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LATVIA

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

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Latvia ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 23 March 1995. Its first national communication (NC1) was submitted on 20 September 1995 and the second national communication (NC2) was submitted in March 1999. The in-depth review was carried out between April 1999 and November 1999 and included a review team visit to Riga from 17 to 21 May 1999. The team consisted of Ms. Marina Shvangiradze (Georgia), Mr. Michael Gillenwater (United States of America) and Ms. Tina Dallman (UNFCCC secretariat, coordinator).
2. Latvia is located on the eastern coast of the Baltic Sea; it is bordered by the Russian Federation to the east, Estonia to the north and by Belarus and Lithuania to the south. It has an area of 65,000 km², of which, in 1997, 45 per cent was forest and 39 per cent agricultural land. Between 1990 and 1998 the population fell from just under 2.7 million to about 2.5 million as the birth rate fell and emigration exceeded immigration. Over two thirds of the population live in urban developments. Latvia has a temperate climate. Over the period October to March temperatures average between -2°C and 2°C, whilst between April and September temperatures average between 11°C and 13°C. Low average temperatures result in relatively high demand for indoor heating.
3. Latvia is a democratic parliamentary state divided into 26 districts, 7 main municipalities and 561 rural municipalities and towns. Local elected governments have their own budgets and the right to levy local taxes.
4. Latvia was established as an independent republic in 1918 and regained its sovereignty in 1991. Since the early 1990s the economy has been in a period of transition geared toward increased market competition, which initially resulted in recession. There was a dramatic decline in gross domestic product (GDP) between 1990 and 1992. Thereafter, GDP fell gradually in the three years to 1995 before rising modestly such that by 1998, in real terms, it was 42 per cent lower than in 1990. At the time of the review, the economy was still growing, but at a lower rate than had been anticipated. However, a few sectors including agriculture were still in decline. On a purchasing power parity basis, GDP per capita was about 5,100 ECU in 1997, compared to a European Community (EC) average of 19,000 ECU.
5. There was a significant change in the structure of the Latvian economy during the early 1990s with a shift away from the production of goods and only a modest change in the provision of services. The most significant changes occurred in the agriculture, manufacturing and construction sectors, which all witnessed especially rapid decline in the early 1990s, although the last two sectors achieved a slight recovery in 1997 and 1998. By 1998, agriculture accounted for 5 per cent, manufacturing 20 per cent, construction 5 per cent, wholesale and retail trade 18 per cent, and transport 14 per cent of value added, whilst other services accounted for the remainder. At that time over half the working population were employed in services. Since regaining its independence, Latvia has significantly reorientated its economy to lessen its previous dependence on the Russian Federation. Now more than half of its trade turnover is with countries in the EC

and it is estimated that, in 1998, only 8 per cent of Latvian GDP was directly attributable to goods and services for the Russian market.

6. Privatization of state-owned companies began in 1991 and is now approaching completion. Between 80 and 98 per cent of activities are now conducted privately in the agriculture, fishing, mining, manufacturing, construction, wholesale, hotel and financial intermediation sectors. The state continues to have a significant role in the provision of electricity, gas, water, transport, education, health and other social services. Privatization of state and local monopolies providing energy and water has been relatively slow, in part, because harmonizing laws and regulations with EC legislation is a lengthy and complex process in these sectors.

7. In recent years, integration into the EC has become a priority. The European Agreement or Associate Agreement came into effect for Latvia on 1 February 1998. This requires the transposition of various pieces of legislation stipulated in EC directives into the national legal framework. In the environment sector, more than 70 major EC directives and regulations should have been transposed by the end of 1999 and plans need to be drawn up on how to integrate less significant directives. In this context, the Government's objectives are based on the principles of competition, private property and open-trade policy. Latvia has already been granted various development funds from the EC, amounting to approximately 24 million ECU between 1992 and 1997 and may be eligible for pre-accession structural funds. Latvia has also received soft loans for environmental investment projects from, *inter alia*, the Nordic Environment Finance Corporation, the World Bank, the Nordic Investment Bank and the European Bank for Reconstruction and Development.

8. The Ministry of Environmental Protection and Regional Development (MEPRD) is the newest of the twelve government ministries in Latvia, having been established in 1993. Eight regional environmental boards are subordinate to the MEPRD and implement state policy on environmental protection, regional development and construction. To prepare and implement local action plans, local governments cooperate with regional environmental boards and the MEPRD in providing information and coordinating training and education. Local governments are still not in a position to assume the state's function in environmental protection to the same extent as in many EC countries. Given this, the MEPRD prepares and leads pilot projects which encourage broader delegation of the state's functions for environmental protection to the local governments.

9. In real terms, Latvia's total environmental expenditure increased in the period 1990 to 1994 from 1.3 million to 33 million Lati, but then fell to 15 million Lats in 1997 (1998 exchange rate: 0.59 Lat = US\$ 1). Of this, 78 to 95 per cent annually has gone toward water protection, 6 to 9 per cent toward air protection and lesser amounts toward waste disposal, land preservation etc. The share of GDP going toward state environmental expenditure increased from 0.1 per cent in 1995 to just 0.2 per cent in 1998.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

10. The NC2 contains inventory data for the gases carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), nitrogen oxides (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO₂) for the years 1990, 1994 and 1995. Since the publication of the NC2 data for 1996 and 1997 have been included in the inventory and several time series have been recalculated as shown in this report.

11. The Latvian inventory relies almost exclusively on default emission factors and tier 1 methodologies from the 1996 revised Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. The review team encouraged research to develop national emission factors and more detailed inventory methodology, where appropriate. Although the inventory has been updated for the years 1991 onward using the revised IPCC Guidelines, the 1990 base year was not recalculated, aside from a few categories. The review team urged that this be done in order to have a consistent time-series. There has been no analysis of the uncertainty associated with emission estimates and such work is also encouraged by the team.

12. Officials noted that an essential prerequisite for the integration of Latvia into the EC is a statistics system which provides timely, accurate, complete and internationally comparable statistical data on economic, demographic and social activities and processes and the environment. The creation of such a system is a priority for the Central Statistical Bureau, which has already started adapting to EC legislation, and the review team was impressed with efforts in this regard. The previous statistical system was not suitable as a basis for greenhouse gas (GHG) inventory calculations as data were compiled on a different reporting basis. Whilst data are plentiful, there are significant omissions in statistical balances for the early 1990s, reflecting the previously confidential nature of military and other activities.

13. Statistical data for all businesses with more than 50 employees and/or a turnover of more than 200,000 Lati annually were collected until 1998 when the thresholds were changed to 20 employees and/or 300,000 Lati which then encompassed around 1,000 firms. The remainder of the industrial sector is subject to random surveys. The return of state land to the private sector has created problems for the collection of agricultural data. A complete register of the thousands of independent farms was due for completion in 1999 and an agricultural census was planned for 2001 covering all farms in excess of one hectare or with an annual production in excess of 500 Lati. Currently, there is a twice annual sample survey of farms.

14. Latvia has an Environmental Data Centre whose primary role is to act as an 'emissions register', collecting, processing, storing and disseminating official data from individual enterprises. This covers air pollution, water use, waste-water discharges and the release of hazardous waste. Emission data are collected and provided to the Environmental Data Centre by the regional environmental boards. Critical validation is not routinely carried out and much of the emission information corresponds to the values allowed under pollution regulation.

15. Latvia is having significant difficulties in collecting information for the “new gases” from either import statistics or consumption data. Surveys of industry resulted in a nil response. The review team noted that Latvenergo, the state electricity company, is installing new electricity switchgear, and it is possible that this contains sulphur hexafluoride (SF₆). New cars with air conditioning are likely to be a source of hydrofluorocarbons (HFCs).

A. Carbon dioxide

16. It can be observed in figure I that total CO₂ emissions fell by 63 per cent between 1990 and 1997. In addition to the severe economic recession, a shift away from heavy industry toward services explains, in part, emission trends. Of total emissions in 1997, the energy and transformation sector accounted for 44 per cent, the transport sector 25 per cent the industrial sector 14 per cent, and the residential sector 5 per cent. Latvia has extensive forests and CO₂ sequestration was broadly stable between 1990 and 1997, approximately offsetting total CO₂ emissions at the end of this period. Industrial process emissions fell as cement and lime production fell from 744,000 and 156,000 tonnes in 1990 to 325,000 and 19,000 tonnes, respectively, in 1996. As part of the review, separate figures were provided for CO₂ emissions from biomass which had previously been included in the total.

