UNITED
NATIONS

Framework Convention
on Climate Change

Distr.
RESTRICTED

FCCC/IDR.2/BGR
7 April 2000

ENGLISH ONLY

BULGARIA

Report on the in-depth review of the second national communication of Bulgaria

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Bulgaria ratified the Convention in March 1995 and submitted its first national communication (NC1) in February 1996. The country adopted 1988 as its base year for the purposes of the Convention, instead of 1990. It submitted its second national communication (NC2) in April 1998 and drew up a national climate change action plan (NCAP) later in the same year. An in-depth review of the NC2 was undertaken between March and August 1999, and included a visit by a review team from 3 to7 May 1999. The team consisted of Mr. Emilio La Rovere (Brazil), Mr. Jiri Zeman (Czech Republic), Mr. Seppo Oikarinen (Finland) and Ms. Amrita Narayan Achanta (UNFCCC secretariat, coordinator).

2. The territory of Bulgaria covers 110,993 km and the climate is described as mild continental. Forests cover 34 per cent of the country's territory, the sector being characterized by limited afforestation and an increasing share of protected forests over the last few decades. The population, which in 1998 was approximately 8.2 million, has been declining over the last few decades, a trend which is expected to continue.

3. In 1989, the country entered an economic recession from which it has not yet completely emerged. Gross domestic product (GDP) in 1995 was 76.2 per cent of that of 1989. The worst year financially was 1996, when GDP plunged by 10.9 per cent compared to the previous year. In 1997, it fell by 6.9 per cent. In mid-1997, the Government tied the Bulgarian leva to an anchor currency, the German mark (DM), at a rate of 1000:1, with automatic convertibility. Subsequently, the value of one leva was fixed at one DM. The more recent figures in this report have been modified accordingly. The review team noted that, while the above measures had led to a certain economic credibility and low inflation, they had also led to restrictions on or the closure of around 42 national funds, including those on energy resources and energy efficiency. The National Environmental Protection Fund, the National Ecotrust Fund and the Republic Road Network Fund are among those which continue to function.

4. 1998 in turn marked the highest positive GDP growth of the decade, namely 3.5 per cent. The team observed that during 1987-1997, the share of industry in GDP declined considerably (61 per cent in 1987 to less than 30 per cent in 1997) whereas that of the service sector (22 per cent in 1987 to 40 per cent in 1997) and agriculture and forestry (11.8 per cent in 1987 to 26 per cent in 1997) has been growing. There was a simultaneous drop in energy consumption within the industrial and household sectors, with the drop in industry being higher. There has been some privatization in the industrial sector and this is also planned for the energy sector. Bulgarian officials stressed that the recent war in Yugoslavia had serious repercussions on the country's economy, including on its trade via the Danube to the European Community (EC), and had boosted the black market.

5. Energy is a major item in the foreign trade of Bulgaria, the annual expenditure on energy imports being around US$ 2 billion equivalent to15-20 per cent of the gross national product (GNP). In 1995, 75 per cent of the energy consumed in Bulgaria was imported. Energy imports made up 30-35 per cent of total imports, highlighting the vital role that energy efficiency

improvements could play. Recently, there has been a decrease in the scale of fuel imports due to the economic crisis. The country also exports electricity (3,308 million kWh in 1997). There have been constant efforts to enhance the use of indigenous fuels, particularly lignite, and increase energy saving although the former option has not always been found cost-effective or environmentally favourable, due to the associated emissions. In 1997, the final energy consumption by sector was: industry (54 per cent), household (29 per cent), other (6.5 per cent), transport (5.9 per cent) and agriculture and forestry (3.5 per cent).

6. The responsibility for formulating and implementing climate change policy lies with the Air Protection Department in the Ministry of the Environment and Waters, which together with the Strategy and Economy Department is also responsible for levying environmental taxes. The preparation of both the 1996 Bulgarian Country Study to Address Climate Change and the 1999 NCAP involved inter-agency consultation. The funding for the country study came from the United States Department of Energy and the National Environmental Protection Fund and the study was coordinated by Energoproekt. The host officials made particular reference to the growing requirements for submission of national communications and in particular the national greenhouse gas inventories necessitating a re-examination of the currently available financial support. The results of the second phase of the country study (SNAP) were fed into the NC2 and the NCAP. Other agencies involved in the process included several institutes of the Bulgarian Academy of Sciences, other independent consultants from various ministries and some non-governmental organizations. The team also met some NGO representatives during the review.

7. The NCAP took into consideration both the 1998 National Energy Strategy by 2010, approved in 1998, and the 1998 Draft National Energy Efficiency Programme (NEEP). The NEEP focuses primarily on technological solutions for all energy end-use sectors and the energy supply and transmission sector. The team observed that it was a very ambitious plan that relied heavily on state or foreign aid for investment in energy efficiency, renewable energy and privatization. The team felt that the calculations were quite optimistic in terms of the costs of measures, energy conserved and payback periods, for example in the case of the thermal insulation of buildings. The NEEP has not been passed by the government in its current form. Subsequent to the review visit in May 1999, the NCAP was approved by the Supreme Environmental Council in the Ministry of the Environment and Waters. It is currently under inter-ministerial review, following which it will be submitted to the Government for approval.

8. In late 1997, the EC opened negotiations with Bulgaria on possible accession to the Community, based on firm requirements for harmonization of the country's institutional base and legislation with those of the EC. An express condition for accession is the liberalization of the power market and the partial closure of the Kozloduy nuclear plant.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

9. The NC2 includes data on the main greenhouse gases (GHGs), namely carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and the ozone precursors such as

carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs), for 1988, and 1990 to 1995. Additionally, revised estimates for 1995 and 1997 (Greenhouse Gas Inventory of Bulgaria –1997) were submitted electronically to the secretariat prior to the visit. Data for 1989 and 1996 were not provided. The team noted that data could not be compared across years without some adjustments, as discussed later. The data for 1997 included an estimate of SO_2 emissions. No estimates have been made for hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

10. Information on such matters as emission factors and activity data was lacking in the NC2 but detailed information on the emission factors used was provided during the visit. The team noted that in the NC2 Bulgaria used the 1995 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, opting for either the IPCC default emission factors (occasionally supplemented by CORINAIR emission factor data) or country-specific emission factors, as indicated in table 1. However, the 1997 national GHG inventory follows the Revised 1996 IPCC Guidelines, using the standard data tables of the 1995 IPCC Guidelines, allowing for easy comparison with previous years. For the 1995 and 1997 estimates, the inventory excluded emissions from international bunkers (limited to marine bunkers due to lack of data on aviation bunkers) from the national total emissions; also some emissions from additional non-energy products were excluded from the CO_2 emissions estimates from fuel combustion using the "top-down" method (reference approach). The team suggested that a similar recalculation be done for the other years incorporating these corrections of deviations from the IPCC Guidelines.

Table 1. Methodology and emission factors used in Bulgarian GHG inventory

IPCC category	Methodology and emission factors
Energy [a]	IPCC tier 2 & tier 3 methods with Bulgarian emission factors (exception : tier 1 for aviation)
Industrial processes	IPCC and CORINAIR 94
Solvent and other product use	CORINAIR 94 and 90
Agriculture	Livestock : IPCC tier 2 for cattle and swine, tier 1 for others (CH_4 and N_2O emissions); others : IPCC
Land-use change and forestry [b]	Bulgarian methodology
Waste	IPCC
International bunkers	Included in total emissions until 1995; IPCC for 1997 (and 1995 recalculation)

a: In the energy sector Bulgarian emission factors were used for CO_2 emissions from different coal and lignite types, natural gas and oil products. For non-CO_2 emissions, specific emission factors were used when available, while IPCC default values were used in other cases, such as for CH_4 fugitive emissions and CO and CH_4 emissions from natural gas and fuel oil used as industrial heat sources. IPCC default values were used in the remaining instances.

b: In the land-use change and forestry sector the national forest estimates of afforested area, mean annual increment of wood and annual cut were used.

11. The review team felt that the national team had done commendable work in incorporating a number of revisions (many of which could be considered improvements) into the NC2 inventory and the 1997 GHG emission inventory, compared with NC1 estimates. The team suggested that further methodological refinements could involve the development of domestic emission factors for fugitive emissions, in particular for surface mining of lignite and natural gas transport (the latter being expected to grow substantially to 30 billion m^3 per annum by around

2010), further development of domestic emission factors for industrial heat use and use in service and household sectors, collection of improved transport sector activity data (composition of the fleet, distances travelled by vehicles, fuel exports/imports), disaggregated sectoral data on gasoline and diesel oil consumption according to the IPCC Guidelines, data collection on HFCs, PFCs and SF_6, CH_4 and N_2O data collection for estimates from the land-use change and forestry sector and N_2O emissions from waste.

