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## LITHUANIA

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

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## I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Lithuania ratified the Convention on 23 February 1995. Its first national communication (NC1), due on 23 August 1995, was received in May 1998. The in-depth review of the NC1 was conducted between January and May 1999 and included a country visit by a review team from 22 to 26 March 1999. The team members were Dr Pojanie Khummongkol (Thailand), Mrs Gunta Pinke (Latvia), Mr Felix Christian Matthes (Germany) and Ms Amrita Narayan Achanta (UNFCCC secretariat, coordinator).
2. Lithuania is situated on the east coast of the Baltic Sea and has a land area of 65,301 square km, of which 30 per cent is forest, 60 per cent is cultivated land and the remainder is under other uses. A slowdown in population growth has led to a population of 3.7 million in 1998. Approximately 68 per cent of the population lives in the urban areas. The country has a temperate climate with relatively high levels of precipitation. Its territorial organization and administration has three levels: the national level, the regional level (10 counties), and the local level (56 administrative districts, including 12 municipalities). Most of the climate-related policies are implemented at the national level, though local government is responsible for the preparation of energy plans, and the transport, space heating and waste management sectors. Lithuania applied for European Community (EC) membership in 1995. Since 1998, the Lithuanian Constitution has required each new legal act to conform to EC requirements and directives.
3. The general recession that the country went through in 1991-1994 is reflected in the changes in gross domestic product (GDP) and industrial output. In 1992, GDP decreased by 36 per cent and industrial output by 52 per cent. It declined further in 1993 by 23 per cent, but then started to rise in 1994. The situation improved in 1995, when GDP increased by 3.3 per cent. In 1996, the real increase in GDP was 4.7 per cent and in 1997, 5.7 per cent. 1997 marked an improvement in all the economic sectors. In the first half of 1998, GDP continued to grow but the growth rate slowed in the second half as a result of the financial crisis in the Russian Federation. The team noted that the Russian Federation is a key trading partner, accounting for 21.4 per cent of Lithuania's exports in 1997 and 21.6 per cent of its imports; a dependence also evident in the case of the import of crude oil and natural gas which is from Russia only.
4. The principal stimulus for change in the Lithuanian economic system came when the country regained its independence from the former Soviet Union in March 1990. Since then, the economy has undergone far-reaching structural change, with declines in the share of industry (57 per cent in 1990 to 25 per cent in 1997) and agriculture (23 per cent in 1990 to 12 per cent in 1997). The manufacturing industry dominates over agriculture and forestry. The services sector has shown an increasing trend (from 7 per cent in 1990 up to 55 per cent in 1997). Between 1993-1997 the share of the services rose from 16 to 55 per cent. The loss of a significant part of the market for industrial and agricultural goods due to the collapse of the former Soviet Union in turn led to a significant fall in production at the beginning of the transition period. In 1994, the real output of industry was 33 per cent of the 1990 level, and that of agriculture 55 per cent. The

ongoing privatization has also resulted in the transfer of a majority of industrial assets from state to private ownership, except in the case of industrial activities such as oil refining.

5. Lithuania has extremely limited indigenous energy resources (wood, peat, hydro and some oil), which accounted for around 8.5 per cent of the energy balance in 1997. In 1997, the total primary energy supply declined by 47 per cent compared with 1990 levels. Of the 9.4 million tonnes of oil equivalent of energy resources consumed in 1997, oil products accounted for 36 per cent, natural gas 21 per cent, nuclear energy 33 per cent and other resources (hydropower, coal, peat, firewood) 10 per cent. For the same year, the breakdown of energy end-uses was: electricity generation (37 per cent), heat production (20 per cent), final energy requirements in industry, transport, household and other end-use sectors (31 per cent) and other categories including oil refining, fuel losses and non-energy requirements (12 per cent). The team observed that during 1990-1997, final energy consumption declined by 58 per cent. In 1997, the dominant shares of energy consumption were held by the transport sector at 45 per cent, and the household sector at 27 per cent; industry accounted for 14 per cent and other categories 14 per cent.

6. The team was informed that 80 per cent of the total electricity produced in 1997 (14.86 TWh) was from nuclear plants, 14 per cent from thermal power plants and 5 per cent from hydropower plants. For the same year, most of the heat produced was in the urban district boiler houses (40 per cent), power plants (33 per cent), power plants and boiler houses of industrial enterprises (19 per cent) and other sources (8 per cent). Of the heat produced, households consumed 48 per cent, industry 31 per cent, agriculture 2.5 per cent and others the remainder. Fifty-five per cent of all buildings, and 70 per cent of urban buildings are connected to district heating systems.

7. In 1995-1996, subsequent to the country's ratification of the United Nations Framework Convention on Climate Change (UNFCCC), a Lithuanian country team under the guidance of the National Committee for the Implementation of the UNFCCC (National Committee from hereon) in Lithuania (constituted in March 1995, comprising officials at the level of vice-minister and chaired by the Vice-Minister for the Environment), prepared a framework national implementation strategy (NIS) under the CC: TRAIN, (joint UNFCCC secretariat and United Nations Institute for Training and Research) programme. This strategy approved by the Government on 25 October 1996, constituted the basis of the first national communication (NC1), prepared in 1998 by a country team comprising representatives from the ministries of the environment, economic affairs, transport and agriculture, Vilnius University, the academies of science and agriculture, and others.

## II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

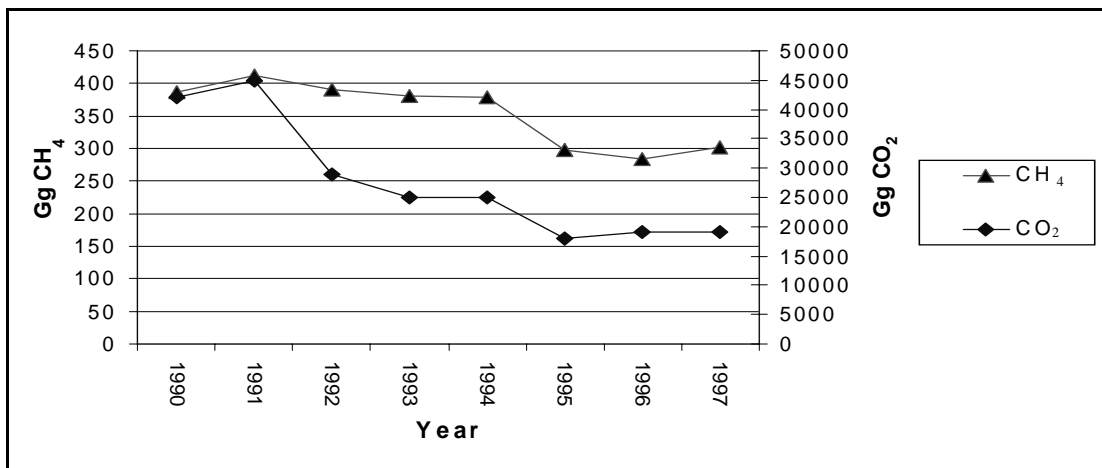
8. The team gathered that the preparation of the national inventory is primarily the responsibility of the Ministry of the Environment. Inputs into the process are also provided by the Lithuanian Academy of Science and the Department of Statistics. The NC1 includes coverage of the greenhouse gases (GHGs), namely carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulphur dioxide (SO<sub>2</sub>) and the precursors, carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), and non-methane volatile organic compounds (NMVOCs) for 1990 only. Emission estimates for hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) were not included in the national greenhouse gas inventory as the team was informed that they are neither produced nor consumed in Lithuania. No complete estimates of emissions for subsequent years were provided to the team.

