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Report on the in-depth review of the third national communication of the Russian Federation

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# I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

## A. Introduction

1. The secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) received the Third National Communication under the Framework Convention on Climate Change of the Russian Federation, hereinafter referred to as the NC3, on 20 November 2002. An in-depth review of the NC3 was carried out from May 2003 to December 2003, including a visit to Moscow from 30 June to 4 July 2003. The review team consisted of Mr. Luis Cacéres Silva (Ecuador), Mr. Zoltan Somogyi (Hungary), Mr. Antonio Soria (European Community), Ms. Isabel Murray (International Energy Agency (IEA)), Mr. James Grabert (UNFCCC secretariat) and Ms. Katia Simeonova (UNFCCC secretariat, coordinator).

2. During the country visit, the review team had a number of meetings and discussions on different aspects of the Russian climate policy as summarized in the NC3. During these meetings with government officials, academics, and business and environmental non-governmental organizations (NGOs), the review team was provided with a range of additional material and information that supported and augmented the information provided in the NC3.

## B. National circumstances

3. The Russian Federation is the largest country in the world. It covers almost 13 per cent of the Earth's surface, with a total mainland area of over 17 million $km^2$. Around 46 per cent of the total land area is covered by forest and other woodland; Russian forests make up almost a quarter of world timber resources; around 8 per cent is arable and permanent crop land, 5 per cent is grassland, 19 per cent is reindeer and pastures; and 12 per cent is covered by marshes and water areas. The remaining part is covered by urban areas and settlements, set-aside lands and roads. Around 67 per cent of the land area is under permafrost, which lies partly beneath marshes and other areas. The climate varies widely across the country: average winter temperatures range from –51°C in Siberia to 0°C in the European part of the country, and in the southern parts summer temperatures can be as high as 30°C.

4. In the census conducted in 2002, the population of the Russian Federation was estimated at about 145 million. It is very unevenly distributed, with most of the population living in the European part of the country. More than 70 per cent of the population lives in cities. Average population density is about 9 inhabitants per $km^2$, with densities ranging from 328 and 76 inhabitants per $km^2$ in Moscow and St. Petersburg respectively, to 1.2 inhabitants per $km^2$ in far eastern regions of Siberia.

5. After the break-up of the Soviet Union in 1991, the Russian Federation experienced severe economic decline. Gross domestic product (GDP) declined by 46 per cent over the period 1989–1998. Since the financial crisis in 1998, the country has experienced 5 years of strong economic growth, peaking in 2000 at 9 per cent growth which then fell to 5 in 2001 and 4.3 per cent in 2002. Initially this growth was fuelled mainly by high prices for exported oil and the devaluation of the rouble to 25 per cent of its earlier level, but since 2000 government management of export revenues, fiscal budget control and monetary policy have greatly improved. The management of the macro-economy and the progress in promoting large-scale economic reform have been responsible, and by and large successful, although higher prices for export commodities have continued to contribute substantially to sustaining the macro-economic improvement.

6. The energy sector plays a huge role in the economy of the Russian Federation. It accounts for about 28 per cent of GDP, 26 per cent of industrial output, 55 per cent of federal budget revenues and 54 per cent of exports. The country's natural resource endowment ranks it among the world's most important energy producers. An estimated one-third of the world's natural gas reserves remains in the Russian Federation's super-giant fields and adjacent smaller fields. Annual natural gas production fell by 11 per cent between 1990 and 1997, from 640 billion $m^3$ (bcm) to a low of 571 bcm. Since 1997, production has been rising, reaching 584 bcm in 2000 and 595 bcm in 2002. Over 60 per cent of this is

used domestically and the rest is exported – the Russian Federation is a key exporter of natural gas to Europe. The country also holds the world's second-largest remaining reserves of crude oil after Saudi Arabia – almost 15 per cent of total world reserves. Although oil production almost halved from 11.4 million barrels a day (mb/d) in 1988 to 6.0 mb/d in 1996, it has steadily increased from 6.1 mb/d since 1999 to 7.6 mb/d in 2002, and the Russian Federation ranks as the world's second largest exporter of oil and oil products.[1]

7. Throughout the 1990s, natural gas was the most important primary energy source, increasing from 42 per cent of the total primary energy supply (TPES) to 52 per cent in 1999 and maintaining this share to 2001. This increase was matched by a fall in the shares of both oil and coal, which decreased respectively from 30 per cent to 21 per cent and 21 per cent to 18 per cent between 1990 and 1999. The rest of the TPES is made up by nuclear energy, with a share that increased from 4 to 5 per cent over the 1990s, followed by hydro, with an almost constant share of around 2 per cent, and combustible renewables and waste, with a share of just over 1 per cent. Between 1990 and 1997, the TPES fell by 30.5 per cent, which was less than the drop in GDP over this period. This is partly because energy demand in the residential sector was not very sensitive to the fall in GDP and associated fall in income, and also because the economy became less efficient, as further elaborated in paragraph 48. This in turn led to the decline in the $CO_2$ emissions being somewhat smaller than the decline in GDP (table 1).

**Table 1. Main macro-economic indicators and greenhouse gas emissions[a]**

| | 1990 | 1999 | Percentage change between 1990 and 1999 |
|---|---|---|---|
| Population (millions)[a] | 148.29 | 146.31 | –1.3 |
| Gross domestic product – GDP (billions of USD of 1995) | 1342.6 | 814.8 | –39.3 |
| Total primary energy supply – TPES (Mtoe)[b] | 868 | 603 | –30.5 |
| Electricity consumption (TWh) | 989.6 | 735.9 | –25.6 |
| GHG emissions[c] (Gg $CO_2$ eq.)[c] | 3 048 000 | 1 877 000 | –38.4 |
| GHG emissions per capita (Mg $CO_2$ eq.) | 20.6 | 12.8 | –37.4 |
| GHG emissions per GDP unit (kg $CO_2$ eq. per USD of 1995) | 2.27 | 2.30 | 1.3 |

[a] The population, energy and GDP data (expressed in 1995 prices through purchasing power parity) are from the IEA database.
[b] Millions tonnes of oil equivalent.
[c] Emissions data are from the UNFCCC database and do not include emissions/removals from land-use change and forestry (LUCF).

8. Throughout the 1990s natural gas was the main source for electricity generation, with a 42 per cent share in 1999, followed by coal, 19 per cent; hydro, 19 per cent; nuclear, 14 per cent; and oil, 5 per cent. Generation from combustible renewables and waste accounted for less than 0.2 per cent. The share of natural gas in the fuel mix for thermal electric power in the European part of the Russian Federation rose from about 68 per cent in 1990 to almost 73 per cent in 2000. Concerns about an excessive dependence on natural gas and the need to secure natural gas exports have strengthened proposals to increase the share of coal in the energy outlook to 2020, which represents a key policy change within the energy strategy of the Russian Federation, hereinafter referred to as the 2003 Energy Strategy.[2]

9. Total final consumption (TFC) dropped by 38 per cent between 1990 and 1999, to reach 410 Mtoe, and thereafter increased to 427 Mtoe by 2001. The share of natural gas in the TFC increased from 22 per cent to 28 per cent, while the share of coal, oil and oil products dropped from 8 per cent to 5 per cent and from 24 per cent to 21 per cent respectively.[3] The TFC by sector remained relatively constant throughout the 1990s. The share of the industrial sector dropped slightly from 38 per cent in 1990 to 33 per cent in 1999, while the shares of the residential and transport sectors increased from 30 per cent to 33 per cent and from 18 per cent to 20 per cent respectively.[4] In comparison with countries of the Organisation for Economic Co-operation and Development, the sectoral breakdown of the Russian Federation has a much higher share of TFC in the residential sector and a much lower share for transport.

[1] The Russian Federation is not a member of the Organization of Petroleum Exporting Countries.
[2] After the review team's visit to Moscow, the 2003 Energy Strategy was adopted by the Russian Government on 28 August 2003.
[3] The breakdown of fuel shares of TFC maintained the same percentages in 2001 as in 1999.
[4] In 2001 the industrial sector increased its share of the TFC to 35 per cent and the residential sector to 34 per cent, while the transport sector's share fell to 19 per cent.

10. Several national circumstances have major implications for the country's emission profile and related policies: (1) The strong economic growth over the last 5 years and the outlook for continued growth will bring with it increased energy demand and upward pressure on emissions of greenhouse gases (GHGs); (2) If the country is to be able to match increasing energy demand both on the domestic front and for export, the anticipated energy sector reforms will need to engender a more attractive investment environment to provide the required incentives for energy efficiency investments and emission reductions; (3) Also, as part of the energy sector reform, natural gas and electricity prices are set to increase to cost-reflective levels, which should stimulate efficient use of energy and enhance the competitiveness of renewable energy sources; (4) Countering this is the intention to focus on increasing the share of coal in the thermal fuel mix for power generation to meet increasing electricity demand.

## C. Institutional framework and recent developments in climate policies

11. The Russian Federation is a presidential republic, established in August 1991 following the break-up of the Soviet Union. Federal executive powers lie with the President and the Government. The Russian Federation consists of 89 territorial "subjects of the Federation" including 49 oblasts, 21 republics, 10 autonomous regions (okrugs), 6 territories (krais), 1 autonomous oblast, and the cities of Moscow and St. Petersburg, which have special status. President Putin recently established the concept of "super regions", creating seven such regions to better manage federal–regional coordination.

12. National climate change policy is coordinated by the Inter-Agency Commission on Climate Change (ICCC) of the Russian Federation. The co-chairmen of the ICCC are the Deputy Minister of the Ministry of Economic Development and Trade and the head of RosHydromet, and all relevant ministries[5] are represented by two members. The ICCC also coordinates work on climate change with companies and, in particular, with Russian Joint Stock Company Unified Energy System of Russia (RAO UES) and AO Gazprom, which are represented in the commission. The Institute of Global Climate and Ecology (IGCE) is the leading institute within this framework. The ICCC and the IGCE coordinate information flows and work on the national communications under the UNFCCC, and contribute to the work of the Intergovernmental Panel on Climate Change (IPCC). The preparation of the NC3 was one of the main outcomes of the 1996 *Federal Target Programme for the Prevention of Dangerous Climate Change and its Negative Impacts*. The review team noted that, as with the previous national communications, environmental NGOs had not been involved in the preparation and review of the NC3.

