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Report on the in-depth review of the national communication of Slovakia

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Under Articles 4 and 12 of the Convention, Parties are required to prepare national communications on their implementation of the Convention. Guidelines for the preparation of national communications and the process for their review were agreed on by the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change, by its decisions 9/2 and 10/1, and by the Conference of the Parties, at its first session, by its decisions 2/CP.1 and 3/CP.1 (see FCCC/CP/1995/7/Add.1). In accordance with these decisions, a compilation and synthesis of the first 33 national communications from Annex I Parties was prepared (FCCC/CP/1996/12 and Add.1 and 2).

When reviewing the implementation of the Convention by Parties, the subsidiary bodies and the Conference of the Parties will have this report available to them in English as well as the summary of the report in the six official languages of the United Nations. (These bodies will also have before them the executive summary of the first national communication of Slovakia and country-specific information drawn from a compilation and synthesis report covering all countries that have submitted national communications.)

Summary[1]

1. The in-depth review was carried out between May 1996 and February 1997 and included a visit by the team to Bratislava from 2 to 7 June 1996. The team included experts from Venezuela, Denmark, Estonia and the United Nations Industrial Development Organization.

2. In its first national communication, Slovakia has followed in general the approved reporting guidelines for national communications. It has also followed, as far as possible, the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (1994) in preparing its national inventory of greenhouse gases (GHGs) not controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer. Slovakia has a national target of reducing by 20 per cent its carbon dioxide emissions in 2005 compared to 1988 levels; it expects its emissions in 2000 to be 16 per cent lower than in 1990. GHG emissions in 1994 were 20 per cent lower than in 1990. Policies and measures are reported in the national communication and are organized by gas and by sector, with a focus on the energy sector. Projections of end-use energy demand by sector, apart from transport, build on the "Energy Strategy and Policy for the Slovak Republic up to the year 2005". The estimates are based on individual sector contributions to gross domestic product (GDP). Though actual developments in some sectors show different trends, the overall trends are in line with the projections.

3. Slovakia has integrated mitigation of greenhouse gases into its energy policy, as well as considering it in conjunction with ongoing measures to reduce transboundary pollution. The energy policy requires energy services to be supplied not only at the minimum price but also with the minimum impact on the environment. The policy includes reducing carbon dioxide emissions, increasing the share of gas in end-use energy and power, conserving energy to decrease fossil fuel consumption, increasing the share of renewable energy and adding nuclear and hydro generating capacity. The Strategy, Principles, and Priorities of Government Environmental Policy, adopted in 1993, based on the concept of sustainable development, are expected to guide the formulation of strategic objectives for the long, medium and short term in the various economic sectors.

4. Slovakia depends on imported energy for nearly 90 per cent of its energy needs. In order to phase out older nuclear units, Slovakia is increasing its nuclear generating capacity with the corresponding decrease in use of fossil fuels. There is a focus on measures to promote energy efficiency and energy conservation in the large industrial units and in residential heating - accounting for three quarters of the energy end-use. Such improvements are feasible and cost-effective, as half of the electricity consumption is in 30 large units; the major barrier is the lack of capital. State subsidies in the energy sector are gradually being reduced. In 1991 the price of household electricity increased by 70 per cent in comparison to

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[1] In accordance with decision 2/CP.1 of the Conference of the Parties, the full draft of this report was communicated to the Slovak Government, which had no further comments.

the 1989 base year. Furthermore in 1996 the price of household electricity was increased by 10 per cent and for industrial users by 5 per cent on average. The price for industrial users is higher and household are cross-subsidised. Similarly, the price for residential heating is 30 per cent less than heating for industrial use, and continues to be subsidized by the State to the extent of about 50 per cent of costs.

5. In Slovakia, emissions of carbon dioxide (CO_2) in 1990 were estimated at 58,278 Gg, and removals by sinks at 4,451 Gg. The national communication includes aggregated emission estimates using global warming potentials (GWP), with CO_2 emissions contributing 80 per cent of total emissions expressed as CO_2 equivalent, methane (CH_4) 12 per cent, nitrous oxide (N_2O) 7 per cent and indirect GHG nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOC) 1 per cent.