12. The reported emissions of the main GHGs and ozone precursors from 1988 to 1997, and for SO_2 in 1997, are shown in table 2. Based on the figures for overall emissions of the main GHGs (CO_2, CH_4 and N_2O) in CO_2 equivalent in the NC2 and the 1997 GHG inventory, the 1997 GHG emissions fell to 62 per cent of their 1988 level, a trend attributed to the economic decline in this period. In 1997, the reductions recorded were 39 per cent for CO_2, 37 per cent for CH_4, 31 per cent for N_2O, 71 per cent for NO_x, 25 per cent for CO and 46 per cent for NMVOCs, relative to 1988. The contribution of the major GHGs to the national total has remained remarkably stable during the period. In 1997, CO_2 contributed 70 per cent to the total (71 per cent in 1988), CH_4 contributed 22 per cent in terms of CO_2 equivalent (identical to that in 1988) and N_2O 8 per cent in terms of CO_2 equivalent (7 per cent in 1988). The team also noted that the use of the 1995 global warming potential (GWP) values in the NC2 recalculation of the base year led to a 4 per cent decrease in total GHGs compared to the NC1 results (141,347 Gg CO_2 equivalent).

Table 2. Total anthropogenic GHG emissions, 1988-1997 (Gg)

Gas/Year	1988	1990	1991	1992	1993	1994	1995	1997
CO_2	96 878.0	85 278.0	67 020.0	61 037.0	63 257.0	60 390.0	63 109.0	59 217.0
CH_4	1 413.0	1 420.0	1358.0	1250.0	1117.0	826.0	901.0	892.4
N_2O	30.8	29.6	23.2	19.1	17.5	17.7	20.6	21.2
NOx	486.4	250.8	191.4	179.4	183.7	162.8	161.3	142.7
CO	826.6	951.8	738.0	755.0	767.7	707.3	760.6	622.7
NMVOC	132.3	104.9	58.3	62.4	67.9	65.6	73.4	72.0
SO_2								1 304.0

A. Carbon dioxide

13. Table 3 presents the emissions and removals of CO_2 by source and sink. The review team added a row to show the recalculation of total emissions excluding international bunkers, which were unduly accounted for in the national inventory submissions for 1990-1995. Sectorally, the energy sector plays an overwhelming role with 90 per cent of the total CO_2 emissions in 1997. Stationary combustion represents 80 per cent of the total, while the transport sector, with 10 per cent, accounts for as much as the other two sectors, industrial processes and waste, taken together. All sectors show a decrease in emissions, reflecting the effects of the economic recession. However, the transport sector demonstrates particular sensitivity to the economic situation, due in part to the constraints on fuel imports that were imposed. Thus,

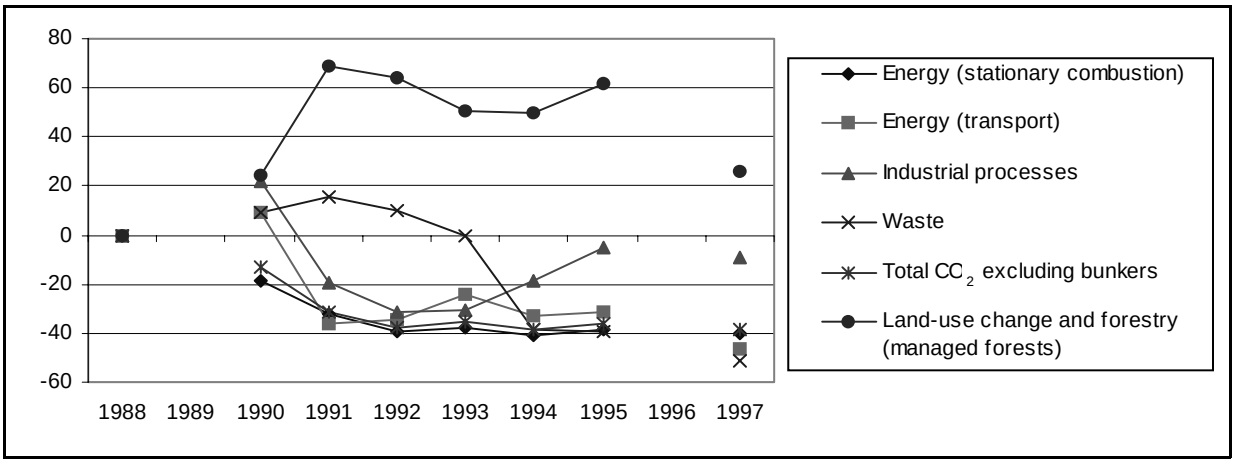
compared to the 1988 levels, the 1997 transport sector emissions declined by 47 per cent, against a 40 per cent reduction for stationary combustion and 39 per cent for the total CO_2 emissions.

14. For the forestry sector, the estimate is restricted to emissions and removals from managed forests as there is no forest clearing or land-use change according to the Government. The input data for the sink calculation are based on the forest inventory and annual statistics on forest harvests. The past afforestation effort, coupled with a decrease in the annual cut due to the economic decline, created a considerable CO_2 sink throughout the 1955-1995 period.

Table 3. Carbon dioxide emissions and removals, by source and sink, 1988-1997 (Gg)

Sectors	1988	1990	1991	1992	1993	1994	1995	1997
Energy (stationary combustion)	79 574	64 728	53 782	48 416	49 468	47 143	48 831	47 784
Energy (transport)	10 753	11 756	6 845	7 000	8 183	7 179	7 394	5 743
Industrial processes	5 890	7 200	4 751	4 023	4 103	4 812	5 602	5 369
Waste	661	721	764	725	659	406	400	321
International marine bunkers	162	874	878	873	844	850	882	1092
Total reported	96 878	85 278	67 020	61 037	63 257	60 390	63 109	59 217
Total excluding bunkers	**96 878**	**84 404**	**66 142**	**60 164**	**62 413**	**59 540**	**62 227**	**59 217**
Land-use change and forestry (managed forests)	-4 657	-5 801	-7 880	-7 636	-7 022	-6 974	-7 520	-5 852

Figure I. Carbon dioxide emissions (excluding bunkers) and removals, percentage change from 1988, by source and sink



15. National forest experts informed the team that the amount of land available for further afforestation is limited, current efforts being directed towards increasing the density of afforested areas. However, the team noted a recent increase in the annual cut of forests, associated with the privatization of land. Accordingly, the CO_2 sink fell considerably in 1997, to a level 22 per cent lower than in 1995. In 1997, the removal of CO_2 corresponded to almost 10 per cent of the country's emissions. Figure I depicts the percentage change in CO_2 emissions from the base year 1988, by source.

16. Besides the calculation of CO_2 emissions by the detailed technology approach ("bottom-up"), the NC2 also provides an estimate of CO_2 emissions according to the reference approach ("top-down"), as recommended in the IPCC Guidelines. The differences between the two approaches, which vary markedly between the period 1988-1992 (0.44 to 2.04 per cent) and the period 1993-1995 (6.67 to 7.97 per cent), are due to problems with the quality of data on fuel exports and imports, the different emission factors used, and different operation modes of fuel processing (refers to the level of loading and output production ratio of the refinery) and storage technologies. However, the fossil fuel quantities used for calculating emissions by the reference approach for 1988-1995 did not exclude all the non-energy products, contrary to the IPCC Guidelines. This was corrected in the 1997 GHG emission inventory.