13. The Russian Federation ratified the UNFCCC on 28 December 1994. As a Party included in Annex I to the Convention (Annex I Parties), it has agreed to implement national policies limiting anthropogenic GHG emissions and to enhance sinks and reservoirs, with the aim of reducing emissions to their 1990 level by 2000 according to Article 4.2 of the UNFCCC. During the review team's visit, inventory data were available up to 1999, but not for 2000. However, given that emissions in 1999 were 38 per cent lower than in 1990, it is likely that the country will contribute substantially to meeting this aim.

14. Under the Kyoto Protocol, the Russian Federation should not exceed emission levels of 1990 between 2008 and 2012. The country's overall GHG emissions in 1990 are estimated to have been 3,048,000 Gg $CO_2$ equivalent. Over 85 per cent (2,360,000 Gg) consisted of carbon dioxide($CO_2$), and fossil fuels are estimated to account for over 98 per cent of direct anthropogenic $CO_2$ emissions. The NC3 estimates that emissions in 2010 are expected to be 78-89 per cent of 1990 levels. The 2003 Energy Strategy presents recent official Russian estimates for future development of the energy sector and related GHG emissions. Levels in 2010 are expected to be at 78–83 per cent of 1990 levels and are not expected to regain 1990 levels even by 2020, thus allowing the country to attain its commitment envisaged under the Kyoto Protocol. This confirms the assessment in the NC3 that the fall in emissions in the 1990s created a basis for a low-cost strategy for the Russian Federation to implement the UNFCCC and the Kyoto Protocol between 2001 and 2010. This assumes effective implementation of reforms in the energy sector and substantial improvements in energy efficiency. Importantly, the 2003 Energy

[5] These include the Ministry of Energy, the Ministry of Natural Resources, the Ministry of Agriculture, the Ministry of Industry, Science and Technology and the Ministry of Transport and the State Statistics Committee.

Strategy recognizes the possibility of ratification of the Kyoto Protocol and the need to establish legal and institutional frameworks to ensure effective and transparent ways to achieve the Protocol's goals.

15. Another important milestone in recent climate change policy development is the preparation in 2003 by the Ministry of Economic Development and Trade of the *National Action Plan for Implementing the UNFCCC and Preventing Dangerous Impacts from Climate Change on Population and the Economy* (hereinafter referred to as the 2003 Climate Action Plan), which is to be approved by the ICCC by the end of 2003. This is a recognition of the need to coordinate various climate change policies across relevant ministries and economic sectors, which was stressed by the Prime Minister of the Russian Federation in the State Dumas in May 2000 and highlighted in the NC3.

16. At the time of the in-depth review, the relevant authorities, in particular RosHydromet and the Ministry of Economic Development and Trade, were considering the ratification of the Kyoto Protocol and the legislation that is needed for this purpose. Also, they were considering possible implications for climate change policy of President Putin's announcement in the State of the Nation Address in 2003 that the country was to double its GDP within a decade. There is a concern that, if the Russian Federation ratified the Kyoto Protocol, this commitment would limit its ability to meet the ambitious new economic goals. However, there is also a recognition that the Protocol could provide added investments through its mechanisms to aid the Russian Federation in its goal to enhance energy efficiency, reduce energy intensity and ensure its energy security during this period of rapid economic growth. In this context, it is a positive development that key companies such as RAO UES and AO Gazprom have already initiated preparation of their GHG inventories and have been involved in joint implementation (JI) projects.

## II. GREENHOUSE GAS INVENTORY INFORMATION

### A. Inventory preparation

17. The institutional arrangements for the preparation of the emission inventory reported in the NC3 remained broadly the same as in the second national communication (NC2). RosHydromet maintained its overall responsibility for coordination and assessment of GHG inventories, while the IGCC continues to oversee this process. On behalf of RosHydromet, the actual estimation for inventories is performed by the IGCE. This work is carried out in cooperation with relevant ministries, agencies, institutions and enterprises, such as the State Statistics Committee, State Construction Committee, Ministry of Energy, Ministry of Transport, Ministry of Natural Resources, Ministry of Agriculture, Ministry of Health, All-Russian Scientific and Research Institute of Silviculture and Mechanization of Forestry, RAO UES and AO Gazprom.

18. The 1996 *Federal Target Programme for the Prevention of Dangerous Climate Change and its Negative Impacts* was intended to support climate change activities and to serve as a main component for work on the preparation of and improvements to national GHG inventories. However, the programme was never fully funded and came to an end in 2001. The reduced resources and insufficient funding hindered the work on GHG inventories. The work was also hindered by lengthy response times from other ministries and agencies in providing information and data as well as reviewing materials, which was also partly due to limited resources. It is expected that with the implementation of the new 2003 Climate Action Plan additional resources will be made available for work relating to GHG inventories.

19. The GHG inventory included in the NC3 is based on the national GHG inventory submitted to the UNFCCC secretariat in 2002, as well as previously submitted inventories. The data for 1997–1999 are based on the 2002 inventory submission. The data for other years (1990, 1994–1996) were largely based on the 1999 inventory submission and the NC2. Some changes and additional sources for these years were also included in the NC3. Although only aggregate estimates for 1991–1993 were provided for some gases in the NC3, additional details for estimates for these years were provided to the review team after the visit, and they are reflected in the analysis, tables and figures below.

20. The inventory covered all GHGs and most sources of emissions and removals, including $CO_2$, methane ($CH_4$), nitrous oxide ($N_2O$) and fluorinated gases – perfluorinated hydrocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride ($SF_6$). The inventory also included, although only

at an aggregated level, emission of indirect GHGs, or precursors, such as nitrogen oxides ($NO_X$), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide ($SO_2$). Although the inventory was largely complete, some sources were not estimated. These included fugitive $N_2O$ emissions, separate estimate of emissions from aviation bunkers, many industrial process emissions and industrial waste water treatment emissions. Of particular concern to the review team was that estimates from fuel combustion were prepared only on a top-down basis using the IPCC reference approach and that estimates following the sectoral approach had not yet been prepared. As a result it was impossible to fully understand the trend in emissions at a disaggregated level, with the exception of emissions data on electricity and heat production from RAO UES which were included in the inventory.

21. As required by the UNFCCC guidelines, the reporting of inventory information in the NC3 is broadly consistent with the inventory submission of the year in which the NC3 was submitted. However, this 2002 inventory was not in accordance with the UNFCCC reporting guidelines for submission of annual GHG inventories, as it did not follow the common reporting format (CRF), and did not contain the required national inventory report (NIR), which provides further detailed explanations of calculation procedures, methodological choice, and detailed information on emission factors and activity data. The lack of the CRF and NIR somewhat hindered the review team’s preparations. During the course of the review the national experts made efforts to provide background materials and information, and further explanations. Also, the review team was informed of the intention of the Russian Federation to submit its next GHG inventory in the required format, subject to availability of resources.

22. The team noted the improvements in emission inventory compared to the information provided in the NC2, which covered all areas of inventory work, from data collection and use, to methodology and preparation processes. New sources that have been included since the inventory of the NC2 are: $CO_2$ emissions from ferroalloy production, carbide production, lime production, soda ash production, ammonia and liming of soils; $CH_4$ emissions from polystyrene, carbon black, ethylene, methanol and coke production; $N_2O$ emissions from human sewage; $SF_6$ emissions from electrical equipment; and calculations from RAO UES of emissions ($CO_2$, $CH_4$, $N_2O$) from electricity and heat production. However, a number of these sources were included only for the years 1997–1999 and not estimated for earlier years, which introduced inconsistency in the time series.

23. A number of recalculations or changes to previously reported estimates were also included in the NC3. These included recalculations of $CO_2$ estimates from land-use change and forestry (LUCF), including the addition of forest fires; $CH_4$ emissions from animal waste and forest fires; and $N_2O$ emissions from agricultural soils, forest fires and animal waste systems. Also, changes were made to the calculation of $CO_2$ emissions from biomass use; 1997–1999 estimates are exclusively calculated on the basis of official fuel wood statistics (whereas earlier estimates still included expert judgment as to additional use of fuel wood). Aviation bunker emissions, previously reported, were excluded because of uncertainty in the estimates.[6] The review team stressed the need for recalculations of emissions, e.g. when new sources were added, as noted in paragraph 22.

24. The overall impact of recalculations and changes in estimates for total GHG emissions, excluding net $CO_2$ from LUCF, is small, as they affected only small sources and only some years, excluding the base year (table 2). However, because of the big change in the LUCF estimates, total GHG emissions, including net $CO_2$ from LUCF showed considerable variations from previously reported estimates (increases of 21 per cent for 1990 and 1994, and of 59 per cent for 1996).

25. The review team was provided with information on the ongoing and planned inventory-related work of IGCE. Noteworthy was the ongoing work on preparation of the sectoral approach for the energy sector in collaboration with the State Statistics Committee aimed at ensuring more accurate fuel data. Other ongoing work include a review of marine bunker data in collaboration with the Ministry of Transport, estimation of $CO_2$ from iron and steel separate from the energy sector, development of country-specific emission factors for cement and agriculture, estimates for additional sources (industrial

[6] Estimates were previously based on the literature, and as no new official data were available, it was felt by the national experts that extrapolating the earlier figures would significantly reduce the accuracy of estimates.

process-related emissions not yet covered, paint application, industrial wastewater treatment, fire extinguishers and expanded coverage of emissions from refrigeration).

**Table 2. Comparison of emission estimates between the NC2, the 1999 inventory and the NC3, (Gg $CO_2$ equivalent)**

| Emissions | NC2 | | 1999 inventory | NC3 | | |
|---|---|---|---|---|---|---|
| | 1990 | 1994 | 1996 | 1990 | 1994 | 1996 |
| $CO_2$ (without LUCF) | 2 372 000 | 1 660 000 | 1 495 920 | 2 362 000 | 1 660 000 | 1 495 000 |
| $CO_2$ (with LUCF) | 1 980 000 | 1 092 000 | 655 920 | 2 517 000 | 1 422 000 | 1 321 000 |
| $CH_4$ | 557 000 | 412 000 | 389 424 | 550 000 | 411 000 | 388 000 |
| $N_2O$ | 70 000 | 40 000 | 40 920 | 98 000 | 48 000 | 41 000 |
| Fluorinated gases | 40 000 | 40 000 | 39 082 | 40 000 | 35 000 | 36 000 |
| **Total (with net $CO_2$ from LUCF)** | **2 647 000** | **1 584 000** | **1 125 346** | **3 205 000** | **1 916 000** | **1 786 000** |
| **Total (without $CO_2$ from LUCF)** | **3 039 000** | **2 152 000** | **1 965 346** | **3 050 000** | **2 154 000** | **1 960 000** |

*Note*: Discrepancies in totals in this table and in the other tables in the report are due to rounding.
Data under the NC3 columns include the most recent estimates.

