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Report on the in-depth review of the first national communication of Belarus

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

A. Introduction

1. The Republic of Belarus approved the United Nations Framework Convention on Climate Change (UNFCCC) by Presidential decree on 10 April 2000. Belarus ratified the UNFCCC on 11 May 2000 and became a Party to the Convention on 10 August 2000. The UNFCCC secretariat received the first national communication of Belarus (NC1) on 29 July 2003.[1]

2. The Ministry of Natural Resources and Environmental Protection (MNREP) coordinated the preparation of the NC1 by about 20 organizations.[2] A steering committee composed of representatives of MNREP, the Research Institute (RI) "Ecology" and the Hydrometeorological Centre provided guidance to expert groups working on individual parts of the communication. The Global Environment Facility (GEF) and the World Bank funded the preparation of the NC1 with a grant of US$ 312,000 under the project "Preparation of the first national communication of Belarus under the UNFCCC". A consultant from the Russian Federation contributed to the preparation of the NC1.

3. Experts from environmental non-governmental organizations (NGOs), scientific and research institutes and universities, and the National Academy of Sciences participated actively in the preparation of the NC1. Private and public stakeholders participated in five national and international workshops devoted to NC1 preparation. Interested environmental and business NGOs received the final version of the NC1 and considered it to be a useful document.

4. The in-depth review of the NC1 was carried out from September 2003 to February 2004 and included a visit by the review team to Minsk from 17 to 21 November 2003. The team consisted of Mr. S. Iliasov (Kyrgyz Republic), Mr. E. Utkin (Russian Federation), Mr. S. Mirasgedis (Greece) and Mr. S. Kononov (UNFCCC secretariat, coordinator). During the visit, the team met national officials, technical experts, and representatives of environmental and business NGOs.

B. National circumstances

5. ***Location and climate***: Belarus is a landlocked country in eastern Europe. It borders Lithuania and Poland in the west, Latvia in the north, the Russian Federation in the north and east, and the Ukraine in the south. In terms of territorial area, Belarus (207,600 km^2) is comparable to Romania (237,500 km^2) or the United Kingdom (244,100 km^2). The country has a temperate continental climate. The average temperature for the coldest month (January) is about –8.1ºC; for the warmest month (July) it is about +18.5ºC. Because of the absence of mountains, air masses from all directions can easily reach and cross the country. For example, maritime air masses from the Atlantic Ocean accentuate the temperate character of the climate.

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[1] According to Article 12, paragraph 5 of the UNFCCC, each Annex I Party should prepare its first national communication within six months of the UNFCCC coming into force for that Party.

[2] In addition to MNREP, the following organizations contributed to the NC1: Ministry of Economy; Ministry of Energy; Ministry of Transport and Communications; Ministry of Residential and Communal Services; Ministry of Agriculture and Food; Ministry of Industry; Ministry of Statistics and Analysis; Ministry of Education; Committee on Energy Efficiency; Committee on Forestry; Committee on Land Resources, Geodesy and Cartography; Research Institute "Ecology"; State University of Belarus; Institute for Problems of the Use of Natural Resources and Ecology of the Academy of Sciences of Belarus; Research Institute of the Ministry of Economy; Institute of Experimental Botany of the Academy of Sciences of Belarus; Central Research Institute for Complex Use of Water Resources; State Concern "Belneftehim"; Hydrometeorological Centre.

6. ***Land use***: Agricultural land covers the largest part of the territory (45.3 per cent in 1990 and 44.6 per cent in 2000). The area covered by forests increased noticeably in the 1990s: from 35.6 per cent in 1990 to 40.6 per cent in 2000. Peatbogs occupy a considerable area: 11.5 per cent of the territory. Many peatbogs were artificially dried out, mostly in the 1960 and 1970s, but since the early 1990s no new areas have been dried out; instead, returning the peatbogs to their natural state has been favoured.

7. ***Institutional framework***: Belarus became an independent state in 1991 after the breakdown of the Soviet Union. Belarus is a presidential republic; according to the constitution, the president is the head of state. Executive power belongs to the government (the Council of Ministers) and legislative power belongs to the parliament, which consists of two chambers: the Chamber of Representatives and the Council of the Republic. Administratively, the country is divided into six regions ("oblast"), further subdivided into 118 smaller administrative units ("raion"). In 1999, Belarus and the Russian Federation signed a treaty on a two-state union; some steps to create this union have been undertaken.

8. ***Population and economy***: In 2001, the population of Belarus was 9.97 million – a slight decrease compared to 1990 (see table 1). The gross domestic product (GDP) declined from 1990 to 1995 but then started to increase and, in 2001, was 7.6 per cent below the 1990 level (table 1). The GDP per capita was about US$ 7,000 in 2001. GDP structure changed noticeably during the last decade: the share of services increased from 28.6 per cent in 1992 to 51.2 per cent in 2001, the share of industry decreased from 47.8 per cent to 38.1 per cent and the share of agriculture decreased from 23.6 per cent to 10.7 per cent.[3] The economy depends noticeably on imports and exports: in 2001, the ratio of imports of goods and services to GDP was 70.3 per cent, and the similar ratio for exports was 66.8 per cent.[4] From 1990 to 1995, emissions of greenhouse gases (GHGs) declined almost in parallel with economic decline but after 1995 the emissions continued to decrease despite the economic recovery.

Table 1. Main macro-economic indicators and GHG emissions for Belarus

	Values			Changes			Growth rate
	1990	1995	2001	1990–1995	1995–2001	1990–2001	1990–2001 (%/year)
Population (millions)	10.19	10.19	9.97	0.0	–2.2	–2.2	–0.2
GDP based on PPP[a] (billions US$ of 1995)	75.9	49.6	70.1	–34.7	41.3	–7.6	–0.7
Total primary energy supply (TPES) (Mtoe[b])	ncd	24.7	24.4	ncd	–1.1	ncd	–5.3
Total primary energy supply (Mtce[c])	ncd	35.3	34.9	ncd	–1.1	ncd	–5.3
Electricity consumption (TWh)	ncd	28.4	29.9	ncd	5.3	ncd	–3.2
GHG emissions[d] (Tg[e] CO_2 equivalent)	126.6	77.2	70.9	–39.0	–8.2	–44.0	–5.1
GHG emissions per capita (Mg CO_2 equivalent)	12.4	7.6	7.1	–38.7	–6.6	–42.7	–4.9
GHG per GDP unit (kg CO_2 equivalent per US$ PPP of 1995)	1.67	1.56	1.01	–6.6	–35.3	–39.5	–4.4

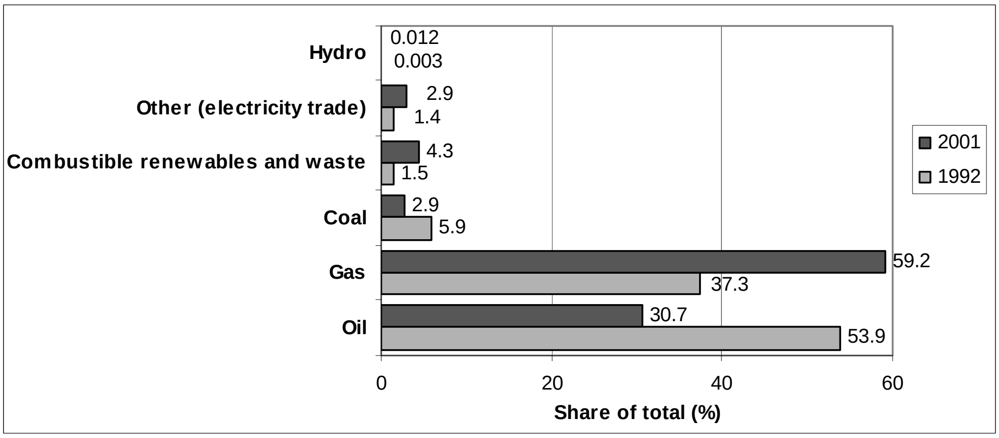
Sources: The data for population, GDP, TPES and electricity are from the International Energy Agency (IEA); GHG emissions are from the GHG inventory of Belarus submitted in 2003. IEA data are in general consistent with relevant information in the NC1 but are used here to ensure transparency of the calculation method and comparability with other countries.
Note: "ncd" means "no comparable data", which indicates that although some estimates may be available (in the NC1 or other sources) for the given year, their comparability with estimates for other years could not be checked.
[a] "PPP": based on purchasing power parities, for details see: www.worldbank.org/data/icp/aboutpppdata.htm
[b] Millions of tonnes of oil equivalent; one toe equals about 41.9 GJ.
[c] Millions of tonnes of coal equivalent; one tce equals about 29.3 GJ or 0.7 toe.
[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.

9. ***Energy supply***: Figures 1 and 2 show that considerable changes in energy and electricity supply occurred in Belarus in the 1990s. The most remarkable change was the replacement of oil by gas, especially in electricity generation. In absolute numbers, the total supply of gas remained almost at the

[3] World Bank country data for 2001 at www.worldbank.org
[4] World Bank country data for 2001 at www.worldbank.org

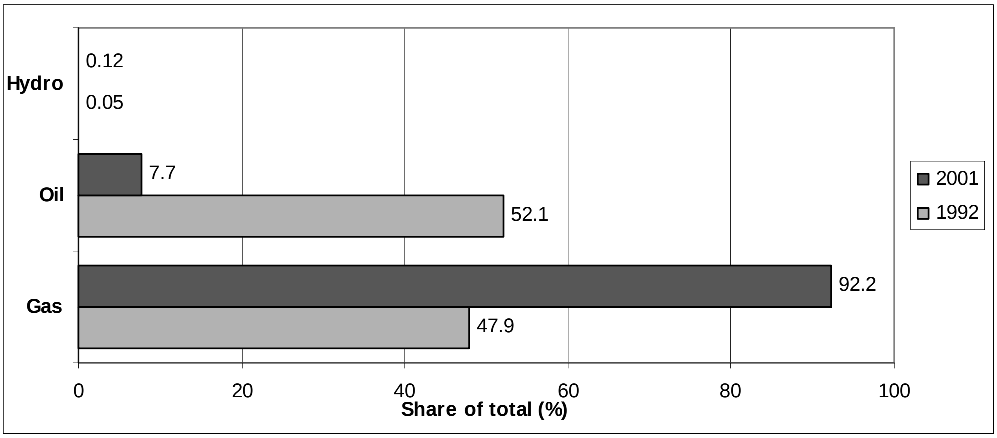
same level (14.8 Mtoe in 1992 and 14.4 Mtoe in 2001) while the supply of oil decreased threefold (from 21.4 Mtoe to 7.5 Mtoe). This change was due to a combination of economic reasons (closure of oil-fired facilities due to economic decline, high competitiveness of gas-fired electricity generation) and environmental reasons (smaller impact of gas combustion on the environment). Two other noticeable changes are a decrease of coal in the energy balance (replaced by gas) and an increase in the use of combustible renewables, mostly wood and peat (in large part due to policy efforts to increase the use of domestic energy resources). Hydro energy and non-combustible renewables are not used much in Belarus, mostly because of unfavourable natural conditions (a relatively small potential of economically viable hydro generation, low wind velocities and low insolation).