Table 1. Emissions of carbon dioxide, by source, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Energy and transformation	8 288	8 659	7 026	5 482	4 726	4 543	3 901	3 819
Industry	2 683	1 682	1 339	1 106	1 772	1 038	742	1 243
Transport	6 011	3 267	2 931	2 677	2 229	1 749	1 612	2 178
Agriculture/forestry	1326	474	431	575	612	238	322	246
Residential	1 589	1 493	1 480	1 235	983	1 173	1 287	438
Industrial processes	563	584	286	89	154	127	185	153
Other ¹	3 201	2 466	1 515	1 789	1 549	1 394	1604	633
Total	23 661	18 625	15 008	12 953	12 024	10 262	9 653	8 710
Land use change & forestry	-10 960	-10 960	-10 960	-10 960	-10960	-10 600	-10 600	-10 600
Biomass	1 426	1 029	1 595	1 687	2 245	1 882	1 511	4 197

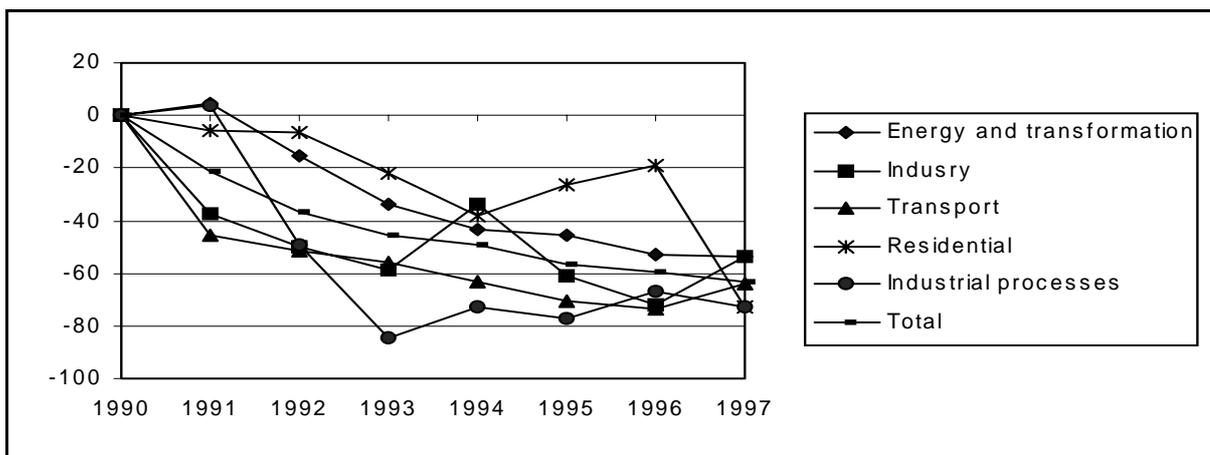
17. The 1990 total CO₂ emission estimate reported in the NC2 is 3 per cent higher than in the NC1. Underlying this change, the figure for emissions from the residential sector fell by 1,551 Gg, whilst the emission estimate for the ‘other’ category rose by 1,676 Gg. The value for CO₂ sequestration fell by 3,360 Gg in 1990 due to more precise data on annual harvesting, a change in the emission factor and the fact that natural forest die-off was taken into account.

18. In constructing an energy balance for 1990 officials produced three versions which vary by more than 30 per cent. With assistance from Polish inventory experts, judgement was used to select the preferred approach for estimating the energy balance, which subsequently has been

¹ Other includes commercial/ institutional combustion and soils

subject to successive improvements. Whilst data for 1990 suffer difficulties associated with conversion from the pre-independence statistical system, data for 1991 and 1992 suffer further due to significant unrecorded black market fuel sales. Improved customs data from 1994 onward are thought to have lessened this problem, but it is not known to what extent recent increases in transport emissions, for example, are due to increased driving or to improved statistics. Officials noted that changes in activity data in the energy balance for the residential sector accounted for the inconsistency in the time-series, which may be due to changes in reporting.

Figure I. Carbon dioxide emissions, percentage change from 1990, by source



19. Officials noted that it is difficult to disaggregate transport fuel statistics and to estimate miles driven. The statistics are distorted by operators declaring some domestic deliveries as goods in transit in order to avoid taxation. The review team noted that transport statistics show declining fuel consumption in some years whilst car numbers are growing. A car registration scheme, begun in 1994, allows for good basic data on car numbers and age profile; however, scrapped cars are not removed from the register. The Ministry of Transport is developing a new database which should, in future, allow for more accurate assessment of the number of cars and of those with catalytic convertors.

20. The emissions estimate for LUCF is based on data from the Latvian State Forestry Service. An annual survey of about 10 per cent of the forest forms the basis of a forest inventory and also results in forest plans for the following 10 years until the next survey is conducted. Since privatization, many land owners have not taken part in the survey unless they required a plan to harvest wood. The survey covers timber quality, cutting conditions, species, composition etc. and is aimed at the timber industry.

21. The review team noted a number of areas in which the CO₂ inventory data could be improved. In particular, there are no estimates of emissions from international bunkers. There may be some emissions from feedstocks in the plastics, asphalt and other petrochemical industries which have not been taken into account due to a lack of data.

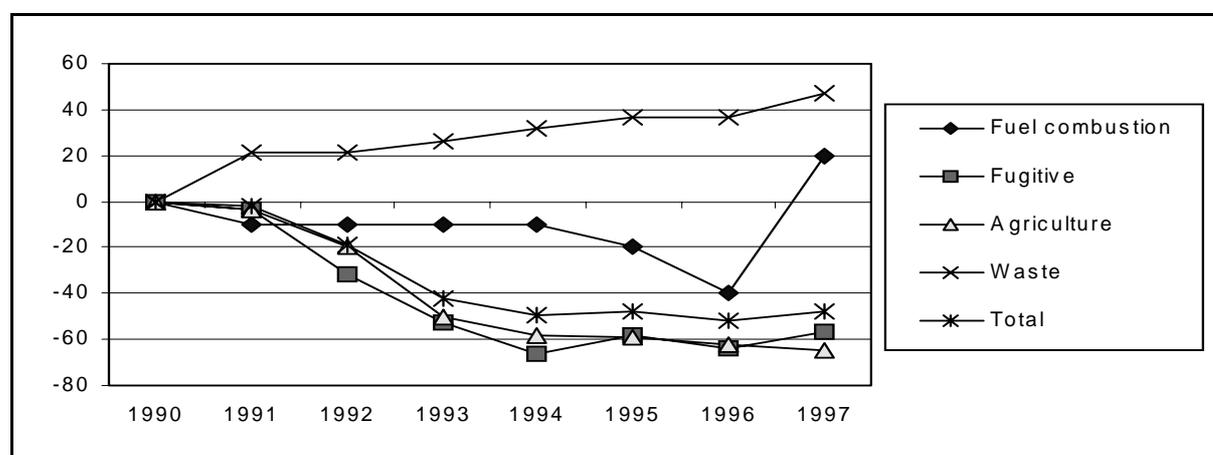
B. Methane

22. The main sources of CH₄ are enteric fermentation and manure management in the agricultural sector, as well as landfill waste. Fugitive emissions from gas pipelines and biomass combustion facilities also contribute, but the significance of this source declined in line with lower gas consumption. It can be observed in figure II that CH₄ emissions fell by 52 per cent between 1990 and 1997. Compared to the NC1, the 1990 total emission estimate for CH₄ increased by 35 Gg or 22 per cent, underlying which the figure for fugitive emissions increased by 51 Gg and the figure for waste fell by 25 Gg.

