



UNITED
NATIONS



Framework Convention
on Climate Change

Distr.
RESTRICTED

FCCC/IDR.2/POL

14 February 2001
ENGLISH ONLY

POLAND

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

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Poland ratified the UNFCCC on 26 October 1994. Its first national communication (NC1) was submitted to the secretariat on 2 February 1995 and the second national communication (NC2) on 29 April 1998. The in-depth review of the NC2 was conducted between October 1999 and September 2000 and included a visit to Warsaw from 27 September to 1 October 1999. The team comprised Mr. Bubu Jallow (Gambia), Mr. John Fitzgerald (Ireland), Mr. Slav Slavov (United Nations Economic Commission for Europe) and Ms June Budhooram (UNFCCC secretariat, coordinator). The in-depth review was coordinated by the Ministry of Environmental Protection, Natural Resources and Forestry and involved discussions with government officials, members of the scientific community and key stakeholders in the business community and non-governmental organizations (NGOs). During the review a wealth of information was provided to the team, which greatly improved the understanding and comparability of information contained in the NC2.

2. Poland with an area of 312,685 sq km is situated on the North European Plain between the Baltic Sea and the Carpathian mountains. Poland's territory is divided into 16 large administrative units called voivodships. In 1995 the population exceeded 38 million, of whom more than 61 per cent lived in towns and cities. The climate is highly variable with continental and oceanic types and wide variations in temperature and precipitation. Mean temperatures vary from 15 °C in the summer to 0 °C in the winter. Agricultural land accounted for 59 per cent of the country's land area in 1996 (18 million hectares) with approximately one-third of the population making its livelihood from agriculture. Forests are mainly coniferous and cover about 28 per cent of the territory.

3. In 1989, Poland initiated a radical programme of policy reform in its transition from a centrally planned economy to a free market economy. The main goal of this structural and economic change was to stabilize the country's economy, while introducing a number of structural and institutional reforms, including the acceleration of economic development, liberalization of prices, trade reform, privatization of state-owned enterprises, reduction of the social costs of reform, improvement of the quality of life, protection of the environment and improvement of Poland's international competitiveness. Other measures included the commercialization of interest and exchange rates, abolition of price subsidies and wage indexation, and encouragement of foreign investment.

4. The immediate result of the reform was a two-year recession from 1990 to 1991, followed by a period of gradual economic recovery during which Poland experienced its highest ever rate of growth of gross domestic product (GDP), of 7 per cent annually, accompanied by a further drop in energy consumption and unemployment. After ten years of reform, positive changes in most economic sectors can be observed. The most important change has been the privatization of public sector production and the development of small private enterprises. The change in ownership patterns has also resulted in stronger national financial markets, and higher revenues of the central budget gained as a result of higher economic efficiency in private enterprises.

In 1996 as much as 52 per cent of the gross domestic product was generated by the private sector and 34 per cent by the state-owned sector.

5. Since 1992, GDP has been growing. Between 1988 and 1991 it fell by 14 per cent after which time it grew by 7 per cent annually, representing a growth of 20 per cent between 1994 and 1995. Over this period the share of the industrial sector in GDP declined while that of services increased. Industry nevertheless contributed about 40 per cent to overall GDP in 1996 and is therefore a key determinant of the pace of economic growth. It also places Poland among the most heavily industrialized countries in the Organisation for Economic Co-operation and Development (OECD). Since 1991 there has been real growth in power generation, agriculture and metal and machinery production.

6. The Polish economy is highly carbon intensive. Its principal mineral asset is bituminous coal, most of the output being derived from the rich Upper Silesian coalfield. Brown coal is mined as well. Poland is also relatively well endowed with other natural resources, including small amounts of petroleum and moderately large deposits of natural gas. Natural gas and petroleum reserves expanded with new gas discoveries in the 1980s and early 1990s. Sulphur is Poland's second most important mineral, and Poland ranks among the world leaders in both reserves and production of this resource. Other major deposits of industrially useful minerals include lead, sodium and zinc. Poland is also a major world producer of copper and silver.

7. Coal is the principal primary fuel in energy production and its domination in the energy balance is likely to continue in the near future. It was used to generate around 70 per cent of electric power and 73 per cent of total energy in 1995. Imported and domestic petroleum and natural gas also play an important part in Poland's energy balance, as the Government's aim is to replace coal by gas in small production plants and domestic boilers. Currently only about 15 per cent of the hydroelectric potential is used, while 3 per cent of energy demand is met by renewables including hydroelectric power. At the time of the review, a major reorganization was planned by the Government for the energy sector in terms of fuel switching and efficiency improvements.

8. Poland became a member of the OECD in 1996. It is also undergoing a preparatory process for accession to the European Community (EC) by bringing much of its existing legislation into line with the EC regulations, in particular its environmental legislation. It is noteworthy that the restructuring of the economy and, more recently, the preparations for EC membership have put in place the necessary framework for developing energy and environmental policy over the next decade.

9. The Ministry of Environmental Protection, Natural Resources and Forestry is responsible for climate change issues since November 1999. While there have been serious concerns about air pollution for many years, climate change is a relatively new issue in Poland. In 1991, the parliament approved the State Environmental Policy. In this context, a goal to achieve stabilization of carbon dioxide (CO₂) emissions at 1988 levels by 2000 was set, but was predicated on the progress of the Polish economy. The target applies to gross anthropogenic CO₂

emissions; carbon sequestration by sinks is taken into account for example and no sectoral targets were set. It now appears that Poland will probably easily meet and surpass this target.

10. At the time of the review, several regulations were planned to strengthen efforts to mitigate greenhouse gas (GHG) emissions. These included a draft Environmental Protection Act prepared by the Ministry of Environmental Protection, Natural Resources and Forestry. Officials are also in the process of preparing a legislative framework relevant to global climate change, which incorporates provisions ensuring Poland's compliance with international commitments made under the UNFCCC. External consultations on the draft framework among interested institutions were planned for the first quarter of 2000. A revised document will be formulated on the basis of these discussions and later presented to the Council of Ministers. Transfer of the final draft of the legal framework to the parliament is expected for the third quarter of 2000, thereby beginning the process of parliamentary approval.

11. A steering team was established in 1999 for climate change activities under the UNFCCC, consisting of representatives of key government agencies, to provide advice to the Minister for Environmental Protection, Natural Resources and Forestry (now Minister of the Environment). The Polish UNFCCC Executive Bureau was also established in July 1999 within the National Fund for Environmental Protection and Water Management, with the mandate to oversee activities aimed at meeting the country's commitments under the UNFCCC.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

12. The NC2 contains inventory data for emissions of the direct GHGs, carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), for the years 1988, 1990, 1992 and 1994. Data for CO₂ removals were also included in the NC2. During the review visit, additional inventory data were provided for 1996 and 1997 and these are included in this report. Data for the perfluorinated hydrocarbons (PFCs), hydrofluorocarbons (HFC_s) and sulphur hexafluoride (SF₆) were not presented in the NC2, as estimates were reported as being very preliminary at this stage. Experts explained that, due to discrepancies between estimates developed by different centres for the indirect GHGs such as nitrogen oxides (NO_x), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOCs), these were not included in the NC2 but were also provided during the review week. Inventories were reported using the Intergovernmental Panel on Climate Change (IPCC) draft Guidelines for National Greenhouse Gas Inventories 1995. Inventory data were not adjusted for temperature or any other variable.

13. Poland adopted 1988 as the base year for determining its commitments under the UNFCCC and was only able to prepare GHG inventories in two-year cycles. Inventories are prepared by the Ministry of Environmental Protection, Natural Resources and Forestry, in collaboration with experts from the Institute of Environment Protection (IOS), the Polish Foundation for Energy Efficiency (FEWE), the Institute for Ecology of Industrial Areas (IETU), among others. The activity data are taken mainly from official data compiled by the Central Statistical Office, publications on energy statistics and other official sectoral yearbooks published by various government departments. The Ministry of Transportation and Marine Management provided information for the transport sector. With the change from a centrally planned to a

more decentralized economy, the system of compiling statistics is undergoing significant modifications in order to bring it into line with common practice and as an essential prerequisite for the integration of Poland into the EC. In this regard, the review team was informed that a National Centre for Inventory emissions will be established in the near future (established in June 2000), and would serve as a unified data collection centre, using a common methodology and identifying a single data source for each type of activity data.