Figure 1. Structure of primary energy supply in Belarus



Source: Energy statistics database of the International Energy Agency (IEA). These data are, in general, consistent with national data presented in the NC1 although some differences exist due to a different system of accounting.
Note: As 1990 data for TPES in Belarus are not available in the IEA databases, 1992 data are used here.

Figure 2. Structure of electricity supply in Belarus



Source: Energy statistics database of the International Energy Agency (IEA). These data are, in general, consistent with national data presented in the NC1 although some differences exist due to a different system of accounting.
Note: As 1990 data for TPES in Belarus are not available in the IEA databases, 1992 data are used here.

10. As Belarus has only small domestic energy resources (some coal, oil and gas; sizeable quantities of peat), the energy supply comes predominantly from abroad, mostly from the Russian Federation (more than 98 per cent of energy imports in 2000 were from Russia). In 2001, 99.2 per cent of natural gas, 89.5 per cent of crude oil, and 28.6 per cent of coal were imported.[5] In total, Belarus imported about

5 Energy statistics database of the International Energy Agency (IEA).

7.9 times more energy in 2001 than it produced (27.8 Mtoe versus 3.5 Mtoe). This high dependence on energy imports is considered to be a serious problem in Belarus, and efforts are being made to increase the use of domestic wood and peat.

11. Emissions of carbon dioxide (CO_2) from fuel combustion in Belarus were 5.65 Mg CO_2 per capita and 0.80 kg CO_2 per US$ of GDP (calculated using the PPP method) in 2001.[6] Compared to the average values for the members of the Organisation for Economic Co-operation and Development (OECD), the per capita emissions in Belarus were lower than the OECD average (10.99 t CO per capita); the emissions per GDP unit were higher than the corresponding OECD value (0.50 kg CO_2/US$).

C. Relevant general, energy and environmental policies

12. ***Economic policy***: The main objectives of social and economic policies are defined in the "Programme of social and economic development of the Republic of Belarus for 2001–2005" and in the "Main directions of social and economic development of the Republic of Belarus for the period until 2010". These planning documents include target values for GDP, GDP per capita, industrial production, population income, and other macro-economic and social indicators. Two macro-economic scenarios are considered: the "inertial" scenario, based on past trends, and the "target" scenario, based on target values for 2005, 2010 and 2020. In both scenarios, the share of services in GDP is expected to increase, whereas the share of industry is expected to decline (consistent with the trends of 1995–2001). The NC1 is based on values for the "target" scenario: GDP should increase (relative to the 1990 level) by about 20 per cent in 2005, by about 60 per cent in 2010 and 2.4–2.6 times in 2020.

13. ***Energy policy***: The energy policy of Belarus is formulated in the "Main directions of energy policy for 2001–2005 and for the period until 2015" (2000). The key objectives are reliable and efficient energy supply, reduction of the dependency on energy imports and preservation of a safe environment. Because of the importance given in Belarus to efficient use of energy, measures to improve energy use efficiency are detailed in the "National programme of energy conservation for 2001–2005" (NPEC) where two strategic objectives are formulated: GDP growth without an increase in energy supply until 2005, and the achievement of GDP energy intensity typical for industrialized countries by 2015.

14. ***Environmental policy***: The main objectives of environmental policy are the preservation of safe living conditions for the population, and rational use and protection of natural resources for the present and future generations. The first "National strategy of sustainable development of the Republic of Belarus" was approved by the government in 1997. This document outlined the objectives, priorities and indicators of sustainable development of Belarus, taking into account the specific situation in the early 1990s (including the economic crisis after the breakdown of the Soviet Union and the consequences of the accident at the Chernobyl nuclear power plant in 1986[7]).[8] At present, a new version of the strategy is being prepared – the "National strategy of sustainable socio-economic development of the Republic of Belarus for the period up to 2020" (NSSD-2020). A reduction in the emissions of air pollutants, including CO_2, is expected to be among the objectives of the new strategy. The review team noted that a consultation process with all levels of government, the scientific community and representatives of industry was organized as part of the preparation of the NSSD-2020.

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[6] "Key World Energy Statistics from the IEA: 2003 edition", OECD/IEA, Paris, 2003.

[7] About 70 per cent of the area contaminated by the Chernobyl accident is located in Belarus. About 23 per cent of the territory of Belarus is at present still contaminated with Cs-137 at a level of more than 37 kBk/m^2; a special status has been assigned to 3.2 per cent of the territory (6,700 km^2) because of the remaining high level of contamination.

[8] An analysis of the implementation of the first version of the national strategy of sustainable development can be found in an analytical report of about 200 pages by O.S. Shimova *et. al*. "Strategy of sustainable development of Belarus: succession and renewal" (in Russian), Minsk, 2003.

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Reporting issues

15. The NC1 inventory contains information for 1990, 1995, 1999 and 2000[9] and includes CO_2, methane (CH_4), nitrous oxide (N_2O), oxides of nitrogen (NO_X), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2). Emissions of hydrofluorcarbons (HFCs) were estimated in the NC1 as negligible; emissions of perfluorcarbons (PFCs) and sulphur hexafluoride (SF_6) were considered non-existent in Belarus. The inventory covers all sectors: energy, industrial processes, use of solvents, agriculture, land-use change and forestry (LUCF) and waste. Emissions of GHGs from international bunker fuels and from biomass are presented in the NC1 but not included in the common reporting format (CRF) tables submitted by Belarus to UNFCCC secretariat in 2002 and 2003 as part of its inventory submission. The review team used the inventory submissions of 2002 and 2003, as well as the 2003 national inventory report (NIR), in the preparation of this report.

B. Inventory preparation

16. The GHG inventory was prepared by expert groups from various organizations, each group being responsible for a particular CRF sector. The sectors were integrated into a single inventory file by RI "Ecology". The review team was impressed by the broad involvement of various organizations in the preparation of the GHG inventory, which helped to involve experts with the greatest expertise. On the other hand, the review team noted that coordination of work among individual expert groups could be improved to ensure an overall consistency of approach and terminology.

17. The national experts based their work on guidance documents of the International Panel on Climate Change (IPCC).[10] National emission factors were used if there were sufficient national data for their assessment; if not, IPCC defaults were used.

18. ***The energy sector***: the emission estimates were based on the amount of fuel burned (the "reference approach"). For 1990, 1995 and 1999, only the total amount of fuel burned in the energy sector was available and, therefore, only the total sectoral emissions of CO_2, CH_4 and N_2O were estimated. For 2000 and 2001, a more detailed breakdown of fuel use within the energy sector was calculated, which made it possible to break down CO_2, CH_4 and N_2O emissions by major categories within the energy sector for these two years.

19. ***Industrial processes***: Most emission estimates were based on national approaches, including national estimates of emission factors. Some of these approaches were not easily accessible and not always clearly explained in the NIR or the NC1. Some estimates of emission factors were based on the so-called "ecological passports", developed according to the requirements that existed in the former Soviet Union. They rely on calculation methods rather than on direct measurements. Emissions of NMVOC from asphalt were not estimated because, according to national experts, the use of the IPCC default emission factor led to unrealistic results but national estimates were not yet available.

20. ***Solvents and other products use***: Only NMVOC emissions were estimated. As for "Industrial processes", some references to researches and ecological passports were not easily accessible.

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[9] These years were selected as the most characteristic from the viewpoint of economic development. The summary tables in the annex to the NC1 and in the 2002 and 2003 inventory submissions contain information for all years from 1990 to 2001. The 1991–1994 and 1996–1998 data in these tables were obtained by interpolation.

[10] Intergovernmental Panel on Climate Change (IPCC), "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories", IPCC, 1996; Intergovernmental Panel on Climate Change (IPCC), "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", IPCC, 2000.

21. ***Agriculture***: Background data and the approaches used to estimate activity levels are clearly and satisfactorily presented in the NC1.[11]

22. ***Waste management***: The emission assessment closely followed IPCC guidelines. The review team felt that the content of waste was estimated from relatively old measurements (the new system of waste separation may have an impact on the composition of municipal waste in some regions).

23. ***Land-use change and forestry***: In general, the review team found the estimate to be robust but noted that the LUCF chapter in the NC1 was not structured by the typical categories of emission sources (given in the CRF tables presented in an annex to the NC1). The CRF table in the annex has an entry for "Other", the meaning of which was not explained, although this entry apparently includes emissions/removals from peatbogs – an important emission source in Belarus.

24. The review team was impressed by the number of original national and international studies that were used to estimate CO_2 and CH_4 emission factors from peatbogs. However, the team noted that emissions from one source (dried peatbogs) appeared in two NC1 chapters: CO_2 in the LUCF chapter, and N_2O in the chapter on agriculture. The emissions from peat fires were not taken into account because there is no methodology for this, although such fires are not rare in Belarus (for forest fires, an assessment was made and included in the inventory).

25. The national experts estimated the uncertainty of emissions and sinks for all sectors at the IPCC's tier 1 level. The uncertainty in activity data was generally lower than the uncertainty in emission factors, because most activity levels were estimated from detailed national statistics. The resulting uncertainty varied from 2 to 35 per cent (see table 2).