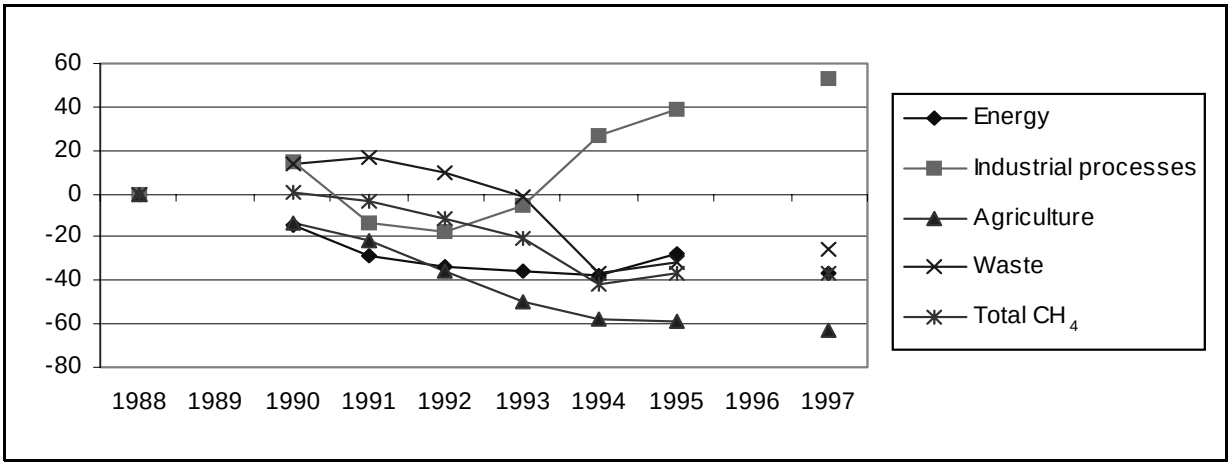
B. Methane

17. In general, CH_4 emissions declined steadily during the period 1988-1997, the level being 37 per cent lower in 1997 than in 1988 (table 4). In 1997, the waste sector contributed 61 per cent to the total, the energy sector 26 per cent, agriculture 13 per cent and industrial processes a nearly negligible amount. In comparison to 1988, 1997 emission levels were 26 per cent lower in the waste sector, 27 per cent lower in the energy sector and 63 per cent lower in agriculture. The NC2 emission estimates incorporated substantial changes due to the new methodology for waste estimates adopted in national statistics and the drop in per capita generation of municipal solid waste (500 kg/capita before 1994, to 436 kg/capita in 1997).

Table 4. Emissions of methane, by source, 1988-1997 (Gg)

Source	1988	1990	1991	1992	1993	1994	1995	1997
Energy	371.4	318.6	263.6	246.3	237.2	229.8	269.9	233.9
Industrial processes	2.4	2.8	2.1	2.0	2.3	3.1	3.4	3.7
Agriculture	306.6	264.5	239.9	196.6	154.4	129.9	125.0	113.0
Waste	732.3	833.7	852.3	805.5	722.8	463.3	503.2	541.7
Total	**1 412.7**	**1 420.0**	**1 358.0**	**1 250.4**	**1 116.7**	**826.1**	**901.4**	**892.4**

Figure II. Methane emissions, percentage change from 1988, by source



18. In the waste sector, a new classification of industrial waste water was introduced in the 1997 GHG emission inventory, to comply with the International Standard Industrial Classification. The hosts indicated that the emission estimate from waste water within the food industry was improved due to the use of more disaggregated activity data, leading to a 7 per cent increase over the 1995 figure. Fugitive CH_4 emissions from coal mining remain comparatively small as 78 per cent of coal production is from open-cast mining (having a unit emission factor 15 times lower than from underground mining). The current emissions from oil and natural gas systems are low but have the potential to increase sharply with construction of the projected gas pipeline from the Russian Federation to Western Europe through Bulgaria. Livestock management is the third important CH_4 source. Figure II depicts the percentage change in CH_4 emissions from the base year 1988, by source.

C. Nitrous oxide

19. N_2O emissions decreased by 31 per cent from 1988 to 1997 (table 5). During that time, N_2O emissions from the energy system increased while those from agriculture and industrial processes declined. The sharp fall in agricultural emissions (a two thirds decrease from 1988 to 1997) can be explained by the drastic reduction in the application of mineral fertilizers entailed by the economic crisis.

Table 5. Emissions of nitrous oxide by source, 1988-1997 (Gg)

Source	1988[1]	1990	1991	1992	1993	1994	1995	1997
Energy	7	11.8	10.2	9.8	9.7	9.4	9.7	9.7
Industrial processes	10.4	9.7	7.0	5.7	4.9	5.8	8.3	6.9
Agriculture	13.4	8.2	6.0	3.6	2.9	2.6	2.5	4.5
Total	**30.8**	**29.7**	**23.2**	**19.1**	**17.4**	**17.7**	**20.6**	**21.2**

20. Consequently, the stationary combustion of fossil fuels became the most important N_2O source after 1990, the emissions being 40 per cent higher in 1997 than in 1988. The team noted that both the CO_2 and CH_4 from the energy sector are twenty per cent lower in 1990 than in 1988, and questioned why the N_20 from the same source are 70 per cent higher. Nitric acid production is the next most significant source of N_2O emissions, although in 1997 the emissions corresponding to industrial processes were one third lower than in 1988. A new feature of the 1997 GHG emission inventory was the incorporation of an estimate of N_2O emissions from manure management.

D. Sulphur dioxide

21. Estimates of SO_2 emissions were included in the 1997 GHG emission inventory and were based on the Revised 1996 IPCC Guidelines. Emission factors for the main Bulgarian power

[1] The host officials informed the team that the N_2O estimate for 1988 was expected to be revised in 1999 and that the trend after 1990 was more reliable.

plants and processing industries lacking special desulphurization equipment, were based on laboratory and experimental work. Emission factors for process emissions were taken from the Revised 1996 IPCC Guidelines. In 1997 the energy sector was the main source of SO_2 emissions with a share of 88.2 per cent of the total, followed by fuel combustion in manufacturing industries and construction (3.3 per cent), transport (0.6 per cent) and other sectors (7.3 per cent). Industrial processes account for 0.56 per cent. The team recommended that the same methodology be used to back-calculate emissions of previous years.

E. Other aspects

22. No quantitative information on the uncertainty of the emission estimates was provided in the NC2. A qualitative country assessment has indicated a predominantly high degree of confidence in the calculation of CO_2 emissions from the energy sector and from land-use change and forestry. The hosts believe that in the near future, quantitative uncertainty estimates for energy-related emissions, following IPCC orientations on good practices could be made. The team gathered that in the future a stable source of finance would be required to ensure the continuity and further improvement of GHG inventories. Currently, an allocation from the National Environment Protection Fund (NEPF) covers the recalculation of annual inventories up to 1988 using current methodology, which is to be completed in 2000. Additionally the quality of activity data for the transport sector, particularly fuel imports and exports, has improved with a reduction in the statistical differences, which were 19 per cent in the early nineties at the time of the Yugoslavia embargo. It is expected that these differences could go as low as 1.5 per cent, due to a 1998 Ministry of Internal Affairs project on the registration of small fuel exports and imports. The quality of activity data is also expected to improve, thanks to the preparation of national energy balances following EUROSTAT requirements, involving harmonization of data formats for energy statistics with those of the EC.

23. The collection of data on hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) is at a very initial stage. A new regulation due for enforcement in 2000 requires the reporting of all imported gases, as part of the national efforts to protect the ozone layer under the Montreal Protocol.

III. POLICIES AND MEASURES

24. Based on the material from the above-mentioned programmes, the NC2 describes various policies and measures to mitigate climate change at the central, regional and local levels. The communication also includes information on many detailed technological examples for future mitigation measures, by gas and sector, in compliance with the UNFCCC guidelines. Yet, it seemed to the review team that the country, in the NC2, had difficulty in estimating the effect of individual policies and measures on GHG emissions. During the review, additional information was provided on the status of implementation of the policies and measures mentioned in the NC2. This enabled the team to learn that most of the policies and measures outlined in the NC2 were still in various stages of planning, with a limited number under full implementation. As regards the financial mechanisms, which include funds, some of which were in use at the time of

the first review, most currently do not exist. Due to the significant contribution of the energy and transformation sector and energy-intensive sectors to national CO_2 emissions, the identified mitigation measures mainly focus on these sectors, though some cross-sectoral and sector-specific measures are also included in the NC2.

A. Cross-sectoral policies and measures

25. Since the publication of the NC1, Bulgaria has made progress in its transition to a market economy. Subsequent to the sharp economic crisis of 1996, a new government took charge in 1997 and a strict fiscal policy and currency board were implemented. Ambitious transformation, privatization and new regulation plans were developed and partially implemented. The team felt that the most significant impact on future GHG emissions was likely to come from the transformation policy in the energy industry, which included removal of energy price subsidies, disaggregation and partial privatization of the state-owned power monopoly (National Electric Company), and change in ownership of district heating utilities from state to municipalities and subsequent privatization. The restricted fiscal policy under the currency board has already led to the closure of some inefficient industrial facilities having a high energy intensity. Although some risk of delay in implementation of the transformation plans was reported, due to the likely social impacts and practical feasibility, these policies are expected to have a significant impact on the future GHG emissions.