14. The NC2 presented a list of emission factors for the emission estimates of three major GHGs and all source and sink categories for all years covered. In general, most emission factors used for preparing the inventories were taken from the Country Case Study on Sources and Sinks of Greenhouse Gases in Poland. Emission factors for emissions and sinks in forests were estimated by the Forest Research Institute. In some instances corrections were made to the emission factors contained in the Country Case Study on the basis of the IPCC and CORINAIR publications. Research institutes in Poland are currently working on the preparation of national emission factors for agriculture and soils.

15. Although information on the uncertainty associated with GHG estimates was not included in the NC2, officials explained the quality of emission estimates in terms of high, medium and low confidence levels, in line with the IPCC Guidelines. CO₂ estimates for energy-related activities are regarded as of high quality. CH₄ estimates are all given a medium rating and N₂O emission data from all categories are rated low.

16. Using the most recent information presented by inventory officials (see table 1), total emissions of all major GHGs fell considerably between 1988 and 1997. CO₂ emissions fell by 24 per cent, methane emissions by 27 per cent and N₂O emissions by 23 per cent. The severe economic recession, restructuring and modernization of many inefficient plants and reduction in the use of coal in heavy industries explain these trends.

Table 1. Total greenhouse gas emissions, 1988-1997 (Gg)

	1988	1990	1992	1994	1996	1997
CO ₂	477 584	381 482	372 311	372 293	373 202	362 300
CH ₄	3 141	2 801	2 474	2 467	2 252	2 279
N ₂ O	70	63	50	50	54	54

A. Carbon dioxide

17. It can be seen from table 1 that total anthropogenic emissions of CO₂ declined significantly from 1988 levels of 477,584 Gg to 362,300 Gg in 1997, a decrease of 24 per cent. Of total CO₂ emissions in 1997, the energy and transformation sector accounted for 55 per cent, the transport sector 8 per cent, the industrial sector 20 per cent and the residential, commercial and institutional sectors collectively 17 per cent, while in 1988 these categories accounted for 56 per cent, 6 per cent, 14 per cent and 24 per cent respectively.

18. CO₂ emissions from the energy and transformation sector plunged by 26 per cent between 1988 and 1997, owing to the closure of many coal-fired power and heating installations, some of which were switched to natural gas. Officials noted many difficulties in the disaggregation of transport fuel data. CO₂ emissions from international marine and aviation bunkers were excluded from transport. Since economic reform began, about 500,000 new cars have been sold annually, more than doubling car sales over the past ten years. However, while CO₂ emissions from transport increased between 1988 and 1992 they have been declining since, primarily because of the closure of several railway lines which consumed coal and whose profitability decreased with the opening of the Polish economy and sharpening of competition. Emissions from the residential sector and industrial processes fell by 35 per cent between 1988 and 1992, as a result of a fuel shift from coal to natural gas in industries such as iron and steel, chemicals, and non-ferrous metals, as well as in small heat boilers in homes. The Government has also introduced efficiency standards for equipment in households and this measure has contributed to reducing household emissions. With the economic recession between 1988 and 1992, CO₂ emissions from both sectors have risen steadily as industrial output has almost doubled in the past 10 years and energy consumption in households increased.

Table 2. Carbon dioxide emissions and removals, by sector, 1988-1997 (Gg)

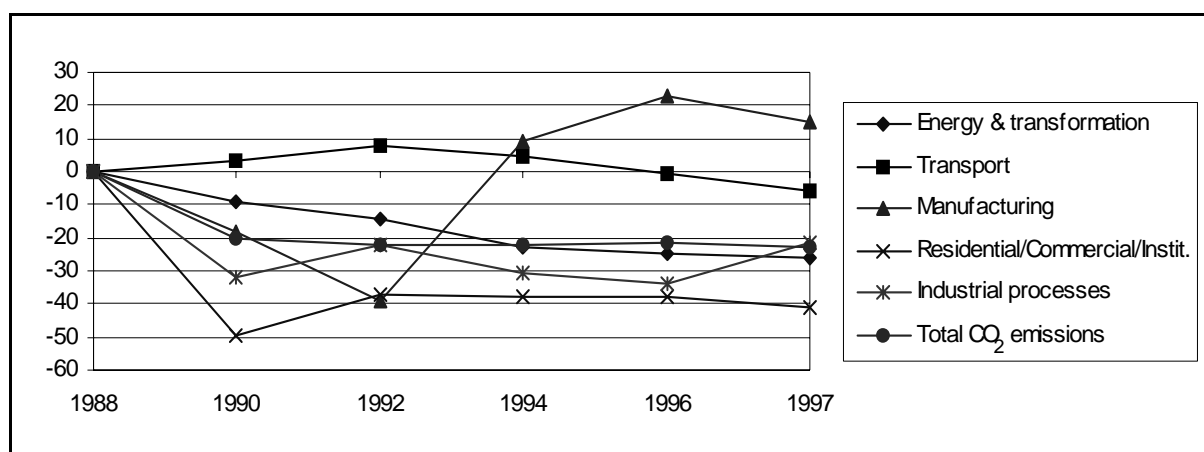
	1988	1990	1992	1994	1996	1997
Energy and transformation	260 537	236 582	223 009	200 331	195 987	192 784
Transport	28 238	29 103	30 475	29 533	28 098	26 662
Manufacturing	60 900	49 820	37 259	66 282	74 682	70 024
Residential/commercial/institutional	103 168	51 881	64 951	64 151	64 106	60 857
Industrial processes	13 574	9 212	10 603	9 422	8 938	10 664
Agriculture	8 061	3 868	5 233	n.e	n.e	n.e
Other	2 147	231	61	1 869	719	635
Total	476 625	380 697	371 591	371 588	372 530	361 626
Land-use change and forestry	35 705	45 448	41 535	42 658	43 288	41 195
Land-use change and forestry	959	785	720	705	672	674

19. The Annual Forestry Statistical Report estimated forest area in Poland at 8.8 million hectares in 1999, accounting for 28.2 per cent of its total land, and representing an increase of 0.4 per cent since 1990 as a result of the adoption of an Environmental Estate Programme. The proportion of forests reportedly being on the increase, CO₂ removals by sinks increased from 35,705 Gg in 1988 to 41,195 Gg in 1997, an increase of 13 per cent. Experts explained that, due to the historic importance of forests and forest management, there are good basic data from the forest inventory. The stock volume of forest stands has increased over the past 20 years with the extension of areas under protection and prolongation of the rotation period.

20. Emissions of CO₂ resulted from deforestation, which itself was the result of urbanization, industrial use of wood, and logging operations. Polish forests are exposed to serious threats from air pollution, fires, climatic change and attacks from parasites and disease, and experts pointed out that these factors affect tree vitality and ultimately sink capacity. While there is a high

logging rate of 0.53 cubic metres per year, the annual harvest of 22 million cubic metres is currently only about 50 per cent of the annual growth increment of 4.6 cubic metres per hectare. The rate of deforestation, including logging, is also low at 500 hectares per year and Polish officials considered this rate negligible compared to the rate of afforestation.

Figure I. Carbon dioxide emissions, percentage change from 1988, by major source



B. Methane

21. CH₄ emissions accounted for about 11 per cent of total direct GHG emissions in 1997. Many of the CH₄ emission estimates are based on national emission factors. Fugitive emissions, mainly from coal mining and gas production, were responsible for 36 per cent of the total, landfill waste 35 per cent, and enteric fermentation (livestock) 24 per cent in 1994. Manure management and industrial processes also contribute to emissions but the significance of these sources, which accounted for 2.4 per cent of total CH₄ emissions in 1990, declined with the reduction in livestock numbers and lower gas consumption by 1997.

