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Report on the in-depth review of the third national communication of the Czech Republic

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

A. Introduction

1. The Czech Republic acceded to the United Nations Framework Convention on Climate Change (UNFCCC) on 7 October 1993 and ratified the Kyoto Protocol on 15 November 2001. The first national communication (NC1) of the Czech Republic was received by the UNFCCC secretariat in 1994, and the second (NC2) in 1998. This **third national communication (NC3) was received on 28 December 2001**.[1]

2. The NC3 was prepared in about 18 months under the guidance of the Inter-ministerial Committee on Climate Change (IMCCC). The Czech Hydrometeorological Institute (CHMI) coordinated the preparation of the NC3 by concerned ministries and agencies.[2] Non-governmental organizations (NGOs) did not take part in the preparation and review of the NC3.

3. The in-depth review of the NC3 was carried out from June to September 2002 and included a visit by the review team to Prague from 15 to 19 July 2002. The team consisted of Mr. K.S. Edjame (Togo), Ms. A. Urbancic (Slovenia), Mr. Y. Sarafidis (Greece) and Mr. S. Kononov (UNFCCC secretariat, coordinator). During the visit, the team met Czech experts involved in the preparation of the NC3, officials from ministries and agencies, and a representative of an environmental NGO.

B. National circumstances

4. The Czech Republic is a landlocked country in the middle of Europe, bordered by Poland in the East, Germany in the North and West, and Austria and the Slovak Republic in the South.

5. In its present form, the Czech Republic was established on 1 January 1993 after the division of the former Czechoslovakia into the Czech Republic and the Slovak Republic. It is a parliamentary democracy. The head of state is the president elected by the parliament for a five-year term. The president appoints the prime minister and, upon the recommendation of the prime minister, the government. The Czech Republic is divided into 14 regions, each with a degree of self-governance.

6. The climate is temperate. The average summer temperature is between 8.8°C and 18.5°C and the average winter temperature is between –6.8°C and 0.2°C. About 80 per cent of the territory lies below 500 m altitude. Some 54 per cent of the territory is agricultural land, and 33 per cent is forest.

7. In 1991, the Czech Republic started the transition to a market economy, which resulted in an economic decline in the period 1991–1993. However, growth began again in 1994. Structural changes in the Gross Domestic Product (GDP) occurred between 1990 and 2000: the share of industry decreased from 49 to 41 per cent while the share of services increased from 45 to 55 per cent.[3] Because of a decline in industrial output, structural changes in industry and in the energy sector, and an increase in energy use efficiency, economic recovery did not lead to a growth in energy consumption or in greenhouse gas (GHG) emissions (table 1).

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[1] According to decision 11/CP.4, the submission deadline was 30 November 2001.

[2] The following organizations took part in the preparation of NC3: Ministry of Agriculture, Ministry of Environment, Ministry of Finance, Ministry of Industry and Trade, Ministry for Regional Development, Ministry of Transport and Communications, CHMI, Department of Meteorology and Environment of the Faculty of Mathematics and Physics of the Charles University, National Climate Program of the Czech Republic, ENVIROS Ltd. (formerly SRC International CS Ltd.), State Environmental Fund, Water Management Research Institute.

[3] World Bank country data at www.worldbank.org

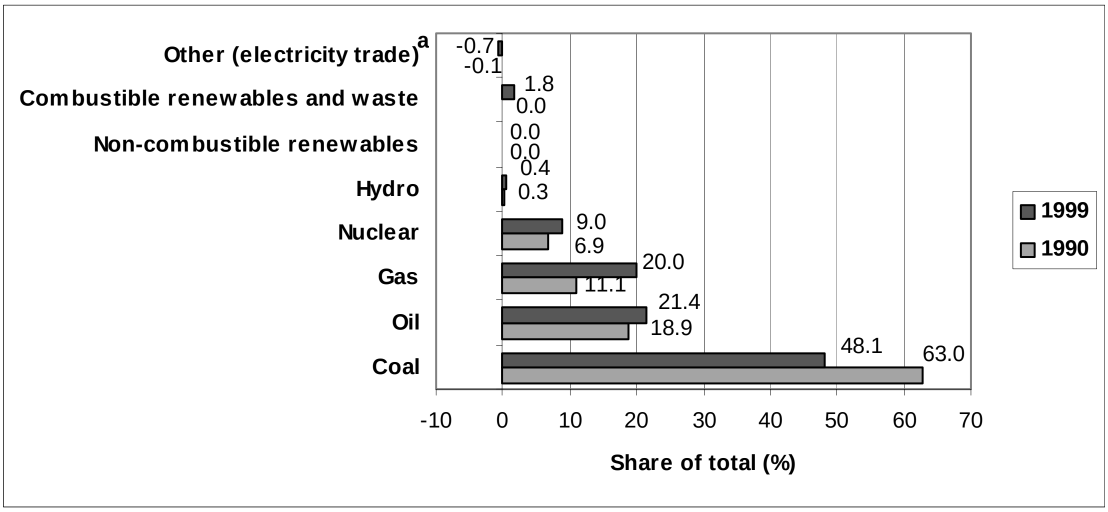
Table 1. Main macro-economic indicators and GHG emissions for the Czech Republic

	1990	1999	Change (%)[a]
Population (millions)	10.36	10.28	–0.8
Gross domestic product – GDP (billions of US$ of 1995)[b]	134.1	128.6	–4.1
Total primary energy supply – TPES (Mtoe[c])	47.40	38.58	–18.6
Electricity consumption (TWh)	48.18	48.12	–0.1
GHG emissions[d] (Tg[e] CO_2 equivalent)	189.8	141.1	–0.1
GHG emissions per capita (Mg CO_2 equivalent)	18.3	13.7	–25.1
GHG emissions per GDP unit (kg CO_2 equivalent per US$ of 1995)	1.42	1.10	–22.5

Note: The data for GDP, TPES and electricity are from “Energy balances of OECD countries, 1998–1999”, OECD/IEA, Paris, 2001. Data for population and GHG emissions are from the NC3.
[a] The change is calculated as: [(1999 – 1990)/1990] x 100.
[b] Calculated using the method of purchasing power parities (PPP), see: www.worldbank.org/data/icp/aboutpppdata.htm
[c] Millions of tonnes of oil equivalent.
[d] Without accounting for land-use change and forestry (LUCF).
[e] One teragram (Tg) is equal to 1,000 gigagrams (Gg) or one million tonnes.

8. Domestic coal is the key energy source, in particular for electricity generation (figures 1 and 2), although its share has noticeably decreased since 1990. Coal is being gradually replaced by natural gas, whose share in energy supply almost doubled in the 1990s. The use of oil products increased due to increasing road transport. The share of nuclear energy in electricity supply is likely to increase in the future because of the commissioning of two 1000 MW(e) units at Temelin: one in 2001 and another planned for 2003. Between 1990 and 1999, there was an increase in the use of combustible renewables, their share reaching 1.8 per cent in 1999.

Figure 1. Structure of primary energy supply in the Czech Republic

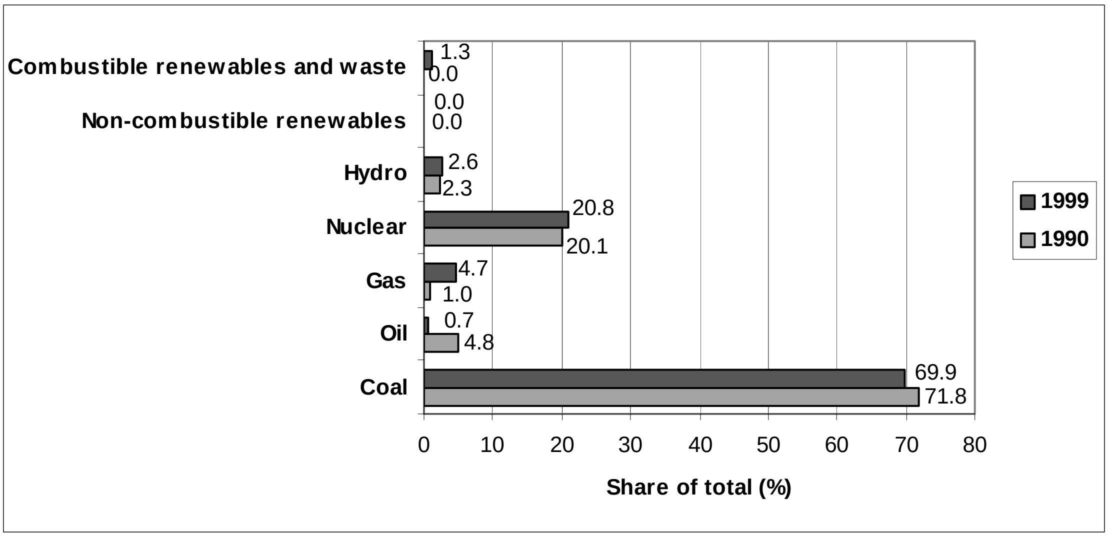


Source: “Energy balances of OECD countries, 1998–1999”, OECD/IEA, Paris, 2001.
Note: The sum of shares may not be exactly 100 per cent because of rounding.
[a] The negative number for electricity trade means, in accordance with the conventions of IEA statistics, that the country exports more electricity than it imports.

9. Table 1 shows that GHG emissions declined considerably in the 1990s. But because of the still large share of coal in energy supply and the still inefficient uses of energy, emissions per GDP unit remain relatively high in comparison with other member countries of the Organisation for Economic Co-operation and Development (OECD). For example, CO_2 emissions from fuel combustion in the Czech Republic in 1999 were 0.86 kg CO_2/US$ while the average for OECD countries was 0.52 kg CO_2/US$.[4]

[4] “Key World Energy Statistics from the IEA: 2001 edition”, OECD/IEA, Paris, 2001.

Figure 2. Structure of electricity supply in the Czech Republic



Source: "Energy balances of OECD countries, 1998–1999", OECD/IEA, Paris, 2001.
Note: The sum of shares may not be exactly 100 per cent because of rounding.

C. Relevant general, energy, and environmental policies

10. The Czech Republic became a member of OECD in 1995 and of the International Energy Agency (IEA) in 2001. **Accession to the European Community (EC) is a key national goal**. Preparation for the accession, including extensive revision of energy and environmental policies, started in the early 1990s and still continues.