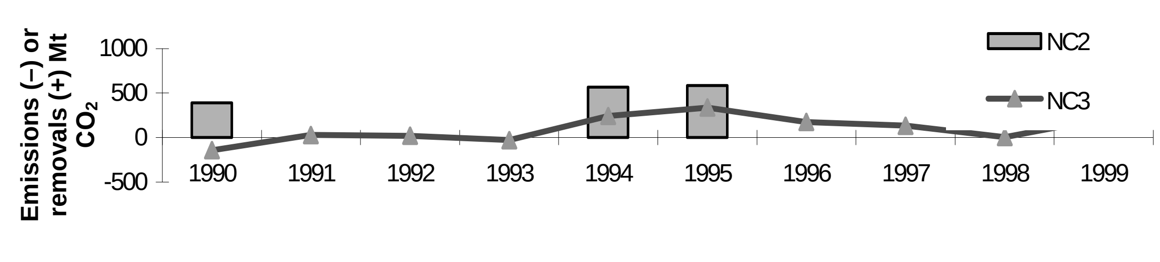
26. The team was also informed of the activities of other agencies and organizations relating to GHG inventories. For example, both RAO UES and AO Gazprom are continuing their inventory-related work with respect to their systems, equipment and operations, including work on related emissions factors. The Moscow Center for Energy Efficiency has also conducted seven regional inventories. The review team highlighted the importance of this work and pointed out how it could serve as a cross-check to the national inventory, especially where the regions concerned are responsible for a large share of a particular industrial activity. The Ministry of Natural Resources informed the team of its ongoing work to improve the accuracy of data collection on landfill composition and impacts on emission estimates.

27. In the previous communication estimates were almost solely based on IPCC Guidelines, except for LUCF. In the 2002 inventory national experts considered adjustments to IPCC methodologies and use of country-specific emission factors for development of national approaches. In the energy sector such emission factors were used for fugitive emissions of $CH_4$ from gas production and from gas transmission. Estimates of $SF_6$ emissions from electrical equipment were calculated using country-specific factors. Emissions related to the use of HFCs were calculated using a country-specific method and production-related emissions were calculated in accordance with the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, hereinafter referred to as IPCC Good Practice Guidance. For agriculture, new country-specific emission factors for $N_2O$ emissions from animal waste systems and fertilizer use were used.

28. Conversely, whereas in the NC2 a country-specific method (a mathematical model) was applied to estimate $CO_2$ emissions and removals in LUCF, in the NC3 estimates were obtained following the IPCC guidelines, which national experts believe enhance transparency, accuracy and comparability. A detailed database for activity data (forest area, growing stock, forest fire, harvests), as well as country-specific (biomass) and default (harvest and fire) expansion and conversion factors were used for these estimates. Using the new data and methodology, both removals and emissions were recalculated for 1990–1994, and were estimated for 1995–1999, which resulted in notably different estimates, e.g. a difference of around 500,000 Gg $CO_2$ for 1990, and about 250,000 Gg $CO_2$ for 1995 (figure 1).

29. The review team thoroughly reviewed the information on the LUCF sector in the NC3, given the notable differences in emission and removal estimates reported in the NC2 and NC3 and the overall contribution of the sector to the inventory. In terms of individual subcategories within the LUCF sector, the NC3 identifies “changes in forest and other woody biomass stocks” as the main contributor to emissions and removals. Emissions of $CO_2$ from “forest and grassland conversion” were not reported, as there is no cultivation of virgin lands, and annual conversion of forest land is regarded as negligible. No estimates were provided for “abandonment of managed lands”, as data are not yet available.

**Figure 1. Comparison of net emission and removal estimates from LUCF**




30. To estimate $CO_2$ removals, the IPCC Tier 2 method was used on the basis of official forest inventory data of the State Census of Forest Stock for 1988, 1993, and 1998, and extrapolated data for 1999. The forest inventory uses combined remote sensing and field sampling data for 65 per cent of the national forest stock (i.e. forests of high productivity) with an uncertainty of volume stock estimated at 10 per cent, while the remaining 35 per cent (i.e. forests of low and very low productivity) are estimated with the use of remote sensing techniques with an uncertainty of 30 per cent. The review team noted complex changes from year to year in the area of “lands actually covered by forests”, which is a major category in estimating stock changes, as a consequence of: (a) decreases due to harvest and forest fires; and (b) simultaneous increases, because lands regenerated and afforested earlier are added to the category as soon as they reach minimum size criteria.[7] To estimate $CO_2$ emissions, the IPCC Tier 1 method was used. The volumes of harvested and burnt timber from national statistics were converted to carbon with the use of default IPCC conversion factors. As these factors are smaller than the factors used to estimate removals, net removals may be overestimated.

31. Emissions of $CO_2$ from forest fires are included in the LUCF sector. It is believed that this modification of the IPCC Guidelines better reflects the $CO_2$ balance under Russian conditions. This balance is negative, because the amount of carbon accumulated over burnt areas as a result of post-fire regeneration is estimated to be lower than its release from fires. The review team noted that if removals are calculated on the basis of changes in volume stocks, a separate accounting of emissions from forest fires may result in double counting. Also, the emissions from biomass burning (i.e. firewood production) were estimated and reported under the energy sector, but not included in the total emissions of the country, in line with the guidelines. They were, however, also estimated as part of the emissions from harvests, and reported under emissions from forestry. The team noted that the Russian Federation might consider reporting on forest fires under the “changes in forest and other woody biomass stocks” subcategory and firewood under the LUCF sector, and checking the estimates to avoid double counting.

32. Although there is no formally implemented uncertainty assessment plan for the inventory as a whole, the review team was provided with information on the level of uncertainty for some sources and sectors. A preliminary estimate suggests uncertainty of 8 per cent for $CO_2$ emissions from energy and 20 per cent from agriculture, noting that the uncertainty of the activity data component in the agriculture sector was around 5 per cent. For LUCF, estimates were a ±20 per cent for harvesting, ±10 per cent for stock changes, and ±20 per cent for volume increment, with an overall ±20 per cent for the sector.

33. The Russian Federation has initiated its preparation for phasing in the IPCC Good Practice Guidance into its GHG inventory preparation. In particular, a process for review of results was established through the ICCC, and internal quality controls in terms of the data handling and calculation procedures were introduced. Also, a system for the preparation of the inventory was designed; however, it is yet to be implemented. A preliminary key source analysis was completed for 1998.

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[7] The unbalanced dynamics may result in either an increase or decrease of total biomass each inventory year and provide potential for underestimates or overestimates of the true growth of forests. The review team noted that the inclusion of intermediate cuttings of “lands actually covered by forests” in total $CO_2$ emissions from LUCF may also cause underestimates of removals, insofar as they might also be included in the estimates of emissions from harvests. The team further noted that the rounding of large values of volume stocks is likely to have caused high and improbable inter-annual variability of removal data. To avoid over- and underestimates of emissions and removals in the LUCF sector, there should be consistent representation of changes in volume stocks over areas of lands actually covered by forests.

## B. Emission profile and trends

34. The total GHG emissions (excluding net $CO_2$ from LUCF) of the Russian Federation in 1999 amounted to 1,876,000 Gg $CO_2$ equivalent, a decrease of 38 per cent of the 1990 level (table 3). This stemmed mainly from the decrease in energy consumption, and industrial and agricultural activity that reflect the overall economic decline since 1990 resulting from the transition to a market-driven economy.

**Table 3. Total GHG emissions and emissions by gas, 1990–1999 (Gg $CO_2$ equivalent)**

| Emissions | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| $CO_2$ (without LUCF) | 2 362 000 | 2 180 000 | 2 010 000 | 1 840 000 | 1 660 000 | 1 589 000 | 1 495 000 | 1 529 000 | 1 505 000 | 1 509 000 |
| $CH_4$ | 550 000 | 509 000 | 482 000 | 446 000 | 411 000 | 393 000 | 388 000 | 302 000 | 309 000 | 290 000 |
| $N_2O$ | 98 000 | 83 000 | 77 000 | 66 000 | 48 000 | 43 000 | 41 000 | 43 000 | 35 000 | 35 000 |
| Fluorinated gases [a] | 40 000 | 40 000 | 40 000 | 40 000 | 35 000 | 38 000 | 36 000 | 40 000 | 41 000 | 42 000 |
| **Total (with $CO_2$ from LUCF)** | **3 205 000** | **2 796 000** | **2 601 000** | **2 428 000** | **1 916 000** | **1 728 000** | **1 786 000** | **1 783 000** | **1 887 000** | **1 664 000** |
| **Total (without $CO_2$ from LUCF)** | **3 050 000** | **2 812 000** | **2 609 000** | **2 392 000** | **2 154 000** | **2 063 000** | **1 960 000** | **1 914 000** | **1 890 000** | **1 876 000** |

[a] $SF_6$ emissions only from 1997 onwards.

### Carbon dioxide

35. Emissions of $CO_2$ accounted for the largest share (80 per cent) of total emissions in 1999. This share has increased by 3 per cent since 1990, largely as a result of the greater decrease in economic activity compared to energy consumption and related emissions. The 36 per cent decrease in $CO_2$ emissions since 1990 is not attributable only to the reduction in energy consumption; around a quarter of the decline could be attributed to the increase in the share of natural gas in the TPES from 44 per cent to 53 per cent, and to the increase in the share of electricity generation from nuclear and hydro power. Conversely, an increase in the energy intensity of the economy has contributed to $CO_2$ emissions declining less rapidly than GDP.