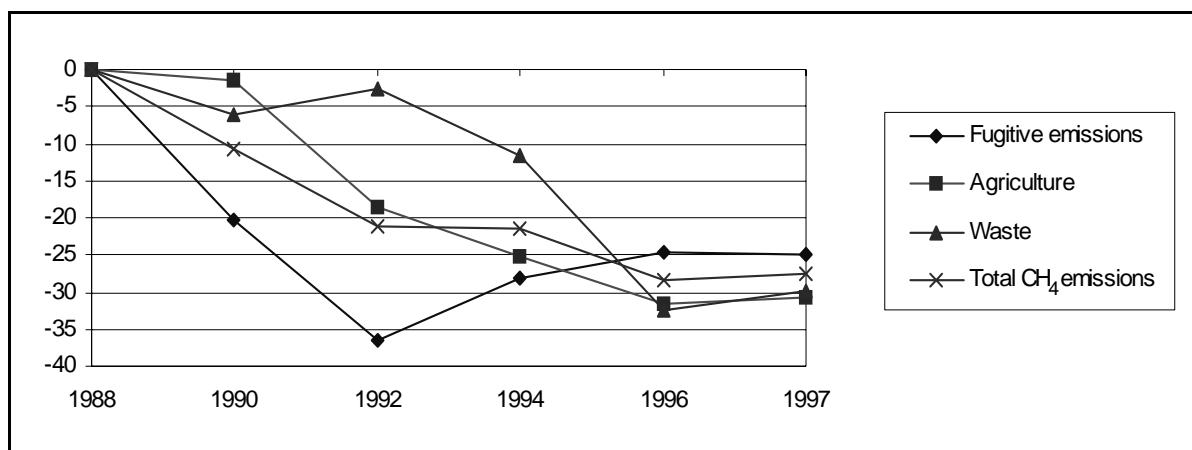
Table 3. Methane emissions, by sector, 1988-1997(Gg)

	1988	1990	1992	1994	1996	1997
Fugitive emissions	1 248	994	793	896	942	937
Agriculture	863	850	704	646	591	598
Waste	966	907	941	855	652	677
Other	64	50	36	70	67	66
Total	3 141	2 801	2 474	2 467	2 252	2 278

22. It can be observed in table 3 and figure II, that total CH₄ emissions fell by 27 per cent between 1988 and 1997, and underlying this, emissions in all main sectors declined. Fugitive emissions decreased by 25 per cent in this period, owing to the closure of many coal mines and improvement of the gas recovery systems in mines still operating. Coal output fell from 145 million tonnes in 1990 to 116 million tons in 1998. Officials expect that fugitive emissions from mines will decrease in the future, as all new mines must be hermetically sealed to prevent

gas leakage. Poland calculates a specific emission factor annually for its coal operation, which is around 20 per cent lower than the IPCC default value for fugitive emissions from coal extraction. This factor is expected to be revised as new research is conducted.

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



23. The reduction in CH₄ emissions from agriculture is primarily attributable to economic reform policies in the sector. According to official statistics, over the period 1988 to 1997, the number of cattle fell from 10.3 million to 7.3 million, that of sheep from 4.4 million to 713,000 and that of pigs from 19.6 million to 18.7 million.

24. Data on waste volumes are not very reliable since there was no official, regular reporting system for municipal waste in place prior to 1995. Available data on waste quantities are primarily based on field surveys and per capita generation of waste on a city-by-city basis. Furthermore, landfill capacities are usually difficult to estimate as most of the older sites, which are small, do not have proper design. Also, they do not incorporate gas collection facilities. In spite of these constraints, officials have reported a decline in the production of CH₄ from managed waste, which represents approximately 54 per cent of all landfill waste. A national emission factor was used for estimating emissions from waste.

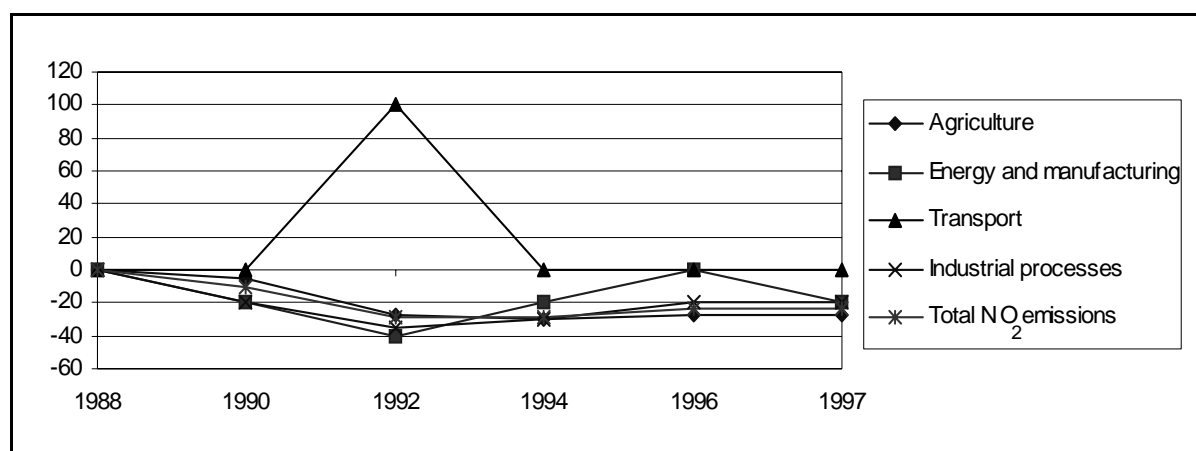
C. Nitrous oxide

25. In 1997, approximately 4 per cent of total GHG emissions were accounted for by N₂O, as shown in table 4. Of total N₂O emissions in 1997, agriculture accounted for about 57 per cent, followed by industrial processes 30 per cent, and energy use 13 per cent. Transport accounted for only 2.6 per cent of total emissions, a percentage which increased marginally between 1988 and 1997 owing to the use of catalytic converters in all new cars. A combination of IPCC default and national emission factors was used to estimate emissions.

Table 4. Nitrous oxide emissions, by sector, 1988-1997 (Gg)

	1988	1990	1992	1994	1996	1997
Agriculture	43.0	41.0	31.0	30.0	31.0	31.0
Energy and manufacturing	5.0	4.0	3.0	4.0	5.0	4.0
Transport	1.0	1.0	2.0	1.0	1.0	1.0
Industrial processes	20.0	16.0	13.0	14.0	16.0	16.0
Other	1.0	1.0	1.0	1.0	1.0	2.0
Total	70.0	63.0	50.0	50.0	54.0	54.0

26. Officials noted that most N₂O emissions in the agricultural sector originate in soils as a result of fertilizer application. Fertilizer use declined from 82 kg per hectare in 1988 to 50 kg per hectare in 1997, which is reflected in the sectoral N₂O emission trends shown in figure III. The underlying reason for this is the ongoing change in farming practices. As a result of a change of process in the production of many chemicals such as nitric acid, ammonia and calcium carbide, N₂O emissions from industrial processes experienced a 20 per cent decline between 1988 and 1997. Agricultural crop production also dropped considerably as State budget subsidies were withdrawn and product prices increased.

Figure III. Nitrous oxide emissions, percentage change from 1988, by major source

D. New gases

27. The NC2 did not report on emissions of the new gases. There is no production of the new gases in Poland, so emission estimates, though preliminary, are based on import data. During the review, officials explained that the import level of these gases is relatively low. They are also having considerable difficulty in collecting information on the new gases from either import statistics or consumption data prior to 1995. There are plans to conduct industry surveys to determine emission levels of these gases for 1995. Officials explained that data collected for 1995 indicate that new cars equipped with air-conditioning systems are likely sources of HFCs while SF₆ may be present in electricity switchgear. While there are no records of SF₆ emissions, there are modest emissions of PFCs and a small amount of HFCs. Data presented for 1997

suggest that actual and potential emissions of HFCs were 0.148 Gg and 0.453 Gg respectively. These gases are contained in imported products such as car air-conditioners and refrigeration systems. Actual and potential estimates of PFCs were calculated at 0.001Gg and 0.120 Gg respectively.