26. Additional to the transformation policy, among the climate change measures already in place, the team felt that the Environment Protection Act adopted in 1991 and amended in 1992, provided a framework, specifying the roles and responsibilities of the various levels of government. Its importance also lies in the fact that various funding mechanisms for environmental projects are under its purview. In the 1980s and early 1990s, there were more than 100 environment-related funds, of which 31 were earmarked for energy-related investments. The functioning of most of these funds has been blocked by the currency board since early 1997. Of the continuing funds, the NC2 mentions the National Environmental Protection Fund (NEPF) and the Municipalities' Environmental Protection Funds directed at financing environmental investment projects. In 1998, the total revenue of the NEPF, derived primarily from the tax on liquid fuels (75-80 per cent of the fund's capital), revenues from privatization of state enterprises (17-18 per cent of the fund's capital), penalties for violation of environmental regulations. For 1998, the broad breakdown of funding by project which was provided made it difficult to determine the precise funding of projects having direct or indirect GHG reduction implications. No information on the Municipalities' Environmental Protection Fund was provided. The review team noted that due to the process of transformation in progress some of the associated uncertainties had in turn led to only a limited degree of funding currently being directed towards energy efficiency investments. Though this situation had been expected to change with the adoption of the Energy Efficiency Law (which occurred in July 1999), which envisaged the creation of a National Energy Efficiency Fund, this did not happen as the approved version of the Law lacked this provision.

27. The team noted that, although the Clean Air Act adopted in 1996 had been identified during the first review as having some potential via its ordinances to increase overall efficiency of stationary combustion and enhance use of environmentally sound technologies, it was expected to only control emissions of sulphur dioxide and nitrogen oxides. However, the team understood that subordinate legislation had not yet been completely drafted, as the prescribed standards were unachievable in the absence of investment for environmentally sound technologies. Consequently, the team felt that the Energy and Energy Efficiency Law (approved by Parliament in July 1999), along with privatization that was under way, could assume a significant role in emission reduction in the energy sector. The Law, which is in harmonization with EC legislation, is expected to balance energy development and energy security with economically efficient use of energy (including use of energy standards and labelling) and adoption of renewable energy resources. Among its goals are a pricing policy that will ensure a transition to market prices, a restricted share of monopolies in the energy sector, restructuring of the sector and privatization. The State Energy and Energy Resources Agency to be set up under the Law, is to make long-term energy plans and forecasts and prepare a strategy for the development of the energy sector and the efficient utilization of energy and energy resources, adopt plans for the total fuel and energy balance of the country, approve programmes for energy efficiency in the energy supply sector and protection of the environment, privatization of the energy sector and approve and publish inventory of the new capacity of over 25 MW and new heat and gas transmission systems that are to be constructed in order to meet the total energy balance of the country. The Law indicates that the National Energy Efficiency Agency established in 1997, is to be transformed into the State Agency on Energy Efficiency that is responsible for the preparation, coordination and implementation of the national energy efficiency policy. The Agency is to be placed directly under the Council of Ministers. Apart from energy efficiency, the Law is expected to promote renewable energy sources via the Agency. The team also noted that the Energy Committee had also developed an action plan in line with the national energy strategy to enable the country to meet its international environmental commitments. Though privatization is expected to provide the investments needed in the energy sector, all energy utilities are state-owned; privatization is expected after 2000 except for the nuclear power plant and the transmission network, which will remain state-owned.

28. The host country informed the team that there was an ambitious programme to liberalize energy prices but indicated that full liberalization was likely to be difficult. In the 1980s, prices were monopoly prices and highly subsidized by the state. At present, energy prices continue to be controlled by the Government. The price of heat used by the industry and other sectors (excluding households) covers the production cost together with a small profit. Household heat prices are subsidized but the subsidies are to be lifted by 2000. Even so, households switch off or disconnect their central heating due to their inability to make the payments. With regard to electricity, the price covers production costs. At present, industrial consumers subsidize households, but this is expected to change. Coal prices for the household sector are subsidized but they are to be liberalized by 2000, with briquettes continuing to receive a subsidy. Because of the high social costs, the Government wishes to avoid raising energy prices in the household sector.

B. Energy supply and transformation

29. In 1997, the energy supply and transformation sector accounted for 63 per cent of net CO_2 emissions, the single largest contribution. The sector, which is heavily reliant on fossil fuels for power and heat production, is considered strategically important and is therefore a state monopoly. Of the overall installed power production capacity of around 12,700 MW, about 51.7 per cent is coal based, 29.7 per cent is nuclear power, 15 per cent is hydropower and 3.4 per cent is combined heat and power (CHP). The National Electric Company, which is responsible for production, transmission, import and export of electricity, owns 87.9 per cent of the installed heat and power capacity, with some additional units connected to the grid owned by companies and industrial enterprises. To date, the only independent energy producer in District heating is the Sofia Power and Heating Company owned by the municipality of Sofia, which provides heat to the city.

30. The predominant use of domestic lignite in most thermal power plants is due to the fact that it constitutes a secure, least-cost, indigenous energy resource. The use of imported fuel is limited to two thermal power plants. The team observed that this dominant use of coal, predominantly of domestic origin, would continue to affect CO_2 emissions, as the NC2 envisages an annual usage of 43 million metric tons in 2005, approximately 72 per cent more than at present. Lignite usage between 1990-1997 has varied within a very narrow range. In addition, since domestic reserves consist primarily of lignite of low calorific value and high sulphur content, high sulphur dioxide emissions are likely. Though the current high share of nuclear power helps to limit emissions (in contrast to the level with comparable conventional power generation) this situation could change, with the closure of the four older units at Kozloduy (which accounted for around 50 per cent of the entire nuclear power production in 1998) in response to EC pressure, the 1990 freeze on construction of new nuclear plants and the pending political decision regarding the location of the new units at Belene. The last-mentioned form part of a “modified” nuclear plan which takes into account safety considerations. Additionally, while the share of CHP capacity, about 14 per cent of the installed total, is quite high compared to other southern European countries, it is based mostly on fossil fuels (coal 45 per cent, gas over 40 per cent, and oil 15 per cent and relatively early cogeneration technology. In 1996, power produced in CHP plants covered about 14 per cent of the total power production and 58 per cent of the total heat production in Bulgaria. The country’s electricity imports were quite high in the 1980s and early 1990s but the country is now an exporter of electricity. Since 1991, the domestic electricity demand has fluctuated greatly due to the unstable economic situation.

31. The major mitigation measures planned for the energy supply sector relate to improving production efficiency in existing power plants and reducing losses in power and heat transmission and distribution systems. Feasibility studies on the rehabilitation of the largest thermal power plants with a total capacity of 4,500 MW were completed in 1999. These studies led to the development of rehabilitation programmes for seven coal-fired plants, with rehabilitation to commence after 2000 based on private investment. The programmes are expected to cost more than US$ 3.5 billion and reduce annual CO_2 emissions by about 6.8 Mt. Other sectoral measures due for adoption in 2000 include upgrading cogeneration and district

heating plants using gas turbines, construction of new gas combined cycle plant for power production, and waste heat utilization.

32. Large hydropower, the most significant renewable source, accounts for 15 per cent of the installed capacity. Other sources include small hydropower stations (capacity less than 10 MW), wind, geothermal, solar thermal and photovoltaic sources, and biomass, as well as biogas. These energy sources have a total installed capacity of 135 MW. The team's attention was drawn to the lack of legislation favouring renewable energy, prevailing low heat and electricity prices, land ownership issues (relating to the use of geothermal springs), the distance to the grid and lack of technical information on renewables. The recent Energy and Energy Efficiency Law stipulation that transmission enterprises should enter into long-term contracts for the purchase of energy produced from renewable energy sources in small power plants (not exceeding 10 MW) and in CHP plants, should favour renewable energy growth. This Law also requires the transmission network operator to give priority in electrical load scheduling to power plants utilizing renewable energy sources. Additionally, the team noted that the draft Water Law was expected to address the ownership issue, facilitating the exploitation of geothermal energy. Both the NC2 and the NCAP have considered the addition of more hydropower plants in the period till 2010, with the analysis showing a potential of 180 MW of new hydropower, including microhydro until 2010 and about 520 MW up to 2020, resulting in an estimated reduction of 13 Mt of CO_2 emissions at an investment cost of US$ 1.6 billion.