9. In general, Lithuania used the 1995 Intergovernmental Panel on Climate Change (IPCC) methodology in preparing its national GHG inventory for the base year 1990. During the visit, the country officials provided the IPCC standard data tables for all the sectors and gases. The team noted that though Lithuania did not submit the worksheets for fuel combustion, land-use change, agriculture and forestry, it did provide a 1990 summary report of all GHGs in the NC1 (table 1).

**Table 1. Greenhouse gas emissions and removals in 1990 (Gg)**

GHG source and sink categories	CO <sub>2</sub> emissions	CO <sub>2</sub> removals	CH <sub>4</sub>	N <sub>2</sub> O	CO	NMVOC
Energy	37 332		31.4	1.0	644	81.4
Industrial processes	2 203		0.2	1.4		1.2
Solvent and other product use						11.1
Agriculture			180.7	10.8		
Land-use change and forestry	2 803	11 651				
Waste			165.7			
<b>Total</b>	<b>42 338</b>	<b>11 651</b>	<b>378</b>	<b>13</b>	<b>644</b>	<b>94</b>

10. The team noted that in 1998 no annual submission of inventory data was made to the UNFCCC secretariat. Subsequent to the visit in 1999, some emission estimates for CO<sub>2</sub>, CH<sub>4</sub>, CO, NMVOCs, SO<sub>x</sub> and NO<sub>x</sub> (figure I covers the 1990-1997 period) from fuel combustion for 1980-1997 were provided to the UNFCCC secretariat, based on the format of the 1979 Convention on Long-range Transboundary Air Pollution, and more detailed estimates were provided for 1995, 1996 and 1997. In the case of the latter, the team found that the lack of information on the correspondence between the categories of the 1979 Convention and those of the IPCC did not allow for a comparison of the data for various years across IPCC sub-categories. Consequently, the team was unable to use the emission data provided for 1995, 1996 and 1997, in this report. The review team suggested that future work aim at preparing a consistent data set for the entire period 1990-1997, using the IPCC 1996 methodology. Lithuania chose to use the 1994 values of the global warming potential instead of the IPCC 1995 values for a 100-year time horizon.

Figure I. Annual CO<sub>2</sub> and CH<sub>4</sub> emissions from fuel combustion, 1990-1997 (Gg)

11. The data for aggregated emissions from fuel combustion in figure I, indicate that CO<sub>2</sub> (the 1997 level fell by around 55 per cent over 1990 levels) and CH<sub>4</sub> (the 1997 level fell by around 22 per cent over 1990 level) showed a declining trend. The review team noted that, given the major contribution (44 per cent in 1990) of the energy and transformation sector to total CO<sub>2</sub> emissions from fuel combustion, the decrease in overall CO<sub>2</sub> emissions from fuel combustion between 1990 and 1997 can be partially attributed to the share of electricity generation from fossil fuels dropping significantly from 39 per cent in 1990 to 14 per cent in 1997, whereas the share of electricity generated by the Ignalina nuclear power plant grew from 60 per cent in 1990 to 80 per cent in 1997. Other reasons for the steep drop in CO<sub>2</sub> emissions between 1991 and 1992 were a decline in GDP of around 36 per cent in 1992 and a reduced industrial output.

12. The CO<sub>2</sub> emissions by sector in 1990 are shown in table 2. Residential and commercial space heating accounted for approximately 17 per cent of the total CO<sub>2</sub> emissions from fuel combustion in 1990, and is based on the use of residual oil and gas. Other sub-categories contributing to the CO<sub>2</sub> emissions from fuel combustion included industry at 15 per cent, transportation at 16 per cent, and others at 8 per cent. In 1990, road transport had the dominant share of transport CO<sub>2</sub> emissions at 83 per cent, followed by 10 per cent from aviation, 7 per cent from rail, and 0.3 per cent from shipping. The team learned that this emission estimate for transport was expected to be an underestimate, due to the exclusion of unofficial fuel imports. The team also noted the trend towards an increased consumption of gasoline and diesel and a very steep decline in the use of liquefied petroleum gas and compressed natural gas between 1992 and 1997. In 1996 and 1997, there was a noticeable increase in diesel consumption. The country's cement, lime and brick industries accounted for the dominant share of the CO<sub>2</sub> emissions from industrial processes. The other GHG emissions from industrial processes are N<sub>2</sub>O emissions from nitric acid and fertilizer production, CH<sub>4</sub> from organic chemicals, NMVOCs from paper pulp and bread factories, and NO<sub>x</sub>.

**Table 2. Emissions and removals of carbon dioxide, by source and sink, 1990 (Gg)**

<b>Sector</b>	<b>Emissions</b>
Energy and transformation	16 352
Industry	5 379
Transport	5 791
Residential heating	6 313
Other	2 882
Industrial processes	2 203
Land-use change and forestry emissions	2 803
Biomass combustion	615
<b>Total</b>	<b>42 338</b>
Land-use change and forestry removals	-11 651

13. Lithuania's total forest area in 1990 was about 1.9 million hectares. In 1990, CO<sub>2</sub> emissions from this sector amounted to 2,803 Gg while CO<sub>2</sub> removals for the same year were 11,651 Gg. The NC1 stated that a large amount of CO<sub>2</sub> was sequestered by the biomass stock and the abandonment of managed lands, whereas the emissions in this sector were from felling in managed forests and CO<sub>2</sub> release during land conversion. The team learned that Lithuania had started conducting forestry inventories at five-year intervals in 1956. The most recent was that of 1993, when a computerized database, "Forests in Lithuania", was used. On the other hand, the hosts informed the team that the information on land-use change during the last 20 years was not very accurate, as the statistical data were not abundant. The review team was unable to obtain a clear picture on the levels of uncertainty associated with these estimates.

14. In 1990, the total CH<sub>4</sub> emissions were estimated at 378 Gg, the dominant share being that of agriculture at 47 per cent, followed by waste at 43 per cent, the energy sector 8 per cent, and industry the remainder. The NC1 reported 162 Gg of CH<sub>4</sub> emissions from landfills and 3.7 Gg from waste-water treatment plants (2.4 Gg from industrial waste-water and 1.3 Gg from domestic and commercial waste-water). The review team felt that CH<sub>4</sub> emissions from landfills were quite high compared to other countries, considering that Lithuania's population was around 3.7 million. The team was informed that one of the possible reasons was that the activity data for solid waste generation were currently supplied by the municipality waste producer and were not completely reliable. The team noted that more recently there had been some improvements in activity data for solid waste generation and this would affect future estimates. During the visit, a revised per capita waste generation rate of 0.367 kg/person/day for Vilnius/Kaunas was provided to the team. No information was provided on the level of uncertainty. The Lithuanian officials also informed the team of ongoing efforts to improve the activity data from this sector, which included the survey and registration of a total of 1,595 industrial and agricultural enterprises in 1994. Subsequently, the original system of waste classification and inventory, was adapted and is now based on the EC requirements, waste list, classification and catalogue. In future, the inventory is to be extended to include waste incineration and waste recycling. The review team was also informed of a Danish project initiated in 1998, under which registration of waste

collection, transport, recovery and disposal enterprises is to commence. This is expected to lead to both regional and national databases lists of enterprises and activity data.