III. POLICIES AND MEASURES

28. Since the preparation of the NC1, considerable effort has gone into policy development. Outlined in the NC2 are the policies, measures and mitigation benefits as they relate to new legislation, and projects being implemented and co-financed by government agencies and local and regional authorities specifically for reducing GHG emissions on a sector-by-sector and gas-by-gas basis. Policies and measures aimed at reducing HFC, PFC and SF₆ emissions were not included in the NC2, given that information on the new gases was not available before 1995. It should be noted that while climate change has not been singled out as a priority area, several policies within the framework of economic reform are already having a significant impact in delivering a reduction in GHG emissions, especially in the energy sector.

29. While the guidelines for the preparation of national communications require that the impact of policy changes be evaluated, in reviewing policies and measures contained in the NC2, the review team felt that this must be seen in the context of the huge changes that are taking place in Poland. The restructuring of the economy is being driven by much wider objectives than the needs of climate change policy. In the case of the industrial sector, almost all the reduction in emissions has so far come from restructuring. As a result, the review team evaluated the wider policies in terms of their impact on GHG emissions, the changes in these emissions being a by-product rather than the primary objective of those policies. Officials explained that it was also difficult to quantify the costs of implementing specific policies and measures, given that the changes which have taken place are so closely tied to the wider process of transforming the economy. During the review week, additional information was supplied on the policies and measures pursued in the industrial, agricultural and forestry sectors.

30. Poland will clearly meet and surpass its target of stabilizing its CO₂ emissions at 1988 levels by 2000. Central to this reduction has been the programme of restructuring undertaken by successive Polish governments over the course of the 1990s. While this programme has been driven by a wider economic imperative, it has also resulted in major changes in the energy sector and in the economy. The restructuring of the industrial sector has resulted in the closure of many outdated plants, plants that were major energy consumers. In the electricity sector, the move to market prices and the wider restructuring has had major benefits in terms of improving efficiency. For households, the restructuring process included the gradual elimination of subsidies, such that energy prices paid by households have risen markedly to levels determined by market forces.

A. Energy and transformation

31. Having already changed much since 1989, the energy sector is still undergoing transformation oriented towards accession to the EC, in terms of price transparency, competition

and removal of the State support system. The Council of Ministers adopted on 17 September 1996 a document entitled "Demonopolization and Privatization of the Energy Sector". Later, on 5 December 1997, the Energy Act came into effect. This Act, whose main objective is to introduce a free economy for energy, defines the principles for the development of energy policies at the production, distribution and consumption levels, including heat and power supply. The Energy Regulation Agency was also established in 1997 to control and oversee these activities.

32. After 1989, the extraction of many raw materials including coal fell substantially. This was a direct effect of economic factors, particularly of the inability of the State to continue covering losses in the mining industry and the drop in the domestic demand for coal for electricity, and a drop in world demand for sulphur, which Poland exported in large amounts. Despite this, Poland retained its second place in Europe in terms of extraction levels for hard coal. Only domestic production of crude oil and natural gas grew.

33. The ongoing process of restructuring the Polish energy sector and, in particular, the coal industry, is aimed at increasing its competitiveness and reducing State subsidies. After 1990, annual coal production decreased from 145 million to 116 million tonnes by 1995. At the same time coal exports fell from 31 million to 27 million tonnes. Coal demand in Poland decreased from 102 million tonnes in 1997 to 87 million in 1998. Prior to the reform of the industry, the cost of wages together with overheads represented about 50 per cent of coal production costs. As a result, the number of employees was also cut from 243,000 in 1997 to 208,000 by the end of 1998. In 1996, the process of transforming state-owned coal companies into State Treasury partnership companies was completed. Several mandatory measures were introduced into coal mining in order to reduce its effects on the environment, including construction, enhancement and modernization of coal flotation plants, advanced methane emission recovery techniques, waste management at mine mouths. As a result of these new measures, 195.5 billion cubic metres of CH₄ were recovered in 1996, of which 143.8 billion cubic metres were reused. This volume represented an increase of 4.8 per cent over 1995 levels of CH₄ recovered.

34. In June 1998, the Government adopted the "Programme of reform of the hard-coal mining industry 1998-2002". The programme assumes an improvement in the economic efficiency of the sector by reducing excess capacity to a production potential of 122 million tonnes in 2002 and cutting back the workforce. Annual coal exports are expected to fall to about 20 million tonnes by 2002. During the 1998-2002 period, it is envisaged that 15 coal mines will be closed and nine merged in order to reduce the production potential. The expenditure of the State budget to finance the restructuring process will amount to PLN 7.2 billion. The Government expects that by 2002, coal companies will be able to generate a profit. Officials also noted that the reduction of coal production would not negatively influence the energy security of Poland, due to the growing degree of efficient utilization of energy sources and the increasing share of natural gas in the energy balance.

35. In the oil sector, and as part of the overall restructuring of the energy sector, the Polish refineries and the Oil Product Company (CPN) were merged into joint stock companies. In 1996 Polska Nafta (The Polish Oil Company) was established, with the merging of the two major

oil refineries, the Plock Petrochemia Inc. and the Gdansk Refinery Inc., as well as five other refineries in southern Poland. Less energy-intensive and less material-intensive technology has been introduced into the crude oil processing units of the refineries and as a result CO₂ emissions per unit of refinery output are expected to decline in the future. Although oil production has risen by 4 per cent since 1990, domestic crude oil production covers only 2 per cent of demand. Oil is imported from the Russian Federation and through Gdansk from the North Sea and Saudi Arabia. Oil supplies from the Russian Federation account for 50 per cent of total imports.

36. Locally produced gas, which includes high-methane natural gas, low-methane gas with a high nitrogen content and coke-oven gas, satisfies approximately 42 per cent of domestic demand. The remaining gas needs are predominantly supplied through gas pipelines from the Russian Federation and about 1000 million cubic metres annually from Germany via a pipeline near Zgorzelec. With the shift to natural gas, officials expect an expansion in the gas distribution network as well as increased imports of gas, and this may lead to increased CH₄ emissions.

37. In the case of the electricity and heat sector, the wider process of restructuring has also been crucial. The electricity sector has been privatized, with all the major generating stations already sold to the private sector. The electricity and the high-voltage transmission networks have also been restructured and are now owned by the State Treasury joint stock company. The order in which the different generating stations are chosen to supply the demand is not yet systematized and there is a need to design a regime which does not penalize plants which have invested in reducing sulphur emissions. Both fuel and electricity prices have been freed from regulation. An exception is the price of gas, which is still subject to regulation. Officials are working on ways of finding the balance between incentives for economic and environmental behaviour. In the long run, the choice of regime will be very important in ensuring the elimination of any hidden subsidies and reducing GHG emissions by lowering fuel consumption in generation. A regulatory regime to monitor these activities has already been introduced for the primary energy sector. The regime is still undergoing development to provide for fully competitive electricity and heat markets in the future.

38. Hard coal and brown coal continue to account for more than 90 per cent of total electricity generation. The plan to decommission some coal-fired plants resulted in a reduction in installed capacity of 100 MW. Additionally, large sums have been invested in flue gas desulphurization equipment for existing coal plants. Experts believe that while this equipment helps in reducing air pollution, it has the potential to decrease energy conversion efficiency and thus increase GHG emissions.