Table 2. Results of uncertainty analysis for the GHG inventory of Belarus (for the year 2000)

Sector	Estimated uncertainty in activity data (%)	Estimated uncertainty in emission factors (%)	Total uncertainty (%)
Energy	1	2–5	2–5
Industrial processes	1–3	5–10	5–10
Solvents	35	5	35
Agriculture	5–20	20	21–28
LUCF	15	10	18
Waste	6–7	10	12
GHG total (with LUCF)	–	–	**6.3**

C. Overall emission trends[12]

26. From 1990 to 2001, the total GHG emissions in Belarus (without LUCF) decreased by 46.8 per cent (see table 3). The largest decrease, by almost 40 per cent, was from 1990 to 1995, which reflects economic decline during these years. Since 1995, GDP has been growing but the emissions have continued to decrease (by 15.0 per cent from 1995 to 2001).

[11] The only point where the review team had difficulties was the adjustment of the method to calculate N_2O emissions from peatbogs with a peat layer of 30 cm in depth or more, as by IPCC guidelines only peatlands with a layer of not less than 40 cm should be considered.

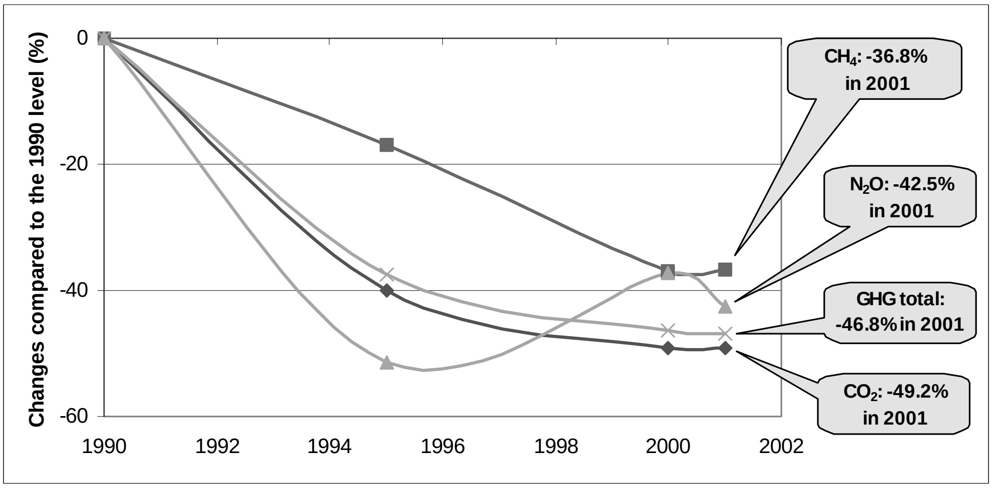
[12] The analysis of GHG inventory in this chapter is based on the 2003 inventory submission and not on the inventory data given in the NC3, in order to utilize data on 2001 emissions.

Table 3. GHG emissions (without CO_2 removals by LUCF) in Belarus, by gas

	Tg of CO_2 equivalent				Change	Share in GHG total
	1990	1995	2000	2001	1990–2001 (%)	in 2001 (%)
CO_2	102.5	61.5	52.0	52.1	–49.2	73.5
CH_4	20.36	16.92	12.84	12.86	–36.8	18.1
N_2O	10.35	5.02	6.49	5.95	–42.5	8.4
GHG total	133.2	83.4	71.3	70.9	–46.8	100.0

27. By gas, reductions in CO_2 were the largest – almost 50 per cent from 1990 to 2001 (figure 3). CH_4 decreased until 2000 and then stabilized. Emissions of N_2O fell by about 50 per cent from 1990 to 1995 but then increased, mostly because of economic recovery in agriculture after 1995.

Figure 3. Relative changes in GHG emissions in Belarus, 1990–2001



28. In general, GHG emissions decreased as a result of four major factors: economic decline from 1990 to 1995, a change in the structure of GDP from 1995 to 2001, an increased share of natural gas in the energy balance from 1990 to 2001, and improvements in energy use efficiency from 1990 to 2001. The individual contributions of these factors to GHG reductions from 1990 to 2001 were not quantified in the NC1.

D. Key emission sources and sectoral trends

29. Table 4 shows that from 1990 to 2001 GHG emissions decreased for the energy sector, industrial processes and agriculture but increased for waste management. The decrease in the energy sector was by far the largest, both relatively (by 49.9 per cent) and in absolute terms (53.7 Tg CO_2 equivalent). Nevertheless, the energy sector remains the main contributor to GHG emissions: 76.5 per cent of the GHG total (without LUCF) in 2001. Removals of GHGs by LUCF offset 23.3 per cent of GHG emissions in 2001. These removals increased by 30.4 per cent from 1990 to 2001.

30. ***Emissions from the energy sector***: CO_2 accounted for 94.4 per cent of GHGs from energy in 2001. As table 4 shows, a breakdown of these emissions by subsector is available only for 2000 and 2001, which complicates the analysis of emission trends within the energy sector.

31. ***Emissions from industrial processes***: The largest GHG source in this sector is CO_2 from the production of mineral products (cement and lime), which accounted for 77.7 per cent of the sectoral total in 2001, followed by N_2O emissions from the chemical industry (nitric acid production), which accounted for 20.2 per cent in 2001. Emissions of GHGs from industrial processes declined sharply, by almost 50 per cent from 1990 to 1995 (see figure 4), following the general economic decline in these

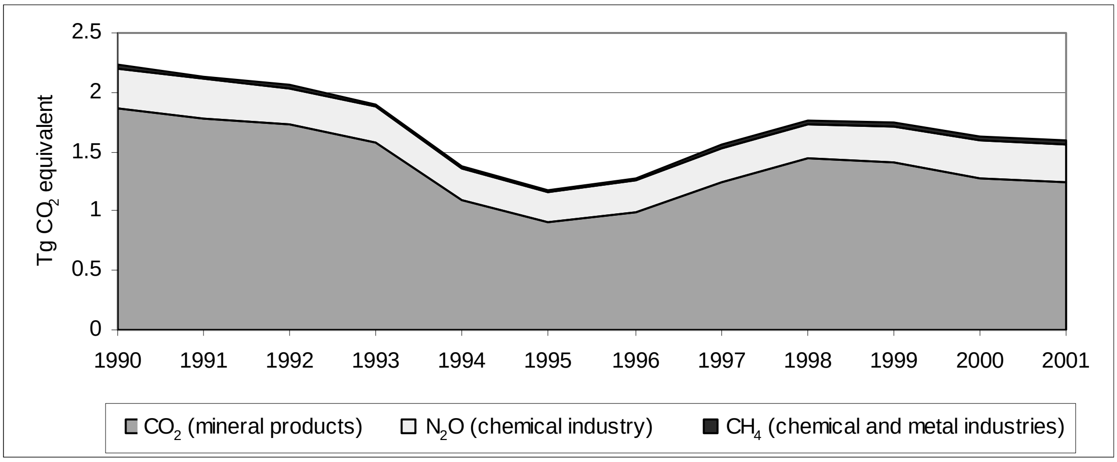
years. Along with economic recovery after 1995, the emissions increased and were 28.3 per cent below the 1990 level in 2001.

Table 4. GHG emissions in Belarus, by sector

	Tg CO_2 equivalent				Change 1990–2001	Ratio to GHG total without LUCF
	1990	**1995**	**2000**	**2001**	**(%)**	**in 2001 (%)**
Energy	107.60	66.73	53.44	53.87	–49.9	76.5
Energy industries	n.a.	n.a.	32.71	33.35	n.a.	47.3
Manufacturing industries and construction	n.a.	n.a.	3.46	3.80	n.a.	5.4
Transport	n.a.	n.a.	5.60	5.51	n.a.	7.8
Other combustion	n.a.	n.a.	9.44	8.65	n.a.	12.3
Fugitive emissions	n.a.	n.a.	2.23	2.56	n.a.	3.6
Industrial processes	2.23	1.18	1.62	1.60	–28.3	2.3
Agriculture	20.63	12.91	12.83	11.97	–42.0	17.0
LUCF	–12.58	–17.72	–18.49	–16.40	30.4	–23.3
Waste	2.59	2.14	2.96	3.00	15.8	4.3
GHG (with LUCF)	120.5	65.2	52.4	54.0	**–55.2**	**76.7**

Note: “n.a.” = “not available”.

Figure 4. Changes in GHG emissions from industrial processes, 1990–2001



Source: The 2003 inventory submission of Belarus to the UNFCCC. The data for 1991–1994, 1996–1998 are interpolated values as presented in the 2003 inventory submission.

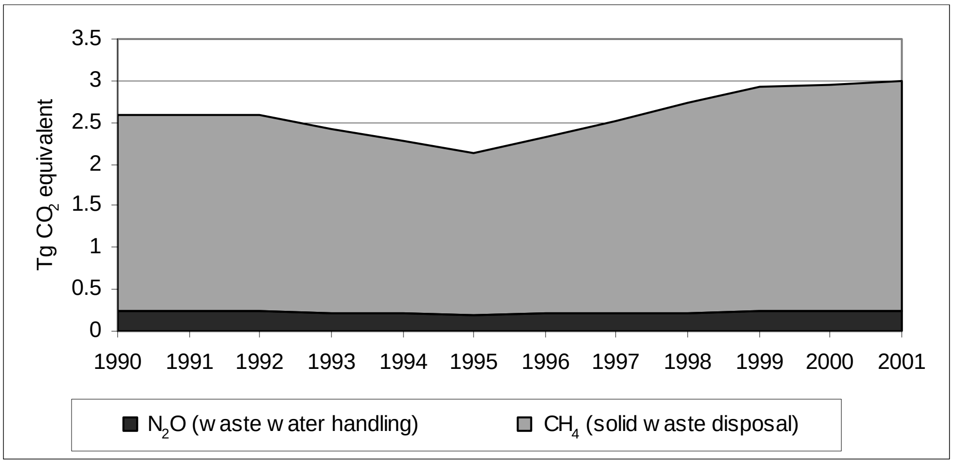
32. ***Agricultural emissions***: Two emission sources predominate in this sector: CH_4 from enteric fermentation (49.7 per cent of agricultural emissions in 2001) and N_2O from agricultural soils (44.0 per cent); the remaining 6.3 per cent is from manure management. Emissions from all agricultural sources sharply declined from 1990 to 1995 but stabilized after 1995. In 2001, agricultural GHG emissions were 42.0 per cent below the 1990 level; CH_4 decreased from 11.1 to 6.7 and N_2O from 9.5 to 5.3 Tg CO_2 equivalent.