15. Lithuanian agriculture was the second largest source of CH<sub>4</sub> emissions in 1990, at 181 Gg. Of the total agricultural CH<sub>4</sub> emissions, enteric fermentation contributed 87 per cent and manure management 13 per cent. In the absence of more recent emission data from this sector, the review team noted some of the trends in activity level in the sector. The total number of livestock (i.e. cattle, sheep, goats, horses, swine and poultry) declined from 22.7 in 1990 to 9.8 million in 1998.

16. In 1990, of the total N<sub>2</sub>O emissions, estimated at 13 Gg, the largest contribution was from agriculture at 82 per cent, followed by industrial processes at 11 per cent and the energy sector at 7 per cent. As in the case of CH<sub>4</sub> emissions, the review team in the absence of trend estimates of N<sub>2</sub>O emissions from the agricultural sector, instead studied the trends in activity level for nitrogenous fertilizer application, as reported by the Department of Statistics. A declining trend in nitrogenous fertilizer application during 1993-1995, from 57,700 to 32,600 tonnes; and an increase in fertilizer application after 1997 was noted. The estimate from industrial processes included emissions from both nitric acid and fertilizer production.

17. The NC1 reported that total emissions of CO, NMVOCs, and NO<sub>x</sub> for all sectors in 1990 were 644 Gg, 94 Gg and 178 Gg, respectively. Fugitive emissions of NMVOCs during oil storage were also reported. Additional data were provided during the visit on CO, NO<sub>x</sub> and SO<sub>2</sub> released. The emissions relating to production and consumption of HFCs, PFCs and SF<sub>6</sub> were not taken into consideration by the country. Emissions from the use of international bunker fuels were not reported in the greenhouse gas inventory. Estimates of emissions from international bunker fuels were limited to marine bunker fuels which were estimated at 273 Gg for 1990.

### **III. POLICIES AND MEASURES**

18. The country reported CO<sub>2</sub> mitigation measures by sector, as required by the UNFCCC guidelines (with limited reporting of measures to reduce other gases). Although the NC1 did include the estimated reduction in CO<sub>2</sub> emissions for 27 measures, during the visit the team gathered that these estimates did not have a firm basis, were likely to be on the high side and were due to be revised. The team noted that the estimates were based in some instances on underlying assumptions described in the NC1. Additionally the host country indicated that, subsequent to the NC1 submission, estimates of GHG reduction due to the use of indigenous fuels and renewable energy sources had been made, but these were not provided to the team. The review team primarily relied on the additional information provided by the country and also policy documents such as the National Energy Strategy (NES) and the National Energy Efficiency Programme (NEEP), which are discussed later.

19. The team noted that it was difficult on the basis of the NC1 to distinguish between implemented and planned policies. During the visit, the team sought clarifications on this issue by sector, which showed that the measures were in various stages of implementation and were primarily being implemented by the national government. No information was provided on the

action taken by the municipalities, in spite of their competence in areas such as district heating and waste management. The team noted that some of the policies and measures undertaken at the national level were planned with the aim of converging with the legislation of the EC.

#### **A. Cross-sectoral policies**

20. In January 1992, the Lithuanian Government approved the first National Energy Efficiency Programme (NEEP), the first national programme to be introduced since the country gained independence. In 1996, an amended version of the NEEP, referred to as the Programme on the Development of Efficiency in National Energy Consumption (DENEK) was developed. Among its targets for the period 1996-2000 are the preparation of legislation and energy efficiency standards, renovation and modernization of existing buildings, promotion of indigenous energy and renewable energy utilization, and development and installation of control and metering equipment for heat and electricity consumption. Based on the DENEK and additional information provided during the visit, the review team gained the impression that implementation of the DENEK programme focussed to some extent on the regulatory basis of energy efficiency policies and measures. The team noted that in the NC1, the policies and measures relating to energy efficiency were reported at a very aggregated level, but the document *Main Means for Implementation of the National Energy Efficiency Program in 1996-2000*, also approved by the Government in November 1996, shows an impressive planned list of 46 activities. The ongoing parliamentary review of the NEEP, which was in progress during the review visit, was expected to lead to the consideration of additional measures.

21. The responsibility for implementing the DENEK programme lies with the Energy Saving Programme Directorate set up within the Lithuanian Energy Agency. The team gained the impression that funding difficulties generated some delays in the implementation process, a lack which is to be addressed by the Energy Conservation Fund. This fund was set up in 1996 to promote energy efficiency and renewable or indigenous energy sources. It is based on the state budget and multilateral funding, and targets a reduction in both industrial energy intensity and energy imports. The team was not provided with any information on the projects functioning under this fund. The team was also informed of a draft Energy Conservation Law, which was yet to be adopted by the parliament.

22. The National Energy Strategy (NES) was approved for the first time in 1994, for a 20-year planning horizon. In accordance with the 1995 Energy Conservation Law, the NES is to be updated at five-year intervals. Consequently, a draft NES prepared in 1998 for the period up to 2020 was under review during the visit, and was to be adopted in the future by the parliament. The NES is based on research partially undertaken with the support of the EC Poland and Hungary Assistance for Restructuring Economies (PHARE) programme. It defines the main thrust of measures to modernize the energy sector, including enhanced energy efficiency, improved cost-effectiveness, energy management and environmental protection among other issues. The NES also facilitates harmonization with the EC requirements, the Energy Charter and other international agreements. Other policy documents which have a limited climate change relevance included the National Environmental Strategy approved in 1996 and the action programme for its implementation adopted in the same year. With regard to subsidies in the



energy sector, the team learned that such subsidies had gradually been phased out up to 1998. According to officials, the prices of gasoline and oil products have been deregulated since 1993 and those of electricity, gas and district heating since July 1997. Currently, energy prices are based on production costs. Only a limited number of consumers receive subsidies from the Ministry of Social Protection for centrally distributed heat, gas and hot water, in instances where expenditure on heating and domestic hot water exceeds 25 per cent of the individual's income.

### **B. Energy supply and transformation**

23. The host country pointed out that electricity production had dropped from 28.4 TWh in 1990 to 14.86 TWh in 1997, due to a steep decline in final energy consumption during 1990-1997 and a fall in electricity exports from 12 TWh in 1990 to 3.5 TWh in 1997. The review team also noted that there had been a 60 per cent drop in demand for district heating between 1990 and 1997, leading to a reduction in fossil fuel consumption for district heating. Overall, fossil fuel consumption for both power generation and district heating in 1997 amounted to 37.5 per cent of the 1990 level. Within power generation, the team noted that the share of fossil fuels had declined from 39 per cent in 1990 to 14 per cent in 1997, while that of nuclear power from the Ignalina nuclear power plant (Ignalina NPP) rose from 60 per cent in 1990 to 80 per cent in 1997. In 1997, of the 14.86 TWh of electricity produced, 12.02 TWh came from the Ignalina NPP, 2.07 TWh from thermal power plants (fired mainly with residual oil and to a lesser extent natural gas) and 0.77 TWh from hydropower plants.