39. In Poland there are no nuclear power plants. The installed capacity of hydropower and other renewables is minimal in the generation of electricity and possibilities for building new plants exist. The bulk of the country's hydroelectricity comes from the Carpathians, the Sudeten region, and the Odra and Vistula rivers. In an effort to reduce GHG emissions from energy production, part of the Government's strategic goal for strengthened environmental protection is to revise the current energy policy to increase the share of renewables by 2010, in keeping with policies established at the EC level. The Ministry of Economy has the sole right to mandate that power distribution companies purchase power from renewables. In early 1990, tax exemptions

for up to five years were given to private businesses and up to 15 years for farmers, using renewables. In July 1993, preferential rates became obligatory for the purchase of power from renewables. Other notable renewable projects include the construction of two geothermal plants in Banska Nizna (in the Tatra mountain region) and in Pyrzyce (near the Baltic coast), to satisfy local heating needs. It is estimated that these projects should reduce CO₂ emissions by about 250-300 tonnes annually. Between 1990 and 1995, several wind farms were established with a total production capacity of 1000 kW of electricity per year.

40. Many developments have taken place in moving towards market prices for energy. On 1 May 1996, regional diversification of electricity tariffs was introduced for energy providers. Later, on 1 January 1997, a new pricing system was introduced for energy consumers and on 1 January 1998 heating prices were also liberalized. Part of this process has been a move to charge households the full economic cost of electricity and heat consumed. As noted above, the price of gas is still subject to regulation. However, with limited data, it was difficult for the review team to assess the effects of price changes on the consumption of electricity, gas and petroleum products and hence on GHG emissions.

41. The NC2 presented detailed information on policies and measures in the industrial sector in the context of structural changes aimed at increasing the international competitiveness of the sector. Major changes between 1992 and 1995 set the stage for further development of policies to meet these objectives as well as to reduce emissions of CO₂. This sector was responsible for almost 20 per cent of total CO₂ emissions in 1997. Two important developments which have been instrumental in indirectly reducing GHG emissions are the improvement in the efficiency of fuel use and the change in fuel mix from coal to gas in some energy-intensive industries, and the modification and upgrading of old technologies used in these operations.

42. In the iron and steel industry, higher-grade coal was introduced into the process, and energy intensities for various products dropped. For open-hearth steel, the energy intensity decreased from 7,236 MJ/t in 1990 to 5,040 MJ/t in 1995. Similarly, in the manufacture of hot-rolled products, this indicator decreased from 4,407 MJ/t to 2,670 MJ/t in the same period. In the production of electrolytic copper, the energy intensity fell from 18,025 MJ/t to 11,471 MJ/t.

43. In the cement industry, following its privatization, plants underwent modernization aimed at reducing energy intensities. The production technology moved from the wet to the dry method, with the result that 50 per cent of total cement is now manufactured using the dry process. This in turn resulted in a 50 per cent reduction in demand for heat. It is expected that by the end of 2000, as more plants are converted to the dry method, fuel consumption will be reduced even further, thus lowering GHG emissions.

44. In order to foster the development of efficiency strategies by industrial enterprises, the Government established a programme for supporting small and medium-sized enterprises (SME), co-financed by foreign donors. The National Service System was also established in parallel, for providing information, advice, training, technological audits and funding. In the framework of a project entitled "Company Technological Assessment", energy audits were conducted in several

dozen companies and tools such as the Technology Audit and Technology Investment Handbook were prepared.

B. Industry

45. As is the case with most OECD countries, it is proving difficult for Poland to mitigate rising GHG emissions from this sector, which are likely to account for an ever-greater share of emissions. In the light of experience elsewhere, the projections for emissions from this sector in Poland over the next decade may prove to be conservative.

46. Between 1990 and 1997, the rail and road network was radically transformed. In recent years, the number of vehicles has more than doubled, contributing to higher fuel use and higher CO₂ and N₂O emissions. The share of transport in total energy consumption and emissions grew between 1990 and 1997, primarily as a result of burgeoning road transport.

47. In 1995, a transport policy was prepared and adopted by parliament, for the development of the sector in light of the requirements for shifting to a market economy and for economic cooperation in Europe. The policy explicitly addressed some environmental protection issues, including GHG emissions. Some measures which have had an effect on reducing GHG emissions include improving the efficiency of rail transport, upgrading the energy efficiency of engines, and shifting from coal to gas or heating oil at many transport facilities.

48. With the withdrawal of steam locomotives from operation, coal consumption for this purpose plummeted from 860,000 tons in 1988 to 10,000 tons in 1995. The amount of gas oil used for rail motor traction also decreased from 550,000 tons in 1988 to 209,000 tons in 1995. Currently, 90 per cent of rail traction is electric. Polish airlines have also replaced old aircraft with modern ones having lower fuel consumption. In marine transport, many heavy fuel ships have been withdrawn from service, resulting in a decrease of 1,426.7 Gg of CO₂ emissions from these vessels in 1995. A fuel shift in the marine fleet from heavy oil to diesel reduced CO₂ emissions by 116.5 Gg between 1991 and 1995.

49. To further strengthen the Government's efforts to make the sector more efficient, in 1997 a package of regulations was introduced for defining and setting standards on the technical requirements for vehicles. Under these new regulations, there is a ban on the first registration of vehicles with two-stroke engines in Poland, a ban on imports of passenger cars older than 10 years and of lorries more than three years old, and stringent emission standards for road vehicles in accordance with the rules of the Economic Commission for Europe. All cars with spark ignition must be equipped with catalytic converters. The Polish State Railways also commenced action to modernize and restructure their most important railway connections, while harmonizing their operations to international standards. While the efficiency of transport is likely to improve, the Ministry of Transport and Marine Management expects that an upward trend in GHG emissions may continue with the modernization of the road infrastructure and increased use of private cars in line with economic growth.

C. Residential sector

50. Official statistics indicate that Poland is currently short of between 1.5 million and 2 million dwellings and many existing dwellings are in urgent need of repair. Although electricity accounts for only a small share of household energy consumption, this is likely to rise rapidly with economic growth. By OECD standards, per capita household demand for electricity in Poland is above average and as a result, policies to improve energy efficiency in the sector are very important for the future. Consumption of heat is also a major part of total household energy consumption. Currently, heat loss from Polish homes is around 2.5 times that of homes in other countries with a similar climate in northern Europe. This means that there is a major unnecessary contribution to emissions of greenhouse gases. However, as households are now required to pay the full economic cost of heat used, this situation may change.

51. There is great potential to simultaneously improve the welfare of Polish households and significantly reduce GHG emissions. An evaluation undertaken as part of the Polish-Danish Cooperation Programme on the Technical Requirements for New Buildings, indicates that with such a large number of dwellings required over the coming decade, the use of building regulations as an instrument for reducing future emissions of greenhouse gases assumes even greater importance. In 1997, an amendment to the Energy Act was introduced whereby the Minister of Interior Affairs and Administration outlined technical regulations on buildings, including thermal requirements, and established strict energy standards for household appliances and equipment. With the introduction of the Thermomodernization Act in 1998, a framework was provided within which major improvements in efficiency can be implemented. These include rationalization of heat consumption at the municipal level, where a typical flat at present requires 250-320 kWh per year for heating only, compared to about 100 kWh for an average new flat, as well as the introduction of new requirements for thermal insulation of buildings.

52. The review team noted that there remains the issue of the mechanisms for introducing enhanced energy efficiency and for ensuring that those who invest in it benefit from its advantages. While households are now paying the economic cost of energy, the absence of individual metering and control of heat is a clear problem. Those who can invest in energy saving in flats, for example through enhanced insulation, cannot currently reap the full benefits. The Polish-Danish Cooperation Programme highlighted the potential gains to both households and the environment from appropriate policy measures in this area. The team noted that while these problems are being tackled through appropriate policy measures, there will remain a problem for low-income households, which are unable to afford the necessary investment in energy efficiency even if they stand to gain financially from it. This problem may require intervention by the municipal authorities.