C. Industry

33. In 1997, the industrial sector contributed around 20 per cent to total national CO_2 emissions, including emissions arising from the industrial use of energy and also from various industrial processes. As recently as the late 1980s, Bulgarian industry was largely based on utilization of the country's natural resources. This included iron ore and coal mining, the heavy metallurgical industry, chemical industry, oil processing and the agricultural produce industry. Since the crisis in the early 1990s, the industrial sector has seen declining output (reaching its lowest level in 1998), large-scale restructuring, the closure of many industrial enterprises and privatization. Production has since been rising but the growth has been slow, with the 1996 industrial output only 55 per cent of the 1989 level. The industrial structure has also undergone change in recent years, with the chemical and oil processing industry currently at 27 per cent, the food industry at 20 per cent and the metallurgical industry at 12 per cent of the industrial output. The downturn in the chemical, fuel and steel markets has also necessitated closure of some of these enterprises or provision of state subsidies.

34. Since 1997, the industrial sector has been marked by large-scale restructuring and privatization, 71 per cent of companies having been privatized by 1999. The Ministry of Industry is in charge of the privatization and restructuring and the financing of the restructuring process. 1999 was singled out by the Government as a critical year, due to the anticipated privatization of the country's main enterprises. Among the conditions put forward by the Government for privatization were the use of environmentally sound technologies. The team noted that a number of state-owned enterprises had significant arrears (amounting to 5 per cent of

GDP) and some of them were in the process of liquidation. The Ministry is also making efforts to minimize the current energy insensitivity of industry. The hosts admitted that making industry more energy efficient was critical to both industrial competitiveness and the fulfilment of the EC environmental standards.

35. Though the NC2 included a list of 70 measures targeted primarily at energy efficiency within various industrial sectors, the team lacked a picture of their actual implementation. However, the trend of final energy consumption shows that, despite the decline in industrial production, industry continues to be the dominant energy consumer. In 1995, the major industrial consumers of energy comprised the chemical and petrochemical industry (34 per cent) and the metallurgical industry (24 per cent). The team noted that the specific energy consumption in the ferrous metals subsector was around 5-7 times the industry average, an indication of the high potential for energy saving in the sector. An encouraging trend was that, up to the date of the review, at least 13 energy audits had been conducted primarily by the energy efficiency centre in typical enterprises of the glass, food, metallurgy, electronics and heavy industries, leading in turn to pilot projects in these sectors. The focus of these audits was primarily on energy expenditure and implementation of measures having a payback period of less than a year. The review team felt that industrial energy efficiency was also being promoted through privatization, changes in the structure and level of energy prices, the use of the Energy and Energy Efficiency Law and international assistance. One instance of international assistance originated from the Japanese International Cooperation Agency in 1995, leading to the formation of the Energy Efficiency Centre in the Ministry of Industry, whose role was to measure energy consumption, and contribute to the improvement and modernization of the production processes. The functioning of the Energy Centre, Sofia, which is responsible for the promotion of efficient and environmentally sound technologies and which is supported by the EC, was another example.

D. Transport

36. In 1997, transport contributed a little less than 10 per cent to the total CO_2 emissions. The sector consumes around 6 per cent of the total energy (although this could be an underestimate, as national statistics only report on the state transportation firms and there is a well developed public road transport and railways system), of which almost 85 per cent consists of oil products. The extent of railway electrification is around 60 per cent. In 1995, railway passenger transport declined by around 20 per cent, road passenger transport by around 30 per cent and road freight by around 68 per cent with respect to 1988. The number of trucks and buses showed a steady decline from 1992 to1997, while that of cars followed an opposite trend (18 per cent increase between 1992 and 1997). The increase in the number of private cars has been attributed to the access to West European markets and to the possibility of buying cheap second-hand cars. In spite of the growth, the level of car ownership is still only half the European average. The imported vehicles are usually old, second-hand cars, having a high fuel consumption, but not higher than that of the old Russian cars in use. The team noted the Government's efforts to regulate imports, discussed below. In spite of the increase in the number of cars, public passenger transport remains the main means of transport, accounting for more

than half of passenger-kilometers As far as goods transport is concerned, the importance of the Danube is illustrated by the fact that it accounts for 85 per cent of goods transported. Railways hold the second place.

37. The team learned of the various taxes on fuels, vehicles and road transport. All transport fuels are subject to an excise duty of 18.7 to 24.3 per cent of the price. Since 1996, the excise duty on unleaded, low-octane gasoline has been 300 leva/ton, whereas for high-octane leaded gasoline it is set at 550 leva. In the case of diesel, the excise duty is set at 110 leva/tonne. The team observed that though there were clear environmental benefits to applying a lower rate of excise duty to unleaded gasoline, it is unclear whether there was an adequate demand for unleaded gasoline as the cars produced before 1982 could use leaded gasoline only. Also, a lower level of tax on diesel fuel, which produces less CO_2 emissions per kilometer, would not necessarily cut fuel consumption as owners could drive those vehicles further for the same price. Of the excise tax revenue, 80 per cent goes to the Road Network Fund and 20 per cent to the National Environment Protection Fund. In addition to the excise tax, a value added tax (VAT) of 20 per cent was introduced on fuel in 1994. There are no exemptions to these taxes.

38. In order to limit imports of second-hand cars and encourage those of new cars, a 10 per cent customs duty was levied on all second-hand cars in 1996. This duty was withdrawn as of the 1st of January 1999 on cars imported from the European Community. Because of the lack of accurate statistics on imports of passenger cars, the team was not able to verify the effect of the customs duty on the composition of the vehicle fleet. Currently there is also an annual tax on cars, defined on the basis of engine horsepower, which also contributes to the Road Network Fund. For vehicles having an engine of more than 110 kW and equipped with a catalytic converter, the tax is 50 per cent less. Buses and lorries with eco-engines that are in compliance with “Euro1"and “Euro 2" standards also pay 50 per cent less. Buses used for urban passenger transport, in mountainous regions, and in sparsely populated and border areas pay only 10 per cent of the full tax. In addition to the excise tax, VAT, and the car taxes, a highway charge is being considered for introduction in 2000, the level of the charge being likely to rise with increasing horsepower.

39. The team noted that in 1997 the EC Poland and Hungary Assistance for Restructuring Economies (PHARE) programme started the conversion of 10 diesel-engine buses to a combination of diesel and natural gas, and the introduction of new engines in 12 buses. In 1999, another PHARE programme was approved for the installation of both new diesel engines and engines capable of using both fuels in 69 buses in Sofia, with commencement due in 2000. Although no firm numbers were available, the team understood that privatization of the transportation firms was under way. No figures regarding the level of subsidy paid to public transport were available though the team noted that the railway sector is strongly subsidized. In 1998, 24 per cent (60 billion leva) of all subsidies in the state budget went to the railway sector. The other sector subsidized was urban public transport. Based on the available information, the team felt that most of the implemented measures (except the promotion of public transport) would not necessarily lead to a direct reduction in overall GHG emissions though they could

generate revenue for the Road Network Fund and National Environment Protection Fund, which could in turn finance other mitigation measures.

E. Residential and commercial sector

40. In 1997, the residential sector accounted for around 29 per cent of final energy consumption and around 5 per cent of total CO_2 emissions. The breakdown of final energy consumption by energy source was: electricity 29 per cent, oil products 25 per cent, heat 21 per cent, other solid fuels 20 per cent, and coal 5 per cent. Space heating is the dominant process type and is supplied from cogeneration plants, district heating plants and individual furnaces in buildings. For space heating, oil is the dominant source (32 per cent of energy used for heating), followed by heat from CHP and district heating plants (20 per cent), and then coal briquettes and wood (12 per cent and 5 per cent, respectively). The review team felt that the existing statistics may not have complete coverage of the fuels used in furnaces.