6. Though recent growth in GDP (7.4 per cent in 1995) has largely come from the service sector and small and medium-sized units, which are not in relative terms major contributors of GHGs, heavy and energy-intensive industry remains important, including in exports. A national programme to stabilize and reduce carbon dioxide emissions from transport was adopted in 1995. The share of public transport remains high and there is reduced movement of goods by road; even though the number of passenger cars and gasoline consumption are both expected to increase, emissions of carbon dioxide from the transport sector are not expected to reach 1900 levels by the year 2000. Industrial production and electricity generation remain below 1990 levels, agricultural production has also declined, and GDP is not likely to exceed 1990 levels by 2000.

7. The statistical system in the country has changed over from the previous system of material balances, which did not measure the service sector or make a distinction between end-use of energy and energy transformation and conversion processes. This requires expert judgement to interpret the activity data for 1990, and also makes comparison with data from 1993 onwards difficult.

8. Slovakia provided projections of its energy-related emissions of CO_2, CH_4 and N_2O in 2005. Total reductions of CO_2 emissions relative to a business-as-usual scenario are estimated to be 5 Gg in 2000 and 15 Gg in 2005, corresponding to about 9 per cent and 27 per cent of levels in 1990, respectively. Of these reductions, roughly 60 per cent is estimated to result from the use of non-fossil fuel sources, while energy savings, including efficiency gains from increased use of combined heat and power and shifts from high to low-carbon fossil fuels (mainly gas), contribute roughly 20 per cent. In view of the uncertainty over future trends in the economy, assertions in the energy policy are the best available parameters to follow.

9. It was stressed to the review team that the future structure, pattern and pace of economic growth remains uncertain, precluding high levels of certainty in the projections of GHGs emissions. The review team was of the opinion that the national target of a 20 per cent reduction in carbon dioxide emissions by 2005 compared to 1988 is likely to be met.

I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

10. Slovakia ratified the Convention on 25 August 1994. Its national communication was received by the secretariat on 11 October 1995.

11. The in-depth review of the national communication was carried out between May 1996 and February 1997, and included a visit by a review team to Bratislava from 2 to 7 June 1996. The team comprised Ms. Martha Perdomo (Venezuela), Mr. Jesper Gundermann (Denmark), Mr. Agu Karindi (Estonia), Mr. Robert Williams (United Nations Industrial Development Organization), and Mr. Mukul Sanwal (UNFCCC secretariat, Coordinator). In the course of the visit the team met representatives of the ministries concerned and members of the scientific and academic communities, as well as representatives of non-governmental organizations.

12. Slovakia is situated in the heart of Europe. The total land area of 49,036 sq km includes 41 per cent forest. It is a mountainous country, with 60 per cent of the territory over 300 metres above sea level. Its population in 1992 was 5.3 million.

13. Slovakia has been an independent state since 1 January 1993. The curtailment of the production of heavy equipment for the military in the early 1990s led to a sharp decline in industrial production, and unemployment. Consumption fell by 25 per cent in real terms in 1991 compared to 1988. Inflation is now seen as being under control and the unemployment rate is going down; however, the average disposable income of the population remains two thirds that of 1988. The fall in real wages in 1991 compared to 1988 (almost 30 per cent) became an important element of increased external competitiveness in the following years. Gross domestic product (GDP) has shown a revival since 1994, with 60 per cent of production now in the private sector - of which about 20 per cent derives from small and medium-sized enterprises. Industrial production rose by about 12 per cent in 1995, compared to 1990, driven by exports. The service sector is growing. The privatization of small units was completed by 1993 but that of large units has yet to be completed. Agriculture's share in GDP is declining; the number of animals slaughtered dropped by 20 per cent between 1989 and 1992.