D. Agriculture

53. Following economic reform, the contribution of agriculture to GDP dropped during the 1990s. While in 1989 some 79 per cent of agricultural production came from private land and 17 per cent from state farms, and 26 per cent of the labour force was employed by the sector, far-reaching reform and land redistribution have changed this situation. Private farms, which

were more numerous, mostly small (5 hectares) and inefficient, and subject to poor availability of materials and infrastructure, were heavily subsidized by the State. After economic reform, farm incomes declined rapidly in real terms as the prices of agricultural inputs rose, and imported processed foods from western Europe competed strongly with Polish products.

54. Many State farms collapsed after 1989, following the removal of the system of State purchase upon which much of the sector had relied. In the early 1990s the number of people employed in agriculture declined by a fifth, partly because of the liquidation of State farms but also through retirement among the aging agricultural population. Whereas in 1980 farmland occupied 61 per cent of the total land area, by 1995 this proportion had fallen to 55 per cent and further reduction is expected as Poland is integrated with the EC. In the mid-1990s there was a reversal of this trend but, even as Polish agriculture recovered, less than a third of the working population was employed in agriculture. In the same time period, 1980-1995, the share of agriculture in the GDP fell from nearly a fifth to less than one tenth. Nevertheless, Poland remains one of the world's leading producers of rye and potatoes. Other principal crops include wheat and sugar beet. Most farming is mixed, and beef cattle, dairy cows, and pigs are raised throughout the country. As Poland became increasingly integrated into the global economy in the mid-1990s, about half of its agricultural exports went to the EC.

55. The Polish agricultural sector comprised approximately 2 million individual farm holdings in 1997. The team learned that over 70 per cent of holdings are low-income farms with less chance of restructuring or modernizing. As a result of the liquidation of the State Agricultural Enterprise in 1989, the area of fallow land is increasing. Agricultural production has dropped compared to the 1980s. State subsidies have been withdrawn and commodity prices have risen. Livestock numbers, especially of cattle and sheep, also declined between 1988 and 1997.

56. In addressing GHG emissions from the sector, steps are being taken to reduce the use of energy in the sector through the Foundation for Assistance Programmes in Agriculture aimed at using renewables such as biomass for energy production. Emissions from enteric fermentation are expected to decline as a result of a further reduction in livestock numbers in the future. With respect to N₂O emissions, officials from the Ministry of Agriculture explained that the downward trend in the use of nitrogen fertilizers, which declined from 1.5 million tonnes in 1988 to 836,000 tonnes in 1995, is likely to continue in the future.

E. Waste

57. Waste management is a priority in Poland's overall environmental policy. National policies on waste are driven by domestic environmental needs and the requirement to harmonize regulations with those of the EC. Officials noted that this process will prove costly; if the only imperative were climate change policy, it would probably not be a very cost-effective instrument for reducing GHG emissions. However, the other benefits arising from policy change in this area will drive the transformation needed to upgrade waste collection and disposal.

58. The Waste Act, which came into effect in June 1997, is a vital step towards the complete overhaul of waste management and disposal policies and practices. This law introduced a new waste classification based on the European Waste Catalogue and the European Waste Classification of the European Community. To a large extent, it improves the ways of acquiring data on waste handling by imposing on the waste producer and collector the obligation to keep records of waste. It establishes priorities to prevent waste production, limit illegal dumping, and safely dispose of waste which cannot be recycled or reused. Many EC directives regulating solid waste management, waste water and hazardous waste are gradually being transposed into Polish law.

59. Industrial waste accounts for about 50 per cent of the total waste generated in Poland. The main sources of industrial waste are coal mining, the extraction of minerals, electricity generation and the metal processing industries. In 1996, 44.7 million cubic metres of solid and 15.3 cubic metres of liquid municipal waste were produced. In terms of volume, the quantity of municipal waste has grown continuously since 1992 while officials stated that, 50 per cent of all industrial waste is being reused. The review team noted that in developed countries an average of 80 per cent of industrial waste is reused. The transition of the Polish economy to a market-based economy has significantly changed the way in which waste materials are handled. Programmes promoting segregated waste collection are already being conducted in several cities and have resulted in a small reduction in the total quantity of municipal waste. Officials believe that in the future further reductions may be achieved. Pilot programmes and educational programmes are under way in many more cities to ensure that the system of segregating waste is adopted at the national level.

60. In 1996, around 200,000 tonnes of municipal waste (2 per cent of the total) were composted. The largest quantities of compost are produced in the voivodships of Warsaw and Katowice. Poland has the largest composting plant in Europe in the town of Radiowo, which composts 145,000 tonnes of solid waste annually. In recent years there have been significant investments in increasing waste treatment in industry and hospitals. Landfilling is by far the most widely applied method of waste disposal. Waste deposited at landfills undergoes uncontrolled physical and biological degradation, leading to an increase in CH₄ emissions. The quantity of industrial waste going to landfills has been declining over the past 10 years, from 49 per cent to 44 per cent of total landfill waste. Since 1975 the surface area of industrial landfills has grown by 700-900 hectares every five years.

61. Officials noted that 98 per cent of solid waste, excluding industrial waste is landfilled. However, in many towns and cities the capacity of existing landfills has been exhausted. Almost 33 per cent of sites now in operation may be abandoned for that reason and/or because their technical conditions are considered sub-optimal. However, public protests against the proposed location of new landfill sites have prolonged the use of the old poorly designed landfills and the emergence of illegal dumps.

F. Forestry

62. Forest resources are very important in Poland. At present there are 45 large forest areas and other mainly small and medium-acreage forests. Most forests consist of young and middle-age stands. Forests aged above 80 years account for 17 per cent of the forest (1,468 ha) whereas those aged up to 40 years represent 42.5 per cent (3,723 ha). The average age of State-owned forests is 55 years and of private forests 37 years. Ecological forest management based on raising the felling age is being promoted. Coniferous species dominate, accounting for 78 per cent of the forest area (6,788 hectares).

63. The State Forests Enterprise is directly responsible for carrying out the forest surveys and managing forest resources, acting on behalf of the Ministry of Environmental Protection, Natural Resources and Forestry. In a report produced in 1995, the Enterprise outlined its priorities in terms of diversifying forest stands, increasing forest acreage, regenerating damaged stands and improving the undergrowth.

64. In 1992, the logging rate returned to 1989 levels where after it stabilized. In recent years, of 3.3 million hectares of area classified as marginal agricultural land, 660,000 hectares were converted to forest. Afforestation projects covered approximately 15,000 hectares annually between 1980 and 1996 under the Afforestation Plan, with an afforestation rate of 1.5 per cent annually. These are expected to enhance Poland's sink capacity considerably in the future. Some 10 million hectares are considered as exploitable forests, managed for wood production and non-wood goods and services. The most notable recent legislation on forests was an amendment to the Forestry Act in September 1991 to include an ordinance regarding a detailed methodology of forest management planning and forest resource inventory count by the Ministry of Environmental Protection, Natural Resources and Forestry. The continuation of reforestation and afforestation within the 1998 nation-wide Forest Increase Programme, under which approximately 16,000 hectares were already planted in both 1998 and 1999, will form the basis for increasing the forest resource.

IV. PROJECTIONS AND ESTIMATES OF THE EFFECTS OF MEASURES

65. The NC2 included projections of CO₂ emissions over the period 1988 to 2010 as well as some estimates of the specific effects of climate change policies and measures on GHG emissions in the industry, construction, transport, agriculture and forestry sectors. Much of the work on projections was initiated under the first Polish Country Study to Address Climate Change, in collaboration with the Institute of Environmental Protection. In 1996, the Ministry of Environmental Protection, Natural Resources and Forests, - Ministry of the Environment as of November 1999, instructed the Institute of Environmental Protection to develop projections. Financial support for this exercise was provided by the National Fund for Environmental Protection and Water Management. The Foundation was later entrusted with developing the study. The data used in this study have been adjusted to be consistent with the 1988 base year data, which were revised subsequent to the NC1. As data were not available for HFCs, PFCs and SF₆ for 1988, projections of these gases are not contained in the NC2. Projections for bunker fuels were also omitted.

