, they will be influenced by the market position of the given fuel vis-à-vis competitive sources of energy. The decisive domestic fuel in the near future will be solid fuel, especially brown coal. Their availability will depend on the territorial ecological mining limits.

Purchase prices of electricity produced from renewable sources and from s combined sources are currently determined in line with the Energy Regulatory Office (ERO) Regulation[17]. Existing legislation[18] guarantees advantageous purchase tariffs for 15 years from putting the source into operation. The ERO may lower these prices by 5% each year. In our projections, we anticipate that the current purchase prices will be maintained over the entire period.

In 2010, the costs of photovoltaic panels dropped and there had been a dramatic increase in the number of new solar facilities. The installed capacity of the photovoltaic plants tripled and reached the capacity of 1 800 MW. High purchase tariff on electricity from these plants would have resulted in higher consumer prices were it not for a new Act allowing reduction of the purchase tariff by 50%. Solar plants constructed after 2009 are subject to withholding tax of 26%.

Availability of domestic coal

The decisive local energy source in the near future will be lignite. Its sources / availability depend on the rigidity of ecological territorial limits for their mining. Mining capacity development is given in Table 5.33. At the ČSA mine, we do not anticipate that limits will be lifted.

Table 5.33: Projections of domestic coal mining

Categories coal	Maximum mining capacity (units)	2010	2015	2020	2025	2030
Black, fit for coking	PJ	193	178	179	137	100
	thousand t	6 700	6 215	6 245	4 695	3 395
Black, energy sector	PJ	100	84	82	60	43
	thousand t	4 300	3 585	3 455	2 505	1 805

[17] ERO decision on prices No. 10/2004, determining electricity prices and prices of related services

[18] Act No. 180/2005 Coll., on support of renewable sources

Categories coal	Maximum mining capacity (units)	2010	2015	2020	2025	2030
Brown (SD – Libouš)	PJ	125	122	112	112	92
	thousand t	12 290	12 000	11 000	11 000	9 000
Brown (SD – Bílina)	PJ	130	132	132	111	111
	thousand t	9 340	9 500	9 550	8 000	8 000
Brown (MUS – Hrabák)	PJ	95	90	90	76	76
	thousand t	8 810	8 300	8 300	7 000	7 000
Brown (MUS – ČSA)	PJ	88	49	50	0	0
	thousand t	4 630	3 000	3 000	0	0
Brown (SU – Jiří)	PJ	97	71	69	0	0
	thousand t	7 670	5 600	5 500	0	0
Brown (SU – Družba)	PJ	8.9	0.0	0.0	47.3	47.3
	thousand t	750	0	0	4 000	4 000
Brown (Kohinoor)	PJ	6.8	0	0	0	0
	thousand t	410	0	0	0	0

Source: VUPEK-ECONOMY, s. r. o.

Energy scenarios

Model calculation of greenhouse gas emissions from energy processes is based on the following assumptions:

(i) Temelín nuclear power plant will operate over the entire monitored period (2000 – 2030);

(ii) Dukovany nuclear power plant will be renovated in order to extend its lifetime and will normally operate over the entire period;

(iii) Two new nuclear blocks should be completed around 2025;

(iv) Territorial ecological mining limits for lignite mined will remain in place at the ČSA mine and at the Bílina mine they will be partially freed up.

(v) There will be no limits in place for oil, gas and black coal imports;

(vi) Import and export of electricity will be limited by technical capacity of the transmission network.

6 ESTIMATED VULNERABILITIES, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

6.1 Anticipated climate change impacts

6.1.1 Construction of scenarios

Integration of the regional climate model (RCM) ALADIN–CLIMATE/CZ[19] with emission scenario A1B for the 1961 – 2050 period, with horizontal resolution of 25 km, was completed in 2008. The outputs of the ALADIN – CLIMATE/CZ model in the form of series for the 1961 – 1990 period with a time resolution of 6 hours were first converted to daily data. The average daily and also maximum and minimum air temperatures and total daily precipitation were calculated. Subsequently, the obtained fields were validated by comparison with the set of measured values.

During the construction of the scenario of changes in the air temperature and atmospheric precipitation, emphasis was placed on three thirty-year time intervals: 2010 – 2039, 2040 – 2069 and 2070 – 2099 andSRES scenario A1B. The basis for the scenario consists in RCM ALADIN – CLIMATE/CZ outputs with a resolution of 25 km, corrected for errors in the model, which were identified when comparing the model simulation for the reference period.

The global climate models (GCM) was used for uncertainty analyses for the 2010 – 2039 and 2040 – 2069 periods. The range of changes in thirty-year average temperatures and total precipitation in the country is characterized by the upper and lower quartiles of the set of changes, calculated by a group of selected GCM; the average change is the multi-model median. In addition to RCM ALADIN – CLIMATE/CZ outputs, the scenario will also include additional time series, which will reflect the "average" change that can be expected in the region of the Czech Republic on the basis of GCM outputs and the interval within which the results of 50% of the monitored GCM lie. A simple additive (for temperatures) and multiplicative (for precipitation) procedure recommended by IPCC[20] was used to obtain these time series. In addition to GCM, the estimate of the uncertainty for the 2070 – 2100 period will also be based on inclusion of the outputs of the ALADIN – CLIMATE/CZ model in the context of further RCM, primarily in the models of the PRUDENCE [21] project.

6.1.2 Climate development estimate for the Czech Republic until mid 21st century

The basis for climate change scenario in the Czech Republic comprises of ALADIN-CLIMATE/CZ regional climate model output with 25 km resolution for the 1961–2100 period according to emission scenario SRES A1B, corrected for errors in the model, which were identified when comparing the model simulation for reference period 1961–1990 with

[19] Farad, A., Skalák, P., Štěpánek, P. (2008): High resolution experiments with the regional climate model ALADIN-Climate/CZ, Geophysical Research Abstracts, Vol. 10, EGU2008-A-08210

[20] IPCC-TGICA (2007): General Guidelines on the Use of Scenario Data for Climate Impact and Adaptation Assessment. Version 2. Prepared by T.R. Carter on behalf of the Intergovernmental Panel on Climate Change, Task Group on Data and Scenario Support for Impact and Climate Assessment, 66 pp.

[21] http://prudence.dmi.dk/

actually measured values. Scenario has been prepared for the basic set of climatological elements: average daily temperature, daily precipitation amount, daily sum of global radiation, average daily wind speed, average daily humidity, daily minimum and maximum temperature. Selection of these climatological elements is based on the requirements of individual sectors involved in estimates of climate change impacts. Changes of climatological elements calculated by the ALADIN-CLIMATE/CZ model for 2010–2100 period in accordance with emission scenario SRES A1B are only one of the possible variants of the future climate development. These changes must be included into the context of uncertainties arising from use of various RCMs, governing GCMs and emission scenarios. For the purposes of estimating climate change development in the Czech Republic, we have used, from the set of compiled scenarios, the short-term (2010–2039) and medium-term timeframe (2040–69). The resulting scenario is a result of an R&D project completed in 2011[22].

Estimate of short-term climate change development in the Czech Republic (2010–2039)

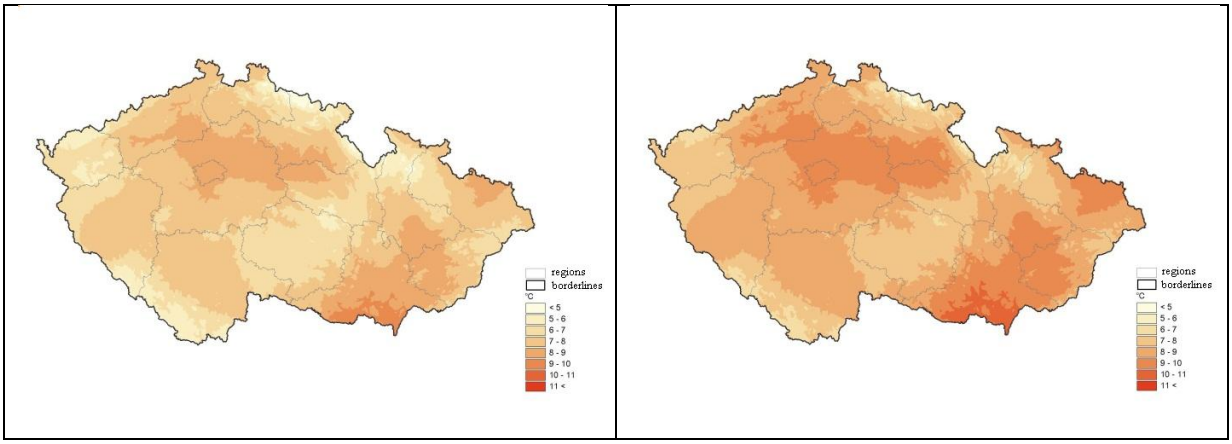
The short-term estimate (midpoint in 2030) shows that the average annual air temperature in the Czech Republic will increase, according to the ALADIN-CLIMATE/CZ model, approximately by 1 °C; warming up in the summer and winter is only slightly less than in the spring and autumn (Table 6.1). There is an apparent systematic increase of temperature with relatively little fluctuation over the area (Fig. 6.1).

Table 6.1: Changes in average seasonal temperature and precipitation in short-term horizon in comparison with reference period 1961–1990 according to simulation by ALADIN-CLIMATE/CZ RCM model for A1B scenario

	Spring	Summer	Autumn	Winter	Year
Temperature [°C]	1.2	1.1	1.2	1.1	1.1
Precipitation [mean share]	1.10	1.03	1.07	0.91	1.03
Precipitation [%]	10	3	7	-9	3

Source: CHMI

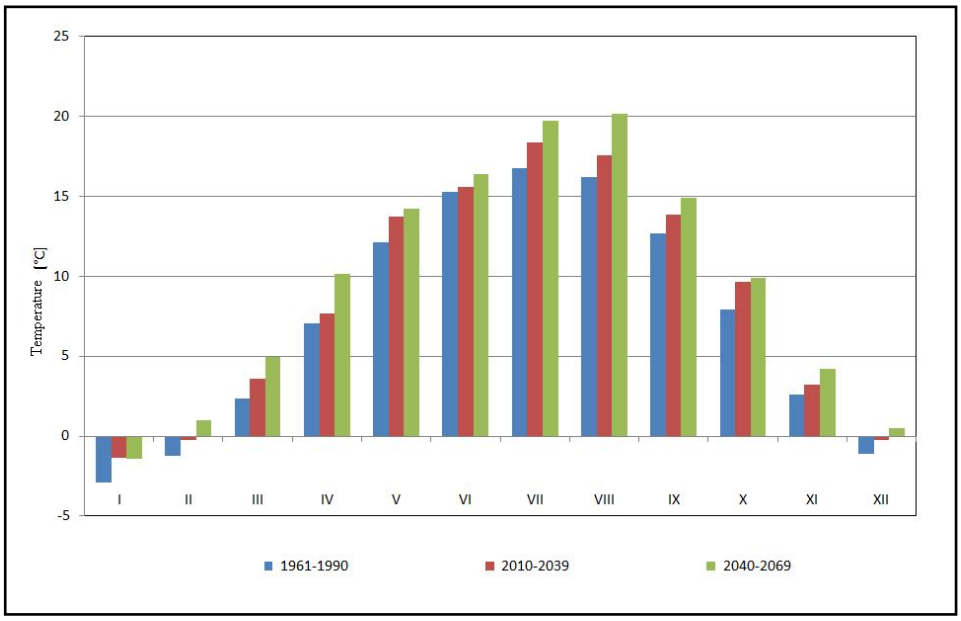
Figure 6.1: Average temperature in the Czech Republic in 1961-1990 (left) and estimated average annual temperature in 2010-2039 (right)



Source: CHMI

[22] Pretel, J. a kol., 2011: Specification of existing estimates of climate change impacts in water management, agriculture and forestry sectors and proposal for adaptation measures. Technical summary of results of the R&D project (Ministry of the Environment, SP/1a6/108/07, 2007–2011). Prague: CHMI, p 67

Figure 6.2: Average monthly temperature in the Czech Republic in reference period 1961-1990 and in 2010-2039 and 2040-2069 (scenarios)



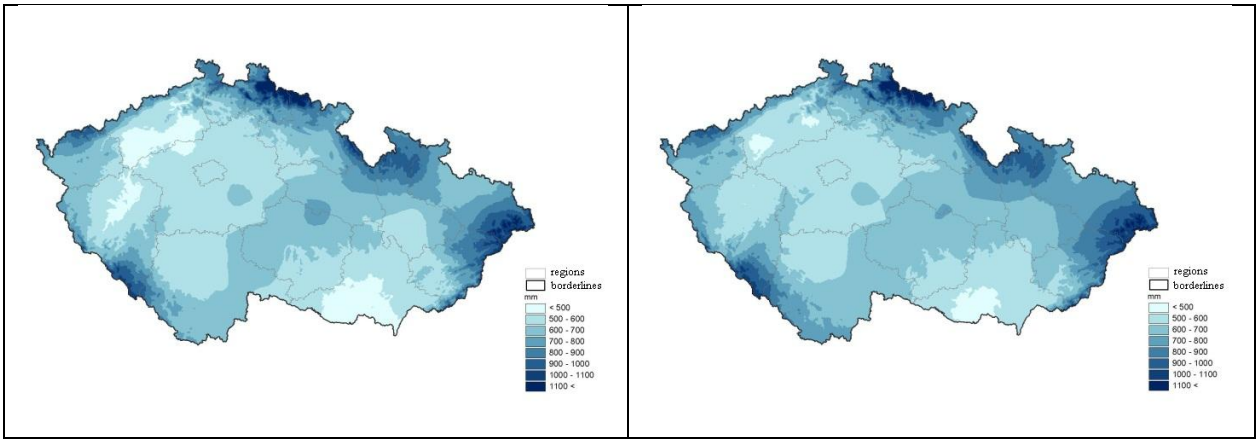
Source: CHMI

Fig. 6.2 above shows change in monthly temperature shown for the scenario periods, for both short- and medium-term horizon with reference to 1961-1990 period. Simulations also indicate that change in temperature is linked to certain related temperature characteristics. In the summer, we may anticipate slight increase in the number of summer and tropical days and nights, in the winter a decrease in the number of frost, ice or arctic days.

Total precipitation changes are more complex. Most nodal points in winter show in simulation decrease of precipitation (depending on specific location by up to 20%), while in the spring the same show increase (by 2 to approximately 16%); in the summer and especially in the autumn the situation varies place to place (some locations show slight decrease by several per cent in the autumn, while elsewhere an increase by up to 20–26%, in the summer slight decrease prevails, but in some location (for instance in Western Bohemia) there is an increase by up to 10%). At the same time, there is an apparent spatial variability of these changes, so it is possible that eventual climate signal may be, in this short timeframe, drowned out by natural (year-on-year) fluctuation of precipitation totals.

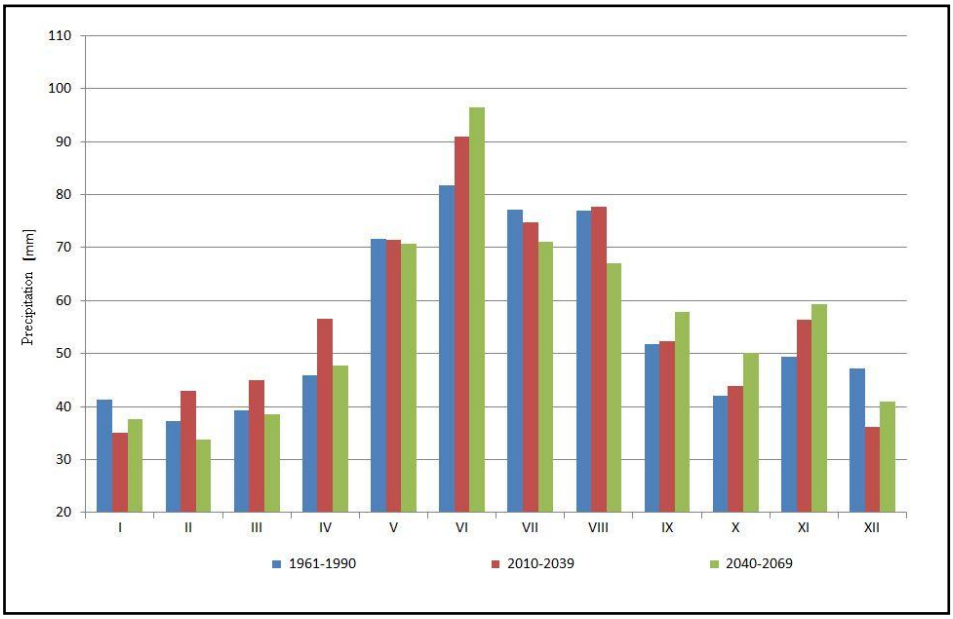
Between the beginning of autumn until the beginning of the summer the anticipated increase of precipitation is accompanied by identical increase in territorial evapotranspiration caused by increased temperature. In the summer, there is a decrease in precipitation and due to a drop in water water reserves in the soil, this will probably not lead to a significant increase in territorial evapotranspiration. An important factor is a shift in snow cover melt in higher altitudes due to higher temperature, roughly from April to January/February.

Figure 6.3: Average annual precipitation in the Czech Republic in 1961-1990 (left) and estimated average annual precipitation in 2010-2039 (right)



Source: CHMI

Figure 6.4: Average monthly precipitation in the Czech Republic in reference period 1961-1990 and in scenario period 2010-2039 and 2040-2069



Source: CHMI

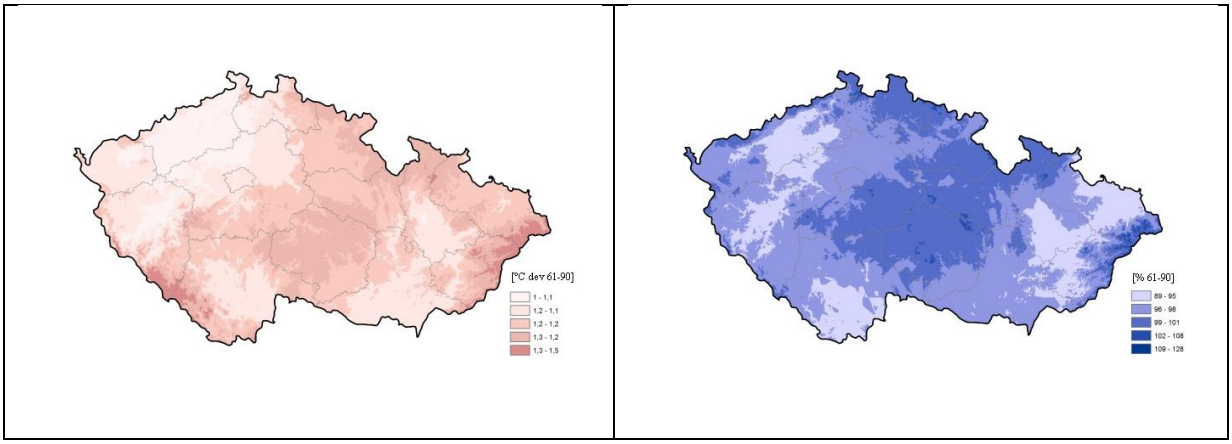
Changes in monthly precipitation in scenario periods in comparison with reference period 1961-1990 are shown in Fig. 6.4.

Model simulations for this period do not provide unequivocal results for subsequent change in terms of precipitation regime (number of floods or drought occurrence). The acquired signals are ambiguous and present themselves in evaluated profiles both increases and decreases in the size of modelled flooding. This ambiguity is caused by the opposing influence of less frequent but more extreme precipitation and lower average initial saturation of the soil (due to potential higher evapotranspiration and longer period of dry episodes during the summer half of the year). Change in runoff in January-May is determined mainly by different snow cover dynamics, change in the summer period by decrease in precipitation.

With regard to the weak signal of anticipated change in relative humidity and with regard to the fact that measured relative humidity values have not changed between 1961 and 2000, it was recommended, that we use measured value from the reference period to estimate these

impacts. Simulated changes in seasonal daily averages of global radiation are most apparent in the winter (exceeding 10%), in other seasons they range in most locations below 4%, however in comparison with model errors the change in global radiation is small. Same recommendation remains therefore in place for application of these sets as for relative humidity.

Figure 6.5: Deviation of average temperature (left) and share of long-term average precipitation (right) in the Czech Republic in 2010-2039 in comparison with reference period 1961-1990



Source: CHMI

Medium-term (2040–2069) climate development estimate in the Czech Republic

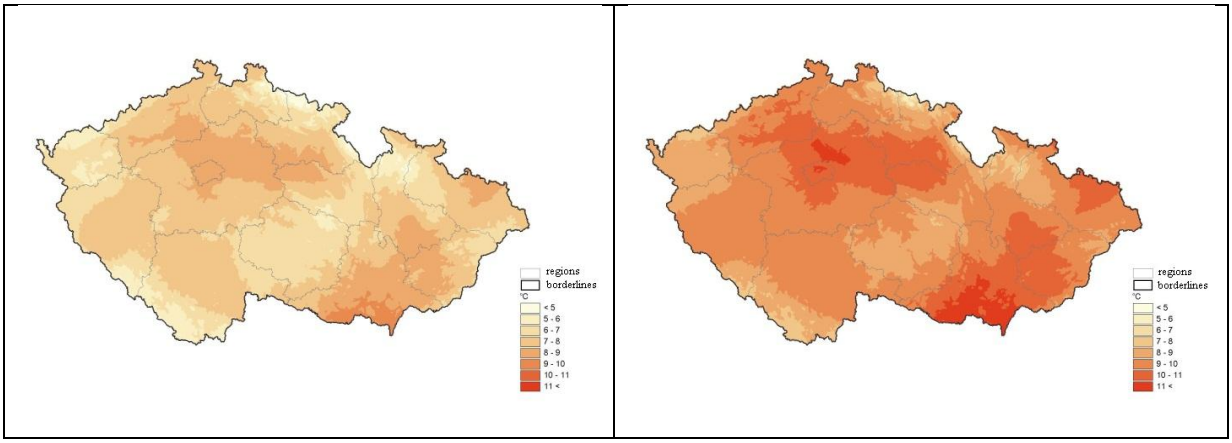
In medium-term timeframe (midpoint in 2050), the simulated warming becomes more significant (Table 6.2); temperature will rise the most in the summer (by 2.7 °C), least in the winter (by 1.8 °C). Temperature increase in August reaching almost 3.9 °C should be especially noted. Changes in temperature at individual grid points may range, in the spring and summer between 2.3 °C up to 3.2 °C, in the autumn between 1.7 °C and 2.1 °C and in the winter between 1.5 °C and 2.0 °C.

Table 6.2: Changes in average seasonal temperature and precipitation in medium-term compared to reference period 1961–1990 according to simulation of ALADIN-CLIMATE/CZ RCM model for A1B scenario

	Spring	Summer	Autumn	Winter	Year
Temperature [°C]	2.6	2.7	1.9	1.8	2.2
Precipitation [mean share]	1.00	0.99	1.17	0.89	1.01
Precipitation [%]	0	-1	17	-11	1

Source: CHMI

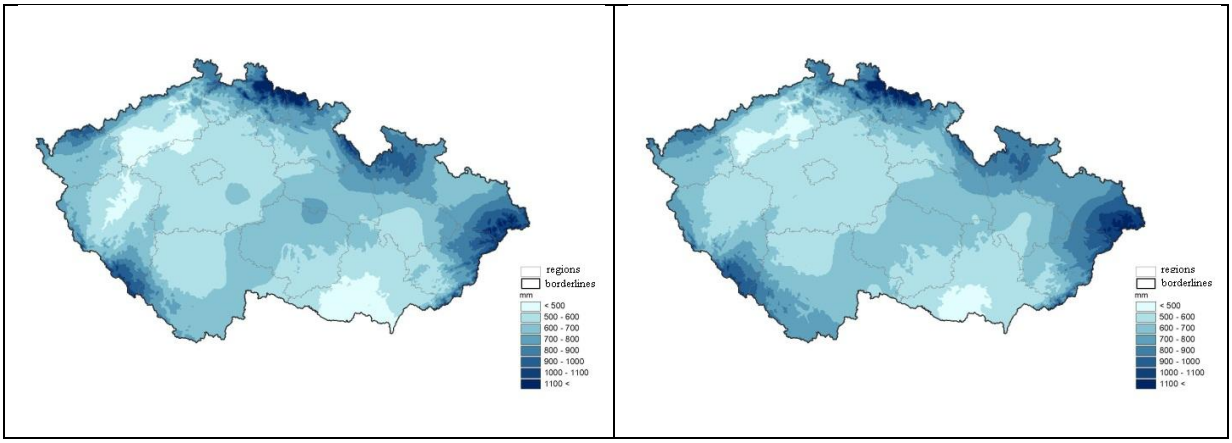
Figure 6.6: Average temperature in the Czech Republic in 1961-1990 (left) and estimate average annual temperature in 2040-2069 (right)



Source: CHMI

The medium-term perspective makes winter decrease in precipitation more apparent (for instance in Krkonoše, Českomoravská Vysočina, Beskydy by up to 20%) and their increase in the autumn. During the summer, the decrease in precipitation becomes dominant factor, which will be even more significant in long-term horizon, while decrease of winter precipitation will be lower in comparison with the preceding period.

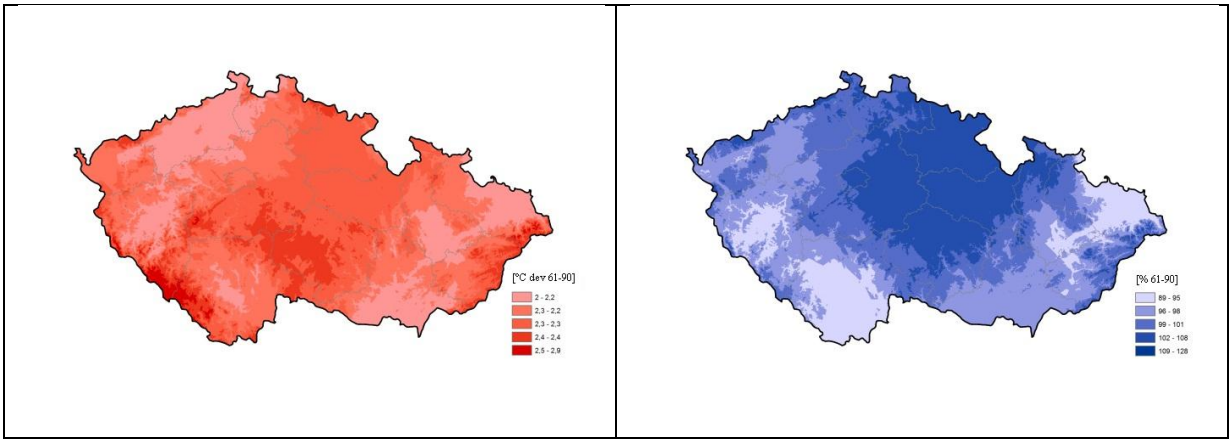
Figure 6.7: Average annual precipitation in the Czech Republic in 1961-1990 (left) and estimate average annual precipitation in 2040-2069 (right)



Source: CHMI

Changes in relative humidity are small, but the model signals decrease for all seasons and time horizons – in the winter below 5%, summer 5–10% and at the end of the 21st century this may become up to 15% (in parts Central Bohemia, Vysočina). This finding is in line with the anticipated increase of air temperature and decrease in precipitation amount.

Figure 6.8: Deviation of average temperature (left) and share of long-term precipitation (right) in the Czech Republic for 2040-2069 in comparison with 1961 – 1990



Source: CHMI

6.2 Vulnerability estimates

Development trends in meteorological characteristics and more frequent occurrence of extreme meteorological events are already being reflected in changes in the water regime, in agriculture and forestry and partly also affect the state of health of the population. In the medium term (around 2030, see the scenario for the 2010 – 2039 period), it can be expected that there will be a further increase, especially in detrimental impacts on the individual components of the natural environment, and it has been relatively newly pointed out that impacts will be felt in the energy sector, potential for recreation and tourism and overall wellbeing of the population, especially in larger residential agglomerations.

In response to climate issues the European Commission adopted an EU strategy on adaptation to climate change in April 2013[23] (EU Adaptation Strategy), which represents a long-term strategy (by 2020) to increase resilience of the EU against negative impacts of climate change at all levels and in line with Europe 2020 Strategy. It lays down framework and mechanisms, which should improve EU preparedness and improve coordination of adaptation activities. The EU Adaptation Strategy also supports the EU Climate-ADAPT platform[24] as an European-wide information system for climate change impacts and adaptation. It contains data, maps, information on adaptation projects, measures and other.

The Czech Republic is currently in the process of preparing its own Strategy on adaptation to climate change in the Czech Republic (for more details refer to Chapter 6.3). Only this new strategy will provide complex groundwork for quantification of vulnerability estimates and define individual measures for relevant sectors. Vulnerability estimates described in this chapter below therefore serve only as preliminary estimate.

6.2.1 Water regime

Water supply in the Czech Republic depends almost entirely on atmospheric precipitation and its transformation in nature.

[23] http://mzp.cz/cz/adaptacni_strategie_eu

[24] http://climate-adapt.eea.europa.eu/

The frequency of dry months has reached, in the last two to three decades, the maximum over the entire observed period. According to CHMI data, the number of below-normal precipitation months grew by approximately 50%, and the number of strongly below-normal precipitation months fell by approximately 1%. These are overall data for the Czech Republic since 1961.

It may be stated, that entirely and sporadically locally there has been a decrease in usable water sources. Supply of both surface and underground water and refilling depends also on the retention capacity of the landscape, which has not yet reached, despite certain positive change since 1989, a satisfactory level.

The Czech territory had been hit several times by large-scale flooding in recent years. After the relatively quiet 20th century, in terms of floods, the last 20 years were marked by higher frequency of flooding.

In the medium term, it can be expected that the average flow rates will decrease in many river basins by 15 – 20% ("optimistic" scenario) to 25 – 40% ("pessimistic" scenario), which would lead to fundamental changes in the overall hydrological regime. Similar relative decreases can be expected for minimum flow rates and minimum outflow of ground waters. As a consequence of higher winter temperatures, the annual outflows will also change due to a reduction (in some places very substantial) in stocks of water from snow and an increase in territorial evaporation. The increased spring flow rates and subsequent additions to groundwater stocks will be gradually shifted to the end of winter and stocks of water will generally decrease. In the spring to autumn period, when a large part of the precipitation will be converted to territorial evaporation as a consequence of elevated temperatures, outflows will generally decrease and this reduction can be prolonged by one or two months compared to current conditions.

Analyses of the impacts of climate change on the storage function of reservoirs point to an increasing risk of a substantial reduction in this function, manifested in altered ability to compensate and provide for withdrawals. The degree of expected reduction is substantially affected by the scenario of further development and can vary in a wide range from several percent to as much as half of current values. Water courses characterized by substantial accumulation space in the form of groundwater stocks or artificial reservoirs are generally more resistant to the climate change impacts. The effect of changes on the hydrodynamics and selected water quality parameters in reservoirs will be demonstrated in increased lowering of water levels in the summer and autumn, shortening of the winter stratification period and of the interval of coverage of the reservoir by ice and increased summer surface temperatures. Decrease in flow rates will be demonstrated in changes in the quality of surface waters through an increase in the water temperature and its subsequent eutrophication. This will augment the water deficits in the summer and autumn months, even in relatively wetter regions. Increased winter run-off and the risk of increased occurrence of spring floods and inundation situations can be expected in parallel with reduced creation of stocks of water from snow cover.

Intense precipitation episodes that occur during summer thunderstorms will present a greater risk of flash floods even when the long-term total precipitation does not change much. The consequences of changes in the climatic regime substantially affect the size of the storage spaces in reservoirs that would be necessary to preserve the existing level of water withdrawals. Larger reservoirs are less sensitive to changes than reservoirs with smaller volumes, in which a seasonal cycle of filling and emptying prevails. Even a relatively insignificant reduction in precipitation, combined with warming, can lead to a substantial reduction in guaranteed water withdrawals.

Calculating cost of inaction will be difficult. In terms of flooding, the experiences of the last 20 years may represent a strong indicator. Damage caused by floods between 1990 and 2010 reached 170 billion CZK, which is approximately 8.5 billion CZK annually only in terms of flood damage compensation. Most of these costs are covered by the state.

Ministry of Agriculture in cooperation with the Ministry of the Environment estimated financial cost of system-oriented measures in the water management sector, i.e. especially measures focusing on flood prevention and management within flood risk managements plans and national river basin plans by 2027, to approximately 50 billion CZK. The timeframe when these financial resources would be required, taking into account the complexity of their implementation, would involve two six-year plan implementation periods to manage flood prevention measures and national river basin plan measures. These financial requirements amount to approximately 4.2 billion CZK annually for water management sector alone.

Cost of drought-related adaptation measures is even more difficult to estimate, as these climate change aspects have not yet been sufficiently explored in the Czech Republic. Cost of inaction will need to include compensation of damage caused by lack of water supply due to lower quality of water (for instance in connection with drinking water production), sanctions arising due to failure to comply with EU commitments in relation to Directive 2000/60/EC and similar. In comparison with the anticipated gross cost estimates for measures in the water management sector, amounting to 4.2 billion CZK annually, these costs will be considerably higher.

In terms of droughts, any further conservation of the current status will not be feasible, especially because the state compensates and provides extraordinary subsidies, now on an almost annual basis, primarily to the agriculture sector (for instance in 2003, which was an extraordinarily dry year, the Government provided compensation in the amount of 1.4 billion CZK, in 2012 farmers required compensation up to 750 million CZK).

6.2.2 Agriculture

Adaptation of the agriculture sector to climate change relates not only to ensuring food supply and general food security, but also to maintaining sustainability of ecosystem services provided by the agriculture.

Climate change will affect plant & fodder production as well as production of other raw materials, it will also affect genetic diversity in agriculture, soil fertility and erosion, quality and availability of water and recreational potential of the landscape.

Future climate development scenarios indicate extension of vegetation period. In the medium-term horizon, the crops may profit from the extended vegetation (10 -15%) period, but on the other hand, less moisture may lower production yields by 5 up to 10%.