24. These structural changes that have occurred within the energy sector since 1990 are indicative of two potentially major problems in the energy supply and transformation sector. The team noted that the possible shutdown of the Ignalina NPP by the end of the next decade and the consequent development of alternative sources of electricity would have a significant impact on future emissions, due to the current high contribution of nuclear power to electricity generation. The phase-out of the Ignalina NPP is expected to be considerably influenced by the progress of the country's accession to the EC. The second problem relates to heat (steam and hot water) production and consumption. Most of the heat produced is consumed by the residential sector (48 per cent), followed by industry (31 per cent) and others, with final heat consumption showing an overall decreasing trend in all the above sectors in part due to the introduction of efficiency measures (such as meters, and insulation) and also due to the privatization process. Since many industrial and other enterprises of the Lithuanian economy went bankrupt leading to their closure, the relative share of heat consumption of the residential sector increased, although it did not increase in absolute terms. Additionally the team learned of the losses and reduced efficiency within district heating systems, due to the lack of control and metering equipment in small industrial and residential consumers; losses occurring within the distribution network range from 19 to 24 per cent, although some success was noted in reducing them at the level of individual enterprises. The host officials indicated that the pace of renovation in the case of the district heating network supplying residential consumers was slower due to the modest financial resources available to them.

25. The team noted that heat production was based on residual oil (37 per cent), natural gas (55 per cent) and other fuels. The team raised the concern that, in view of recent pricing trends

favouring residual oil over natural gas, residual oil could in the near future be preferred to natural gas for use in district heating boilers, in turn leading to increased emissions. Subsequent to the visit however this price trend has been reversed favouring natural gas. Also the use of heavy fuel oil is limited due to the Law on Taxes for Pollution which discourage the use of lower quality fuels. The team concluded that, with the expected strengthening of incentives for energy efficiency improvements and in view of the varied heat consumption trends caused by economic changes, the changes in the ownership structure of the housing stock and the production and distribution facilities assume significance.

26. In both the district heating and electricity sectors, a gradual process of liberalization and privatization began in mid-1997. As a first step, the ownership of district heating grids and cogeneration and heat plants was transferred from the state-owned Lithuanian Energy Company to the municipalities. In a second step, yet to be implemented, an independent company will take over the distribution grids, which are to be separated from generation and transmission. In the electricity sector, the Ignalina NPP continues to be operated as a separate state-owned enterprise. The team noted that the de-monopolization process may introduce enhanced competition into the electricity sector. Taking into account the sizeable surplus capacity of Lithuania and the low short-run marginal costs of electricity generation of Ignalina NPP, there may be problems of competition for the existing municipal and industrial cogeneration plants and for new investments in this sector.

27. The 1998 NES predicts that the share of indigenous fuels (local oil, peat, wood), renewables and waste energy resources will rise to 5.2 per cent of total primary energy supply (TPES) in 2000 and 14.8 per cent in 2020. The Strategy's goals are based on experience of state-of-the-art pilot projects which have already started, such as the waste treatment plant in Utena, the Klaipeda geothermal plant and boiler conversion projects. By an order dated January 1999, the Ministry of the Economy promotes the development of autonomous energy equipment utilizing renewables and targets the installation and effectiveness of renewable energy. The order establishes a contract price for the joint stock venture "Lietuvos Energija" for the purchase of autonomous energy produced using renewables. For instance, the minimum feed-in price of LTL 0.265 per kWh for electricity produced from wind power stations, leads to a payback time of seven to nine years for such stations. The team noted that the draft Law on Energy Saving encourages the Government to invest in renewable resources and provides price and tax incentives for renewable energy. The Law also sets minimum quotas of renewable-based power generation for every power supplier. With regard to the conventional renewables, Lithuania's large hydropower plants currently have a capacity of 706 MW (Kruonis pumping station, Kaunas hydropower station and other plants). The NC1 also reported hydroelectric schemes on the Neris and Nemunas rivers which have shown a realistic potential of 100 MW for the Neris and 200 MW for the Nemunas. The hosts informed the team that the mitigation effect of both plants, if implemented, would be less than that reported in the NC1.

28. The Klaipeda geothermal pilot plant, with a capacity of 40 MW, is due to be commissioned at the end of 1999, under a project being financed by loans from the Global Environment Facility, the World Bank, the Danish Energy Agency, the PHARE programme and the Lithuanian state budget. Lithuania is currently negotiating additional funding with Germany.

The team learned of an information and screening service provided by the Lithuanian Energy Agency on the feasibility of small hydropower and solar thermal facilities. So far, the Lithuanian Energy Agency has facilitated the reconstruction of 30 small hydroelectric plants using funding from private investors. Furthermore, a pilot solar-thermal installation of 150 sq m for a children's sanatorium is in the initial stages of implementation, with Danish collaboration. The Lithuanian municipalities are urged by the national government to develop municipal energy plans. In this framework, a National Bioenergy Programme was developed to promote and advise on bioenergy sources. Some facilities for biofuel use (waste-water treatment plant, landfill gas use, etc.) are planned. Funding is expected to come from international sources, municipalities and some private investors.

### **C. Residential and commercial sector**

29. According to the Lithuanian energy balances, residential energy consumption fell by 32 per cent from 1990 to 1997. Residential electricity consumption decreased slightly between 1990 and 1993 and rose subsequently till 1997 to levels close to those of 1990. The total final energy consumption of the commercial and public service sectors declined from 1990 to 1997 by 46 per cent. In contrast, the electricity demand in these sectors grew by more than two times in the same period, mainly because of the fast penetration of electrical appliances. The residential sector is a key area for energy saving. In 1997, it accounted for 34 per cent of total final energy demand, with space heating (including heat transmission and distribution) showing the largest potential for improved energy efficiency. Moreover, the potential for cost-effective energy saving measures in the sector is estimated to be as high as up to 45 per cent, according to the 1998 NES. Finally, the privatization of 92 per cent of the housing stock, which is relatively old, badly insulated, with poor regulation of heating and poor quality of construction, has led to the transfer of ownership from municipalities to homeowners' associations. The high energy consumption within the sector in combination with the significant hike in energy prices creates severe economic burdens for the private owners. Although this should normally be an incentive to invest in energy efficiency measures, the varying access to investment capital for homeowners hampers improvements in many cases. Nevertheless, improvements in energy efficiency have taken place, thanks to the introduction and further improvement of building standards, the activities of the Housing Fund and energy audits.