Table 2. Emissions of methane, by source, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Fuel combustion	10	9	9	9	9	8	6	12
Fugitive	53	51	36	25	18	22	19	23
Agriculture	111	107	89	55	46	45	42	39
Land-use change and forestry	0	0	0	0	0	2	0	0
Waste	19	23	23	24	25	26	26	28
Total	194	190	157	112	98	101	93	102

Figure II. Methane emissions, percentage change from 1990, by source



23. Recession accounts for the emission trend in the agricultural sector. According to official statistics, over the period 1990 to 1998, the number of cattle fell from 1,439,000 to 434,000, pigs from 1,401,000 to 421,000, sheep from 165,000 to 29,000 and poultry from 10,321,000 to 3,209,000. In 1998 the Ministry of Agriculture began conducting full livestock surveys. Figures show that animal numbers may have been significantly underestimated in the official statistics used for the inventory such that there may be about 50,000 more cattle, for example, than stated.

24. Waste volumes are estimated on the basis of population size, assumed amount of waste per person and numbers of factories. The inventory estimation takes into account differences in assumed waste generation in the cities and countryside and assumes that industry generates one third as much waste as the general population. Furthermore, it was assumed that half of all waste generated was landfilled in 1995 and 60 per cent in 1996. The review team noted that the assumed 1.3 m³ or 0.6 kg of waste per annum generated per person in Riga is lower than the IPCC default value.

25. Data on waste volumes and composition are poor. Determining the quantities and type of waste generated is difficult due to the absence of an official definition of waste and of a regular reporting system for municipal waste. There are no waste statistics for 1990. In 1991 and 1992 a questionnaire survey of landfills was conducted, primarily to establish their number, location, ownership and size. This was repeated in 1997 and the results placed into a database. Available data on waste quantities are based on field surveys, reflecting the average volume produced per capita and per area or region. Quantities could be much greater than the statistics indicate, due to illegal dumping. Registration of municipal waste disposal took place in 1990 and 1994 although this excluded industrial, building and some other wastes. On the basis of this information, it was estimated that about 25 million m³ of municipal waste was disposed of in landfills in 1994. Very limited information is available about the production of non-municipal solid waste (agricultural, industrial, construction etc).

26. The team was informed that it is impossible to assess the overall landfill disposal capacity as most disposal sites are established without proper design. The majority of landfill sites are small. About two thirds are smaller than 2 hectares and receive, in general, less than 1,000 m³ of waste per year. Those in large cities have capacities of up to 3 million m³. So, many landfills are likely to be shallow with fairly aerobic conditions and hence to generate little CH₄.

27. Reliable data on waste composition are not available although there are some indications that in major towns and cities the organic fraction exceeds 50 per cent, whereas in small towns and villages this component makes up less than 10 per cent of all waste due to recycling for composting and animal fodder. From 1998 onward, in accordance with the Law on Municipal Waste, waste managers are obliged to identify the origin, composition and characteristics of waste based on set criteria. Whilst this is primarily intended to identify hazardous waste, it should also provide useful information for the estimation of the GHG inventory.

28. Waste-water treatment is mostly aerobic. The inventory does not estimate the small amount of CH₄ emissions from anaerobic decomposition. Waste-water treatment plants currently under construction could impact on future emissions from this source. Gas consumption statistics along with the IPCC default emission factors for the Russian Federation are used to estimate CH₄ emissions from gas pipelines. There is no estimate in the inventory of CH₄ emissions from oil pipelines.

C. Nitrous oxide

29. The 1990 estimate for total N₂O emissions increased almost fivefold from the 2.4 Gg estimated in the NC1, almost entirely due to an increase in the estimate for the agricultural sector.

30. Officials from the Ministry of Agriculture noted that about 7 per cent of agricultural soils are classified as high organic soils (i.e. histosols) in contrast to the 100 per cent assumed in the emissions inventory in the NC2. Consequently, inventory officials have recalculated the N₂O estimates which has resulted in a significant reduction in estimated emissions, as shown in table 3. Officials noted that N₂O emissions from managed manure, agriculture residue burning, waste-water treatment and anaesthesia were excluded from the inventory and no data were available related to catalytic converter use in cars.

Table 3. Nitrous oxide emissions, by source, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Fuel combustion	1.1	0.5	0.4	0.4	0.3	0.3	0.4	0.4
Waste	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Agriculture	9.7	7.0	6.5	4.5	3.8	3.2	3.1	3.1
Total	11.0	7.7	7.2	5.1	4.4	3.8	3.8	3.8

III. POLICIES AND MEASURES

31. In recent years, considerable effort has gone into policy development. However, the review team focused more on policies and measures currently implemented. The systematic inclusion of environmental concerns into policy-making began in 1994 when the first National Environmental Policy Plan was drafted. It established policy goals and principles along with analysis of environmental problems. Priorities then established remain, *inter alia*, the reduction of pollution, improvement of water quality and implementation of solid household waste and hazardous waste management systems. Climate change has not been singled out as a priority area although several environmental policies, and air quality policies in particular, are likely to have an impact on GHG emissions.

A. Cross-sectoral policies and measures

32. Latvia is a party to the Convention on Long-range Transboundary Air Pollution but is not yet subject to any limits under its protocols, although at the time of the review actual emissions of SO₂, NO_x and volatile organic compounds were below the abatement targets in these protocols and Latvia was considering the consequences of signature. Meanwhile, air quality regulations exist relating to SO₂, NO_x, hard particulates, lead and ozone. The levels of these emissions are monitored and where they exceed limit values or assessment shows increasing air pollution levels, local governments are obliged to prepare and implement ambient air quality improvement programmes. Such programmes are coordinated with the regional environmental boards and approved by the MEPRD.

33. The Natural Resource Tax Act was approved in 1990 and, after first having a limited impact, was elaborated in 1996 to widen the tax base and upwardly revise the tax levels. It is Latvia's main economic instrument related to the environment. Its objective is to limit the mismanagement of natural resources, reduce environmental pollution, reduce production and sale of products polluting the environment, promote the implementation of new technology to reduce pollution and provide funds for environmental protection measures. The tax is paid on extraction of natural resources, environmental pollution, goods harmful to the environment and packaging. Under the Act, permits are granted for the extraction of natural resources, including water, and emission of pollutants to air or water. Permits for waste storage in landfills are also granted to designated landfill managers. In some cases the permits establish limits for natural resource extraction or emissions. The permit holder is responsible for performing related environmental quality measurements and assessments and calculating the tax due accordingly, although environmental inspectors are responsible for verifying the calculations. Emissions covered by the tax are dust, CO, SO₂, NO_x, ammonia, volatile organic compounds, hydrocarbons, heavy metals and other non-organic compounds. Charges are levied on the basis of tonnes emitted. For emissions above permitted limits, a higher rate of taxation is applied. Penalties for the illegal (unlicensed, unregistered) use of natural resources, for pollution without a permit or for the import or sale of goods without a licence are twice the regular tax on top of the unpaid tax.

34. Pollution charges are constrained by a parliamentary decision that environmental taxes must not exceed one per cent of total corporate taxes. Companies taking action to reduce emissions or natural resource use, including switching to cleaner production technologies, installing end-of-pipe treatment and increasing recycling, can apply for a grace period for the payment of the natural resource tax whilst they carry out the project. All tax revenues are to be used exclusively in financing measures directly related to environmental protection, rehabilitation, disposal or recycling of harmful waste and research or renewal of natural resources. Since 1994 state revenues from taxes on natural resources, in nominal terms, have increased from 601 million Lati to 1,447 million Lati to account for 1.5 per cent of the state budget, mainly as a result of the natural resource tax.

35. The Latvian Environmental Protection Fund (LEPF), which commenced its activities in 1996, manages the Special State Environmental Protection Budget. The fund is administered by a Board approved by the Cabinet of Ministers and chaired by the State Minister for Environment. Representatives of local authorities, trade unions, regional associations and educational establishments, together with independent experts, are invited to take part in the activities of the board. It receives 40 per cent of the proceeds of the natural resource tax, whilst the remainder of the proceeds is allocated to municipalities' environmental budgets in accordance with where the tax is raised. Its main goal is to provide additional financial resources for funding environmental protection activities. The fund provides assistance to environmental projects in the form of grants or loans. It sometimes co-finances projects with the private sector. Sectors targeted by the Fund are, *inter alia*, water and air quality protection, waste management, nature protection, biological diversity and environmental education. Each sector is allocated a set amount of funding which the Fund aims to commit to appropriate projects based on the priorities and guidelines established by the board. In 1997, about 40 per cent of LEPF funding went toward

water projects, 19 per cent to capacity-building, 15 per cent to waste projects, 6 per cent to air quality projects, 6 per cent to monitoring activities, 5 per cent to accident mitigation, 4 per cent to nature protection and 4 per cent to environmental awareness.