A number of the Czech most productive farming areas, suffering from falling moisture indexes, will be endangered by droughts in the future, if the current precipitation amount continues to fall and evapotranspiration increases. Changes in current precipitation regime and more frequent occurrence of storm rainfall may increase soil water erosion risks, which affect more than half the area of the national farming land. Extension of periods without freezing temperatures by 20-30 days may be a potentially positive consequence of climate change, due to a shift in the main vegetation period in the warmest regions to the beginning of March until the end of October. Higher air temperatures will allow earlier seeding and influence growth and development of crops. In comparison with current situation, the

harvesting period around 2050 may come sooner in lower altitudes (below 400 above sea) by 10 – 14 days and in higher altitudes by 15 – 20 days.

Anticipated temperature increase may create favourable conditions for growing of thermophilic crops even in cooler regions. This will make it possible to cultivate more thermophilic species (such as red grapes) in the warmest regions of Southern Moravia and Elbe River valley. A serious threat eliminating positive effect of an earlier onset of the main vegetation period constitutes spring frost, which is the probable and most significant (current and future) meteorological extreme of early spring weather.

Increase of photosynthesis intensity and increased concentrations of carbon dioxide constitute favourable climate change effect. According to experimental research, type C3 plants (most of the temperate zone plants) react to increase of each 100 ppm by increased biomass production in terms of percentage, while for C4 plants (tropical fast-growing plants such as corn) the biomass increase is minimal. A positive, physiological effect demonstrated by plants vegetating in higher CO_2 concentration environment, is increased water efficiency in plants.

The anticipated warming and small decrease in atmospheric precipitation between April and September will likely trigger increase in evaporation in the most productive farming regions in the Czech Republic and cause their subsequent exposure to drought, which already negatively influences farm yields today. In some regions, it may be expected that the number of locations, which will not be suitable for farming, will grow. On the other hand, some locations at higher altitudes may prove to become more attractive in terms of farming, due to climate change, and their production potential may grow. It must be noted however, that the soil fertility in these regions is often lower, soil shallower and more prone to erosion and nutrient runoffs.

Warming in the spring months (April-June) may trigger stronger convection streams and resulting change in precipitation distribution, in terms of decrease in precipitation-days or days with lower precipitation than normal in this key period for crops. At the same time, there is a risk of increased probability of daily precipitation amount exceeding 10 mm, which trigger erosion risks. Area of the land exposed to erosion will rise by at least 10%. Erosion causes both financial losses and increased cost of crop farming.

Climate change will also influence changes in environment in terms of extending territory for diseases and pests, which were so far typical only for warmer regions. Warmer climate may increase number of pest populations and contagious pressure of certain crop diseases. On the other hand, temperate winters could expose the wintering pest populations to predators or other positive development in local shifts in of pest and host phenology, which may lead to disharmony and alleviation of damage caused by at least some pest populations.

It may also be anticipated that rising temperatures and longer vegetation period, will extend natural proliferation of plants growing in the wild and feral animals habitats tied to agro-ecosystems. Besides that, there will be a gradual introduction of crops and species from warmer climates to locations in the Czech Republic. This will change the crop and animal production composition and resulting impact on soil management and composition of associated vegetation.

Agriculture will continue to have, besides simple productive function, a significant landscaping role. The proposed adaptation measures are therefore based on existing knowledge and analyses of regional and local natural conditions. In this respect, and in connection with the anticipated climate change, it will be necessary to strengthen measures aiming to protect soil against erosion and measures to promote water retention in the agricultural landscape.

6.2.3 Forest management

Plants and tree species respond to climate change mainly through migration, while genetic adaptation negligible. Thus, the anticipated increase in average temperatures will be manifested in a shift in the occurrence of many tree species to higher altitudes. For example, an increase in the average annual temperature by 1 – 2 °C can lead to a shift in the tree line by 100 to 200 meters.

The effect of dangerous stress by drought will be reflected on forest vegetation. Further habitat factors, such as light, air temperature, availability of nutrients or environmental pollution will act synergically with soil moisture and could reduce tolerance to drought. From climate change perspective drought remains the most pronounced risk factor, increasing the risk of forest fire, and having a negative effect on forest ecosystem production and services they provide.

Climate change effects will play a significant role in terms of worsened health and stability of regulated area felling tree stands which are mostly spruce monocultures, in lower and medium altitude locations, which are locations which are pivotal for logging in the Czech Republic.

The current less-than-satisfactory state of tree stands, caused in the past particularly by burdening by high pollutant concentrations in the air, could become even worse with changes in climatic conditions.

Many pest species are being activated, acting as initiation and mortality stressors affecting forest growth of all ages and simultaneously increasing frequency of calamities caused by abiotic effects during sudden climatic events (destructive gusty winds, wet snow, landslides after extreme rainfall, forest fires etc.). Monoculture forests are at most risks from these negative events. We must anticipate more frequent pest occurrences. Species that have not yet been recorded in this country could spread. The stress burden will probably lead to an increased proportion of dry wood and thus greater occurrence of fungal diseases.

The increased concentration of carbon dioxide in the atmosphere is demonstrated in promotion of the growth of plants and production of biomass; nonetheless, the long-term effect can lead, especially for spruce, to the occurrence of acclimation depression of photosynthetic activity. The resulting effect of increasing concentrations can thus vary between zero effect on accretion, through increased growth of roots and new shoots, to changes in the growth of new shoots and roots in favour of one or the other.

Stabilization of forestry sector will be the main task. This will require close linkage between adaptation and mitigation measures, as measures to prevent areal collapses of forest ecosystems due to climate change represent simultaneously measures that stabilize carbon stock in forests and thus decelerate climate change. The optimum model, from the perspective of climate change, respecting principles of due care, appears to be cultivation of structurally rich forest, avoiding regulated area felling, with preference given to suitable tree stands with high and stable wood mass production, managed by methods that are close-to-natural processes with minimum energy contributions.

6.2.4 Biodiversity

Despite that fact that decreases in biodiversity and degradation of ecosystem services are caused by varying environmental and socio-economic factors (regional transitions due to other economic factors, fragmentation of environment, unsustainable use of ecosystems or pollution of environment), climate change has even larger effect. The most vulnerable ecosystems in the Czech Republic include alpine ecosystems and ecosystems consisting of

residues of the original grasslands. Changes are manifested most in ecosystems above the shifting upper boundary of forests, where their relatively small area exacerbates the vulnerability. Approximately one tenth of monitored plant species will be in danger of extinction by the end of the century, while one fifth of plant species can rapidly and effectively adapt to a changing climate. Climate change will enable the spreading of invasive non-indigenous species, i.e. species whose intentional planting or inadvertent introduction and subsequent spreading endangers biological diversity, biotopes or even entire ecosystems.

Potential negative impacts on biological diversity also include new interventions of humans into nature and the landscape. A typical example is the construction of dams, which on the one hand intend to prevent potential lack of water but, on the other hand, sometimes constitute a substantial danger for biodiversity through a change in the water regime in the particular area, its migratory permeability for water and water-related animal life, chemical and biological characteristics etc. Subsidized cultivation of crops processed to first-generation biofuel and extensive afforestation (especially in farmed landscape) can destroy valuable residues of the original environment or can promote the spreading of invasive non-indigenous plants species, including tree species.

Climate change effects have been recorded for many animal and plant species. In the Czech Republic, there has been a decrease in the number of northerly species of birds with corresponding increase in southerly bird populations. Northerly bird populations fell over the last 30 years by approximately 40%, which is by approximately 1.3% decrease annually. The main cause is growing spring temperatures. Between 1951–80 and 1995–2001, there has been a significant shift in habitats of 12 species of butterflies to higher altitude locations. Climate change also contributes to proliferation of alien plant species, which migrate in higher numbers into mountain areas.

Biological systems are very closely tied to natural climatic conditions. Migrating species are especially sensitive to climate change. EUROMOVE model anticipates that by 2050 the Czech Republic will host dozens and hundreds of entirely new plant species, while dozens will become extinct. These changes will result in overall decrease of the original biological diversity and its homogenization. Extinction will jeopardize especially the rare species with specific environmental requirements, and which also act as indicators of the quality of environment.

Climate change influences ecosystem dynamics. Changes in species and population biodiversity will trigger emergence of new ecosystem types, which may affect the ability to provide certain ecosystem services. Climate change will have effect primarily on ecosystems that are key for carbon accumulation, such as forests (especially the fragile even-aged monoculture tree stands consisting of inappropriate tree species), grassland ecosystems and wetlands and moorland. Shift in vegetation zones and change in quality and extent of individual biotopes will affect ecosystem productivity and their ability to accumulate carbon, probably in both directions (favourably by, for instance, fertility-increasing effect of CO_2 or larger distribution of more productive ecosystems, unfavourably by drought and fire). Changes in land use may also have effect on albedo and contribute to regional climate change. Last but definitely not the least, it is also estimated, that climate change will lead to increased risk of natural disasters, such as flood, droughts and biological invasions.

6.2.5 Urbanized landscape

Urbanized landscape represents a highly specific environment which is very sensitive to change in climatic conditions and simultaneously having low ecological stability and low

inherent adaptation potential to the changes. Large share of paved surfaces affects microclimate of territories and causes overheating of surfaces, higher air temperature, higher evaporation, fast runoff of precipitation water, dustiness etc. Prognoses of gradual climate change in the Czech Republic generally indicate changes in weather throughout the year. Prognoses indicate significantly more frequent (extreme) changes in high temperature couple with low precipitation with periods with high precipitation over a short period of time (in the summer).

These changes (in the direction of extreme fluctuations) will have significant impact in urban areas (and especially in large cities) on the quality of life and on availability and quality of water. Another climate change effect having a detrimental impact on quality of life in urban areas is more frequent periods with high (tropical) temperatures and low or zero precipitation between April and September. Climate change will affect housing, technological constructions and construction sector as such. The fluctuations between temperature minima and maxima will be dramatic, affecting exposed materials and buildings. More intensive precipitation events and strong winds, among other, will increase the danger of building constructions being damaged, lowering their value and lifetime, thus increasing repair and maintenance costs.

6.2.6 Hygiene & Health Protection

Climate change may affect health of the population by an entire complex of direct and indirect impacts. Direct impact is a consequence of changes in physical climate value (temperature change, consequences of more frequent and intensive extreme weather events, increase UV radiation etc.). Indirect impacts are a combination of environment with other living conditions accentuated and modified by climate change, for instance air pollution, depleted ozone layer, pollen, which may trigger increase in seasonal occurrence and duration of allergies and changes in occurrences of contagious diseases.

Climate change will probably increase frequency of extreme weather events, especially floods, which will be accompanied by a wide variety of direct and indirect effects, including diseases, death due to serious infections spread by water and risk carried by mosquitoes and diseases they may transmit; stress is also a factor, capable of triggering mental disorders. Increasing numbers of day with temperatures exceeding 30 °C may lead to increased risk of overheating of organism, heat-strokes, dehydration and health problems generally (along with increased mortality rates) especially for high risk population segments with lowered thermoregulation abilities (children, seniors and sick people) as well as cardiovascular, renal, respiration and metabolic disorders. It may also be anticipated, that increase in average air temperature between spring and autumn will also unfavourably influence occurrence of infections borne in food.

Population migrations related to climate change will represent health risk both for the migrants and for the receiving population. Deteriorating conditions may lead to higher population mobility. There may be increased demand for humanitarian aid and healthcare for the migrant groups, demanding more healthcare capacity and pharmaceuticals.

As a result of climate change, there has been significant rise in diseases transmitted between animals and men, affecting both animal host and the agent. There have been cases in Europe involving agents transmitting subtropical diseases, previously unknown in these regions, and which are transmitted further due to favourable climatic conditions. There are infections being transmitted by originally domestic arthropods into higher altitudes. Keeping in mind that

approximately 70% of infections originate in animal agent, we may expect that new infections will be identified in the future.

The hygiene and health sector is closely related to spatial development, architecture and construction sector. Suitable architecture, spatial planning and suburban vegetation helps in alleviating the effects of the so-called heat islands in cities and in reducing thermal stress. Health risks triggered by extreme meteorological events (heat waves, extreme precipitation, wind) will need to be reduced by preventive measures in the construction sector and infrastructure, as well as by appropriate risk management and flood prevention plans.

6.2.7 Crisis situations, protection of population and the environment

Climate change increases the likelihood of crisis situations arising as a result of changes. It is anticipated that the intensity and frequency of extreme meteorological events will rise (extreme heat, precipitation, wind) as well as long-term droughts, large-scale flooding, landslides, rock formation collapses and large-scale forest fires. Protection of the population and of the environment will be central as well as preventing large-scale damage to property.

Protection of population should be understood as minimizing the negative impact of extraordinary situations and crises on health and lives of people and their living conditions. If there will be more disasters in the future, triggered by climate change, there will be more need and demand on civil protection, more demand on resources, crisis and risk and rescue management.

Climate change also fundamentally affects environmental security, which is understood as a state in which the probability of a crisis situation arising as a result of disruption of the environment remains acceptable. Activities in this area will be focusing on measures alleviating effects of natural disasters triggered by climate change on the health of the population, on the environment and the property.

Critical infrastructure, such as energy & water supplies, transport, telecommunications and information technology, securing basic needs of the population, is especially jeopardized in this respect. High vulnerability of critical infrastructure results from its mutual interconnectedness. For instance, a breakdown in energy supply or IT services will lead to breakdown or outage in all other critical infrastructure sector.

On the international level, we may expect increased migration pressure from those regions, which will be affected by climate change more severely than the Central European region. This applies to regions suffering from insufficient water supply, drought, failing harvests or from other climatic extremes (from the perspective of the Czech Republic, this may involve Asian population, which already have a functional migrant networks in place). We must also anticipate the possibility of increase in local and cross-border conflicts related to lack of access to basic natural resources, which could trigger migration waves into EU and to a certain degree to the Czech Republic.

Crisis situations are closely related to health and the environment, but also to other sectors such as energy, urbanized landscape, forests or agricultural ecosystems. In terms of water management, the most relevant measures are measures coping with flood risks, alleviating effects of droughts, rainfall water management, ensuring stability of slopes etc.

6.2.8 Potential for tourism and recreation

Changes in the distribution of precipitation, increased variability and extremes of temperature and humidity and other changes in meteorological factors, together with their feed-back, will influence the landscape and its natural units. A number of tourist and recreational activities are directly dependent on the weather. There has been a trend in shortening of the winter skiing season in recent years, and this can be expected to continue in the future. Artificial snow and its production on ski slopes and cross-country ski tracks, which could prolong the season, will be increasingly complicated by lack of water sources and energy barriers (especially increasing prices).

The expected increase in summer temperatures could increase interest in summer recreation around natural and artificial water reservoirs, but prolonged high temperatures will cause substantial heating of water volumes with subsequent reduction in water quality, accompanied by the growth of blue-green algae. This is a high-risk factor that could even prevent the use of water bodies. Therefore, it can be expected that the recreation season will tend to shift to the spring or autumn months, which will have more acceptable temperatures

Even optimistic scenarios anticipate that the main affected areas will be the areas of concentrated tourism. This is already apparent from the developments in the last decade. For instance, the area known as České Švýcarsko has not had a proper touristic season since 2002, without having been significantly affected by natural disasters – in this location specifically the floods, which have caused an estimated 500 mil CZK worth of damage as a result of climate change. Based on these estimates in this one location, we may estimate that the climate change impact in this sector in the entire Czech Republic would reach tens of billions CZK annually.

6.2.9 Transport systems

Extreme weather fluctuations such as sudden intensive rain or snow fall, flooding, heat waves or low river water levels may significantly affect road, railway, river-born and also air transport. More frequent and more intensive precipitation affects especially the road transport (lower visibility, slippery surface etc.).

More frequent occurrences of extreme weather events will cause impassability of transport infrastructure due to flooding, physical damage or destruction, fallen trees etc. Landslides falling on roads and railways may also considerably disrupt traffic. This will reflect itself in more demand for capacity and alternative routes, organization of transport generally, as well as affecting the ability of infrastructure operators to react, with sufficient speed, to these extraordinary events. Preventive measures and maintenance of vegetation and pylon, which may disrupt use of infrastructure, will be also necessary. The threat of complete disruption is especially serious in locations where alternative routes do not exist.

Rise in temperatures and more frequent fluctuations of high and low temperatures increase the demand for air-conditioning in public, personal and even freight transport. Besides heating by engine redundancy, it will probably be necessary to provide additional heating inside the vehicles as well as provide sufficient cooling in the summer months, which are both energy intensive activities. Due to these reasons, we may expect increase energy consumption in the transport sector by up to 1 to 10% (estimate provided by Ministry of Transport - MoT).

Heat waves in the summer may result in increased accident rate due to lowered concentration of drivers and cause damage to road infrastructure (for instance thermal disruption of asphalt).

On the other hand, sudden frost or snowdrifts in winter will also have effect on accident rate, infrastructure quality and general functioning of transport.

6.2.10 Industry and Energy sector

Energy infrastructure forms a part of the critical infrastructure, and comprises of production and non-production systems and services, whose lack of functionality would have an adverse and serious impact on the protected interests of the state (security, lives and health of the population, economy and public administration). Energy infrastructure includes electricity, heat gas and oil supply.

As a result of climate change, the energy sector in Europe will most probably suffer from differences between available energy supply and demand for energy. Climate change will also affect volume and distribution of precipitation during the course of the year and that will in run have effect on hydropower electricity generation. Northern Europe may expect more than 5% increase in electricity production from this source, while southern Europe anticipates more than 27% decrease. Lower precipitation amount during the summer as well as more frequent extremely hot periods may have an adverse effect on the cooling process in thermal power plants. Climate change may also affect transmission and distribution networks, which may find it difficult to cope with demand for cooling during summer peaks, but also with damage caused by high winds and flooding.

Long-term occurrences of extremely high temperatures have an adverse effect on the cooling processes within power plants (whether nuclear, gas or coal-fired) and along with higher electricity consumption dedicated to cooling in addition to planned maintenance of power sources and network may even lead to network overload and in extreme cases to breakdowns. On the other hand, long-term occurrences of extremely low temperatures may lead to complications in the energy supply areas, where icing may jeopardize dull functionality of the transmission and distribution network.

Longer periods without precipitation will affect accumulation reservoirs of hydropower plants and that will reduce availability of this source. In the medium-term outlook, we may expect that the average flow in many basins will decrease by 15 – 20% (in "optimistic scenarios) up to 25 – 40% (in "pessimistic" scenarios), which will lead to reduced electricity generation capacity in hydropower plants if adequate measure will not be taken. Lack of precipitation may lead to reduced production of biomass used in production of electricity and heat, and limit production in sectors which are water intensive (such as paper mills, chemical plants).

Conversely, heavy precipitation / flooding may disrupt electricity supply networks and product pipelines as well as limit or shutdown supply by road or railway, disable production in industrial plants, disrupt hydropower plants functionality and cause hazardous materials leakages; similarly, it may limit production of biomass that is used for energy generation.

Extreme weather events (windstorms, tornadoes) may disrupt transmission networks leading up to total disintegration of the electricity supply network, shutdowns of certain power plants, limit production of biomass that is used for energy generation, in cases when industrial plants are affected, also to limited production and distribution.

More frequent extreme climatic events may represented increased risk for security of the industry and business activities in general, put employees in jeopardy, operation of manufacturing and operational facilities,, but also have a negative impact on the environment (such as in cases of leaks of hazardous materials). On the other hand, the strategy for

adaptation and mitigation of climate change effects brings new opportunities in the innovations and environmental technologies sector.

6.3 Adaptation measures

The Czech Republic is already in process of implementing a number of adaptation measures especially in connection with protection of water regime in the landscape and water management, forestry and agriculture.

Preparations of the Strategy on Adaptation to Climate Change in the Czech Republic (Strategy) have been nearing completion in the autumn of 2013. The Strategy drafting is a cooperative effort of a number of individual Ministries, coordinated by the Ministry of the Environment.

The Strategy, which is based on the pertinent EU documentation, has been adjusted to specific conditions prevalent in the Czech Republic. The Strategy objective is to reduce anticipated climate change impacts, adapt to these impacts, maintain good living conditions and develop economic potential for the future generations.

The Strategy presents observed climate change and recommends appropriate adaptation measures including their mutual linkages in connection to anticipated manifestations of these changes. Adaptation measures are proposed in the following areas:

- Water regime in landscape and water management
- Agriculture
- Forest management
- Biodiversity and ecosystem services
- Urbanized landscape
- Health and hygiene
- Crisis situations, protection of the population and environment
- Tourism and recreation
- Transport
- Industry and Energy sector

The proposed measures develop and complement existing measures, which are described below. Measures presented in the approved version of the Strategy (probably in 2014) may differ.

6.3.1 Water regime in landscape and water management

Water retention in the landscape achieved by optimising its structure and by utilization of effective and close-to-nature technical preventive measures forms a fundamental basis for protection against extreme hydrological events. In order to meet these conditions, it will be necessary to involve responsible regional bodies and local governments in preparation of long-term estimates regarding the required volume of water and prepare appropriate

legislative measures. These responsible bodies should take care to adopt water management measures for the management of rainfall water, allowing for its retention, seeping into soil and for its direct use (especially in urbanized areas); additional measures must be put in place ensuring renewed functionality of existing reservoirs by removing sediment. Protection of locations, which are suitable for artificial accumulation of surface water, is also an important activity. Climate change (change in precipitation patterns) will result in increased pressure on surface and underground water source, especially in connection with increased intensity of water consumption in agriculture.

One of the most suitable tools for implementing adaptation measures combating droughts and lack of water are river basin management plans along with complex land modifications (see section 6.3.2 Agriculture). The first batch of river basin management plans has already been elaborated and currently they are being updated.

Main climate change adaptation instruments and measures

Plan of Main River Basins

The Plan of Main River Basins was prepared by the Ministry of Agriculture in cooperation with the Ministry of the Environment and was approved by the Government in 2007 (Government Resolution No. 562/2007). It is a strategic planning document in the area of waters, based on the Framework Directive on waters (2000/60/EC), other related European legislation and international agreements, and conventions and obligations of the Czech Republic in the area of waters.

The Plan of Main River Basins introduces full support for implementation of the adaptation measures stipulated in the National Programme to Abate the Climate Change Impacts in the Czech Republic (Government Resolution No. 187/2004 Coll.) and concerned particularly with increasing the retention of water in the landscape and improving the structure of the landscape. This programme determines the following framework objectives in the area of protection against floods:

- Limitation of activities in floodplains which worsen runoff of water and increase the risk of flooding;
- Ensuring effective proposals addressing preventive flood-protection measures based on high-quality analyses and optimising alternative concepts of flood protection solutions, utilizing risk analyses and cost and benefit analyses;
- Ensuring that preventive flood-protection measures combine suitable measures allowing landscape to naturally retain and accumulate water with technical measures influencing flow and volume of flood waves;
- Application farming and forestry management methods that prevent worsening of soil retention capacity and negative effects on the water regime in landscape; these methods must be supported by corresponding economic instruments;
- Improvement of technical conditions of waterworks and their operations with respect to flood protection;
- Improve and extend communication with the public about all aspects of flood prevention.

The Plan of Main River Basins also defines the following objectives in terms of water protection against other harmful effects (droughts and water erosion):

- Preparation of legislative measures achieving cohesion between river basin management plans and complex land-use planning;
- Application of rainfall water management plan allowing retention, infiltration and direct use of rainfall waters within drainage plans in urbanized areas ;
- Application of "good farming and environmental condition" and "cross compliance' requirements to enhance water infiltration,
- Managing existing reservoirs and renewing their function by removing sediment;
- Protection of locations, which are suitable for artificial accumulation of surface water.

This Plan also strengthens competences of water management bodies and authorities with respect to supervision of the fulfilment of the objectives and principles of increasing water retention in landscape in line with approved river basin management plans; it also includes rainfall water management plan in urbanized areas.

River Basin Management Plans

River Basin Management Plans are a key instrument for implementation of adaptation measures addressing droughts and lack of water. These instruments can significantly contribute to appropriate management of territories adjacent to watercourses and in riverbasin areas while respecting principles of nature protection, protection of water and water-dependent ecosystems.

These instruments are subject to periodical updates. The first planning cycle was completed for 2004-2009 and the results were formulated in River Basin Management Plans approved by the Government at the end of 2009. These Plans remain valid until their next update and should be approved by Government in December 2015.

The Czech Republic is currently in the second planning cycle. Plans in this cycle include flood risk management plans, including flood risk maps that are being prepared and should be completed in December 2013 to be published with invitation for public comments by In December 2014. Flood risk management plans will be consulted with the general public and approved no later than by 22. 12. 2015.

The objective of the second planning cycle is to update the currently valid river basin management plans as well as to prepare appropriate flood risk management plans paying special attention to protection against flash floods, which may in the Czech Republic affect any part of the territory and whose forecasting is almost impossible given the currently available technology. Given that more frequent occurrence of heavy rainstorm precipitation is anticipated, it is necessary to develop efficient early warning systems to protect the population against flash floods and use risk management processes in identifying suitable measures for individual river basins.

Flood Prevention Programme II

Flood Prevention Programme II implements technically aimed subprograms supporting flood-protection measures with retention activities, flood-prevention measures along water courses, increased security of waterworks and facilities, delineation of floodplains and studies mapping runoff rates in territories. The main objective is to further reduce risk of flooding in

floodplains, which were among the worst affected in 2002. In May 2010 the programme was extended to subprogram supporting water retention in dry reservoirs on small watercourses, which should reduce risk faced by municipalities during flash floods.

The programme runs from 2007 to 2013 and the planned funding reaches 11.5 billion CZK.

Restoration, cleaning and reconstruction of fishponds and water reservoir construction

This programme aims to strengthen water management and supplemental functions (outside primary production) of fishponds emphasising their flood-protection potential (by renovating and reconstructing dykes and related facilities as well as restoration of retention areas by excavation of sediment layers).

At present time, the 2nd phase of the programme amounting to 3.2 billion CZK is implemented. This phase accentuates even strongly the flood-protection potential of fishponds and small water reservoirs and security of dykes and related facilities.

River System Restoration Programme

This programme financed for instance measures related to restoration of water environment (revitalization of water courses, establishment and restoration of TSES elements dependent on water regime, water reservoirs, fish passes) and construction of sewers and WWTPs.

This program, now completed, financed projects in total value of 4.9 billion CZK between 1992 and 2009.

Implementation of restoration and close-to-nature flood-protection measures in water courses and floodplains

In 2007, the Ministry of the Environment drafted a concept of close-to-nature flood-protection measures in selected priority areas in Nežárka, Dědina, Ploučnice, Opava, Bečva, Dyje and Svratka river basins. These concepts proposed measures reducing water erosion and eliminating water pollution by nutrients, increasing water retention in the landscape maintaining production capacity of the land while implementing good farming practices.

Implementation of these measures was supported between 2007 and 2013 also by OPE and Rural Development Programme (run by the Ministry of Agriculture).

Measures are continuously being implemented and the programme deadline is anticipated in 2015.

Programme of renewal of the natural functions of the landscape

Programme of renewal of the natural functions of the landscape is a national subsidy programme run by the Ministry of the Environment between 2009 and 2018 supporting, among other, investment and non-investment projects related to implementation of adaptation measures reducing climate change effects on water, forest and non-forest ecosystems.

Measures are being implemented since 2009. One-year and multi-year projects are provided with subsidies covering up to 100% of the total project cost. The programme plans to fund projects in the amount up to dozens of million CZK annually.

Operational Programme Environment

The programme based on European funds (Cohesion Fund and European Regional Development Fund) for the 2007 – 2013 is concerned, amongst other things, with cofinancing projects concerned with improving the water management infrastructure and reducing the risk

of floods (reducing water pollution, improving drinking water quality, reducing the risk of floods) and improving the condition of nature and the landscape (optimization of the water regime in the landscape, anti-erosion measures and measures to reduce the negative consequences of surface runoff of water).

Adaptation measures in water management sector are covered primarily by the following Priority Axes:

- Area of Intervention 1. 3 – **The reduction of flood risks**: projects supported under this area focus on the flood hazard and flood risk mapping in areas that were previously identified as prone to flooding; development and modernisation of the forecast systems and early-warning systems and close-to-nature adaptation of river beds located within currently developed areas and construction of polders.
- Area of Intervention 6. 4 – **Optimisation of the landscape water regime**: projects supported under this area focus on measures aimed to slow down surface water runoff from the basin by supporting natural inundation in floodplains, construction and renewal of retention spaces, revitalisation of watercourses and wetlands, construction of polders (up to the capacity of 60 thousand m^3) and measures against water and wind erosion. Even though these measures influence more of less the course of local flooding, they do contribute to the complex solution of the issue and may thus also contribute to reduction of overall damages.

OPE has been in place since 2007 and the last financing will be processed in 2015. The programme allocation for projects in Priority Axis 1 dealing with water protection reaches almost 2 billion EUR. Priority Axis 6 promoting the objective of halting biodiversity loss and increasing ecological stability of the landscape has a budget of almost 600 million EUR.

Planned measures

The Strategy proposes a number of adaptation measure in water management sector, whose objective is to stabilize water regime in the landscape, strengthen water sources capacity and their protection, efficient use of water sources and management of extreme hydrological events – whether floods or droughts:

- Measures to stabilize water regime in landscape via continuing complex land-use planning, proposals for good farming practices and spatial and functional arrangement of modified land.
- Measures to increase infiltration of precipitation in urbanized areas using green (grass) areas, permeable surfaces, surface drainage systems leading water off into retention and infiltration areas and installation of infiltration technologies on rain drainage systems.
- Measures for water supply systems during droughts creating complex solutions addressing preventive, operational and crisis situations.
- Adaptation measures on water courses and floodplains using close-to-nature adjustment of river beds and ensuring protection and creation of biotopes for water and water-dependent ecosystems.
- Optimising function of existing water reservoirs and water management systems by re-evaluating their existing use and optimising their management, so that they can fulfil the newly defined requirements in the future.
- Redefinition of the existing licensing schemes for water withdrawal and discharge: innovations in the water balance evaluations systems aiming to continuously evaluate

development of hydrologic and water management balance and its utilization during permitting of withdrawals and discharges.

- Rainstorm precipitation management, re-use of water and increase of infiltration of rainfall into soil and ground water.
- Protection of existing and future water sources: revision of areas for increased water protection and activities, which could negatively influence quality and quantity of water.
- Measures implemented at WWTPS and sewerage systems by securing these facilities against negative effects of rainstorm precipitation, flooding or droughts.

6.3.2 Agriculture

Risks and potential benefits of climate change are closely linked together, meaning that in order to take advantage of potential benefits caused by climate change, one must be actively implementing adaptation measures. One of the fundamental prerequisites of successful adaptation is flexible and environment-friendly land-use, introduction of new technology as well as diversification in farming. In terms of landscape, this involves adaptation and preventive measures with combined effects especially on soil quality, water (with emphasis on retention) and agro-biodiversity.

Due to the major significance of land / soil, its sustainable use (for instance, by protecting against erosion and degradation, or by improving its retention capacity and maintaining fertility), remains the crucial aspect of climate change adaptation. Potential solutions should be based on the following principles of sustainable farming:

- Suitable spatial arrangement of agricultural land,
- Soil-protecting and anti-erosion measures,
- Improvement of soil structure,
- Increasing the proportion of organic matter in the soil.

All these measures are very complex in their nature and linked to a number of factors. One factor is the relationship of owners to the land, which predetermines the possibilities that the above measures are actually implemented.

Issues related to agriculture are also closely linked to other sectors. Agriculture is linked to water management, biodiversity and provision of ecosystem services. Agriculture depends on sufficient supply of water and the demand for water is likely to anticipated increase in frequency of dry periods. Farming co-determines the quality of surface and ground water. Agriculture contributes to maintenance of indigenous species agro-biodiversity. There exists a strong link to forest management and LULUCF sector, especially in connection with mitigation measures involving possible afforestation and planting of energy crops on farming land.

Agricultural ecosystems have the potential to mitigate climate change especially in terms of accumulating carbon in soil and reducing greenhouse gas emissions released within the sector, especially N_2O released from the soil and CH_4 generated by livestock. In this respect, the primary significance should be placed on increased content of organic carbon in soil, use of soil protecting technology or sustainable management of grasslands. Agriculture is the actual or potential source or raw materials for energy use. This involves energy plants cultivated on

farming land, biologically degradable waste and secondary products. Their use reduces consumption of fossil fuels as well as limits releases of CH_4 from non-decomposed biomass.

Considering the diversity of agricultural adaptation measures, these may be classified in the following groups.

Land-use planning

Land-use planning creates conditions for rational management by property owners. Properties are thus classified in terms of space and function and provision is made for access to them. An integral part of all land-use planning also consists in a plan for joint facilities, encompassing, amongst other things, 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 measures to increase the ecological stability of the territory (TSES and other green areas). Thus, land-use planning substantially reduces the impacts of extreme meteorological situations, prevents erosion of the soil and helps prevent floods.

Land-use planning measures are **already underway**. Estimates of the necessary and planned costs amount to 550 million CZK annually.

Agro-environmental measures

These measures were proposed in accordance with Council Regulation (EC) No. 1257/1999 and Commission Regulation (EC) No 817/2004, as well as Government Regulation No. 242/2004 Coll., on performance of agro-environmental measures, as amended.

The new programming period (2014 – 2020) of the Rural Development Programme will implement agro-environmental-climatic activities. The planned measures aim to maintain the existing high-quality ecosystems in order to strengthen the higher carbon (C) sequestration potential, reduce risk of nitrogen-related (N) emission impact in connection with more extensive farming and their appropriate adjustment will contribute to climate change adaptation by:

- Suitable treatment of grassland in wetland locations which have considerably higher potential to fix C and N;
- Maintenance of stabile ecosystems in areas suffering from deteriorating moisture conditions which minimises negative impact of wind erosion and threatened increased C and N loss;
- Sustaining increased C sequestration and N retention at waterlogged locations;
- Management of steppe locations minimises negative impacts of certain specific climate effects;
- Appropriate management on organic soil prevents increased greenhouse gas emissions;
- General management approaches supporting development of specific ecosystems with high adaptation potential to specific effects in their environment;

and simultaneously preventing climate change (mitigation functions):

- Maintenance of existing high-quality ecosystems leading to maintenance or strengthening of increased sequestration potential;
- Reducing nitrogen emissions consequences;

- Maintenance of strengthening of N retention capacity by implementing of appropriate soil management practices, respectively transition to cultures with higher potential;
- Strengthening of anti-erosion measures with high sequestering effect especially in vulnerable locations, land areas endangered by erosion and in protective zones around water sources;
- Supporting sequestering potential of arable land temporarily influenced by water logging.