33. The reasons for emission reductions were economic: the deteriorating economic situation in the early 1990s made the maintenance of livestock unprofitable, resulting in decreasing cattle numbers. At the same time, mineral fertilizers, which are a source of N_2O emissions, became too expensive and their consumption dropped. With the improvement of the general economic situation in the second half of the 1990s, cattle numbers and the use of mineral fertilizers stabilized.

34. ***Emissions from waste management***: GHG emissions from waste management, which are mostly CH_4 emissions from solid waste disposal on land, decreased by about 20 per cent from 1990 to 1995 but increased continuously after 1995. In 2001, these emissions were 15.8 per cent above the 1990

level. Two major factors were behind this increase: (a) the improved standards of living after 1995 led to increased amounts of municipal and industrial waste; and (b) the strengthened regulations, which came into force in 1995, increased the amount of waste disposed at landfill sites.[13] The efforts to increase separation and recycling of waste in the second part of the 1990s have not yet influenced the CH_4 trend. Collection of CH_4 from landfills and waste incineration are not carried out in Belarus.

Figure 5. Changes in GHG emissions from waste management, 1990–2001



Source: The 2003 inventory submission of Belarus to the UNFCCC. The data for 1991–1994, 1996–1998 are interpolated values as presented in the 2003 inventory submission.

35. ***GHG removals by LUCF***: Net GHG removals by LUCF increased by 30.4 per cent from 1990 to 2001. This increase reflects the successful policy of forest management pursued by Belarus in the 1990s, which led to a continuous increase in biomass stock in forests. Emissions of CO_2 from peatbogs are considerable in Belarus – about 10 Tg per year (for comparison, total CO_2 removals by changes in biomass stocks were about 36 Tg CO_2 in 2001). These emissions come, to a large extent, from artificially dried peatbogs, of which some are or were used for peat production.[14]

E. General comments on the GHG inventory

36. The review team was of the opinion that summary information on GHG emissions for 1990, 1995, 1999 and 2000 was presented in the NC1 in accordance with the UNFCCC guidelines.[15] The NC1 and the inventory submissions of 2002 and 2003 mark a notable improvement in reporting under the UNFCCC. These documents reflect a high level of relevant expertise in Belarus, which made a positive impression on the review team. At the same time, in discussing the inventory with national experts the review team made the following general comments relating to the preparation of the GHG inventory and its presentation in the NC1.

37. ***Completeness of GHG inventory***: In its present state the national GHG inventory is far from complete. Addition of the currently missing years (1991–1994, 1996–1998), preparation of background tables,[16] full description of national methodologies to estimate activity levels and emission factors, and

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[13] Before 1995, some amounts of municipal and industrial waste were disposed of irregularly at small, poorly managed landfills or directly into the environment (see the section on policies and measures in this report).

[14] CO_2 emissions from peatbogs in their natural state are also considerable but they are fully offset by a larger CO_2 absorption. The function of absorption is much weaker in artificially dried peatbogs.

[15] Document FCCC/CP/1999/7.

[16] Detailed background CRF tables are not available for 1990, 1995, or 1999–2000. Such tables were prepared for 2001 in the inventory submission of 2003 but they are not complete. The calculation of implied emission factors is suppressed in all tables.

key source analysis are possible directions for the further improvement. Should such work lead to the need to recalculate some inventory data for the years now available (1990, 1995, 1999–2001), the recalculations should be consistently carried out and clearly documented. The national experts recognize these deficiencies and intend to complete CRF files in the future. A specialized inventory review by a team of UNFCCC inventory experts could be very useful in this process, as well as the participation of experts from Belarus in expert reviews of GHG inventories of other countries.[17]

38. The review team emphasized the need to fill in subsectoral data within the energy sector. Improvements in national statistics might be necessary in this process. For example, the emissions from transport were estimated (for 2000 and 2001) on the basis of the amount of fuel used. This approach can give a reasonable estimate for CO_2 emissions, but not for CH_4 and N_2O emissions. Moreover, there is a lack of data on key parameters for road transport: although specific fuel consumption, passenger-kilometres and tonne-kilometres for state-owned transport are accounted for in national statistics, there are no comparable statistical data or analytical studies relating to passenger cars, buses and freight vehicles which are privately owned. Given that the number of cars in Belarus increased from 650,100 in 1990 to 1,533,400 in 2001, this lack of knowledge may be important.

39. There is a similar lack of detailed information for key parameters relating to energy use in buildings, such as estimates of energy use (by type of fuel and type of usage) in residential and commercial buildings and estimates of average energy use (per square metre of floor area).

40. ***Continuing support of GHG inventory***: The review team emphasized the importance of permanent support for the national GHG inventory. Given that under the UNFCCC inventory submissions are required from Belarus every year, it is important to have a dedicated expert group responsible for the preparation and timely submission of these annual GHG inventories, preferably under the supervision of an interministerial steering committee or another decision-making body. Such policy-level guidance should ensure that the work of technical experts provides results that are necessary to fulfil the international obligations of Belarus and are also useful for policy-making at the national level.

41. ***Quantitative analysis of emission trends***: As already noted (paragraph 28), GHG emissions in Belarus decreased due to four major factors: economic decline, change in GDP structure, increased share of natural gas in the energy balance, and improvements in energy use efficiency. The NC1 does not show the contribution of each of these factors to the overall emission reduction.

42. During the visit to Minsk, the review team provided the national experts with examples of such analyses in other countries. In addition, the review team estimated the impact of one factor – increased share of natural gas in the energy balance from 1990 to 2001 – on CO_2 emissions. The NC1 contains the shares of different fuels used for energy production and transformation in 1990, 1995, 1999 and 2000 (table 1.6 on page 54 of the Russian version). The national GHG inventory for 2000 contains emission factors for each of the fuels used by energy industries.[18] If one assumes that the implied emission factors for the main fuels – solid fuels, liquid fuels, gaseous fuels, other fuels – were the same in 1990 as in 2000, one can estimate the total implied emission factor for the total CO_2 emissions from energy industries in 1990 and 2000. Following on from this, one can further estimate what CO_2 emissions Belarus would have had in 2000, had the structure of fuel use in energy industries remained the same in 2000 as it was in 1990.

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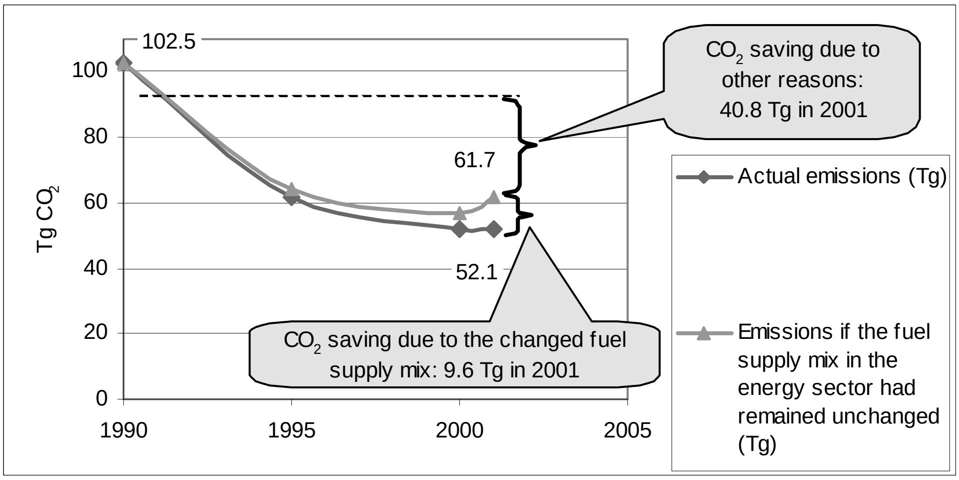
[17] For such participation to become possible, Belarus should nominate a sufficient number of national inventory experts to the UNFCCC expert roster.

[18] Strictly speaking, the inventory does not show these emission factors because the calculation of implied emission factors was suppressed in the CRF file. But as the amounts of fuel (in TJ) and the amounts of emissions (in Gg CO_2) are available, one can calculate the implied emission factors.

43. This rough estimate (figure 6) shows that the impact of the increased share of gas in the energy balance was considerable – about 10 Tg CO_2. But the impact of other factors seems to be larger: about 41 Tg CO_2. Because of the lack of data, the review team could not disaggregate this figure further. Such disaggregation, in particular the separation of the part relating to general economic decline from the part relating to improved use of energy, may be helpful in the preparation of GHG projections and in the design of GHG mitigation measures.

Figure 6. Impact of increased use of gas on CO_2 emissions from the energy sector



III. POLICIES AND MEASURES

A. Reporting issues

44. The NC1 chapter on policies and measures describes a great number of policies and measures in all sectors of the economy and gives sufficient information on the implementing entities. The monitoring process is covered in less detail, but this point was clarified during the review team's visit (the measures are monitored by those entities that are entrusted with their implementation; there is periodic reporting on implementation). Nevertheless, notwithstanding the large amount of information presented, the review team noted the following deviations from UNFCCC reporting requirements.

45. ***Estimates of emission reductions***: The NC1 does not provide estimates for GHG reductions from individual GHG mitigation measures. The few quantitative estimates available relate to economy in fuels and improvements in energy use efficiency, but not to GHG reductions. The summary table of measures (table 1 on page 86 in FCCC/CP/1999/7) was not provided in the NC1.

46. ***Evaluation of progress***: The degree of progress in the implementation of policies and measures is often not clear in the NC1, which does not use the classification of measures suggested by the UNFCCC guidelines (implemented, adopted, planned).

47. ***Costs and cost-efficiency of GHG mitigation measures***: The NC1 does not contain estimates of the costs of policies and measures. As a result, the cost-effectiveness of measures and the economic impact of their implementation is not clear from the NC1. However, during the review team's visit national experts clarified that economic analyses had been undertaken during the preparation of national and sectoral planning programmes. The experts also mentioned that funding was usually available for the implementation of such programmes.