11. **The national energy policy**, revised in 2000, stipulates further harmonization of the Czech energy legislation with that of the EC. In addition to security of energy supply, efficiency of energy use and the establishment of energy markets, the policy sets environmental targets, such as an increase in the share of renewable energy sources (to 5–6 per cent of the total consumption of primary energy by 2010). The policy is implemented through governmental decrees ('Acts'), such as the new Energy Act and the Act on Energy Management, both of which have been in force since January 2001. The national energy policy is currently being revised to strengthen the need for sustainable, secure and environmentally benign energy supply, including GHG emission reductions.

12. **The environmental policy**, adopted by the government in 2001, also aims at harmonization with EC countries. The policy defines about 20 priority issues (emissions of GHG gases being one of them), outlines policy principles such as sustainable development and public participation, and sets long-term targets and progress indicators. GHG emissions are among the progress indicators. The new Clean Air Act (in force since June 2002) is to play the key role in policy implementation.

13. **Climate-related policies** are under the responsibility of the Ministry of Environment (MoE). The IMCCC, formed in 1998, coordinates implementation of the UNFCCC. Reflecting the growing importance of climate change, in 1999 the government approved a national "Strategy of Protection of the Climate System of the Earth in the Czech Republic". This strategy should be transformed in 2003 into a "National Program to Mitigate Changes in the Climate of the Earth".

14. When the Czech Republic acceded to the UNFCCC in 1993, national GHG emissions were considerably below the 1990 level, and they have continued to decline. Therefore, the UNFCCC aim to stabilize GHG emissions at the 1990 level by end of the 1990s was not relevant. Accordingly, the "Strategy of Protection of the Climate System of the Earth in the Czech Republic", while defining

directions of GHG mitigation in various sectors, did not include emission reduction targets. However, the State Environmental Policy, approved by the government in January 2001, stipulates the reduction of the national GHG emissions by 20 per cent by 2005 in comparison with the 1990 level, which is in line with the objectives of the UNFCCC. Under the Kyoto Protocol, the Czech Republic made a commitment to decrease GHG emissions by 8 per cent in comparison with the 1990 level in the first commitment period from 2008 to 2012. The "National Program to Mitigate Changes in the Climate of the Earth" is expected to contain targets consistent with the Kyoto Protocol.

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Inventory preparation

15. The **NC3 inventory was prepared by CHMI under supervision of MoE**. Emissions from combustion in the energy sector, fugitive emissions and some emissions from industry were calculated in cooperation with KONEKO Ltd. For the emissions of the precursors from mobile sources, data provided by the Centre for Transportation Research under the Ministry of Transport and Communications (MTC) were used.

16. The NC3 inventory covers the period from 1990 to 1999 and includes information on CO_2, CH_4, N_2O, PFCs, HFCs, SF_6 and GHG sinks as well as summary information on CO, NO_X, NMVOCs and SO_2. (In NC2, PFCs and SO_2 were not reported, and HFCs and SF_6 were only roughly estimated.) For HFCs, PFCs and SF_6, potential emissions are reported based on data provided by major importers and users (the relevant substances are not produced in the Czech Republic). CHMI is working on the evaluation of actual emissions instead of potential ones. In discussing the NC3 inventory, the review team used the latest (2002) inventory submission to the UNFCCC, including the National Inventory Report (NIR), and results of a recent desk review of the inventory by the UNFCCC secretariat.[5]

17. **The NC3 inventory is, in general, prepared in conformity with the UNFCCC guidelines, except for two inconsistencies**. First, sectoral emissions for the years before 1996 are not calculated with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as IPCC Guidelines) but later emissions are. Some emissions before 1996 are estimated with outdated emissions factors that are not consistent with the factors used for later years. Thus, these two parts of the NC3 inventory, 1990–1995 and 1996–1999, are not fully compatible.[6]

18. The second inconsistency relates to the allocation of process emissions from the "Iron and Steel" industry. These emissions are reported as part of energy emissions under "Fuel Combustion – Manufacturing Industries" instead of being part of "Industrial processes". This affects the outlook of emissions trends. The Czech experts are aware of these inconsistencies (also noted by the UNFCCC desk review of the Czech inventory) and they plan to recalculate GHG emissions for 1991 to 1995, subject to availability of funds.

19. The estimates of emissions uncertainty have not been updated since NC2 (CO_2, 7–10 per cent; CH_4, 30 per cent; N_2O, 100 per cent). A Tier 1 uncertainty analysis according to IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as IPCC good practice guidance) is planned for the 2004 inventory submission.

20. Emissions from international aviation are reported separately only for the period from 1996 to 1999. Calculations for the remaining years are in progress.[7] CO_2 emissions from biomass are not

[5] FCCC/WEB/IRI(1)/2001/CZE.
[6] Recalculated 1990 emissions were provided in the 2002 inventory submission and NIR.
[7] In the 2002 inventory submission and NIR, these emissions are reported separately also for 1990 and 2000.

reported; Czech experts estimate that they account for not more than about 2 per cent of the total CO_2 emissions.

21. Since NC2, major recalculations of emissions have been done. The key changes between the NC2 and the NC3 relate to CH_4 fugitive emissions from coal mining (based on updated emission factors), N_2O emissions (some changes have been made to emission factors), and emissions of HFCs, PFCs and SF_6 (based on improved data on imports). Only the recalculations of CH_4 fugitive emissions from coal mining were applied to the whole period from 1990 to 1999; other recalculations were applied only to 1990 and 1996–1999.

22. After the submission of the NC3, additional recalculations were done for CH_4 emissions from waste for the whole period from 1990 to 1999 (in accordance with IPCC good practice guidance), for CO_2 emissions from energy production and transformation (applying the sectoral approach for 1990, 1996, 1997), for N_2O emissions in 1990 (using the IPCC Guidelines and substituting obsolete emission factors), and for CO_2 removals through sinks. These changes are reflected in the 2002 NIR. The differences in the 1990 emissions among the NC2, the NC3 and the NIR are presented in table 2.

Table 2. Comparison of the 1990 emissions in the NC2, the NC3 and the 2002 NIR

	Tg CO_2 equivalent			Change from NC2 to NC3 (%)[a]	Change from NC3 to NIR (%)[b]
	NC2	NC3	NIR		
CO_2	165.5	165.5	164.0	0	–0.9
CH_4	18.6	16.3	16.8	–12.4	3.1
N_2O	7.9	8.1	11.3	2.5	39.5
GHG without LUCF	192.1	189.9	192.0	–1.1	1.1
LUCF	–2.281	–2.281	–2.128	0	–6.7
GHG with LUCF	189.8	187.6	189.9	–1.2	1.2

[a] The change is calculated as: [(NC3 – NC2)/NC2] x 100.
[b] The change is calculated as: [(NIR – NC3)/NC3] x 100.

B. Overall emission trends

23. GHG emissions decreased considerably from 1990 to 1993 as a result of economic decline after the start of the transition to a market economy (table 3). Since 1994, the emissions have been stable notwithstanding economic recovery. **Total GHG emissions in 1999 were about 26 per cent lower than they were in 1990**.

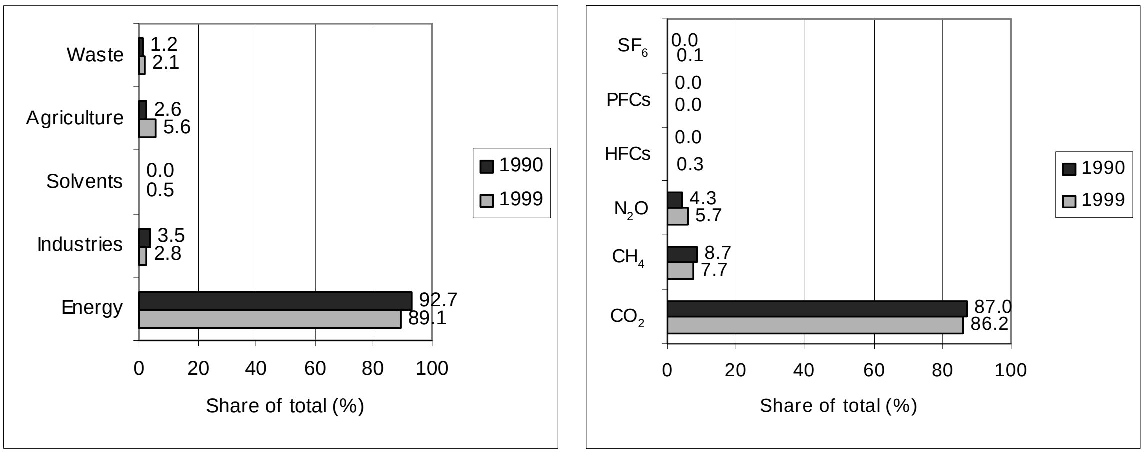
Table 3. GHG emissions by gas, 1990–1999

	Tg CO_2 equivalent										Change (%)[a]
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
CO_2	166	153	140	135	128	129	133	135	129	122	–26.5
CH_4	16.3	14.9	14.0	13.3	12.9	12.6	12.0	11.8	11.1	10.9	–33.1
N_2O	8.0	7.3	7.0	6.6	6.7	6.7	9.1	8.9	8.4	8.1	1.3
HFCs+PFCs+SF_6						0.2	0.3	0.6	0.5	0.5	150[b]
GHG without LUCF	190	175	161	155	147	148	155	156	149	141	–25.8
LUCF	–2.3	–5.0	–6.0	–5.6	–3.9	–5.5	–4.5	–4.6	–3.8	–3.4	47.8
GHG with LUCF	188	170	155	149	143	143	150	152	145	138	–26.6

Note: These are the emissions reported in the NC3; as in the NC3, the emissions from international bunkers are included in the total. Latest emission data from the NIR are not used because of their inconsistency with NC3 data due to the noted numerous recalculations. The 2000 data from the the NIR show an increase of the GHG total from 1999 to 2000: from 141 to 148 Tg CO_2 equivalent for emissions without LUCF, and from 138 to 144 Tg CO_2 equivalent with LUCF.
[a] The change is calculated as: [(1999 – 1990)/1990] x 100.
[b] Calculated relative to 1995.

24. The energy sector is the key contributor to GHG emissions with a share of about 90 per cent (figure 3). CO_2 accounts for more that 85 per cent of the total GHG emissions.

Figure 3. Structure of GHG emissions



Note: The sum of shares may not be exactly 100 per cent because of rounding.

25. **CO_2 and CH_4 emissions** decreased in the 1990s. **N_2O emissions** decreased in the early 1990s but began to increase in 1996 (table 3). This trend is attributed to the recalculations of N_2O emissions introduced since 1996 – the recalculations were not applied to the period from 1991 to 1995. CHMI acknowledged the need to complete the recalculations and provided new estimates for the N_2O emissions in 1990 (as part of the 2002 NIR) shown in table 2.