30. The team was informed of the functioning of the Housing Fund set up in 1994 by the Ministry of Construction and Urban Development. Since 1995, this fund has provided approximately LTL 9 million for primary measures, e.g. modernization of heating systems, and window insulation. In 1996, the reorganization of the fund led to the creation of the Housing Credit Fund, which obtained US\$ 10 million from the World Bank, US\$ 6.5 million from the Lithuanian state budget, US\$ 0.5 million from municipalities, US\$ 1.6 million from homeowners' associations, and US\$ 2.5 million from international donors. At present, a sum of approximately US\$ 20 million is at the Fund's disposal for allocation till 2001, the broad allocation being 80 per cent to homeowners' associations or multifamily housing, 10 per cent to single family houses and 2 per cent to schools, the remainder going towards technical support. In 1997-1998, the loans totalled US\$ 2 million, together with LTL 12 million from the Lithuanian budget and extra budgetary funds, the loans being used for upgrading of heating systems,

insulation of windows, and roof renovation, among other improvements. So far, an amount of LTL 1.8 million has gone to schools and LTL 7-8 million to the residential sector. Technical monitoring of the project showed that maximum saving of energy was achieved in schools. Additionally, five towns have consultancy facilities paid for by the fund for the provision of associated technical, financial and legal assistance. The team noted that 302 homeowners' associations had registered till the date of the review for energy audits, a stipulation for receiving credits; 113 audits had been completed and 35 housing associations had received loans.

#### **D. Transport sector**

31. The transport sector has been identified by the Lithuanian Government as being among the priority sectors for investment. In terms of trends, passenger transport (including railways, buses, trolleybuses, ships and inland waterways) dropped from 13,465 million passenger-kilometres in 1991 to 4,315 million passenger-kilometres in 1997. There was a simultaneous increase in the number of private cars. Of the passenger-kilometres travelled on public transport, road transport dominated with a 74 per share, followed by railways at 17 per cent and air travel at 8 per cent. In 1997, the distribution of road vehicles by type was: cars (86 per cent), lorries (8.3 per cent), motorcycles (1.9 per cent), buses (1.4 per cent), trolleybuses (0.1 per cent) and others. The team was cautioned that the actual number of vehicles in use could be lower, as the registration system was a permanent one, not an annual or biennial one. There has been a decline in freight transport, both by road (from 295.6 million tonnes in 1991 to 58.8 million tonnes in 1997; 7,019 million tonne-kilometres in 1991 to 5,146 million tonne-kilometres in 1997 ) and by rail (from 63.9 million tonnes in 1991 to 30.5 million tonnes in 1997; 17,748 million tonne-kilometres in 1991 to 8,622 million tonne-kilometres in 1997). The team also learnt that the international corridor, "Via Baltica", which since 1993 had registered a 25 per cent increase in transit traffic, has now been given the status of an international motorway.

32. The team noted that the measures listed under transport in the NC1 were limited to the 1994 National Transport Development Programme up to the year 2010. The programme, which has a separate environmental section, had been revised and was under consideration at the time of the review visit. Among the measures additionally identified by the team, was the application of a differential customs duty depending on the year of manufacture of the vehicle. The intention was to bring about replacement of the vehicle fleet, which has hitherto consisted of ex-Soviet models, and thus improve fuel efficiency. For cars older than 10 years, the rate of duty was 10 per cent of the base price, for cars 5-10 years old the rate was 5 per cent, and for cars less than seven years old, no duty was charged. This customs duty is likely to be abolished in 2000 because of free trade agreements. It is unlikely that this differential customs duty has achieved its goal, as the average age of passenger cars is 13.6 years.

33. The excise tax on fuel at the time of the visit in 1999 was LTL 1,210/tonne for gasoline and LTL 560/tonne for diesel, a device to encourage the use of diesel. The excise tax makes up 52 per cent of the gasoline price and approximately 50 per cent of the diesel price. The team noted that a planned increase in the excise tax on diesel could level prices and lower this impact.

34. The bus fleet fell from 16,000 in 1990 to 14,800 in 1998. Of the fleet, 80 per cent is considered old by officials, partly because of a drop in renewal. The team learned that in 1998, 81 new Euro-1 buses were added to the fleet in implementation of the National Transport Development Programme. A limited (and declining) amount of subsidy, estimated at 15 to 20 per cent of the operating costs and amounting to LTL 70 million, is disbursed annually. Some transport utilities operate on a completely commercial basis. Whereas the subsidies for municipal bus transport are provided by the Ministry of Municipalities and Management Reform, the railway company is subsidized by the Ministry of Transport and Communication. In 1998, the Lithuanian Railways received a subsidy of LTL 12.7 million for public transport, which is to be compared with the required sum of LTL 123 million. Moreover, the team was told that it was difficult to increase fares because of the political sensitivity of such action. The estimated revenue from ticket sales in 1993 covered just 30-45 per cent of the operating costs of the public transport companies. The team was not provided any additional information on how the current gap in funding was being covered given the declining subsidies. The team also learned of the preparation, with PHARE funding, of master plans for urban transport for Vilnius and other major Lithuanian cities and the operation of trolley buses in Vilnius and Kaunas.

#### **E. Industrial sector**

35. Industry's contribution to GDP fell from 44 per cent in 1990 to 24 per cent in 1997. In terms of energy consumption, the sector had the third largest share of 14 per cent in 1996, with petroleum products, electricity and heat leading the way, followed by coal. Within the industrial sector, the chemicals, building materials, textile and leather sectors showed varied rates of expansion up to 1996 whereas the metallurgical, engineering and food processing sectors showed a decline.

36. The host officials informed the team that emissions from the cement, lime and brick industries, contributing the dominant share to industrial process emissions were expected to decrease by around 30 per cent by 2000, compared to the 1990 level due to reduced demand for construction materials and consequent reduced production. Emissions from the cement industry, a major source of industrial process emissions, have declined because of the fall in cement output (from 3.4 million tonnes in 1990 to 0.7 million tonnes in 1997). This decline has been attributed to the recession, the efforts that the industry has been making to reduce energy costs, and the influence of export markets. During the review, the team learned that the Government had targeted the environmental performance of the industrial sector via the use of environmental impact assessments, which prevented the creation of new pollution sources. It had also recommended the introduction of cleaner production as an important policy objective of the 1996 National Environmental Strategy and Action Programme and was operating a Pollution Prevention Centre (PPC).

37. The PPC, which was opened in 1998 at the Institute of Environmental Engineering of Kaunas University of Technology, was considered by the team to be a useful initiative. Originally the PPC was funded completely through international funding but at present is state and project funded. The PPC was originally financed entirely from international sources but is now state- and project-funded. In 1999, the PPC training programme was allotted

LTL 24,500 (US\$ 6,125) from the state budget, which covers approximately 50 per cent of the Centre's budget. Seminars were conducted by the PPC for representatives of municipalities, industry, regional environmental departments and the Ministry of the Environment, and dealt with subjects such as "cleaner production" projects (e.g. waste minimization, efficient use of raw materials and resources such as energy and water, and minimization of air and water pollution). The seminars also helped to identify low-cost, good housekeeping measures and low-cost, short-payback investments. Among the projects being implemented which had a potential impact on climate change was the reconstruction of boiler houses and windows. According to the host country, the payback periods of most "cleaner production" projects could be classified as: less than 1 year (38 per cent), 1-2 years (20 per cent), 2-3 years (26 per cent), and 3 years (16 per cent). By applying "cleaner production", the energy consumption of an enterprise could be reduced by 46 per cent.