B. Framework and objectives of climate change policy

48. The MNREP is responsible for a large number of environmental issues, including climate change and reporting to the UNFCCC. The Ministry of Economy, the Ministry of Energy, the Committee on Energy Efficiency, the Ministry of Transport and Communications, the Committee on Forestry, the Ministry of Residential and Communal Services and the Ministry of Agriculture and Food deal with climate-related issues within their administrative domains.

49. As Belarus ratified the UNFCCC only in 2000, its climate policy is still under development. Although an interagency working group on the implementation of the UNFCCC was created in June 2000 by the order of MNREP, it did not meet regularly and its actions in developing a climate policy have been limited so far. Nevertheless, the first national climate programme of Belarus was drafted as early as 1999.[19] This document defined as the main objectives: (a) the setting up of an effective system to provide the state authorities with reliable hydrometeorological information and projections of possible climate changes, (b) the reduction of damage caused by climate changes, and (c) the fulfilment of international commitments under the UNFCCC and the Kyoto Protocol. This draft version was never adopted officially and is now out of date, but its development provided a first opportunity to outline a coherent climate policy. At present, the need to revise this programme is being discussed.

50. Belarus did not participate in the Third Conference of the Parties to the UNFCCC in Kyoto, Japan in 1997. As a consequence, Belarus does not have an established emission reduction target under the Kyoto Protocol, although under the UNFCCC Belarus is an Annex I Party. During the nineteenth session of the Subsidiary Body for Implementation (SBI) under the UNFCCC in Milan, Italy in December 2003, Belarus brought this issue to the attention of the Parties.[20] According to the relevant conclusion of the SBI, the SBI may consider the issue further at its next session (in June 2004).

51. Notwithstanding the absence of an approved reduction target under the Kyoto Protocol, Belarus is considering ratification of the Kyoto Protocol. A number of projects have been implemented in order to study the procedure of ratification and its implications for Belarus.[21] The review team was informed that the government had already prepared the package of documents necessary for the ratification of the Kyoto Protocol and had sent the package to the parliament for consideration.

C. Cross-sectoral measures

52. In addition to the NSSD-2020 (see paragraph 14), the key cross-sectoral measures are the Law on Atmospheric Air Protection (1997), the “National action plan on rational use of natural resources and environmental protection for 2001–2005” (2001) and the Law on Environmental Protection (2002).

53. The **Law on Atmospheric Air Protection** and the **Law on Environmental Protection** laid out a legal basis for the protection of the environment in Belarus. Although these laws do not have provisions relating to GHGs, they influence GHG emissions indirectly through the establishment of general environmental regulations for industrial and commercial activities.

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[19] See V.F. Loginov, A.S. Senko, I.V. Eliseeva, V.M. Zhukovsky, “National climate programme” (in Russian), Minsk, 1999.

[20] Simultaneously, Belarus informed the Parties that it would use 1990 as the base year under the UNFCCC.

[21] Examples are a project (now completed) of the United Nations Development Programme (UNDP) and the United Nations Economic Commission for Europe (UNECE) “Analysis of the possibilities for the Republic of Belarus to join the Kyoto Protocol” and the recently launched UNDP–GEF project “National self-assessment of opportunities for global management of the environment”.

54. The **"National action plan on rational use of natural resources and environmental protection for 2001–2005"** defines the reduction of emissions of air pollutants, improvements in the system of standards on atmospheric air quality, and the development of a monitoring system for air pollution as national priorities. The plan stipulates a number of general measures to achieve these objectives; more detailed measures are considered in sectoral plans and programmes (see below).

55. The sectoral analysis of policies and measures below is structured as follows: energy sector (including energy production, transformation and use), transport, industry, agriculture, forestry, and waste management. Regulatory measures seem to be well developed in all sectors. Economic measures are also used, and voluntary measures are starting to appear.

D. The energy sector

56. According to the NC1, there is considerable potential for energy conservation in the energy sector, estimated at 5.6–7.2 Mtce for the period from 2001 to 2005 (of which 50 per cent relates to the residential and commercial sector and 13.5 per cent to the energy transformation sector).[22] To utilize this potential, the following main policy instruments were introduced: the "Main directions of energy policy for 2001–2005 and for the period until 2015" (see paragraph 13), the Law on Energy Conservation, the NPEC and the "Programme on rational use of natural resources and environmental protection for 2003–2005 of the 'Belenergo' Concern".[23]

57. The **Law on Energy Conservation** came into force in 1998. It outlines the key importance of energy saving in Belarus because of the lack of domestic energy resources and the high dependence on energy imports. The law laid out a legal basis for far-reaching energy-saving measures.

58. The **"National programme of energy conservation for 2001–2005"** (NPEC) was approved by the Council of Ministers of Belarus on 16 January 2001. This programme follows up an earlier programme, the "National programme of energy conservation for 1996–2000", which was successfully completed. From 1996 to 2000 GDP increased by 37 per cent, whereas GDP energy intensity decreased by 28 per cent; the total energy saving during this period is estimated as 6.8 Mtce.[24] Upgrades of boilers at power plants, modernization of thermal insulation at boilers and district heating networks, replacement of electric boilers with more economic heat sources, and reduction of transmission losses are among the key measures implemented.

59. The main objectives of the 2001–2005 programme are: (a) that by 2005 the planned increase of GDP does not lead to increased energy consumption, and (b) that by 2015 the energy intensity of GDP is at the same level as in industrialized counties. The programme envisages an expansion of combined-cycle electricity generation, an increase in electricity generation at co-generation plants, conversion of some boilers into small co-generation plants, optimization of electricity loads in the grid, modernization of insulation in boilers and heat pipelines, modernization of instrumentation and control systems, installation of heat accumulators, and other measures. Introduction of local and renewable energy sources, where it is economically efficient, is mandated. Attention is paid to measures to improve energy use in residential, commercial and institutional buildings where the potential for energy saving is known to be large. The programme contains annual and cumulative assignments for energy saving for relevant

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[22] This estimate is cumulative for 5 years from 2001 to 2005. For comparison, the TPES in Belarus in 2001 was, according to IEA data, about 35 Mtce.

[23] The "Belenergo" concern is a state-owned company consisting of major producers and distributors of electricity in Belarus. In addition to "Belenergo", there are six regional generation companies in each of the six regions.

[24] A considerable increase in energy prices during the period 1995–2000 also contributed to the improvement in energy use efficiency. However, the Belarusian experts could not provide information on the contribution of higher energy prices to the overall improvements of energy intensity.

ministries and other organizations (see table 5); these assignments are used in the process of programme monitoring. The assignments are supported by an allocation of funds, which includes the state budget, internal funds of organizations and international funding (see table 6).

Table 5. Assignments for energy saving for major energy consumers

Ministry or organization	Energy use in 1999 (ktce)	Planned energy saving (ktce)					
		2001	2002	2003	2004	2005	2001–2005
Ministry of Residential and Communal Services (“Минжилкомхоз”)	2,026.4	47.9	41.7	44.4	42.2	43.1	219.2
Ministry of Construction and Architecture (“Минстройархитектуры”)	1,631.1	66.1	68.7	70.7	75.5	77.8	358.8
Ministry of Transport and Communications (“Минтранс”)	178.9	1.82	0.95	0.47	0.95	0.60	4.80
Ministry of Agriculture and Food (“Минсельхозпрод”)	3,106	120.7	89.1	84.3	77.4	75.9	447.4
Ministry of Industry (“Минпром”)	1,627	60.8	65.0	67.8	72.2	75.9	341.7
Bellesbumprom («Беллесбумпром»)[a]	627.1	8.8	8.9	9.0	9.1	9.2	45.0
Belneftehim («Белнефтехим»)[b]	5,330.5	62.3	64.3	66.3	67.1	70.0	330.0
Belenergo («Белэнерго»)	12,296.7	112.9	104.02	190.53	171.51	171.0	750.0
Other[c]	–	94.1	87.7	88.2	83.6	68.5	422.0
Total	**–**	**575.4**	**530.3**	**621.7**	**599.5**	**592.0**	**2,918.9**

Source: State Committee on Energy Efficiency. “National programme of energy conservation for 2001–2005” , Minsk, 2001.
Note: these assignments were partially amended in 2002 by governmental decree No. 1820.
[a] A state-owned concern for the production of wood and paper.
[b] A state-owned concern for the production of chemicals, including oil refining.
[c] Includes all other organizations listed in the programme.

Table 6. Actual (1996–2000) and planned (2001–2005) investments in energy saving

Source	1996–2000		2001–2005	
	US$ million	%	US$ million	%
Internal sources of enterprises	164.2	44.3	433.3	54.5
Innovation funds	168.0	45.3	274.3	34.5
Budget (state and regional)	37.3	10.1	35.8	4.5
Credits and loans	1.0	0.3	43.7	5.5
Foreign investments	–	–	7.9	1.0
Total	**370.5**	**100**	**795**	100

Source: State Committee on Energy Efficiency. “National programme of energy conservation for 2001–2005” , Minsk, 2001.

60. The implementation of the NPEC was strengthened in 2002 by governmental decree No. 1820 **“Additional measures for economic and efficient use of fuel and energy resources”**. This decree established, for 2003–2005, the following additional targets for major energy consumers (shown in table 5): an annual decrease in the energy intensity of GDP by not less than 4.5 per cent; an annual decrease in the consumption of energy resources in the productive sectors of the economy by 7 per cent; the replacement of imported energy resources by not less than 0.6 Mtce[25] by 2005 compared to the 2002 level (of this, 0.2 Mtce should be replaced by the end of 2003). The organizations concerned must report regularly to the government on both the NPEC and decree No. 1820.

61. The State Committee on Energy Efficiency (CEF), which is directly under the Council of Ministers of Belarus, plays an important role in the implementation and monitoring of the NPEC and decree No. 1820. The CEF was created in 1993 and now has about 40 employees and branches in all regions. To monitor the implementation of energy-saving measures, CEF has, by governmental decision, far-reaching powers, including the right to impose fines. Using budgetary and extra-budgetary resources,

[25] The total of 0.6 Mtce is composed of 0.14 Mtce of peat, 0.33 Mtce of biomass, and 0.13 Mtce of other renewable and secondary resources.

including funding from international sources, CEF is active in designing and implementing its own energy-saving projects; in this process, priority is given to projects with quick rates of return on investment. This helps to improve energy use efficiency in a cost-effective manner.