36. The Latvian Environmental Investment Fund (LEIF) is a non-profit limited company which began operating in 1998. Almost one third of its funds are derived from the LEPF. The main aim of LEIF is to attract local and international funds, to be further disbursed as soft loans to local governments or private organizations for the realization of projects that benefit the environment, provide technical assistance, develop local management skills for the entire project cycle and increase the capacity of organizations that are granted loans. The LEIF board has representatives from the MEPRD, local government, international finance institutions and other interested parties. In 1998, 74 per cent of LEIF funding went toward water projects, 19 per cent toward clean technologies, 5 per cent toward small hydroelectric stations and 2 per cent toward energy savings. Around 67 per cent of the funds were allocated to the public sector and 33 per cent to the private sector.

B. Energy and transformation

37. In 1997, the total primary energy supply (TPES) amounted to 4,514 thousand tonnes of oil equivalent, of which about two thirds was imported. Around 38 per cent of the TPES was made up of oil products, 3 per cent coal, 26 per cent other solid fuel, 24 per cent natural gas and 9 per cent electricity. Of the electricity, almost two thirds was produced domestically, mostly from hydropower, and the remainder imported. Whilst investigations continue into the possibility of offshore oil and gas reserves, peat is the only exploitable fossil fuel reserve and about 450,000 to 550,000 tonnes are produced annually. Domestically produced wood is also available.

38. Following independence, Latvia no longer benefited from cheap Russian imports and has paid world market prices for its fuel. This has been a major contributing factor in the reduction in energy consumption, which fell from 379 PJ to 189 PJ between 1990 and 1997. The economic recession caused a sharp decrease in district heating energy consumption between 1990 and 1993 although it recovered somewhat thereafter. Most of the decrease occurred in the industry and agriculture sectors. Electricity consumption also fell in the early 1990s, but in the five years to 1998 annual electricity consumption stabilized at around 6.2 to 6.3 GWh.

39. According to the Energy Act, energy companies must be licensed. Special requirements are incorporated into these licences to achieve particular objectives including, *inter alia*, efficiency in operations, requirements for environmental protection, reductions in heat losses and the promotion of competition. A Licence Office and reporting system is in operation based on annual reports of business activity to follow companies' progress.

40. The state company Latvenergo produces both electricity and heat. Around 85 per cent of the fuel used by Latvenergo to generate electricity and heat, was natural gas with peat and heavy fuel oil accounting for 8 per cent and 7 per cent respectively. Previously, heavy fuel oil

accounted for a much higher share, especially in 1994. In 1996, Latvenergo was responsible for a total installed electricity generating capacity of 2,038 MW, of which 1,517 MW was hydroelectric power and 521 MW combined heat and power plants, and it generated over 97 per cent of domestically produced electricity. Independent power producers, including small hydroelectric plants, had an installed capacity of 65 MW.

41. In recent years the power system has benefited from investment to upgrade plant, transmission and distribution systems and the operating structure of Latvenergo has undergone changes to prepare it for privatization, although the high voltage transmission network will remain in the public sector. As a result of such investments and more efficient operations in combined heat and power (CHP) plants, fuel consumption efficiency has improved, such that between 1996 and 1997, for example, energy generation grew by 8.5 per cent whilst fuel consumption increased by 5.3 per cent. Conversion of boilers to three-stage fuel burning has helped to reduce NO_x emissions, although they grew by 11 per cent in 1997 compared to 1996, due to a growth in electricity generation. In this period, Latvenergo's SO₂ emissions decreased fivefold as a result of increasing volumes of natural gas substituting for heavy fuel oil.

42. At the time of the review, Latvenergo was working on the implementation of the EC Integrated Pollution Prevention and Control Directive at their largest thermal power plant. This has involved measures to reduce various emissions and improve energy efficiency through improvements in technology and processes. The goal of the Directive is to prevent, or where that is not practicable, reduce emissions from industrial facilities to air, water and land. It covers activities with a high polluting potential, especially across frontiers. The activities of small and medium enterprises are mostly not affected by the Directive. One hundred and thirty installations have been identified which may be subject to the Directive by 2001, although only new enterprises will be able to apply the 'best available technology' required.

43. Electricity, and gas prices are set by a quasi-independent regulator under the Ministry of Economy which also sets heat prices for Riga. Municipalities have powers to regulate heat prices in other regions. The National Programme on Energy foresees a gradual increase in average electricity tariffs, which should put downward pressure on demand, but favourable hydroelectricity supply in recent years meant that prices did not increase as much as expected. Given the dominance of renewables in the electricity balance, changing prices may have little impact on domestic GHG emissions, except to the extent that changes in relative prices encourage switching between electricity and other types of energy for industry and households.

44. According to the 1998 Energy Act, small hydro plant and wind turbines are to receive support through the imposition of an obligatory purchase order on the state electricity supplier for eight years from the start date of any operations. Capacity up to a limit up to 2 MW will receive 200 per cent of the average electricity sales tariff whilst capacity with a limit of up to 7 MW will receive 150 per cent. The policy should led to the continued renovation of small hydro stations, new construction and the attraction of private and foreign capital. By 1 January 1999, 34 small hydroelectric plants had been renovated and 7 were under construction.

There are also price support systems for cogeneration plant up to 4 MW and electricity generated from biogas with a capacity up to 7 MW.

45. As a result of earlier economic integration, there is a Baltic electricity grid which is also connected to the Russian Federation. There is sufficient generating capacity within this system to meet current demand in the Baltic region and there are plans to connect the Baltic and Nordic grids. Despite opportunities to import, the Baltic states have each agreed to produce 85 per cent of electricity domestically. Given this, and the possibility of Lithuania closing its nuclear power station, which would reduce the availability of imports, Latvia is planning to construct a new thermal power station. The choice of fuel will be based on costs and environmental factors, but economic modelling suggests that coal will be the cheapest option.

46. Latvia has an extensive gas pipeline and storage infrastructure. Imported natural gas is supplied to all major cities and liquefied gas is widely available. Around 3 billion m³ of natural gas was supplied in 1990, but at the time of the review only around 1.3 billion m³ was being supplied annually, significantly less than capacity. Overcapacity is greatest in the south-east of Latvia, where it is cheaper to import heavy fuel oil from the Russian Federation. In Riga the demand for natural gas is increasing as boiler houses are converted to gas for central heating. All consumers have individual gas meters. The first phase of privatization of the state gas company, Latvijas Gaze, has been completed. The market for liquefied gas has also been liberalized, with independent suppliers taking an increasing share. (Of liquefied gas sales, about two thirds go to households and the remainder mostly to the transport sector with a small amount going to industry.)

47. Latvijas Gaze informed the review team that losses from the gas system amount to 4 to 5 per cent annually, but this includes theft by some customers who disable their meters and hence could not be used as a basis for inventory calculations. There are practically no losses from major pipelines. Latvijas Gaze is spending around 2 million Lati to rebuild compressor stations, which should reduce CH₄ losses from this source. Minor losses may occur in cities where the metal gas pipes are old, but newly laid gas pipes are plastic.