38. The financing of such "cleaner production" projects in industry was favoured by the creation by the Ministry of the Environment in 1996 of the Lithuanian Environmental Fund for Investment. The criteria for project selection include the use of new low-waste technologies and appropriate equipment, waste management, and the construction and renovation of water treatment plants. The fund which started operations only in 1999 includes two projects having a climate change relevance, namely a boiler conversion to wood waste in a paper company and the improvement of diesel-fuelled road vehicles and tractors. Additionally, the Nordic Environmental Finance Corporation (NEFCO) and the Council of Nordic Countries, have initiated a cleaner production capacity-building programme in Lithuania (1995-1999) and also promote the activities of the PPC. So far four "capacity-building schools" have been conducted during which a number of cleaner production projects were approved and received financing. These schools were initially conducted using Norwegian expertise and also involved the PPC. Furthermore, a revolving facility for cleaner production investments was established by NEFCO in 1998. Its objective is to finance on favourable terms the implementation of high priority cleaner production projects with short payback periods of up to three years. Till the date of the review, NEFCO has approved cleaner production investments in 16 Lithuanian companies. The review team noted that it was too early to have a reaction to the PPC from industry.

#### **F. Land-use change and forestry**

39. The team was informed about the 1998 state forest assessment, based on a stand-wise forest inventory. This assessment showed that the forest stands cover an area of about 1.9 million ha, approximately 30.3 per cent of the land area, an increase of 27,800 ha over the previous inventory in 1993. The team learned that not only did the forest area increase but also the timber volume rose by 14 million m<sup>3</sup>, an increase of approximately 3 million m<sup>3</sup> annually, over the same period. Furthermore, the host country experts indicated that the current distribution of forest stands according to maturity groups comprises 26 per cent of young stands, 41 per cent middle-aged stands, 20 per cent premature and 13 per cent mature stands. Reforestation has been encouraged by the 1994 Forest Law stipulation that it should follow within two years of the harvest. In the case of afforestation, state forest enterprises financed their own activities, and in the case of private individuals the state forest enterprises provided free consultations and planting material at reduced costs. Apparently there has been a shortfall in the

income of the state forest fund, as a result of reduced returns on timber following a drop in international prices, which has had repercussions on fund allocation for afforestation and reforestation. The country expert expressed the view that the current trend towards the abandonment of agricultural land was likely to favour afforestation, although recent afforestation rates have been low (around 500 ha in 1998). According to the country experts, a high natural rate of regeneration implied a potential 2-3 per cent increase in forest cover over the next 10 years. The review team expressed concern over the fact that only around 20 per cent of the forests were stated to be in a healthy condition, a situation that could be detrimental to carbon sequestration. Recently, forest monitoring showed a reduction in the impact of local air pollutants such as NO<sub>x</sub> and SO<sub>x</sub> on forests.

### **G. Agriculture**

40. The agricultural system in Lithuania has become more market-oriented since 1992. In 1997, of the 3.9 million hectares of agricultural land, cultivated land occupied 3.3 million hectares. Ownership is being transferred from the State to private enterprise. The team noted that the use of agricultural chemicals, which had been at a high level prior to the country's independence in 1990, had declined drastically during the initial stages of transition to a market economy. Between 1993 and 1997, the use of nitrogenous fertilizers fell from 57.7 kg per ha to 32.6 kg per ha, with a resultant drop in nitrous oxide emissions. With regard to CH<sub>4</sub> emissions, no information was provided on the status of implementation of the mitigation measures in the 33 large-scale pig complexes mentioned in the NC1, though the pig population did decline from 2.2 million to 1.2 million between 1992 and 1998. No information update was provided on the status of the dairy farms either, although there has been a steep decline in the number of dairy cows. The team learned that livestock farms came within the scope of those agricultural activities to be subject to a full environmental impact assessment.

41. The NC1 focussed primarily on the promotion of organic agriculture, using a pilot project approach to converting traditional agriculture to a sustainable and organic mode in the Karst region of northern Lithuania. The Karst region currently covers approximately 3 per cent of the Lithuanian territory. This pilot project which was implemented between 1993 and 1998 with a total funding of LTL 11 million, initially from the rural support fund and later also from the state budget has not yet ended. Farms bearing the organic label are provided with a 25 per cent subsidy for ecological education, training and research and the establishment of a certification system. This project is being implemented in accordance with the EC regulations on "certification of ecological farming" and has been accompanied by the development of a market infrastructure for organic produce. It has since been extended to other parts of the country under the National Agricultural Development Programme approved in August 1996. Furthermore in 1998, a monitoring programme on organic farming was initiated, involving 10 research institutes with a funding of LTL 240,000. By 2005-2010, organic farms will occupy around 5 per cent of all agricultural land (compared with 0.1 per cent at present).

## **H. Waste management**

42. The team was informed that waste management at the local level fell within the competence of the municipalities, with the responsibility for the state inventory lying with the Ministry of the Environment. Most municipalities run their own waste collection and management companies, but there is also some subcontracting to private companies. They are also responsible for the preparation and implementation of the territorial waste management plans under the 1998 Law on Waste Management. The team gathered that the Law on Waste Management determined the priorities and organization of waste management and treatment. The Law itself is complemented by the Framework of National Strategy and Action Plan on Waste Management for the period up to 2005, approved by the Government in April 1999. The Strategy includes not only provisions for the implementation of EC requirements but also additional measures for the improvement of waste management in Lithuania. Regulations on the construction and operation of landfills (in line with the draft EC landfill directive) and the requirements for waste incineration were approved in July 1999. Denmark is currently funding the strengthening of the framework and implementation of the Lithuanian laws relating on waste management.

43. Prior to 1997, around 3 million tonnes of municipal solid waste were being generated annually in Lithuania. The amount generated rose to around 4 million tonnes in 1997. Of the approximately 1,000 landfills, only 266 were operating and were legal and therefore managed, the rest being open dumps. The team was informed that only one landfill was equipped with a leaching collection and treatment system which could be considered compatible with the EC requirements. Most municipal landfills, especially in small rural municipalities, are poorly designed and constructed. Numerous landfills are old abandoned gravel quarries, some of them already full. Rules are being developed for locating such sites. The programme on landfill management contained in the National Strategy and Action Plan is expected to cut the number of landfills to around 200 by 2005 and lead to the construction of some specialized landfills.

44. Waste collection is financed by the tariffs charged to households and industries disposing of their waste in landfills, which are based on proposals by the waste collecting companies (covering operating and capital costs of waste collection and transport). The team learned that the revenue is not usually sufficient to cover operating costs, obliging the municipalities to provide subsidies. Furthermore, though the recovery of landfill gas from existing landfills has not yet started, the European Renewable Energy Study (1994) estimated that an amount of 40 million m<sup>3</sup>/year of methane was recoverable, corresponding to a thermal value of 150 TJ. A pilot project is in operation in Kaunas, where only liquids are collected at present as the temperature conditions do not favour gas formation. There are no municipal incinerators.