62. The sectoral **"Programme on Rational Use of Natural Resources and Environmental Protection for 2003-2005 of the 'Belenergo' Concern"** includes a range of energy conservation measures in the energy sector, which are largely consistent with the measures defined in the NPEC. Given the shortage of financial resources, preference is given to low-cost measures promising a quick return on investment, such as optimization of combustion regimes for boilers.

E. Transport

63. The NC1 lists a number of policies and measures in transport relating to the legislative and organizational framework, monitoring and reduction of the environmental impact of transport, modernization of the car fleet, and personnel training. The most important policy documents are the "Concept of the development of the transportation complex of the Republic of Belarus", the "State programme of the development of the transportation complex of the Republic of Belarus", the "Concept of social and economic development of the transportation complex of the Republic of Belarus until 2015" and the "Concept of reducing the negative impact of transport on the environment". The NC1 does not provide information about the expected impact of these programmes on GHG emissions. This may be partially explained by the fact that, according to the NPEC, the potential of energy saving in transport is small: 10–13 ktce (by 2005) compared to 5,575–7,234 ktce for the whole economy (about 0.2 per cent).

64. The review team felt that the existing system of transport statistics might not be sufficient for the design of GHG mitigation measures in transport, because this system contains little data about passenger cars and buses owned by individuals. Only the total number of such vehicles is recorded; their characteristics, such as fuel consumption and emissions into the environment, are not available.

F. Industry

65. Emissions of GHGs from industrial processes decreased by 28.3 per cent in 1990–2001, largely as a result of economic recession. The NSSD-2020 and the "Programme of development of the industrial sector of the Republic of Belarus for 1998–2015" stipulate accelerated development of key industrial branches (the highest growth rates are planned for food production, the forest industry, and the wood, pulp and paper industries) and the introduction of new, environmentally clean technologies. This process is integrated into the "Programme of environmental protection for 2002–2005" of the Ministry of Industry and the "Programme of environmental protection of the 'Belneftehim' concern".

G. Agriculture

66. Agriculture accounted for 17 per cent of total GHG emissions in 2001. Since 1990 the agricultural part of GDP has decreased by about 29 per cent; both the use of nitrogen fertilizers and the number of livestock decreased. These changes led to the reduction in GHG emissions from agriculture by about 40 per cent. The use of nitrogen fertilizers is expected to reach 600 kt by 2005 and then stabilize, whereas the number of livestock is expected to remain stable or increase slightly in comparison with the current levels. The development strategy of the agricultural sector is determined by the NSSD-2020 and the "Programme for increased efficiency of agribusiness for 2000–2005". Emissions of GHGs are not expected to be among the key factors for agricultural development in Belarus.

H. Forestry

67. The key objective of forest policy is to ensure that forests in Belarus fulfil their economic, environmental and social functions in a balanced, sustainable manner. The "Strategic plan of development of forestry in Belarus" (1997), prepared by experts from the Committee on Forestry in cooperation with experts from Sweden and Finland, is the key guiding document of the national forest policy. The notable increase in biomass stocks in forests, and, consequently, in CO_2 removals from 1990 to 2001 (see table 4) shows that this policy is being implemented successfully. The increase in biomass stocks makes it possible to expand the use of wood – the total volume of cuttings is planned to reach 18 million m^3 by 2010. It is expected that the further development of sustainable forest management will permit CO_2 removals by forests to remain at a high level.

68. A number of institutional, economic and technical measures have been implemented to reduce CO_2 emissions from artificially dried peatbogs, including environmental rehabilitation, transition to environmentally and economically efficient utilization of degraded peat soils, and prevention of fires.

I. Waste management

69. Waste accounted for about 4 per cent of the total GHG emissions in 2001. Emissions of CH_4 from the disposal of solid waste increased by 16 per cent during the 1990s, mainly as a result of increased volume of waste. All waste is disposed of in landfills; collection of CH_4 from landfills and waste incineration are currently not carried out in Belarus.

70. An important change in waste management occurred in 1995 when the Council of Ministers issued decree No. 176 "On the norms of payment for the deposition of industrial and municipal waste" and the MNREP issued the "Instruction for granting licences for the deposition of waste into the environment". These documents considerably strengthened control on the amounts of industrial and municipal waste,[26] and improved the management of landfill sites. The Law on Waste (2000) further strengthened waste management procedures.

71. The "National programme of municipal waste management", supported by a number of additional governmental decrees, introduced a new system to manage municipal waste, from separate collection of waste to its complete industrial treatment, including maximum utilization of secondary resources extracted from waste. By the end of 2002, the system of separate waste collection covered 125,000 people (1.7 per cent of the total population). Annual rates of increase of about of 3–5 per cent per year are envisaged, which would allow the system to cover 35 per cent of the population by 2010 and the entire urban population by 2020.

72. According to the NC1 the implementation of this programme would reduce CH_4 emissions from the sector by 31 Gg in 2010 and by 70 Gg in 2020. The NC1 does not provide estimates for the costs of the programme.

J. General comments on policies and measures

73. The review team commented that, although policies and measures were described in detail in the NC1, their climate change component was not always clear. The absence of quantitative estimates for GHG reductions from individual measures does not allow the reader to understand which measures are important from the viewpoint of climate change and which are not. Such estimates, along with estimates for the relative cost-efficiency of measures for energy saving and emission reductions, could not only

[26] As a side effect of improved control, a marked increase in the amount of waste occurred from 1995 to 1996, because some part of waste, earlier unregistered, was taken into account in 1996.

help to improve compliance with UNFCCC reporting guidelines, but might also be useful for the formulation and implementation of national economic, energy and environmental policies.

74. Climate-related policies are implemented by several key ministries within their areas of responsibility. The review team understood the complexity of coordination of climate-related issues among the various organizations involved and felt that coherence in the design and monitoring of climate-related measures could be enhanced. The development of a national climate programme and a clear definition of responsibility for the coordination of climate-related measures could help to increase such coherence.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Reporting issues

75. Two projection scenarios are presented in the NC1: "optimistic" and "pessimistic". The definition of scenarios suggested by the UNFCCC reporting guidelines – "without measures", "with measures", "with additional measures" – is not used. The NC1 does not include the scenario that is mandatory under the UNFCCC guidelines – the "with measures" scenario.

76. The base year for projections was 2000. The emissions in the base year are consistent with the GHG inventory data for 2000. Emissions of CO_2, CH_4 and N_2O are projected for 2005, 2010 and 2020 individually for each gas and for the GHG total using the global warming potential (GWP) values. The results are presented by gas and by sector. The NC1 does not provide projections for the solvents sector (not likely to be important), international aviation fuels (possibly important), and HFCs, PFCs and SF_6 (probably not important).

B. Methodology

77. CO_2 emissions from the energy sector were estimated as a function of expected GDP changes, planned changes in the GDP energy intensity, and an assumed CO_2 emission factor per unit of energy. The formula used was $E_{CO2} = GDP \times EE \times K_{CO2}$ where E_{CO2} is CO_2 emission from the whole energy sector, EE is the energy intensity of GDP and K_{CO2} is the emission factor (in Gg CO_2 per unit of energy). The formula was applied consecutively for all years of the projection period assuming certain annual changes in GDP, EE and K_{CO2}. For non-CO_2 emissions from the energy sector and for non-energy emissions, the projections were based on projected activity levels and expected changes in emission factors (per unit of activity).

C. Scenario definitions and key assumptions

78. The **"pessimistic" scenario** assumes the absence of progress in energy use efficiency (in that respect, this scenario resembles a "without measures" scenario). Consequently, it assumes that energy intensity of GDP remains constant (at its present level) during the projection period.[27] Thus, GDP growth is accompanied by a respective growth in energy use and in GHG emissions. In the waste sector the scenario assumes that separate collection of municipal solid waste would not be implemented; in agriculture some growth of the livestock numbers is envisaged.

79. The **"optimistic" scenario** implies steady and considerable progress in energy use efficiency (making this scenario close to a scenario "with additional measures"). Consequently, a continued

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[27] For the "pessimistic" scenario, the review team felt that it might be not fully consistent to assume, on one hand, a constant energy intensity during the projection period (which means that a considerable amount of investments would not be available) and, on the other hand, a rather high GDP growth.

decrease in GDP energy intensity is assumed.[28] In the waste sector, separate collection and sorting of municipal waste is assumed to cover 70 per cent of the population by the year 2020. In agriculture, it is assumed that livestock would stabilize at the contemporary level for the entire projection period.

80. Most of the other assumptions are common to the two scenarios. The GDP is assumed to be about 60 per cent above the 1990 level in 2010 (and 2.5 times greater by 2020). Further structural changes in GDP, such as a continued increase in the share of services and a decrease in the share of industry, are assumed. The CO_2 emission factor per unit of energy is assumed to remain close to the 2000 level (about 0.06 Gg CO_2 per TJ) because only minor changes in the structure of energy balance are expected. The population is expected to decrease by 6.3 per cent from 1990 to 2010 and by 11.4 per cent from 1990 to 2020.

D. Projected emission trends

81. Figure 7 and table 7 show that under the "pessimistic" scenario, GHG emissions in 2010 would be about 11 per cent below the 1990 level (118.3 Tg CO_2 equivalent); under the "optimistic" scenario, the decrease is about 41 per cent (77.9 Tg CO_2 equivalent).