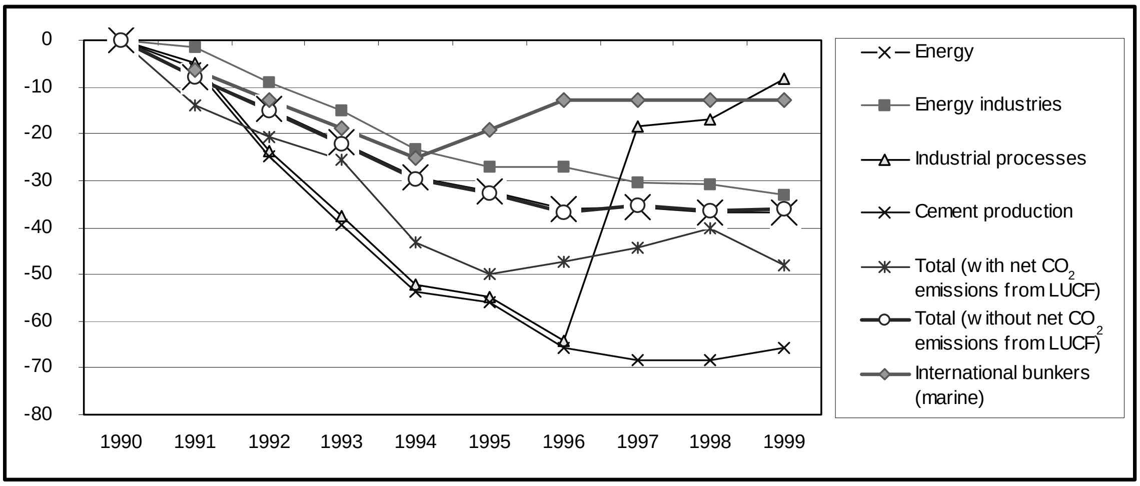
36. Emissions of $CO_2$ from aluminium and cement production also fell dramatically between 1990 and 1999, e.g. for cement production there was a 66 per cent decrease. Emissions from several other processes have been included in the national inventory only from 1997 onwards. Thus total emissions from the industrial processes sector do not indicate a major decline over the period (table 4). From the agriculture sector, only emissions due to the liming of agricultural soils were estimates, and they fell from 13,800 Gg to 1,100 Gg over this period. Agricultural activity is estimated to have been a source of about 161,000 Gg $CO_2$ in 1995, and emissions from this sector have probably increased recently. Both $CO_2$ emissions and removals are reported for all forests in the country, with the net $CO_2$ emissions from the LUCF sector varying considerably over the period from a net emission of 154,947 Gg in 1990 to a net removal of 334,947 Gg in 1995.

**Table 4. Carbon dioxide emissions by source, 1990–1999 (Gg)**

| Source and sink categories | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Energy [a] | 2 320 000 | 2 140 100 | 1 977 900 | 1 813 800 | 1 640 000 | 1 570 000 | 1 480 000 | 1 495 183 | 1 469 736 | 1 470 383 |
| *Energy industries* [b] | 708 000 | 698 530 | 644 407 | 601 548 | 542 000 | 517 000 | 517 000 | 492 973 | 489 858 | 474 780 |
| Industrial processes [c] | 42 000 | 39 900 | 32 100 | 26 200 | 20 000 | 19 000 | 15 000 | 34 282 | 34 864 | 38 538 |
| *Cement production* | 41 000 | 38 600 | 30 800 | 24 900 | 19 000 | 18 000 | 14 000 | 13 000 | 13 000 | 14 000 |
| Agriculture | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE |
| LUCF [d] | **154 947** | **–16 013** | **–8 305** | **35 584** | **–238 066** | **–334 947** | **–173 929** | **–131 557** | **–2 927** | **–211 742** |
| Total $CO_2$ emissions with LUCF | **2 516 947** | **2 163 987** | **2 001 695** | **1 875 584** | **1 421 934** | **1 254 053** | **1 321 071** | **1 397 908** | **1 501 673** | **1 297 179** |
| Total $CO_2$ emissions without LUCF | **2 362 000** | **2 180 000** | **2 010 000** | **1 840 000** | **1 660 000** | **1 589 000** | **1 495 000** | **1 529 465** | **1 504 600** | **1 508 921** |
| International bunkers (marine) | 9 500 | 8 900 | 8 300 | 7 700 | 7 100 | 7 670 | 8 290 | 8 293 | 8 293 | 8 300 |

[a] Includes losses and fugitive emissions: burning of gas and emissions from coal mining and burning of coal dumps.
[b] Emissions from fuel combustion by power stations and boilers of RAO UES.
[c] Emissions from production of lime, soda, ammonia, carbides and ferroalloys are included only from 1997 onwards.
[d] The reported values from the LUCF sector represent net $CO_2$ emissions and removals. They are based on values reported in Addendum I to the NC3 for the years 1997–1999 and in the submission for the years 1990–1996 subsequent to the IDR visit. Also, they included estimates of emissions from liming according to table III.13 from the NC3. IE stands for Included Elsewhere.

**Figure 2. Carbon dioxide emissions, percentage change from 1990, by source**



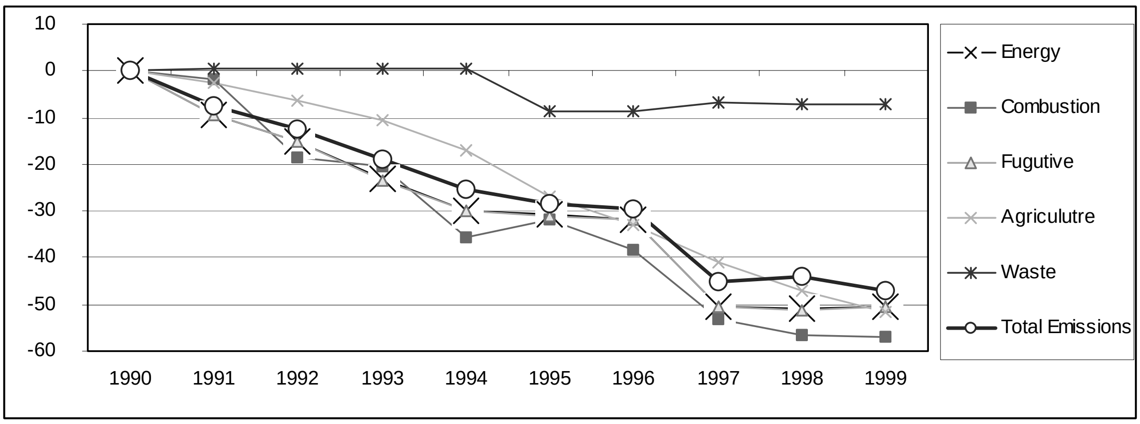

<u>Methane</u>

37. Emissions of $CH_4$ account for 16 per cent of total emissions, with fugitive emissions being by far the largest source, accounting for 68 per cent of total $CH_4$ emissions in 1999, followed by agriculture (18 per cent) and waste (13 per cent). As with $CO_2$, the overall decline in the economy and reduced energy consumption has resulted in a major decrease in $CH_4$ emissions. The 47 per cent decline in these emissions is underpinned by the 50 per cent decline in fugitive fuel emissions. It was underpinned also by the sharp decrease in livestock, e.g. from 59 million cattle in 1990 to 27 million in 2000, resulting in a more than 50 per cent decline in emissions relating to manure and enteric fermentation. Waste-related emissions declined by only 7 per cent. Considerable amounts of $CH_4$ are emitted by forest fires, with the estimates being quite variable, from 63 Gg in 1991 to 900 Gg in 1998 (table 5 and figure 3).

**Table 5. Methane emissions by source, 1990–1999 (Gg)**

| **Source categories** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** |
|---|---|---|---|---|---|---|---|---|---|---|
| Energy | 19 100 | 17 337 | 16 240 | 14 661 | 13 400 | 13 218 | 13 012 | 9 464 | 9 352 | 9 463 |
| *Combustion* | 246 | 242 | 200 | 196 | 158 | 168 | 152 | 115 | 107 | 106 |
| *Fugitive emissions* | 18 900 | 17 095 | 16 040 | 14 465 | 13 242 | 13 050 | 12 860 | 9 349 | 9 245 | 9 357 |
| Agriculture | 5 000 | 4 867 | 4 686 | 4 464 | 4 142 | 3 658 | 3 349 | 2 951 | 2 650 | 2 421 |
| *Enteric fermentation* | 4 400 | 4 270 | 4 110 | 3 930 | 3 660 | 3 230 | 2 950 | 2 606 | 2 334 | 2 108 |
| *Manure management* | 500 | 490 | 470 | 430 | 405 | 360 | 330 | 285 | 258 | 244 |
| *Rice cultivation* | 115 | 107 | 106 | 104 | 77 | 68 | 69 | 60 | 58 | 69 |
| LUCF (forest fires) | 149 | 63 | 70 | 141 | 65 | 54 | 354 | 138 | 900 | 139 |
| Waste | 1940 | 1950 | 1950 | 1950 | 1950 | 1770 | 1770 | 1806 | 1801 | 1800 |
| *Solid waste disposal* | 1800 | 1800 | 1800 | 1800 | 1800 | 1640 | 1640 | 1681 | 1676 | 1673 |
| *Wastewater handling* | 140 | 150 | 150 | 150 | 150 | 130 | 130 | 125 | 125 | 127 |
| **Total emissions** | **26 189** | **24 217** | **22 946** | **21 217** | **19 557** | **18 700** | **18 485** | **14 359** | **14 703** | **13 823** |

**Figure 3. Methane emissions, percentage change from 1990, by source**



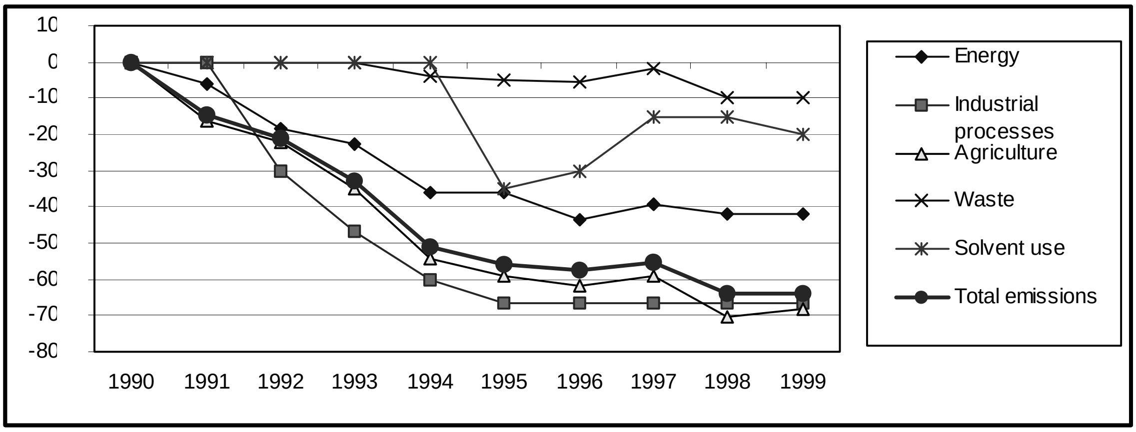
Nitrous oxide

38. Emissions of $N_2O$ declined by 64 per cent between 1990 and 1999, which is more than the decline in $CO_2$ and $CH_4$. The agricultural sector is the key source of $N_2O$ emissions, accounting for 78 per cent of total emissions in 1999. The major sources are agricultural soils. The large reduction was due largely to a two-thirds decrease in emissions over the period from fertilizer use. Emissions of $N_2O$ from organic soils and cultivated histosols were not estimated. Emissions from energy fell by 42 per cent and from waste by 10 per cent. Emissions of $N_2O$ from forest fires were variable, depending largely on the changing occurrence of these events (table 6).