## **IV. PROJECTIONS AND EFFECTS OF MEASURES**

45. In the NC1, emission projections were provided for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and the precursors NO<sub>x</sub>, CO and NMVOC, for 2000 and 2010. Information provided by the host country during the visit shows that all the projections in the NC1, including the scenario options I and II for the year 2010, should be treated as "with measures" scenarios which take into account reported policies



and measures. No “reference scenario” was provided. The projections for all gases were reported by sector in accordance with the IPCC Guidelines. The team noted that there was very limited information on projections provided within the NC1. Moreover, for the new gases HFCs, PFCs and SF<sub>6</sub>, no projections were provided. As in the inventory reported in the NC1, emissions from international bunker fuels were included in the national total and not reported separately as required by the UNFCCC guidelines. Projections of CO<sub>2</sub> removals due to activities associated with land-use change and forestry were reported for the years 2000 and 2010, and excluded from the total.

46. During the visit information provided by the host country revealed that the projections were mainly based on energy sector scenarios developed under the framework of the National Energy Strategy with support from the PHARE programme. The results of the energy scenarios from the National Energy Strategy were based on expert judgement for energy demand in certain industrial sectors, agriculture and forestry. These scenario results were converted to the sectoral structure of the IPCC Guidelines. The team noted that the NC1 lacked information on the model used for the projection of emissions. During the visit, information on two integrated models used for the projections, viz. the disaggregated demand analysis system (DDAS) model and the reference energy system (RES) model, was provided to the team. The DDAS model served to develop the sector-by-sector energy demand scenarios based on a given scenario of demographic and economic development. The RES model was used to simulate the energy supply.

47. The political decision on the future of Ignalina nuclear power plant is expected to have a significant influence on future GHG emissions. The methodological approach adopted to model the influence of this policy decision on future GHG emissions assumed that, in the case of a complete phase-out of Ignalina NPP by 2010, the full capacity of the nuclear power plant would be compensated by electricity generation using residual oil and some natural gas. The increase in GHG emissions resulting from such a substitution was assumed to be about 16,900 Gg in 2010, which would bring the total GHG emissions in terms of CO<sub>2</sub> equivalent up to a level 13 per cent above the 1990 level. The review team felt that substituting Ignalina NPP with relatively less efficient, mainly residual oil based generation and maintaining electricity exports at 6 TWh even under a shutdown of Ignalina NPP were questionable assumptions. Furthermore the team learned that the phase-out of Ignalina NPP had been analysed in greater detail in connection with energy projections made within the first National Energy Strategy (1994), which could shed more light on the consequent impact on GHG emissions. This information was not available to the team.

48. Taking into account the scenario approach that was chosen to model the uncertainties concerning the shutdown of Ignalina NPP, scenario II probably describes the upper range of additional emissions caused by replacement of the nuclear power plant. The team asked the country team whether Lithuania was likely to strengthen GHG emission constraints in the ongoing least-cost investigation of policies and measures for compensations related to a possible shutdown of Ignalina NPP.

49. The NC1 contains a limited amount of background data and key underlying assumptions some of which have been described in table 3. Additional material provided by the host country during the visit improved the review team's understanding of the CO<sub>2</sub> emission projections.

**Table 3. Key assumptions used in emission projections**

		1990	2000	2010
GDP level	1990=100	100.00	91.00	142.90
Population	million	3.74	3.86	4.01
Residential surface	million sq m	72.00	83.80	100.00
Employment in services & trade	thousand	632.40	740.00	845.00
Crude oil price (world market)	US\$/GJ	3.86	3.63	4.80
<b>Total primary energy supply</b>	<b>PJ</b>	<b>749.00</b>	<b>452.00</b>	<b>521.00</b>

50. The underlying assumptions regarding GDP growth and future TPES appear to be rather robust. GDP was assumed to reach a level of 91 per cent in 2000, relative to the 1990 level and to be 42.9 per cent higher than the 1990 level in 2010. This corresponds to an annual GDP growth rate of more than 4 per cent after reaching the lowest level in the economic crises between 1993 and 1995. Recent projections arising from the revision of the National Energy Strategy were also made available by the hosts. These projections assume the GDP to be at a level of less than 80 per cent in 2000 and approximately 120 per cent in the year 2010, compared to the 1990 level. In the long run, this would correspond to an annual GDP growth of about 4 per cent. The team additionally learned that a near-term projection up to 2001 had predicted a GDP growth rate of 5 to 6 per cent, but the host team stated that, based on the development since 1996, a long-run growth rate of around 5 per cent could be considered optimistic.

51. Driven by economic and demographic growth and taking into account the changes in the structure of the national economy and in the energy supply, the energy projection which formed the basis of the emission projection resulted in a total primary energy supply of approximately 452 PJ in 2000 and 521 PJ in 2010. In comparison to the level in 1990, this represents 60 per cent for the year 2000 and 70 per cent for the year 2010, respectively. The projection arising from the recent revision of the National Energy Strategy provided during the visit showed a slightly lower TPES for the year 2010.

52. The NC1 described a single projection for the year 2000 and two different scenario options for the year 2010. In the projection for 2000, the total GHG emissions, excluding CO<sub>2</sub> emissions from land-use change and forestry, in CO<sub>2</sub> equivalent terms were expected to reach 68 per cent of the 1990 level. The two scenarios for the year 2010 describe the political options with regard to the shutdown of the Ignalina NPP and their consequent implications on the CO<sub>2</sub> emissions. Scenario I, examines the option of continued operation of the Ignalina power plant beyond 2010. It shows a 2010 emission level in terms of CO<sub>2</sub> equivalent 18 per cent lower than that in 1990. Scenario II assumes a complete shutdown of Ignalina NPP by the year 2010, which leads to GHG emissions in terms of CO<sub>2</sub> equivalent exceeding the 1990 level by 13 per cent.

53. The NC1 provided information on 26 policies and measures. For 14 policies and measures, stand-alone assumptions on the mitigation effects were reported. The estimates of mitigation effects were given in terms of CO<sub>2</sub> emissions saved. The mitigation effects range from about 10 Gg of CO<sub>2</sub> up to more than 2,400 Gg of CO<sub>2</sub>. The largest mitigation effects were related to the conversion of boilers to indigenous fuels (2,454 Gg) and to the use of local construction materials (1,227 Gg). Mitigation effects of 122 and 176 Gg, respectively, were assumed for the hydropower schemes on the Neris and Nemunas rivers. According to information provided to the review team during the visit, these assumptions may be rather optimistic. The mitigation effects of different programmes for the use of indigenous energy sources range from 12 to 184 Gg of CO<sub>2</sub>.