Figure 7. Actual and projected GHG emissions (without LUCF) in Belarus

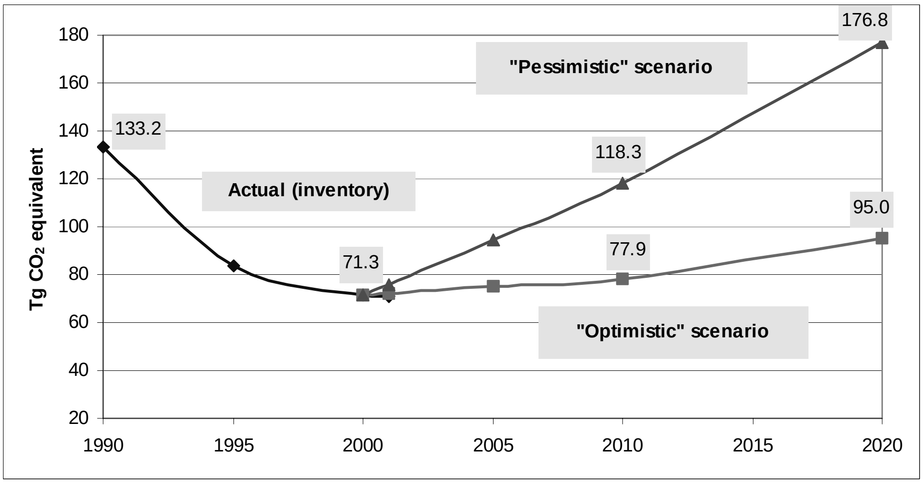


Table 7. Projected GHG emissions, by gas

		2010 emissions (Tg CO_2 equivalent)		Change from 1990 to 2010 (%)	
	1990	"pessimistic"	"optimistic"	"pessimistic"	"optimistic"
CO_2 (with LUCF)	89.8	74.5	35.8	–16.9	–60.1
CO_2 (without LUCF)	102.5	94.6	55.9	–7.7	–45.5
CH_4	20.4	14.7	13.0	–27.9	–36.1
N_2O	10.3	9.0	9.0	–12.7	–12.7
GHG with LUCF	120.5	98.3	57.8	–18.4	–52.0
GHG without LUCF	133.2	118.3	77.9	–11.1	–41.5

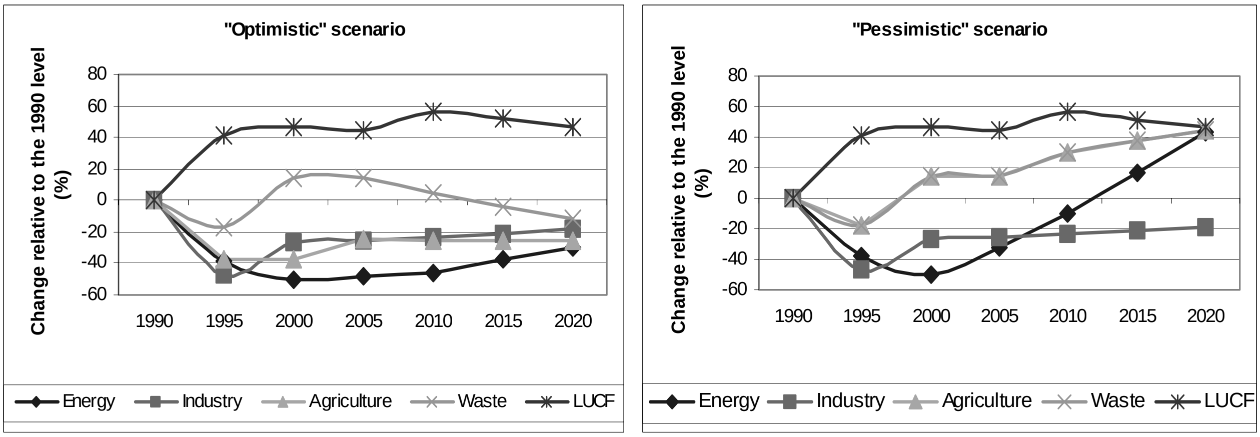
E. Effects of policies and measures

82. Figure 8 shows projected changes in sectoral emissions. Large differences between the "pessimistic" and "optimistic" scenarios are observed for the energy sector, agriculture and waste management. For the emissions from industrial processes and LUCF, figure 8 shows no difference

[28] The NC3 does not contain exact values for the energy and CO_2 intensities used in the projections. Only expected average changes are given such as the relative decreases (in per cent) in GDP energy intensity: 4.0 in 2001, 4.7 in 2002, 4.5–5.5 in 2003, 8.4–11.0 by 2005, 16–20 in 2006–2010, 10–15 in 2011–2020.

between the two scenarios because the NC1 did not evaluate such a difference for these two sectors. In both scenarios, GHG emissions from industrial processes are assumed to increase by about 6 per cent by 2010 (compared to the 2000 level) whereas the industrial GDP is projected to increase, in the same period, by about 50 per cent. The growth rate for emissions is lower than the growth rate for GDP as a result of the introduction of new technologies and planned structural changes in industry.

Figure 8. Projected changes in sectoral GHG emissions



83. As the NC1 does not include a "with measures" scenario and quantitative estimates for GHG emission reductions of individual measures are not provided, the overall effect of *implemented and adopted* policies and measures cannot be estimated accurately. For the same reasons, it is not possible to estimate the total effect of *planned* policies and measures. However, by taking the difference between the two scenarios presented in the NC1, one can roughly estimate the total effect of *implemented, adopted and planned policies and measures taken together*. This estimate (table 8) indicates that GHG reductions are to be achieved predominantly in the energy sector.

Table 8. Full mitigation effect[a] of policies and measures (Tg CO_2 equivalent)

	2005	2010	2020
Energy	18.1	38.7	79.1
Industrial processes	n.a.	n.a.	n.a.
Agriculture	0.9	1.0	1.2
LUCF	n.a.	n.a.	n.a.
Waste	n.a.	0.7	1.5
Total	**19.0**	**40.4**	**81.8**

Note: "n.a." = "not available". The two projection scenarios do not differ for the industry and forestry sectors.
[a] The mitigation effect is the difference in annual GHG emissions between the "pessimistic" and "optimistic" scenarios.

F. General comments on the projections

84. The review team concluded that the projections in the NC1 cover the most important sectors of the economy. The results are, for the most part, transparent and consistent with the inventory part of the NC1 as well as with major assumptions. At the same time, the review team identified four areas where further improvement appeared to be possible.

85. ***Formulation of a "with measures" scenario***: The NC1 does not contain a "with measures" projection encompassing the currently implemented and adopted policies and measures. The formulation of such a scenario would allow for a more representative indication of future trends in GHG emissions and removals. It would also make it possible to distinguish the mitigation effect of those policies and measures that are already in place from those that are only under consideration.

86. ***Projection of CO_2 emissions from the energy sector***: Projections for the energy sector were prepared using a formula linking CO_2 emissions with macroeconomic assumptions (evolution of GDP and improvements in the energy intensity) and with an aggregated emission factor for the entire energy system. This approach has the advantage of simplicity, but it also has drawbacks. For example, it does not permit the modelling of explicit links from individual GHG mitigation measures to overall emission reductions; the impact of changes in the structure of GDP on GHG emissions could not be quantified; the impact of future changes in the energy supply mix, including the penetration of renewables (wood in particular), on emissions could not be evaluated. This approach also does not make it possible to project future emissions in energy subsectors (such as fuel combustion in industry, transport, and fuel use in residential and commercial buildings). Nor does it permit simulation of the impact of macroeconomic policy, including the price and taxation policy, on GHG emissions[29] (this is typically done in macroeconomic models), or detailed evaluation of the options for fuel switching and use of new energy technologies[30] (which is typical for engineering bottom-up energy models). Overall, the review team felt that the use of energy models could allow for more robust projections. The team was informed that some energy models were used in a number of research institutes in Belarus.

87. ***Presentation and analysis of key emission drivers***: The transparency of projections could be further improved by including more detailed information on assumed and calculated key variables, such as the distances travelled in passenger transport, specific energy use in industrial processes, and energy use per square metre in residential and commercial buildings.

88. ***Sensitivity analysis***: The NC1 presents two scenarios for future GHG emissions, assuming the same growth of GDP. The review team noted that it could be useful to investigate the impact of some key parameters, especially GDP growth, on future evolution of GHG emissions.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

89. The presentation of issues of vulnerability and adaptation in the NC1 complies with the UNFCCC guidelines. According to studies based on national observations at 49 weather stations over the period from 1881 to 2001, there is credible evidence that climate in Belarus is becoming warmer, and the character of the change indicates anthropogenic influence. For example, the night-time temperature is increasing faster that the daytime temperature, which is consistent with increased CO_2 concentrations (daytime heat is retained near the surface for longer periods). Increases in the daytime temperature are lower in summer than in winter, which can be explained by the compensating effect of aerosols.

90. The increase in average annual temperature in the period from 1988 to 2001 is the largest for the period under consideration (1881–2001).[31] The probability of this increase being a random fluctuation is estimated as less than 5 per cent. Total precipitation did not change much in the 20th century, but its variability increased and its spatial pattern changed noticeably: precipitation increased in the northern part of Belarus but decreased in the central and southern parts. [32] The average wind velocity decreased from 3.6 m/s in 1940–1970 to 2.9 m/s in 1991–2001, which may have an impact on the use of wind energy in Belarus.

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[29] This might be important, especially with respect to fuel imports from the Russian Federation.

[30] Because the formula used reflects technological progress in a highly aggregated manner.

[31] There were two large temperature increases in Belarus in the twentieth century: one in 1910–1939 and one in 1988–2001. The 1988–2001 warming is stronger and its character (for example, temperature increases in winter) indicates anthropogenic influence. Of the seven large increases (more than 1.5°C) of average annual temperature over the long-term average, five were observed in 1988–2001.

[32] Studies on climate change in Belarus are summarized in a comprehensive book (in Russian) of 330 pages by V.F. Loginov *et al*.: “Climate changes in Belarus and their consequences” (2003).

91. Future climate change in Belarus was estimated using the HadCM2, HadCM3 and GFDL models.[33] Most of these estimates assumed a doubling of CO_2 concentrations in the atmosphere during the 21st century, compared to the 1990 level. As a result of increased CO_2 concentration, by 2020–2039 the average temperatures are estimated to increase by 1.0–1.3°C for July and 2.5–2.9°C for January. The variability of precipitation would continue to increase. Extreme weather events, such as light frosts in autumn and spring, thaws in winter, droughts and storms may become more frequent.