26. The emission reductions in the 1990s were driven by (1) decline in GDP; (2) structural change in the GDP with a decrease of the share of industry (especially in energy-intensive sectors) and an increase in the share of services; (3) change in the energy supply mix (increase in the shares of gas and nuclear energy at the expense of coal); (4) improvements in energy use efficiency; and (5) some increase in the use of renewable energy (mostly biomass and combustible waste). Climate change considerations did not play a notable role in these reductions.

27. The sum of the **emissions of HFCs, PFCs and SF_6** in 1999 was 1.5 times higher than it was in 1995. The increase in HFCs has been particularly high, whereas SF_6 emissions decreased from 1997 on (table 4). However, the apparent decline of SF_6 emissions in 1998 may be a consequence of inconsistent information on the imports of relevant substances. Another possible reason is that users may import irregularly (by creating stocks for more than one year[8]).

Table 4. Emissions of HFCs, PFCs and SF_6 (Gg CO_2 equivalent)

	1995	1996	1997	1998	1999
HFCs	2.2	134.5	295.6	381.8	411.9
PFCs	0.4	4.2	7.0	9.1	2.7
SF_6	166.8	183.1	323.1	131.7	110.8

C. Key emission sources and sectoral trends

28. According to the analysis of key sources in the NIR, five sources account for about 87 per cent of the total GHG emissions: stationary combustion of solid (57.7 per cent), gaseous (12.1 per cent), and liquid (6.7 per cent) fuels, road transport (7.0 per cent), and fugitive emissions from coal mining (3.4 per cent). Table 5 shows the development of GHG emissions by sectors and subsectors.

[8] This may be the reason for the high value for 1997 SF_6 emissions shown in table 4.

Table 5. GHG emissions by sector and subsector, 1990–1999

	Tg CO_2 equivalent										Change
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**(%)[a]**
1. Energy	176.5	164.1	150.1	142.1	136.8	136.9	137.9	142.3	132.5	125.4	–29.0
A1. Energy industries	*98.0*	*93.8*	*88.0*	*87.3*	*64.3*	*69.5*	*58.2*	*59.5*	*59.4*	*54.5*	*–44.4*
A2. Manufacturing and construction	*23.7*	*23.9*	*21.0*	*17.6*	*35.0*	*31.4*	*43.9*	*43.4*	*35.7*	*34.5*	*45.6*
A3. Transport	*8.3*	*7.2*	*8.5*	*8.7*	*8.6*	*9.2*	*10.6*	*12.1*	*11.1*	*12.7*	*53.0*
A4. Other	*38.2*	*31.7*	*25.4*	*21.5*	*22.3*	*20.1*	*18.8*	*20.8*	*20.0*	*17.8*	*–53.4*
B. Fugitive emissions	*8.3*	*7.5*	*7.2*	*7.0*	*6.7*	*6.6*	*6.4*	*6.5*	*6.3*	*6.0*	*–27.7*
2. Industrial processes	6.6	5.5	6.1	5.3	5.3	5.5	3.8	4.4	4.5	3.9	–40.9
3. Solvents	0.7[b]						0.4	0.4	0.7	0.6	–14.3
4. Agriculture	4.9	4.5	4.2	3.7	3.5	3.5	9.3	8.6	7.8	7.8	59.2
5. LUCF	–2.3	–5.0	–6.0	–5.6	–3.9	–5.4	–4.4	–4.6	–3.7	–3.3	43.5
6. Waste	2.2	2.2	2.2	2.1	2.1	2.1	2.4	2.7	2.7	3.0	36.4

[a] The change is calculated as: [(1999 – 1990)/1990] x 100.

[b] The estimate in the 2002 NIR. Emissions from "Solvents and Other products use" are not reported in the NC3 for the period from 1990 to 1995. The need to fill-in this gap is recognized in the NC3.

29. Notwithstanding the mentioned inconsistencies in emission calculations, the review team noted the following trends in sectoral emissions: (1) decrease in the emissions from energy industries, variations in the emissions from manufacturing and constructions industries, decrease in the emissions from the “Other sectors” within “Energy”; (2) increase in the emissions from transport; (3) decrease in fugitive emissions; (4) decrease in industrial emissions; (5) changes in the emissions from agriculture and waste; and (6) variations in CO_2 removals through LUCF.

30. ***GHG emissions from energy, manufacturing and construction***. The decrease of GHG emissions from energy industries resulted from a decrease in energy demand in the 1990s and a decline in the coal share of energy supply (see figure 1 and table 1). Variations in the emissions for “Manufacturing Industries and Construction” appear to be mainly because of methodological problems in disaggregating fuel consumption between energy and manufacturing industries and the inconsistency of the 1991–1995 and 1996–1999 data. The decrease of GHG emissions in "Other sectors" is due to switching to gas and electricity in the residential and commercial sectors. Demand decrease in response to growing energy prices after partial deregulation of energy markets in the 1990s also played a role.

31. ***GHG emissions from transport*** increased by 53 per cent between 1990 and 1999. As a result, the share of transport in the total GHG emissions was 9.0 per cent in 1999 compared to 4.4 per cent in 1990. These changes were driven by increased use of cars for both passenger and freight transport. According to MTC and CHMI, 40 per cent more passenger cars were registered in the Czech Republic in 2000 than in 1990. From 1995 to 2000, individual passenger transport by road increased from 54.5 to 63.8 billion passenger km; freight transport by road (including both the transport for own use and the transport as paid service) increased from 14.7 to 39.0 billion tonne-km.[9]

32. ***Fugitive emissions*** from the energy sector decreased by 28 per cent between 1990 and 1999. This resulted from a combination of two different trends: CH_4 emissions from mines decreased because of reduced use of domestic coal while fugitive CO_2 emissions increased due to the introduction of SO_2 scrubbing (with limestone) at power plants since 1996.

33. ***GHG emissions from agriculture and waste***. The estimates of these emissions were affected by the recalculations in N_2O and CH_4 emissions introduced since 1996. The recalculations resulted in a sharp increase of agricultural emissions from 1995 to 1996 (from 3.5 to 9.3 Tg CO_2 equivalent). This increase cannot be justified by any development in the sector because all relevant sectoral parameters (agricultural area, number of livestock, contribution to GDP) decreased in the 1990s. According to the

[9] “Transport Yearbook 2000”, Ministry of Transport and Communications of the Czech Republic, Praha, 2001.

NIR, the GHG emissions from agriculture in 1990 should be 12.5 Tg CO_2 equivalent, which makes the trend from 1990 more consistent with economic development of the sector. But emissions for the remaining years (from 1991 to 1995) still need to be recalculated. The growth in GHG emissions from waste may reflect the growing volumes of waste but recalculations of the 1991–1995 emissions are required before definite conclusions can be drawn.

34. ***CO_2 removals through LUCF***. The sink capacity given in the NC3 varies considerably between 1990 and 1999 (a 43.5 per cent increase in 1999 compared to 1990), although the forest area did not change much (an increase by about 0.3 per cent) and the total standing timber increased by 12 per cent in the same period. As a result, GHG removals through sinks increased from about 1 per cent of the total GHG emissions in 1990 to some 2.5 per cent in 1999.[10] The Czech experts indicated that LUCF calculations were simplified and further progress in the methodology was expected.

35. The review team felt that the analysis of emission trends in the NC3 could be strengthened. For example, analysis of such parameters as energy intensity in industry and the distances driven in transport would allow key emissions drivers to be identified. However, making emission data between 1990 and 1999 fully consistent is a prerequisite for a credible trend analysis.

III. POLICIES AND MEASURES

36. The UNFCCC guidelines[11] require that the reporting on policies and measures be organized by sectors, sub-divided by GHGs. This chapter of the NC3 is organized differently: 1) evaluation method; 2) process of preparation of measures; 3) measures and their benefits; 4) measures not implemented. However, notwithstanding a different structure, most of the required issues are covered. The summary table of measures is presented in accordance with the guidelines.

37. Harmonization with EC legislation in energy and environmental policies as part of the preparation for EC accession is the key objective of most cross-sectoral and sectoral measures. For example, the new energy policy (revised in 2000) and the new environmental policy (adopted in 2001) are designed to be compatible with relevant EC policies. These new policies are implemented through corresponding decrees (‘Acts’).

38. Because of the considerable decline of GHG emissions after 1990, the Czech Republic did not establish quantitative reduction targets under the UNFCCC. Under the Kyoto Protocol, ratified by the Czech Republic in November 2001, the country committed itself to an eight per cent reduction in the emissions of GHGs (compared to the 1990 level) in the first commitment period of 2008 to 2012.

39. The implementation of the UNFCCC and the Kyoto Protocol is coordinated by the MoE. The MoE also coordinates the work of the IMCCC. The Ministry of Industry and Trade (MIT), the MTC, and the Ministry of Agriculture (MA) are responsible for the coordination and implementation of policies and measures in their relevant fields and the Ministry of Finance creates a corresponding financial framework. The review team noted the complexity of the coordination of climate-related issues among the various organizations involved and felt that improvements in communications among the ministries and in the assignment of responsibilities for specific climate change issues could be considered.

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[10] This reflects the effect of increased reforestation and afforestation in the 1990s to replace dead forests damaged by sulphur dioxide emissions in the 1980s.

[11] FCCC/CP/1999/7.

A. Cross-sectoral policies and measures

40. The key cross-sectoral measures are: the Energy Act, the Act on Energy Management, the Clean Air Act, and the "Strategy of Protection of the Climate System of the Earth in the Czech Republic".

41. ***The Energy Act*** (in force since January 2001) provides operators of cogeneration, renewable energies and waste combustion installations with preferential access to grids, provided that the technical requirements are met. Quantitative targets for the penetration of renewable energy sources have been set for 2005. The share of renewable electricity in the total gross electricity consumption is to be 3 per cent without large hydro power stations[12] or 5.1 per cent including large hydro power stations. The share of renewable energies in primary energy consumption is set at 2.9 per cent without large hydro power plants or 3.2 per cent with large hydro power plants.