**Table 6. Nitrous oxide emissions by source, 1990–1999 (Gg)**

| Source categories | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Energy | 17.4 | 16.3 | 14.2 | 13.5 | 11.1 | 11.1 | 9.8 | 10.6 | 10.1 | 10.1 |
| *energy industries* | 5.5 | 5.3 | 4.7 | 4.4 | 3.9 | 3.9 | 4.0 | 4.0 | 3.8 | 3.6 |
| Industrial processes | 3 | 3 | 2.1 | 1.6 | 1.2 | 1 | 1 | 1 | 1 | 1 |
| Agriculture | 279.5 | 234.4 | 217.8 | 181.8 | 128 | 113.6 | 107.1 | 113.9 | 83.4 | 88.1 |
| Waste | 12.3 | 12.3 | 12.3 | 12.3 | 11.8 | 11.7 | 11.6 | 12.1 | 11.1 | 11.1 |
| *Wastewater handling* | 12 | 12 | 12 | 12 | 11.5 | 11.5 | 11.5 | 12 | 11 | 11 |
| *Waste incineration* | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Other | 3 | 2.4 | 2.5 | 3 | 2.4 | 1.7 | 3.8 | 2.7 | 7.9 | 2.6 |
| *Forest fires* | 1 | 0.4 | 0.5 | 1 | 0.4 | 0.4 | 2.4 | 1 | 6.2 | 1 |
| *Solvent use* | 2 | 2 | 2 | 2 | 2 | 1.3 | 1.4 | 1.7 | 1.7 | 1.6 |
| **Total emissions** | **315.2** | **268.4** | **248.9** | **212.2** | **154.5** | **139.1** | **133.3** | **140.3** | **113.5** | **112.9** |

**Figure 4. Nitrous oxide emissions by source, percentage change from 1990**




Fluorinated gases

39. Although initially there was a decline in emissions from fluorocarbons, by the end of the 1990s overall emissions had risen slightly (table 7). The overall emissions of HFCs have remained broadly stable, except for some unexplained decline between 1993 and 1997. The only reported sources of these emissions were from the use of HFCs in the refrigeration sector[8] (although emissions from mobile refrigeration were not estimated) and estimates for hydrofluorocarbons (HFC-23) from the production of hydrochlorofluorocarbons (HCFC-22). Emissions of PFCs from aluminium production have increased slightly. No other sources of PFC emissions were reported. Emissions of $SF_6$ from electrical equipment, based on information from RAO UES, were reported, but only as of 1997. Data for earlier years were not available, and the market penetration of the related equipment was limited.

**Table 7. Fluorinated gases emissions by gas, 1990–1999 (Gg $CO_2$ equivalent)**

| Source categories | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Emissions of HFCs | 9 700 | 9 800 | 9 800 | 9 800 | 7 000 | 7 600 | 5 900 | 9 449 | 9 458 | 9 466 |
| Emissions of PFCs | 30 000 | 29 700 | 29 700 | 29 700 | 28 000 | 30 600 | 30 200 | 30 487 | 31 411 | 32 982 |
| Emissions of $SF_6$ | NA | NA | NA | NA | NA | NA | NA | 16 | 16 | 16 |
| **Total emissions** | **39 700** | **39 500** | **39 500** | **39 500** | **35 000** | **38 200** | **36 100** | **39 952** | **40 885** | **42 464** |

NA for this table and for the rest of the tables stands for Not Available.

[8] It remained unclear to the review team which particular species of HFC emissions were estimated.

## III. POLICIES AND MEASURES

40. The NC3 presents an overview of the policies, measures and programmes, in place and being implemented, that have implications on climate change, rather than a national climate policy. The focus is on energy efficiency, with some estimates of the potential emission reductions. Essentially, climate change policy builds on the energy efficiency part of the energy strategy as outlined in the document *Main Directions of the Energy Strategy of Russia by 2020* adopted in 2000 and its 2002 and 2003 updates,[9] as well as the *Federal Target Programme Energy Efficient Economy for 2002–2005 with an outlook to 2010*, adopted in 2001, hereafter referred to as the 2001 Energy Efficiency Programme, and the preceding *Federal Target Programme Energy Saving in Russia for 1998–2005* adopted in 1997, hereinafter referred to as the 1997 Energy Saving Programme. It also builds on the 1996 *Federal Target Programme for the Prevention of Dangerous Climate Change and its Negative Impacts*.

41. The NC3 contains information on policies and measures to mitigate emissions of $CO_2$, mainly from energy and agriculture, as well as emissions of $CH_4$, mainly from agriculture. Other emissions and sources, including emissions from transport and industrial processes, have not been addressed by policies in the Russian Federation. Also related to energy are fugitive $CH_4$ emissions from coal mines and natural gas systems, which represent by far the most important source of $CH_4$ emissions. No measures to address these emissions are reported in the NC3, in contrast to the NC2, e.g. on the results from the 1998 programme for coal-bed $CH_4$ utilization launched by the Ministry of Energy. Instead, it is assumed that until 2010 emissions from coal mines will remain below the 1990 level because many mines will close down and the coal demand will be met by an increased share of coal from open-cast rather than underground mining. Information on measures taken to limit fugitive emissions from natural gas was provided to the review team during the visit and is reviewed in paragraph 65.

42. With regard to the presentation of information on policies and measures on $CO_2$ and $CH_4$ in the NC3, the team acknowledged that the information was more complete than in the NC2. However, in most cases the information was still very limited and it continued to follow the same pattern as in the NC1 and the NC2, i.e. presenting the policies and measures as strategic objectives at a conceptual level, rather than as specific initiatives with clear links to climate change and expected outcomes. Also, the information on policies and measures was not presented by sector and by gas, as required by the UNFCCC guidelines. The summary table with information on key policies was missing. Some sectors where actual measures were taken were not included at all, e.g. the oil and gas industry. Little attention was given to some sectors that are important in terms of emissions, e.g. transport and industrial processes. In some other sectors, e.g. waste, reported policies and measures were of little relevance to climate change objectives.

### A. Cross-cutting issues

43. The NC3 lists six state strategies and programmes that form the foundation of the climate policy; the three most important of these are referred to in paragraph 40 above. Four of these acts and laws are related to energy. Since the completion of the NC3, the 2003 Energy Strategy, which sets the foundations for the contemporary energy policy of the Russian Federation, has been adopted by the Government. The strategy aims to match the energy demand of an economy with GDP growing at an average rate of 5–8 per cent annually. It calls for a change in the existing patterns of energy use to improve energy efficiency, and sets the objective of reducing the environmental impact of the energy sector among the sector's development priorities. It highlights energy efficiency and the 2001 Energy Efficiency Programme as the keys to realizing its goals.

44. The NC3 provides information on three elements of this programme: efficiency of energy supply, development and safety of nuclear energy, and energy efficiency in energy consumption. Implementation is estimated to require around 3 trillion roubles (equivalent to USD 95.7 billion) in 2002–2005 and just over 4 trillion roubles (equivalent to USD 127.6 billion) in 2006–2010. The third component of this programme centres on six energy consumption sectors and provides estimates of the

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[9] These updates are referred to in the current report as the 2002 Energy Strategy and the 2003 Energy Strategy.

potential savings. The energy supply sector accounts for almost a third of the potential savings, industry and construction another third, household and services just over a quarter, with transportation and agriculture 6–7 per cent and 3 per cent respectively (table 8).

**Table 8. Estimates of effects from the 2001 Energy Efficiency Programme and the 1997 Energy Saving Programme**

| Sector | 1997 Energy Saving Programme | | | | 2001 Energy Efficiency Programme (annual effect) |
|---|---|---|---|---|---|
| | Annual effect in 2005 compared to 1995[a] | | Total effect for 1998–2005 | | |
| | Energy saving (Mtce) | Emission saving (Gg) | Energy saving (Mtce) | Emission saving (Gg) | Energy saving (Mtce) |
| Energy supply | 33–37 | 75 000–80 000 | 136–155 | 310 000–330 000 | 42 |
| Residential and commercial | 22–25 | 40 000–45 000 | 93–110 | 170 000–190 000 | 40–43 |
| Energy-intensive industry | 33–34 | 70 000–75 000 | 136–170 | 300 000–310 000 | 49–52 |
| Transport | NA | NA | NA | NA | 8–9 |
| **Total** | **88–102** | **185 000–200 000** | **365–435** | **780 000–830 000** | **144–152**[b] |

a The annual effect is assumed to increase over time. This is why the total effect is smaller than the expected effect in 2005 multiplied by the duration of the programme of 8 years.
b The total annual effect from the programme includes also expected savings from agriculture, which are 5.5–6.5 Mtce.

45. The NC3 provides specific estimates of potential for energy efficiency improvements expected from this programme as a result of both organizational and technological measures within the range of 360-430 Mtce[10] within 8 years, which corresponds to 780,000–830,000 Gg $CO_2$ saved. The effect of the programme is envisaged to increase over time and to reach around 90–100 Mtce, or 185,000-200,000 Gg $CO_2$ saved in 2005, which is the last year of the programme.

46. Despite the importance of the regional dimension in energy efficiency and GHG mitigation, no information on this is presented in the NC3. However, the little information that was provided during the in-depth review was encouraging. A growing number of regional policies and measures was under way, with over 650 energy efficiency programmes, 43 regional energy efficiency laws adopted, and 537 local and city programmes. Although many of these programmes were coordinated by the Federal Government, the Ministry of Energy was able to provide only brief descriptions of them, without information on their progress to date.