66. The projections of CO₂ emissions until 2010 were based on differing macroeconomic assumptions, taking into account the Government's economic plans for development. Using three scenarios as a basis for further development of emission reduction scenarios, the macroeconomic reference scenario (MERS) was also developed. The first is BASE, a baseline scenario assuming the successful continuation of the current economic reform under which there is rapid privatization, market liberalization and restructuring of the economy and an average of 6 per cent annual growth of GDP between 1996 and 2020. This is also accompanied by an assumption of Poland's entry into the European Community in 2004 and the European Monetary Union in 2010. The second scenario is ACE, Advanced Competitive Economy, which anticipates an extremely active economy within a favourable international environment which results in deepened restructuring and dematerialization of GDP, whose average annual growth between 1996 and 2020 is estimated at 7 per cent. The third scenario is "PASS", Passive Scenario, which assumes a lack of social acceptance of painful economic reform. GDP is assumed to grow at a slower rate of 4.5 per cent annually between 1996 and 2020, accompanied by doubts concerning Poland's accession to the EC.

67. Under all three scenarios, the composition of GDP is expected to change over time, with services taking an increasing share and agriculture decreasing in importance. Another important consideration in all the projections is the alignment of Polish law with EC requirements. Officials explained that the greatest uncertainty in connection with GDP projections and overall economic growth was the anticipated accession to the EC in 2004. For CO₂ emissions, a sophisticated iterative procedure was applied as part of the modelling exercise. For CH₄ and N₂O, expert judgement was used; for this reason, these estimates are considered preliminary and subject to change as new information becomes available.

68. CO₂ projections for the energy sector presented in the NC2 are based on sectoral projections using a market-oriented model of energy economy, EFOM-PL, and taking into account different long-term economic development forecasts. For forestry, experts used their own methods to estimate CO₂ emissions. The COSMIC model was used to define the anticipated changes due to climate change.

69. The climate change policy instruments in the energy sector aim at a reduction between 18 to 28 per cent in emissions compared to 1988 levels. A carbon tax has also been modelled, at rates of around US\$ 32/t C; US\$ 64/t C; and US\$ 160/t C; it comprises a half-rate tax from 2005 to 2010 and a full-scale tax between 2010 and 2020. Projections also assumed that if a carbon tax is not applied, a carbon emission fee may be imposed on large emission sources in the power sector. Its rate would be US\$ 10/t CO₂; US\$ 20/t CO₂ and US\$ 50/t CO₂, and its implementation would be the same as for the carbon tax.

70. The results of the projection exercise for the three reference scenarios (without emission reduction measures), shown in table 5, indicate that CO₂ emissions in 2010 may vary between 402,000 and 411,000 Gg of CO₂ compared to 1988 emission levels of 477,584 Gg of CO₂, depending on the scenario adopted, which represents a range varying from a 14 to 16 per cent decrease.

71. Data provided to the review team show that the energy sector claims the highest share of CO₂ emissions followed by industry, which shows the highest growth in the period analysed. It is estimated that the total investment needed in the transitional economy may reach PLN 370 billion in 2010, with PLN 5,9 billion for actual GHG emission reductions.

Table 5. Projected emissions of carbon dioxide, 1988-2020 (thousand Gg)

Year	CO ₂ (PASS scenario)	CO ₂ (BASE scenario)	CO ₂ (ACE scenario)
1988	478	478	478
2000	382	378	378
2010	406	411	402
2020	421	446	449

72. The review team was informed of the assumptions on Poland's energy policy as contained in the document entitled "Assumptions for Poland's National Energy Policy until 2010". These assumptions are based on a change in the primary energy structure to less polluting fuels such as natural gas and electricity, with an increase in gas imports from the Russian Federation and other suppliers. Demand for hard coal is expected to fall by 3 per cent annually from 1988 demand levels and demand for oil is projected to increase by 66 per cent by 2010 compared to 1990. Electricity demand will amount to 180 billion kWh by 2010, assuming a 5 per cent economic growth rate. The introduction of renewables was marginal in the projections, accounting for 1.7- 5.5 per cent of the primary energy balance by 2010.

73. A decrease in energy intensities in terms of energy use per unit of output in all sectors is anticipated, based on a rise in all energy prices to their real economic levels, and a change in industry structure due to more energy efficient technology. In this regard, energy consumption in the industrial sector is expected to decrease by 29 per cent between 1988 and 2000, and by 24 per cent in 2010. Other sectors where significant drops in energy consumption are projected, are construction and residential. Conversely, in transport, energy consumption may grow by 37 per cent by 2010 compared to 1988. It is assumed that public transport for passengers will become more efficient in terms of passenger numbers in order to be competitive. It is envisaged that the State will subsidize certain aspects of public passenger transport to promote the use of railways. It is also assumed that the number of road vehicles will increase in 2005, with the estimated increase for cars at 140 per cent, buses 47 per cent and trucks 85 per cent compared to 1988.

74. The base forecast assumes the continued removal of price subsidies for domestic consumers of heat and electricity as the Energy Regulation Agency controls pricing mechanisms for gaseous fuels, electricity and heat, with an aim to eliminate the monopolistic behaviour of energy producers. Prices of petroleum products are completely liberalized. Hard coal prices should be in line with world market prices by 2010, while it is assumed that the price of lignite will continue to be controlled.

75. Projections of CH₄ and N₂O, which are embedded in this forecasting exercise, relate to the combustion process and energy activities. In agriculture, a reduction of solid fuel use is foreseen as crop productivity decreases and livestock production decreases. Solid fuels are also

projected to be replaced by gas and liquid fuels. Under these assumptions, CH₄ emissions are projected to increase by 10 per cent by 2010 and N₂O by 5 per cent compared to their 1988 levels.

76. The review team was informed that further work is to be done on modelling international GHG reduction efforts to ascertain their effects on national emissions. The creation of a national monitoring system of GHG reduction projects and the development of a system of tradable GHG emission permits for Poland will be incorporated into future modelling of GHG emission scenarios. Assessment of the economic effectiveness of different options for the redistribution of revenue from a carbon tax and emission fees will also be incorporated in subsequent simulations, together with the actual effects of policies and measures as more information becomes available.

V. VULNERABILITY ASSESSMENT AND ADAPTATION MEASURES

77. The NC2 provided detailed information on the economic sectors which are vulnerable to an enhanced greenhouse effect, and their adaptability. Information is based on the results of the Polish Country Study to Address Climate Change and research studies conducted by independent experts under the National Climate Programme.

78. It is expected that the projected climate change will have multiple impacts on agricultural production. Positive impacts include improvements in certain types of agriculture, especially thanks to a longer vegetation period that will create favourable conditions for pasture management, and maize, soybean and sunflower cultivation. However, the intensity of various diseases and plant pest infestations will grow, as will the water deficit. Negative impacts include degradation of the coastal area, which extends over 2,200 sq km and is inhabited by more than 230,000 persons, and long-term damage to forests, with a change in the biotic environment and more forest fires and possible water shortages. Officials explained that with higher temperatures the need for irrigation will grow.

79. Poland lies mostly within the basins of its two largest rivers, the Vistula and the Odra, but it is a country with meagre surface water resources. Surface water resources were estimated at 1,600 m³/year/capita, which is one third of the European average. Moreover, a long period of drought began in the mid-1980s.

80. Poland has developed a strategy for adapting its coast to sea level rise. This includes full protection through the implementation of many precautions and protective measures aimed at minimizing any loss of land and deterioration of its value, including the construction of dykes, seawalls and offshore wave breakers. The Polish Country Study to Address Climate Change also noted that the cost associated with its protection is much less than the value of the land which may be lost. Similarly, adaptation strategies in forestry include the promotion of indigenous species and ecotypes and the avoidance of monocultures.

81. While officials explained that the uncertainties associated with climate change make it difficult to formulate a list of possible adaptation options, possible actions which may be taken to cope with the negative consequences of climate change include: new legal and economic

measures for conserving water, and improved management of water resources through temporarily limiting the use of water by industry and developing new water storage systems.