Measures created for the purposes of reducing negative effect of agricultural production on the environment **are already in effect** and at present time, majority of these measures are also adopted as a part of climate change-driven adaptation measures. Additional planned measures are a part of the framework of the Rural Development Program 2014-2020. The necessary and actual costs cannot be defined at present time.

Agro-environmental measures work in synergy with measures implemented under OPE 2014-2020 in the area concerned with management of valuable biotopes.

Afforestation and grass planting

Changing arable land to forest with good species composition or to permanent grassland operates as a measure combating wind and (in case of forests, partially) water erosion and reduces soil moisture loss. This measure also has a mitigation effect as forests and grassland accumulate more carbon than arable land and even non-aerated soil reduces oxidation processes leading to nitrous oxide and carbon dioxide emissions. Similar significance should be placed upon groves, balks and free standing trees.

The Rural Development Program will continue in the new programming period with afforestation and grass planting measures within the framework of agro-environmental and climatic activities.

These **measures are already in the process of implementation**. Planned measures will be implemented in 2014 – 2020. The necessary or planned costs cannot be defined at present time.

Organic farming

Principles applied in organic farming create prerequisites for achieving higher average carbon content and humus in soil, better treatment of organisms living in soil etc. They also support biodiversity of organism cultures as well as organisms that are directly or indirectly linked to farming land, which reduces the speed of genetic erosion. Organic farming may contribute to adaptation of agriculture to climate change by maintaining genetic sources of indigenous species and plants, maintaining traditional knowledge, methods and pest control processes, methods limiting water consumption and soil erosion or methods of biological protection of plants (which is the preferred method of protection due to ban on chemical protection and GMO use). All that may contribute to climate change adaptation of agriculture.

The main measure supporting development of organic farming is stable support and activities with emphasis on non-farming functionality with adaptation effects.

This is a **continuously implemented** measure. In near future the organic farming should be implemented within the framework of an independent area of intervention within the programming period 2014-2020.

Research, cultivation and biotechnology in farming

Research focuses especially on cultivation of agricultural crops and on selection of suitable species and plants that are resistant to climate change and on cultivation of new and revitalization of original species and cultivars of arable crops and livestock that are aimed at producing good yield while being pest-resistant and coping well with drought, heat waves, high air temperatures, soil erosion etc.

The Czech Republic is involved in two European projects operated under Food security, Agriculture and Climate Change (FACCE) focusing on simulation and adaptation of agricultural systems. At national level, there are numerous partial research activities involving individual plants including their cultivation with respect to their increased resilience, i.e. increased ability to cope with new climate change effects and pests.

These are **measures already under way** requiring continuing support. The Ministry of Agriculture, acting as one of support providers, estimates that support of these measures will amount to 10-15% of the total cost of agricultural research.

Measures combating agricultural drought

Keeping in mind the anticipated more frequent occurrences of agricultural dry periods it will be necessary to also support measures contributing to increased water retention capacity of the landscape and optimisation of irrigation systems as well as minimizing negative effects of drainage systems on accelerated runoff of water from the land. These measures relate to application of technologies and research results contributing to reduced water consumption and reduced losses of soil moisture. Irrigation systems also depend on continuous availability or irrigation water.

Specifically, these measures include construction and upgrades of irrigation systems which use irrigation water more efficiently and make crop production possible even during linger periods of drought. Irrigation systems should only subsidize moisture deficits preventing damage to soil structure and preventing other negative effects on production. Technologies and methods reducing the so-called non-productive evaporation and promoting more efficient use of soil moisture by plants represents also an important measure.

Measures are **already partially underway.** This area is directly linked to adaptation measures in water management sector described in Section 6.3.1.

Ensuring soil stability against erosion

Water erosion in the Czech Republic threatens almost 50% of land. Wind erosion threatens approximately 14% of the agricultural land in the most productive area of the Czech Republic.

Grass planting applied to arable land or creation of grassy strips on sloping parcels constitute some of the anti-erosion measures implemented during the monitored period; other measures include plough-free soil processing, planting methods protecting the soil, implementation of protective elements and zones and planting of anti-erosion barriers.

Wind erosion effects will gradually grow in importance, especially in warm and dry areas of Southern Moravia. The proposed anti-erosion elements and their individual parts will need to be corrected in this respect. Any proposal involving long-term high-cost anti-erosion measures (terraces, wind barriers, anti-erosion reservoirs etc.) must take into consideration potential climate change effects.

Measures are already being partially implemented as a part of general agriculture management. Additional anti-erosion measures will be implemented during the new

programming period 2014-2020 (Rural Development Programme). The required and actually planned costs cannot be defined at this stage.

Monitoring, risk analysis, early warning systems and disease prevention in reaction to changing climatic conditions

Risk analysis concerning harmful plant organisms are being implemented by State Phytosanitary Administration of the Czech Republic (SPA) in the form of the so-called express analyses, which assess the degree of risk represented by newly imported and transmitted harmful organisms in the Czech Republic, and the availability of phytosanitary measures combating such imports and transmission.

Detection surveys carried out by SPA partially focus on alien thermophilic harmful plant organisms invading the Czech Republic. During 2013, the first confirmed findings of three yet-unrecorded occurrences of alien harmful plant organisms in the Czech Republic were announced.

Required future measures:

- Monitoring of transmissions and changes in disease and pests distribution patterns abroad (within the framework of international cooperation);
- Monitoring of ecologic niches, increase in the number of generations and occurrences or new invasive pathogens (state supervising bodies and research institutes)
- Measures ensuring protection of agricultural production.

These measures are already **underway** and need to be **continued in the future.**

Modification of the regions of production areas

Altered climatic and habitat conditions for cultivation of field crops and especially the ever more frequent occurrence of extreme weather conditions make it necessary to modify the current classification into regions. The extreme situations over the past 15 years have been a decisive negative factor in the quantity of production for a number of agricultural enterprises. New classification into regions will form a basis for re-evaluation of subsidy policy of support for farmers and primary producers.

These are **planned** measures.

Diversification of agriculture

Systems, where an agricultural enterprise has more revenue sources (from other than just agricultural production) reduces risks arising in connection with agricultural production alone, especially when these risks are exacerbated by climate change.

The Rural Development Programme and other activities at national level provide support to production and processing of biomass used outside food processing industry as well as agro-tourism and other services. Use of biomass as renewable energy source must observe sustainability principles without exacting more negative influence on the environment or food prices. Impact on the environment is being continuously assessed (in terms of soil erosion, biodiversity, effect on farms / enterprises, energy security, consumption of water etc.).

These measures have already been implemented or are either already **underway**.

Measures protecting farming against extreme weather events

There are effective technical measures that are in place against some of the extreme meteorological events (such as hailstorms in orchards). Their implementation is mostly driven by support provided at national level.

On the other hand, there is no effective protection against some other types of events. More frequent occurrence of extreme meteorological events reduces the availability of insurance cover and raises policy prices.

In these cases, implementation of preventive and adaptation measures is the priority, with the insurance playing a smaller part of a complex risk management and prevention solutions against climate change impacts.

Use of agriculture-related insurance is supported by the Relief & Guarantee Farming and Forestry Fund and a new fund is in preparation, to cover certain uninsurable risks, which will help cover those risks that are not insurable commercially.

These measures are already being **partially implemented.**

Good Agricultural and Environmental Conditions (GAECs)

GAEC-compatible farming activities have favourable influence on the content of organic substances in the soil, protection of soil structure, help in protecting various landscape features and permanent grasslands; they also partially limit spreading of invasive plant species etc.

Compliance with these measures, such as use of soil protecting technology in cultivating crops, bans on erosion hazardous plants and compliance with post-harvest soil cover in location that are prone to erosion, is being rigorously monitored.

These measures are presently **being implemented**.

6.3.3 Forest management

Timely adaptation measures in forest management sector are required to reduce the risk of calamities and disruption of ecosystem services and functionality related to biological diversity of the forest life. Diversity in growth conditions makes it impossible to entirely generalize the potential impact of climate change on forests and to adopt sweeping overall measures. On general level, forest management potential in terms of adaptation to climate change include preference of closer-to-nature, environment-friendly forms of management along with changes in the species and spatial composition of forest cover. Application of these management methods will bring an increase in biological diversity of forests, increase of their ecological stability and resilience, respectively their ability to adapt to climate change. The importance of adaptation is evident in the inclusion of these issues as one of the crucial activities in the National Forestry Programme II, which is the cornerstone document for forestry-related policies and which had already been approved by Government Resolution No. 1221/2008.

Species, age and spatial diversity

The aspect of species diversity is connected particularly with reduction of spruce stands and increasing the share of broad-leaved and fir trees. The number of broad-leaved trees in the natural composition of forests should be approximately three times their current quantity.

Spatial diversity means provision for adequate girth and height differentiation of the forest and is related to age and species diversity. Trees of various ages fill the space of a forest stand at various levels, mixing tree species with various requirements on light and temperature and with various natural root depths facilitate more effective utilization of the above-ground and soil space for the formation of biomass capturing carbon, and trees of various sizes are exposed to different risk factors. Forest differentiation thus reduces the risk of extensive decomposition of the forest and substantially contributes to stabilization of carbon stocks.

Adaptation measures in this area focus on cultivation of spatial and species-related variety of tree stands using the natural processes in the greatest possible degree, while maintaining diverse composition, natural restoration processes and variability of silvicultural methods, use of wider spectre of tree species, including pioneering and advance species; we anticipate a wider use of species with broader ecological amplitude and stabilization function.

These are **continuously implemented** measures as defined in Principal Forestry Policy (Government Resolution No. 249/1994) and the Forests Act (Act No. 289/1995 Coll.).

Prioritising natural restoration of forests

Natural restoration of forests should be taking place on at least 20% of the total area. In order to ensure that these processes take place, it is necessary to minimise technical drainages of forest land, while increasing use of amelioration, pioneering and advance tree species, creation of e regulated pools, smaller reservoirs etc. A funding system must be in place in order to maintain increased share of ameliorative and stabilising tree species in tree stands even after initial stabilization.

These measures are a part of existing legislation and require additional support to extend their application.

Implementation of sounder management methods and elimination of pressure from game

Sounder management methods reduce the use of clear-cutting and prefer noncompartmentalized or undergrowth forms of management and natural renewal, contributing to increasing the species, spatial and genetic diversity of forest ecosystems. High numbers of game do not permit natural renewal with a suitable species composition and cause further damage and are a demonstrable limiting factor for effective introduction of adaptation measures in relation to climate change. Game populations must therefore be limited to a degree that is manageable for forest ecosystems, so as to allow natural restoration of an entire spectre of tree species, without having to apply measures for area-wide forest protection.

Timber production must comply with processes limiting or slowing down surface rainfall water runoff, or be accompanied by sufficient measure combating soil erosion.

These measures are being **implemented only marginally** and require more prominent support.

Reduction of the risk with respect to increased populations of insect pests, vascular mycosis and especially root rot

Measures aiming to eliminate or reduce risks due to an increase of populations of insect pests monitoring of the state of health of forests and the dynamics of insect pest populations (by satellite and air-borne monitoring, insect traps etc.)

In addition to the use of traditional methods for liquidation of insect pests, chemical means with minimum impact on the other components of nature are also used in calamity situations

in exceptional cases and to a minimum degree (where possible biological means are preferred).

These measures are being **implemented already.**

Stabilization of carbon volumes bound in forest ecosystems

Promoting forest management techniques ensuring permanent soil cover with long-term or uninterrupted recovery periods with the objective of minimising fluctuations in top humus layers and use of tree species with high primary production and favourable effect on pedosphere support stabilization of accumulated carbon. Another necessary measure is represented by stabilization of area in terms of forest types groups influenced by water and protection of wetlands in forests.

It is expected that these measures will continue to be implemented within the framework of the new programming period of the Rural Development Programme 2014-2020, especially in terms of support provided to increased share of ameliorative and strengthening tree species using the forestry-environmental payments. Maintenance of the existing high-quality ecosystems will contribute to maintenance or strengthening of increased sequestering potential of forest soil and stocking in forest biomass.

These measures are predominantly **planned** measures to be implemented in the next programming period 2014-2020.

Determining priorities for support of adaptation measures in forest ecosystems

In order to apply adaptation measures effectively, it is necessary to determine what areas are most threatened by various risks in the Czech Republic in order to prioritise implementation in forest ecosystems and to project these results into regional forest development plans. Once these complex adaptation measures will have been formulated, responsible bodies will formulate *best management practices* (BMP) for these areas for the need of forest owners and forest management specialists.

In terms of financing of these measures, both national and European financial contributions to implementation of adaptation measure will be tied to compliance with these BMPs.

This is a **planned measure.**

Measures within the National Forestry Programme

The updated version of the National Forestry Programme 2013 (Government Resolution No. 1221/2008) contains the following measures aiming to reduce climate change impacts, focusing on:

- Supporting species and ecotypes of more resilient tree populations which are able to maintain high and stable production of wood;
- Supporting ecologically suitable afforestation of farming land especially by fast-growing tree species;
- Extending statutory deadlines for afforestation and ensuring tree cover in connection with natural recovery of forests;
- Reducing soil degradation and increasing volumes of carbon stocked in soil;
- Focusing subsidy rules on support to be provided toward adaptation measures reducing climate change impact.

These principles were gradually implemented within OPE (2007 – 2013), Rural Development Programme (2007 – 2013) and Programme of renewal of the natural functions of the landscape (2009 – 2018). It is anticipated that support will continue to be granted in the next programming period within the Rural Development Programme 2014-2020.

6.3.4 Biodiversity and ecosystem services

Measures protecting biodiversity, which have so far been supported from national and European programmes, focus on maintenance and increase in the number of various species, ecosystem protection and creation of suitable conditions for their further existence, protection and support of biodiversity *in situ*, optimisation of water regime, reducing climate change effects on ecosystems, increased adaptive ability of ecosystems and species especially with regard to increasing fragmentation of landscape and care for handicapped animals.

A large part of these measures is already funded from **national subsidy programmes** (such as Programme of renewal of the natural functions of the landscape, Landscape Programme, "Administration of Vested State Property in Special Protected Areas") and this funding amount to approximately **180 million CZK annually.** In medium-term horizon (2014 – 2016) it is anticipated that this funding will continue at about the same rate even thought the requirements are already higher.

Biodiversity measures are also supported by Operational Programme Environment (OPE), where, between 2007 and 2013, the total sum allocated to Priority Axis 6 - Improving the State of Nature and the Landscape reached **15.281 billion CZK**.

The future programming period of OPE will emphasize measures aiming to strengthen eco-stabilization functions of the landscape, especially restoration of natural water regime, increase of close-to-nature landscape features and defragmentation of landscape. Preliminary estimates of costs related to protection of nature and landscape within the future programming period 2014 – 2020 reach **11 billion CZK** (depending on the total allocation available for the program which had not yet been exactly determined).

The specific implemented and planned measures include:

<u>Measures for protection and defragmentation of landscape and migration permeability</u>

Various biotope areas within landscape matrix need to be reconnected using tools available in zoning procedures, especially those which function as source areas for various species, as well as implement TSES in order to ensure maintenance and reproduction of natural abundance of species, and to influence less table landscape fragments in their vicinity while increasing adaptation potential of the landscape as a whole.

Climate change adaptation will be best served by protection and restoration of the corresponding types of environment allowing spreading of individual elements of biodiversity threatened by climate change and especially by ensuring sufficient general protection of nature and landscape, especially its interconnectedness and permeability for organisms.

Some of these measures have already been **partially implemented,** for instance protection and implementation of TSES, fish passes and eco-corridors.

Further support in this area is planned in the future by supporting continuous implementation of the above measures and increased permeability and restoration of backbone migration corridors (incl. water courses).

Measures aiming to protect and improve populations of rare and endangered species and key biotopes

These measures should extend, building on the existing instruments and systems ensuring territorial and population protection (Natura 2000, special protected areas, endangered species, general protection of nature), the concept of nature protection from the perspective of climate change, especially in those areas, which are important for their biological diversity such as flower and orchid meadows or primal forest ecosystems.

Some of these measures have already been **partially implemented,** especially in terms of protection and management of SPA, the NATURA 2000 system, revitalized landscape features, measures supporting bird nesting, bio corridors, protection and implementation of TSES, fish passes, eco-corridors.

Planned measures include further and higher support of the above.

Measures aiming to increase ecosystems capacity to ensure key services

Objective of these measures is to ensure protection, maintenance and potential restoration of ecosystems which are significantly sequestrating carbon from the atmosphere and stocking it in its biomass for long term, such as indigenous or close-to-nature forest ecosystems, wetlands and moorlands; further support measures eliminating irreversible appropriation of arable land due to urbanization.

The objective is to include integration of ecosystem services with measures implemented in agricultural, forest and water ecosystems. From the perspective of adaptation in urban areas, it will be necessary to promote consideration of ecosystem services in these locations.

Some of these measures have already been **partially implemented** for instance in the form of revitalization of important landscape features - water courses, floodplains and wetlands.

Increased support in this area is **planned in the future** to allow for implementation of additional measures; future activities involve revitalization of moorland affected by mining or by change of water regime, elaboration and application of ecosystem services evaluation, support environment-friendly management in forests and on agricultural land etc.

Measures aiming to protect, restore and improve ecosystems and natural areas and elements contributing to adaptation to climate change

These measures aim to support establishment and management of vegetation in urban areas, such as parks, vegetation isolation zones, water features etc.

Further measures are designed to ensure protection and restoration of ecosystems and natural elements in open landscape that increase ecological-stabilization functionality of landscape and permeability for migrating animal species, such as water courses, floodplains, small water reservoirs, fishponds, springs, wetlands, copses, alleys, naturally structured forests and grasslands etc.

Some of these measures have already been **partially implemented** for instance protection and support of urban vegetation and revitalization of ecosystems and natural elements in open landscape.

Planned measures include extended support to the above measures, introduction and implementation of a complex and systemic approach.

Analyses of climate change impact on biodiversity

Analyses of future impacts of climate change on individual species, biotopes, ecosystems and SPA in order to define priorities for management and protection of the most potentially endangered phenomena (especially mountain and alpine species, ecosystems involving remnants of primal grasslands, biotopes with specific microclimatic conditions such as iced scree fields, upland moors and sand dunes) and securing periodical monitoring of sensitive organism reactions to climate change and efficiency of implemented measures.

These measures **are planned**, as they have not been yet sufficiently implemented.

Ensuring synchronicity between adaptation measures and nature protection measures

The objective is to limit potential adverse impacts of adaptation and mitigation measures on biodiversity and ecosystem services in arable and forest land, for instance as a consequence of afforestation, planting of energy tree stands or introduction of anti-erosion zones. These measures aim to strengthen populations of endangered species whether they are wild plants or animals within the framework of rescue programmes. Implementation of anti-erosion and soil protection measures and measures supporting soil biodiversity by implementing suitable agro-technical solutions and good farming practices.

These are predominantly **planned measures**, some of which have been **implemented only partially.**

Measures preventing and limiting the spread of invasive species

These measures aim to slow down spreading of invasive alien species of plants and animals and their eradication, if possible, and in this connection to ensure active approach of nature protection authorities if a situation would require solution on a larger scale; limit the effect of other factors which may favour invasive species and negatively influence biodiversity, such as environmental pollution by heterogeneous substances or accumulation of nutrients in the environment.

Liquidation of selected invasive plant species has been **already partially implemented** within the framework of above measures.

Planned measures include liquidation of selected invasive plant species, introduction of preventive measures, support of monitoring and prevention and early response systems.

6.3.5 Urbanized landscape

Spatial Development Policy in the Czech Republic

Spatial Development Policy in the Czech Republic approved by Government in the form of Resolution No. 929 in 2009 defines the following spatial planning priorities having impact on adaptation measures:

- Creating conditions for preventive protection of the territory and population against potential risks and natural disasters (flooding, landslides, erosion etc.) with the objective to minimise damage. This especially includes territorial security and protection of areas to be built up and measures establishing protection against flooding and designation of areas for managed inundation. Creating conditions for increased natural retention of rainfall water in the territory taking into account settled areas and cultural landscape as alternatives to artificial water accumulation. Creating conditions in built up settled areas

for retention, infiltration and utilization of rainfall water as a source of water with the objective of reducing flood impact.

- Defining the boundaries of floodplains in built up areas and locating public infrastructure within these areas only in entirely exceptional and especially justified cases. Defining of areas suitable for development for the purposes of displacement of buildings from high-risk locations.

Article 167 of the Spatial Development Policy defines areas that are morphologically, geologically and hydrologically suitable for accumulation of surface water. These areas will be specified in more detail and set aside within the spatial development principles on the basis of prepared complex plan for protected areas and areas suitable for accumulation of surface water.

Operational Programme Environment (2007 – 2013)

Operational Programme Environment (OPE) and its Area of Intervention 6.5 focusing on regeneration of urban landscape, aims to restore natural vegetation within urban environment, including city and municipal forest parks, school gardens and orchards and landscaped complexes, parks, alleys and important groups of trees within settlements as well as restoration of vegetation within the framework of green rings around settlements. OPE also focuses on planting on land parcels smaller than 10 ha, which used to form a part of former military exercise areas, areas burdened with consequences of geological surveys etc., and to construction and modifications of water features in urban areas and their surroundings.

Planned measures

The draft version of the Strategy on Adaptation to Climate Change in the Czech Republic (working version October 2013) contains a number of urban adaptation measures, including:

- Measures aiming to minimise surface water runoff, which contain an entire set of partial measures such as maintenance of reservoirs and restoration of artificial yet close-to-nature water features in settlements etc.
- Measures focusing on reduction of pollution in runoff with objective of minimising potential contact of the runoff with pollution sources.
- Measures aiming functional and ecologically stable system of urban vegetation.
- Measures in the urban development sector, construction sector and architecture with the objective of supporting technologies using renewable energy sources in cooling and air-conditioning of buildings, implementation of low-energy passive standards and technologies in public buildings, re-use and revitalizations of brownfields.
- Construction solutions implementing shading of buildings, installation of external shutters and awnings, implementation of “green” and “white” roofs and pavements, replacement of black tarmac with pale surfaces etc.
- Lowering of settlements ecological footprint that rises as a result of spontaneous development, traffic (especially personal road traffic) and increased demand for heating, water and energy generally.

6.3.6 Health and hygiene

Adaptation in healthcare and hygiene sector primarily involves measures combating contagious and other diseases (such as cardiovascular disorders and allergies) and in prevention of harmful effects on human health caused by extreme weather events.

In certain European countries there continue to exist diseases that may be transmitted between humans and animals (zoonosis), and which were already eradicated in the Czech Republic. Their repeated spreading cannot be excluded due to unrestricted international movement of goods and food. Migration of people, whether due to business, work or recreation, may contribute to spreading of other contagious diseases, which have not been present in local conditions.

Measures for infectious and non-infectious disease elimination

The primary objective is to ensure that clinical and laboratory professionals are fully informed of any potential risks arising in connection with changing epidemiological situation in relation to impact on occurrences of infections due to climate change. The existing monitoring system must be reviewed to ensure that it covers climate-sensitive pathogens and their animal vectors and reservoirs.

Since June 2007, there has been a forecasting system in place, issuing warnings regarding tick-related activity levels and in connection with recent floods, there is monitoring of mosquitos in place.

These measures are already **partially implemented.** Cost estimates for these activities amounting to 1.5 million CZK annually.

Information and healthcare

The healthcare sector needs to be involved in information capacity to support decision-making processes during exceptional situations, which may potentially endanger the health of the population.

Healthcare information and education system needs to implement an early warning system eliminating potential harmful health consequences (such as during heat waves, landslides etc.). At the same time, general public needs to be educated regarding dangers associated with climate change in order to preventively influence their behaviour and reduce subsequent health risks.

These measures are already **partially implemented**.

6.3.7 Crisis situations, protection of the population and environment

Due to the anticipated more frequent occurrences of extraordinary situations triggered by climate change, it will be necessary to support development of population protection and environmental security measures, especially of integrated forecasting systems for natural disasters, early warning systems and systems ensuring protection of critical infrastructure. Adaptation measures must be efficient and economical.

Protection of the population, early warning systems

Existence of early warning systems and forecasting systems predicting natural disasters form an important part of population and environmental protection against consequences of crisis situations triggered by natural disasters. In this area, responsible authorities need to designate

those settlements that may be affected by various types of risk triggered according to specific local conditions by climate change and to draft appropriate adaptation measures for local households. Most of the preventive measures should focus on areas and populations living in areas, which are already critical (for instance in terms of regular or repeated risk of flooding, erosion etc.).

These measures are mostly **planned** or, if implemented, than only partially.

Development and strengthening of the Integrated Rescue System

Integrated rescue system needs further development and strengthening of its capacities so as to ensure that it is capable of coordinating actions of all its units (Fire Rescue and fire protection units, Police and emergency services etc.) in preparation for extraordinary situations or during these situations and in providing rescue and liquidation services.

These measures are mostly being **planned.**

Measures protecting critical infrastructure

Adaptation measures for critical infrastructure are closely linked to specific measures in the industry and energy sector. Additional measures include:

- Displacement of housing built in flood-prone areas by exchanging affected land parcels between the house owners and the municipality for suitable land outside the zone;
- Creation of local early warning system using text messaging (warnings sent by mobile operators upon instruction of the municipality emergency committee (contractual arrangement on regional level),
- Creation of a methodological assistance for households facing frequent climatic extremes, which may be uninsured due to unavailability of commercial insurance policies.

These measures are **partially implemented.**

Environmental security

The main task for achieving environmental security is completion of a system of specific legislative, technical, institutional and information measures, including:

- Drafting of a proposal for a system of indicators and measures addressing droughts and protection of ecosystems against its consequences,
- Drafting of a proposal for a template plan for crisis situation for "long-term dry periods,"
- Analyse existing template plans for solution of crisis situations with respect to environmental security and provide appropriate adaptation measures,
- Analyse and propose corresponding change to legislation preventing forest (vegetation) fires,
- Improve forecasting, warning and alarm services and monitoring systems and harmonize them with similar system in the EU and global systems,
- Draft legal regulation ensuring meteorological and hydrometeorological services,
- Support research, development and innovations in environmental security sector.

These measures are being **prepared and planned.**

Development of research in the environmental security sector

With regard to anticipated climate change, it will be necessary to strengthen security research and development focusing on areas, which may be critically endangered by climate change. The following measures arise in connection with formulation of the Strategy:

- The need to formulate priorities of the Security Research Programme of the Czech Republic focusing on addressing the fundamental aspects of climate change and its mitigation for the needs of the state,
- Define procedures for the use of data for purposes of risk evaluation related to climate change,
- Define criteria for determining investment priorities in connection with various risks and describe corresponding risk scenarios;
- Elaborate methods reducing vulnerabilities of the society and increasing resilience in connection to extreme climatic events and natural risks.

These measures are being **prepared and planned.**

Measures aiming to ensure slope stability

Precipitation is one of the most important triggers of landslides. Monitoring of risk slopes and water regime, documentation and analysis of data for the purposes of creating preventive measures forms the basis of effective protection against this type of risk.

Alleviation of climate change impacts in this area must also involve active development of elements stabilising not only location that are already in emergency condition but also those which may enter such state in the near future.

These measures are already **partially implemented and partially planned**.

6.3.8 Tourism and recreation

Implemented measures

There is no coherent set of adaptation measures in place in the Czech Republic for the tourism sector.

Planned measures

The draft version of the Strategy (working version October 2013) contains a number of tourism-related adaptation measures, whose objective is to improve existing knowledge base, which is currently not sufficient to define short-term adaptation measures in the tourism sector.

6.3.9 Transport

Implemented measures

There is no coherent set of adaptation measures in place in the Czech Republic for the transport sector.

Planned measures

The draft version of the Strategy (working version October 2013) contains adaptation measure for the transport sector, which are closely interlinked with measures to be implemented in urban landscape:

- Ensure flexibility and reliability of traffic during extreme weather events by removing "bottlenecks", construction of new and increasing capacity of the existing alternate routes or use of telematics and intelligent transport systems for information on negotiability, traffic flow and transport management.
- Identify and monitor unsuitable technologies in transport infrastructure, support research and development of new materials with the objective of increasing lifetime of infrastructure and transport constructions.

6.3.10 Industry and Energy sector

Adaptation measures in industry and the energy sector focus in particular on ensuring the functioning of critical infrastructure whose failure would impact not only the end consumer, but which would also have a serious impact on the protected interests of the state, and therefore, the following section is divided according to individual energy sectors (electricity generation and distribution, gas, oil heating, renewable energy sources). A measure equally important for the industry is to ensure security of industrial facilities.

Draft Strategy on Adaptation to Climate Change in the Czech Republic (Strategy, draft October 2013) contains a number of proposals leading to adaptation of current security measures and risk management systems in industrial facilities in case of accidents due to high winds, flood protection and emergency rescue plans, increased efficiency of water resources use in production processes, etc.

7 FINANCIAL RESOURCES AND TECHNOLOGY TRANSFER

7.1 Support directed to developing countries

Foreign development cooperation

The Ministry of Foreign Affairs (MFA) is the administrator of all activities related to foreign development cooperation (FDC), while other Ministries are involved in the activities of the FDC Council, which is an interdepartmental coordinating body for FDC matters; all Ministries contribute to the formulation of Czech policies vis-à-vis international bodies in their specific areas of expertise. Czech Development Agency (CDA), established in January 2008, is the implementing body responsible for preparation and implementation of bilateral projects of FDC.

The Czech Republic is also involved in a number of multilateral FDC activities overseen by a number of international organizations, which aim to achieve global development objectives and other international commitments. The Czech Republic participates and contributes funding to development activities of the UN, EU, OECD, international financial institutions and other organizations. For the purposes of the Strategy we consider only those organizations whose activities are in line with OECD-DAC definition of development cooperation and contributions provided are fully or partially creditable toward official development assistance (ODA). Organizations were divided into four groups: 1) EU, 2) development banks and financial institutions, 3) programs and funds of the UN, and 4) other organizations. The Czech Republic is a member of Development Assistance Committee OECD (DAC) since 14 May 2013.

Key strategic documents in this area include **Development Cooperation Strategy of the Czech Republic 2010-2017** and **Multilateral Development Cooperation Strategy of the Czech Republic 2013 – 2017**, which define territorial and sectoral priorities of FDC of the Czech Republic and reflect international commitments and actual challenges in development assistance area.

Sectoral priorities of FDC:

- Environment (including climate protection);
- Economic development in partnership countries (incl. commerce and energy sector);
- Sustainable agriculture and food security;
- Social development incl. education, social and healthcare services;
- Human rights and democratic and legal principles.

Territorial priorities of FDC:

- Geographic priorities for bilateral FDC according to the **Development Cooperation Strategy of the Czech Republic 2010-2017** (countries with cooperation programmes:

Afghanistan, Bosnia and Herzegovina, Ethiopia, Moldavia, Mongolia; and the so-called project countries - Georgia, Cambodia, Kosovo, Palestine and Serbia).

- Countries, which represent a humanitarian priority, are a part of the programme of transformation cooperation of the MFA (for instance Burma) or priority according to The Czech Republic´s Foreign Policy.
- Regions where the Czech Republic may offer, thanks to its own transformation experiences, comparative advantage (especially in Western Balkans, in Eastern Partnership countries in former Soviet central Asian countries).

Total volume of funding provided towards FDC of the Czech Republic reached in 2012 **1.3 billion CZK**. In 2012 FDC amounted to **0.124 % of the Czech GDP**.

Table 7.1: Bilateral development assistance of the Czech Republic per territory in 2009 – 2012 (million CZK)

Territory	2009	2010	2011	2012
Sub-Saharan Africa	182.11	144.64	145.97	138.43
Southern and Central Asia	716.47	456.24	310.68	367.76
Other Asia and Pacific	285.41	197.39	141.20	135.68
Middle East and Northern Africa	92.10	66.66	83.77	118.17
Latin America and Caribbean	78.24	106.47	34.64	23.36
Europe	537.97	402.35	353.80	372.48
Non-specified	26.40	140.46	289.82	142.15
Total	**1 918.70**	**1 514.20**	**1 359.88**	**1 298.03**

Source: MFA

Table 7.2: Multilateral development assistance of the Czech Republic in 2010 - 2012

	2010		2011		2012	
	Funding provided (millions CZK)	**Funding provided (millions USD)**	**Funding provided (millions CZK)**	**Funding provided (millions USD)**	**Funding provided (millions CZK)**	**Funding provided (millions USD)**
European Union	2 102.78	110.21	2 556.61	144.67	2 298.63	117.65
World Bank	210.72	11.04	276.54	15.65	329.49	16.89
Programs, funds and agencies run by UN	119.58	6.27	147.84	8.37	153.29	7.84
Regional development banks	252.40	13.23	99.19	5.61	25.37	1.30
Other organizations incl. international NGO	142.11	7.45	13.34	7.55	29.85	1.53
Total	**2 827.59**	**148.20**	**3 093.52**	**175.05**	**2 836.63**	**145.21**

Source: MFA

7.2 Financing of climate protection measures in developing countries

The Czech Republic is not a party to Annex II to the Convention and as such it is not obliged to adopt measures, in line with Article 12.3 of the Convention and fulfil obligations pursuant to Articles 4.3, 4.4 and 4.5 of the Convention and create additional financial sources.

Nevertheless, the Czech Republic along with other developed countries committed itself, at the 15th Conference of Parties to the *United Nations Framework Convention on Climate Change* – UNFCCC in December 2009 in Copenhagen, to support measures reducing greenhouse gas emissions (mitigation) and adjustment measures to climate change (adaptation), as well as capacity building and technology transfer to developing countries (*fast start finance* - FSF) in the period 2010 – 2012. The total support provided to developing countries should have reach 30 billion USD between 2010 and 2012. The Czech Republic assumed a voluntary commitment to contribute 12 million EUR via its bilateral and multilateral official assistance channels to selected developing countries.

The Czech Republic financed a number of projects in 2010 - 2013, focusing on reduction of greenhouse gas emissions – modernization energy facilities and systems, utilization of alternative/renewable energy sources etc. Almost 65 % of FSF funding was directed toward adaptation measures financing, predominantly in water management and agriculture sectors.

Table 7.3 gives an overview of projects that were financially supported by the Czech Republic in individual countries within the framework of the fast start finance between 2010 and 2012 in adaptation, mitigation and REDD+. The Czech Republic contributed in total **12.62 mil EUR** to FSF projects, which is slightly more than its initial commitment.