47. The review team had difficulties in reviewing the effects or results of policies and measures achieved to date. There is little or no information in the NC3 on these results, on the type of policy instrument used, how the policy interacts with other policies, its status of implementation and how the measure is expected to function, as requested by the UNFCCC guidelines. The review team highlighted the importance of improving the monitoring of programmes and collection of data and information across all the regions in order to be able to better assess the effectiveness of policies and to set priorities for investment, as well as to provide models for regions that have been less active to date. The review team was encouraged by the energy efficiency exhibitions held within regions and nationally on a regular basis. It noted that more focus on the links between climate change mitigation and energy efficiency, as well as public health, comfort and competitiveness, could help to raise public awareness on these issues. This could support the implementation of the UNFCCC and the Kyoto Protocol once it enters into force.

## B. Energy

48. The dramatic decrease in GHG emissions in the Russian Federation between 1990 and 1999 was a result of the huge economic losses the country experienced in the 1990s during its transition to a market-oriented economy. Also, there was an effort to improve air quality management and introduce fuel switching to natural gas, which came to account for more than half of TPES. This resulted in a huge decline in emissions in absolute terms during the 1990s. Still, they did not fall as fast as GDP. This is

[10] Russian statistics generally use millions of tonnes of coal equivalent (Mtce) defined as 27.8 Million BTU (British thermal unit) per ton of coal. One Mtce is equal to 0.7 toe. Mtce is used in this report along with toe for easy reference to the information in the NC3.

due to some increase in energy intensity at the beginning of the 1990s, which stemmed mainly from low prices for natural gas and electricity and an overall unattractive investment environment. This limited incentive or investment opportunities in efficient energy use in all sectors, including industry and households. Also, there was a lack of metering and controls on the end use of energy.

49. The 2003 Energy Strategy lays the basis for an increase in heat and electricity tariffs. Average electricity tariffs for residential consumers and for government organizations, averaging 49 kopecks or 0.016 USD/kWh,[11] continue to be subsidized mainly through industry, where the average tariffs are considerably higher, averaging 65 kopecks or 0.022 USD/kWh in 2002. However, the level of cross-subsidization is decreasing, as residential tariffs continue to increase faster than industrial ones. Average wholesale electricity tariffs are projected to increase to USD 0.030–0.36/kWh by 2005–2007.

50. "Getting the prices right" is seen as an approach to ensure that the electricity and heating infrastructure does not deteriorate further. This approach will encourage more investments in energy efficiency and allow the Russian Federation to unlock its huge potential for energy saving, which can lead to a reduction in both energy demand and emissions. Underlying the outlook for higher electricity and heat tariffs is the goal of the 2003 Energy Strategy to increase domestic gas prices to a level that will ensure the viability of the domestic gas industry. By 2007, domestic gas prices are expected to be at parity with European export prices. This is a challenging target, especially for 2005–2007, when the Government plans to increase prices from about USD 20/Mcm in 2002 to USD 29–37/Mcm and USD 40–47/Mcm, in 2005 and 2007 respectively.

51. Energy price reforms are expected to help raise the competitiveness of renewable energy, currently disadvantaged by electricity pricing levels that do not reflect the cost of production. However, in terms of renewable energy, the 2003 Energy Strategy focuses almost exclusively on the country's large hydro potential, whose rate of use currently amounts to 18 per cent. It projects an increase in large hydro generation from the current 160 TWh to 180 TWh in 2010 and 215 TWh in 2020, maintaining its current share of around 2 per cent. It does not consider in any detail non-traditional renewable energy.

## Electricity and coal sectors

52. In 2002, the Russian Federation ranked fourth largest in the world in terms of installed generating capacity, which totalled 215 GW. The country's electricity sector is currently dominated by RAO UES, which owns three quarters of the generating capacity. The world's largest power company, RAO UES was created in 1992 as a joint-stock corporation, with the federal Government holding 53 per cent of the company's shares. Electricity production declined from 1,082 TWh in 1990 to 827 TWh in 1998, almost exclusively as a result of much lower demand by industry due to the economic decline. Since 1999 electricity demand has begun to increase and production has been on the rise, reaching 891 TWh in 2001. This is still 18 per cent less than 1990 levels. Related emissions followed the drop in production but did not increase in 1999 (table 4).

53. The NC3 presents important results of the implementation of the *Energy Saving Programme in the Electricity Sector* with specific fuel consumption for electric and thermal power generation being reduced by 1.8 and 0.7 grams of coal equivalent/kWh, respectively. The programme targeted relatively inexpensive technological measures, such as an increase in the efficiency of equipment and a reduction of losses of electric power in grids primarily through introduction of automated power controls. The total fuel and energy saved in 1999 reached 3.8 Mtce or 0.02 per cent compared to 1998 levels, equivalent to a reduction of 15,000 Gg $CO_2$.

54. The 2003 Energy Strategy projects electricity consumption in 2020 at 1,290 TWh, a 20 per cent increase over 1990 levels. This means that high rates of GDP growth may be achieved with much lower rates of increase in electricity production. In 2000–2001 this was indeed the case, as electricity consumption increased by 2.3 per cent compared to the very high GDP growth rate of 7 per cent. However, with increased electricity consumption, fuel consumption in the power sector increased and consequently there was a 4 per cent increase in GHG, or 17,300 Gg $CO_2$.

[11] The exchange rate for 2002 was USD 1=31.34 roubles.

55. This is important in the light of the current energy outlook, which projects the need to reduce the share of natural gas in the electricity generation fuel mix, as noted in paragraph 8. One scenario, backed by the Ministry of Atomic Energy, encompassed in the *Safety and Development of Nuclear Power* subprogramme of the 2003 Energy Efficiency programme, projects an increase in the share of nuclear-generated electricity to 23 per cent of the total by 2020. The Ministry of Energy, however, in the 2003 Energy Strategy, places more confidence in the coal sector's ability to compensate for a lower natural gas share in electricity generation. In terms of the outlook for the thermal electricity fuel mix, where most of the change will be concentrated, the share of coal is to almost double from 24 per cent in 1999 to 44 per cent in 2020, while the share of natural gas is to be reduced from 63 per cent to 51 per cent. This outlook, however, encompasses major uncertainties in terms of the need to attract major investments, economics, safety, environment and public acceptance.

56. At present, natural gas still maintains its dominance in the thermal electricity fuel mix. If the share of natural gas were to drop and be replaced by coal, as is projected, there could be serious implications for GHG emissions. The importance of this major policy change, especially in the context of the political goal to double GDP over the next decade, is yet to be examined.[12]

57. The anticipated electricity sector restructuring and price reform is expected to engender a more attractive climate for investment. Energy efficiency will be stimulated, thus further reducing the need for building new generating capacity, with consequent reductions in GHG emissions. As the electricity sector restructuring unfolds and prices increase to cost-reflective levels, renewable energy, which now accounts for just over 1 per cent of TPES, is likely to become more competitive with traditional fuels.

58. The *Efficiency of Energy Supply* subprogramme of the 2001 Energy Efficiency Programme, referred to in paragraph 40, envisages a range of non-traditional renewable projects offsetting 3–5 Mtce in 2010 from an estimated 1 Mtce in 2001. Renewables are increasingly being used in the remote, off-grid regions of Siberia and the Far East of the country as an economically viable alternative to the existing small boilers and electricity generators, which operate on coal or fuel oil which in most cases has to be transported by rail or truck. In these circumstances, renewable energy is already competitive and would not only provide economic benefits to remote regions but also help in terms of social and environmental goals. This is the aim of the 1997 programme *Energy Supply of the Far North, as well as People of the North, Siberia and the Far East with Renewable Energy and Energy from Local Sources*.

59. To promote renewable energy further, the 2003 Energy Strategy envisages the adoption of a Federal Law on Renewable Energy Sources. In addition, some low-cost measures could enhance its development. Transparent and fair access of renewable power to the grid is essential. Raising public awareness of the benefits of renewable energies – economic, social and environmental – is also essential. The review team felt that more emphasis on renewables and more incorporation of renewables within the existing goals for energy efficiency and climate change mitigation could be beneficial.

60. The Russian Federation already uses combined heat and power (CHP) to some extent, but there is also considerable potential for its increased use. Most district heating systems use heat-only boilers for heat production, and a large number of thermal power plants do not capture their waste heat. Use of CHP would reduce total energy consumption by approximately one quarter at each combined installation, compared to the energy used for separate production. District heating accounts for 70 per cent of the space-heating market in the Russian Federation, one of the highest such percentages in the world, and also makes up 32 per cent of the national TFC. Yet cogeneration accounts for a relatively small percentage of the country's power and heat supply.

61. The NC3 does not list promoting further cogeneration among the policies and measures. The 2003 Energy Strategy does mention boosting cogeneration, but in distributed applications, not at large power or heating plants. Providing greater incentives to district heating plants to upgrade to CHP,

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[12] Results of a study by the Russian Academy of Sciences on the impact on emissions of $CO_2$, $SO_2$, $NO_X$ and ash from increased use of coal in electricity and heat generation show a significant increase in both $CO_2$ and $NO_X$ emissions over the base-line level. This study assumes the extrapolation of current technical and emissions standards for coal. (D.A. Krylov and V.E. Putintseva (2000), *PodzemGazprom*, Moscow, Institute for the Safe Development of Nuclear Energy).

guaranteeing market access to independent power producers and ensuring that costs are fairly split between heat and power in cogeneration would all help boost the share of cogeneration.

62. Although the NC3 mentions several measures to improve efficiency in district heating systems and at end-user facilities, the document assumes that total heat production will rise with economic growth. Policies and measures in this sector include fuel switching, consolidating boilers, improving insulation in new buildings, improving controls at heat substations and installing meters. The emission reductions reported for each measure seem achievable. The question is, however, whether greater reductions could be made by focusing on other measures that typically have a large impact on energy efficiency, such as improvements in heat distribution systems and energy efficiency retrofits in buildings.