14. The economy is undergoing transition from a central planned to a market economy, with changes in all sectors. It continues to be an industrial economy; industry consumes more than half the energy used and about two thirds of the electricity generated. Thirty large units account for half of the electricity consumed and three large plants producing iron and steel, aluminium and petrochemicals account for one quarter of the electricity consumption. Modernization, including energy efficiency measures in these plants, is going on, or is under consideration, and is expected to reduce greenhouse gas (GHG) emissions.

15. Changes are taking place in the energy balance. In 1990 the primary energy sources contributed 945 PJ, with solid fuels accounting for 38 per cent, gas 24 per cent, liquid fuels 21 per cent, nuclear 14 per cent and hydro power 3 per cent. Electricity generated in 1990 comprised nuclear 50 per cent, thermal 39 per cent and hydro 10 per cent. About 30 per cent

of primary energy was used in the energy and transformation sector and 70 per cent as final energy. The breakdown of final energy consumption, including electricity and heat, was over 50 per cent in industry and construction, 20 per cent in households, 16 per cent in the service sector, 5 per cent in agriculture and 4 per cent in the transport sector. In 1993, the primary energy sources contributed 755 PJ, with solid fuels accounting for 35 per cent, gas 27 per cent, liquid fuels 16 per cent, nuclear 17 per cent and others 5 per cent.

16. In addition, 60 per cent of the electricity is being generated from non-fossil fuel sources (1990) and one third of the power generated comes from combined heat and power (CHP) plants. The energy infrastructure has a well developed gas transmission and distribution network, and includes extensive district and block heating systems, covering about one-half of heating demand. Heating of buildings is predominantly done by large boilers, or heat from public power plants or industries, rather than from installations in each dwelling.

17. A network of gas transmission pipelines, with branches to the Czech Republic and Austria, provides supplies of natural gas to western European countries from Russian gas fields. The gas distribution network covers a large part of the country, including many towns and villages. Of the over 1 million dwellings, about half are apartments in multi-storey buildings, with those constructed prior to 1984 being of prefabricated panel design with little or no insulation. Later construction has external walls with some improvement in insulating properties. There is a considerable potential for energy savings through adding insulation in the apartments.

18. In the transport sector, public transport has a large share while in freight transport the ratio of rail to road is high. The number of passenger cars is on the rise, with the annual increment balanced by significant replacement of old, less fuel-efficient cars. Despite the increasing number and use of passenger cars, the favourable modal composition provides opportunities for limiting the growth of GHG emissions.

19. The State Forestry Policy (1994) stresses afforestation of farmland unsuitable for agriculture to the extent of 50,000 hectares, largely in the mountains, over the next 15 years. The forested area increased by 20 per cent between 1920 and 1990, and the age composition of the largely deciduous and mixed stands, is favourable to the sequestration of carbon dioxide.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

20. The GHG inventory presented in the first national communication was compiled by the Slovak Hydrometeorlogical Institute in collaboration with other agencies and research centres.

21. The national communication covers all gases included in the Intergovernmental Panel on Climate Change (IPCC) Guidelines. However, the standard reporting tables required by

the IPCC Guidelines have not been included. Information on the main GHGs was made available to the review team during the visit. The GHG inventory was developed through a top-down methodological approach, using the IPCC default emission factors and aggregate activity levels, including estimation of carbon dioxide (CO_2) emissions from individual subsectors of the energy sector. A bottom-up approach was used to estimate methane emissions, and emission factors were modified according to the specific national conditions, with the exception of fugitive emissions. For nitrous oxide (N_2O) emissions, the IPCC top-down methodology was used, with the exception of emissions from waste water, which were calculated by applying emission factors given in the CORINAIR[2] handbook. Government officials and the review team shared concern over the lack of detailed data and information in the national communication, especially statistics on fuel consumption and energy balances, fugitive emissions from losses during natural gas distribution, quantification and even determination of some of the sources of N_2O, and waste handling. The review team noted that efforts are continuing to improve the activity data.