42. ***The Act on Energy Management*** (in force since January 2001) introduces obligatory measures to increase the efficient use of energy (such as minimum levels of electricity and heat production efficiency); measures to support cogeneration; an obligation to provide energy labels for certain equipment; and an obligation to carry out energy audits in buildings in the commercial, public and industrial sectors with a total annual energy consumption[13] higher than a set value as follows:

- 1,500 GJ in the case of institutions owned by state and regional administrations and municipalities
- 35,000 GJ in the case of private persons or companies/organizations
- 700 GJ in the case of private persons or companies/organizations operating a single building or a complex of buildings with its own energy supply

43. Formulation of a four-year implementation programme, subject to government approval and progress assessment at least every two years, is foreseen. The implementation programme is called the "National Program for Promotion of Efficient Use of Energy and a Wider Use of Renewable and Waste Energy Sources". It was approved in 2001 for the initial period of four years. The programme contains framework goals in energy efficiency and use of renewables; it will serve as a background document for detailed annual programmes. Under the Act, all 14 regions of the country are legally obliged to prepare a regional energy concept every five years.

44. ***The Clean Air Act*** (in force since June 2002) establishes comprehensive air protection legislation relating to conventional air pollution, protection of the ozone layer and climate protection. It also provides a legislative basis for a new "National Program for Mitigation of Climate" and for the preparation of a national system under Article 5.1 of the Kyoto Protocol.

45. ***The "Strategy of Protection of the Climate System of the Earth in the Czech Republic"*** was approved by the government in 1999 in response to the adoption of the Kyoto Protocol. It defines climate protection as a top priority issue and contains measures to reduce GHG emissions.

46. The "Strategy of Protection of the Climate System of the Earth in the Czech Republic" will be replaced by the "National Program for Mitigation of Climate Change" (NPMCC). A draft version of the NPMCC was prepared in December 2002 and submitted to the MoE for discussion within the ministry and with other ministries before the submission of the document to the government (expected by the end of 2003). According to the NC3, NPMCC should set "reduction targets for substances affecting the climate system of the Earth and deadlines for achieving these targets". The review team discussed the

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[12] With the installed capacity of more that 10 MW(e).

[13] The total annual consumption is the sum of energy consumptions in all supply points operated under one company identification number.

expected reduction targets with Czech experts. As the team understood, the NPMCC would contain effective policies and measures to ensure meeting the Kyoto Protocol target and also additional policies and measures. These additional policies and measures could allow for a national GHG target to be established, which would require a more substantial emission reduction than the one stipulated by the Kyoto Protocol. High preference will be given to policies and measures to reduce CO_2 emissions, with priority going to the use of renewable energy sources. Implementation of the NPMCC will be evaluated at least every three years. The review team emphasized the importance of tangible targets for effective monitoring of the programme.

47. The NC3 does not contain estimates for costs and GHG reductions of the described cross-sectoral measures.

48. The sectoral analysis of policies and measures below is structured as follows: energy production and transformation (excluding transport), transport, industry, agriculture, forestry, and waste management.

B. Energy production and transformation

49. The energy sector accounts for the predominant part of GHG emissions in the Czech Republic (80 per cent in 1999), the main reason being the large role of coal in energy supply (see figures 1 and 2). **Three national programmes with considerable effect on GHG emissions are in place in the energy sector**: the programme of support for savings of energy and use of renewable energy sources, the programme of support for reconstruction and recovery of concrete panel buildings, and the efficient lighting initiative.

50. ***"The State program of support for savings of energy and use of renewable energy sources"*** is managed by two organizations: the Czech Energy Agency (CEA) and the State Environmental Fund (SEF). CEA operates under MIT and SEF operates under the MoE. The objectives of the programme are decrease of energy intensity, minimization of environmental pollution and decrease in GHG emissions. CEA and SEF implement the programme through support of specific projects selected at annual tenders. Mitigation of GHG emissions is not among the project selection criteria, but GHG reductions have to be evaluated for completed projects.

51. CEA, established in 1996, promotes introduction of energy saving measures in production, distribution and consumption of energy, greater use of renewable and secondary energy sources, and cogeneration. Support is provided in the form of subsidies from governmental funds in accordance with a selection process that takes into account a detailed technical description of the project, the energy saving targets and the results of a detailed energy audit. Project implementation includes progress monitoring and the evaluation of results relative to the initial energy audit.

52. SEF was founded in 1991 with the objective of creating an additional funding source for the implementation of environmental policy. SEF is independent from the State budget, as its income is based on pollution/emission fees and penalties. The income of SEF is then redistributed as subsidies or loans to projects beneficial to the environment. SEF is particularly helpful when there are not sufficient local resources to implement projects (for example, in local self-governing units). Project implementation includes progress monitoring and the evaluation of results.

53. In general, CEA and SEF projects in environmental protection and energy use efficiency have been successful and could be considered for replication in other countries.

54. Table 6 shows annual implementation costs of CEA and SEF as well as estimated GHG reductions. The NC3 provides only highly aggregated estimates for emission reductions. For SEF, the

expected emission reductions are given for 1999 and 2000 only. The review team noted that a more detailed presentation of the effects (by sectors and subsectors) and the respective costs could enhance the transparency of the estimates.[14]

Table 6. Implementation costs and GHG emission reductions for CEA and SEF projects

		1995	2000	2005	2010
Projects within the "State program of support for savings of energy and use of renewable energy sources"					
CEA projects	Costs (CK million/year)[a]	884	1 336	no data	no data
	GHG reductions (Gg CO_2 equivalent/year)	150	222	297	336
SEF projects	Costs (CK million/year)[a]	no data	815	no data	no data
	GHG reductions (Gg CO_2 equivalent/year)	no data	73	no data	no data
Projects outside the "State program of support for savings of energy and use of renewable energy sources"					
SEF projects	Costs (CK million/year)[a]	no data	3 459	no data	no data
	GHG reductions (Gg CO_2 equivalent/year)	no data	1 160	no data	no data

[a] In July 2002, the exchange rate was about 30 Czech Koruna (CK) to 1 US$.

55. SEF also supports measures relating to energy savings and air protection outside the framework of the "State program of support for savings of energy and use of renewable energy sources". These measures relate to the substitution of solid fuels for natural gas in small- and medium-sized energy sources, promotion of cogeneration and the development of energy infrastructure in small municipalities. The estimated effect in CO_2 reduction is 1160 Gg CO_2 equivalent per year in 2000 (table 6). This effect is considerably larger than the impacts of projects within the "State program of support for savings of energy and use of renewable energy sources", the probable reason being a large impact of the substitution of coal with gas.

56. Table 6 shows that the three given groups of projects differ in the ratio of annual implementation costs to the annual emission reductions. The NC3 does not explain these differences and does not compare cost efficiency of various GHG mitigation measures. The review team thought that a probable reason is that GHG mitigation is a side effect of the projects and not the primary objective.[15]

57. ***"The State program of support for reconstruction and recovery of concrete panel buildings"*** is administered by the Ministry for Regional Development. It provides support, through subsidies and financial guarantees, for repair, reconstruction and modernization of apartment buildings constructed with concrete panels. Preference is given to economically depressed areas and areas with damaged environment. The programme started in 2000 and its duration is unclear because of the possible lack of resources. It is expected that 20,000 apartments would be repaired in 2001 and then 50,000 apartments annually. No estimate of expected GHG emission reductions is provided.

58. ***The efficient lighting initiative*** (ELI) is a three-year programme prepared by the International Financial Corporation (IFC) and financed by the Global Environment Facility (GEF). The programme, started in 2000, aims to decrease GHG emissions through the introduction of energy-saving technologies for lighting. The programme budget is US$ 1.25 million and the expected emission reductions are of the order of 400 Gg CO_2 per year starting 2002.

59. The Czech Republic will also participate in a new US$ 11.25 million regional project, approved by the GEF in May 2002, to reduce greenhouse gas emissions in five countries of Central and Eastern Europe. The project, entitled "Commercializing Energy Efficiency Finance," aims at providing incentives for local banks to lend money for energy efficiency projects.

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[14] Some information on disaggregated costs was provided to the review team during the country visit.

[15] It is only in the Programme for the year 2003 that the reduction of GHG emissions is a subject of a special sub-programme.

60. The review team noticed that the policies and measures chapter of the NC3 does not note **transition from coal to natural gas in the energy sector** as a GHG mitigation measure. However, the projections chapter of the NC3 considers this transition as a measure and estimates that the relevant emission reductions are about 4500 Gg CO_2 equivalent per year in 2000, which is larger than the effects given in table 6.

C. Transport

61. **The share of the total GHG emissions attributable to transport increased from 4.4 per cent in 1990 to 9.0 per cent in 1999**. This is still lower than in many countries in Western Europe; the share of the total CO_2 emissions attributable to transport in the EC was 26 per cent in 1999.[16]

62. Key measures in transport include application of international technical standards to vehicles, support for transfer of passenger and freight transport from road and air to rail, support for the development of non-motor means of transport, development of transport infrastructure, introduction of integrated transport systems and support for alternative vehicles. These measures, developed and implemented by MTC, are part of the transport policy of the Czech Republic adopted in 1998.

63. The policies and measures in the transport sector are designed with the objective of retaining the role of public transport and preventing an increase of emissions from road transportation that is observed in many other countries. Table 7 shows that the state support of measures in the transport sector increased in the 1990s, which helped bring about substantial reductions in GHG emissions.

Table 7. Funding and effects of measures in the transport sector[a]

Measures		1995	2000	2005	2010	2015
Application of international technical standards to vehicles	Funding (million CK/year)[b]	600	979	2 170[c]		
	CH_4 reductions (Mg/year)	231	420	618	821	952
	N_2O reductions (Mg/year)	1 152	2 739	4 351	4 818	5 551
Transfer of passenger and freight transport From road and air to rail	Funding (million CK/year)[b]	2 100	3 800	5 590[c]		
	CO_2 reductions (Gg/year)	319	495	761	1 005	1 319
	CH_4 reductions (Mg/year)	231	420	618	821	952
	N_2O reductions (Mg/year)	45	108	171	190	219
Development of non-motor means of transport	Funding (million CK/year)[b]	9	39	36[c]		
	CO_2 reductions (Gg/year)	80	124	190	251	330
	CH_4 reductions (Mg/year)	46	84	124	164	190
	N_2O reductions (Mg/year)	18	43	69	76	87
Public mass transport and introduction of integrated transport systems	Funding (million CK/year)[b]	2 500	3 500	6 404[c]		
	CO_2 reductions (Gg/year)	399	619	952	1 256	1 649
	CH_4 reductions (Mg/year)	231	420	618	821	952
	N_2O reductions (Mg/year)	45	108	171	190	219
Improved organization and regulation of highway transport	Funding (million CK/year)[b]	85	186	219[c]		
	CO_2 reductions (Gg/year)	399	619	952	1 256	1 649
	CH_4 reductions (Mg/year)	185	336	494	657	761
	N_2O reductions (Mg/year)	45	108	171	190	219
Research, development, and use of alternative vehicles	Funding (million CK/year)[b]	23	107	128[c]		
	CO_2 reductions (Gg/year)	399	619	952	1 256	1649
	N_2O reductions (Mg/year)	91	216	343	379	437
TOTAL	Funding (million CK/year)[b]	5 317	8 611	1 547[c]		
	CO_2 reductions (Gg/year)	1 596	2 476	3 807	5 024	6 596
	CH_4 reductions (Mg/year)	924	1 680	2 472	3 284	3 807
	N_2O reductions (Mg/year)	1 396	3 322	5 276	5 843	6 732

[a] This table is based on materials received by the review team from MTC at the country visit.
[b] In July 2002, the exchange rate was about 30 Czech Koruna (CK) to 1 US$.
[c] An estimated average for the future.