48. Latvia has an energy-inefficient district heating system with more than 100 networks, largely exceeding the country's heat demand. In 1995, only about 21 per cent of the heat energy produced by the district systems was produced in cogeneration plants. Of 695,000 households with central heating, about 491,000 were linked to district heating systems. An analysis of energy consumption in households for 1996, based on survey data, indicates that for Latvia as a whole, from a total of around 75,835 TJ, about 49 per cent was attributed to fuelwood, 37 per cent to heat and hot water from district heating systems, 5 per cent to electricity, less than 5 per cent to natural gas, less than 3 per cent to coal, less than 2 per cent to liquefied petroleum gas and less than 1 per cent to other fuels combined. Of the energy consumed about 78 per cent was for space heating. Wood predominates in households without access to district heating, whereas, in 1998, average district heating consumption was made up by about 37 per cent gas, 39 per cent heavy fuel oil, 21 per cent wood, 2 per cent peat and 2 per cent coal. Owing to a deterioration in district heating systems there is a growing tendency toward decentralized heat

supply, which means that consumers install their own boilers or other heating equipment, which typically leads to lower costs and greater individual heat control, but increases the costs per remaining household of supplying district heating. In Riga there is an urgency to increase the efficiency of district heat production and reconstruction projects are planned.

49. After the Second World War, the Latvian population increased rapidly due to significant population shifts within the Soviet Union. This led to the hasty construction of many dwellings with, in many cases, materials unsuitable for the climate such that insulation levels are very poor for a great number of households. In rural areas there had been thousands of smallholdings, but these were reorganized into collective farm villages with multi-storey housing. Pagasts, the smallest form of administrative municipality in Latvia, are now responsible for the non-privatized infrastructure of former collective farms, including heat supply. Remedies for many of the problems associated with dwellings will stem from regulations related to planning. Implementation of plans is being delayed by administrative reform, including the consolidation of many of the smaller pagasts.

50. Residential and public buildings accounted for about 65 per cent of the energy used for heating purposes at the time of the review. It has been estimated that on average Latvian buildings in these sectors require two to three times as much heat energy per m³ as Western buildings at the same latitude, due to low insulation factors and poor window construction. At the time of the review, a programme for thermal insulation of residential and public buildings was being drawn up, with a view to implementing measures over the period 2000 to 2010. These would include activities to reduce the costs of energy efficiency improvement and to promote energy efficiency technologies, including through pilot projects to update buildings to modern energy-saving standards. It is estimated that insulating the 52 million m³ of residential and public building space in Latvia would cost about 28 Lati per m³. Finance for the considerable sum needed is under investigation, including possible access to foreign sources. The National Programme on Construction envisages promotion of energy-saving building techniques through pilot projects to develop and test different types of buildings.

51. Typically households receiving district heating do not have individual meters and cannot regulate the heat supply; instead they pay a fee based on floor area and so have no incentive to save energy. Until the end of 1998, state funding was provided for the Programme on Installation of Heat Meters in Rural Area Heat Systems. Within the scope of the Public Investment Programme, state funding has also been provided for village and city heat supply reconstruction projects covering boilers, pipelines, heat sub-stations and co-generation plant. In 1998, 13 projects benefited with a total amount of funding of almost 6 million Lati of which about 0.4 million Lati was in the form of direct grants.

52. Based on technical, not economic, assessment, it is estimated that biomass could account for 20 to 30 per cent of the future energy balance, taking into account the coverage of woodland and agricultural land. This would involve increasing the amount of wood used as fuel, using rapeseed oil as biodiesel, increasing the amount of grain, potatoes and sugar beat converted to ethanol for use in transportation (there are currently 3 ethanol factories in Latvia with a total

annual capacity of 11 million litres), and producing biogas from agricultural and industrial wastes, municipal waste-water treatment plants and landfills. Equipment in most district heating plants is not suitable for burning wood or wood-wastes, although some boiler houses have been converted for this purpose. In recent years, the domestic price of wood has risen as exports to Nordic countries increased, which may slow down growth in the Latvian market. The biofuel programme described in the NC2 has been estimated by officials to cost more than 200 million Lati and, due to a lack of investor interest, is unlikely to be implemented.

C. Forestry

53. Due to their overall size, forests are of particular importance in Latvia. The total forest area was around 2.9 million hectares in 1997, having changed very little during the 1990s. Of this, 2.0 million hectares were categorized as commercial forest, 0.5 million as restricted or management forests and 0.3 million as protected forest. Since independence, the forest has gradually been returning to private ownership such that by 1997 the state owned about 52 per cent, 44 was in private ownership, and the remainder was owned by various agricultural enterprises. Prior to independence, there was large-scale forest land drainage, which has now ceased. Wetter land should lead to faster tree growth, but also higher emissions of CH₄ from soils, although there have been no surveys of forest soil conditions.

54. The total growing stock steadily increased from around 300 million m³ in the early 1970s to just below 500 million m³ in 1993, was stable at this level up to 1996 and increased by about 13 million m³ in 1997. The increase was due to an increase in forest area, increasing productivity, due to silviculture methods (afforestation, selection, intermediate felling and drainage) and comparatively low harvesting. The total increase in felling over the period 1991 to 1996 from around 4.5 million m³ to almost 9 million m³ was largely due to increased access to Western timber markets, privatization of domestic resources and privatization of the state-owned harvesting business in 1992. Although the forest authorities designate a so-called 'volume of available cut' for a period of five or in some cases 10 years for private forest areas, the owners are permitted by law to cut their designated volume at any time within this period and large numbers are taking early advantage of this possibility, which is one of the reasons for the recent increase in the total felling volume.

55. The area of afforestation and reforestation fell from around 9,000 hectares in 1989 to about 5,000 hectares in 1994 and thereafter increased to reach about 6,000 hectares in 1996. Natural reforestation takes priority over artificial planting in order to maintain biodiversity. In 1997, total forest regeneration amounted to about 11,000 hectares, compared to around 6,000 hectares in 1993. Afforestation and reforestation are mainly carried out in state-owned forest as many farmers cannot afford to reforest abandoned land, although limited government support is available. By 2020 it is estimated that there could be almost 0.6 million hectares of abandoned agricultural land. Farmers have an incentive to reforest because the tax on forest land is lower than that on agricultural land.

56. The forests suffer losses, in part because prevailing winds bring pollution from the highly industrialized countries of central and western Europe. In 1994, almost 2,400 hectares of forest stands perished, approximately one third due to pest damage. A rapid increase in the beaver population is also a significant problem, causing flooding of large forest areas and complicating forest management.

57. At the time of the review, the goals of forest policy were to prevent reduction of forest cover by setting limits on the transformation of forest lands, to ensure protection and improvement of the productivity and value of forest lands and to facilitate afforestation of marginal agricultural and other lands, through the use of existing state mechanisms. By observing these principles it should be possible to increase the total area of the forest and its future contribution to Latvia's economy. Forests owned by the state, local governments, individuals and legal entities, are subject to the same basic principles of forest management.

58. In the public sector, the Forest Development Fund collects the revenues mainly generated by the use of forests and their resources. Private forest owners pay property tax and then have free rights, so there is no other tax on forests as a resource even though forestry generates around 25 per cent of Latvia's export earnings. The Fund uses revenues to finance reforestation.

D. Agriculture

59. In real terms, the value of agricultural output in 1997 was 44 per cent of the 1990 level and the agricultural, hunting and forestry sectors combined contributed only about 7 per cent to gross value added, compared to around 21 per cent in 1990. Over this period the contribution of private farms to total agricultural output rose from about 28 per cent to approximately 80 per cent. The decline of agricultural output in the 1990s has been mainly due to shrinking domestic and export markets along with unfavourable price changes. There has been a steady decline in agricultural land use in the past 40 years and after 1990 there was a massive decrease in cultivated land area and livestock numbers. By 1997 overall livestock production was 29 per cent of its 1990 level and crop production had fallen by about a third. At the time of the review, imports of meat, especially pork, were cheaper than domestic production so further erosion of the market and declining livestock numbers may be expected.

60. About 3 per cent of the Government's expenditure is allocated to income support or subsidies for the introduction of new technology, buildings and soil improvement, but it has had a limited role in the agricultural sector since quota systems were removed; as of 1993, minimum prices and subsidies were only provided for a few agricultural products. Farmers receive a state subsidy for fuel use equivalent to 220 litres per hectare of land farmed.