Table 7.3: Overview of climate change –related projects 2010 - 2012 in EUR

	2010			**2011**			**2012**		
	A[1)]	M[2)]	R[3)]	A	M	R	A	M	R
A. Bilateral									
Ethiopia	227 200		120 000	725 000			1 076 000		
Moldavia	644 920			196 000			196 000		
Indonesia			119 200						
Peru	72 200								
Mongolia	840 680			434 000			362 000		
Angola	120,000			485 000					
Georgia		317 000		160 000	102 000		162 000	198 000	
Yemen		338 400					128 000		
Vietnam		178 400			120 000			108 000	
Afghanistan				160 000			120 000		
Palestine				320 000	280 000		300 000	200 000	
Cambodia					240 000			160 000	
BaH[4)]					686 000			574 000	
Serbia					124,000			367,000	
subtotal	1 905 000	833 800	239 200	2 481 000	1 552 000	0	2 343 000	1 606 000	0
Total A	**2 978 000**			**4 033 000**			**3 951 000**		
B. Multilateral									
GEF	50 000			1 000 000			680 000		
Total (A+B)	**3 028 000**			**5 033 000**			**4 631 000**		

1) A = Adaptation, 2) M = Mitigation, 3) R = REDD+, 4) BaH =Bosnia and Herzegovina *Source: CDA*

Detailed overview of sample FSF projects including its description is provided in Annex 5.

The sustainability is considered to be a key factor in project preparation. Relevant trainings of beneficiaries and other necessary measures are included in project design in order to ensure project outputs durability after a project is finished. As a rule the project outputs are monitored also after the conclusion of the project activities. If any shortcomings are identified further phase-out/remedial activities are put in place in order to ensure the project outputs are sustainable.

As regards project shortcomings/failures, these are mainly connected to the lack of ownership of the project outputs by the beneficiaries and to the subsequent insufficient sustainability of the project outputs. The Czech Development Agency strives to avoid project shortcomings/failures by putting in place pre-emptive measures, and if any shortcomings/failures are identified by implementing relevant corrective measures in order to rectify the identified issues.

7.3 Information according to Article 10 of the Kyoto Protocol

Information provided according to Article 10 of the Kyoto Protocol to be provided within the framework of the 6th National Communication is provided in Annex 3.

8 RESEARCH AND SYSTEMATIC OBSERVATION

This chapter summarizes information on the structure of research in the area of climate change and its basic results in the period since the Fifth National Communication of the Czech Republic to UNFCCC[25]. It also provides basic information on the ongoing systematic observation 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 sectoral, economic or social consequences. Attention is also devoted to international cooperation and exchange of scientific and technical and also socio-economic information.

8.1 General organization of research and systematic observation

Research on aspects connected with the current state and developments of the climate system is concentrated particularly in the following institutions:

- The Committee on the Environment of the Academy of Sciences of the Czech Republic
- The National Forestry Committee
- Institutes of the Academy of Sciences of the Czech Republic (Global Change Research Centre AS CR, public research institution – CzechGlobe; Institute of Atmospheric Physics AS CR, public research institution; Geophysical Institute AS CR, public research institution; The Institute of Hydrodynamics of the AS CR, public research institution; Institute of Systems Biology and Ecology, public research institution; Institute of Geology AS CR, public research institution)
- University departments (Faculty of Mathematics and Physics, Charles University in Prague; Faculty of Science, Masaryk University; Faculty of Science, Charles University in Prague; University of South Bohemia in Èeské Budìjovice; the Mendel University of Agriculture and Forestry in Brno)
- Sectoral institutes (Czech Hydrometeorological Institute; National Institute of Public Health; the T.G. Masaryk Water Research Institute, public research institution; Czech Geological Survey) and other research institutes (Crop Research Institute, public research institution; Research Institute of Agricultural Engineering, public research institution; Research Institute of Ameliorations and Soil Conservation public research institution; etc.).

Some of these institutes are members of or are represented in the National Climate Programme of the Czech Republic, which is an association of legal persons entrusted, amongst other things, with performance at a national level of the tasks of the World Climate Research Programme of the World Meteorological Organization (WMO), creation of research teams of scientists in the area of the climate in the Czech Republic and publication of the results obtained.

[25] http://unfccc.int/resource/docs/natc/czenc5.pdf

The research, which is part of the basic tasks of the individual institutions, is financed both from their budgets and also through the Czech grant agencies and the Academy of Sciences of the Czech Republic or grant projects announced by the Ministry of the Environment and Ministry of Agriculture. Some projects are carried out in the framework of international cooperation and co-financed by foreign partners.

Systematic observation of the climate system is carried out mostly by the Czech Hydrometeorological Institute (CHMI) which performs the function of a State institute for the area of air quality protection, hydrology, water quality, climatology and meteorology, with a competence to establish and operate State monitoring and observation networks, including international data exchange pursuant to the WMO principles. Other institutions carry out monitoring for their own needs, usually for a limited period of a certain project.

Exchange of scientific and technical information between Czech and foreign institutions is not regulated in any way and occurs quite freely; CHMI provides basic data, usually for a fee according to the valid tariff.

In addition to participation in the activities of the WMO and UN Environmental Programme (UNEP), the Czech Republic cooperates on a number of international projects concerned with the climate. The most important in this respect is participation in the RC LACE project (the ARPEGE-CLIMAT model). 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 for example participates in the Intergovernmental panel on Climate Change, the World Climate Programme, the International Geosphere-Biosphere Programme and the Global Climate Observing System. The cooperation is mainly based on data delivery to relevant databases and international exchanges.

The Czech Republic regularly provides assistance to developing countries in the area of training courses, and assistance in installation and calibration of instruments (e.g. monitoring of the ozone layer, etc.).

8.2 Research projects, experimental development and innovations 2009 - 2013

For the period covered by this 6th National Communication, 63 research, development and innovations projects related to climate change were identified by qualified selection. This includes project initiated and completed within this period, projects commenced prior and completed within this period and projects initiated in this period and continuing beyond this period. Some of these projects were commenced during the 5th National Communication. The Research and Development and Innovations Information System of the Czech Republic (R&D IS) is the source of information on these projects.

From the 63 projects 41 have demonstrated at least partial results of their research in the Information Register of R&D results (RIV) in 2009 – 2013. 22 projects showed no results in RIV during that period.

The total volume of funding provided to R&D projects reached 334.8 million CZK. From this amount, 227 million CZK will be (was) paid out in 2009 – 2013. The funding structure in individual years and structure of providers / sources of the support is given in the tables below.

Table 8.1: Actual funding provided toward R&D (climate change) projects in 2009 - 2013

Year	million CZK
2009	40.4
2010	49.3
2011	49.9
2012	43.1
2013[26]	44.3
Total	**227.0**

Source: R&D IS

Table 8.2: Actual funding provided toward R&D (climate change) projects in 2009 – 2013according to provider and source (millions of CZK)

Provider / Source	FP6[27]	EEA/Norway	ECOP[28]	SB–R&D[29]	TOTAL
Academy of Sciences (AS CR)				6.7	**6.7**
Czech Science Foundation				50.9	**50.9**
Ministry of Education, Youth and Sports (MEYS)	1.0	4.8	39.9	24.9	**70.7**
Ministry of Agriculture (MoA)				39.7	**39.7**
Ministry of the Environment (MoE)				48.9	**48.9**
Technology Agency (TA CR)				10.1	**10.1**
Total	**1.0**	**4.8**	**39.9**	**181.2**	**227.0**

Source: R&D IS

8.2.1 Chief beneficiaries

R&D projects focusing on climate change were implemented between 2009 and 2013 mainly by the following bodies (number of projects given in brackets):

The T. G. Masaryk Water Research Institute, public research institution (8), Institute of Atmospheric Physics AS CR, public research institution (7), Charles University (6), Global Change Research Centre AS CR, public research institution – CzechGlobe (5), Masaryk University (4), the Mendel University of Agriculture and Forestry in Brno (MU) (4), Czech Hydrometeorological Institute (CHMI) (3), Czech Geological Survey (2), Czech University of Life Sciences in Prague (formerly of Agriculture) (2), Czech Technical University in Prague (CTU) (2), University of South Bohemia in České Budějovice (USB) (2), Technical University in Liberec (2), Crop Research Institute, public research institution, (2), CENIA, Czech Environmental Information Agency (1), Transport Research Centre, public research institution (1) Czech Metrology Institut (1), EKOTOXA Ltd.(1), Geophysical Institute AS CR, public research institution (1), IFER – Institute of Forest Ecosystems Research Ltd. (1), Palacký University in Olomouc (1), Institute of Animal Physiology and Genetics AS CR, public research institution (1), Regional Museum in Olomouc (1), VŠB-Technical University of Ostrava (1), Brno University of Technology (1), Forestry and Game Management Research Institute, public research institution (1), Research Institute of Ameliorations and Soil

[26] Allocation to be disbursed in 2013

[27] 6th EU Framework Programme

[28] The Education for Competitiveness Operational Programme

[29] State Budget Expenditures on Research, Development and Innovations

Conservation (1) and The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, public research institution (1).

8.3 Information on selected important national research projects

A number of important national research projects focusing on climate change have been supported since 2007; these include:

- Refinement of current estimates of the impacts of climate change in the sectors of water management, agriculture and forestry and proposals for adaptation measures (provider MoE, beneficiary CHMI)
- Assessment of the effect of climate change impact on hydrological balance and proposal for practical measures to mitigate its impacts (provider MoE, beneficiary Czech Geological Survey)
- Research of available measures to ensure drinking water supply during climate change (provider MoA, beneficiary The Faculty of Mining and Geology - VŠB-Technical University of Ostrava)
- Integration of the KLIMATEXT team into international cooperation (provider MEYS, beneficiary Technical University of Liberec – Faculty of Education)
- Partnership in climate research and adaptation strategies (provider MEYS, beneficiary CzechGlobe)
- Multi-level analysis of urban and suburban climate (medium-sized cities) (provider of support Czech Science Foundation, beneficiary Faculty of Natural Science at Masaryk University in Brno)
- Influences of climate variability and meteorological extremes on production of selected crops between 1801 and 2007 (provider of support Czech Science Foundation, beneficiary MU Brno)
- Integrated influence of climate change, ambient air quality and forest management to water ecosystems in spring areas of river basins (provider of support Czech Science Foundation, beneficiary Natural Sciences Faculty, Charles University)
- Probability scenarios for climate in the Czech Republic (provider AS CR, beneficiary Institute of Atmospheric Physics AS CR, public research institution)
- High-resolution climate change scenarios for study of their impacts in agriculture (provider MEYS, beneficiary Faculty of Mathematics and Physics, Charles University)
- Reliability and security of water management facilities in changing climatic conditions (provider MoA, beneficiary Faculty of Engineering, CTU Prague)
- Research of adaptation measures for purposes of eliminating impact of climate change in Czech regions (provider MoA, beneficiary the T. G. Masaryk Water Research Institute, public research institution)
- Climate change and population dynamics of invasive species of plants in the Czech Republic considering alternative scenarios of global climate change (provider MoE, beneficiary Natural Sciences Faculty USB)

- Sustainable use of water sources under climate change conditions (provider TA CR, beneficiary the T. G. Masaryk Water Research Institute, public research institution)
- Towards geological storage of CO_2 in the Czech Republic (provider MEYS, beneficiary Czech Geological Survey)
- Climate change and migration as a form of adaptation (provider MEYS, beneficiary CzechGlobe)
- Biogenic greenhouse gas emissions and carbon and nitrogen transformation processes in soil in connection with global climate change: regulatory mechanisms, influence of various land management methods and extreme weather fluctuations (provider MEYS, beneficiary Crop Research Institute, public research institution)
- Growth models as a tool for increase of production potential and food security in the Czech Republic under climate change (provider MoA, beneficiary CzechGlobe)
- Alleviating climate change impact on landscape using research focused on biological diversity of landscape and their functional features for sustainable agriculture and systems supporting life in anthropogenic landscape mosaic (provider MEYS, beneficiary Faculty of Agriculture USB)
- Sustainable urban development planner for climate change adaptation (provider MEYS, beneficiary CENIA, Czech Environmental Information Agency)
- Mapping natural focal points for zoonosis in the Czech Republic and their changes doe to climate modification (provider: Ministry of Health Internal Grant Agency, beneficiary National Institute of Public Health)
- Time and spatial characteristics of links between weather and cardiovascular diseases (provider Czech Science Foundation, beneficiaries National Institute of Public Health and Institute of Atmospheric Physics AS CR, public research institution)

The above projects are described in more detail in Annex 6.

8.4 Information on selected major projects involving international cooperation

International projects include:

- ***Global and regional climate model simulations focusing on Central Europe in the 18th–20th centuries in comparison to observed and reconstructed climate***

The Czech Science Foundation is the provider of funding required for the GAP 209/11/0956 project. The chief beneficiary is **Department of Geography, Faculty of Natural Science, Masaryk University in Brno**. CHMI and Faculty of Mathematics and Physics of the Charles University in Prague cooperate on the project. Project runs from 2011 to 2015

Using the CGCM ARPEGE-Climat/NEMO global circulation model, the project puts together an ensemble of simulations with perturbed initial conditions of ocean model. Data of a selected member of the CGCM ensemble will then serve as an input into regional climatic model RCM ALADIN-Climate/CZ for detailed simulation of Central European climate in 1701-2010. Air temperature and precipitation are validated using homogenized temperature and precipitation series recorded by meteorological stations (commencing in the 2nd half of

the 18th century for temperature and in the 1st half of the 19th century for precipitation) and air temperature and precipitation data are then reconstructed using various documentary sources (1701-1854) and natural proxy data. Comparisons of model simulations and empirical series are used for study of low frequency and high-frequency signal in both types of series. Subject of study is then the extent of natural and impact on climate variability in the last three centuries using empirical series and models.

- ***Development of the regional climate model for a very high resolution***

The Czech Science Foundation is the provider of support for the implementation of GAP209/11/2405 project. The main beneficiary is **Institute of Atmospheric Physics AS CR, public research institution.** Project runs from 2011 to 2014.

The proposed research project involves development of a high-resolution regional climate model able to work in the so-called "grey zone" physics (horizontal resolution of 4 - 7 km). This very high spatial resolution is not yet used in practice of regional climate modelling due to the complications with development of physical parameterizations, internal formulation of the model and also due to the high costs incurred by increased resolution. Moreover, the developed model will retain its ability to be operated in resolutions in between 20 and 50 km, which are typical for contemporary generation of regional climate models. Model ALARO-Climate/CZ will be developed from numerical weather prediction model ALARO. CHMI will contribute its technical resources (central supercomputer, central storage server), its experience with operation of NWP model and climate version of ALADIN LAM model. An integral part of the project will be a detailed validation, which will provide feedback on the model development. During the course of the project, we expect three cycles of the development, running, and validation of the model.

- ***WATer and global CHange***

Technology Agency of the Czech Republic is the support provider for this project (7A08036) and the chief beneficiary is **the T. G. Masaryk Water Research Institute, public research institution.** Project was funded using EEA / Norway financing mechanisms. Project ran between 2008 and 2010.

The Integrated Project (WATCH) brings together the hydrological, water resources and climate communities to analyse, quantify and predict the components of the current and future global water cycles and related water resources states, evaluate their uncertainties and clarify the overall vulnerability of global water resources related to the main societal and economic sectors. WATCH project: analyses and describes the current global water cycle, especially causal chains leading to observable changes in extremes (droughts and floods); evaluates how the global water cycle and its extremes respond to future drivers of global change (including greenhouse gas release and land cover change); evaluates feedbacks in the coupled system as they affect the global water cycle; evaluates the uncertainties in the predictions of coupled climate-hydrological- land-use models using and combination of model ensembles and observations; develops an enhanced (modelling) framework.

8.5 Systematic observations

Systematic observations, which are directly connected to the subject of climate change, are provided mainly through the Czech Hydrometeorological Institute which, in connection with Act No. 219/2000 Coll., on the property of the Czech Republic and acts thereof in legal

relations, and according to the founding document of the Ministry of the Environment of 2004, acts as the central State institute for the areas of air purity, hydrology, water quality, climatology and meteorology.

Its activities also encompass establishment of a state monitoring and observation network for monitoring the quantitative and qualitative condition of the atmosphere and hydrosphere and the causes leading to their pollution and damaging, processing of the results of the observations, measurements and monitoring while complying with the principles of the legislation of the European Communities, creation and administration of databases for the field and provision of up-to-date information on the state of the atmosphere and hydrosphere, including forecasts and warnings relating to dangerous hydrometeorological phenomena

In the sense of its authorization and in connection with climate change, CHMI acts as the regional telecommunication centre in the World Weather Watch system coordinated by WMO, as the national reference centre for Hydrological Operational Multipurpose System of WMO (HOMS), as the authorized professional entity for determining and evaluating the state of surface and groundwaters, the authorized professional entity for drawing up the hydrological balance, the meteorological calibration laboratory and the workplace of the flood forecast service.

A good database and its administration form the fundamental basis for all activities connected with protection of the climate of the Earth. The developed countries, including the Czech Republic, are working on development and improvement of modern databases, permitting integration of the available methods of observation and their coordination with similar activities on an international scale.

The programme database of the CLIDATA[30] system was created through cooperation between CHMI and ATACO s.r.o. in Ostrava and has been highly praised by WMO. The Czech CLIDATA programme system is based on the modern ORACLE53 database environment. It enables users easy transition from older database systems, especially the internationally used CLICOM system. Work with the CLIDATA system is lucid and comprehensible, but is protected against unauthorized access to the application. One of the main objectives in creating this system was maximum safeguarding of information contained in the database. It allows connection of the database with the geographic information system (GIS) and this connection can also be used to control data for other applications. The CLIDATA programme system was developed so as to enable simple creation of language mutations. CHMI uses CLIDATA for the following activities:

a. Metadata administration pertaining to meteorological, climatological and precipitation (including foreign) networks used by CHMI. This includes information on geographical location of stations, including their history, defining linkages between individual stations and previously used systems of station record-keeping, administrative classification of individual measurement points, definitions of the content of measurements in individual stations (measured elements, instruments used and time schemes from a single minute to monthly records) and description of measurement points and their graphical documentation (historical plans, photographs).

b. Administration of descriptive metadata (calculation methods, control mechanisms, importing methods, historical units, element tables and meteorological events, river basins, districts and other).

[30] http://www.clidata.cz

c. Acquisition and control of data, definitions of acquisition forms in line with current and historically used reports, definitions of control procedures in line with national requirements. Data verification during acquisition and imports, user control based on element and time consistence of data, spatial data control in GIS.

d. Archiving of climatologic records of the Czech Republic since 1775.

e. Calculation of derived climatologic data and characteristics (interval data, daily, decade, monthly and annual values, long-term averages and extremes, normal values).

f. Calculation and preparation of special climatologic products (wind rose, precipitation intensity, typical days, numbers of event days and more).

g. Preparation of data sets for forecasting and warning services (SIVS) and for evaluations in meteorology and climate sector (dealing with the regular and ad hoc agenda and requests for the meteorological and climatological information).

h. Preparation of CHMI web-based products (monthly and spatial reports, graphs of element development in regions, maps).

i. Application includes a section that is designated for work with phenological data (FENODATA), probe data (ADATA) and a section that cooperates with HYDROG forecasting model.

In connection with the increasing weather extremes and their manifestations in recent years, the warning system has been further improved on the basis of the innovated Integrated Warning Service System in the Czech Republic. This system includes forecast warning information on 26 dangerous phenomena and each phenomenon is awarded a danger level (low, medium, extreme). Information on the occurrence of dangerous phenomena is issued for five phenomena with extreme levels of danger[31]. A large number of stations with operative presentation of measured data and forecasts have been placed on the web site of the reporting and forecasting flood service [32]; the new version of presentation is more suitable for the needs and requirements of users.

In the framework of the Global Climate Observing System (GCOS), the Czech Republic participates only in meteorological atmospheric observations GCOS: in the network of GSN round-level stations at the Milešovka observatory, in the GAW network at the Hradec Králové CHMI Solar and Ozone Laboratory and at the CHMI observatory for monitoring the quality of the natural environment on a regional level, located in Košetice[33]. All three observatories adhere to the principles of climate monitoring introduced in GCOS/GOOS/GTOS. It has also been increasing international activities in the last few years. For example, the 15th congress of WMO supported the Intergovernmental GEO – *Group on Earth Observations*, of which the Czech Republic became a member in 2006. The programme of GEO encompasses the GEOSS programme – *Global Earth Observations System of Systems*. The Czech Republic is actively involved in the EU GMES/Copernicus, which represents the EU contribution to the global GEO program. The main objective of GMES/Copernicus is to ensure a continuous, independent and reliable access to data and information from the Earth observations for the EU. The Czech Republic is also actively participating in IBCS - *Intergovernmental Board for Climate Services* established following onto the 16th WMO congress.

[31] http://portal.chmi.cz/files/portal/docs/meteo/om/sivs/sivs.html

[32] http://hydro.chmi.cz

[33] CHMI Annual Report 2012, CHMI, Prague 2013

The Czech Republic became the full member of the EUMETSAT on 14. 4. 2010 after ratification of the Accession Agreement between EUMETSAT and the Czech Republic which was signed on 22. 6. 2009. Information from meteorological satellites are today in the Czech Republic one of the fundamental sources for forecasting and warning system. CHMI also operates, in cooperation with the Czech military hydrometeorological services, the Integrated Warning Services System where the satellites data are crucial.

The CHMI workplace in Hradec Králové acts as the European Dobson spectrophotometry calibration centre and, together with the workplace of the Slovak Hydrometeorological Institute, is also active in the area of measuring ozone and solar radiation levels. In 2007, the Czech Republic became a co-working member of the METEOALARM project of the EUMETNET (Network of European Meteorological Services organization. The project, which is available at the website [34], provides a rapid survey of warnings against dangerous meteorological phenomena in Europe.

The WMO is always appreciative about Czech foreign assistance provided to developing countries in meteorology and hydrology as this assistance is being requested more and more in connection with building up climate-related databases[35,36], where the CLIDATA system is currently at the cutting edge of available technology worldwide. By virtue of the system flexibility, easy administration and multi-language support, the system is capable of set up in any foreign country and for any meteorological service. In 2013, national meteorological services in 34 countries all over the world (e.g. Guyana, Georgia, Ethiopia, Nigeria, Jamaica, Latvia, Lithuania, Serbia, Montenegro, etc.) used the CLIDATA system (further information in Chapter 8.5). In addition, there are projects related to the capacity building support in developing countries reffered to in Chapter 7.2, respectively Annex 5 (e.g. *Capacity development in the field of engineering geology and hydrogeology in Ethiopia* and *Capacity building in environmental geology - mapping of geo-risk including hydrogeological condition in Dila and Hosaina areas*).

[34] http://www.meteoalarm.eu

[35] http://www.clidata.cz

[36] www.wmo.int

9 ENVIRONMENTAL EDUCATION AND PUBLIC AWARENESS

9.1 General policy

The obligation to promote environmental education and public awareness (EE&A) arises from valid legislation, the fundamental statute being Act No. 123/1998 Coll., on the right to information on the environment awareness and Act No. 561/2004 Coll. on School Education.

The key strategic and cross-sectional document for elaboration of detailed environmental programmes, including climate change, is the State Environmental Policy 2012 – 2020 (SEP). SEP defines EE&A as a "*long-term preventive instrument in the environment, aimed at limiting future damage on the environment caused by insufficient knowledge and awareness, and resulting incompetent decision-making processes"*. The SEP formulates the following measures in this respect:

- Use all levels of education system (including pre-school and extra-curricular), training and adult education to increase environmental awareness / literacy.
- Increase environmental awareness of the general public by provision of systematic information, edification and eco-counselling.
- Provide quality information, support information exchange, awareness and enlightenment.
- Ensure efficient application of the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention).

The Sustainable Development Strategy (SDS) for the 2004 – 2009 period (update process commenced in 2007) stipulates that one of the main priorities of sustainable development is protection of the Earth's climate system. Government Resolution No. 37 dated 11. 1. 2010 approved the Strategic Framework for Sustainable Development (SFSD) of the Czech Republic, which is compliant with the updated SDS. SFSD defines Priority 1.2 / Objective 2 as achieving "Reduction in consumption and its impact on the economic, social and environmental sector." This objective is to be achieved by implementing awareness campaigns supporting sustainable consumption patterns, projects contributing to information exchange on initiatives aiming to achieve sustainable production and consumption at local level in the Czech Republic and a host of similar measures.

The above documents that are broader in their scope are complemented by specific EE&A strategies, which include:

- The State EE&A Programme (Government Resolution No. 1048/2000). The key objective of this programme is to raise awareness and knowledge of the environment amongst the population, education towards a sustainable development and public participation in environmental matters.
- The Action Plan of the State EE&A Programme for 2010 – 2012 (Government Resolution No. 1302/2009) and previous Action plans.
- Strategy of Education for Sustainable Development in the Czech Republic (Government Resolution No. 851/2008).

Key documents in terms of school environmental education and awareness include:

- The Methodological Instruction of the Ministry of Education, Youth and Sports on EE&A – updated in October 2008 (replaces the older document of December).
- Individual framework education programmes (see below), which should introduce environmental education as a compulsory cross-cutting subject for all types and levels of schools.

The Intersectoral Agreement on cooperation in the area of environmental awareness, education and communication was concluded between the Ministry of the Environment and the Ministry of Education, Youth and Sports in 2004 and was updated and specified by addenda in 2007. Both ministries emphasize environmental education, communication and public awareness.

The Government Council for Sustainable Development (Council) was established by Government Resolution No. 778/2003 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 Council created the Working Group for education for sustainable development.

The regions have become important actors in EE&A in recent years, where each region formulates their own EE&A concepts and funding mechanisms.

9.2 Education system

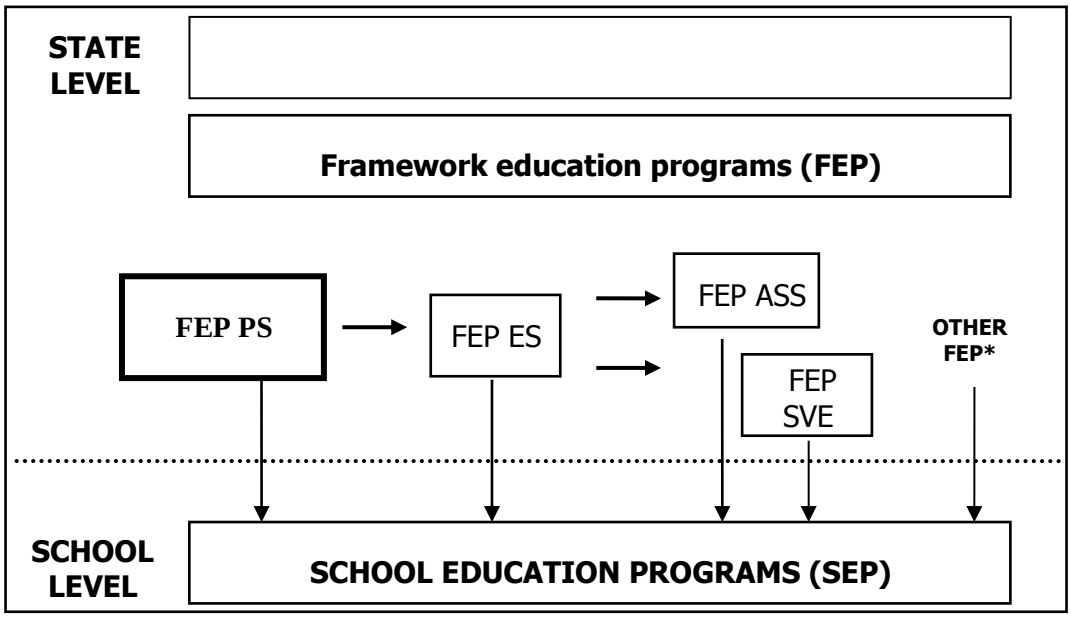
EE&A is a part of the National Programme of Development of Education in the Czech Republic – the so-called White Paper (2001). One of the main provisions of the programme consists in education in environmental protection in the sense of providing for sustainable development in society. The Act on Schools of 2004 stipulates acquiring knowledge of the environment and its protection based on the principles of sustainable development as one of the components of a general education. The Strategy of Lifelong Learning, adopted in 2007 by Government Resolution No. 761, mentions, in the main strategic directions, social partnership, intended to promote harmonization of educational opportunities with the needs of economic, environmental and social development and also contains proposals for measures that emphasize sustainable development. The long-term plan for education and development of the educational system in the Czech Republic was also adopted in 2011 in Government Resolution No. 836. It also contains proposals for measures emphasizing sustainable development and describes the reasons for reform steps in education, based, amongst other things, on the role of education as a guarantee of sustainable development.

9.2.1 Formal education

In accordance with the new principles of curriculum policy formulated in the White Paper and new Act on Schools, a new system of curriculum documents for education of children from the age of 3 and pupils aged 6 to 19 years is being introduced into the educational system. Curriculum documents are created at two levels – state and school. Framework educational programmes (FEPs) constitute the central / state level of the curriculum system. FEPs delimit the required content, scope and conditions of education for every field of education in basic and secondary education and pre-school, elementary art and language education. The school level corresponds to school education programmes (SEPs), according to which education is provided at the individual schools. Each school creates its own school

environmental programme according to the principles laid down in the FEP. Framework and school education programmes are public documents available for the pedagogical and general public.

Figure 9.1: System of curriculum documents



Legend:

FEP PS – Framework education program for preschool education; FEP ES - Framework education program for elementary education; FEP ASS – Framework education program for academic secondary schools; FEP SVE -- Framework education program(s) for secondary vocational education.

** Other FEP – 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.*

Source: MEYS

Framework education programmes include cross-sectional issues that are concerned with education and training of students in selected socially important and topical areas. These aspects are a compulsory part of SEPs.

Cross-cutting subjects in FEP for elementary, secondary academic and secondary vocational education encompass topics that are important for education on climate change – especially "Man and the Environment" (in FEP secondary vocational education), or "Environmental education" (in FEP elementary education and FEP secondary academic education, and also, e.g., "Education in thinking in European and global context."

A methodical web site (http://www.rvp.cz/) has been set up to support schools and pedagogues in creating and planning school education programs, including sections concerned with cross-sectional topics, including EE&A for the individual FEPs.

The Methodical Instruction of the Ministry of Education, Youth and Sports (MEYS) on EE&A in schools and educational facilities, which replaced the 2001 version, was also updated in 2008. This document describes in detail the system of environmental education in schools and educational facilities; it also introduces and describes the function of the school coordinator of EE&A and recommends how to plan and incorporate EE&A into school documents, etc.

9.2.2 Preschool education

Since September 1, 2007, all kindergartens work with their own school education programmes created on the basis of the updated version of the Framework education programme for preschool education, which came into effect in 2004. The area of environment "Child and the World" is one of five basic areas in which individual targets and outputs of preschool education are set.

A national network called the Mrkvička (Little Carrot) network has been in existence since 2007 for kindergartens that are interested in EE&A (approximately 770 kindergartens in all the regions participate in that network). The objective of the project is to implement modern environmental education in kindergartens and provision of up-to-date information and guidelines for kindergarten teachers. A wide range of environmental educational programmes of environmental education centres is available for kindergartens, which is supported, for example, by the joint programme of the Ministry of the Environment and the Ministry of Education, Youth and Sports and National network of EE&A centres.

9.2.3 Elementary education

The Ministry of Education, Youth and Sports issued FEP for elementary education in 2004, with validity from 2005. Environmental education appears in the FEP for elementary schools at key competences level, targeted educational areas (educational goals), outputs and teaching in some fields of education and is simultaneously a cross-cutting topic that must be included at levels 1 and 2. According to the conditions for school integration, cross-cutting topics can be included in various subjects in the form of projects or courses and also in the form of an independent subject concerned with the environment.

Several hundred elementary schools interested in EE&A are associated in the M.R.K.E.V. network or the Environmental Education Club and in a number of school environmental projects. The best known include the Eco-school project (Tereza Association) and the School for sustainable life (Partnership Foundation and SEVER – Centre of Environmental Education and Ethics). A wide range of aids, publications and also environmental educational programmes provided by lecturers from environmental education centres are available for elementary schools. These are either short programmes for several teaching hours or several days long with accommodation in the centres.

9.2.4 Secondary education

The Ministry of Education, Youth and Sports issues FEPs for 2 secondary academic education levels (gymnasia) and 283 high schools in three stages. Gymnasia curriculums include in their SEPs cross-cutting topic "Environmental Education" and all secondary vocational levels include "Man and the environment". There are 26 secondary schools that even have professionally focused curricula focusing on the protection of the environment. These include topics such as "Ecology and the environment," or "Industrial ecology." Some of the best examples of emphasis being placed on environmental education in SEP are available at Gymnasium Přírodní škola in Prague, EKO Gymnasium Brno or EKO Gymnasium and Secondary Vocational School in Poděbrady. A large number of secondary schools are also associated in the Environmental Education Club and make use of school environmental projects, based on one-day and several-day environmental education programmes.

9.2.5 University education

Over 100 fields of study at universities are available at bachelor, masters and post-gradual levels which are concerned with EE&A. EE&A is a part of mandatory-optional, or purely optional or selective courses in departments curricula involved mostly in liberal arts, public administration, civic sector, regional policies, agriculture or architecture. EE&A courses re being taught at almost all public universities (an exception are art schools) and at several private universities.

The potential for an interdisciplinary approach and cooperation amongst universities is one of the fundamental EE&A approaches at the university level. Some universities concluded agreements allowing their students to choose from courses taught at various universities in addition to their own. There is an automatic possibility to choose courses offered in various departments within the university. This fluidity offers a wide range of EE&A courses to all students who may have an interested in this topic.

E-learning courses offer additional instruction in sustainable development in interdisciplinary or international setting: such as Virtual Campus for Sustainable Europe bringing together European universities; or European Virtual Seminars, Virtual Campus for Sustainable Europe, PASDEL).

Universities offer EE&A-related courses to all senior citizens of the Czech Republic within the "Lifelong Learning" programmes (for instance course entitled "Man, energy and waste" taught at Czech University of Life Sciences in Prague). Lifelong learning programmes are a priority for the Ministry of Education, Youth and Sports, which finances these activities from the state budget.