64. The review team visited MTC and discussed the Czech transport policy with MTC officials. The team was impressed by the efforts of Czech authorities to develop a modern, efficient and

[16] "CO_2 emissions from fuel combustion (2001 edition)", OECD/IEA, Paris, 2001.

environmentally benign transport system. MTC is aware of the advantages of the present structure of transport and is determined to develop it, enhancing the role of public transport. When discussing the target setting for measures in transport, the Czech experts explained that the policy has monitored targets, but they are mostly qualitative. The review team felt that use of quantitative targets, to the extent possible, might be beneficial for effective monitoring of policies and measures.

65. The team, however, was not fully convinced that the current efforts would be sufficient to contain the growth of CO_2 emissions from road transport. As table 8 illustrates, although the funding for measures in transport had been increasing from 1995 to 2000, CO_2 emissions from transport had been generally growing as well. Further efforts might be necessary to counter-balance the growth of road transportation with efficient and attractive alternatives. Continuous monitoring of GHG emissions from transport, and of their link to measures, may be important for the transport policy to succeed.

66. The Ministry of Agriculture promotes the production and use of alternative motor fuels (bio-diesel and bio-ethanol) through non-investment, direct non-returnable subsidies. The amount of support is up to CK 3000 per ton of methyl-ester, or up to CK 15 per liter of bio-ethanol. In 1999, the MoE also supported the production of bio-fuels. The intention to continue support for bio-fuels is noted in the NC3. However, the related GHG emission reduction is reported only for 2000 (60 Gg CO_2 equivalent) and the methodology of this evaluation is not explained.

Table 8. Trends in the funding of GHG mitigation measures and CO_2 emissions from transport

	1995	1996	1997	1998	1999	2000
Cost of measures:						
In million CK	5 317	5 895	6 432	7 869	7 418	8 611
Relative to 1995	100	111	121	148	140	162
CO_2 emissions from transport:						
In Tg CO_2 equivalent	8.912	9.896	11.392	10.779	12.016	11.110
Relative to 1995	100	111	128	121	135	125

D. Industry

67. Emissions from industrial processes accounted for about 3 per cent of the total GHG emissions in 1999. This estimate in the NC3 excludes process emissions in the iron and steel industry (see the inventory section of this report).

68. A new Act in accordance with the provisions of the EC directive on the Integrated Pollution Prevention and Control (IPPC) is in preparation. It is estimated that about 850 enterprises and 1400 installations will fall under the IPPC regime. The NC3 does not provide estimates of the related impact on GHG emissions.

69. Some projects of CEA and SEF (table 6) are implemented in the industrial sector but the review team could not separate these projects from the total for all CEA and SEF projects.

70. In preparation for the Act on IPPC, the MoE, the Federation of Industry and Transport, and the Czech Business Council for Sustainable Development concluded an agreement in 2000 and developed an action plan for the period from 2000 to 2002. The plan envisages voluntary measures in industry to support the implementation of IPPC. This should have a positive impact on GHG emissions but there are no estimates for such impact.

71. Independently from existing national programmes, Czech industries implemented various technological improvements over the latest decade (such as improvements in the steel and cement industries or capture of methane from closed mines). Although these improvements were driven by considerations other than climate change (for example, cost savings or increase in the quality of final

product), their impacts on GHG emissions may have been considerable. Such impacts are not evaluated in the NC3.

E. Agriculture

72. Agriculture accounted for about 6 per cent of GHG emissions in 1999. Since 1990, the agricultural part of GDP decreased by 30 per cent; both the crop harvest and the number of livestock decreased. The use of nitrogen fertilizers also declined in these years (mostly because of the high prices). These changes have led to a reduction of GHG emissions from agriculture by some 40 per cent.[17] Changes in agricultural policy are expected as a result of the preparation for EC accession, but they have not been evaluated yet.

F. Forestry

73. The Ministry for Agriculture provides support for afforestation of uncultivated agricultural land. The area of forests increased by about 8,000 hectares between 1990 and 2000 (0.3 per cent). The effect of afforestation on GHG emissions is reported in the NC3 as a constant reduction of 84 Gg CO_2 equivalent per year throughout the whole period from 1995 to 2020.[18] The review team felt that more transparency was needed for this estimate.

G. Waste management

74. Waste accounted for about 2 per cent of total GHG emissions in 1999. Waste-related legislation was revised recently in the framework of harmonization with EC provisions. In January 2002, the Act on Wastes and the Act on Waste Packaging entered into force. These Acts aim to decrease waste production, promote recycling, ensure better final disposal and improve monitoring at landfill sites. The goal, consistent with EC requirements, is to reduce dumped waste by 20 per cent of 2000 level by 2010 and 50 per cent by 2050.[19]

75. At present, collection of biogas is implemented in 12 out of 250 existing landfill sites and the biogas was used for energy production in six of them.

76. The NC3 does not provide estimates for costs and mitigation effects of policies and measures in waste management.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

77. The NC3 projections were prepared by a private research, engineering and consulting company SRC International CS (recently merged into ENVIROS) at the order of MoE. CHMI provided SRC International CS with inventory data for 1990 to 1999 and preliminary estimates for 2000 to ensure consistency between the projections and the GHG inventory. Emissions of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and, in less detail, emissions of CO, NO_X, SO_2 and NMVOC, were projected. Each gas was projected individually for the period from 2000 to 2020.

78. The MARKAL optimization model, based on the technique of linear programming, was the main projection tool. Detailed background studies were used for the formulation of parameter assumptions in the model. The applied disaggregation by sectors and fuels appeared to be quite sufficient for GHG analysis. The demand was modelled at the level of useful energy, so that only projections of long-term changes in activity drivers (such as changes in GDP components, transport distances driven, and some others), development of energy intensities (for various types of useful energy demand) and assumptions

17 This estimate is very rough because of inconsistency in the GHG inventory; see the inventory section.
18 Based on the estimate provided by the Ministry of Agriculture.
19 A transition period might be needed.

on limits for penetration for different technologies had to be expert-defined. The model then determined the demand for final and primary energy at the level of sectors and subsectors. A large built-in technological database of MARKAL was used, with adjustments relevant to NC3 preparation.

79. In reporting on the projections, the NC3 follows, in general, the UNFCCC guidelines. The definition of scenarios and the modelling assumptions are presented comprehensively.

A. Scenario definitions and key assumptions

80. Six projections are presented in the NC3: **projections with measures, with additional measures, and without measures**, each evaluated for **a reference scenario and a high scenario**. In addition, a sensitivity analysis was carried out.

81. The base year for modelling is 2000. Information for the base year was prepared using a preliminary version of the 2000 GHG inventory. There are some differences between the assumed and the actual data for 2000, but they are not meaningful. No adjustment (normalization of data) was made.

82. The **reference scenario** can be understood as a continuation of the current trends with a moderate economic growth (3 per cent per year) and a decrease in the share of industrial production in GDP structure (from 36.5 per cent in 2000 to 26 per cent in 2020). The **high scenario** assumes an average economic growth of 5.4 per cent per year, a relatively stable structure of the economy with a slight increase of industrial production to 37.7 per cent of GDP, and a decrease of services to 41.6 per cent by 2020. As Czech experts explained, the high scenario reflected a policy objective to revitalize basic industries and, at the same time, to build the energy policy on use of domestic sources. The assumed oil prices are higher in the high scenario than in the reference scenario (26–28 vs. 21–22 US$/barrel).

83. By considering two scenarios, the Czech experts tried to analyse uncertainties related to economic growth. However, in the Czech Republic there are no official projections of such critical parameters as GDP, GDP structure and useful energy demand (by categories). Therefore, the modelling team used its judgement in selecting the most feasible values for such parameters. Corresponding long-term energy balances for final and primary energy were then derived by the MARKAL model (table 9).

Table 9. Projected structure of primary energy supply (for the projection with measures)

	Reference scenario						High scenario			
	2000		2010		2020		2010		2020	
	PJ	share (%)	PJ	share (%)	PJ	share (%)	PJ	share (%)	PJ	share (%)
Coals	860.9	51.9	776.9	46.0	711.4	42.8	831.9	44.3	803.2	39.4
Oil and oil products	315.8	19.1	238.6	14.1	209.5	12.6	293	15.6	322.6	15.8
Natural gas	323.7	19.5	344.2	20.4	383.5	23.1	431.8	23.0	555.5	27.3
Nuclear	145.8	8.8	273.6	16.2	273.6	16.5	273.6	14.6	273.6	13.4
Combustible renewables and waste	23.8	1.4	41.9	2.5	65.5	3.9	49.4	2.6	83.1	4.1
Electricity and heat from non-combustible renewables	22.9	1.4	28.6	1.7	34.3	2.1	32.3	1.7	35.6	1.7
Electricity trade	–35.3	–2.1	–16.2	–1.0	–16.2	–1.0	–36	–1.9	–36	–1.8
TOTAL in PJ	**1 657.6**		**1 687.6**		**1 661.6**		**1 876**		**2 037.6**	
TOTAL relative to 2000	**100**		**102**		**100**		**113**		**123**	

Note: The sum of shares in this table may not be exactly 100 per cent because of rounding.

84. Table 9 shows that the total primary energy supply (TPES) is almost constant under the reference scenario, whereas the high scenario shows a 20 per cent growth from 2000 to 2020. Consumption of oil and natural gas is notably higher in the high scenario. The high scenario also assumes a much larger contribution of combustible renewables and waste to energy supply. Nuclear generation increases

considerably from 2000 to 2010 in the both scenarios because of the assumed commissioning of two 1,000 MW(e) units at Temelin in the early 2000s.