92. Vulnerability of the following sectors and systems was assessed in the NC1 as most relevant for Belarus: agriculture, forestry, water resources and human health. For **agriculture**, the positive impact of higher CO_2 concentrations and temperatures would be counteracted by the negative impact of decreased precipitation (in some parts of Belarus) and increased frequency of light frosts (in autumn and spring), thaws, droughts and floods. Adaptation measures would be necessary, such as changes in the selection of agricultural crops and an increase in the amount of fertilizers (despite the fact that the efficiency of fertilizers increases at higher temperatures). For **forests**, an increased CO_2 concentration may have a positive impact, notwithstanding the higher probability of droughts, decreased water availability, higher probability of fires and the expansion of pests.

93. In terms of **water resources**, water levels and water availability generally are likely to decrease. The frequency and severity of floods may increase. Promotion of efficient use of water and enhanced protection of areas vulnerable to floods are the most relevant adaptation measures. The NC1 notes that climate change may also affect **human health** as a result of increased temperature (in particular in summer), increased variability of atmospheric pressure, increased air humidity, and an increase in vector-carried diseases.

94. Two types of economic impacts of climate change are discussed in the NC1: an impact on agriculture and an impact on fuel use for heating. The national experts are aware of the preliminary character of these studies.

95. Estimates of climate change impacts and adaptation measures were carried out by individual organizations within their areas of competence and responsibility. Possibly for this reason the sectoral estimates, presented in the NC1, are sometimes based on differing assumptions, which may complicate the planning and implementation of adaptation measures at the national level.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

96. As Belarus 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 of the UNFCCC. Accordingly, the NC1 does not contain a chapter relating to financial resources and technology transfer.

97. During the country visit, national experts informed the review team about existing projects that use funding from international financial institutions and foreign countries. Such projects often have a technology transfer component. Usually they are implemented through the CEF. Examples of international funding are a World Bank loan and a grant from Japan for the project "Modernization of infrastructure in the social sector of the Republic of Belarus",[34] a United Nations Development Programme (UNDP)-GEF project "Use of biomass in the heat supply system of the Republic of

[33] HadCM2 and HadCM3 are global circulation models developed in the United Kingdom; GFDL is a global circulation model developed in the United States.

[34] The project involves energy efficiency improvements at about 550 facilities such as schools, kindergartens, clinics and hospitals; at some of them a conversion to local and renewable energy sources is planned. By the end of the project (2008), a cumulative emission saving of 105–120 Gg CO_2 equivalent is expected.

Belarus",[35] and another UNDP-GEF project "Removal of obstacles to improvements in energy use efficiency in the public sector of the Republic of Belarus".[36] There are also several smaller projects with international funding.

98. The review team noticed that the work of the CEF focused on economy in energy resources. Reductions in GHGs are sometimes estimated, but are not considered as a target or an integral component of a project. The national experts explained that it is difficult to integrate GHG reductions into the project framework because at present there is no approved national target for GHG emissions. Moreover, calculation and monitoring of GHG reductions from projects is neither an assigned task of the CEF nor a responsibility of any other organization in Belarus.

99. In parallel with the preparations for the ratification of the Kyoto Protocol, Belarus is considering opportunities for using emissions trading (ET) and Joint Implementation (JI) under the Protocol. For ET, estimates of the available emission quotas in the first commitment period of the Kyoto Protocol have been made.[37] For JI, project requirements have been reviewed by the CEF. A joint project with Germany is now under consideration and will provide an opportunity to study and test the framework for JI projects. Project opportunities with Sweden, Denmark and a number of other countries are under discussion.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

100. In general, the information given on this topic complies with the UNFCCC reporting guidelines, although more information about the structure, operation and development plans for the national climate observing system could have been provided. (The review team obtained such information during the country visit.) The next national communication could provide more information on research and development of mitigation and adaptation technologies (paragraph 63(e) of the UNFCCC guidelines).

101. Notwithstanding economic difficulties, Belarus managed to retain a high level of climate observation and climate science. The climate observation system consists of 49 stations (approximately 1 station per 5,000 km^2) that take several measurements every day and report to the national Hydrometeorological Centre where the information is stored and analysed. Long-term data series (from 1881) are maintained. Weather and climate observation are funded from the state budget.

102. Climate-related studies are conducted by the Institute of Ecology and the Use of Natural Resources of the Academy of Sciences of Belarus, the national Hydrometeorological Centre and some other organizations. Results are discussed within the scientific community, although there is no formal coordination of such studies.

103. The NC1 does not contain much information about participation of Belarusian experts in international climate research. The review team gained the impression that such participation has been limited. Wider participation of Belarus in relevant international programmes (such as those carried out by the IPCC, UNDP, United Nations Environment Programme and the World Meteorological Organization) could be beneficial for these programmes as well as for Belarusian experts. It could also stimulate the involvement of young Belarusian scientists in climate research.

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[35] Installation of biomass boilers and measures to ensure reliable supply of biomass are planned. By the end of the project (2006), the cumulative decrease in GHG reductions is estimated to be 76 Gg CO_2 equivalent.

[36] The objective of the project is to prepare a full-scale demonstration of opportunities to improve energy use efficiency in the public sector. The estimated GHG reduction is 65 Gg CO_2 equivalent per year.

[37] The quotas for ET were estimated by Belarusian experts as 53–56 Tg CO_2 equivalent per year in 2008–2012 (assuming the 1990 level of GHG emissions as the target) but such estimates are only indicative because Belarus does not yet have an established emission reduction target under the Kyoto Protocol (see paragraph 50).

104. Belarus is a member of the Global Climate Observing System (GCOS). However, submission of a national GCOS report to the UNFCCC secretariat is currently not planned.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

105. The NC1 of Belarus covers issues of education, training and public awareness in compliance with the UNFCCC guidelines. Environmental subjects, including climate change, are considered at all educational levels: in pre-school, primary, secondary, specialized and higher education as well as in postgraduate courses for technical experts and decision-makers. The MNREP, the Ministry of Statistics and Analysis, and the RI "Ecology" regularly publish reports covering the condition of the environment.[38] In December 2003, a special contact point was opened at RI "Ecology" – anyone can use this point to raise an environmental concern, enquire about an issue or obtain information.

106. Belarus has begun to use information technologies, the Internet in particular, for the dissemination of information on environmental topics, including climate change. The Internet portal of the presidential administration (www.president.gov.by) contains links to environmental subjects and to Internet sites of relevant organizations such as MNREP and the RI "Ecology". The review team noted that electronic copies of the national GHG inventory and of the NC1 could be made available on the Internet for ease of access by the general public and to facilitate feedback.

107. The review team noted that NGOs could play an important role in raising public awareness of climate change. At present, Belarusian NGOs seem to have relatively little information about the international climate change process, although the 2003 World Climate Change Conference in Moscow helped some of them to obtain up-to-date information in this respect.

IX. CONCLUSIONS

108. The review team concluded that the NC1 of Belarus was a comprehensive, well-prepared document that marked a considerable achievement in reporting under the UNFCCC. The NC1 reflects a high level of relevant expertise in Belarus, and a notable organizational and technical effort. The NC1 complied with most of the UNFCCC reporting guidelines.

109. From 1990 to 2001, GHG emissions in Belarus (without LUCF) decreased by about 47 per cent (from 133.2 to 70.9 Tg CO_2 equivalent), mostly as a result of GHG reductions in the energy sector. The largest decrease, by almost 40 per cent, was from 1990 to 1995, which reflects economic decline during these years. Since 1995, GDP has been growing but the emissions have continued to decrease, which may indicate their decoupling from economic growth. Considerable GHG decreases in Belarus contributed to the attainment of the UNFCCC objective of GHG stabilization at the 1990 level by the year 2000.

110. In general, four factors contributed to the reduction in GHG emissions: economic decline from 1990 to 1995, change in GDP structure from 1995 to 2001, increased use of natural gas from 1990 to 2001, and improvements in energy use efficiency from 1990 to 2001. Quantification of the individual contributions of these factors to emission reductions and completion of the GHG inventory (including GHG data for energy sub-sectors) are among the areas where further studies could be useful.

111. The NC1 described a great number of policies and measures in all sectors of the economy. These policies and measures, in particular comprehensive programmes for energy saving, helped to decrease

[38] See, for example, "Environmental Protection in Belarus" (published by the Ministry of Statistics and Analysis in 2003), or "National Report on the Condition of the Environment in the Republic of Belarus" (published by MNREP and RI "Ecology" in 2003 and available at http://www.president.gov.by/Minpriroda/rus/publ/)

GDP energy intensity in Belarus from 1.67 kg CO_2 equivalent per US$ in 1990 to 1.01 kg CO_2 equivalent per US$ in 2001. However, the review team noted that the NC1 did not contain quantitative estimates for GHG reductions from individual policies and measures, for either past or future measures.

112. The development of a national climate programme and a clear definition of responsibility for the coordination of climate-related measures could help increase the coherence of climate-related policies implemented by individual ministries and committees within their areas of responsibility.

113. The NC1 contains two projection scenarios: the "pessimistic" scenario assumes a constant GDP energy intensity, whereas the "optimistic" scenario assumes a decreasing GDP energy intensity. The NC1 does not include the "with measures" scenario that is mandatory under the UNFCCC guidelines.

114. Under the "pessimistic" scenario, GHG emissions in Belarus (without LUCF) in 2010 would be about 11 per cent below the 1990 level (118.3 Tg CO_2 equivalent); under the "optimistic" scenario, the decrease is about 41 per cent (77.9 Tg CO_2 equivalent). Future GHG reductions are to be achieved predominantly in the energy sector; the review team noted that GHG projections for this sector could be enhanced by the use of energy models.

115. According to comprehensive studies by national experts, there is credible evidence that the climate in Belarus is becoming warmer, and the character of change indicates anthropogenic influence. Agriculture, forestry and water resources are most vulnerable to climate change in Belarus.

116. Belarus did not participate in the Third Conference of the Parties to the UNFCCC in Kyoto, Japan in 1997. As a consequence, Belarus does not have an established emission reduction target under the Kyoto Protocol, although under the UNFCCC Belarus is an Annex I Party. During the nineteenth session of the SBI of the UNFCCC in Milan, Italy in December 2003, Belarus brought this issue to the attention of the Parties. Nevertheless, Belarus is considering ratification of the Kyoto Protocol and opportunities for using ET and JI under the Kyoto Protocol.

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