The university training of future teachers deserves special attention - there are 37 faculties in the Czech Republic that perform this function. Students at pedagogic faculties may choose from a wide range of environmentally focused courses, at their own schools or elsewhere, and use domestic or international e-learning course, summer schools etc.

An electronic web encyclopaedia "Enviwiki" (http://www.enviwiki.cz) has been created to support education of all students not just for the benefit of future pedagogues. The Centre of environmental studies has been publishing its own electronic magazine for environmental education "Envigogika" since 2006.

A growing demand for specialists who will be able to theoretically and practically solve current and future issues in the environmental area resulted in creation of independent faculties focusing solely on the environment. The Charles University established its own Environment Center. The Faculty of Natural Sciences opened its own interdisciplinary Institute for Environmental Studies, which provides courses and preforms related environmental research. The Institute of Chemical Technology, Prague opened a specialized Faculty of Environmental Technology offering study programs that are designed for students who wish to study a field that represents an interdisciplinary synthesis of technical chemistry, ecology, biological sciences and sciences dealing with the living environment. The Faculty of Economics at University of Economics in Prague, has its own Department of Environmental Economics, which contributes to the research of current environmental problems, on the theoretical basis as well as in practical applications providing perspective of environmental dimension of economic development and interface of ecological politics with other political subjects.

The Environment Center at Charles University initiated establishment of a "Forum of University Teachers: Education for sustainable future". The objective of the Forum is to contribute to clarification and generation of content, scope and methods of education for

sustainable development and to ensure mutual awareness, promote cooperation in preparation of courses, lectures and teaching materials, research and project work.

EE&A also forms a part of the lifelong learning courses offered by the universities, whether in short-term and long-term form focusing on improving qualification in employment, or as a hobby. These courses are offered in full-time or part-time study as specialist, requalification, and additional or supplemental education.

EE&A is also a part of objectives stipulated by the Strategy for Education for Sustainable Development in the Czech Republic (2008-2015), approved by the Government on 9 July 2008 and in Action plan to the Strategy (specific measures for 2011 and 2012), approved on 23 February 2011, in university education sector.

9.2.6 Further education of pedagogical workers

Further education of pedagogical workers is also an important area. The Ministry of Education, Youth and Sports is responsible for integration of the elements of environmental education and awareness into the post-graduate education of pedagogues. A number of NGOs and educational facilities offer certified EE&A seminars and courses for pedagogues lasting from several hours to several dozen hours.

Between 2005 and 2012, there have been **38 specialised studies** integrating efforts of 11 organizations. Specialization course in EE&A takes up to 250 hours. These studies were implemented by NGOs, civic association or publicly beneficial organization (a total of 27 studies) and universities (3) or other schools and institutions.

9.2.7 Informal education

The education system (and thus also EE&A) encompasses both activities taking place at schools and educational facilities (formal education) and also in employers' facilities of, private educational institutions, NGOs, school facilities and other organizations (non-formal education), as well as unorganized, every-day experience and activities at work, in the family, during free time, interactions with society and nature and through the influence of the media (informal learning).

The State EE&A Programme and the regional EE&A concepts also pay great attention to education of various target groups. Action plan supporting the State EE&A Programme was in force in 2010-2012 with outlook to 2015. The Ministry of the Environment and the Ministry of Education, Youth and Sports are in negotiations on integrating strategic documents for EE&A and environmental consulting onto one strategic document and one action plan. These documents will remain controlled by the Ministry of Education, Youth and Sports, which will also coordinate activities of related interdepartmental working group. The Ministry of the Environment will remain responsible for EE&A as a whole. The State EE&A Programme remains in force and its key objectives are being fulfilled.

E-learning program for state administration employees and officers focusing on environmental education prepared by the Ministry of the Environment in 2011 has been transferred over to the Institute for Public Administration (under the Ministry of Interior of the Czech Republic). Some of the training sessions are implemented by NGOs such as by the National Network of Healthy Cities or Czech Ecological Management Centre (CEMC). Training sessions focus on legislation, EMAS, ISO standards, cleaner production, voluntary agreements, waste economy, packaging, chemicals and hazardous substances, monitoring,

modern technologies, international and national experience, work with the general public, codices and charts in this area etc.

A wide range of extracurricular education for children and young people is available, with participation of numerous of school institutions and NGOs.

NGO's also play an important role. Greenpeace, the DUHA Movement, the CZ Biom Association and others are systematically involved in climate change-related issues.

Support for EE&A related to climate change is also provided by some important foundations, such as the Partnership Foundation, the Foundation for the Development of a Civic Society, the Via Foundation and the Open Society Fund, and also regional foundations – for example, the Foundation for the Jizera Mountains and the Community Foundation of Ústí nad Labem.

Governmental institutes in the area of the environment participate in environmental education of the general public – in addition to the Ministry of the Environment (see below), also the Regional Authorities, Administrations of Protected Landscape Areas and National Parks, CENIA, the Czech Environmental Information Agency, the Nature Conservation Agency of the Czech Republic as well as other institutions.

Each year, the Ministry of the Environment opens a tender for projects formulated by civic associations. Detailed results of all supported projects in this area since 1997 are available at www.projektymzp.cz. Between 2009 and 2011 the Ministry of the Environment supported a total 22 projects in EE&A sector focusing on climate change and the total funding amounted to 5.4 million CZK. There was no project supported in this area by the Ministry of the Environment in 2012.

9.2.8 Summary of supported projects in individual years

2009

Project	Author
Measures aiming to reduce energy intensity of panel houses	EkoWATT
Solar power generation on buildings - experience for future development	EkoWATT
Development of database of details for passive houses	Centrum pasivního domu
Ekolist.cz and climate change	BEZK
Climate calculator on www.zmenaklimatu.cz	Calla
Exhibition "Greenland, land of vanishing ice and dramatic climate change"	Polární svět, a.s.
Information campaign promoting reduction of greenhouse gas emissions	Hnutí Duha – Přátelé Země ČR
Involving NGOs in informing on the EU and international climate agenda	Zelený Kruh
Protection of climate on local level	ZO CNCS Veronica

2010

Project	Author
With your own eyes – savings and renewable energy sources in buildings	ZO CNCS Veronica

Information campaign promoting reduction of greenhouse gas emissions	Hnutí Duha – Přátelé Země CR
Local contribution to climate protection in municipalities – guidelines for climate protection	Civitas per populi
Climate protection – educational programme not only for public administration	ZO CNCS Veronica
Climate protection and renewable energy sources – Energy for third millennium	Pravoslavná akademie Vilémov
Carbon detectives – education of pedagogues and students on CO_2 emissions	ZČ HB Sever
Publishing the "Air Protection" magazine in 2010	Protection of air quality

2011

Project	Author
Information campaign promoting reduction of greenhouse gas emissions – practical examples	Hnutí Duha – Přátelé Země CR
How to teach about climate change?	Asociace pro MO, a.s.
Promoting Covenant of Mayors in the Czech Republic	PORSENNA, o.p.s.
Carbon detectives – education of pedagogues and students on climate change	ZČ HB Sever
Awareness campaign – Comparing quality of built passive houses in the Czech Republic from environmental perspectives	EkoWATT
Practical information for development of energy plant cultivation and fast growing plant life	CZ BIOM – Czech Biomass Association

Some of the examples of individual project implemented by NGOs between 2009 and 2012 are given in the Annex 7.

9.3 Financing

EE&A is financed in the Czech Republic from various sources, the most important sources being the state budget and funds, local government funds (municipality budgets), EU funds, foundations, private funding and own funding of various NGOs.

Funds from public administration expended both in the form of financing of the activities of the bodies of the public administration and the activities of directly subordinate organizations, and also in the form of grants, subsidies and contracts for other entities.

Amongst the grant and subsidy support for EE&A activities provided from national sources the most important are programmes run by Ministry of the Environment (since the early 90s for NGOs), the Ministry of Education, Youth and Sports (new programmes since 2007 for NGOs and schools) and regions (gradually established since 2002).

Another significant source of funding are contracts for EE&A services. The largest contract since 1999 is tendered by the Ministry of the Environment to establish National EE&A network, amounting to approximately 5 million CZK annually, which has been called since 2008 jointly with the Ministry of Education, Youth and Sports and extended to reach approximately 10 million CZK annually. In 2012, these public contracts were replaced by subsidies provided to Regions and reduced, due to austerity measures affecting the entire budget, to about 2 million CZK. The State Environmental Fund of the Czech Republic (SEF) is another source, both for investment and non-investment projects. In recent years SEF supported establishment of centers and consulting offices. The subsidy programmes in the

EE&A sector have undergone a change since 2008 – there is a subsidy programme for centers and consulting in Prague (outside Prague these activities are funded from European funds – see below), and another one covers networking of education centres and consulting bureaus and education programs focusing on selected topics – within the framework of the first Call, one of the three priorities included the topic "climate change and protection of the air." Additional calls addressed current topics in the environmental sector. In the past, SEF also supported the "Sun to Schools" programme focused on installations of photovoltaic or photo-thermal low-output equipment in schools facilities. This program was 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.

In 2010, a new programme was established to support curative stays of children from regions suffering from bad air quality. These stays of 10 to 15 days focus on EE&A and take place in recreational facilities, EE&A centres etc.

Between 2004 and 2008, funding from Human Resources Development Operational Programme represented another significant source of funding, itself financed from the European Social Fund. Three calls within that programme established a Network of environmental information and consulting centres in individual Regions and supported their activities.

In 2007, the first call within the new Operational Programme Environment (OPE) programming period was announced focusing on building and reconstructions EE&A centres; additional calls for EE&A-related programmes were made in 2008 from the Education for Competitiveness Operational Programme (ECOP). The OPE and ECOP programming periods end in 2013. In the new programming period, the EE&A sector is to be supported from the Operational Programme Research, development and Education (non-investment activities) and to a smaller degree from Integrated Operational Programme (investment activities). Eventual support from Operational Programme Employment (lifelong learning) is in negotiation.

EE&A is also financed by foundations and by private sector – Lesy ČR (Forests CR – state forest management authority) support the "Forest in Schools, schools in the forest" programme and project for creations of aides, education programs and seminars, educational footpaths etc.); Toyota company support the "School of sustainable development" and "Green package" projects; furthermore EKO-KOM supports packaging-related EE&A activities, plus additional projects supported by water management and waste management companies.

9.4 Related legislation

Act No. 106/1999 Coll., on free access to information, as amended, outlines the conditions of the right to free access to information by the public and lays down conditions for provision of information. For the purposes of this Act, 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 which is available to the state administrative bodies, territorial self-governing bodies and legal persons established, directed or authorized by them. Amendment of this Act, which is in the process of preparation, reformulated Article 13, which regulates environmental education and awareness and newly

should also regulate environmental consulting. This amendment failed to clear all hurdles prior to the Parliament being dissolved in summer 2013, and we cannot presume whether the new Parliament will adopt this regulation anew.

Act No. 561/2004 Coll., on preschool, elementary, secondary, higher vocational and other education, as amended (*School Act*) came into force on 1 January 2005. The preamble of this Act defines "acquisition and application of knowledge about the environment and its protection based on principles of sustainable development" as one of the general targets of education, and thus the EE&A must be seen as a priority reflected in the entire Act.

9.5 International activities

Organizations in the Czech Republic participate in a number of international projects concerned with environmental communication, education, and public awareness. Some of these activities are supported methodically and financially directly by the Ministry of the Environment and Ministry of Education, Youth and Sports.

The *GLOBE* programme is a global programme for schools, which the Czech Republic joined together with other countries in 1995. For the *GLOBE* programme, 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* programme, 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 center in the USA. The project also includes monitoring the carbon cycle, with participation by about 400 pupils at 14 schools.

Several projects are also underway in the Czech Republic in the framework of the "Intelligent Energy – Europe" grant programme of the European Commission. The SEVEn organization participates in the Cities with sustainable energy consumption project, concerned with promoting examples of sustainable energy consumption at an urban level in the new EU Member States; in 2008, the Carbon Detectives project for elementary schools and the Intelligent Use of Energy at School project for secondary vocational schools, with participation of the SEVER centers were newly approved.

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

Several EE&A projects were also implemented within the framework of bilateral, mostly cross-border cooperation with Polish, German, Slovak, Serbian and Austrian organizations. These included projects in the area of environmental consulting, environmentally oriented kindergartens or EE&A for children and youths.

ANNEXES

ANNEX 1 Biennial Report

FIRST BIENNIAL REPORT OF THE CZECH REPUBLIC

Accompanying the document:
Sixth National Communication
of the Czech Republic
under the United Nations Framework Convention on
Climate Change

CONTENT

1. Introduction

The first Biennial Report of the Czech Republic (BR1) was prepared under Decision 2/CP.17 of the Conference of the Parties to the UNFCCC and was submitted as an Annex to the 6th National Communication of the Czech Republic under the UNFCCC (NC6).

This document is structured according to an outline defined in Annex 1 of the Decision 2/CP.17. Provisions of many chapters are reflecting information already provided in the Czech 6th National Communication in its corresponding chapters. Some required provisions were merely referenced pointing to corresponding chapters in the Czech 6th National Communication. Although the outlines of Biennial report and National Communication are not completely identical we believe the structural and informational integrity has been retained in both documents.

Tabular information as defined and required by the UNFCCC Biennial report guidelines has been enclosed in the CTF annex at the end of the Czech first Biennial report and also submitted electronically through UNFCCC Application and Network Access Portal.

Abbreviations

To avoid confusion please check abbreviations in the List of Abbreviation of the Czech 6th National Communication.

2. Information on GHG emissions and trends

Since its 5th National Communication on Climate Change (NC5), the Czech Republic has:

- more accurate and comprehensive emissions estimates following the adoption of new data, methods and source/sink categories;
- improved the national inventory system through strengthening of the planning and quality control systems.

2.1 Introduction and summary information from the Czech national GHG inventory

Annual monitoring of greenhouse gas emissions and removals is one of the obligations following from the *UN Framework Convention on Climate Change* and its *Kyoto Protocol*. In addition, as a result of membership in the European Union, the Czech Republic must also fulfil its reporting obligations concerning GHG emissions and removals following from Regulation of the European Parliament and Council No.525/2013/EC. This Regulation has succeeded the Decision of the European Parliament and Council No. 280/2004/EC and we are currently in the state of transition since the implementing legislation for monitoring and reporting is not yet in place

The *Czech Hydrometeorological Institute* (CHMI) was appointed in 1995 by the *Ministry of the Environment* (MoE), which is the founder and supervisor of CHMI, to be the institution responsible for compiling GHG inventories. Thereafter, CHMI has been the official provider of the Czech greenhouse gas emission data. The role of CHMI was improved following implementation of the establishment of the National Inventory System (NIS) in 2005, when CHMI was designated by MoE as the coordinating institution of the official national GHG inventory. Further information on the institutional arrangement of the Czech National Inventory System is provided in chapter 3.3.2 of the 6th National Communication of the Czech Republic.

The inventory covers anthropogenic emissions of direct greenhouse gases CO_2, CH_4, N_2O, HFC, PFC, SF_6 and indirect greenhouse gases NO_X, CO, NMVOC and SO_2. Indirect means that they do not contribute directly to the greenhouse effect, but that their presence in the atmosphere may influence the climate in various ways. As mentioned above, ozone (O_3) is also a greenhouse gas that is formed by the chemical reactions of its precursors: nitrogen oxides, hydrocarbons and/or carbon monoxide.

The trends of the greenhouse gas emissions are described in the chapter 3.1 of the 6th National Communication of the Czech Republic. More detailed information about greenhouse gas inventory and about each greenhouse gases is provided in the chapter 3.2. of the 6th National Communication of the Czech Republic, i.e. in the chapters 3.2.2.1 for CO_2, 3.2.2.2 for CH_4, 3.2.2.3 for N_2O and 3.2.2.4 for F-gases.

The results of the Czech greenhouse gas inventory for the 1990 – 2011 period are presented in the CTF Table 1.

These results are taken from the National Inventory Report (NIR), which was submitted to the secretariat of the UN Framework Convention on Climate Change in April 2013. CTF Table 1 gives four trend tables, where are tables related to the main greenhouse gases (CO_2, CH_4 and N_2O) and also to the overall (aggregate) greenhouse gas emissions expressed in CO_2 equivalents.

In accordance with UNFCCC requirements on data outputs, the total emissions in CTF Table 1 are given both including emissions and sinks in the Land Use, Land Use Change and Forestry (LULUCF) sector and also without inclusion of this sector. Overall (aggregated) emissions for all the sectors (excluding LULUCF) decreased by 34.8 % from 1990 to 2011.

The trends in emissions and sinks in the main inventory categories are also depicted in Fig. 3.1 in the 6th National Communication of the Czech Republic. 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 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. The decrease in emissions from the Energy sector (stationary combustion) and the Agricultural sector has been substantial, but emissions from Transport are continuing to increase. Fig. 3.2 in the 6th National Communication of the Czech Republic depicts the share of individual sectors on the total greenhouse gas emissions in the 1990 – 2011 period.

3. Quantified economy-wide emission reduction target

The EU and its Member States committed themselves, in accordance with Art. 4 of the KP, to jointly fulfil quantified economy-wide emissions target for the 2nd commitment period of reducing greenhouse gases emissions by 20% in comparison with 1990. However, the ratification process adopting this particular change in KP, amended in Doha on 8 December 2012, has not been yet completed, on the EU or the national level.

The level of this commitment corresponds to the requirement for reduction of greenhouse gases emissions as determined by the relevant EU legislation within the framework of the so-called climate and energy package. The key parts of the package are Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC and Decision No. 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020; Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC further defines targets for share of renewable sources in final energy consumption by 2020.

Detailed information regarding this joint commitment is provided in the EU submission to UNFCCC dated 20 March 2012, and contained in document FCCC/AWGLCA/2012/MISC.1. The potential increase of the target to 30% remains valid under the condition that other developed countries will commit themselves to comparable increase of emission reduction targets and developing countries will contribute adequately according to their respective capabilities. Emissions and sinks from LULUCF are not a part of this quantified target. Valid legislation also contains limits for the use of credits from flexible mechanisms.

The issues related to accounting for and evaluation of progress are regulated by Regulation (EU) No. 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No. 280/2004/EC. In line with the KP, the reference year for emissions in the Czech Republic is 1990 for carbon dioxide, methane and nitrous oxide emissions and 1995 for fluorinated gases. For Tabular summary please see CTF Table 2 and 3.

4. Progress in achievement of quantified economy-wide emission reduction targets and relevant information

The Czech Republic committed itself to reduce its greenhouse gas emissions between 2008 and 2012 by 8% in comparison with 1990. Between 1990 and 2011 the total greenhouse gas emissions in the Czech Republic excl. LULUCF, fell by 31.9% and incl. LULUCF by 34.8%. The Czech Republic therefore does not plan to use flexible mechanisms to meet its commitment in the first KP commitment

period. On the contrary, the Czech Republic has already sold, on international emission trading markets, more than 100 million AAUs, which represent the majority of the anticipated surplus in this period. The revenue was used to finance the so-called Green Investment Savings Programme seeking to achieve further energy savings. Following table gives overview of the use of credits from flexible mechanisms by facilities operators falling under the EU ETS, which represents approximately 60% of greenhouse gas emissions in the Czech Republic.

Use of credits from flexible mechanisms within the EU ETS

Unit type	Removed by stationary facility operators	Removed by aircraft operators	Removed total
CER	19 874 444	79 350	19 953 794
ERU	18 735 943	56 346	18 792 289
Total CER/ERU	38 610 387	135 696	38 746 083
EUA/EUAA[1]	375 918 343	907 820	376 826 163

[1] *EUA – stationary facility emission allowance, EUAA – aircraft emission allowance* *Source: OTE, a.s., MoE*

In the second commitment period, the Czech Republic will fulfil its quantified objective jointly with other EU Member States. According to Member States' projections submitted in 2013, in line with Decision of the European Parliament and the Council No. 280/2004/EC, with inclusion of international aviation, it is anticipated that EU emissions in 2020 will be 21 % lower than in 1990 and 22% lower if international aviation is excluded. EU-28 countries are well on the way to meet the EU objective by 2020. 13 Member States will nevertheless need to make extra effort to meet the 2020 objective in certain sectors outside the EU ETS. 15 Member States, including the Czech Republic, expect, according to current estimates, to achieve these objectives without the necessity to adopt new policies and measures. More detailed information on progress monitoring and meeting the objectives are available in the European Commission report to the European Parliament and the Council of the European Union on progress towards Kyoto and 2020 objectives (COM (2013) 698 final).

For further information on relevant mitigation policies and measures please see chapter 4 of the 6th National Communication of the Czech Republic. Summary overview of all quantified implemented or prepared measures on national level in the Czech Republic is given in Annex 4 of the 6th National Communication of the Czech Republic.

For Tabular summary of mitigation progress please see CTF Table 3 and 4.

5. Projections

Projections were prepared in accordance with the required methodology in particular pursuing two scenarios:

• Emission projection with existing measures, i.e. with implemented measures, which came into force before June 2012

• Emission projection with additional measures, i.e. with measures that are currently prepared or under preparation.

Additional measures included in preparation of projections are:

- Implementation of Energy Performance of Buildings Directive (Directive 2010/31/EU)

- Measures adopted on the basis of the EU Climate and Energy Package, e.g. continuation of EU ETS with full or partial auctioning of emission allowances

- Measures introduced on the basis of the prepared Regulation of the of the European Parliament and of the Council, laying down emission standards for new passenger cars (COM(2007)0856).

Information on projections of greenhouse gases emissions is given in detail in chapter 5 - Greenhouse gas emissions projections of the 6th National Communication.

For broad summary of Projections please see CTF Table 5 and 6.

5.1 Changes in Projection system, Methodology

The methodology employed for preparation of emission projections is identical with the methodology required for preparation of projections for 5th National Communication and remained the same during last 4 years. Progress in methodology innovations are bound to planned systematic improvement - projection preparation and development shall be transferred to a brand new system for policies, measures and projections. Detailed provisions of this new institutional arrangement are currently under development and are to be decided in 2014.

Current methodology includes following set of steps:

1. Acquisition of inventory of greenhouse gases
2. Selection of base and final year and cross-cutting years for creating projections,
3. Selection of the actual methodology and model instruments for preparing the projection,
4. Collection and analysis of input data for the projection,
5. Establishment of initial assumptions,
6. Definition of scenarios,
7. Calculation of scenarios and presentation of their results,
8. Execution of sensitivity analysis over projected data and sets of assumptions

Information on provisions of individual steps is given in detail in its appropriate sub-chapters in the 6th National Communication.

6. Provisions of financial, technological and capacity-building support to developing country Parties

The Czech Republic as a Party not included in Annex II to the Convention and is not obliged to adopt measures, in line with Article 12.3 of the Convention and fulfil obligations pursuant to Articles 4.3, 4.4 and 4.5 of the Convention and create additional financial sources. Nevertheless, the Czech Republic is willing to provide to the certain extent available information on the financial support provided to developing countries in the years 2011 and 2012.

The climate financial support provided to developing countries through the Czech bilateral or multilateral cooperation is partially or fully credible for Official Development Assistance in accordance with the OECD-DAC methodology. More detailed information about our sectoral or territorial priorities are included in chapter 7 of the 6th National Communication of the Czech Republic.

All the funds are reported in Czech crowns (CZK). The methodology used for calculating currency exchange is the Annual Average Exchange Rates announced by the Czech National Bank. The used exchange rates are as follows: 2011: 1 USD = 17,69 CZK, 2012: 1 USD = 19,59 CZK.

The climate specific funding provided through the bilateral or multilateral channels has been identified in accordance with the OECD-DAC methodology. Only projects with adaptation or mitigation RIO Markers (significant or principal objective) have been included the climate specific funding. Other financial support provided to developing countries, which is also accountable for Official Development Assistance, but where the climate related component couldn't be identified, has been reported as the core/general funding in the BR1 CTF tables.

For the reason that the Czech Republic has not contributed to any specific programme aimed at capacity building or technology transfer in developing countries, the CTF Table 8 and Table 9 remain blank. However, many Czech bilateral projects also have the capacity building or the technology transfer element and these projects are reported among the other projects in CTF Table 7(b).

7. Other reporting matters

No other reporting matters supplied in this submission

CTF Annex: Common Tabular Format workbook for the 1st Biennial Report of the Czech Republic

Overview of CTF tables provided with the first Biennial Report:

CTF Table 1: Emission trends

CTF Table 2: Description of quantified economy-wide emission reduction target

CTF Table 3: Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

CTF Table 4: Reporting on progress

CTF Table 4(a)II: Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

CTF Table 4(b): Reporting on progress

CTF Table 5: Summary of key variables and assumptions used in the projections analysis

CTF Table 6(a)/(c): Information on updated greenhouse gas projections under a 'with measures' scenario and under a 'with additional measures' scenario

CTF Table 7: Provision of public financial support: summary information

CTF Table 7a Provision of public financial support: contribution through multilateral channels

CTF Table 7(b): Provision of public financial support: contribution through bilateral, regional and other channels

CTF Table 1

GREENHOUSE GAS EMISSIONS	Base year[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	(%)
CO_2 emissions including net CO_2 from LULUCF	161,063.42	145,166.86	129,061.30	126,342.64	119,647.89	120,716.21	124,726.58	122,787.35	116,087.53	108,360.14	118,075.11	117,473.69	114,371.25	119,617.89	120,188.53	118,926.93	123,501.76	126,412.32	117,067.00	107,424.34	112,368.94	106,270.18	-34.02
CO_2 emissions excluding net CO_2 from LULUCF	164,812.75	154,306.92	139,954.47	135,893.77	126,908.55	128,037.89	132,486.96	129,595.98	123,216.89	115,636.37	125,711.08	125,466.64	122,126.15	125,510.87	126,509.64	125,744.39	127,127.71	127,346.27	122,004.67	114,427.74	118,005.01	114,296.49	-30.65
CH_4 emissions including CH_4 from LULUCF	17,915.09	16,277.58	15,339.56	14,420.96	13,575.80	13,395.62	13,274.42	13,018.90	12,571.32	11,975.71	11,176.34	10,886.27	10,501.16	10,445.75	10,155.47	10,513.46	10,816.51	10,470.03	10,532.74	10,205.50	10,412.56	10,288.77	-42.57
CH_4 emissions excluding CH_4 from LULUCF	17,815.07	16,203.01	15,261.06	14,330.42	13,482.53	13,308.12	13,159.11	12,894.28	12,462.46	11,875.05	11,083.87	10,789.99	10,397.68	10,316.49	10,036.85	10,400.20	10,676.46	10,288.20	10,389.11	10,084.05	10,284.36	10,233.67	-42.56
N_2O emissions including N_2O from LULUCF	13,364.89	11,587.58	10,344.24	9,163.61	9,007.81	9,278.46	8,875.16	8,955.67	8,760.40	8,593.51	8,697.13	8,859.36	8,561.65	8,060.21	8,753.05	8,443.31	8,277.19	8,313.75	8,436.79	7,896.25	7,639.11	7,782.94	-41.77
N_2O emissions excluding N_2O from LULUCF	13,333.53	11,559.36	10,316.50	9,135.88	8,981.50	9,254.38	8,850.73	8,932.50	8,737.84	8,572.98	8,677.87	8,840.60	8,542.76	8,039.14	8,733.51	8,424.61	8,255.95	8,288.47	8,415.61	7,877.41	7,619.70	7,770.95	-41.72
HFCs	NO	NO	NO	NO	NO	0.73	101.31	244.81	316.56	267.47	262.50	393.37	391.29	590.14	600.30	594.21	872.35	1,605.85	1,262.45	1,020.25	1,467.85	1,130.42	100.00
PFCs	NO	NO	NO	NO	NO	0.12	4.11	0.89	0.89	2.55	8.81	12.35	13.72	24.53	17.33	10.08	22.56	20.16	27.48	27.14	29.43	29.43	100.00
SF_6	77.68	77.32	76.96	76.60	76.24	75.20	77.52	95.48	64.19	76.98	141.92	168.73	67.72	101.25	51.89	85.88	83.07	75.85	47.04	49.61	16.22	34.55	-55.52
Total (including LULUCF)	192,421.08	173,109.33	154,822.06	150,003.81	142,307.75	143,466.34	147,059.10	145,103.09	137,800.88	129,276.37	138,361.80	137,793.77	133,906.79	138,839.78	139,766.55	138,573.86	143,573.44	146,897.96	137,373.51	126,623.08	131,934.11	125,536.29	-34.76
Total (excluding LULUCF)	196,039.02	182,146.60	165,608.99	159,436.67	149,448.82	150,676.45	154,679.74	151,763.94	144,798.83	136,431.41	145,886.05	145,671.68	141,539.32	144,582.43	145,949.52	145,259.37	147,038.10	147,624.79	142,146.37	133,486.19	137,422.56	133,495.50	-31.90

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	(%)
1. Energy	156,764.91	149,464.92	133,384.03	131,908.42	121,745.25	123,652.36	127,351.01	123,606.44	117,071.61	111,370.65	119,603.41	119,901.74	116,255.36	118,757.78	119,162.73	120,084.32	120,767.73	120,111.99	115,470.97	110,163.85	113,328.33	109,514.58	-30.14
2. Industrial Processes	19,602.83	14,619.03	16,069.16	12,922.95	13,855.70	13,188.23	13,893.50	14,847.10	14,850.27	12,102.86	13,561.11	12,885.78	12,546.46	13,656.01	14,239.70	12,979.24	14,156.44	15,264.70	14,085.39	11,153.29	12,025.82	11,790.63	-39.85
3. Solvent and Other Product Use	764.83	728.05	690.99	650.54	616.05	596.31	586.63	584.76	580.41	578.49	568.56	549.96	539.65	525.16	519.28	513.77	512.93	512.17	515.27	506.15	492.05	469.42	-38.62
4. Agriculture	16,233.28	14,611.72	12,731.33	11,204.85	10,372.50	10,331.98	9,966.29	9,758.20	9,284.71	9,350.12	9,094.86	9,220.88	8,955.86	8,314.94	8,750.49	8,385.03	8,249.77	8,403.04	8,583.06	8,134.29	7,964.57	8,064.84	-50.32
5. Land Use, Land-Use Change and Forestryb	-3,617.94	-9,037.27	-10,786.93	-9,432.86	-7,141.07	-7,210.11	-7,620.64	-6,660.85	-6,997.96	-7,155.04	-7,524.24	-7,877.91	-7,632.54	-5,742.66	-6,182.96	-6,685.51	-3,464.66	-726.83	-4,772.86	-6,863.11	-5,488.45	-7,959.22	119.99
6. Waste	2,673.17	2,722.88	2,733.48	2,749.91	2,859.32	2,907.58	2,882.31	2,967.44	3,011.85	3,029.28	3,058.11	3,113.32	3,242.00	3,328.53	3,277.31	3,297.01	3,351.23	3,332.89	3,491.67	3,528.62	3,611.79	3,656.03	36.77
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
Total (including LULUCF)	192,421.08	173,109.33	154,822.06	150,003.81	142,307.75	143,466.34	147,059.10	145,103.09	137,800.88	129,276.37	138,361.80	137,793.77	133,906.79	138,839.78	139,766.55	138,573.86	143,573.44	146,897.96	137,373.51	126,623.08	131,934.11	125,536.29	-34.76

Notes:

(1) Further detailed information could be found in the common reporting format tables of the Party's greenhouse gas inventory, namely "Emission trends (CO_2)", "Emission trends (CH_4)", "Emission trends (N_2O)" and "Emission trends (HFCs, PFCs and SF_6)", which is included in an annex to this biennial report.

(2) 2011 is the latest reported inventory year.

(3) 1 kt CO_2 eq equals 1 Gg CO_2 eq.

Abbreviation: LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Includes net CO_2, CH_4 and N_2O from LULUCF.