VI. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

82. Poland participated in the pilot phase of activities implemented jointly in a domestic project with Norway involving the substitution of coal by natural gas in residential heating. Under this project, Norway provided supplementary funding of US\$ 1.1 million, the Government of Poland US\$ 22 million and the Global Environment Facility (GEF) US\$ 25 million. The project included coal-to-gas heating conversion in 30 small and medium boiler houses in homes and offices, fitting energy-saving installations in several hundred new flats and training experts. It is expected that this project, which was initiated in 1997, will result in a cumulative reduction of 141 Gg of CO₂. Two other programmes were completed, one with GEF funding (US\$ 5 million) on energy efficient lighting and the other with the World Wide Fund for Nature (DM 150,000) on reducing energy consumption in schools. Other GHG emission reduction projects are being conducted with the Netherlands, Norway Sweden and the United States of America.

83. At the time of the review, several bilateral projects were being conducted by Poland under its international cooperation and financial support programme. They include the rational use of energy in the conversion of coal to other energy sources, improved methane utilization, thermal insulation and energy savings in dwellings, and utilization of renewable energy in Asia and Africa. These cooperative efforts were conducted with the United States of America and the EC.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

84. Most of the research in Poland has focussed on climate variability and dynamic and regional climatology. National and international research is conducted by the Polish Academy of Sciences, the Institute of Meteorology and Water Management, and the Institute of Environmental Protection, and to some extent in universities and polytechnics. While Poland does not have an integrated climatic research programme, plans are under way to formulate a comprehensive one under the National Climate Programme. Under this Programme, many actions are outlined including: assessment of extreme climatic phenomena variability and long-term climate change in Poland and Central Europe. Polish scientists are particularly interested in current changes in hydrometeorological conditions, especially rainfall. With funding from the State Committee for Scientific Research, several studies were undertaken to define climate change scenarios for Poland on a regional scale and using regional models.

85. Research on a vast array of climate change related topics has been conducted in Poland. These include the impact of non-stationariness of global geophysical processes on water resources in Poland (1994-1996); assessment of climate change on catchments water balance (1994-1995), with funding from the State Committee for Scientific Research; adaptation of water management to climate change (1994-1996), with funding from the United States Country Studies Programme; and the impact of climate change on water resources in Poland (1995-1997), funded by the European Commission.

86. Two monitoring stations were established for measuring GHG emissions in the atmosphere, one at Kasprowy Wierch in the Tatra mountains and the other at Diabla Gora in the Mazurian lake region. It should be noted that since 1994 the Academy of Mining and Metallurgy has been measuring CO₂ and CH₄ concentrations at the Kasprowy Wierch monitoring station, and in March 1995 this work was extended to include N₂O and SF₆ concentrations.

87. Scientists expressed their concern about the future of climate change research in Poland as government expenditure on scientific research, including research on climate change, has been severely cut back since 1991. In terms of percentage of GDP, such expenditure declined by almost 38 per cent, from a level of 0.76 per cent of GDP in 1991 to 0.47 per cent in 1999.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

88. Since publication of the NC1, environmental education has been expanded and specific projects have been undertaken to increase public awareness of climate change issues. This has been done in two ways, through formal environmental education in schools and through the media and existing research institutes. Environmental education has been introduced among the three-year high school cross-curricular issues and for elementary schools (grades IV-VI), and a programme called NATURE was introduced in 1997. Since 1992, a new topic, environmental protection, has been offered at universities. State administrators, administrators at the community level, specialists, engineers and local government officials have been trained at the National Centre for Training of Environmental Protection and Water Management Personnel and through special educational programmes for local communities on the economy and energy policy in light of the Kyoto Protocol commitments.

89. Publications of the Ministry of Environmental Protection, Natural Resources and Forestry which are used to increase the general public's awareness of climate change include, among others, a bulletin entitled "Zmiany klimatu" (Climate Change) published twice a year. Interviews with experts and scientists on climate change are also frequently conducted and aired by the media. Other environment educational programmes include "The World Around Us" and "Advice on Waste".

90. There are 1,000 environmental NGOs in Poland all of which are actively involved in public awareness campaigns, in collaboration with the Government or independently. The most important activities undertaken by NGOs in recent years include educational campaigns on eco-education, climate impacts and actions to cope with adverse effects. Some NGOs focus on monitoring local air pollution and taking practical steps for energy saving and waste management, and nature protection. Others work at a sectoral level, such as in transport, running campaigns to promote environmentally sustainable development of the sector.

IX. CONCLUSIONS

91. Poland's priorities continue to be market reform and economic growth. Poland became a member of the OECD in 1996 and aspires to accede to the EC by 2004. Although climate change has not been an explicit issue in policy formulation since issue of the NC1, the review

team was informed of many recent initiatives which have been specially introduced for coordinating and overseeing action in line with Poland's commitments under the UNFCCC and the Kyoto Protocol. This includes the establishment in 1999 of a steering team for climate change activities, consisting of representatives of key government agencies, to provide advice to the Minister for Environmental Protection, Natural Resources and Forestry, and a Climate Change Convention Implementation Office and the Polish UNFCCC Executive Board.

92. Previous concerns about air pollution and environmental damage in Poland, as an important coal producer, and the process of aligning national legislation with that of the EC have already brought about a significant reduction in GHG emissions to well below 1988 levels. Inventory data for 1997 indicate that Poland's total emissions of the three major GHGs were then around 20 per cent lower than in 1988. The industry, agriculture, construction, and waste sectors all experienced significant falls in output and emissions during two years of recession in 1990 and 1991 and as a result of restructuring of the economy.

93. The team was impressed by the improvements made in preparing the inventory in the NC2, and especially by the work that has been done on establishing national emission factors for most sectors. The inventories team has moved from its two-year inventory cycle to annual inventories since 1995 and a full 1988-1998 series was completed in July 2000. All of this was made possible through collaboration among the ministries and agencies involved in this task, which was commended by the team. An inventory database is in the formative stage and, when established, will improve the statistics needed for preparing a complete time-series, ensuring that definitions and methods are in line with those of the IPCC and filling in data gaps for international bunkers and the new gases.

94. As Poland has enjoyed a period of sustained economic growth since 1993, the evolving structure of the Polish economy is likely to move closer to that of the EC generally - a structure where industrial production is less dependent on large energy inputs. However, as the economy becomes more competitive, the quality of living improves, and hard and brown coal continue to dominate the energy balance, GHG emissions can be expected to increase, especially in the transport sector, where policies have yet to be effective in reducing GHG emissions. There is much scope for major efficiency gains, especially in the household sector. In addition, much of the legislative framework for future climate change policy is already in place, including the Energy Act of 1997 and the Thermomodernization Act of 1998. In the area of economic instruments - taxes and charges - a draft law is in preparation. This will provide the framework for any future developments in policy - such as the possible introduction of carbon taxes as part of a wider EC agreement.

95. The team commended Poland on its ongoing work on projections of GHG emissions, in spite of the uncertainties associated with Poland becoming a member of the EC and the inherent assumptions made in the exercise. The projections indicate that Poland should have no major difficulty in meeting its future GHG reduction commitments, if investment funds are forthcoming to attain the energy efficiency objectives set out in the recent energy policy. GHG emissions are projected to lie within a range varying from a decrease of 11 per cent to an increase of 4 per cent by 2010 compared to 1988 levels.

96. Poland has conducted a wide array of research on the impacts of climate change and possible mitigation measures in this regard. The development of climate science by research institutions is commendable, in spite of the marked reduction in State funding for these activities since 1990.

97. Several steps have been taken recently to stimulate public awareness of climate change issues. This is being done in two ways, through formal environmental education in schools and through the media and existing research institutes. Noteworthy efforts include the introduction of environmental education in primary schools, high schools and universities. Special educational programmes have been designed at the community level for local government officials, local administrators, specialists and engineers, on the economy and energy policy in light of the Kyoto Protocol commitments. Environmental NGOs have provided support for the implementation of some of these activities.