54. As noted before, all the projections contained in the NC1, including scenarios I and II for the year 2010, should be treated as "with measures" scenarios. The review team understood also that the mitigation effects described in the NC1 were incorporated only to a certain extent in the projection, due to the uncertainties associated with the implementation of the reported policies and measures. The host country indicated that the projections had assumed 50 per cent of the reported mitigation effect associated with hydroelectricity generation on the Neris and Nemunas rivers, biofuel and biogas utilization, the programme to promote local construction materials, and the modernization of public bus transport. The full impact of mitigation was assumed for the implementation of small hydropower generators, the Klaipeda geothermal plant, the modernization of burners and that of the Klaipeda port infrastructure. Scenario II for the year 2010 did not take any additional policies and measures into consideration compared to scenario I. The review team encouraged the host country to improve the consistency between the assumptions regarding mitigation effects of policies and measures and their incorporation into the "with measures" scenario.

## **V. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION MEASURES**

55. The review team was informed about the vulnerability and adaptation work being conducted at various institutes, including the Lithuanian Hydrometeorological Board, the Department of Hydrology and Climatology at Vilnius University, the Department of Climatology at the Institute of Geography, and the Dendroclimatic Laboratory at Vytautas Magnus University. It also learned of the ongoing work on temperature trends for Vilnius, which had revealed some warming, an increase in rainfall during the colder months and a decrease in overall precipitation. Other work mentioned to the team related to the modelling of agroclimatic resources under various climate scenarios generated by three general circulation models. Another project being conducted was on the physico-geographical processes in Lithuania. Most of the research on vulnerability and adaptation has hitherto been funded by the university budget, and the Lithuanian Fund for Education and Research, although the team got the impression that funding for such work was very limited.

## **VI. RESEARCH AND SYSTEMATIC OBSERVATION**

56. Lithuania is involved in the World Meteorological Organization (WMO), Background Air Pollution Monitoring Network (BAPMON) programme. In 1979, one BAPMON station was

set up, followed by three integrated monitoring stations. The team learnt of the involvement of scientists of the hydrometeorological service in global networks working on (a) climate forecasts and (b) the study of the Baltic hydrology within the Baltic Sea Energy and Water Cycle Experiment (BALTEX) as part of the Global Energy and Water Cycle Experiment (GEWEX). Additionally, surface observations of ozone concentration had been taken since 1995 at three automatic observing systems, and there were plans to fully automate all the stations in Vilnius.

57. Research conducted since 1966 at the Lithuanian Institute of Ecology on the wintering sites of birds, has shown changes in both the direction and the periods of migration. Research is also under way at the Institute of Botany on plant growth in relation to climate change, ozone concentration, ultraviolet radiation, and vulnerability of various plant types. The exchange of pollutants, including nitrogen compounds, between different ecosystems was also under study. A study on the effects of air pollution on forests under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) was also mentioned. Apparently, the monitoring of around 960 forest plots had shown that mature spruce and fir stands which had suffered from both defoliation and die-back, had shown improvement in recent years. Some palaeoecological research was also being conducted.

## **VII. EDUCATION, TRAINING AND PUBLIC AWARENESS**

58. The host country informed the review team that in 1998 the Government had initiated environmental education and information dissemination to increase awareness particularly of the need for atmospheric protection. The ministries of education and environment had targeted children and youth by providing financial support for the publication of educational materials. This included the publication of a teacher's guide on global climate change. The host country officials also spoke of a collaborative project, coordinated by a non-governmental organization, entitled "European Air Pollution Project", which had been under implementation for the last five years and had led to the current involvement of 300 schools (initial number 15-20).

## **VIII. CONCLUSIONS**

59. The Lithuanian economy is gradually emerging from the severe recession of the early nineties. The steps taken by the Lithuanian Government to establish the necessary institutional framework to deal with matters of climate change must be seen in that light. Two positive elements in the institutional setting which should considerably aid the efforts to address climate change issues at the national level, are the formation of the National Committee for the Implementation of the UNFCCC and the widespread representation within the national country team. On the other hand, both financial and manpower constraints have significantly affected the work within the country. Lithuania has been partially addressing these shortcomings by training additional staff in key areas such as inventory construction. The ongoing efforts to harmonize legislation with that of the EC in specific sectors and the provision of bilateral technical and financial assistance to the country have been useful in addressing the climate change issue.

60. In general, Lithuania complied with the IPCC reporting requirements for the national GHG inventory for 1990, except that it did not submit detailed worksheets for the sectors of fuel

combustion, land-use change and forestry, and agriculture. The IPCC standard data tables for all sectors were provided during the visit. The absence of an official submission of national inventory data in the IPCC format in 1998 is noteworthy, although the country did submit emission estimates for CO<sub>2</sub>, CH<sub>4</sub>, CO, NMVOCs, SO<sub>x</sub> and NO<sub>x</sub> from fuel combustion for the period 1980-1997, using the format for reporting data under of the Convention on Long-range Transboundary Air Pollution. Slightly more disaggregated emission estimates from fuel combustion were provided subsequent to the visit for 1995, 1996 and 1997 using the same format. Clearly, a future focus could be the construction of a homogeneous data set using the most recent IPCC methodology from 1990 to the present. The lack of such a homogeneous data set prevented an analysis of GHG emission trends over time or the construction of a link between GHG emissions, policies and measures, and projections.

61. In terms of compliance with the reporting guidelines for policies and measures, information in the NC1 was provided only by sector. The exercise focussed primarily on measures directed at CO<sub>2</sub> reduction and, due to its preliminary nature, was likely to be revised. A significant amount of information was provided subsequent to the visit. In the energy and transformation sector, the overall contribution to total emissions has been positively impacted over the 1990-1997 period, due to the high share of nuclear-based electricity compared with that of fossil fuels. The anticipated phase-out of the Ignalina NPP in response to international pressure and the consequent development of alternative sources of electricity will be a key factor in determining the trend of future emissions; the only estimate available indicates that its replacement by generation based on residual oil and natural gas would lead to a 13 per cent increase in total GHG emissions in CO<sub>2</sub> equivalent, relative to 1990. In the residential sector, changes in ownership of the housing stock will influence the adoption of energy efficiency improvements, contingent on the financial situation of homeowners and the efficacy of the Housing Credit Fund. In the industrial sector, operation of the Pollution Prevention Centre is noteworthy due to its role in building capacity and also its direct encouragement of “cleaner production”.

62. Although the team was provided with additional information on projections during the visit, the NC1 itself contained limited information on projections. In accordance with the guidelines, the projections for all gases were reported by sector. The mitigation effects of policies and measures, were only partially incorporated into the scenarios in the NC1, an area which needs considerable strengthening. Any further assessments of the GHG implications of replacing the Ignalina NPP, given its importance, could find inclusion in the next communication. Additionally, the results obtained under different projection scenarios revealed that total GHG emissions in CO<sub>2</sub> equivalent terms in 2000, excluding CO<sub>2</sub> emissions from land-use change and forestry, are likely to reach only 68 per cent of the 1990 level, clearly within the UNFCCC target. This expectation is supported by the available trend data for GHG emissions from fuel combustion. As regards the scenario options for 2010, the current phase-out date for Ignalina NPP, scenario I leads to an emission level (in CO<sub>2</sub> equivalent) 18 per cent lower than in 1990 for 2010, whereas scenario 2, which envisages a complete shutdown by 2010, leads to an emission level (in CO<sub>2</sub> equivalent) exceeding the 1990 level by 13 per cent.

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