22. In Slovakia, emissions of carbon dioxide in 1990 were estimated at 58,278 Gg, and removals by sinks at 4,451 Gg. The national communication includes aggregated emission estimates using global warming potentials (GWP), with CO_2 emissions contributing 80 per cent of total emissions expressed as CO_2 equivalent, methane (CH_4) 12 per cent, nitrous oxide 7 per cent and indirect GHG nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOC) 1 per cent.

23. For CO_2, the largest source is fuel combustion, with energy and transport contributing 94.4 per cent, industry 4.8 per cent, and waste treatment less than 1 per cent. For CH_4 emissions (347 Gg) the main contributor is agriculture, accounting for half of the total, while fugitive emissions accounted for 27.7 per cent, open dumps 15.3 per cent, fossil fuel combustion 6 per cent, and forest ecosystems 1.4 per cent. Agriculture is the major source of N_2O emissions (16 Gg) contributing 55 per cent of the total. Emissions of other trace gases from incomplete combustion of fuels were estimated, of which CO accounted for 489 Gg and NO_x for 227 Gg, with power, engineering and transport the major sources, and NMVOC 147 Gg, with the application of paints and solvents together with extraction, transport, processing and use of crude oil and its products as the major sources. The data on these gases should be treated as preliminary. No information was provided on emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

24. During the visit additional material, including an update of the inventory being prepared with assistance from the United States Country Studies Program, was provided to the review team. Since the submission of the national communication, additional work has been done on the revision of energy statistics and estimations of land-use change sources and sinks, N_2O emissions from agricultural soils, GHG emissions from industrial production, fugitive emissions, CH_4 and N_2O emissions from waste water treatment and waste combustion,

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[2] CORINAIR is the component dealing with air emissions inventories of the European Community CORINE (Coordinated Information System on the State of Natural Resources and the Environment).

and emissions of CO_2, CO, tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6). A comparison of CO_2 estimates using the top-down approach of the national communication and the bottom-up approach now being developed shows higher emissions using the bottom-up approach.

25. When compared with data in the national communication, the new estimates show 3 per cent additional CO_2 emissions and 4 per cent lower CO_2 removals from land-use change. Regarding methane, there is an increase of 24 per cent in the fugitive emissions sector because of revised figures for natural gas related emissions. Additional emissions from waste water treatment were also estimated. As a result, an increase in total methane emissions of 12 per cent was obtained. N_2O emissions increased by 59 per cent in the agriculture sector and by a very small amount owing to the inclusion of the waste sector, resulting in a total increase in N_2O emissions of 34 per cent. As to the aggregated emissions in terms of GWP, small changes were produced with the new estimates, from 81 to 79 per cent for CO_2, and 7 to 9 per cent for N_2O. The review team appreciates the continuing work being done to update the estimates of emissions of all gases and to include emissions in new sectors.

26. Forests in Slovakia cover more than 40 per cent of the territory and play an important role in the country's carbon balance. The total area of forests has increased during this century, and this trend is expected to continue during the next 10-20 years. From the beginning of the century, there has been a conversion of agricultural land to forest following the abandonment of agricultural land. During the period 1970-1990, about 100,000 hectares of land were afforested in Slovakia. A national assessment of carbon sequestration in forests is being made.

III. POLICIES AND MEASURES

27. Slovakia is developing a national policy related to climate change. The measures reported in the national communication, and described by gas and by sector, were adopted for other goals and will only indirectly affect emissions of GHG's. Slovakia has developed a strategy to reduce CO_2 emissions with a focus on the energy sector. These measures reflect the need to provide energy security and energy supplies at affordable prices, as well as the need to deal with transboundary pollution arising from energy-intensive industries, district heating and power plants.

A. Energy

28. Slovakia has incorporated in its energy policy the national target of reducing emission levels of carbon dioxide by 20 per cent in the year 2005 (the "Toronto Target") in relation to 1988 emissions. The energy policy includes elements which will reduce emissions of GHGs in the generation as well as end-use of energy.