61. Due to rising prices and a halving of the land area sown, nitrogen fertilizer use fell from about 123,900 tonnes in 1985 to 11,500 tonnes in 1995 before rising to 19,400 tonnes in 1997, thereby reducing emissions of N₂O over the period. As future agricultural output increases it is not clear whether the use of mineral fertilizer will increase correspondingly or whether good agricultural practices will offset this. The Ministry of Agriculture is preparing a code of practice

which should come into effect in 2000 to comply with the EC directive on nitrates so as to minimise pollution and environmental impact from agricultural fertilizers, especially sewage sludge. Voluntary training schemes will be run for farmers in relation to the Code. State subsidies are available for the construction of storage facilities for organic fertilizer and there is an organic farming association in Latvia, but only about 0.02 per cent or 200 farms were organic in 1999. It is now commonplace to burn the stubble in Latvia as there are insufficient tractors for reploughing, which could affect GHG emissions.

E. Waste

62. Waste management has been established as a priority in Latvia's overall environmental protection plan. A national municipal solid waste management strategy for 1998-2010 was adopted in 1998. It establishes priorities to prevent waste production, reduce waste volumes, recover and recycle waste, use waste for energy production, limit illegal dumping and safely dispose of waste not suitable for recycling or energy production. The strategy aims to have only 10 to 12 landfills with gas collection for energy use for the whole of Latvia by 2010, if funding permits. By contrast, in 1998 there were around 550 operating landfills, about two-thirds of which were smaller than 2 hectares, 160 closed landfills and no waste incineration facilities.

63. The Municipal Waste Act, an umbrella law setting the general framework for solid waste management in Latvia, was adopted in 1998. Whilst the MEPRD is responsible for coordinating activities under this legislation, waste management is to be implemented by local government, which should issue regulations related to the collection, storage and transportation of waste and also determine charges for waste management services.

64. Many EC directives regulating solid waste management, waste water and hazardous waste are being transposed into Latvian law. Officials expect Latvia to be compliant with the directives by 2010. The cost of meeting EC solid waste management requirements has been estimated at 233 million to 545 million ECU. Around a further 1, 215 million ECU is required for compliance with water standards.

65. The situation regarding solid waste disposal is quite varied across Latvia. In large cities and towns there are well organized waste management systems, but elsewhere approaches to waste disposal are ad hoc in terms of frequency of waste collection, size of landfill, degree of waste separation etc. Currently only about 50 to 60 per cent of all municipal waste produced is collected. This amount should be increased by about 10 per cent per annum under the waste management strategy from about 390,000 tonnes to 733,000 tonnes at the end of the strategy period. In rural areas, only about 20 per cent of the population is serviced by waste collection and illegal dumping in forests and ditches is commonplace.

66. In addition to landfill user fees, the Natural Resource Tax Act provides for industry taxes on the disposal of municipal waste and on packaging materials (mainly plastic and cardboard) and hence provides incentives for minimization. As 60 per cent of the tax revenue is provided to municipalities with an official landfill within their territorial boundaries (with the remainder

going toward the Latvian Environmental Protection Fund) each has an incentive to provide a landfill site. This law also provides for subsidies for the recycling or reuse of goods or products defined as being harmful to the environment. These subsidies are based on weight or are per item and cover, *inter alia*, mineral oils, batteries, substances depleting the ozone layer, glass and packaging. In general, the possibilities for recycling waste are limited in Latvia. There are two facilities for glass recycling and three plants for recycling plastics, although the market for recovered plastics is limited.

67. The World Bank, the Swedish Government and the Global Environment Fund (GEF) are supporting a solid waste project in Riga with loan funds of US\$ 8.8 million, US\$ 1.5 million and US\$ 5.1 million, respectively, in addition to local funds, resulting in a total of US\$ 24.1 million. This project comprises the clean-up of the existing waste site, including measures to deal with possible contamination, the construction of new landfill facilities and the extraction of landfill gas for electricity generation. As a condition for this project, the state electricity company has contracted to purchase the electricity at a premium price. The project is important in that the landfill serves about 40 per cent of Latvia's inhabitants.

F. Transport

68. The geographic position of Latvia has enabled it to become an important transport link between East and West. It has a relatively well developed transport network which caters more for transit traffic than domestic flows, as around 80 per cent of all rail traffic and 70 per cent of all road freight traffic is in transit. The transport and associated logistics sectors generated about 20 per cent of Latvia's GDP in 1997, accounted for around 45 per cent of all direct foreign investment and generated almost half of the country's foreign earnings.

69. Emissions of CO₂ in the transport sector fell between 1990 and 1996 and then rose in 1997, which can be explained by underlying trends in activity data. Passenger traffic on all modes fell during the 1990s. Between 1990 and 1997, in terms of million passenger-kilometres, there was a decline in rail travel from 5,366 to 1,148, in bus travel from 5,862 to 1,720, in trolleybus travel from 1,362 to 562 and in tram travel from 1,465 to 550. In the early 1990s, total freight transport in Latvia, in terms of tonne-kilometres, fell by more than half. There has been some recovery in recent years in both rail and road freight. The number of lorries increased from about 59,000 to 76,800 between 1994 and 1997 whilst the number of passenger cars increased from 251,600 to 431,800. In this period the number of buses also grew from 14,200 to 18,600, whilst the number of trolleybuses, trams and trains all declined. Rail freight predominates over road, as shown by the fact that in 1998, around 12,966 million tonne-kilometres were travelled by rail and 4,108 million tonne-kilometres by road. In 1996, Latvia had 176 passenger cars and 31 lorries per thousand of population compared to an EC average of 410 and 58, respectively, so their numbers and hence CO₂ emissions may be expected to further increase.

70. Following independence, the Government made the promotion of transit traffic a priority. The demand for transport services and related infrastructure form the basis of transport

policy. The main short-term efforts are directed at the rehabilitation and modernization of the existing inland transport infrastructure and also investment in ports to allow for larger volumes of cargo to be handled more efficiently. To a large extent, transport policy reflects the change in the volume of traffic flowing from Latvia to Western Europe due to changing trade patterns.

71. In November 1995, the Cabinet of Ministers approved the National Transport Development Programme for the period 1996 to 2010. It was estimated that 0.5 to 2.5 billion Lati would be required over the period 1996 to 2000 and 2.0 to 6.5 billion Lati over the period 2001 to 2010 to achieve its aims (equivalent to around US\$ 6 billion in total). Only part of the funding is available from the state budget, the rest coming from private enterprise and foreign assistance or loans. These figures include funds for ports, rail, road, aviation and oil pipelines. Thus far, the programme has resulted in several projects related to infrastructure, including highway construction, road repairs, bridge reconstruction and rural road development. It is possible that such improvements will encourage more private car transportation although much work is needed to simply maintain existing roads.

72. The State Road Fund was established in 1994 to provide investment funds for network maintenance and development. It obtains revenue, in part, from the excise tax on fuel and annual vehicle registration fees. According to the law on taxes, the excise duty is to increase by 0.04 ECU per half year in the period 1996 to 2001, thereby annually increasing funds for the road network. There is an annual road tax which is differentiated by type of vehicle and weight. There are natural gas filling stations in cities and for high mileage users it is economic to switch from petrol to gas; the excise duty level is also lower. There is state support for public transport and, in 1999, 8.3 million Lati were provided in subsidies for city, regional and long-distance bus services. These tax and subsidy measures may have some impact in limiting GHG emissions.

IV. PROJECTIONS AND THE EFFECTS OF MEASURES

73. The NC2 contains projections of CO₂, CH₄, N₂O, NO_x, CO, NMVOC and SO₂ emissions over the period 1990 to 2020 and some estimates of the individual effects of policies and measures.

74. Underlying the emissions projections are projections of GDP growth. The Government only produces 'official' GDP projections for the current and forthcoming year. In the context of EC accession, projections have been made up to five years ahead, but these do not have official status. In order to make emission projections, GDP projections were made specifically by the Latvian Technical University and the Ministry of the Economy, based on a macroeconomic structural long-term forecasting model. Two scenarios with different GDP growth rates were developed, the higher of which was used as the basis for GHG emission projections. In this scenario, economic growth is expected to be 5 per cent per annum in the period 1996-2000, 4 per cent in 2001-2010, 3 per cent in 2011-2015 and 2 per cent in 2016-2020. The composition of GDP is expected to change over time, with services and transport taking an increasing share.