Oil and gas sectors

63. The Russian gas industry is dominated by OA Gazprom, the world's largest gas company. In 2000 it produced 90 per cent of gas in the Russian Federation, and controlled virtually all the gas transported through high-pressure, large-diameter pipelines, as well as gas exports to Europe. It provided 20 per cent of both the federal budget and export revenues. Although declining GDP caused production of other energy resources to drop sharply in the 1990s, output of natural gas eased by only about 10 per cent between 1990 and 1999, while the gas share in TPES increased to over 50 per cent. The main emissions from the natural-gas sector are $CH_4$ and $CO_2$ and the GHG precursors CO and $NO_X$.[13]

64. In terms of climate change, the greatest challenge for AO Gazprom is to control the losses in the gas transportation network and to improve its efficiency. Until recently, a scarcity of data on leakage and losses from the high-pressure transmission system and an almost complete absence of such data for the low-pressure distribution networks rendered analysis impossible. In 1997, jointly with Germany's Ruhrgas AG, Gazprom initiated a JI project to improve long-distance, high-pressure gas transmission in the Russian Federation. The first stage of the project, comprising six-line systems of gas mains totalling 5,000 km, was completed at Volgatransgaz. This resulted in an annual reduction of fuel-gas consumption by 0.120 bcm and a reduction of $CO_2$ emissions by 231 Gg.

65. Since then Gazprom has undertaken an in-depth inventory of leakage and losses from the high-pressure transmission system. The reduction of leakages and losses of about 1 bcm reported for 1990–2000 was attributed mainly to the economic decline of the 1990s. Gazprom has adopted a programme focusing on the reduction of fugitive $CH_4$ emissions over the period to 2012, which includes establishing an inventory of emissions, monitoring emissions and prioritizing the technologies and projects to limit emissions. It is actively working with the Government on issues related to the Kyoto Protocol, promoting dialogue and exchange with major investors interested in JI projects with potential to limit emissions from the gas transportation system (table 9).

66. Estimated leakages in low-pressure distribution in 1998 reached at least 5 bcm. Most distribution companies have had serious financial difficulties and have undertaken very little new investment. The lack of metering and measurement infrastructure in gas distribution compounds this problem.

67. Official statistics of the Ministry of Energy report the volume of associated gas flared by oil companies in 1999 as 7.2 bcm (20 per cent of total associated gas production of 35.5 bcm) with volumes ranging from a high of 10 bcm (20 per cent) in 1991 to a low of 4.3 bcm (19 per cent) in 1996.[14] Despite some paucity of information, the reasons why gas is flared are clear: the low flow rate and pressure of associated gas and the large distances to pipelines, aggravated by problems relating to pipeline access and the low prices set by Gazprom and its subsidiary Sibur for sales by oil companies entering the gas-supply system. Investments such as those planned by Yukos to make use of 90 per cent of its associated gas by 2004 to provide it with 2–3 bcm per year of casing-head gas to fuel cogeneration plants, at an estimated cost of USD 25 million, are a way for the company to avoid this access issue.

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[13] Much progress has been made in reducing emissions of $NO_X$, which fell by almost 60 per cent from 1993 to 1999 through modernization of combustion chambers and replacement of gas compressor units at compressor stations.

[14] During the 1990s, official statistics show that about 80 per cent of associated gas was "used" by oil companies, and this is understood to mean "not flared". However, some oil companies, such as Yukos, have claimed that they flare considerably more associated gas (*Fuel and Energy in Russia*, edited by A. M. Mastepanov, published by the Ministry of Energy of the Russian Federation in 2000, Moscow).

An alternative approach is reflected in the long-term contract Lukoil signed in mid-2003 with Gazprom for purchase of its associated gas.

**Table 9. GHG emissions from natural gas extraction and the distribution system as well as the potential for their reduction**

| Fugitive emissions and reductions on an annual basis | Year, or period of years | | | |
|---|---|---|---|---|
| | **1990** | **2000** | **2008** | **2012** |
| Emissions of $CH_4$ (bcm) | 11.0 | 10.0 | 7.8 | 5.1 |
| *emissions of $CH_4$ in $CO_2$ eq. (Gg)* | 160 700 | 148 000 | 114 600 | 75 000 |
| $CO_2$ from gas flaring (Gg) | 105 400 | 84 000 | 74 000 | 70 000 |
| | | **1990–2000** | **2000–2008** | **2008–2011** |
| Reduction in $CH_4$ emissions (bcm) | | 1.0 | 2.2 | 2.7 |
| Reduction in $CO_2$ emissions (Gg) | | 21 400 | 10 000 | 4 250 |

*Source*: VNIIGAS study commissioned by Gazprom, excerpts of which were provided to the review team during the visit.

Energy use in industry

68. The Russian manufacturing sector accounted for 35 per cent of TFC in 2001, a share it maintained through the 1990s. Energy consumption in industry is generally in line with other industrialized countries, except for the iron-and-steel and machinery sectors, where energy is a large input to the production process. Despite a 20 per cent drop in energy consumption between 1995 and 1999, these sectors remain very energy intensive. Overall, Russian industry is still in a process of restructuring, streamlining costs and ensuring that its products meet demand in the most economic and environmentally safe way. However, during the 1990s, some plants, which were conscious of their energy bills and could self-finance energy-efficiency investments, achieved remarkable improvements. These success stories illustrate how competitive forces spur this process, unlike monopolistic markets.

69. The NC3 provides estimates of energy efficiency potential in energy-intensive subsectors of industry based on the 2001 Energy Efficiency Programme and the 1997 Energy Saving Programme. These estimates suggest that around 40 per cent of the total energy saving potential between 360 and 430 Mtce annually is attributable to these subsectors. This corresponds to around 70,000 Gg $CO_2$ saved in 2005. The 2001 Energy Efficiency Programme envisages measures in iron and steel, pulp and paper, and building material industries that centre on technology improvement and the construction of micro power plants using wood waste.

Energy use in residential, commercial and public sectors

70. In 2001, the residential sector consumed around 35 per cent of the TFC of the Russian Federation. This was as much as the industrial sector, as is typical for lower-income countries in harsh climates. The inefficiency of the country’s residential energy consumption mainly stems from very low energy prices, non-payment and price subsidies, lack of consumer control over the regulation of heating systems, and low level of private ownership of apartments. The NC3 provides little information on this important sector. It presents estimates of energy efficiency potential based on the 2001 Energy Efficiency Programme and 1997 Energy Saving Programme, which attribute around 25 per cent of total energy saving potential of 360–430 Mtce/year to the residential sector. This corresponds to around 40,000 Gg $CO_2$ saved in 2005. The focus of measures in this sector is on the provision of energy controls and regulating devices, efficient light bulbs, the automation of central and individual heating devices, and the replacement of low-efficiency boilers by high-powered boilers.

71. Recent budgetary constraints have provided a powerful incentive at the municipal level to raise heat prices and increase payment discipline. Several federal and local housing programmes have set specific standards for insulation and heat consumption per square metre and per degree-day in new buildings, and in the rehabilitation of old buildings. These measures have reduced specific consumption to about 50 per cent of previous standards. In addition, there have been several developments recently, including voluntary participation in the establishment of “energy passports” and certificates for buildings through energy audits. A key problem remains the transfer of ownership of apartments and the vesting of authority in occupants, whether owners or tenants, to undertake improvements and share benefits with

owners. No information was available as to how the progress of programmes and measures is being measured and will be measured in the future. The review team noted that more attention could be placed in the next national communication on the importance of standards, building codes, efficiency labels (on appliances) and raising public awareness of the benefits of more efficient energy consumption (both financial and in terms of comfort).

### C. Transport

72. The share of commercial and private transport in Russian energy consumption remained relatively small: 19 per cent in 2001.[15] However, this sector is likely to become a larger and faster-growing sector in terms of energy consumption and emissions, as commercial transportation becomes privatized and the share of private cars increases. The number of cars per capita has shot up since 1991, increasing by 5.3 per cent in 2002 alone. As in almost every economy in transition, efficiencies cannot keep pace. Fuel-price incentives could become more effective and lead to improved efficiency, but this will likely only slow down the trend towards increased use of transport fuel. Other measures to limit GHG emissions are reflected in the *2002 Concept for the Development of the Auto Industry to 2010*, including the passage of regulations to limit the import of older cars mainly from the EC and to match the EC emissions standards.

73. Since 2001, the Ministry of Transport has assumed responsibilities for the coordination of policies on water, rail and air transportation, as well as road infrastructure and car transport, which were previously implemented by different ministries. In the past, several energy-efficiency initiatives for transport were launched, but they did not deliver the results expected because of financial constraints. Given the outlook for economic growth, it is critical that measures of this type succeed in the future.

74. The NC3 provides limited information on measures targeting the transport sector. It makes a reference to the 2001 Energy Efficiency Programme, which encompasses measures in transport along with other sectors. These measures are projected to deliver energy savings in transport of the order of 8-10 Mtce in 2002–2005 and, similarly, in 2006–2010. The focus of this programme is on the introduction of an energy-efficient fleet, the introduction of modern oil additives and increased shares of high-octane petrol; improvements in the technical operation and organization of transportation; and replacement of liquid fuels by alternative fuels. Overall, it is projected that energy-saving measures would account for a decrease in fuel and energy demand of 3.5 per cent by 2000 and 9.5 per cent by 2005 relative to 1998. However, during the in-depth review, the review team gained little insight into these measures, monitoring or progress to date. The review team noted that the NC3 contains little information on data needed for establishing effective energy consumption transportation measures or for monitoring results, and encouraged the Russian Federation to collect such data. The review team also noted a potential role for fuel taxes as the best direct policy to enhance energy-efficiency in the transport sector.

### D. Agriculture

75. The NC3 contains descriptions of several programmes at the federal level with a potential impact on the emissions from agriculture. The main focus is on enhancing the productivity of the sector, particularly soil productivity, while reducing the overall environmental impact from agricultural activities. The impact of these programmes on GHG emissions was not estimated, although some increase in the use of fertilizers and associated emissions is expected. Also, the impact of a possible increase in cattle productivity on emissions levels was not estimated.

76. New and ongoing programmes reported in the NC3 include Improving the Environmental Conditions of the Volga River and its Tributaries: Restoration and Maintenance of Ecosystems of the Volga Basin for the Period to 2010, subprogramme Environmentally Safe Development of Agriculture, and Federal Comprehensive Programme to Increase Soil Fertility in Russia, 2002–2005. There is also ongoing research on a system for collection and anaerobic treatment of manure that could possibly reduce emissions from manure fermentation.

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[15] Russian statistics count natural gas transmission losses in the transport sector, which would nearly double this share, but the statistics of the Organisation for Economic Co-operation and Development do not ascribe transmission losses as transportation.