B. Projected emission trends

85. Figures 4 and 5 show that **in all projections GHG emissions in 2000 to 2020 are well below the Kyoto target**. This is a change in comparison with NC2 where the baseline scenario led to GHG emissions above the Kyoto target in 2010. The difference between the scenarios is large: the 2010 emissions (with implemented measures) are about 128 Tg CO_2 equivalent for the reference scenario and 142 Tg CO_2 equivalent for the high scenario (a 10 per cent difference). The scenarios differ qualitatively. Under the reference scenario, the emissions continue decreasing after 2000 and, after a temporary increase around 2010 (due to economic growth), they still decrease after 2010, so that the emissions in 2020 are lower than in 2000. Under the high scenario, the emissions gradually increase after 2000, unless additional measures are implemented that allow the emissions to be stabilized at the 2000 level until 2020.

Figure 4. GHG projections for the reference scenario (Tg CO_2 equivalent)

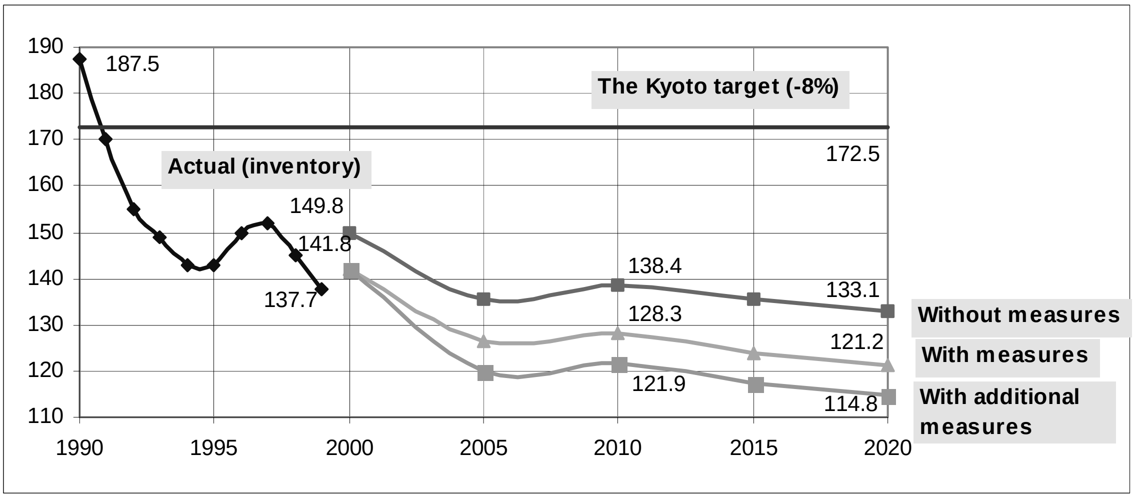
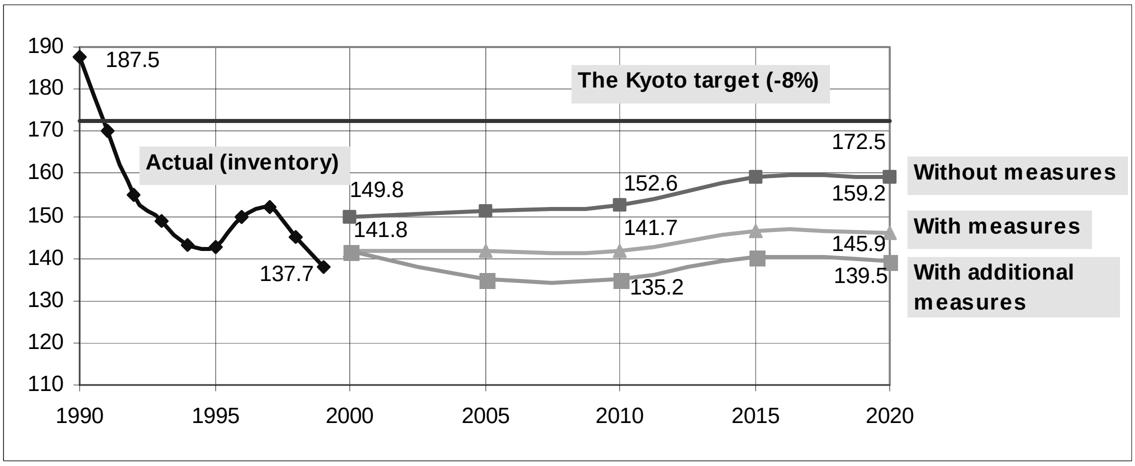


Figure 5. GHG projections for the high scenario (Tg CO_2 equivalent)

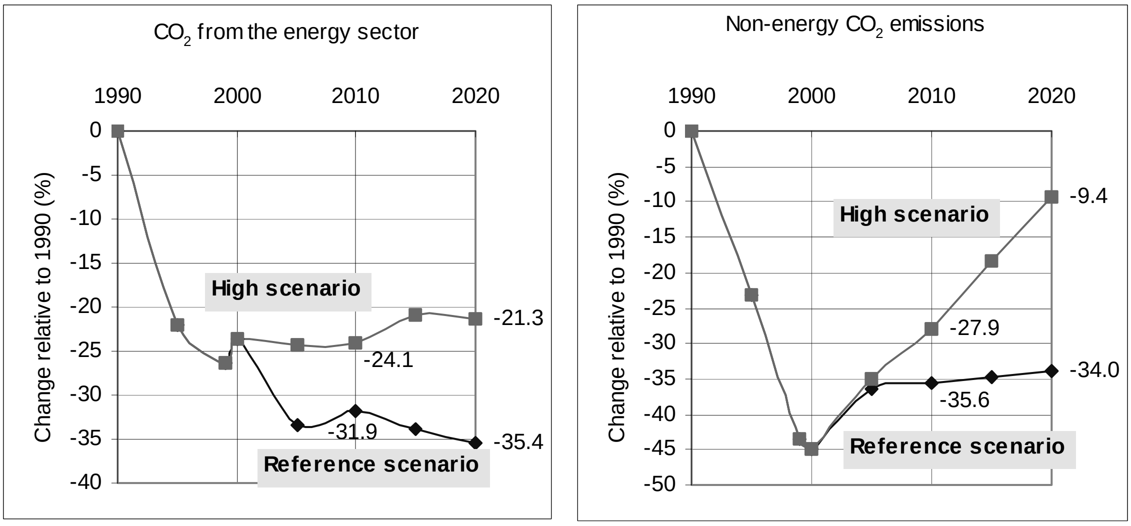


86. Differences between projections within one scenario are smaller than differences between scenarios. As comparison of the projections with and without measures indicates, the already

implemented measures resulted in about 5 per cent emission reduction (some 142 instead of 150 Tg CO_2 equivalent in 2000). Implementation of additional measures would allow a decrease in GHG emissions of an additional 5 per cent (figures 4 and 5). Thus, **scenario assumptions seem to be more important for the projected emission levels than differences in the number and extent of GHG mitigation measures**.

87. Figure 6 shows that CO_2 emissions from the energy sector are projected to increase in the high scenario and to decrease in the reference scenario. (In the high scenario the demand growth outweighs the assumed improvements in energy use efficiency.) The growth of **non-energy CO_2 emissions** in the high scenario is due to the assumed growth in cement production.

Figure 6. Projections of CO_2 emissions (the "with measures" projection)



88. The behaviour of **CH_4 emissions** is similar in the two scenarios (figure 7). The largest difference is in fugitive emissions: these emissions change from 257 Gg CH_4 in 1999 to 175 Gg CH_4 in 2020 for the reference scenario and to 195 Gg CH_4 for the high scenario. The difference is particularly large for fugitive emissions from oil and natural gas. These differences are not explained in the NC3. The review team understood that a part of the difference could be attributed to larger imports of natural gas in the high scenario.[20] **N_2O emissions** are projected to remain close to the 2000 level, with a small difference between the two scenarios that is related to a larger transport demand in the high scenario.

89. **HFC, PFC and SF_6 emissions** grow similarly in the two scenarios, with a more accelerated growth in the high scenario due to higher demand for these substances (figure 8). **CO_2 removals through LUCF** are slightly larger in the high scenario because of larger availability of funds for afforestation.

[20] The Czech experts noted that there are several related trends: decrease of CH_4 from coal mining and use, decrease of CH_4 from landfills due to landfill gas collection and use, and increase of CH_4 from transport and use of natural gas and oil.

Figure 7. Projections of CH_4 and N_2O emissions (the "with measures" projection)