CTF Table 1a - Emission trends (CO_2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	%
1. Energy	146,069.96	140,167.01	124,557.41	123,455.69	113,761.33	115,710.35	119,474.26	115,862.48	109,600.97	104,525.20	113,364.08	113,941.04	110,671.96	113,134.49	113,653.92	114,118.67	114,510.23	114,181.79	109,584.07	104,573.83	107,603.34	103,872.26	-28.89
A. Fuel Combustion (Sectoral Approach)	145,609.70	139,766.58	124,158.24	123,073.73	113,388.83	115,342.95	119,118.95	115,512.20	109,254.73	104,204.76	113,035.44	113,602.92	110,328.59	112,800.53	113,328.62	113,793.84	114,165.05	113,869.73	109,277.45	104,306.51	107,330.28	103,603.96	-28.85
1. Energy Industries	57,702.19	57,393.91	51,278.87	53,524.14	53,708.88	60,464.52	64,412.93	60,416.89	58,079.74	56,022.65	59,287.69	61,555.98	59,942.45	59,891.14	59,919.14	60,866.72	60,319.79	63,914.45	58,766.58	55,907.25	58,602.52	58,119.62	0.72
2. Manufacturing Industries and Construction	46,484.78	48,995.89	40,973.40	41,844.33	32,498.17	27,696.93	27,939.40	27,447.22	24,359.03	22,184.89	27,126.45	24,645.31	23,805.06	23,305.89	23,455.69	23,150.65	22,547.22	20,272.50	20,476.73	19,271.09	19,298.51	17,804.88	-61.70
3. Transport	7,576.09	6,782.97	7,617.60	7,535.34	7,862.54	9,617.05	10,703.33	11,402.71	11,627.20	11,817.01	11,931.81	12,771.81	13,344.93	15,129.28	15,891.71	17,220.94	17,548.71	18,470.60	18,321.07	17,761.96	16,728.75	16,564.58	118.64
4. Other Sectors	32,245.74	25,184.81	22,967.71	18,893.90	18,034.04	16,373.01	14,922.77	15,056.81	13,924.88	12,934.80	13,454.70	13,436.15	12,096.22	13,413.66	12,955.45	11,461.51	12,675.34	10,127.34	10,579.96	10,248.73	11,617.31	10,023.42	-68.92
5. Other	1,600.90	1,409.00	1,320.66	1,276.02	1,285.19	1,191.44	1,140.51	1,188.56	1,263.88	1,245.41	1,234.79	1,193.67	1,139.94	1,060.56	1,106.63	1,094.02	1,073.99	1,084.84	1,133.10	1,117.48	1,083.19	1,091.45	-31.82
B. Fugitive Emissions from Fuels	460.27	400.43	399.17	381.96	372.50	367.40	355.32	350.28	346.24	320.43	328.64	338.12	343.37	333.97	325.30	324.83	345.18	312.07	306.62	267.32	273.06	268.31	-41.71
1. Solid Fuels	456.24	395.10	392.83	373.45	362.60	356.21	343.65	337.79	332.53	306.33	315.13	324.03	322.98	309.65	301.87	300.85	324.80	293.09	288.00	250.22	259.30	255.45	-44.01
2. Oil and Natural Gas	4.02	5.33	6.34	8.51	9.90	11.19	11.66	12.49	13.70	14.10	13.50	14.09	20.39	24.32	23.43	23.98	20.39	18.98	18.62	17.10	13.76	12.86	219.64
2. Industrial Processes	18,169.32	13,598.67	14,888.07	11,957.66	12,682.71	11,875.05	12,569.52	13,288.79	13,175.19	10,670.75	11,929.93	11,104.03	11,005.01	11,873.66	12,370.50	11,151.25	12,128.39	12,665.02	11,897.10	9,381.36	9,962.44	9,999.94	-44.96
A. Mineral Products	4,829.84	4,035.32	3,851.96	3,513.84	3,610.47	3,602.45	3,908.44	4,035.98	4,187.14	4,082.17	4,166.32	3,859.10	3,602.97	3,685.61	3,874.20	3,855.38	3,974.79	4,364.06	4,130.05	3,449.11	3,425.23	3,823.69	-20.83
B. Chemical Industry	806.81	781.92	806.14	753.81	841.62	743.05	799.72	732.91	755.54	643.56	736.48	619.87	540.77	703.91	698.65	609.30	581.10	544.38	616.13	634.42	617.82	552.95	-31.47
C. Metal Production	12,532.67	8,781.42	10,229.96	7,690.01	8,230.63	7,529.55	7,861.35	8,519.90	8,232.51	5,945.01	7,027.13	6,625.06	6,861.28	7,484.13	7,797.64	6,686.57	7,572.50	7,756.59	7,150.92	5,297.83	5,919.38	5,623.30	-55.13
D. Other Production																							
E. Production of Halocarbons and SF_6																							
F. Consumption of Halocarbons and SF_6																							
G. Other																							
3. Solvent and Other Product Use	550.31	513.53	476.47	436.02	401.53	381.79	372.11	370.24	365.89	363.97	354.04	335.44	325.13	310.64	304.76	299.25	298.41	297.65	282.77	273.65	259.55	236.92	-56.95
4. Agriculture																							
A. Enteric Fermentation																							
B. Manure Management																							
C. Rice Cultivation																							
D. Agricultural Soils																							
E. Prescribed Burning of Savannas																							
F. Field Burning of Agricultural Residues																							
G. Other																							
5. Land Use, Land-Use Change and Forestry	-3,749.32	-9,140.07	-10,893.17	-9,551.13	-7,260.66	-7,321.68	-7,760.39	-6,808.64	-7,129.36	-7,276.24	-7,635.97	-7,992.95	-7,754.90	-5,892.98	-6,321.11	-6,817.47	-3,625.95	-933.95	-4,937.68	-7,003.40	-5,636.07	-8,026.31	114.07
A. Forest Land	-5,057.19	-9,485.66	-11,121.28	-9,842.36	-7,356.00	-7,363.48	-7,614.49	-6,814.95	-7,420.51	-7,342.05	-7,592.77	-7,910.17	-7,673.45	-5,882.05	-6,271.43	-6,750.22	-3,508.06	-795.02	-4,840.68	-6,869.63	-5,551.27	-7,964.19	57.48
B. Cropland	1,315.34	548.59	305.94	300.17	268.98	273.92	269.52	248.94	370.02	200.64	200.40	180.03	155.41	161.75	141.95	144.77	134.27	127.23	165.09	113.93	132.50	147.70	-88.77
C. Grassland	-127.89	-293.05	-198.90	-195.82	-305.17	-331.13	-542.68	-380.12	-282.25	-361.07	-418.60	-399.58	-395.66	-379.60	-393.06	-388.33	-394.01	-383.09	-384.39	-371.00	-371.32	-328.93	157.19
D. Wetlands	22.53	33.32	18.73	8.69	8.01	9.94	11.42	16.40	24.74	24.03	27.70	11.69	33.71	22.75	19.19	20.44	19.89	19.55	22.26	20.48	34.25	31.62	40.31
E. Settlements	86.08	51.41	95.23	172.07	121.41	88.01	115.73	121.08	178.19	201.76	126.78	112.83	112.23	181.29	175.50	154.74	114.56	94.22	94.62	102.79	117.51	87.48	1.63
F. Other Land																							
G. Other	11.82	5.32	7.11	6.12	2.11	1.06	0.12	0.01	0.45	0.44	20.53	12.24	12.85	2.87	6.73	1.13	7.41	3.15	5.42	0.04	2.25	0.01	-99.89
6. Waste	23.15	27.71	32.52	44.41	62.97	70.70	71.07	74.49	74.84	76.46	63.04	86.13	124.05	192.08	180.46	175.22	190.66	201.80	240.74	198.91	179.67	187.37	709.41
A. Solid Waste Disposal on Land																							
B. Waste-water Handling																							
C. Waste Incineration	23.15	27.71	32.52	44.41	62.97	70.70	71.07	74.49	74.84	76.46	63.04	86.13	124.05	192.08	180.46	175.22	190.66	201.80	240.74	198.91	179.67	187.37	709.41
D. Other																							
7. Other																							
Total CO_2 including net CO_2 from LULUCF	161,063.42	145,166.86	129,061.30	126,342.64	119,647.89	120,716.21	124,726.58	122,787.35	116,087.53	108,360.14	118,075.11	117,473.69	114,371.25	119,617.89	120,188.53	118,926.93	123,501.76	126,412.32	117,067.00	107,424.34	112,368.94	106,270.18	-34.02
Total CO_2 excluding net CO_2 from LULUCF	164,812.75	154,306.92	139,954.47	135,893.77	126,908.55	128,037.89	132,486.96	129,595.98	123,216.89	115,636.37	125,711.08	125,466.64	122,126.15	125,510.87	126,509.64	125,744.39	127,127.71	127,346.27	122,004.67	114,427.74	118,005.01	114,296.49	-30.65
Memo Items:																							
International Bunkers	542.86	446.18	516.33	429.24	534.17	578.55	434.97	504.83	598.46	563.22	615.42	657.05	567.40	763.13	980.81	1,019.22	1,044.31	1,095.74	1,161.28	1,062.23	993.63	985.06	81.46
Aviation	542.86	446.18	516.33	429.24	534.17	578.55	434.97	504.83	598.46	563.22	615.42	657.05	567.40	763.13	980.81	1,019.22	1,044.31	1,095.74	1,161.28	1,062.23	993.63	985.06	81.46
Marine																							
Multilateral Operations																							
CO_2 Emissions from Biomass	2,367.75	2,406.77	2,384.39	2,358.04	2,355.08	4,593.46	4,652.85	5,098.46	5,695.64	5,788.24	5,353.62	5,900.00	6,108.53	6,377.73	7,070.48	7,180.62	7,755.42	8,821.97	8,885.86	9,464.47	10,692.28	11,258.62	375.50

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Fill in net emissions/removals as reported in CRF table Summary 1.A of the latest reported inventory year. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

CTF Table 1b - Emission trends (CH_4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	%
1. Energy	474.33	409.52	389.15	371.09	349.36	344.15	339.16	332.34	318.57	288.3	256.28	240.78	220.72	217.94	209.63	229.33	242.35	224.63	224.01	211.08	218.22	214.66	-54.74
A. Fuel Combustion (Sectoral Approach)	69.66	52.08	49.63	40.49	35.47	35.64	36.13	34.93	29.82	24.41	25.91	26.04	22.3	24.16	24.62	24.98	28.97	26.66	25.61	26.28	28.6	26.62	-61.79
1. Energy Industries	0.67	0.68	0.6	0.64	0.63	0.72	0.81	0.81	0.81	0.78	0.76	0.79	0.77	0.91	0.99	0.8	0.83	0.9	0.93	0.98	1.06	1.08	61.83
2. Manufacturing Industries and Construction	4.31	4.88	3.91	4.22	3.34	2.88	2.85	2.91	2.61	2.34	2.72	2.52	2.6	2.31	2.34	2.57	2.58	2.42	2.46	2.38	2.4	2.36	-45.22
3. Transport	1.38	1.19	1.41	1.41	1.51	1.67	1.83	1.91	1.88	1.87	1.74	1.77	1.66	1.71	1.62	1.64	1.55	1.55	1.5	1.43	1.26	1.2	-12.9
4. Other Sectors	62.97	45.03	43.44	33.96	29.73	30.12	30.42	29.11	24.37	19.32	20.6	20.88	17.2	19.16	19.6	19.9	23.95	21.71	20.64	21.42	23.81	21.9	-65.22
5. Other	0.34	0.29	0.27	0.26	0.26	0.24	0.22	0.19	0.14	0.1	0.08	0.08	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	-77.19
B. Fugitive Emissions from Fuels	404.67	357.45	339.52	330.61	313.9	308.52	303.03	297.41	288.75	263.89	230.36	214.74	198.41	193.78	185	204.34	213.38	197.97	198.4	184.81	189.62	188.04	-53.53
1. Solid Fuels	361.93	321.01	306	298.03	282.02	276.64	268.51	263.5	253.1	229.04	197.25	183.66	166.41	164.62	157.91	171.96	180.29	164.83	168.08	152.54	155.69	156.32	-56.81
2. Oil and Natural Gas	42.74	36.43	33.52	32.58	31.87	31.87	34.52	33.9	35.65	34.85	33.11	31.08	32.01	29.16	27.09	32.38	33.09	33.14	30.32	32.26	33.92	31.72	-25.78
2. Industrial Processes	6.93	5.95	4.67	4.76	4.88	5.1	5.2	4.76	4.63	4.12	4.45	4.51	4.5	4.52	4.84	4.64	4.72	4.61	4.53	3.55	3.91	3.97	-42.64
A. Mineral Products	0.14	0.12	0.12	0.13	0.14	0.14	0.16	0.18	0.2	0.18	0.25	0.25	0.2	0.2	0.22	0.22	0.21	0.21	0.23	0.17	0.16	0.16	16.29
B. Chemical Industry	0.73	0.63	0.67	0.68	0.74	0.7	0.73	0.74	0.79	0.85	0.92	0.94	0.88	0.89	1.12	1.17	1.13	1.07	1.13	1.08	1.19	1.14	56.92
C. Metal Production	6.06	5.2	3.88	3.95	4	4.26	4.3	3.84	3.64	3.09	3.28	3.32	3.42	3.42	3.5	3.25	3.38	3.33	3.18	2.3	2.56	2.67	-55.99
D. Other Production																							
E. Production of Halocarbons and SF_6																							
F. Consumption of Halocarbons and SF_6																							
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
3. Solvent and Other Product Use																							
4. Agriculture	248.6	235.43	211.97	185.42	162.35	157.11	156.12	146.87	138.11	140.15	134.06	133.91	131.01	129.09	125.64	122.28	120.52	121.33	121.3	116.91	114.09	113.42	-54.38
A. Enteric Fermentation	200.92	189.53	169.9	147.06	128.79	125.33	124.2	115.99	108.76	111.13	106.71	107.47	105.21	104.09	101.84	99.72	98.3	99.22	100.14	97.48	95.18	95.38	-52.53
B. Manure Management	47.68	45.91	42.07	38.37	33.56	31.78	31.92	30.89	29.34	29.02	27.34	26.45	25.8	25	23.8	22.55	22.22	22.11	21.16	19.43	18.91	18.04	-62.15
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
D. Agricultural Soils	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	0
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
5. Land Use, Land-Use Change and Forestry	4.76	3.55	3.74	4.31	4.44	4.17	5.49	5.93	5.18	4.79	4.4	4.58	4.93	6.16	5.65	5.39	6.67	8.66	6.84	5.78	6.11	2.62	-44.9
A. Forest Land	4.76	3.55	3.74	4.31	4.44	4.17	5.49	5.93	5.18	4.79	4.4	4.58	4.93	6.16	5.65	5.39	6.67	8.66	6.84	5.78	6.11	2.62	-44.9
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
D. Wetlands	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
E. Settlements	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
F. Other Land	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
G. Other	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	0
6. Waste	118.48	120.66	120.93	121.12	125.43	127.36	126.15	130.04	132.15	132.91	133.02	134.61	138.9	139.72	137.84	139.01	140.81	139.34	144.88	148.64	153.51	155.27	31.05
A. Solid Waste Disposal on Land	79.17	82.79	85.97	89.48	92.95	96.2	97.12	99.89	102.65	105.48	107.27	109.78	112.26	115.14	113.4	114.69	115.95	114.85	120.39	124.46	128.96	130.69	65.08
B. Waste-water Handling	39.31	37.88	34.96	31.64	32.48	31.16	29.02	30.16	29.5	27.43	25.75	24.82	26.64	24.57	24.44	24.32	24.86	24.49	24.49	24.18	24.55	24.57	-37.48
C. Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	709.41
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
Total CO_2 including net CO_2 from LULUCF	853.1	775.12	730.46	686.71	646.47	637.89	632.12	619.95	598.63	570.27	532.21	518.39	500.06	497.42	483.59	500.64	515.07	498.57	501.56	485.98	495.84	489.94	-42.57
Total CO_2 excluding net CO_2 from LULUCF	848.34	771.57	726.72	682.4	642.03	633.72	626.62	614.01	593.45	565.48	527.8	513.81	495.13	491.26	477.95	495.25	508.4	489.91	494.72	480.19	489.73	487.32	-42.56
Memo Items:																							
International Bunkers	0.09	0.07	0.08	0.07	0.09	0.1	0.07	0.08	0.1	0.09	0.1	0.11	0.09	0.13	0.16	0.17	0.17	0.18	0.19	0.18	0.16	0.16	81.83
Aviation	0.09	0.07	0.08	0.07	0.09	0.1	0.07	0.08	0.1	0.09	0.1	0.11	0.09	0.13	0.16	0.17	0.17	0.18	0.19	0.18	0.16	0.16	81.83
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
CO_2 Emissions from Biomass																							

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

CTF Table 1c - Emission trends (N_2O)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	%
1. Energy	2.37	2.25	2.11	2.13	2.09	2.31	2.43	2.47	2.52	2.55	2.77	2.92	3.06	3.38	3.57	3.71	3.77	3.91	3.82	3.73	3.69	3.66	54.57
A. Fuel Combustion (Sectoral Approach)	2.37	2.25	2.11	2.13	2.09	2.31	2.43	2.47	2.52	2.55	2.77	2.92	3.06	3.38	3.57	3.71	3.77	3.91	3.81	3.73	3.68	3.66	54.57
1. Energy Industries	0.81	0.81	0.73	0.76	0.75	0.86	0.91	0.86	0.84	0.81	0.86	0.89	0.88	0.89	0.9	0.89	0.89	0.95	0.89	0.85	0.9	0.91	12.34
2. Manufacturing Industries and Construction	0.58	0.65	0.52	0.54	0.43	0.36	0.35	0.35	0.31	0.27	0.33	0.3	0.31	0.27	0.28	0.31	0.31	0.29	0.29	0.29	0.29	0.28	-50.6
3. Transport	0.49	0.42	0.52	0.55	0.64	0.78	0.9	0.97	1.07	1.18	1.28	1.43	1.61	1.91	2.08	2.22	2.25	2.36	2.32	2.28	2.16	2.15	341.16
4. Other Sectors	0.43	0.32	0.29	0.22	0.21	0.26	0.23	0.23	0.22	0.2	0.22	0.22	0.19	0.23	0.23	0.21	0.25	0.24	0.23	0.23	0.26	0.25	-43.34
5. Other	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.05	0.08	0.08	0.08	0.08	0.08	0.07	0.08	0.07	0.07	0.07	0.08	0.08	0.07	0.07	17.18
B. Fugitive Emissions from Fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	230.38
1. Solid Fuels	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
2. Oil and Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	230.38
2. Industrial Processes	3.9	2.64	3.25	2.54	3.21	3.64	3.33	3.6	3.86	3.22	3.63	3.59	3.14	3.13	3.54	3.36	3.07	2.58	2.44	1.94	1.51	1.65	-57.63
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
B. Chemical Industry	3.9	2.64	3.25	2.54	3.21	3.64	3.33	3.6	3.86	3.22	3.63	3.59	3.14	3.13	3.54	3.36	3.07	2.58	2.44	1.94	1.51	1.65	-57.63
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
D. Other Production																							
E. Production of Halocarbons and SF_6																							
F. Consumption of Halocarbons and SF_6																							
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
3. Solvent and Other Product Use	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.75	0.75	0.75	0.75	8.38
4. Agriculture	35.52	31.19	26.71	23.58	22.46	22.69	21.57	21.53	20.6	20.67	20.26	20.67	20.01	18.08	19.72	18.77	18.45	18.89	19.47	18.32	17.96	18.33	-48.4
A. Enteric Fermentation																							
B. Manure Management	5.51	5.23	4.71	4.19	3.73	3.47	3.65	3.54	3.35	3.39	3.13	2.99	2.81	2.67	2.58	2.46	2.42	2.41	2.37	2.26	2.2	2.14	-61.14
C. Rice Cultivation																							
D. Agricultural Soils	30.01	25.96	22	19.39	18.73	19.22	17.92	17.99	17.25	17.28	17.13	17.68	17.2	15.41	17.14	16.3	16.03	16.47	17.1	16.06	15.76	16.19	-46.06
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
5. Land Use, Land-Use Change and Forestry	0.1	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.07	0.06	0.06	0.07	0.08	0.07	0.06	0.06	0.04	-61.78
A. Forest Land	0.03	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.05	0.04	0.04	0.02	-44.9
B. Cropland	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-69.85
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
D. Wetlands	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
E. Settlements	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
F. Other Land	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
G. Other	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	0
6. Waste	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.66	0.67	0.67	0.67	0.67	28.45
A. Solid Waste Disposal on Land																							
B. Waste-water Handling	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.65	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.66	0.66	0.66	0.66	26.61
C. Waste Incineration	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	709.41
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
Total CO_2 including net CO_2 from LULUCF	43.11	37.38	33.37	29.56	29.06	29.93	28.63	28.89	28.26	27.72	28.06	28.58	27.62	26	28.24	27.24	26.7	26.82	27.22	25.47	24.64	25.11	-41.77
Total CO_2 excluding net CO_2 from LULUCF	43.01	37.29	33.28	29.47	28.97	29.85	28.55	28.81	28.19	27.65	27.99	28.52	27.56	25.93	28.17	27.18	26.63	26.74	27.15	25.41	24.58	25.07	-41.72
Memo Items:																							
International Bunkers	0.07	0.06	0.07	0.06	0.07	0.08	0.06	0.07	0.08	0.08	0.09	0.09	0.08	0.11	0.14	0.14	0.14	0.15	0.16	0.15	0.14	0.14	81.83
Aviation	0.07	0.06	0.07	0.06	0.07	0.08	0.06	0.07	0.08	0.08	0.09	0.09	0.08	0.11	0.14	0.14	0.14	0.15	0.16	0.15	0.14	0.14	81.83
Marine	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0
CO_2 Emissions from Biomass																							

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

CTF Table 1d - Emission trends (HFC, PFC, SF_6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from base to latest reported year
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	%
Emissions of HFCsc - (kt CO_2 eq)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.73	101.31	244.81	316.56	267.47	262.5	393.37	391.29	590.14	600.3	594.21	872.35	1,605.85	1,262.45	1,020.25	1,467.85	1,130.42	100
HFC-23	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
HFC-32	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	0	0	0.02	0.02	0.05	0.04	0.03	0.04	0.04	100
HFC-41	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
HFC-43-10mee	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
HFC-125	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0.01	0	0.02	0.01	0.02	0.02	0.04	0.05	0.05	0.09	0.14	0.11	0.11	0.14	0.13	100
HFC-134	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
HFC-134a	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0.07	0.16	0.23	0.11	0.16	0.14	0.2	0.25	0.21	0.21	0.25	0.58	0.59	0.27	0.36	0.27	100
HFC-152a	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	0	0	0	0	0	0	0	NA, NO	0	0	100
HFC-143	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
HFC-143a	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0.02	0.01	0.04	0.01	0.03	0.05	0.04	0.07	0.11	0.04	0.08	0.14	0.1	100
HFC-227ea	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	IE, NA, NO	IE, NA, NO	IE, NA, NO	IE, NA, NO	0	0	0	0	0	0	0	0	0	0	0	100
HFC-236fa	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	100
HFC-245ca	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	0	0	100
Unspecified mix of listed HFCsd - (kt CO_2 eq)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
Emissions of PFCsc - (kt CO_2 eq)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.12	4.11	0.89	0.89	2.55	8.81	12.35	13.72	24.53	17.33	10.08	22.56	20.16	27.48	27.14	29.43	29.43	100
CF4	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	NA, NO	NA, NO	NA, NO	0	0	0	0	NA, NO	NA, NO	0
C2F6	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	0	0	0	0	0	0	0	0	0	0	100
C 3F8	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	0	IE, NA, NO	IE, NA, NO	0	0	0	0	0	0	0	0	0	0	0	IE, NA, NO	IE, NA, NO	0
C4F10	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
c-C4F8	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
C5F12	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
C6F14	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0
Emissions of SF_6(3) - (Gg CO_2 equivalent)	77.68	77.32	76.96	76.6	76.24	75.2	77.52	95.48	64.19	76.98	141.92	168.73	67.72	101.25	51.89	85.88	83.07	75.85	47.04	49.61	16.22	34.55	-55.52
SF_6	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0	-55.52

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

a The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

c Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

d In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.)

CTF Table 2a - Description of quantified economy-wide emission reduction target: base year

Party	*Czech Republic*	
Base year /base period	1990	
Emission reduction target	% of base year/base period	% of 1990 [b]
	20.00%	20.00%
Period for reaching target	BY-2020	

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

CTF Table 2b - Description of quantified economy-wide emission reduction target: gases and sectors covered

Gases covered		*Base year for each gas (year):*
CO_2		1990
CH_4		1990
N_2O		1990
HFCs		1995
PFCs		1995
SF_6		1995
NF_3		To be decided
Other Gases (specify)		
Sectors covered[b]	Energy	Yes
	Transport[f]	Yes
	Industrial processes[g]	Yes
	Agriculture	Yes
	LULUCF	No
	Waste	Yes
	Other Sectors (specify)	

Abbreviations: LULUCF = land use, land-use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b More than one selection will be allowed. If Parties use sectors other than those indicated above, the explanation of how these sectors relate to the sectors defined by the IPCC should be provided.

f Transport is reported as a subsector of the energy sector.

g Industrial processes refer to the industrial processes and solvent and other product use sectors.

CTF Table 2c - Description of quantified economy-wide emission reduction target: global warming potential values (GWP)

Gases	*GWP values* [b]
CO_2	4nd AR
CH_4	4nd AR
N_2O	4nd AR
HFCs	4nd AR
PFCs	4nd AR
SF_6	4nd AR
NF_3	4nd AR
Other Gases (specify)	

Abbreviations: GWP = global warming potential

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b Please specify the reference for the GWP: Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) or the Fourth Assessment Report of the IPCC.

CTF Table 2d - Description of quantified economy-wide emission reduction target: approach to counting emissions and removals from the LULUCF sector

Role of LULUCF	LULUCF in base year level and target	Excluded
	Contribution of LULUCF is calculated using	-

Abbreviation: LULUCF = land use, land-use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

CTF Table 2e1 - Description of quantified economy-wide emission reduction target: market-based mechanisms under the Convention

Market-based mechanisms under the Convention	*Possible scale of contributions (estimated kt CO_2 eq)*
CERs	NE
ERUs	NE
AAUs[i]	NE
Carry-over units[j]	NE
Other mechanism units under the Convention (specify)[d]	

Abbreviations: AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

d As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17 .

i AAUs issued to or purchased by a Party.

j Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision 1/CMP.8.

CTF Table 2e2 - Description of quantified economy-wide emission reduction target: other market-based mechanisms

No information provided in table 2e2

CTF Table 2f - Description of quantified economy-wide emission reduction target: any other information

No information provided in table 2f

CTF Table 3 - Progress in achievement of the quantified economy-wide emission reduction target: information on mitigation actions and their effects

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
PANEL/NEW PANEL	Energy	CH_4, CO_2, N_2O	Energy efficiency	Economic	Implemented	Support for reconstructoin/modernization of apartment buildings in pursuiit of increase of value, efficiency and extending of life-time	2001	MIT	158.00
State programme in support of energy savings and use of renewable energy sources	Energy	CH_4, CO_2, N_2O	Energy efficiency	Economic	Implemented				115.00
IPPC	Energy	CH_4, CO_2, N_2O	Energy efficiency	Regulatory	Implemented	Protection of environment against pollution from industrial and agricultural facilities.	2002		2,600.00
Preferential feed-in tariffs for electricity produced from renewable energy sources	Energy	CH_4, CO_2, N_2O	Energy efficiency	Regulatory	Implemented				2,873.00
Directive on energy performance of buildings	Energy	CH_4, CO_2, N_2O	Energy efficiency	Regulatory	Implemented				538.00
Implementation of directive on co-generation	Energy	CH_4, CO_2, N_2O	Energy efficiency	Regulatory	Implemented				90.00
Operational Programme Industry and Enterprise (OPIE)	Industry/industrial processes	CH_4, CO_2, N_2O	Manufacturing industry and related services	Economic	Implemented			MIT	17.00

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
Operational Programme Enterprise and Innovation	Industry/industrial processes	CH_4, CO_2, N_2O	Manufacturing industry and related services	Economic|Research|Education	Implemented	It will be possible for applicants to use financial resources from these programmes for co-financing business projects in the manufacturing industry and related services. Funding will derive in part from EU structural funds (85%) and in part from the state budget (15%).	2007	MIT	1,195.00
Operational Programme Environment	Energy, Industry/industrial processes, Waste management/waste	CH_4, CO_2, HFCs, N_2O, NF_3, PFCs, SF_6	Water Management Infrastructure and Reduction of Flood Risks, Air Quality and Reduction of Emissions, The Sustainable Use of Energy Sources, The Improvement of Waste Management and the Rehabilitation of Old Ecological Burdens, The Limiting of Industrial Pollution and Environmental Risks, Improving the State of Nature and the Landscape, The Development of Infrastructure for Environmental Education, Consultancy and Awareness	Economic	Implemented	Based on the amount of financial resources, the Operational Programme Environment (OPE) is the second largest Czech operational programme. Between 2007 and 2013, this programme will offer almost EUR 5 billion from the Cohesion Fund and the European Regional Development Fund, and an additional EUR 300 million from the National Environmental Fund of the Czech Republic and the state budget. The Operational Programme's main goal is to protect and improve environmental quality throughout the Czech Republic.	2007	MoE, SEF of CR	245.00
Green savings programme	Energy	CO_2, CH_4, N_2O	support for heating installations utilising renewable energy sources	Other (Regulatory)	Implemented	The Green Savings programme focuses on support for heating installations utilising renewable energy sources but also investment in energy savings in reconstructions and new buildings. The programme will support quality insulation of family houses and multiple-dwelling houses, the replacement of environment unfriendly heating for low-emission	2009	MoE, SEF of CR	860.00

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
						biomass-fired boilers and efficient heat pumps, installations of these sources in new low-energy buildings, installation of solar-thermal collectors as well as construction of new houses in the passive energy standard.			
Improvement of the fuel quality	Transport, Energy	N_2O, CO_2, CH_4		Regulatory	Implemented				266.00
Emission limits on new cars	Transport	CO_2, N_2O, CH_4		Regulatory	Implemented				152.00
Rural Development Program (2007-2013)	Agriculture, Forestry/LULUCF	CH_4, N_2O, CO_2	rural areas	Other (Regulatory)	Implemented	Rural Development Programme measures assist in achieving goals of the Lisbon Strategy in all its areas.	2007	MoE	325.00
Horizontal Rural Development	Agriculture, Forestry/LULUCF	CH_4, N_2O	ensure the sustainable development of agriculture, the countryside and its natural resources	Regulatory	Implemented	preservation and support of the agricultural system with low inputs, protection and support of sustainable agriculture meeting environmental demands, preservation and strengthening of a viable social structure in rural areas	2004	MoA	150.00
Action Plan for Development of Organic farming	Agriculture	CH_4, N_2O	organic farming in CR until 2015	Economic	Implemented	Strategy for the development of organic farming (OF) in the Czech Republic (CZ) until 2015. The main objectives of the Action Plan are to achieve a 15 % proportion of organic farming by 2015, a 60 % share of Czech organic foods in the organic foods market, and a 3 % share of organic foods in the food market overall.	2011	MoA	250.00

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
Cross Compliance	Agriculture	N_2O, CH_4	control system for farmers	Regulatory	Implemented	The direct payments and other selected subsidies can be granted only on the condition that a beneficiary meets the statutory management requirements addressing environment, public health, the health of animals and plants, and animal welfare; the standards of good agricultural and environmental conditions (GAEC); and minimum requirements for fertilizer and plant protection product use as part of agri-environmental measures.	2009	MoA	NA
Measures on vehicles - devices for gas adjustment	Transport	N_2O, CH_4, CO_2	quality of vehicles	Other (Regulatory)	Implemented				266.00
Economic and tax tools	Cross-cutting	CO_2, CH_4, HFCs, N_2O, NF_3, PFCs, SF_6		Other (Fiscal)	Implemented				209.00
Increase of the public transport attractiveness	Transport	N_2O, CH_4, CO_2		Economic	Implemented			MoE	190.00
Combined transportation support	Transport	N_2O, CH_4, CO_2		Regulatory	Planned				114.00
Mobility management	Transport	N_2O, CH_4, CO_2		Regulatory	Planned				95.00
Environmental education, education and enlightenment at primary and secondary schools on				Education	Implemented				95.00

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
"ecological transport"									
Eco-labelling	Agriculture, Industry/industrial processes, Waste management/waste	CO_2, CH_4, N_2O	labeling systems for food and consumer products	Other (Regulatory)	Implemented	Labeling systems for food and consumer products, which are more friendly to environment and to the health of the consumer.	1993	MoE, CENIA	76.00
Integration of public in the transport projects	Transport	N_2O, CO_2, CH_4		Information	Planned				76.00
Eco-driving	Transport	N_2O, CO_2, CH_4	energy efficient use of vehicles	Education	Planned				171.00
Territorial planned measures				Other (Economic)	Implemented				190.00
Waste management plan (2003) Government Regulation No. 197/2003	Waste management/waste			Regulatory	Implemented				6.00
Waste management plan (2003) Government Regulation No. 197/2003	Energy			Regulatory	Implemented				130.00
Waste management plan (2011)	Waste management/waste, Energy			Regulatory	Implemented				400.00
EU ETS	Energy, Transport, Industry/industrial processes	CO_2		Other (Fiscal)	Implemented		2005		3,230.00

Name of mitigation action[a]	*Sector(s) affected*[b]	*GHG(s) affected*	*Objective and/or activity affected*	*Type of instrument*[c]	*Status of implementation*[d]	*Brief description*[e]	*Start year of implementation*	*Implementing entity or entities*	*Estimate of mitigation impact (not cumulative, in kt CO_2 eq)*
Support of voluntary commitments to energy savings	Energy	CH_4, CO_2, N_2O	Energy efficiency		Implemented				458.00
Energy labelling of household electrical appliances	Energy	CO_2, CH_4, N_2O	labeling of home appliance products	Information	Implemented	Energy labelling of household appliances is a means by which EU states are attempting to accommodate the end users of these products and help them purchase the most energy efficient products possible as well as achieve the goal of 20% reduction of energy consumption in the EU by 2020.	1999	Electrotechnical testing institute	952.00
Support to housing fund modernization using the building saving	Energy	CO_2, CH_4, N_2O	Energy efficiency	Economic	Planned				513.00
Energy Star	Energy	CH_4, CO_2, N_2O	Energy efficiency	Regulatory	Planned				1.17
Eco-design	Energy	CO_2, CH_4, N_2O	Energy efficiency	Education	Implemented				166.00
Minimum share of biofuels	Transport, Energy	CH_4, CO_2, N_2O		Regulatory	Planned				912.00
Recast of the Directive on energy performance of buildings	Energy	CH_4, CO_2, N_2O	Energy efficiency	Regulatory	Implemented		2010		410.00
Regulation on CO_2 from light-commercial vehicles	Transport	CO_2		Regulatory	Planned				486.10

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a–-c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

c Parties may add additional rows for years other than those specified below.

d Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

CTF Table 4 - Reporting on progress

	Total emissions excluding LULUCF	*Contribution from LULUCF*[d]	*Quantity of units from market based mechanisms under the Convention*		*Quantity of units from other market based mechanisms*	
Year[c]	*(kt CO_2 eq)*	*(kt CO_2 eq)*	*(number of units)*	*(kt CO_2 eq)*	*(number of units)*	*(kt CO_2 eq)*
(1990)	196,039.02	-3,617.94	NO	NO		
2010	137,422.56	-5,488.45	789,859,031.00	789,859.03		
2011	133,495.50	-7,959.22	780,200,222.00	780,200.23		
2012	130,660.67	-7,251.97	765,302,222.00	765,302.22		

Abbreviation: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b For the base year, information reported on the emission reduction target shall include the following: (a) total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the Conference of the Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a–-c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

c Parties may add additional rows for years other than those specified below.

d Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

CTF Table 4a1 Progress in achieving the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector in 2011

No information provided in table 4a1

CTF Table 4a2 Progress in achievement of the quantified economy-wide emission reduction targets – further information on mitigation actions relevant to the counting of emissions and removals from the land use, land-use change and forestry sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	*Base year*[d]	*Net emissions/removals*[e]					*Accounting parameters*[h]	*Accounting quantity*[i]
		2008	2009	*2010*	*2011*	Total[g]		
	($kt CO_2$ eq)							
A. Article 3.3 activities								
A.1. Afforestation and Reforestation								-1'245.81
A.1.1. Units of land not harvested since the beginning of the commitment periodj		-271.99	-294.68	-322.26	-356.88	-1,245.81		-1'245.81
A.1.2. Units of land harvested since the beginning of the commitment periodj								NO
A.2. Deforestation		160.20	170.19	206.87	163.70	700.97		700.97187
B. Article 3.4 activities								
B.1. Forest Management (if elected)		-4,403.99	-6,441.15	-5,096.22	-7,568.71	-23,510.07		-5866.66667
3.3 offset[k]							0	0
FM cap[l]							5866.66667	-5866.66667
B.2. Cropland Management (if elected)	0	NA	NA	NA	NA	NA	0	0
B.3. Grazing Land Management (if elected)	0	NA	NA	NA	NA	NA	0	0
B.4. Revegetation (if elected)	0	NA	NA	NA	NA	NA	0	0

Note: 1 kt CO_2 eq equals 1 Gg CO_2 eq.