41. The district heating system is well developed, operating in 21 cities and supplying heat to around 1.6 million inhabitants (20 per cent of the population). The prevailing energy sources for heat production are natural gas (63 per cent) and oil (23 per cent). The use of oil products in district heating lowers the contribution of CO_2 as compared to other fuels, excluding gas, though there are significant losses in heat distribution and in usage. The review team was informed of the development of a master plan in 1999 which included a technical assessment and investment programme for district heating systems in Sofia and the town of Pernik. This is expected to be funded by a US$ 80 million loan from the World Bank. The project, involves insulation of the hot water pipelines and reconstruction and modernization of consumer distributing stations. The review team learned that the efficiency of district heating was impaired by the lack of metering equipment, the fact that heat is billed on the basis of floor area, and the relatively low prices, which discourage conservation. The lack of thermal insulation in the walls, roofs and windows and basements of around 80 per cent of existing buildings, has led to significant heat losses. In June 1996, tariff changes were introduced for electricity, heat and coal supply for households. The attempt by producers to alter the heat tariffs to cover production costs remained only a partial success, since many households disconnected from the source.

42. Due to the recession, power consumption has declined drastically within the residential sector. In discussing the mitigation measures within the household and service sectors, the NC2 limited its attention to those identified in the NEEP, with the options being analysed in groups of settlements by types of energy end-use. According to the analysis, the technological options to save energy included improved thermal insulation for houses and public buildings, rehabilitation of district heating plants and individual metering of heat used. However, the problem remains one of funding. The team observed that it was difficult to identify the corresponding annual energy savings for the individual measures listed above, as the NC2 presented them in an aggregated fashion and the extent of implementation remained unclear. The NCAP proposed five different measures to initiate investments, some of which have already commenced, including demonstration projects, the start of municipal energy efficiency funds, the harmonization of energy-use standards and energy tariffs with those of the EC, the Energy and

Energy Efficiency Law, and the development of a municipal energy efficiency network (discussed elsewhere). The Energy and Energy Efficiency Law stipulates that heat energy consumers existing at the effective date of this Law must, by 1 January 2001, fit space and hot-water heating appliances in their houses with heat energy expense divisors (device which allows the definition of the share of heat consumed by each heating device compared to the overall heat consumption of the building) and thermostatic valves, and that hot water meters will be installed by the heat transmission enterprises. The absence of heat consumption meters in private estates will lead to a charge being levied for heat in proportion to the volume heated. The team noted the demonstration project, "Energy Efficiency Demonstration Zone in the City of Gabrovo", aimed at capacity-building of the municipal authorities, demonstration of energy efficient street lighting, renovation of the existing district heating system and retrofitting typical buildings with better heat insulation.

F. Land-use change and forestry

43. The total forest area in Bulgaria is approximately 3.77 million ha, representing 34 per cent of the country's territory, most of which is under state ownership. According to the 1997 Law on Forest Area Restitution, 15 per cent of the forests are to be restituted, a process to be completed by 1999. The team gathered that the state was closely monitoring the process of restitution and its implications on forest management. The team noted that 0.4 million ha had been cleared due to a shift in ownership and this trend was likely to continue. The situation of those forests which were the property of the municipalities remained unclear. The hosts indicated that there were no statistics on natural forests; forests were categorized as protected and managed. The category of protected and managed forests, primarily consisting of coniferous forests, increased from 8 per cent to 40 per cent of the total between 1955 and 1995, an increase attributed to the increased establishment of national parks. The increase referred to in the NC2 relates to the addition of the Central Balkan national park (area 44,080 ha), the Rila national park (area 67,359 ha) and the Stranzha national park (area 83,073 ha). Though there were certain measures listed against the forestry sector in the NC2, the team was informed of the afforestation activities and the increase in managed forests mentioned above. The team noted the decline in afforestation from 16, 473 ha in 1993 to 13,583 ha in 1997. At the same time, it was encouraged by the finding that there had been an increase in the total volume of the above-ground biomass of wood from 396 million m^3 in 1990 to 456 million m^3 in 1995, an increase attributed to low productivity forests being replaced by those with higher productivity and also to the level of the cut being lower than the annual increment of above-ground biomass. The hosts admitted that the pace of afforestation had been considerably slowed by the uncertainties associated with the land ownership issue, the state's inability to influence people on how to use their forests, and the lack of finance. The team was unable to come to a conclusion regarding the amount of land actually available for afforestation, though the NC2 identified various land categories.

G. Agriculture

44. Based on the limited information provided, the team gathered that there had been a decline in the livestock numbers during the period 1989 to 1996, with the number of bulls

declining by 59 per cent, dairy cattle by 43 per cent, sheep by 56 per cent and swine by 50 per cent. This is reflected in the declining methane emissions over the same period.

H. Waste management

45. The team was presented with a comprehensive picture of the waste management sector and was able to assess clearly the status of measures included in the NC2. At the time of the review, the number of legal landfills was around 720 and the quantity of waste generated annually around 3 130 425 tons The financial support for waste management comes from the National Environment Protection Fund, municipality funds and the state budget, whereas the formulation of waste management policy rests with the Ministry of the Environment and Water, with implementation being at the municipality level. Municipalities are responsible for the development of municipal action plans; around 90 per cent of the 262 municipalities have already prepared plans and about half of them have been accepted by the authorities. The municipalities also own the landfills.

46. The NC2 mentions the Law on the Reduction of the harmful impact of waste upon the environment act (RHIWEA) from 1997 and the National Waste Management Program (NWMP) for the period 1999-2002, approved by the Council of Ministers in 1999. The host country expert indicated that the above mentioned law is in accordance with the EC Waste framework directive (75/442/EEC) requirements. The RHIWEA establishes the legal basis for issuing various supporting regulations, such as Regulation No 12 on the requirements which must be met by the waste treatment facility sites and Regulation No 13 on the conditions and requirements for the construction and operation of waste landfills. The NWMP envisages measures for the reduction of quantity of waste to be landfilled instead of prevention, recycling and recovery (composting and incineration). At the time of the review, the team gathered that no incinerators had been established, primarily because of the financial constraints but also because of strong public opposition to their siting, though feasibility studies for Sofia, Plovdiv, and other major sites had been completed. Under the NWMP 37 regional landfill sites are identified and the construction of landfills is to be carried out by the municipalities (the construction and/or rehabilitation of 19 landfills commenced in 1999). It was mentioned that the waste tax levied by municipalities does not cover the waste disposal costs. Additionally the host officials indicated that there had been a decline in the quantity of waste entering the landfills which they attributed to the overall country situation and also due to a change in the national statistical methods.

IV. PROJECTIONS AND THE EFFECTS OF POLICIES AND MEASURES

47. With respect to projections, some progress in the methodological approach can be observed compared to the NC1. Although the review team suggested some further improvements, the NC2 broadly complied with the UNFCCC guidelines. The team recommended that future projections of emissions should incorporate the effects of individual measures to the extent possible. Additionally, sensitivity analysis and a discussion of the strengths and weaknesses of the model used should be included. The team further suggested that for each of the projection scenarios the assumptions used should be listed, including an

identification of those individual policies and measures to be implemented. It should be clear which of the policies and measures are implemented and included in the baseline scenario, and which are additionally considered in other projection scenarios. The team suggested that interaction among individual measures must be accounted for while estimating the total impacts. In the interest of consistency, it would be useful if, subsequent to the recalculation of the entire data series according to a single methodology, the base year emissions were recalculated. The team also suggested that the reference year for the emission projections (1995 in the NC2) be accurately adjusted to correspond to the actual inventory of emissions.

48. The NC2 includes four scenarios of projected CO_2, CH_4 and N_2O emissions and CO_2 removals, presented at five-year intervals for the period 1995 to 2020. The reported data are presented sectorally and broadly correspond to the IPCC inventory categories: (i) energy (fuel combustion and fugitive emissions from fuels), (ii) industrial processes, (iii) solvent and other product use, (iv) agriculture, (v) land-use change and forestry, (vi) waste and (vii) international transit road transport. International bunker fuels are reported separately. For all the four scenarios, the projections of CO_2, CH_4 and N_2O emissions are presented in mass units (Gg) and the results of baseline and mitigation scenario emissions are also presented as CO_2 equivalents. The team noted that the lack of statistical data on GHGs such as PFCs, HFCs and SF_6 led to their exclusion from this section. In the case of the precursors CO, NO_x, and NMVOCs there were estimates available but they had not been included in this section. It is expected that the availability of statistical methodology to register the sources of these gases will enable future estimates of these trends to be made after 2000-2001.

49. The four emission projection scenarios comprised a baseline scenario, an energy supply scenario, an energy efficiency scenario, and a mitigation scenario. All four relied on a single scenario of future GDP growth till 2020 prepared by the Institute of Economics of the Bulgarian Academy of Sciences, using their own macroeconomic model, and sectoral projections of responsible ministries and other institutions. The host country informed the team that the decision to use a single scenario of future GDP growth was taken on the recommendation of the central bank experts, which argued that the establishment of the currency board would not allow for a path of economic development other than the planned one.