29. Slovakia has decided to maintain the current share of nuclear power in the generation of electricity. The two older units (each of 440 MW) of the four units nuclear power station

at Jaslovake Bohunice will be phased out a year after units 1 and 2 of the nuclear power station Mochovce are operating on reliable commercial basis. Also, Slovakia intends to commission two additional units of 440 MW in Mochovce during the period 2000-2004. The decision is expected in 1998.

30. Substantially greater use of natural gas and biomass is planned in order to reduce the use of coal and liquid fuel, in the production of electricity, heating and for combined electricity and heat production. There is a potential to substitute all coal-fired plants with gas and wood-based CHP stations. A ready supply of relatively inexpensive gas is available from the Russian Federation through an existing pipeline.

31. Fuel and energy efficiency programmes are being implemented. The power utility has identified technical options for demand-side efficiency through energy audits in energy-intensive industries. The stringent emission limits for new sources, financial support for energy efficiency and adoption of new technology, relatively higher prices paid by industry and the current poor end-use efficiency suggest that investment in efficiency measures will be viable. The electricity generating company estimates that savings of about one third of the current demand (65 PJ) could be achieved in large industries, through voluntary agreements. Total expected energy savings in all sectors are estimated in the national communication to be 31.5 PJ by the year 2005, which is about 15 per cent of the current demand.

32. As 50 per cent of the apartments are connected to district or block heating systems, substitution of coal by gas or biomass and conversion of the plants to CHP has been identified as an important element of the overall strategy. Fuel substitution is to be largely induced by the emission limits for sulphur dioxide (SO_2) and other pollutants introduced in 1991, which existing plants will have to meet at the latest by the end of 1998. Fiscal measures such as a tax on SO_2 have also been introduced. For the conversion of district heating plants from hard coal or brown coal to waste wood, the Government reimburses 70 per cent of the interest paid by municipalities for the modernization of boiler plants. Up to 30 per cent saving in fuel can be achieved with the new technology. The flexibility of the district heating systems to exploit future new energy sources, such as biomass, waste heat or geothermal heat, could be considered an asset for implementing measures in the future.

33. Slovakia proposes to increase the use of renewable energy sources, mainly biomass and geothermal, and increase the utilization of the hydro potential from the present level of 53 per cent of the potential up to 67 per cent. The untapped hydro and minihydro potential is 1.3 GW, with a potential production of 3.5 TWh per year. There is a five-year tax break for the use of renewable energy sources and for CHP plants.

34. Reconstruction of the two largest fossil fuel power plants is planned, primarily to curb transboundary pollution. The adoption of fluidized bed combustion will improve conversion efficiency but is not likely to have a significant impact on GHG emissions.

B. Transport

35. The Slovak national programme to stabilize and then reduce CO_2 emissions from transport was adopted in 1995. In the transport sector, there are two unique circumstances favouring limitations in the growth of GHG emissions. First, the extensive existing infrastructure for public transport could favourably influence the modal split between public and private transport; and, second, the large fleet of old private vehicles is progressively being taken out of service because they will not pass inspection. Since 30 September 1995 all internal combustion cars without catalytic converters have been subject to annual mandatory inspection. From 30 September 1995 till 31 December 1996 customs duty and additional charge on import of new personal cars up to 1500cc capacity was withdrawn.

C. Agriculture, forestry and land use

36. Agricultural production and emissions of methane continue to decline compared with 1990 levels. There is a programme for afforestation of non-arable land, covering a total area of about 50,000 hectares by the year 2100. The programme has already started, with afforestation of 500 hectares in 1995, 1,200 hectares in 1996, and planting stock for a planned 4,000 hectares for the period 1997-2000. The programme of afforestation is well managed, but could suffer from lack of investment.