Abbreviations: CRF = common reporting format, LULUCF = land use, land-use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b Developed country Parties with a quantified economy-wide emission reduction target as communicated to the secretariat and contained in document FCCC/SB/2011/INF.1/Rev.1 or any update to that document, that are Parties to the Kyoto Protocol, may use table 4(a)II for reporting of accounting quantities if LULUCF is contributing to the attainment of that target.

c Parties can include references to the relevant parts of the national inventory report, where accounting methodologies regarding LULUCF are further described in the documentation box or in the biennial reports.

d Net emissions and removals in the Party's base year, as established by decision 9/CP.2.

e All values are reported in the information table on accounting for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, of the CRF for the relevant inventory year as reported in the current submission and are automatically entered in this table.

f Additional columns for relevant years should be added, if applicable.

g Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

h The values in the cells "3.3 offset" and "Forest management cap" are absolute values.

i The accounting quantity is the total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activity in accordance with the provisions of Article 7, paragraph 4, of the Kyoto Protocol.

j In accordance with paragraph 4 of the annex to decision 16/CMP.1, debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than the credits accounted for on that unit of land.

k In accordance with paragraph 10 of the annex to decision 16/CMP.1, for the first commitment period a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3 paragraph 3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

l In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period of the Kyoto Protocol only, additions to and subtractions from the assigned amount of a Party resulting from Forest management under Article 3, paragraph 4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

CTF Table 4b Reporting on progress

Units of market based mechanisms			*Year*	
			2011	*2012*
Kyoto Protocol units[d]	*Kyoto Protocol units*	*(number of units)*	780,200,222.00	765,302,222.00
		(kt CO_2 eq)	780,200.23	765,302.22
	AAUs	*(number of units)*	766,345,459.00	747,756,091.00
		(kt CO_2 eq)	766,345.46	747,756.09
	ERUs	*(number of units)*	1,813,118.00	4,063,078.00
		(kt CO_2 eq)	1,813.12	4,063.08
	CERs	*(number of units)*	12,041,645.00	13,483,053.00
		(kt CO_2 eq)	12,041.65	13,483.05
	tCERs	*(number of units)*	NO	NO
		(kt CO_2 eq)	NO	NO
	lCERs	*(number of units)*	NO	NO
		(kt CO_2 eq)	NO	NO
Other units [d,e]	*Units from market-based mechanisms under the Convention*	*(number of units)*		
		(kt CO_2 eq)		
	Units from other market-based mechanisms	*(number of units)*		
		(kt CO_2 eq)		
Total		*(number of units)*	780,200,222.00	765,302,222.00
		(kt CO_2 eq)	780,200.23	765,302.22

Abbreviations: AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, lCERs = long-term certified emission reductions, tCERs = temporary certified emission reductions.
Note: 2011 is the latest reporting year.
a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.
b For each reported year, information reported on progress made towards the emission reduction target shall include, in addition to the information noted in paragraphs 9(a-c) of the reporting guidelines, on the use of units from market-based mechanisms.
c Parties may include this information, as appropriate and if relevant to their target.
d Units surrendered by that Party for that year that have not been previously surrendered by that or any other Party.
e Additional rows for each market-based mechanism should be added, if applicable.

CTF Table 5 Summary of key variables and assumptions used in the projections analysis

Key underlying assumptions		*Historical*[b]		Projected			
Assumption	*Unit*	2010	2011	2015	2020	2025	2030
Population	*thousands*	10,517.00		10,635.00	10,761.00	10,839.00	10,861.00
Number of households	thousands	4,614.00		4,803.00	4,975.00	5,095.00	5,173.00
GDP growth rate	%	100.00		118.24	143.30	167.70	191.38
International oil price	USD / boe			86.00	88.50	89.20	93.10
International coal price	USD / boe			22.00	22.60	23.70	24.00
International gas price	USD / boe			53.80	61.50	58.90	64.50
Population growth	*%*	100.00		101.12	102.32	103.06	103.27

a Parties should include key underlying assumptions as appropriate.
b Parties should include historical data used to develop the greenhouse gas projections reported.

CTF Table 6a Information on updated greenhouse gas projections under a 'with measures' scenario

	GHG emissions and removals[b]							GHG emission projections	
	(kt CO_2 eq)							(kt CO_2 eq)	
	Base Year	1990	1995	2000	2005	2010	2011	2020	2030
Sector[d,e]									
Energy	147,381.47	147,381.47	112,546.55	105,976.97	101,021.23	94,796.27	91,143.18	79,611.50	67,777.30
Transport	9,383.44	9,383.44	11,105.81	13,626.44	19,063.09	18,532.06	18,371.41	18,754.00	17,931.00
Industry/industrial processes	20,367.66	20,367.66	13,784.54	14,129.67	13,493.01	12,517.87	12,260.05	12,783.70	12,690.70
Agriculture	16,233.28	16,233.28	10,331.98	9,094.86	8,385.03	7,964.57	8,064.84	7,809.50	7,648.60
Forestry/LULUCF	-3,617.94	-3,617.94	-7,210.11	-7,524.24	-6,685.51	-5,488.45	-7,959.22	-459.00	-2,042.00
Waste management/waste	2,673.17	2,673.17	2,907.58	3,058.11	3,297.01	3,611.79	3,656.03	3,738.80	3,608.30
Other (specify)									
Gas									
CO_2 emissions including net CO_2 from LULUCF	161,063.42	161,063.42	120,716.21	118,075.11	118,926.93	112,368.94	106,270.18	103,446.00	90,237.20
CO_2 emissions excluding net CO_2 from LULUCF	164,812.75	164,812.75	128,037.89	125,711.08	125,744.39	118,005.01	114,296.49	104,134.90	92,511.40
CH_4 emissions including CH_4 from LULUCF	17,915.09	17,915.09	13,395.62	11,176.34	10,513.46	10,412.56	10,288.77	9,506.70	8,295.00
CH_4 emissions excluding CH_4 from LULUCF	17,815.07	17,815.07	13,308.12	11,083.87	10,400.20	10,284.36	10,233.67	9,378.60	8,164.80
N_2O emissions including N_2O from LULUCF	13,364.89	13,364.89	9,278.46	8,697.13	8,443.31	7,639.11	7,782.94	7,626.00	7,378.00
N_2O emissions excluding N_2O from LULUCF	13,333.53	13,333.53	9,254.38	8,677.87	8,424.61	7,619.70	7,770.95	7,595.00	7,347.00
HFCs	NO	NO	0.73	262.50	594.21	1,467.85	1,130.42	1,534.30	1,569.10
PFCs	NO	NO	0.12	8.81	10.08	29.43	29.43	29.40	29.40
SF_6	77.68	77.68	75.20	141.92	85.88	16.22	34.55	24.60	24.60
Other (specify)									
Total with LULUCF[f]	192,421.08	192,421.08	143,466.34	138,361.81	138,573.87	131,934.11	125,536.29	122,167.00	107,533.30
Total without LULUCF	196,039.03	196,039.03	150,676.44	145,886.05	145,259.37	137,422.57	133,495.51	122,696.80	109,646.30

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

a In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

b Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

c 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

d In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

e To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

f Parties may choose to report total emissions with or without LULUCF, as appropriate.

CTF Table 6c Information on updated greenhouse gas projections under a 'with additional measures' scenario

	GHG emissions and removals[b]							GHG emission projections	
	(kt CO_2 eq)							(kt CO_2 eq)	
	Base Year	1990	1995	2000	2005	2010	2011	2020	2030
Sector[d,e]									
Energy	147,381.47	147,381.47	112,546.55	105,976.97	101,021.23	94,796.27	91,143.18	78,687.90	66,450.50
Transport	9,383.44	9,383.44	11,105.81	13,626.44	19,063.09	18,532.06	18,371.41	18,244.00	17,108.00
Industry/industrial processes	20,367.66	20,367.66	13,784.54	14,129.67	13,493.01	12,517.87	12,260.05	12,783.70	12,690.70
Agriculture	16,233.28	16,233.28	10,331.98	9,094.86	8,385.03	7,964.57	8,064.84	7,809.50	7,648.60
Forestry/LULUCF	-3,617.94	-3,617.94	-7,210.11	-7,524.24	-6,685.51	-5,488.45	-7,959.22	-235.00	-1,602.00
Waste management/waste	2,673.17	2,673.17	2,907.58	3,058.11	3,297.01	3,611.79	3,656.03	3,327.60	2,908.70
Other (specify)									
Gas									
CO_2 emissions including net CO_2 from LULUCF	161,063.42	161,063.42	120,716.21	118,075.11	118,926.93	112,368.94	106,270.18	102,425.80	88,780.50
CO_2 emissions excluding net CO_2 from LULUCF	164,812.75	164,812.75	128,037.89	125,711.08	125,744.39	118,005.01	114,296.49	102,808.50	90,530.60
CH_4 emissions including CH_4 from LULUCF	17,915.09	17,915.09	13,395.62	11,176.34	10,513.46	10,412.56	10,288.77	9,013.20	7,459.20
CH_4 emissions excluding CH_4 from LULUCF	17,815.07	17,815.07	13,308.12	11,083.87	10,400.20	10,284.36	10,233.67	8,883.00	7,331.10
N_2O emissions including N_2O from LULUCF	13,364.89	13,364.89	9,278.46	8,697.13	8,443.31	7,639.11	7,782.94	7,595.00	7,347.00
N_2O emissions excluding N_2O from LULUCF	13,333.53	13,333.53	9,254.38	8,677.87	8,424.61	7,619.70	7,770.95	7,564.00	7,316.00
HFCs	NO	NO	0.73	262.50	594.21	1,467.85	1,130.42	1,534.30	1,569.10
PFCs	NO	NO	0.12	8.81	10.08	29.43	29.43	29.40	29.40
SF_6	77.68	77.68	75.20	141.92	85.88	16.22	34.55	24.60	24.60
Other (specify)									
Total with LULUCF[f]	192,421.08	192,421.08	143,466.34	138,361.81	138,573.87	131,934.11	125,536.29	120,622.30	105,209.80
Total without LULUCF	196,039.03	196,039.03	150,676.44	145,886.05	145,259.37	137,422.57	133,495.51	120,843.80	106,800.80

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

a In accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", at a minimum Parties shall report a 'with measures' scenario, and may report 'without measures' and 'with additional measures' scenarios. If a Party chooses to report 'without measures' and/or 'with additional measures' scenarios they are to use tables 6(b) and/or 6(c), respectively. If a Party does not choose to report 'without measures' or 'with additional measures' scenarios then it should not include tables 6(b) or 6(c) in the biennial report.

b Emissions and removals reported in these columns should be as reported in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in this biennial report. Where the sectoral breakdown differs from that reported in the GHG inventory Parties should explain in their biennial report how the inventory sectors relate to the sectors reported in this table.

c 20XX is the reporting due-date year (i.e. 2014 for the first biennial report).

d In accordance with paragraph 34 of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications", projections shall be presented on a sectoral basis, to the extent possible, using the same sectoral categories used in the policies and measures section. This table should follow, to the extent possible, the same sectoral categories as those listed in paragraph 17 of those guidelines, namely, to the extent appropriate, the following sectors should be considered: energy, transport, industry, agriculture, forestry and waste management.

e To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors (i.e. cross-cutting), as appropriate.

f Parties may choose to report total emissions with or without LULUCF, as appropriate.

CTF Table 7 Provision of public financial support: summary information in 2011 and 2012

Allocation channels	*Year 2011 (in thousands)*									
	Czech koruna - CZK					*USD*[b]				
	Core/ general[c]	*Climate-specific*[d]				*Core/ general*[c]	*Climate-specific*[d]			
		Mitigation	*Adaptation*	*Cross-cutting*[e]	*Other*[f]		*Mitigation*	*Adaptation*	*Cross-cutting*[e]	*Other*[f]
Total contributions through multilateral channels:	386,640			25,000		21,857			1,413	
Multilateral climate change funds[g]				25,000					1,413	
Other multilateral climate change funds[h]										
Multilateral financial institutions, including regional development banks	375,740					21,241				
Specialized United Nations bodies	10,900					616				
Total contributions through bilateral, regional and other channels	1,259,070	38,809	62,001			71,174	2,194	3,505		
Total	1,645,710	38,809	62,001	25,000		94,031	2,194	3,505	1,413	

Footnotes attached to next table.

Allocation channels	*Year 2012 (in thousands)*									
	Czech koruna - CZK					*USD*[b]				
	Core/ general[c]	*Climate-specific*[d]				*Core/ general*[c]	*Climate-specific*[d]			
		Mitigation	*Adaptation*	*Cross-cutting*[e]	*Other*[f]		*Mitigation*	*Adaptation*	*Cross-cutting*[e]	*Other*[f]
Total contributions through multilateral channels:	366,621	2,900		17,000		23,320	148		868	
Multilateral climate change funds[g]				17,000					868	
Other multilateral climate change funds[h]										
Multilateral financial institutions, including regional development banks	354,871					22,720				
Specialized United Nations bodies	11,750	2,900				600	148			
Total contributions through bilateral, regional and other channels	1,199,239	40,190	58,601			61,217	2,051	2,992		
Total	1,565, 860	43,090	58,601	17,000		79,932	2,200	2,992	868	

Abbreviation: USD = United States dollars.

a Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

b Parties should provide an explanation on methodology used for currency exchange for the information provided in table 7, 7(a) and 7(b) in the box below.

c This refers to support to multilateral institutions that Parties cannot specify as climate-specific.

d Parties should explain in their biennial reports how they define funds as being climate-specific.

e This refers to funding for activities which are cross-cutting across mitigation and adaptation.

f Please specify.

g Multilateral climate change funds listed in paragraph 17(a) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17.

h Other multilateral climate change funds as referred in paragraph 17(b) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17.

CTF Table 7a Provision of public financial support: contribution through multilateral channels in 2011

Donor funding	*Total amount (in thousands)*				*Status*[b]	*Funding source*[f]	*Financial instrument*[f]	*Type of support*[f, g]	*Sector*[c]
	Core/general[d]		*Climate-specific*[e]						
	Czech koruna - CZK	*USD*	*Czech koruna - CZK*	*USD*					
Total contributions through multilateral channels	366,621	18,715	19,900	1,016					
Multilateral climate change funds [g]			17,000	868					
1. Global Environment Facility			17,00	868	Provided	ODA	Grant	Cross-cutting	Cross-cutting
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund									
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds									
Multilateral financial institutions, including regional development banks	354,871	18,115							
1. World Bank	329,491	16,819			Provided	ODA	Other (Grant/Equity)	Cross-cutting	Cross-cutting
2. International Finance Corporation									
3. African Development Bank									
4. Asian Development Bank									
5. European Bank for Reconstruction and Development	25,380	1,296			Provided	ODA	Grant	Cross-cutting	Cross-cutting
6. Inter-American Development Bank									
7. Other									
Specialized United Nations bodies									
1. United Nations Development Programme	10,750	549	2,900	148					
UNDP	1000	51			Provided	ODA	Grant	Cross-cutting	Cross-cutting
2. United Nations Environment Programme									
UNEP	366,621	18,715	19,900	1,016	Provided	ODA	Grant	Cross-cutting	Cross-cutting
3. Other			17,000	868					

Abbreviations: ODA = official development assistance, OOF = other official flows.

a Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

b Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

c Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

d This refers to support to multilateral institutions that Parties cannot specify as climate-specific.

e Parties should explain in their biennial reports how they define funds as being climate-specific.

f Please specify.

g Cross-cutting type of support refers to funding for activities which are cross-cutting across mitigation and adaptation.

CTF Table 7a Provision of public financial support: contribution through multilateral channels in 2012

Donor funding	*Total amount (in thousands)*				*Status*[b]	*Funding source*[f]	*Financial instrument*[f]	*Type of support*[f, g]	*Sector*[c]
	Core/general[d]		*Climate-specific*[e]						
	Czech koruna - CZK	*USD*	*Czech koruna - CZK*	*USD*					
Total contributions through multilateral channels	354,871	22,720	17,000	868					
Multilateral climate change funds [g]			17,000	868					
1. Global Environment Facility			17,000	868	Provided	ODA	Grant	Cross-cutting	Cross-cutting
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund									
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds									
Multilateral financial institutions, including regional development banks	354,871	22,720							
1. World Bank	329,491	21,424			Provided	ODA	Other (Grant/Equity)	Cross-cutting	Cross-cutting
2. International Finance Corporation									
3. African Development Bank									
4. Asian Development Bank									
5. European Bank for Reconstruction and Development	25,380	1,296			Provided	ODA	Grant	Cross-cutting	Cross-cutting
6. Inter-American Development Bank									
7. Other									
Specialized United Nations bodies									
1. United Nations Development Programme	10,750	549	2,900	148					
2. United Nations Environment Programme	1000	51							
3. Other									

Abbreviations: ODA = official development assistance, OOF = other official flows.

a Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

b Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

c Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

d This refers to support to multilateral institutions that Parties cannot specify as climate-specific.

e Parties should explain in their biennial reports how they define funds as being climate-specific.

f Please specify.

g Cross-cutting type of support refers to funding for activities which are cross-cutting across mitigation and adaptation.

CTF Table 7b Provision of public financial support: contribution through bilateral, regional and other channels in 2011

Recipient country/ region/project/programme[b]	*Total amount (in thousands)*		*Status*[c]	*Funding source*[g]	*Financial instrument*[g]	*Type of support*[g, h]	*Sector*[d]	*Additional information*[e]
	Climate-specific[f]							
	Czech koruna - CZK	*USD*						
Total contributions through bilateral, regional and other channels	100,810	5,699						
Afghanistan /	4,000	226	Provided	ODA	Grant	Adaptation	Agriculture	
Angola /	12,139	686	Provided	ODA	Grant	Adaptation	Agriculture	
Bosnia and Herzegovina /	17,148	969	Provided	ODA	Grant	Mitigation	Energy	
Ethiopia /	5,322	301	Provided	ODA	Grant	Adaptation	Cross-cutting	Sectors affected: Water, Agriculture, Forestry
Ethiopia /	2,291	130	Provided	ODA	Grant	Adaptation	Other (Water)	
Ethiopia /	4,000	226	Provided	ODA	Grant	Adaptation	Agriculture	
Georgia /	4,013	227	Provided	ODA	Grant	Adaptation	Cross-cutting	Prevention against extreme weather events
Georgia /	2,561	145	Provided	ODA	Grant	Mitigation	Energy	
Moldova /	4,894	277	Provided	ODA	Grant	Adaptation	Other (Water)	
Mongolia /	5,908	334	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Mongolia, Zalugiin Gol
Mongolia /	4,934	279	Provided	ODA	Grant	Adaptation	Agriculture	
Palestine /	5,500	311	Provided	ODA	Grant	Adaptation	Other (Water)	
Palestine /	7,000	396	Provided	ODA	Grant	Mitigation	Energy	
Palestine /	2,500	141	Provided	ODA	Grant	Adaptation	Other (Water)	
Serbia /	3,100	175	Provided	ODA	Grant	Mitigation	Energy	
Viet Nam /	3,000	170	Provided	ODA	Grant	Mitigation	Energy	
Ethiopia /	4,500	254	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Ethiopia - Sidama
Ethiopia /	2,000	113	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Ethiopia - Alaba
Cambodia /	6,000	339	Provided	ODA	Grant	Mitigation	Energy	Specification of recipient country: Cambodia, Robi

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollars.

a Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

b Parties should report, to the extent possible, on details contained in this table.

c Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

d Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

e Parties should report, as appropriate, on project details and the implementing agency.

f Parties should explain in their biennial reports how they define funds as being climate-specific.

g Please specify.

h Cross-cutting type of support refers to funding for activities which are cross-cutting across mitigation and adaptation.

CTF Table 7b Provision of public financial support: contribution through bilateral, regional and other channels in 2012

Recipient country/ region/project/programme[b]	*Total amount (in thousands)*		*Status*[c]	*Funding source*[g]	*Financial instrument*[g]	*Type of support*[g, h]	*Sector*[d]	*Additional information*[e]
	Climate-specific[f]							
	Czech koruna - CZK	*USD*						
Total contributions through bilateral, regional and other channels	98,791	5,043						
Afghanistan /	3,000	153	Provided	ODA	Grant	Adaptation	Agriculture	
Bosnia and Herzegovina /	14,366	733	Provided	ODA	Grant	Mitigation	Energy	
Ethiopia /	4,200	214	Provided	ODA	Grant	Adaptation	Cross-cutting	Sectors affected: Water, Agriculture, Forestry
Ethiopia /	2,230	114	Provided	ODA	Grant	Adaptation	Other (Water)	
Ethiopia /	2,400	123	Provided	ODA	Grant	Adaptation	Other (Water)	
Ethiopia /	3,500	179	Provided	ODA	Grant	Adaptation	Agriculture	
Georgia /	4,047	207	Provided	ODA	Grant	Adaptation	Cross-cutting	Prevention against extreme weather events
Georgia /	4,954	253	Provided	ODA	Grant	Mitigation	Energy	
Moldova /	4,894	250	Provided	ODA	Grant	Adaptation	Other (Water)	
Mongolia /	5,189	265	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Mongolia, Zalugiin Gol
Mongolia /	1,523	78	Provided	ODA	Grant	Adaptation	Agriculture	Specification of recipient country: Mongolia, Gobi
Mongolia /	2,340	119	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Mongolia - Chovsgul
Palestine /	5,000	255	Provided	ODA	Grant	Adaptation	Other (Water)	
Palestine /	5,000	255	Provided	ODA	Grant	Mitigation	Energy	
Palestine /	2,500	128	Provided	ODA	Grant	Adaptation	Other (Water)	
Serbia /	9,170	468	Provided	ODA	Grant	Mitigation	Energy	
Viet Nam /	2,700	138	Provided	ODA	Grant	Mitigation	Energy	
Yemen /	3,200	163	Provided	ODA	Grant	Adaptation	Agriculture	

Ethiopia /	12,578	642	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Ethiopia - Sidama
Ethiopia /	2,000	102	Provided	ODA	Grant	Adaptation	Other (Water)	Specification of recipient country: Ethiopia - Alaba
Cambodia /	4,000	204	Provided	ODA	Grant	Mitigation	Energy	Specification of recipient country: Cambodia, Robi

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollars.

a Parties should fill in a separate table for each year, namely 2011 and 2012, where 2014 is the reporting year.

b Parties should report, to the extent possible, on details contained in this table.

c Parties should explain, in their biennial reports, the methodologies used to specify the funds as provided, committed and/or pledged. Parties will provide the information for as many status categories as appropriate in the following order of priority: provided, committed, pledged.

d Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under "Other".

e Parties should report, as appropriate, on project details and the implementing agency.

f Parties should explain in their biennial reports how they define funds as being climate-specific.

g Please specify.

h Cross-cutting type of support refers to funding for activities which are cross-cutting across mitigation and adaptation.

CTF Table 8 Provision of technology development and transfer support
No information provided in table 8

CTF Table 8 Provision of capacity-building support
No information provided in table 9

ANNEX 2 Overall inventory of greenhouse gases in the 1990 – 2011 period

1990-1997 period

Sector specific aggregate CO_2 eq. emissions	1990 (Gg)	1991 (Gg)	1992 (Gg)	1993 (Gg)	1994 (Gg)	1995 (Gg)	1996 (Gg)	1997 (Gg)
1. Energy	156765	149465	133384	131908	121745	123652	127351	123606
A. Fuel Combustion (Sectoral Approach)	147807	141558	125855	124584	114781	116806	120632	117011
1. Energy Industries	57967	57658	51517	53772	53955	60745	64713	60702
2. Manufacturing Industries and Construction	46754	49298	41217	42102	32703	27869	28107	27616
3. Transport	7756	6938	7808	7737	8091	9895	11021	11745
4. Other Sectors	33702	26231	23971	19677	18725	17086	15632	15739
5. Other	1628	1432	1342	1297	1306	1211	1159	1209
B. Fugitive Emissions from Fuels	8958	7907	7529	7325	6964	6846	6719	6596
1. Solid Fuels	8057	7136	6819	6632	6285	6166	5982	5871
2. Oil and Natural Gas	902	770	710	693	679	681	737	725
2. Industrial Processes	19603	14619	16069	12923	13856	13188	13893	14847
A. Mineral Products	4833	4038	3854	3517	3613	3605	3912	4040
B. Chemical Industry	2033	1613	1826	1557	1851	1888	1847	1866
C. Metal Production	12660	8891	10312	7773	8315	7619	7952	8600
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF6	78	77	77	77	76	76	183	341
G. Other	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	765	728	691	651	616	596	587	585
4. Agriculture	16233	14612	12731	11205	10372	10332	9966	9758
A. Enteric Fermentation	4219	3980	3568	3088	2705	2632	2608	2436
B. Manure Management	2710	2585	2344	2106	1862	1742	1802	1745
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	9304	8046	6819	6011	5806	5959	5557	5578
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	-3618	-9037	-10787	-9433	-7141	-7210	-7621	-6661
A. Forest Land	-4947	-9404	-11035	-9743	-7253	-7267	-7487	-6678
B. Cropland	1337	569	326	319	286	289	282	259
C. Grassland	-128	-293	-199	-196	-305	-331	-543	-380
D. Wetlands	23	33	19	9	8	10	11	16
E. Settlements	86	51	95	172	121	88	116	121
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	12	5	7	6	2	1	0	0
6. Waste	2673	2723	2733	2750	2859	2908	2882	2967
A. Solid Waste Disposal on Land	1663	1739	1805	1879	1952	2020	2040	2098
B. Waste-water Handling	987	956	895	826	843	815	770	794
C. Waste Incineration	24	28	33	45	64	72	72	76
D. Other	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA
Total emissions including emissions from LULUCF	192421	173109	154822	150004	142308	143466	147059	145103
Total emissions excluding emissions from LULUCF	196039	182147	165609	159437	149449	150676	154680	151764

Sector specific aggregate CO_2 eq. emissions	1990	1991	1992	1993	1994	1995	1996	1997
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
Memo Items:								
International Bunkers	568	467	540	449	559	605	455	528
Aviation	568	467	540	449	559	605	455	528
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	2368	2407	2384	2358	2355	4593	4653	5098

NE – Not Estimated; NA – Not Aplicable; NO – Not Occuring; LULUCF – Land Use, Land Use Change and Forestry *Source: CHMI*

1998-2005 period

Sector specific aggregate CO_2 eq emissions	1998	1999	2000	2001	2002	2003	2004	2005
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	117072	111371	119603	119902	116255	118758	119163	120084
A. Fuel Combustion (Sectoral Approach)	110661	105508	114437	115054	111745	114354	114952	115468
1. Energy Industries	58358	56291	59570	61849	60230	60187	60219	61158
2. Manufacturing Industries and Construction	24509	22318	27285	24791	23955	23439	23591	23301
3. Transport	12000	12223	12364	13252	13878	15758	16570	17944
4. Other Sectors	14504	13404	13955	13941	12515	13886	13440	11946
5. Other	1290	1273	1262	1220	1166	1084	1132	1119
B. Fugitive Emissions from Fuels	6410	5862	5166	4848	4510	4403	4210	4616
1. Solid Fuels	5648	5116	4457	4181	3818	3767	3618	3912
2. Oil and Natural Gas	762	746	709	667	693	637	592	704
2. Industrial Processes	14850	12103	13561	12886	12546	13656	14240	12979
A. Mineral Products	4191	4086	4172	3864	3607	3690	3879	3860
B. Chemical Industry	1968	1660	1880	1752	1534	1694	1820	1674
C. Metal Production	8309	6010	7096	6695	6933	7556	7871	6755
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF6	NO	NO	NO	NO	NO	NO	NO	NO
F. Consumption of Halocarbons and SF6	382	347	413	574	473	716	670	690
G. Other	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	580	578	569	550	540	525	519	514
4. Agriculture	9285	9350	9095	9221	8956	8315	8750	8385
A. Enteric Fermentation	2284	2334	2241	2257	2209	2186	2139	2094
B. Manure Management	1654	1659	1544	1483	1414	1351	1299	1236
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	5346	5357	5310	5481	5332	4778	5313	5054
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	-6998	-7155	-7524	-7878	-7633	-5743	-6183	-6686
A. Forest Land	-7301	-7231	-7491	-7804	-7559	-5740	-6141	-6625
B. Cropland	382	211	210	189	164	170	149	152
C. Grassland	-282	-361	-419	-400	-396	-380	-393	-388
D. Wetlands	25	24	28	12	34	23	19	20
E. Settlements	178	202	127	113	112	181	176	155
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	0	0	21	12	13	3	7	1
6. Waste	3012	3029	3058	3113	3242	3329	3277	3297

Sector specific aggregate CO_2 eq emissions	1998	1999	2000	2001	2002	2003	2004	2005
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
A. Solid Waste Disposal on Land	2156	2215	2253	2305	2357	2418	2381	2408
B. Waste-water Handling	780	736	741	720	758	715	712	710
C. Waste Incineration	76	78	64	88	126	196	184	179
D. Other	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA	NA	NA
Total emissions including emissions from LULUCF	137801	129276	138362	137794	133907	138840	139767	138574
Total emissions excluding emissions from LULUCF	144799	136431	145886	145672	141539	144582	145950	145259
Memo Items:								
International Bunkers	626	589	644	687	594	798	1026	1066
Aviation	626	589	644	687	594	798	1026	1066
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	5696	5788	5354	5900	6109	6378	7070	7181

NE – Not Estimated; NA – Not Aplicable; NO – Not Occuring; LULUCF – Land Use, Land Use Change and Forestry *Source: CHMI*

2006-2011 period

Sector specific aggregate CO_2 eq. emissions	2006	2007	2008	2009	2010	2011
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	120768	120112	115471	110164	113328	109515
A. Fuel Combustion (Sectoral Approach)	115942	115642	110998	106016	109073	105297
1. Energy Industries	60612	64228	59061	56192	58905	58424
2. Manufacturing Industries and Construction	22697	20412	20620	19412	19438	17943
3. Transport	18280	19234	19072	18498	17424	17255
4. Other Sectors	13254	10659	11086	10771	12198	10559
5. Other	1098	1110	1159	1143	1108	1116
B. Fugitive Emissions from Fuels	4826	4470	4473	4148	4255	4217
1. Solid Fuels	4111	3755	3818	3454	3529	3538
2. Oil and Natural Gas	715	715	655	695	726	679
2. Industrial Processes	14156	15265	14085	11153	12026	11791
A. Mineral Products	3979	4369	4135	3453	3429	3827
B. Chemical Industry	1556	1368	1396	1257	1111	1090
C. Metal Production	7644	7826	7218	5346	5973	5679
D. Other Production	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF6	NO	NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF6	978	1702	1337	1097	1514	1194
G. Other	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	513	512	515	506	492	469
4. Agriculture	8250	8403	8583	8134	7965	8065
A. Enteric Fermentation	2064	2084	2103	2047	1999	2003
B. Manure Management	1218	1212	1179	1107	1079	1043
C. Rice Cultivation	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	4968	5107	5301	4980	4886	5019
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO
G. Other	NA	NA	NA	NA	NA	NA

Sector specific aggregate CO_2 eq. emissions	2006	2007	2008	2009	2010	2011
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
5. Land Use, Land-Use Change and Forestry	-3465	-727	-4773	-6863	-5488	-7959
A. Forest Land	-3354	-595	-4682	-6736	-5410	-7903
B. Cropland	141	134	172	120	139	154
C. Grassland	-394	-383	-384	-371	-371	-329
D. Wetlands	20	20	22	20	34	32
E. Settlements	115	94	95	103	118	87
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	7	3	5	0	2	0
6. Waste	3351	3333	3492	3529	3612	3656
A. Solid Waste Disposal on Land	2435	2412	2528	2614	2708	2745
B. Waste-water Handling	722	715	718	712	720	721
C. Waste Incineration	194	206	245	203	183	191
D. Other	NA	NA	NA	NA	NA	NA
7. Other (as specified in Summary 1.A)	NA	NA	NA	NA	NA	NA
Total emissions including emissions from LULUCF	143573	146898	137374	126623	131934	125536
Total emissions excluding emissions from LULUCF	147038	147625	142146	133486	137423	133496
Memo Items:						
International Bunkers	1093	1146	1215	1111	1040	1031
Aviation	1093	1146	1215	1111	1040	1031
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	7755	8822	8886	9464	10692	11259

NE – Not Estimated; NA – Not Aplicable; NO – Not Occuring; LULUCF – Land Use, Land Use Change and Forestry *Source: CHMI*

ANNEX 3 Summary of supplementary information pursuant to Article 7.2 of the Kyoto Protocol

Following table gives a summary of supplementary information pursuant to Art. 7.2 of the Kyoto Protocol in classification according to the 6th National Communication.