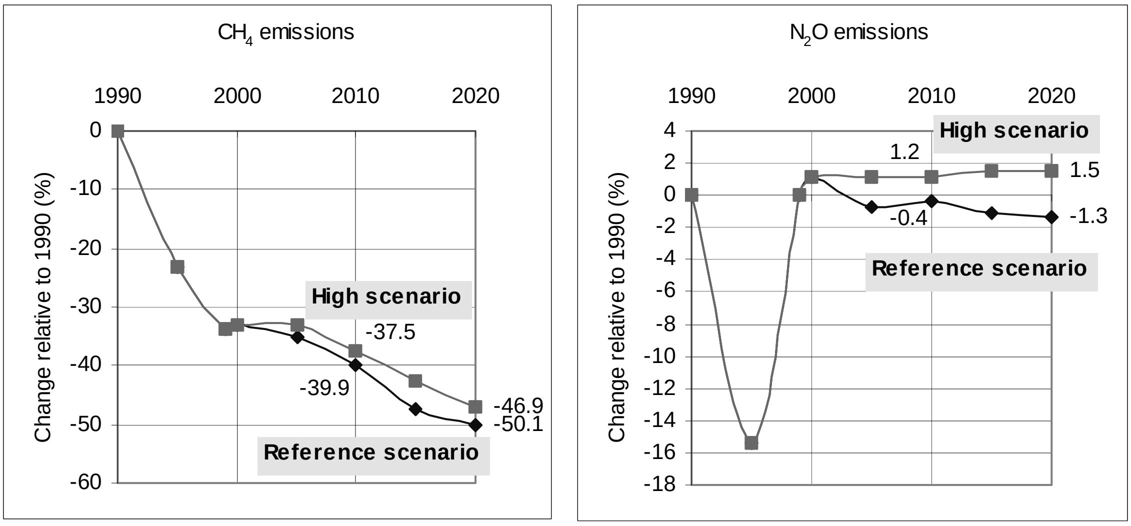
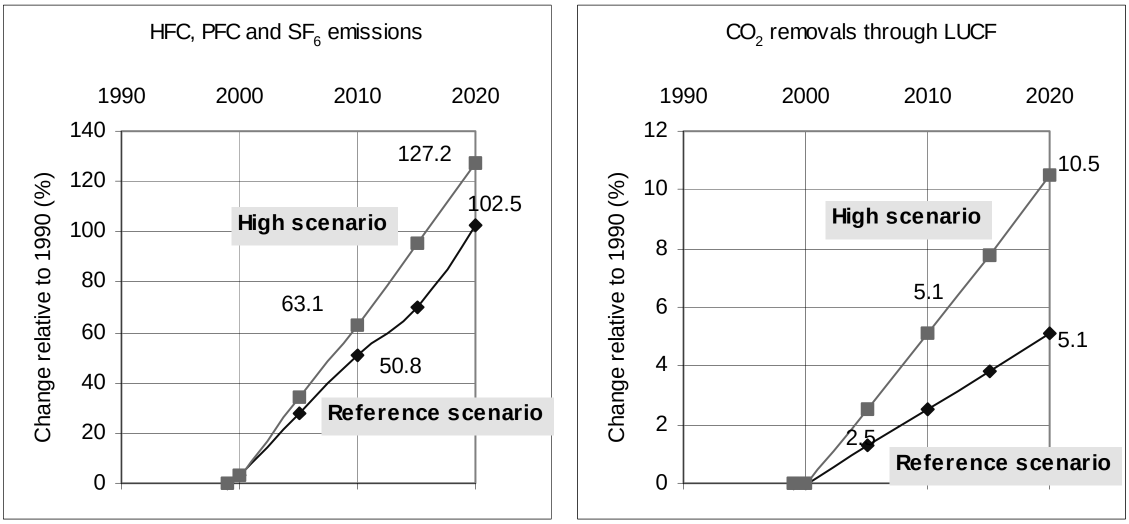


Figure 8. Projections of HFC, PFC and SF_6 emissions and CO_2 removals through LUCF (the "with measures" projection)



C. Effects of policies and measures

90. The "with measures" projection was calculated with MARKAL for the both scenarios. To obtain the "without measures" projection, the Czech experts evaluated the separate annual effects of the measures implemented in 1990 to 2000 and deducted these effects from the "with measures" projection. Thus, the "without measures" projection was not explicitly modelled with MARKAL. A similar approach was used for the preparation of the scenario with "additional measures": the estimated emission reductions from additional measures were deducted from the emissions under the "with measures" scenario.

Comparison of projections "with measures" and "without measures" (reference scenario)

91. The **switch from coal to gas and measures in transport dominate among the already implemented measures** (table 10). Together, they account for about 80 per cent of the mitigation effect.

Table 10. Mitigation effect of implemented measures for the reference scenario

	Tg CO_2 equivalent		
Sector	**2000**	**2010**	**2020**
Fuel switch from coal to gas	4.556	4.238	4.604
Other measures in energy and industry[a]	1.455	1.834	1.834
Transport	1.843	3.917	5.321
Use of bio-fuels in transport	0.060	0.060	0.060
Afforestation	0.084	0.084	0.084
Total	**7.998**	**10.133**	**11.903**

Note: The mitigation effect is the difference in annual GHG emissions between the projection without measures and the projection with measures.

[a] The estimate is based on programmes of CEA and SEF that deal with both the energy sector and industry.

Comparison of projections "with measures" and "with additional measures" (reference scenario)

92. The review team needed additional explanation to understand the definition of additional measures. The NC3 states that the most pertinent additional measures are the new Clean Air Act, the application of the EC directive of IPPC, and the two new Acts on wastes (see chapter III on policies and measures). However, the NC3 also notes that it is not yet possible to evaluate the effects of these measures. The evaluation of the effects of additional measures is based on a "National program of economic energy management and use of renewable and secondary energy sources". This programme is in preparation by the MIT in cooperation with the MoE. The content of the programme and its relation to the mentioned three key additional measures were not clear for the review team.

93. Information on the structure of additional measures by sectors and gases is not provided in the NC3; only a total mitigation effect (the difference in annual GHG emissions between the projection without measures and the projection with measures) is available: 6.543, 6.414 and 6.414 Tg CO_2 equivalent in 2005, 2010 and 2020, respectively. In the opinion of the review team, this leads to a lack of transparency in the projected effects.

D. Overall evaluation of the projections

94. The projections in the NC3 have improved in comparison with NC2. Of particular note are the comprehensive coverage of the GHGs (only CO_2, CH_4, and N_2O were covered in NC2) and consistency with the GHG inventory. The projections are based on a sophisticated modelling technique and an extensive database with parameters of energy supply technologies. Expert knowledge and communication with related ministries and agencies were widely used to ensure good quality of the information used in the projections.

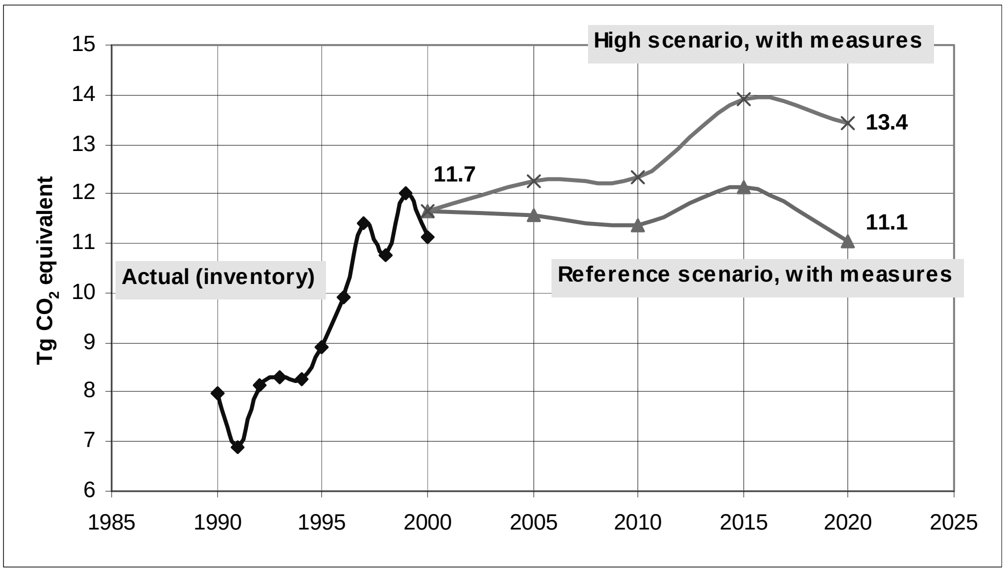
95. At the same time, the team identified that the following elements may require improvement in the future: assumptions for the high growth scenario, projection of GHG emissions from transport, sectoral analysis of emission trends, evaluation of the effects of additional measures, projection methodology for effects of liberalized energy markets, and comparison with NC2 projections.

96. ***Assumptions for the high growth scenario***. The review team felt that there might be some inconsistency in this scenario. For example, a high growth in basic industries is combined with oil prices higher than in the reference scenario (26–28 vs. 21–22 US$/barrel). The team commented that, as imported oil and gas account for a large part of primary energy supply, higher oil (and, probably, gas) prices might hinder industrial growth. Improvements in the average efficiency of energy and electricity use are more radical in the high scenario, although the industrial share of GDP is higher (38 per cent in 2010 vs. 32 per cent in the reference scenario).

97. ***Projection of GHG emissions from transport***. According to NC3 projections, future CO_2 emissions from transport would either stabilize at the 2000 level under the reference scenario or

moderately increase under the high scenario (figure 9). While acknowledging the thoroughness of the related modelling, the review team questioned the robustness of these results.

Figure 9. NC3 projections of CO_2 emissions from transport (the "with measures" projection)



98. As figure 9 illustrates, the projected emission growth is considerably lower than the actual trend of the 1990s. The team was of the opinion that it is important to make comparisons with other studies on future developments in transport, for example with projections of MTC. During the country visit, the review team concluded that these projections differed from the ones of the NC3.

99. The MARKAL optimization technique should be applied with particular caution in transport. The model selection of best transport technologies based on economic criteria might sometimes be not quite realistic because of the existence of non-economic barriers for transport technologies (a need for technological and infrastructural developments, for example).

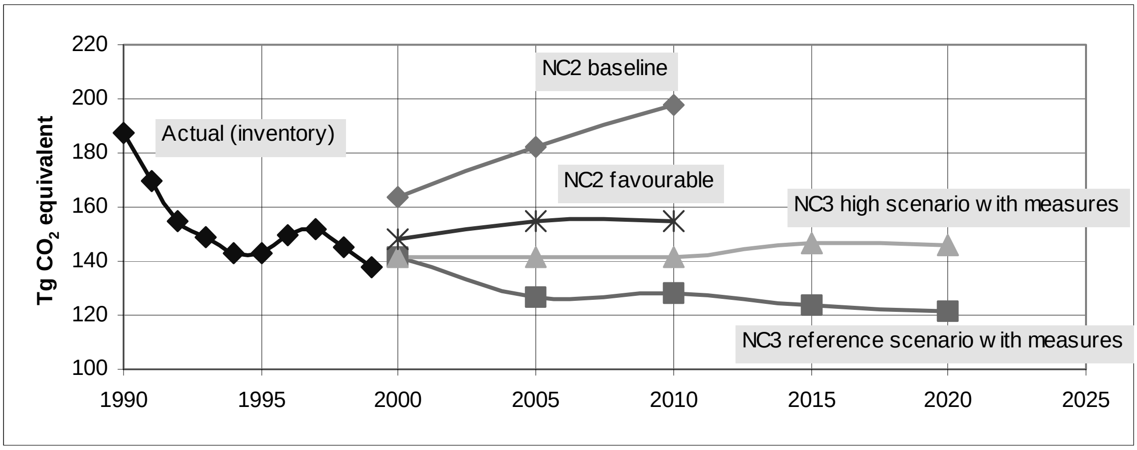
100. ***Sectoral analysis of emission trends*** in the NC3 appears to be limited. Closer attention to emission trends and emission reductions in individual sectors could be considered. With MARKAL, which is an optimization model and thus enables automatic selection of certain measures, it is not simple to simulate and analyse effects of a set of measures. Therefore, presentation of assumptions for limits on penetration of specific technologies and future development of key indicators, such as energy demand per square metre of the residential flat area, could be useful as part of sectoral analysis.