D. Measures under consideration

37. Important new legislation is being considered. This includes an energy management act, which will more clearly define the framework for the various actors and set out the conditions for commercial activities in the generation, transmission and distribution of energy. Legislation is also being considered to define the framework for local and regional energy supply planning and to increase the use of local resources, including waste wood, renewable energy sources and cogeneration.

IV. PROJECTIONS AND ESTIMATES OF THE EFFECTS OF MEASURES

38. Slovakia provided projections of its emissions of energy-related CO_2, CH_4 and N_2O in 2005. Total reductions of CO_2 emissions relative to a business-as-usual scenario are estimated to be 5 Gg in 2000 and 15 Gg in 2005, corresponding to about 9 per cent and 27 per cent of levels in 1990, respectively. Of these reductions, roughly 60 per cent is estimated to result from the use of non-fossil fuel sources, while energy savings, including efficiency gains from increased use of CHP and shifts from high- to low-carbon fossil fuels (mainly gas), contribute roughly 20 per cent. Though actual developments in some sectors show different trends, the overall trends are in line with these projections. In view of the uncertainty over future trends in the economy, assertions in the energy policy are the best available parameters to follow.

39. Projections of end-use energy demand by sector, apart from transport, build on the "Energy Strategy and policy for the Slovak Republic up to the year 2005". The estimates are

based on individual sector GDP contributions, taking into account the expected moderate decrease in the share of industry in total GDP and a gradually decreasing energy intensity, along with the effects of conservation and efficiency improvements resulting from measures being taken. In agriculture, energy demand is expected to develop slightly faster than the growth of GDP. For households, a growth in electricity consumption of about 2 per cent per year is assumed, whereas demand for heating fuels is assumed to decrease gradually. Total primary energy end-use in 2000 is projected to be 31.5 PJ lower than in a business-as-usual projection, as a result of energy savings in all sectors excluding transport.

40. Energy savings and renewable energy programmes, both with economic incentives from the State, have achieved a primary energy saving of 5-6 PJ since 1991, at which rate the assumed saving of 31.5 PJ in all sectors by 2005 would be halved. Combined with other measures, however, such as continued price liberalization and demand-side management by utilities, it is likely that greater savings than the assumed 31.5 PJ could be achieved. The concentration of electricity demand in a few energy-intensive industries in the metallurgical and chemical sectors makes demand projections very dependent on developments in those industries. Under the above assumptions the review team considers the electricity projection to be rather robust.

41. Projections of future CO_2 emissions are affected by the uncertain structure, direction and pace of change in the economy during the economic transition. In the estimates given in the national communication, GDP is assumed to grow at an average rate of 2.8 per cent annually for the period 1995-2000, increasing to 3.1 per cent per annum from 2000 to 2005. GDP decreased by about one quarter in real terms between 1990 and 1994, after which a rebound occurred with a positive GDP growth rate of 4.8 per cent in 1994 and 7.4 per cent in 1995. The implications of the rebound could only be estimated in a preliminary manner at the time of the review team's visit. The team was informed that GDP trends up to 1995 indicate that the growth rates assumed in the projection are lower than those actually achieved.

42. For transport, more than for the other sectors, projections are complicated by the economic transition. Gasoline consumption remained stable until 1992, increased by 14 per cent in 1993, and then by 7 per cent in 1994, whereas diesel consumption decreased steadily to reach a level 40 per cent below that of 1990 in 1994, because of reduced movement of goods by road. In the energy strategy, demand for transport fuels is assumed to follow a simple regression with GDP. However, projections for estimating the most likely level of total CO_2 emissions in 2000 and 2005 are now being developed based on more recent and more detailed work in the Slovak national programme to stabilize and reduce CO_2 emissions from transport. Analyses of measures included in this study indicate a possible 10 per cent reduction in CO_2 emissions from transport relative to the baseline projection in 2005. In the projection included in the national communication, a reduction of about half of this amount is given, as a result of implemented and planned measures, resulting in a growth rate of 4.2 per cent per annum of emissions in 1995-2000, falling to 3.6 per cent per annum in 2000-2005.