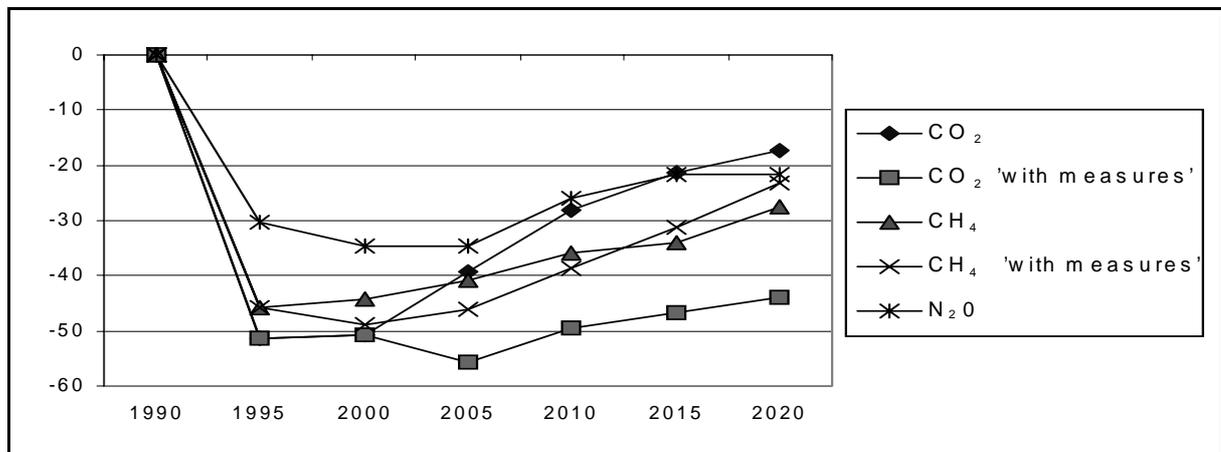
As a result of recent developments in the Russian Federation, officials are now less optimistic about economic growth than at the time of the NC2.

75. The greatest uncertainty related to GDP projections concerns external factors, given Latvia's high reliance on export markets and transit traffic and its anticipated accession to the EC. The projections assume that Latvia becomes a member of the EC in 2005. Later admittance would delay potential investment flows and development opportunities. Population is also a key factor underlying emission projections; it is assumed that there will be a small decline such that there are 2.33 million inhabitants in 2020, compared to 2.56 million in 1994.

76. Econometric models cannot be used to make energy projections in Latvia due to the lack of comparable time-series data for the pre-1990 period and significant changes in the structure of the economy, such that relationships between key variables have changed over time. Consequently, the CO₂ projections shown in the NC2 are based upon sectoral projections using a bottom-up MARKAL model and long-term economic development forecasts for the industry, agriculture and waste sectors reflecting expert opinion and strategic plans. One of the hardest tasks in making the projections was establishing a technology database for existing and future technologies covering costs and technical parameters, as MARKAL optimizes the choice of technology over time based on cost and availability. In this respect, the model is more useful as a policy tool to identify energy efficiency potential than for long-term energy and emission projections.

77. A number of supply- and demand-side assumptions were made in the model work, to a large extent based on Latvenergo development plans. The average efficiencies of CHP are expected to increase from 75-80 per cent in 1994 to 84-86 per cent by 2020, the share of cogeneration in heat production should increase from 21 per cent in 1994 to 31 per cent in 2020 and the average annual increase in energy efficiency should be 1 per cent. Electricity prices are expected to increase dramatically after 2000, but prices for all other fuels increase only modestly or remain constant to 2020. Heat losses in district heating are expected to fall from 20-30 per cent, on average, to about 8 per cent by 2019. Power transmission losses should be reduced from around 21 per cent in 1994 to about 12 per cent in 2020. Heat losses in buildings should also be reduced. Industry's demand for energy is expected to grow at 1.6 per cent annually along with a switch toward less energy-intensive industries, compared to annual growth of energy demand in services of 2.2 per cent. A rapid increase in car numbers is expected, but little growth of energy demand in the residential sector due to improved planning and building insulation. These assumptions should prove valid if there are no organizational, legal or financial barriers to their realization and if supporting measures for energy efficiency improvement such as subsidy removal are carried out.

Figure III. Past and projected emissions, percentage change from 1990



78. The reference scenarios include the expected effects of existing policies and measures and those for which legislation is in place but which have not been implemented. The CO₂ 'with measures' scenario assumes additional fuel switching, increased use of CHP, increased use of biomass, reconstruction of small hydroelectric plant and greater use of wind energy. The CH₄ 'with measures' scenario assumes significant efforts in the waste sector to decrease landfilling, recovery of CH₄ and its use for energy production.

79. The projections data do not fully correspond to those in the inventories section of the report, due to subsequent revisions of the latter. It can be observed in figure III that emissions of all the GHGs fell dramatically between 1990 and 1995 and that all are expected to trend upward toward 2020. In the reference scenario, CO₂ emissions from energy increase from 12,100 Gg in 1995 to about 12,300 Gg in 2000, 17,800 Gg in 2010 and 20,800 Gg in 2020, which is 17 per cent below the 1990 level. If energy efficiency improvements are not fully introduced, then CO₂ emissions could be 3,000 to 4,000 Gg higher than in the reference scenario. If additional measures are implemented then CO₂ emissions could be about 13,900 Gg in 2020. CH₄ emissions are projected to be in the range 95 to 104 Gg in 2000, compared to 186 Gg in 1990, and be in the range 135 to 143 Gg by 2020. There is only one scenario for N₂O emissions, which are projected to be 15 Gg in 2000, compared to 23 Gg in 1990, and increase to 18 Gg by 2020. The energy projections indicate a shift from natural gas to increased use of coal and peat. This will entail significant increases in emissions of NO_x, SO₂ and CO.

80. The results of the modelling indicate that from 2004 onward there will be no electricity imports, which will put pressure on domestic wood and peat reserves. Coal is the cheapest fuel and will be used in new CHP plant such that it will make up about one third of total primary energy supply in 2020, compared to 6 per cent in 1994. The share of natural gas in primary energy supply, having fallen from 27 per cent in 1990 to 17 per cent in 1994 may increase to 23 per cent in 2020, whilst the share of oil products may decrease to 30 per cent in 2020 compared to 53 per cent in 1990. By 2020 biomass is expected to account for 8 per cent of primary energy supply, without additional government support.

81. Separate projections were made for the transport sector. They presume that the number of cars will increase steadily to reach the current per capita level of Western European countries by 2020 and show emissions in the range 4,030 Gg to 4,070 Gg in 2020, compared to 5,830 Gg in 1990. Expert opinion differs as to whether emissions from transport could still be below the 1990 level in 2020 or exceed their 1990 level by 2010. No significant additional transport measures were included in the 'with measures' emissions projection. Officials from the Ministry of Transport have projected that the number of international aviation passengers arriving in Riga could more than double from 1997 to reach 1.3 million in 2012, so, although not projected, emissions from international aviation bunkers can be expected to grow considerably. Separate projections were also made for non-energy emissions. Cement and lime production is expected to remain stable until 2010, but thereafter if construction targets are achieved production of these and other raw materials could increase considerably.

82. LUCF projections were based on data from the State Forest Service and expert judgement. It was assumed that the area of agricultural land decreases due to economic factors and that about 0.6 million hectares are transformed into low-quality forest land. The area of forest should increase from 2.9 million hectares in 1995 to 3.4 million in 2020 and would cover about 52 per cent of the land area. The volume of forest harvesting is expected to increase over time to reach 12 million m³ by 2020, compared to almost 7 million m³ in 1995. Of clear-cut areas, about 70 per cent should be replanted and 30 per cent regenerated naturally. Net CO₂ sequestration should increase from almost 11,000 Gg in 1990 to about 13,600 Gg in 2010 and be over 12,300 Gg in 2020. Carbon enrichment of the soil of afforested abandoned agricultural land is included in the calculations. In the 'with measures' CO₂ scenario, the effect of afforestation of 10,000 hectares of abandoned agricultural land annually from 1997 to 2020 was incorporated, which could increase CO₂ sequestration by a further 310 Gg in 2020.