50. Based on the single GDP forecast, two scenarios of future final energy demand were constructed by the Institute of Nuclear Research and Nuclear Energy, of the Bulgarian Academy of Sciences. For each of the final energy demand projection scenarios, two primary energy demand scenarios were developed, using the Energy and Power Evaluation Programme (ENPEP) model. The use of an optimization MARKAL model was assessed during the first communication, though preference was given to the former because it allowed for additional adjustments of the calculated scheduling plans for calling the plants into operation. After the projected operating schedules for power plants were developed, the projections of the primary energy balance were calculated using the BALANCE module of ENPEP. Finally the emission projections were calculated with the help of the IMPACT module of ENPEP.

51. The mitigation measures considered included a comprehensive list of measures in the energy supply. A list of energy efficiency measures in energy end-use sectors (industry, household, services, lighting and transportation), and measures to promote renewable energy were taken from the National Energy Efficiency Programme. The measures evaluated were almost exclusively investment projects. In light of the fact that the NC2 was partially based on the NEEP, the team was informed about that it is intended to be a 12-year programme with a total investment of US$ 2.35 billion in energy efficiency projects (compared to the US$ 3 billion needed for investment in the supply side if the energy efficiency programme is not implemented) and an additional US$ 686 million for the promotion of renewable energy. The average payback period of all measures is reported to be 2.5 to 3 years. The National Energy Efficiency Agency, author of the Programme, expects that implementation of the NEEP will lead to (a) savings of 3,941 kilotonnes of oil equivalent per year and 5,446 MWh per year till 2010, (b) the avoidance of construction or availability of shutdown of 2,345 MW of electricity capacity, (c) the reduction of national energy intensity by a factor of 2 and (d) reduction of GHG emissions by 10.4 per cent for the forecast final energy demand by 2010. However the host country expressed certain reservations regarding the practical feasibility of the NEEP, and also indicated that it had not been approved and that the State Agency on Energy Efficiency was in the process of developing a revised Energy Efficiency Programme.

52. The emission scenarios lacked a list of concrete measures and their individual impacts. Instead, the impacts of all measures were evaluated together as a single package, and each of the scenarios assumed a different penetration rate of the package (see table 6). The officials noted that no analysis of policies had been carried out or incorporated in the NC2 emission projections. The four scenarios are described below.

Table 6. Assumptions on penetration of mitigation measures in different scenarios

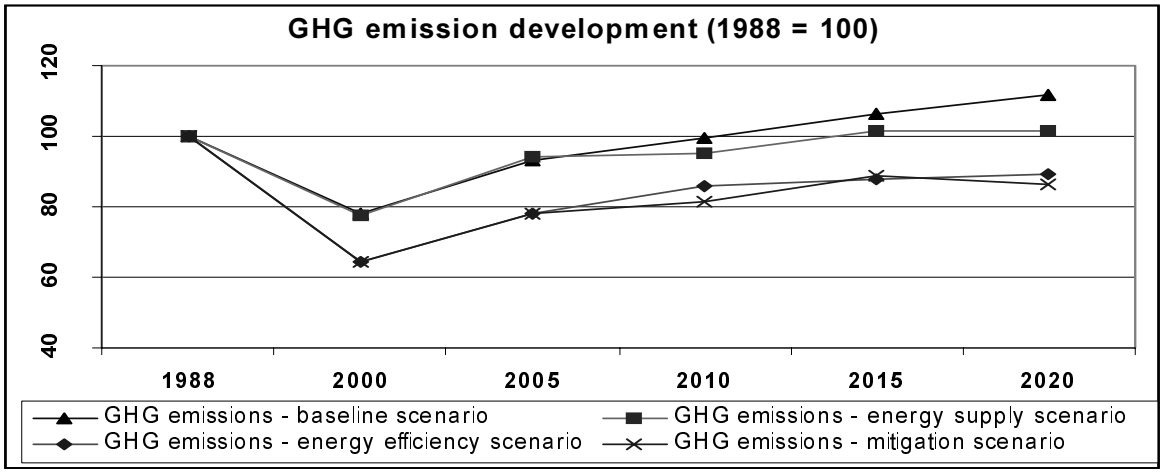
	Penetration rate of the package of demand side mitigation measures from NEEP	Supply side measures included
Baseline scenario	40-50 per cent	No
Energy Supply scenario	40-50 per cent	Yes (80-90 per cent)
Energy Efficiency scenario	80-90 per cent	No
Mitigation scenario	80-90 per cent	Yes (80-90 per cent)

53. The baseline and energy supply scenarios correspond to the higher final energy demand projection, whereas the energy efficiency and mitigation scenarios are based on a lower final energy demand forecast. The baseline scenario assumes a lower penetration rate (40-50 per cent) of the whole investment package of energy efficiency and renewable measures. The scenario does not include mitigation measures on the supply side such as decrease of coal consumption and increase of nuclear energy. The scenario is based on a higher final energy demand forecast. In the energy supply scenario also, a lower penetration rate (40-50 per cent) of the whole package of energy demand measures is assumed. The scenario considers mitigation measures on the supply side as well and is based on a higher final energy demand forecast. The energy efficiency scenario envisages the highest penetration rate (80-90 per cent) of the whole package of

measures. The scenario does not include the mitigation measures on the supply side. The scenario is based on a lower final energy demand forecast. In the case of the mitigation scenario, the team noted that it also assumed the highest penetration rate of 80-90 per cent of the investment package of energy efficiency and renewable energy measures and therefore was based on a lower final energy demand forecast. The scenario also considers supply-side mitigation measures such as decrease of coal consumption and increase of nuclear energy.

54. The GHG emission projections (NC2, figure III) show that the target to stabilize emissions by the year 2000 at a level not exceeding the 1988 level, will be met in each of the four scenarios. As regards the Kyoto Protocol target to reduce emissions by 8 per cent by the period 2008-2012 compared to the 1988 levels, it is met in the energy efficiency and mitigation scenarios but not in the baseline and energy supply scenarios. The calculated projections show that the growth of CO_2 emissions is lower, or decrease higher, than that of all three GHGs together. The CO_2 emission projections thus meet the 2008-2012 target not only in the energy efficiency and mitigation scenarios but also in the energy supply scenario and perhaps also the baseline scenario (which remains unclear because emissions in 2012 are not evaluated). The figure III shows projections of net GHG emissions including CO_2, CH_4, and N_2O in CO_2 equivalent, for all four scenarios.

Figure III. Scenarios of GHG emission projections (1988=100 per cent)



Note: The x-axis shows years are not on the same scale between 1988 and 2000.

55. In 2000, the projected emissions of both CO_2 only and the three GHGs together, evaluated in Gg of CO_2 equivalent, are expected to be far below the levels of the 1988 baseline. The net emissions of the three GHGs (in Gg of CO_2 equivalent) are projected to decrease compared to the 1988 levels by 23 per cent in the baseline and energy supply scenarios, and by 36 per cent in the energy efficiency and mitigation scenarios. In 2020, the net emissions of CO_2, CH_4, and N_2O, expressed in Gg of CO_2 equivalent, are projected to increase compared to the 1988 levels by 12 per cent in the baseline scenario, to increase by 1.7 per cent in the energy supply scenario, to decrease by 11 per cent in the energy efficiency scenario, and to decrease by 14 per cent in the mitigation scenario. The CO_2 emissions are projected to be below the 1988

level in all scenarios during the whole projection period till 2020. These values of net GHG emissions in Gg of CO_2 equivalent (CO_2 emissions and removals and CH_4 and N_2O emissions) were calculated by the team based on the primary inventory data contained in the NC2.

56. The team noted that several policies that could have a key impact on GHG emissions had been developed and were implemented to a limited extent. Among such measures could be included the removal of energy price subsidies, which has already commenced, and privatization and energy market liberalization within the national energy strategy already approved by the parliament in April 1999. The Energy and Energy Efficiency Law has also been approved by the parliament. However, the effects of these policies have not been evaluated on an individual bases but within the whole package in the GHG projections due to the country's lack of an evaluation methodology.