43. In the projections being developed, a baseline scenario has been constructed assuming growth in transport and the foreseeable improvements in the stock of vehicles. The increase in passenger and freight transport is assumed to be met by cars and lorries, respectively, whereas bus and rail will remain stable or only slightly increase. From this and other assumptions, such as the continued electrification of rail transport from the present level of 80 per cent of the transport work, it follows that total emissions from transport will grow in the period from 1995 to 2005 and reach 1990 level in about 2005.

44. Slovakia has also presented projections of non-energy emissions, all showing a declining trend in line with agricultural and industrial production. These include CO_2 emissions from three industrial sources, namely, production of cement, lime and magnesium oxide refractory bricks. Projection of fugitive CH_4 emissions from the gas distribution network assumes the same level of leakage as in the year 1990. Recognizing the uncertainties in the ongoing transformation process, the national communication asserts that historical trends cannot be used for emission projections, and that there is a considerable degree of uncertainty in the projections of GHGs other than CO_2.

V. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION MEASURES

45. Slovakia has relied on long-term observations rather than global climate models in conducting its vulnerability studies. The results show that a 2.5°C increase in temperature is anticipated with the doubling of CO_2 concentrations in the atmosphere; this, coupled with the absence of snow cover in low lands and increased evaporation, could decrease water resources by as much as 20 per cent. A reduction in river discharge has already been observed. In forests, a change in composition from spruce to deciduous species could increase yields by 10-30 per cent. In agriculture, a 30 per cent increase in the production of winter wheat and other crops is expected with the doubling of carbon dioxide concentrations. However, the overall impact is likely to be negative.

46. The Forest Research Institute is developing projects for adaptation measures in ecological systems of forest management, biodiversity and forest protection. Long-term strategies for adaptation in agriculture, including changes in crop cultivation technologies and practices, are also being devised.

VI. INTERNATIONAL COOPERATION

47. A national panel was set up in 1995 to identify, prepare and evaluate joint implementation projects. The panel is chaired by the Ministry of the Environment, with the Ministry of Economic Affairs as the vice-chair, and with a secretariat in the Energy Agency, thus effectively involving all the principal actors. Other members of the panel include the Ministries of Transport, Agriculture, Construction and Foreign Affairs. The first meeting of

the panel was held in March 1996. Two proposals are under consideration, in the industry and forest sectors.

48. The iron and steel plant (which accounts for 16 per cent of total carbon dioxide emissions) has prepared a project for a combined heat and power plant which would cut its emissions by 20 per cent. The Forest Research Institute has prepared an afforestation project, for development of biomass energy through fuel switching in district heating plants at ten locations.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

49. Slovakia has a national climate research programme coordinated by the Ministry of the Environment. The programme has developed national activities in accordance with the World Climate Research Programme; it also prepares material and information for government bodies and coordinates research.

50. The country has data relating to precipitation and temperature going back to 1871, water flow data from 1931 and groundwater data from 1961. These data have been used to prepare homogeneous climatological and hydrological long-term data series to provide preliminary assessments of possible climate change impacts upon water management, agriculture and forestry, and work to design framework adaptive strategies has begun.

VIII. EDUCATION AND PUBLIC AWARENESS

51. The review team was informed that the Ministry of the Environment and the Ministry of Education are working together to develop material on climate change for public distribution, and enhance the low level of public awareness concerning climate change.

52. The first national communication on climate change has been distributed widely to ministries, government departments, research institutes, schools, libraries and non-governmental organizations. Information booklets have been prepared on global warming, impacts of climate change, mitigation and adaptation strategies and on the Slovak climate change policy. Dissemination of the information has been done through radio presentations, newspaper articles, press conferences and seminars.

53. The municipality of Rajec, which participates in the network of European "Brundtland Cities", is conducting a pilot project to increase public awareness of the need for greenhouse gas mitigation, seen in the wider context of sustainable development, through the active participation of the citizens in local initiatives.

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