83. Projections of CH₄ and N₂O emissions from the energy sector were based on the outputs of the MARKAL modelling. For other sectors expert judgement was used in conjunction with long-term economic forecasts made by the Ministry of the Economy. Fugitive emissions are expected to grow in line with increased gas usage. It is assumed that efficient large-scale farming will grow in the coming years and that livestock numbers will not grow. Based on population and economy growth rate, waste volumes are expected to grow, such that CH₄ emissions from landfills are projected to exceed the 1990 level by 70 per cent in 2020. Taking into account the closure of the smallest landfills and increasing number of deep landfills, CH₄ emissions may be expected to increase, although this will be countervailed to the extent that gas is collected and flared or used for energy production. According to the 'with measures' scenario, such emissions could be 6 per cent below the 1990 level in 2020.

V. EXPECTED IMPACTS OF CLIMATE CHANGE AND ADAPTATION MEASURES

84. There have been no studies to assess the potential impact of climate change on Latvia as the Research Council has not made this a priority for its limited funding. However, the NC2 notes that European studies on 'Strategies for a Process of Long-term Adaptation of Forests in Europe to Climate Change' are of relevance to Latvia.

85. Currently, there are no specific climate change adaptation measures. Under the EC PHARE multi-country programme, a project for integrated coastal zone management between Latvia and Lithuania was conducted and a follow-up project on the development of a coastal zone management strategy is being implemented in Latvia. However, sea level rise is not of particular concern for Latvia as the country is still rising.

VI. EDUCATION AND PUBLIC AWARENESS

86. Few activities are directly targeted at climate change, although there are various initiatives related to environmental education in general. Environmental activism had a prominent place in the politics of the late 1980s and early 1990s, when most Latvian non-governmental organisations (NGOs) were also founded, such that public awareness of environmental issues is relatively high.

87. The public's right to have access to information about the environment is enshrined in various legal acts, in particular the Environmental Protection Act. Furthermore, at the time of the review, Latvia was preparing to ratify the Convention on access to environmental information, public participation in environmental decision-making and access to justice on environmental matters. Such rights to information are typically not accompanied by procedural provisions to supply such information. However, the new Environmental Impact Assessment Act provides for a public hearing, places an obligation on authorities to take public opinion into account and offers the possibility for the public to appeal decisions.

88. Environmental education has no formal status in the curriculum, but environmental education projects have been organized since 1996 related to a wide range of activities, including training programmes for schoolchildren, students, lecturers, journalists and local government employees. NGOs are also actively involved in public awareness campaigns. At the time of the review, an environmental education and communication strategy was under preparation which considers possibilities to integrate environmental education into various sectors such as state administration, local government, educational establishments, pre- and post-school training, NGOs, industry, mass media and households. Despite this, officials noted that the feasibility of supporting educational activities is limited by budgetary concerns.

89. The MEPRD produces various annual publications which inform about the state of the environment. The functions of the regional environmental boards also encompass the provision of ecological education to the general public. In 1997, Latvenergo established an Electrical Energy Efficiency Centre for consumers in Riga to receive advice on how to use electrical appliances safely and efficiently. There are no such schemes to assist industry.

VII. ACTIVITIES IMPLEMENTED JOINTLY

90. At the time of the review there were 27 projects under the pilot phase of activities implemented jointly (AIJ) with Sweden, Germany and the Netherlands. Two projects to convert CHP plants to natural gas have received support from the Netherlands. During the period 1993

to 1997, Sweden took part in 22 projects in Latvia involving an investment of SKr 65 million. Most of these projects related to increased use of renewables, whilst four related to improved energy efficiency in heat distribution systems and two were to improve efficiency in end-user installations and buildings. As a result of these projects, approximately 355,000 MWh energy was produced from biofuels resulting in annual energy savings of 14,500 MWh per annum and a reduction in CO₂ emissions of about 108 Gg, in addition to savings of 0.9 Gg of SO₂ and 0.05 Gg of NO_x.

91. These projects all involved soft loans, local project management and support from Swedish consultants. A maximum of 10 years is usually permitted for repayment, with an initial two-year grace period. In general, projects have shown good profitability with short pay-off periods of around three to five years for boiler conversion to use biofuel for example. A special project has been established to produce small boilers in Latvia. Projects are chosen in consultation with the responsible Latvian ministries to ensure that the activities are in keeping with domestic policies. Sweden has also held seminars and workshops in Latvia covering issues such as biofuel extraction and handling, measures to upgrade district heating networks and energy efficiency in heat distribution.

VIII. RESEARCH AND SYSTEMATIC OBSERVATION

92. Since regaining independence, Latvia has had greater opportunities to contribute toward international research efforts such as the World Climate Research Programme, the International Geosphere-Biosphere Programme and the Global Change Human Dimension Programme. Various areas of domestic research related for example, to waste for energy production, transformation of agricultural land to forest, coastal zone management and energy efficiency are related to climate change, but such activities are not coordinated under a climate change umbrella. Academic environmental science mainly falls within the competence of the Latvian Academy of Science and the Ministry of Education and Science. The MEPRD suggests the topics and scale for desirable research and participates in financing of such research activities. It particularly supports the development of applied environmental science.

93. The meteorological observation network comprises 23 observation stations with additional precipitation and snow cover observations at 70 sites. There are 10 marine hydrological observation stations located along Latvia's coastline and 21 hydrometeorological stations aboard Latvian ships. The hydrological network includes 56 water level measurement points, 7 lake and 3 reservoir points, and 2 points for measuring evaporation from the water surface. Environmental pollution observation stations work in conjunction with meteorological stations.

IX. CONCLUSIONS

94. Latvia, like other economies in transition, has witnessed a substantial fall in its GHG emissions since 1990. The industry, agriculture and construction sectors experienced significant falls in output during several years of recession, but Latvia may now be entering a period of

sustained economic growth as policies geared toward closer international integration, free trade and competition have increasing effects, so GHG emissions can be expected to increase.

95. The team were impressed by the significant efforts made to convert statistical reporting to international standards, whilst recognizing the resultant difficulties for GHG inventory calculation, especially for the early 1990s. During the review the team suggested a number of possible improvements to the inventory. Where revisions have occurred, this has not always been applied to the whole time-series. Furthermore, there are several omissions including the new gases and international bunkers. The team encouraged additional work to ensure the consistency of inventory data as well as national studies on emission factors and methodologies.

96. Electricity generation is dominated by hydropower so fuel use in district heating, households, transport and industry is currently of greater relevance to GHG emissions. CHP accounts for less than a quarter of the fossil fuel based district heating system. Heating requirements are great due to the low average ambient temperatures and poor standards of insulation. Whilst the majority of households are connected to district heating systems, in cities some are installing their own gas boilers. Future electricity and heat demand could be met by the construction of new coal-fired plant, which would increase GHG emissions accordingly. Biomass could have an increasingly important role in the energy balance, although, in part, this will depend on future Scandinavian demand and the price of wood. Car and lorry numbers per capita are currently below the EC average are expected to increase with economic growth.

97. Environmental awareness in policy-making has increased during the 1990s, but climate change mitigation is yet to become a priority. Nevertheless, many of the cross-sectoral policies targeted at air pollution will also have an impact on reducing GHG emissions. With a view to acceding to the EC, Latvia is transposing the most significant EC directives into its legislation. Provided sufficient funds are available to implement such measures, this could also have a substantial influence on the future path of GHG emissions. The Latvian forest covers almost half of the land area and its maintenance and continued expansion should result in increasing CO₂ sequestration.

98. The team noted the difficulties encountered in projecting emissions and hence the uncertainty attached to the projections. It is clear that Latvia will have no difficulty in meeting its commitments under the UNFCCC as CO₂, CH₄ and N₂O emissions are projected to be 51, 47 and 35 per cent, respectively, below the 1990 level by 2000. In the longer term, emissions could remain below the 1990 level up to 2020, especially if the energy efficiency improvements forecast transpire.