101. ***Evaluation of the effects of additional measures***. The review team felt that there was a lack of transparency in the formulation and presentation of the scenario with additional measures. A clearer presentation of the assumed emission reduction effects of additional measures, if possible in a breakdown by sectors and gases, could help a reader of the NC3 to understand the projections better.

102. ***Projection methodology for the effects of liberalized energy markets***. Effects of energy market liberalization were not assessed in the projections. As MARKAL is based on a quite aggregated optimization approach, it may not be completely applicable to assessing such effects. The impact of liberalization on energy supply mix can be important and it could be analysed, with or without models, to ensure the robustness of the projections in this respect.

103. ***Comparison with NC2 projections*** was not provided in the NC3, although the UNFCCC reporting guidelines require it (paragraph 45).[21] The comparison made by the review team (figure 10) shows that the actual development between 1995 and 2000 was considerably different to the one projected in the NC2. The baseline scenario of the NC2 looks unrealistic now, whereas the other one, “favourable”, turned out to be closer to reality (for the year 2000) and closer to the NC3 projections. The review team was of the opinion that analysis of changes from one set of projections to another could be beneficial for the quality of the projections.

Figure 10. Comparison of GHG projections in the NC2 and the NC3



V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

104. The coverage of vulnerability and adaptation issues in the NC3 corresponds to the UNFCCC guidelines. In comparison with NC2, more research results are reported. Most of them were obtained in the framework of the “National Climate Program”, which is an association of some 20 organizations engaged in climate-related research.

105. Studies show that by the year 2050 climate change in the Czech Republic can result in an increase in temperature (0.9 to 3.0°C for the average daily temperature), and a slight decrease in the total annual precipitation (0.2 to 0.6 per cent). The behaviour of precipitation during the year will change: a notable decrease can be expected in summer (especially in August), in September and in April; an increase is likely to occur in winter and in October.

106. Three areas of vulnerability have been studied as most relevant: water resources, agriculture and forests. Decrease in precipitation and increase in temperature can lead to decreased water availability. Increased variability of precipitation may result in increased water runoffs leading to more frequent floods. For agriculture, increased CO_2 concentrations may have a positive effect, but decreased precipitation in the growing season would have a negative effect. The expected climate change will influence the characteristics of soils and the diversity of agricultural production in individual regions. It will become necessary to monitor water supply for agriculture and to use water more efficiently. Soil erosion will probably increase. Measures to protect soils and cultivated agricultural species against weeds, diseases and pests will have to be introduced. In forestry, a shift of climatic zones will be favourable to some tree species. At higher altitudes, increased temperature coupled with higher CO_2 concentrations will generally accelerate tree growth, although the areas covered by some tree species

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21 See page 90 in document FCCC/CP/1999/7.

(particularly conifers) will shrink. At lower altitudes, higher CO_2 concentrations will offset the negative impact of increased evapotranspiration, particularly by increasing the woody species' stress tolerance.

107. The NC3 recommends pursuing policies that increase sustainability and adaptation capacity of natural systems. The recommendations have not been implemented yet, with the exception of forestry (increasing the share of broad-leaved species is being tested in some places).

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

108. As the Czech Republic is not an Annex II Party to the UNFCCC, it is not bound by the commitments relating to the provision of financial resources and promotion of technology transfer to developing countries defined in Article 4.3, 4.4 and 4.5. Accordingly, for this subject, the NC3 is not obliged to, and does not, follow the UNFCCC reporting guidelines that relate mostly to Annex II Parties.

109. As a country in transition, the Czech Republic received some support from the GEF in the 1990s, the initiative for efficient lighting (see chapter III on policies and measures) being one of the projects. There have also been activities financed by international funds in the framework of activities implemented jointly (AIJ). From 1996 to 1999, five AIJ projects were implemented.

110. Since 1997, the Czech Republic has been making contributions to the World Bank, the European Bank for Reconstruction and Development, the International Monetary Fund and the GEF. The two recent GEF projects (see chapter III on policies and measures) are likely to be the last ones for the Czech Republic in the role of aid recipient.

111. Preparation for the Kyoto flexibility mechanisms is in progress. A working group on climate change, established by the MoE in 2001, prepared methodological guidelines for joint implementation (JI) that were officially published on 17 May 2002. The contact point for the submission of JI proposals is an administrative centre established at the MoE. SEF and CEA are responsible for technical and economic evaluation of the proposals. One memorandum of understanding (MoU) relating to JI has been signed (with Austria); two MoUs are under discussion (with the Netherlands and Germany).

112. Preparation for emission trading (ET) is not yet as advanced as preparation for JI, mainly because there is an intention to wait for detailed EC and UNFCCC guidelines.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

113. The NC3 presents the status of research and observation activities in accordance with the UNFCCC guidelines. Several new studies conducted since the time of the NC2 submission are described.

114. The "National Climate Program", mentioned in chapter V, provides a framework for the organization of climate-related studies and dissemination of their results. The research is normally funded from the budget of concerned organizations; additional support for selected projects is provided through state grants. Sometimes there is also funding from international projects.

115. Climate-related research concentrates on two areas: climate change modeling and climate change impacts. In the modeling of climate change, the development of new regional scenarios of climate change by the year 2050 was an important achievement. They are based on two extreme scenarios from IPCC's Special Report on Emission Scenarios and high/low assumptions on temperature sensitivity, so that the results are likely to cover the full range of possible changes. For the impacts of climate change, most studies deal with impacts on water resources, agriculture and forestry.

116. Economic impacts of climate change have not been studied yet. As Czech experts indicated, one of the reasons is insufficient methodological guidance for such studies.

117. Czech organizations participate in meteorological atmospheric observation. Preparation of the Czech report for the Global Climate Observing System (GCOS) is being considered but time is needed to prepare all necessary data.

118. Some assistance to developing countries in climate research is provided through a national training centre located at the Solar and Ozone Observatory of CHMI in Hradec Kralove. Training is provided in monitoring stratospheric ozone and in related data management and equipment maintenance.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

119. The NC3 reporting on these subjects is in compliance with the UNFCCC guidelines. The role of environmental education was strengthened by a recent (2000) “State Program on Environmental Education and Public Awareness”. Environmental education is present in pre-school education, in elementary and secondary schools, and in institutes and universities.

120. MoE makes considerable efforts to increase public awareness on environmental issues. This is done through periodical and thematic publications, promotion of environmentally friendly products, organization of an international EKOFILM festival (for films on the environment, and natural and cultural heritage), communication and cooperation with NGOs, and support of the web site of MoE. The web site also provides an opportunity to ask any question on the environment, for which a qualified answer would be given in compliance with the citizens’ right to information on the environment. About 50 such questions per month are answered.

121. To facilitate cooperation with NGOs, MoE organizes, twice a year, a meeting of the Green Forum, where the Ministry and senior officials answer questions and provide information. Even so, the review team felt that cooperation with NGOs in climate-related activities might be strengthened. For example, NGOs were not involved in the preparation and review of the NC3.

122. There is Czech participation in international programmes relating to environmental education and public awareness. Examples are the European “Blue from the sky” programme for children, the Dutch–Czech “Tulip” project for schools, and the international GLOBE programme for students.

123. The review team was impressed by the work of MoE in raising environmental awareness. But the team also noted that the specific issue of climate change appeared to be receiving only minor attention. For example, the mentioned web site of MoE does not have a section on climate change, from where, for example, the NC3 could be downloaded[22] (but a climate change web site, mostly with technical information about climate change, is provided by CHMI). The impact of MoE work on the level of public awareness on climate change was not clear for the review team. There seemed to be relatively little communication on climate change problems with industrial, regional and national decision-makers (for example, with managers of large enterprises and with members of parliament).

IX. CONCLUSIONS

124. **In general, the NC3 follows the UNFCCC guidelines and it has improved in comparison with the NC2**. The most notable improvements are: full coverage of GHG gases in the inventories and the projections, update of emission factors in the GHG inventory, estimates for effects of separate

[22] The current web site is presently being extended to provide such information.

policies and measures, a more comprehensive set of projections (six instead of two in NC2), and new information on climate-related research.

125. The review team identified the following **areas for further improvement**: recalculation of the GHG inventory to make the emission data from 1990 to 2000 fully consistent, trend analysis for GHG emissions, evaluation of costs and GHG reductions for some policies and measures, sectoral analysis of projected GHG emissions, preparation of the projection with additional measures, and some others. The team also felt that **coordination of climate-related work** among the various organizations involved could be improved, in particular with respect to communication among the ministries and the assignment of more transparent institutional responsibilities for specific climate change issues.

126. **GHG emissions in the Czech Republic decreased in the 1990s: the total GHG emissions (without LUCF) in 1999 were 26 per cent lower than in 1990**. The emissions declined particularly strongly in industry (41 per cent) and the energy sector (29 per cent). The emission reductions were driven by structural changes in the GDP (with an increased share of services) and in energy supply (with an increased share of gas), improvements in energy use efficiency and some increase in the use of renewable energy.

127. In the State Environmental Policy approved by the government in January 2001, the Czech Republic pledged to reduce its GHG emissions by 20 per cent by 2005 in comparison with the 1990 level. According to NC3 projections, this national target, formulated in the framework of the UNFCCC, could be met. Under the Kyoto Protocol, the Czech Republic made a commitment to decrease GHG emissions by eight per cent in comparison with the 1990 level in the first commitment period from 2008 to 2012. The draft of the new "National Program to Mitigate Changes in the Climate of the Earth" was recently released for discussion; the programme is likely to be approved by the government in 2003. This programme is expected to contain revised targets for GHG emission reductions.

128. According to NC3 projections, **the Czech Republic is very likely to comply with the Kyoto Protocol;** in all projections GHG emissions in the period from 2000 to 2020 are well below the Kyoto target. This is a change from the NC2 where the baseline scenario led to GHG emissions higher than the Kyoto target in 2010.

129. GHG emissions from transport are projected to remain stable or to decline slightly in the period from 2000 to 2020. These model results appeared optimistic to the review team.

130. The Czech Republic carries out intensive work on JI preparation, such as the establishment of the national center for JI, and preparation and release of guidelines. Preparation of ET is less advanced.

131. Since 1997, the Czech Republic has been making contributions to international financial institutions. Two recent GEF projects are likely to be the last ones for the Czech Republic in the role of aid recipient.

132. Climate-related research in the Czech Republic focuses on climate change impacts on water management, water supply, agriculture and forestry.

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