Summary of supplementary information pursuant to Article 7.2 of the Kyoto Protocol

Information pursuant to Art. 7.2		**Relevant part of the 6th National Communication**
National system of inventories of greenhouse gases pursuant to Art. 5.1		Chapter 3.3
National registry of trading in allowances		Chapter 3.4
Mechanisms pursuant to Art. 6, 12 and 17		Chapter 5.5
Policies and measures pursuant to Art. 2		Chapter 4.2, 4.3 and 4.4
Domestic and regional programs, legislative instruments, effectiveness and administrative procedures		Chapter 4.1
Information pursuant to Art. 10	Art. 10a	Chapter 3.3
	Art. 10b	Chapter 4.1, 4.2, 4.3 and 4.4
	Art. 10c	Chapter 7.3
	Art. 10d	Chapter 8
	Art. 10e	Chapter 9
Funding		Chapter 7

ANNEX 4 Summary of all quantifiable implemented and prepared measures

Title of measure (framework / multisectoral measure)	Expected benefit in reducing greenhouse gas emissions (in kt CO_2 eq./year)				Costs	Everall costs
	2015	2020	2025	2030	EUR/ton reduced CO_2	thousand EUR/year
State Programme to Promote Energy Savings and the Use of Renewable Sources of Energy	115	115	115	115	780	8094
Programme PANEL/NEW PANEL	105	158	145	134	2752	1877000
IPPC	500	2600	3000	3160		951000
Preferential feed-in tariffs for electricity produced from renewable energy sources	3028	2873	2587	1978	7	
Directive on energy performance of buildings	403	538	665	667	6788	
Implementation of directive on co-generation	114	90	76	43	2	
Operational Programme Industry and Enterprise	19	17	16	14	334	
Operational Programme Enterprise and Innovation	1346	1195	1097	887	1048	
Operational Programme Environment	263	245	233	204	26300	
Green Savings Programme	864	860	840	800	1455	
Improvement of the fuel quality	151	266	367	469		283
Emission limits on new cars	87	152	210	268		162
Rural Development Program (2007-2013)	220	325				
Horizontal Rural Development	150	150				
Action Plan for Development of Organic farming	210	250				
Cross Compliance	NA	NA				
Measures on vehicles - devices for gas adjustment	151	266	367	469		283
Economic and tax tools	119	209	289	369		
Increase of the public transport attractiveness	108	190	262	335		
Combined transportation support	65	114	157	201		
Mobility management	54	95	131	168		
Environmental education, education and enlightenment at primary and secondary schools on "ecological transport"	54	95	131	168		101
Eco-labelling	43	76	105	134		81
Integration of public in the transport projects	43	76	105	134		81
Eco-driving	97	171	236	302		182
Territorial planned measures	108	190	262	335		202
Waste management plan (2003) Government Regulation No. 197/2003 (zahrnut vliv na sektor Odpady)	0	6	12			141000
Waste management plan (2003) Government Regulation No. 197/2003 (zahrnut vliv na sektory Odpady a Zásobování energií)	50	130	280			141000
Waste management plan (2011) (impact on the Waste sector included)	-6	-12	-18			160000
Waste management plan (2011) (impact on the Waste sector and energy supply included)	160	400	700			160000
EU ETS	1050	3230			25	
Support of voluntary commitments to energy savings	191	458	571	556	770	
Energy labelling of household electrical appliances	786	952	1042	876	0	
Support to housing fund modernization using the building saving	396	513	607	565		172800
Energy Star	969	1172	1277	1049	0	
Eco-design	91	166	223	212		
Minimum share of biofuels	715	912	912	912	1008	
Recast of the Directive on energy performance of	173	410	617	686	6384	

Title of measure (framework / multisectoral measure)	Expected benefit in reducing greenhouse gas emissions (in kt CO_2 eq./year)				Costs	Everall costs
	2015	2020	2025	2030	EUR/ton reduced CO_2	thousand EUR/year
buildings						
EU draft regulation on CO_2 from light-commercial vehicles (vans)	147	486.1	788.2	787.2		162

Source: CHMI

ANNEX 5 Summary of fast start finance projects

Country	Thematic area	Project title	Impl. period	Contribution (million EUR)	Description
Mongolia	Adaptation	Plant Production Support in Arid Regions of Mongolia	2010	0.36	The aim of the project is to carry out analysis of needs in crop production sector and afforestation of desert areas and to recommend steps to maintain, enhance and optimize crop production. Moreover, appropriate protection measures against sand and dust storms will be proposed together with efficient irrigation measures, measures to prevent soil salinisation, and to use alternative energy resources.
Georgia	Mitigation	Electrification of remote areas in Georgia	2010	0.30	The project aims to ensure sustainable development of Tusheti region through electrification of public buildings and building an appropriate grid, using renewable energy resources (photovoltaic panels).
Mongolia	Adaptation	Water supply - extention of water resources in the province of Orkhon	2010 - 2012	0.60	Under this project 16 wells are going to be built in order to secure sustainable supply of water in the Zalugeen Gol and Ulaan Tolgoi regions. Complementary objective is to create water balance of these regions and to develop a water management plan for further development of grazing lands, fields and residential centers.
Moldova	Capacity Building	Flood warning and monitoring system on the Prut River	2010 - 2012	0.83	The primary objective is to improve public awareness of incoming floods on the river Prut. The new monitoring system will enable early warning of population by periodical monitoring of water flow. The secondary objective is to demonstrate suitable technological approach to river basin monitoring network, which could be used for others river basins as well.
Ethiopia	Capacity Building	Soil protection, minimization of negative effects of agriculture and water supply management in the Southern Nations, Nationalities and Peoples' Regional State	2010 - 2012	0.50	The project will be carried out in Alaba Special Wereda and Awassa Zuriya Wereda districts. The water management part of this project is focused on revitalization of existing wells and enlargement of water supply system. The second part of the project will deliver specific measures among others to prevent soil degradation, for cultivation and planting of seedlings and application of erosion control measures.
Ethiopia	Capacity Building	Capacity development in the field of engineering geology and hydrogeology	2010 - 2012	0.28	The project aims to train the employees of Geological Survey of Ethiopia (GSE) in the field of engineering geology and hydrogeology in order to introduce new methods of compilation, editing, presentation and practical interpretation of maps of groundwater sources.
Ethiopia	Adaptation	Sustainable usage of natural resources and assistance to small-scale farmers	2011 - 2013	0.88	The programme comprises of direct activities tackling erosion and deforestation in degraded areas, as well as on introduction of the alternative livelihoods and sources of energy among the locals, so the direct dependence on natural resources would be eventually decreased. Second component of the programme aims at introducing

Country	Thematic area	Project title	Impl. period	Contribution (million EUR)	Description
					sustainable management of the watershed through a participatory integrated watershed management approach.
Georgia	Capacity Building	Enhanced Preparedness of Georgia against Extreme Weather Events	2011 - 2013	0.56	The project aims to promote prevention of disasters caused by extreme weather events in Georgia through introduction of an early warning system, which is a major element used for disaster risk reduction (DRR). Its successful realization would prevent losses of lives and reduce the negative economic and material impact on society.
Bosnia and Herzegovina	Mitigation	Utilization of renewable sources of energy for district heating system in the village of Nemila	2011 - 2013	1.48	The project will contribute to reduction of air pollution and GHG emmissions from heating of individual housings through construction of a biomass heating plant and a heat distribution network. Biomass (wood chips) will replace coal and other non-renewable sources as fuel for heating. Apart from positive environmental impacts the project will also contribute to improvement of local population's health.
Cambodia	Mitigation	Development of a Permanent, Market-Oriented, Biodigester Sector for Sustainable Energy Supply in Rural Cambodia	2011 - 2013	0.56	The project aims to contribute to the development of a permanent, market oriented, biodigester sector in seven provinces of Cambodia with its main focus on Takeo province. Biodigesters are a locally well-proven technology which takes advantage of gasses released from decomposing manure and with a durability of 15-20 years. Through stimulating market demand by subsidising biodigesters construction, developing the private sector which constructs biodigesters and supporting biodigester users, the project intends to achieve, by the end of 2013, sustainable energy supply for at least 12,800 people living in rural areas of Cambodia; the creation of 40 companies constructing biodigesters; an annual reduction of fuel-wood consumption by 6,350 tons; annual emissions reduction by at least 10,850 tons; the employment of 300 people; and improvement in the health of biodigester users.
Vietnam	Mitigation	Renewable Energy Sources for Rural Areas of Thua-Thien Hue Province	2011 - 2013	0.36	The objective of the project is to improve access of rural people in the Thua-Thie Hue province to sustainable energy sources through the use of renewable sources of energy for thermal and electric energy production and provide capacity building in this area, thus reducing fuel-wood consumption and GHG emissions. The project activities are focused on construction of family size anaerobic digesters to produce sufficient quantities of biogas, which cover household energy needs for cooking and possibly lighting. Further project activities are focused on the installation of two experimental photovoltaic units for monitoring electricity production under the specific conditions in the target area. Implementation of the above mentioned

Country	Thematic area	Project title	Impl. period	Contribution (million EUR)	Description
					technologies will be accompanied by information campaigns, training courses and workshops for target groups and project beneficiaries.
Georgia	Mitigation	Renewable Energy for Remote Areas of Georgia - Solar Thermal Systems and Solar Photovoltaic Panels in Tusheti"	2011 - 2013	0.26	The project will increase energy independence of the Tusheti region in Georgia through supplying solar thermal and solar photovoltaic panels and subsequently leading to reduction of GHG emissions from individual heat/electricity sources. Secondary benefit of the project is increased protection of forests and other natural resources in the area.
Ethiopia	Adaptation	Establishment of a Sustainable System of Drinking Water Supply in Small Towns of Sidama Zone, SNNPR, Ethiopia	2011-2013	0.90	The overall objective of the project is to improve the water supply, the management of water sources, the sanitation and the hygienic situation of the populations living in the targeted areas of the Sidama Zone. It is intended to strengthen the potential social and economic development within the area by improving the potable water supply and the sanitation as well as the hygiene habits of the community, reducing the presence and incidence of diseases caused by low quality water and bad sanitation, and improving the maintenance of water sources as well as of the management of the potable water supply within the zone.
Ethiopia	Adaptation/ Capacity Building	Capacity building in environmental geology - mapping of geo-risk including hydrogeological condition in Dila and Hosaina areas	2012 - 2014	0.48	The project aims to establish cooperation in the field of disaster prevention and preparedness. Main areas of concern are soil erosion and sustainability of water sources and other natural resources. The project should support Ethiopian government in its efforts to improve living conditions of Ethiopian citizens and organizations, with special attention being paid to their ability to reduce poverty with their own powers. This should be achieved by developing capacities in the field of geology, geological risks evaluation and hydrogeology, which will contribute to the protection of environment and sustainable use of natural resources.

Source: MFA

ANNEX 6 Information on selected important national research projects

- ***Refinement of current estimates of the impacts of climate change in the sectors of water management, agriculture and forestry and proposals for adaptation measures***

The Ministry of the Environment supported project SP/1A6/108/07 and the chief beneficiary was the **Czech Hydrometeorological Institute (CHMI)**. Project ran from 2007 to 2011.

The project aimed to improve accuracy and update scenarios for climate development in the Czech Republic for periods covering 2021-2050 and 2071-2100, and to make the anticipated climate change impacts more accurate with regard to water management, agriculture and forestry sectors and to propose suitable adaptation measures, and lastly, to support meeting of the objectives defined by the National Programme to Abate Climate Change Impacts in the Czech Republic.

The results of the project included improved and updated regional climate change scenarios in the Czech Republic in cross-cutting periods 2010–2039, 2040–2069 and 2070–2099, including impacts of climate change to hydrological balance, water sources and extreme hydrological events and impacts of climate change onto agriculture and forestry sectors.

- ***Assessment of the effect of climate change impact on hydrological balance and proposal for practical measures to mitigate its impacts***

The Ministry of the Environment provided support for project SP/1A6/151/07 and the chief beneficiary was the **Czech Geological Survey (CGS)**. Project ran in 2007 – 2011.

Objective of the project was to provide valid estimates of climate change impact on hydrological balance and extreme hydrological events and water sources in the Czech Republic.

Project included research of hydrological characteristics in selected river basins, detailed re-evaluation of hydro-physical parameters of various watercourses. Project described a sophisticated local warning system built using the most up-to-date knowledge of hydrodynamic mechanisms associated with creation of torrential runoff. Early warnings methods are based on new findings concerning hydrodynamic mechanisms of runoff from small river basins. Extreme runoff events are caused by the following factors or their combinations: (1) over-saturation of the soil with water, (2) hydrophobia of the soil cover, (3) gravitationally destabilized flow of water within the soil, (4) extreme precipitation, usually after a long-term dry periods. Typical combinations causing extreme runoff scenarios include (1) and (3) – on over-saturated soil even small precipitation may cause gravitationally destabilized flow of water; (2) and (4) – long-term dry period may cause hydrophobia and simultaneously trigger extreme rainstorms. Research proposed practical eco-stabilization measures for selected river basins.

- ***Research of available measures to ensure drinking water supply during climate change***

The Ministry of Agriculture financially supported project QI112A132 and the chief beneficiary was the **Faculty of Mining and Geology at VŠB-Technical University of Ostrava**. Project was commenced in 2011 and will be completed in 2014.

Objective is to elaborate a complex proposal for measures to ensure drinking water supply to population during dry periods with lack of water sources.

- ***Integration of the KLIMATEXT team into international cooperation***

The Ministry of Education, Youth and Sports provided support to project EE.2.3.20.0086 and chief beneficiary was the **Technical University of Liberec – Faculty of Education**. Project was financed through ECOP. Project commenced in 2011 and will be completed in 2014.

One of the key topics in current climatology and statistics is development of statistical models of probabilities of extremes. This inter-departmental project will link research undertaken in the Czech Republic more closely to international activities and top foreign laboratories, effectively linking scientists working in various fields of statistics and climatology and broadens the current state of knowledge base and potential of these advanced methods among broader professional public and students.

- ***Partnership in climate research and adaptation strategies***

The Ministry of Education, Youth and Sportsprovides support for project EE2.4.31.0056 and the chief beneficiary is the **CzechGlobe – Global Change Research Centre AS CR**. Project was financed by the Education for Competitiveness Operational Programme. Project commenced in 2012 and will be completed in 2014.

The main objective of the project was to establish strategic partnership in the field of climate research and adaptation to climate extreme impacts. Creation of a multidisciplinary team of scientists from tertiary education institutions and research organizations will create conditions for high-quality research and publishing activities exceeding standard.

- ***Multi-level analysis of urban and suburban climate in medium-sized cities***

The Czech Science Foundation supported project GA205/09/1297 and the main beneficiary was the **Natural Sciences Faculty of the Masaryk University in Brno**. Project ran in 2009 – 2012.

Project studied the climate in Brno and Olomouc including its surroundings. Time and spatial climate variability of these two medium-sized cities had been analysed on several levels using high-resolution data (satellite thermal surveys, standard and topical and ambulatory measurements). Project created a database of available data sources and supplemented new measurements to it. Studies of extreme values of selected meteorological elements (maximum temperature, heat waves, extreme precipitation, gusts of wind) were paid special attention as well as certain effects of selected extreme hydrometeorological events (storm rainfall, storms, hailstorms).

The main results of the project are monographs comprehensively covering climate in Brno and Olomouc. It covers changes in climate over time and space and its impact on the

environment in these two cities. Results provide valuable information on climatic circumstances in both cities, which may both positively and negatively influence their territorial development and quality of life.

- ***Influences of climate variability and meteorological extremes on production of selected crops between 1801 and 2007***

The Czech Science Foundation provided support for project GA521/08/1682 and the main beneficiary was the **Mendel University in Brno.** Project ran in 2008 – 2010.

Project focused on evaluating influences of climate variability and meteorological extremes on production of selected crops in two important farming regions. The first phase of the project reconstructed unusually long time series of data (extending over 200 years) in terms of: (A) production parameters on various levels (location/farm/district); (B) technology used such as planting methods, use of fertiliser, species planted etc.; (C) daily meteorological data and other parameters such as soil characteristics. Subsequently, the resulting agro-meteorological indexes and dynamic growth models were used to answer the following questions: (1) Is it possible to detect impact of change in climate variability and frequency/intensity of extreme events on crop production in the last 200 years? (2) Has crop production vulnerability changed due to climate variability or occurrences of meteorological extremes (by, for instance, new silvicultural technologies) or changes in climate variability alone? (3) How appropriate are the currently used silvicultural technologies in the light of climate change?

- ***Integrated influence of climate change, ambient air quality and forest management to water ecosystems in spring areas of river basis***

The Czech Science Foundation provided support for project GA526/09/0567and the chief beneficiary was the **Natural Sciences Faculty of the Charles University**. Project ran in 2009 – 2013.

Project is based on integrated forestry, hydrological, atmospheric and limnology research of spring areas in medium-altitude, mountainous and alpine river basins. Mountain lakes and small watercourses draining these basins represent very suitable ecosystem models allowing quantitative monitoring of a broad spectre of natural and anthropogenic environmental factors on the environment. Project focuses especially on global climate change and air pollution which is closely related to processes triggering anthropogenic acidification and recovery from acidification – which have so far been the most significant phenomena affecting spring basins. Health of forest growth, hydrological parameters, substance runoff and watercourse recovery serve as appropriate indicators quantifying effects of the above factors. Predictions of future changes are carried out using hydro-geo-chemical models applied to global climate scenarios adapted to these specific regions and anticipated trends of acidic depositions.

- ***Probability scenarios for climate in the Czech Republic***

The Academy of Sciences CR provided support for project IAA300420806 and the chief beneficiary was **Institute of Atmospheric Physics**. Project ran between 2008 and 2011.

Project aimed to develop probability generator of climate scenarios, which combined scenarios derived using various methods from the most current global climate change

simulation models (GCM). Scenarios defining annual course of changes of ground-level climate characteristics are derived using the "pattern scaling" method. Time series (daily and monthly) of these characteristics are created using statistical downscaling (transfer function will be expressed in various ways) and stochastic generator modified according to climate change scenarios.

The main objective was to validate input GCM models; constructions of climate change scenarios, time series and analysis of uncertainties; development of probability generator of climate scenarios, which will produce climate change scenarios from a set of scenarios derived from available GCM simulations using available methods and subsequently generations time series representing changed climate and evaluation of climate change impacts using more complex climate characteristics.

- ***High-resolution climate change scenarios for study of their impacts in agriculture***

The Ministry of Education, Youth and Sports provided support for project OC10061 and the chief beneficiary was the **Faculty of Mathematics and Physics of the Charles University in Prague**. Project took place in 2010.

The main objective was to construct an innovated scenario for climate change in Central Europe for period covering 2021-2050 and 2071-2100 and determine the corresponding change in agro-climatic indexes.

- ***Reliability and security of water management facilities in changing climatic conditions***

The Ministry of Agriculture supported project QH71201 and the beneficiary was the **Faculty of Engineering, CTU Prague**. Project ran 2007 – 2011.

The project's objective was to quantify impacts of climate change on the combined supply and retention functionality of the reservoirs / dams and reliability of the facilities' functions during floods and operative managements.

- ***Research of adaptation measures for purposes of eliminating impact of climate change in Czech regions***

The Ministry of Agriculture supported project QH81331 and the chief beneficiary was the **T. G. Masaryk Water Research Institute**. Project ran in 2008 – 2012.

Project proposed methods, and verified these method on pilot applications, for designing efficient adaptation measures eliminating climate change impact on water sources in the Czech Republic.

- ***Climate change and population dynamics of invasive species of plants in the Czech Republic considering alternative scenarios of global climate change***

The Ministry of the Environment provided support to project SPII2D1/37/07 and the chief beneficiary was the **Natural Sciences Faculty at University of Southern Bohemia in České Budějovice**. Project ran in 2007 – 2010.

Project evaluated prediction systems and selected those suitable for conditions in the Czech Republic; project mapped variants of potential proliferation of invasive species in individual

climate change scenarios; it created maps of places of interest (location with threatened biodiversity, location suitable for monitoring, locations suitable for early intervention during invasion); it also evaluated potential economic impact triggered by proliferation of alien species as well as formulating proposed strategy for management of plant invasions.

- ***Sustainable use of water sources under climate change conditions***

The Czech Technology Agency supported the TA01020508 project and the chief beneficiary was the **T. G. Masaryk Water Research Institute**. Project runs in 2011 – 2014.

Project aimed to estimate the probable development of water balance in connection with climate change using the outlook for volume of surface and ground water. The existing recommended approaches to water balance outlooks did not correspond to the current conditions, which are already influenced by climate change and the resulting change in water regime in the Czech Republic. New software solutions need to be designed for these evaluations. One should address the link between hydrological balance of water and water management balances of surface water and ground water. Different programme software should address outlook of water volumes. At the end of the project (2014), once the software programmes and related methodologies will have been verified on pilot projects preparing outlooks for volumes of surface and ground water, a certified methodology will be drafted.

- ***Towards geological storage of CO_2 in the Czech Republic***

The Ministry of Education, Youth and Sports provided support for project 7F09023 and the main beneficiary was the **Czech Geological Survey (CGS)**. Project was financed by EEA/ Norway financing mechanism. Project ran in 2009 – 2010.

Carbon dioxide (CO_2) capture and geological storage (CCS) is one of the most important options of decreasing man-made emissions of CO_2 - the substantial greenhouse gas. The main objective of the project was to significantly increase the level of knowledge of the most promising structures potentially suitable for geological storage of CO_2 in the Czech Republic - i.e. the deep saline aquifers of the Central Bohemian Permian-Carboniferous basins and (semi-) depleted hydrocarbon fields of eastern Moravia, and to re-assess more accurately their CO_2 storage potential. The partial project objectives were to increase the knowledge of petro-physical, lithological and geo-mechanical properties of both reservoir and seal rocks by laboratory analyses; to build initial basin and reservoir models of one selected storage site and perform the very first simulation of potential CO_2 injection and storage; and to assess the depleted oil fields in the Czech Republic with respect to their suitability for CO_2-driven enhanced oil recovery and CO_2.

- ***Climate change and migration as a form of adaptation***

The Ministry of Education, Youth and Sports supported project LD13032 and chief beneficiary was the **CzechGlobe – Global Change Research Centre AS CR.** Project will run in 2013 – 2015.

Research will contribute to meeting the objective of improving understanding of links between climate change and migration using theoretical and empirical research. Another objective of the project is to broaden research capacity in the area of climate change and migration in the Czech Republic and to involve the up to date Czech research into

international research consortia and structures. Partial objective is to contribute to creation and refinement of the concept of environmental migration incl. analysis of methods to perform research of environmental migration and estimate numbers of potential environmental migrants; analysis of various migration processes under similar climate change scenarios; analysis of migration as an adaptation strategy; mapping the perception of the changes in environment brought by climate change by the affected population; field research of climatic extremes on demographic processes.

- ***Biogenic greenhouse gas emissions and carbon and nitrogen transformation processes in soil in connection with global climate change: regulatory mechanisms, influence of various methods of soil management and extreme weather fluctuations***

The Ministry of Education, Youth and Sports supports project LH13276 and chief beneficiary is the **Crop Research Institute (CRI).** Project runs between 2013 and 2015.

The main objective is to explore influence of extreme meteorological events accompanying global climate change on biogenic greenhouse gas emissions and mechanisms, which regulate the processes of accumulation and transformation of carbon and nitrogen in soil in various contrasting methods of farming (arable land, fallow land, meadows and pastures, recultivated anthropogenic soil etc.). Special attention will be paid to evaluation of impacts of various agro-technical soil processing methods, level of fertilisation (especially by organic fertilisers), planting methods and length the land is used for farming in conditions undergoing climate change and its effect on basic balance parameters of carbon-nitrogen cycle in typified agro-ecosystems. The expected results will enable elaboration of scientifically justified practical recommendations for achieving reduced greenhouse gas emissions levels and increased accumulation of carbon and nitrogen compounds in soil differentiated according to individual soil types and methods of their management.

- ***Growth models as a tool for increase of production potential and food security in the Czech Republic under climate change***

The Ministry of Agriculture is the provider of support for project QJ1310123 and the main beneficiary is the **CzechGlobe – Global Change Research Centre AS CR**. Project started in 2013 and will run until 2017.

Project seeks to develop and apply methods enabling use of an ensemble of growth models for evaluation of main crops production potential in the current and in the anticipated climate and to carry out experiments validating these models in required extent, as these have not been yet done in the Czech Republic. The findings will be applied to case studies, which will include specific farms in key production areas as well as the entire Czech Republic, which will produce basis for strategic decision-making processes. Project will attempt to resolve this objective not only for the Czech Republic, but thanks to involvement in the JPI FACCE-MACSUR pilot project, also use the upcoming experiments in various European countries and to increase the quality of the achieved output to Czech users, especially in terms of documentation used in decision-making processes on regional and national level.

- ***Alleviating climate change impact on landscape using research focused on biological diversity of landscape and their functional features for sustainable agriculture and systems supporting life in anthropogenic landscape mosaic***

The Ministry of Education, Youth and Sports is the provider of support for project 7AMB13AR017 and the main beneficiary is the **Faculty of Agriculture at USB in České Budějovice**. The 6th EU framework programme provides financing. Project started in 2013 and will run until 2014.

The objective is to characterize variability and dynamics of agricultural methods of managements, wildlife locations and bio-geo-chemical cycles in various spatial arrangements (fields, farms, landscape and region) in varying conditions in Argentina and the Czech Republic, analyse socio-economic causes and consequences of strategies used in agricultural and water management (pilot research) and to propose models, which will analyse relations between agricultural landscape and spatial distribution of wild plant and wild animal populations.

- ***Sustainable Urban Development Planner for Climate Change Adaptation***

The Ministry of Education, Youth and Sports was the provider of support for project 7E10041 and the chief beneficiary was **CENIA, Czech Environmental Information Ag*ency***. Project was financed from EEA/Norway financing mechanism. Project was completed between 2010 and 2012.

The SUDPLAN project aimed at developing an easy-to-use web-based planning, prediction, decision support and training tool, for the use in an urban context, based on and what-if scenario execution environment, which helps to assure population's health, comfort, safety and life quality as well as sustainability of investments in utilities and infrastructures within and changing climate. The tool is based on an innovative and visionary capacity to link, in an ad-hoc fashion, existing environmental simulation models, information and sensor infrastructures, spatial data infrastructures and climatic scenario information in and service-oriented approach, as part of the Single Information Space in Europe for the Environment (SISE).

ANNEX 7 Examples of EE&A-related projects in the field of climate change implemented by NGOs in 2009 – 2012

- ***Model climate conferences***

This international project on climate change was implemented by –)the Centre for Environmental Education and Ethics (SEVER)) and Partnership Foundation involving pupils from the UK, Poland and the Czech Republic. The InterClimate Network (ICN) approached its partnership organizations SEVER, Partnership Foundation, Fundacja Miejsc i Ludzi Aktywnych, Global Dimension Trust and Gymnázium 1 in the Polish city of Myślenice in 2012, with a proposal to jointly organize 15 climate conferences in the Czech Republic, Poland and in the United Kingdom. Conferences were organized following the example of the UNFCCC and took place at the same time as the 18th Conference of the Parties – COP 18 in Doha in Qatar (26 November to 8 December 2012). In total 930 young adults between 13 and 19 years met to discuss the second commitment period of the Kyoto Protocol.

- ***How to teach about climate change***

The Association for international affairs in 2011 implemented this project. It mapped courses on climate change at selected high schools and received feedback from pedagogues. A workshop with climate change experts and NGOs and private sector representatives formed a part of the project; the workshop took place on 14 September 2011 in the UN information centre in Prague, which hosted the project. The result was publication "How to teach about climate change?" summarising the main climate change facts, provides unbiased outline of contestable points of the public debate on the topic, and introduces the reader into the environmental and political framework of the issue and helps pedagogues in preparing their lectures.

- ***Cyber DISPLAY***

This was an international project involving National network of healthy cities in the Czech Republic, running from 2008 until 2011; it was financed by Intelligent Energy Europe programme. The objective of the project was to show how it is possible to apply principles and objectives of the EU Directive on the Energy Performance of Buildings by communication and publication of data on energy (and other media) consumption in buildings in cities and municipalities. The campaign continued in the vein the popular Display programme, which demonstrated that knowledge of the actual energy consumption in school buildings and other public and private buildings may promote introduction and implementation of savings measures and help in monitoring their effect. The main instruments of the campaign were: energy labelling of buildings, energy management and educational activities.

- ***SUNFLOWER***

This was an international project involving National network of healthy cities in the Czech Republic, running from 2008 until 2011; it was financed by Intelligent Energy Europe programme. The objective of the project was to support development of renewable energy sources at local and regional level via sharing good practice principles, establishing renewable energy sources, training of selected personnel wanting to do business in the field

of renewable energy sources. Project aimed to develop a broad partnership between entrepreneurs and local authorities in order to promote use of renewable energy sources and to encourage local economy. The project managed to form long-term partnership between commercial and public sphere, between entrepreneurs and scientific institutions etc. in the Czech Republic and within the EU. Project contributed to increased awareness about renewable energy sources among general public thanks to a number of campaigns and educational programmes, excursions, workshops and study trips.

- ***Promotion of the Covenant of Mayors in the Czech Republic***

This project was implemented in 2011 by PORSENNA, o. p. s. in cooperation with SEVEn, o. p. s. with the support of the Ministry of the Environment, within the framework of the Come2CoM project enjoying the support of the European Commission and its Intelligent Energy Europe and the office of Covenant of Mayors in Brussels. The objective was to generally promote involvement of cities and municipalities in the Covenant of Mayors. A conference on the topic "Covenant of Mayors – opportunity for Czech cities" was the first step to distributing information and raising awareness about the development of European cities and their efforts to be energy-responsible, self-sufficient and secure.

- ***Carbon footprint of cities – instrument of climate protection policies on local level***

This project took place in 2010 – 2012 and was implemented by TIMUR (a civic association) in cooperation with 6 medium-sized cities. The objective was to create, test and present tools and processes allowing cities to determine their equivalent greenhouse gas emissions (i.e. carbon footprints). Partial objective was to determine, group and present general recommendations for the climate protection for cities in the Czech Republic. Project included educational activities focusing on involvement of Czech cities in the most important European activities in the area of climate protection at local level – via Covenant of Mayors. Project built Internet presentation at www.uhlikovastopa.cz, 6 case studies including recommendations for measures at local level; workshops were organized, information materials were published for citizens of participating cities addressing the topic of carbon footprint and climate change.

- ***Information campaign presenting practical methods for reductions of greenhouse gas emissions***

Information campaign run by Duha Movement – Přátelé Země ČR (Friends of the Earth of the Czech Republic) took place in 2010 and in 2011 with the support provided by the Ministry of the Environment. The campaign raised awareness of the general public bout climate change, explained the need for efficient measures aimed at reducing greenhouse gas emissions and motivated participants to be active themselves. Project included an information tour, a conference and communication and media activities. Thousands of recipients familiarised themselves with practical solutions for reducing greenhouse gas emissions in households and with opportunities brought by the recommended measures.

- ***Carbon detectives – educating pedagogues and pupils about climate change***

The Centre for Environmental Education and Ethics (SEVER), with the support of the Ministry of the Environment, organized in 2011 a series of education seminars for pedagogues to make them familiar with various teaching aides, their use and their

possibilities to implement them into courses at schools. The main result of the project is the increased awareness and knowledge of pedagogues about the concepts of intelligent energy in the context of sustainable development and climate change and increased skill set of the pedagogues in integrating these topics in their teaching.

- ***Centre for ecologic education at Kaprálův mlýn***

The Centre for ecologic education at Kaprálův mlýn in Moravský kras was established due to extensive renovation financed by the Operational Programme Environment. The Centre is an example of low impact, low carbon footprint building and operation. The Centre and its calculation of carbon footprint serve as a model/reference example for other accommodation facilities. The operator of the facility, a youth organization, uses the process of calculating the carbon footprint and measures to reduce it as an example during ecological education programmes and present its result on international level as an inspiration for other boy-scout bases.

- ***Education campaign – Comparing the quality of built passive houses in the Czech Republic***

The EkoWATT company organized an education campaign in 2011 focusing on increasing awareness in the sector of passive house construction in the Czech Republic and increased quality of this type of construction. The project evaluated on complex scale the energy quality of six types of family houses using different construction approaches and all resulting in passive standard. The evaluation included already completed passive house ideally with one-year operation behind them, which are normally offered by Czech construction companies. Evaluated indicators included primary energy properties of used construction materials and their equivalent CO_2 values.

- ***With your own eyes – savings and renewable energy sources in buildings***

A branch of the Czech Union for Nature Conservation bearing the name Veronica implemented an awareness programme which presented specific measures to several tens of thousands of Czech inhabitants, which could assist in bringing about reduction of their households' contribution to greenhouse gas emissions and to raise their awareness of opportunities to reduce greenhouse gas emissions in the Czech economy generally. Campaign took place in 2010 via information kiosks, presentations etc. Veronica implemented a similar project focusing on public administration in that same year.

- ***Measures aiming to reduce energy intensity of panel houses***

The EkoWATT company created an online calculator in 2009 for owners and managers of panel buildings, which allows modelling of energy intensity and balances of the building and searching for ways to implement complex savings measures via renovating the building. The on-line calculator has a manual and was later complemented by a series of seminars and articles.

- ***Climate calculator at www.zmenaklimatu.cz***

The "Calla" association motivated general public in 2009 to calculate their carbon footprint and to reduce greenhouse gas emissions in their households and in their life by directing them

to the above online site. On the basis of their own data on electricity consumption, consumption of other energies, appliances, lifestyle, travel information, eating habits and waste management, users may calculate how many CO_2 equivalent emissions per year they produce and then compare their footprint with the average production of other inhabitants on Earth.

- ***Involving NGOs in informing on the EU and international climate agenda***

The main objective of the project managed by the Zelený kruh (Green Circle), which is a platform of ecologically-oriented NGOs, was to contribute, by coordinated action of NGO elements, to successful adoption of the ambitious version of the EU climate and energy package and consequently to conclude post-Kyoto agreement at the UNFCCC conference in Copenhagen in December 2009. Project was implemented in the form of series of seminars, corporate mission statements, information sheets and a bulleting covering the topic.

- ***Ekolist.cz – climate change reporting***

The "Ekolist" is the most read electronic medium focusing on nature protection and conservation and sustainable development in the Czech Republic. Project focuses on reporting of all aspects of climate change and was brought to life by its publisher a civic association BEZK. Between March 2010 and April 2011 it published 749 climate-related reports. Reporting focused on post-election negotiations, Government declaration and first steps of the new Minister of the Environment in the field of air protection and climate. Ekolist was also one of the few media outlets that informed about the Climate Conference in Cancun. Project organized virtual roundtables with experts. Ekolist published 410 press reports and republished 142 articles, of that 82 in translation. According to Google Analytics, the website had 636 546 unique visitors in the monitored period, which is 53 045 visitors monthly during twelve months of the project. Between 2010 and 2011 State Environmental Fund of the Czech Republic financed the project. A similar project called "Ekolist and climate change" was operated in 2009 with the support of the Ministry of the Environment.

- ***Bedrník Magazine***

Magazine for eco-literacy Bedrník is published by Pavučina Association of Environmental Education in cooperation with the Centre for Environmental Education and Ethics (SEVER). The first issue was published in November 2002. Magazine is involved in complex environmental education and within that mission it also focuses on climate change. For example, issue 1/2009 focused on "Peak Oil", issue 1/2011 on "Green Low-Carbon Economy." Magazine is distributed mostly among pedagogues, lecturers etc.

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