57. As mentioned earlier, the team noted that expert estimations were made for the penetration rate of the components of the NEEP being used for each scenario, including supply side measures such as different mixes of coal and nuclear based power plants. Thus, the team found it difficult to identify which concrete measures and associated effects were considered in any single scenario. Only the total effect of the whole package of measures could be identified from the scenario projections.

58. The NC2 emission projections are associated with very significant uncertainties that would have been difficult to incorporate into the projections. This relates to the recent as well as current and future economic development of Bulgaria. After the serious economic crisis and establishment of the currency board in 1997, the Government adopted strict budgetary constraints and ambitious privatization and deregulation plans, including plans to liberalize the energy industry, introduce competition into the electricity and gas industries, and remove energy price subsidies. However, due to time constraints, these plans were not incorporated into the energy and emissions projections of the NC2. These economic transformation measures, which are partially implemented, are expected to significantly speed up restructuring of the national economy, and thus decrease energy consumption. Evidence of economic restructuring and a decrease in energy intensity (and consequent decrease in GHG emissions) was reported to the team for 1998. In 1998, GDP grew by 3.5 per cent while electricity consumption of industry decreased by around 11 per cent.

59. Another major uncertainty to which the hosts repeatedly drew attention was the anticipated negative impact of the Kosovo crisis on the Bulgarian economy. According to the hosts, the crisis has greatly reduced Bulgaria's export capability, primarily to the Central European and EC countries, due to the impossibility of using the Danube river for transportation. The crisis and the embargo on Yugoslavia also drastically reduced traditional trade within the Balkan region. During the review, the country experts presented opinions which suggested that, because of both the Government's economic reform plans and the Kosovo crisis, the energy demand and related emissions might not reach the levels originally forecast. The actual level of future emissions might therefore be lower than projected. No sensitivity analysis of emission projections which considered the above-mentioned uncertainties or others was performed.

60. The base line emission projections in both the NC1 and the NC2 were based on the actual situation in the country, including traditional state-owned monopolistic structure of the power industry and the current structure of the economy, with a significant share of energy-intensive industry, with some planned restructuring of the energy sector and privatization. These projections included only market penetration of energy efficiency without any special government support or policy. The transformation policies that are currently under implementation are expected to reduce future GHG emissions substantially. This was already partially demonstrated when the new Government, subsequent to the 1997 economic crisis, accelerated the privatization of the economy and removal of energy price subsidies. However, weighty uncertainties surround the successful implementation of these policies and the path of future economic development. The traditional mitigation measures, such as improved energy efficiency and renewable energy measures and financial support schemes, will also have an impact on the future GHG emissions. However, their impact compared to the transformation policies in economies in transition in the short term may be considered much less significant. The relatively lower impact of traditional mitigation measures also reflects the existing lack of finance available for large-scale investment in energy efficiency and renewable energy.

V. ACTIVITIES IMPLEMENTED JOINTLY

61. Bulgaria views activities implemented jointly (AIJ) and joint implementation (JI) as cost-effective mechanisms for mitigating GHG emissions. 1998 marked the start of a United Nations Development Programme (UNDP) project on capacity-building and assessment of the country's JI potential, which is due for completion in 1999. The project preparation unit set up under this project by the Ministry of the Environment and Waters is responsible for the identification, assessment and implementation of GHG mitigation projects. The project proposals under consideration are in the areas of district heating, the food industry and light industry. The expected outputs of the UNDP project include a data bank on such mitigation projects, capacity-building and the conduct of a workshop for information dissemination. Subsequent to the submission of the NC2, Bulgaria initiated its first JI project with the Netherlands (including a credit-sharing agreement). The project, for which a feasibility study has been completed, is located in Pleven city and involves the improvement of combustion of energy sources and automation of boilers in the district heating plants. The project is now in its second phase, with the installation of the equipment scheduled for mid-2000. The Ministry has also prepared 19 JI project proposals, which have been sent to France, Italy, Japan and the Netherlands; the hosts expected that three or four projects would be accepted in 1999. Japan and Bulgaria have signed a letter of intent but credit shares remain undefined. Eight of the identified enterprises were scheduled to have energy audits, which were to be funded by the Japanese Energy Conservation Center by May 1999.

VI. RESEARCH AND SYSTEMATIC OBSERVATION

62. Bulgarian climate research has grown substantially in recent years. Presently, it is conducted at more than 20 institutions and is coordinated by the National Coordination Centre on

Global Change of the Bulgarian Academy of Sciences. In addition to that academy, the institutions involved include the Forest Research Institute, the Nuclear Research and Nuclear Energy Institute, the Institute of Economics, the National Institute of Meteorology and Hydrology, the Agricultural Academy and Energoproekt. This also includes research undertaken as part of international projects. More recently, the NCAP has given priority research status to the regional impacts of climate change, vulnerability and adaptation of Bulgarian agriculture to climate change, vulnerability and adaptation of forests to climate change and sea level rise in the Black, Caspian and Mediterranean seas.

VII. EDUCATION, TRAINING AND PUBLIC AWARENESS

63. Since 1997, environmental studies have been integrated into the curricula of both secondary schools and technical universities. The hosts discussed the role of the regional energy centres and the media in informing the local governments. One such initiative mentioned was the Municipal Energy Efficiency Network involving 23 municipalities, set up in 1997, of which the NGO Centre for Energy Efficiency, EnEffect functioned as the secretariat. The network, which was initially funded by the United States Agency for International Development, is now funded under the Global Environment Facility and the UNDP project on “Energy Efficiency Strategy to Mitigate GHG emissions”. The network not only facilitates energy management and planning at the municipality level but also produces a bulletin containing up-to-date information on efficient energy use, renewable energy sources and environmental protection. The network has also developed a trainer training programme on energy management and planning and completed training courses for the network on energy efficiency, municipal energy planning, the law on energy efficiency and other subjects.

VIII. CONCLUSIONS

64. Bulgaria used the 1995 IPCC Guidelines in the preparation of its national GHG inventory, except in calculating its 1997 estimates. Some of the deviations from the IPCC Guidelines such as the inclusion of emissions from international bunker fuels in national totals (except in 1995 and 1997) did not allow for an easy comparison between years without adjustments. The current inventory in the NC2, which is considerably revised and improved in comparison to the NC1, would be further strengthened by the inclusion of recalculation estimates for previous years incorporating corrections for earlier deviations from the Guidelines. As regards actual emissions, the general trend has been downward since 1988, with the overall GHG emissions in 1997 being 62.1 per cent of the emissions in 1988. The team recognized the concern of the host officials regarding the financial support available for preparation of national communications and in particular national GHG inventories.

65. An extensive description of planned and implemented measures directed primarily at the energy and transformation sector and energy intensive end-use sectors is contained in the NC2. Detailed technological mitigation measures by gas and sector were also indicated, in adherence to the UNFCCC guidelines. The country had some difficulty in estimating the effects of individual policies and measures. Information provided during the review on the status of

implementation of the policies and measures included in the NC2 revealed that most measures were still at various stages of planning, with actual implementation being limited.

66. The most significant impact on GHG emissions is likely to come from the ongoing transformation of the energy industry, including the complete removal of subsidies and restructuring and privatization of the state-owned power monopoly. The 1999 Energy and Energy Efficiency Law is likely to strengthen this move forward. The country's continued reliance on indigenous coal-based power generation is expected to exert a significant influence on emissions, coal consumption in 2005 being estimated at 72 per cent above the current level. The post-2000 rehabilitation programmes for major thermal power plants primarily using domestic coal are expected to depend largely on the availability of private investment. Efforts to conserve energy in the industrial sector, the dominant energy consumer, are being made via the energy audits and attempts at improvement of production processes by the State Agency of Energy Efficiency and other Energy Efficiency Centres, supported by external funds. The residential sector, despite a decline in power consumption, shows vast potential for improvement in electricity and district heat distribution and use. Initiatives such as the demonstration project "Energy Efficiency Demonstration Zone in the City of Gabrovo", and the Municipal Energy Efficiency Network are noteworthy in facilitating capacity-building, energy management and planning at the municipality level.

67. The emission projections showed improvement over the earlier communication and broadly followed the UNFCCC guidelines. The projection exercise evaluated a series of measures primarily limited to the National Energy Efficiency Programme as a package, with individual scenarios assuming different rates of penetration of the package. Though the projection exercise involves considerable uncertainties due to the impossibility of incorporating most recent developments (which was difficult to do because of the timing of preparation of the NC2), all the projection scenarios indicate that the country's emissions in 2000 will probably not exceed the 1988 level.

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