## E. Land-use change and forestry

77. Sustainable use and development of natural resources is a major principle of forestry management. This principle is reinforced in the updated Forest Code that was expected to be adopted by the State Dumas at the end of 2003.[16] Although this principle is not directly linked to climate change, its implementation may have a positive impact on carbon stock in the forests of the Russian Federation. An important element of the current forest policy is to maintain state ownership at least for the coming decade, although the timber industry and around 10 per cent of agriculture has been privatized. Management plans are the main policy tool for forest management.

78. While the NC3 focuses primarily on the limitation of emissions from other sectors, policies and measures to enhance forest sink capacity are also considered important. In addition to being effective in climate change mitigation, policies and measures implemented in the forestry sector have to comply with other requirements, such as compatibility with the goals of sustainable national social and economic development, cost minimization, coordination with assessment of climate change impacts and preventive/adaptation measures, and taking maximum advantage of the positive effects of climate change. Although the NC3 does not contain any estimate of the effect from current policies on forest sink capacity, it indicates that the area affected by specific measures is around 30 million ha.

79. The main approach to enhancing forest sink capacity relies on forest restoration (reforestation and assisted natural regeneration) of 900,000–1,000,000 ha per annum, suppression of forest fires, improved harvesting technologies and timber use, and afforestation. With some 48 million ha of former agricultural lands recently abandoned, the Russian Federation has great potential for reforestation and afforestation, but few resources to undertake such large programmes. No special considerations are reported in the NC3 on the commercial use of wood as a renewable source for energy.

80. The forests of northern Siberia and the Far East are primarily used as the resource base for the economy. Existing research suggests that improving their rational use, while considering climate change aspects, could substantially increase the carbon stock. This is now a focus of the forest management strategy in the Russian Federation, and requires much financial support and new measures.

81. The NC3 also reports on a large reduction of $CO_2$ emissions achieved through improvement of control and protection against fires, insects and diseases, as well as improvement of various technologies in forest operations. In particular, the Federal Target Programme *The Russian Forest* contains measures related to forest regeneration, drainage, silviculture and protection against insects and fires. These measures have resulted in higher forest cover and increased forest productivity. Another programme launched was *Protection of Forest Against Fires*, 1999–2005. Within the framework of a third programme aimed at enhancing soil fertility, the Forest Service established 112,000 ha of forest shelter belts between 1996 and 2000 to protect agricultural lands and pastures from erosion. The Russian Federation plans to confine illegal felling, and is calling for effective international cooperation.

## F. Waste

82. Emissions of $CH_4$ from waste management stood at 1,800 Gg in 1999. With a share of 13 per cent of total $CH_4$ emissions, waste management ranked as the third largest source of $CH_4$ emissions after fugitive emissions from coal mines and natural gas systems, and agriculture. The NC3 refers only to waste from building materials, which is of little relevance to GHG emissions from waste.

83. During the visit, the review team was provided with information on activities undertaken in this sector by the Ministry of Natural Resources and, in particular, by the Federal Service on Environmental Protection. It is responsible for the implementation of waste management policy and in particular of policy on municipal waste, which is the major source of GHG emissions. These activities centred on inventory of waste, landfills, waste composition, and emissions from waste, discussed in the inventory

[16] The previous Forest Code was adopted in 1997.

sections of this report, and also on the setting up of a register of state landfills.[17] They also centred on the implementation of the main principles of waste management outlined in the 1998 Federal Law on Waste, including the minimization, prevention, recycling and safe disposal of waste. The law also introduced the economic and administrative tools for waste management and procedures for licensing.

84. Also, the *2002 Federal Programme on Environment and Natural Resources* contains a subprogramme on waste management. It defines the administrative methods for waste management and allocates financial resources to implement specific projects on waste processing. The review team was informed of two specific projects implemented in Moscow for waste utilization for energy purposes.

## IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

### A. Preparation of projections

85. The IGCE prepared projections reported in the NC3, based on the 2002 Energy Strategy. Hence, projections indirectly reflect some input from the Ministry of Energy and the Economic Research Institute (ERI). During the visit, the review team was provided with the most recent projections prepared by the ERI and included in the 2003 Energy Strategy, as well as projections of emissions from agriculture and an assessment of the future levels of forest removals, prepared by the IGCE with some input from the Ministry of Natural Resources. AO Gazprom provided projections for $CH_4$ emissions from the gas industry. All these projections are included in this report.

86. The NC3 contains a set of projections for energy-related $CO_2$ emissions only, covering the period from 2000 to 2020. Projections are presented only as percentage changes compared to 1990, not giving absolute values. The tabular format for presenting projections by sector in quantitative values, required by the UNFCCC guidelines, was not used. This made it difficult for the team to determine consistency between inventory data and the base year for projections, 2000. Also, projections were presented for a single sector, the energy sector, without distinguishing between different subsectors, e.g. transport, as suggested by the UNFCCC guidelines. No projections were reported for non-energy-related GHG emissions, e.g. emissions from industrial processes, agriculture, waste, and emissions and removals from LUCF. Estimates of effects from policies were rarely provided. In this sense, the reporting is of lower quality in the NC3 than in the NC2, where projections were reported for many of these sectors. Projections for emissions from bunker fuels and biomass were absent in both the NC2 and NC3.

87. Little information was provided in the NC3 on how projections were prepared and in which instances these projections differ from the 2002 Energy Strategy projections. Also, little information was provided on the models used and on the interim results, e.g. energy supply mix. The review team had little opportunity to discuss the NC3 projections during the visit, but had a detailed discussion on the projections included in the 2003 Energy Strategy. In addition to projections for $CO_2$, this strategy also contains projections for $CH_4$ and $NO_X$ and total GHG emissions from the energy sector.

88. The review team noted that reporting of the information on projections was incomplete and did not strictly follow the UNFCCC requirements. It encouraged the Russian Federation to improve completeness and transparency of reporting and to present the information by sector and by gas, and also in aggregated format for each sector, as well as for national totals using global warming potentials (GWP) for each scenario, as required by the UNFCCC guidelines. It also encouraged the Russian Federation to report information on sensitivity analysis and the estimated and expected total effect of implemented and adopted policies and measures, as required by the UNFCCC guidelines. It further encouraged the IGCE team to prepare and report projections of $CO_2$ emissions in close cooperation with the Ministry of Energy and the ERI, and projections of non-$CO_2$ gases in close cooperation with other relevant institutions, e.g. the Ministry of Energy and the Ministry of Natural Resources, where most of the data on activities and policies, as well as on methodologies for projections, seem to be available.

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[17] In 2002 a study on GHG emissions from waste was completed that covered $CH_4$ emissions from municipal waste, $CO_2$ emissions from waste incineration and $N_2O$ emissions from microbiological decomposition of manure and oil sludge.

### B. Scenarios, models and assumptions underlying future emission trends

89. In the NC3, $CO_2$ emissions were provided for three scenarios: "optimistic" (scenario I), "realistic" (scenario III) and "unfavourable" (scenario II), which differ in terms of assumptions for the growth of GDP, energy consumption and energy intensity of GDP. Given that the "optimistic" scenario encompasses the effect from the policy to promote energy efficiency, which constitutes the main thrust of the national climate policy, this scenario could be characterized as a "with measures" scenario according to the UNFCCC guidelines. The "optimistic" and "unfavourable" scenarios are based on the 2002 Energy Strategy, whereas the "realistic" scenario seem to be included in the NC3 to reflect a view of the IGCE and the ICCC on probable future economic development and the associated emission levels.

90. Similarly, the main scenario from the 2003 Energy Strategy, the "moderate" scenario, could be considered as an updated "with measures" scenario. The 2003 Energy Strategy also contains an "optimistic" scenario, which together with the "moderate" scenario forms the package of the basic scenarios. These scenarios are discussed in the present report. Two additional scenarios were considered in the strategy: a "favourable" scenario, which was assumed to be somewhere between the two basic scenarios, and a "critical" scenario, which assumed an unfavourable combination of internal and external factors, including low world energy prices and a decline in the world demand for the energy exports of the Russian Federation. The main difference among these scenarios stems from assumptions of the world energy prices (high, moderate and low) and growth rate of GDP, as shown in paragraph 95.

91. As in the NC2, the $CO_2$ projections of energy-related emissions in NC3 were prepared on the basis of an aggregated single-equation model, assuming an exponential growth of emissions with power equal to the sum of the growth rates of the GDP, energy intensity improvement and the change of carbon intensity of the TPES. In contrast to the NC2, however, the carbon intensity of the TPES was assumed constant in all three scenarios.

92. The review team noted that the simplicity of the top-down approach used to prepare projections facilitates the generation and analysis of alternative scenarios. However, this approach does not seem to be productive for policy-making purposes as it does not permit tracking chains of causality within the model or identifying the impact from policies and policy instruments deemed relevant in modifying emission levels, e.g. regulatory, technological research and development and fiscal instruments. Also, such approaches are suitable for short-term projections, in which changes in the economic structure and energy supply mix are small. In the long term these assumptions are no longer valid, and the ability of a single-equation model to produce correct results under a given set of assumptions is greatly reduced.

93. Importantly, the top-down approach does not capture the endogenous impact from the likely changes in the structure of the GDP, as this impact is only reflected through a single indirect and exogenous parameter such as energy intensity of the GDP. This issue is of particular relevance for the Russian Federation because different sectors are likely to evolve differently in terms of primary energy demand, carbon intensity and carbon emissions. Other issues, such as industry restructuring, promotion of energy efficiency and changes in energy pricing policy are mentioned in the NC3 and seem to be embedded in the analysis to some extent, but it is difficult to establish a chain of causality (an economic rationale) between these variables and the actual design of and results from the emission scenarios.

94. In contrast to the NC3 methodology, the ERI methodology used for projections included in the 2003 Energy Strategy is a comprehensive bottom-up one. It includes an adequate representation of external markets (with a particular emphasis on the Commonwealth of Independent States market) and a set of sectoral demand models, in which econometric estimates of the relevant elasticities (price, income and substitution in non-captive markets) are embedded. Potential technological developments for each sector are predicted using a database with more than 1,200 energy-saving technologies. These developments define the need for investment and evolution of the installed capacity in the energy supply subsectors, e.g. electricity, heat and power, and oil and gas. An optimization approach was used for the energy supply part of the energy system, whereby the endogenous evolution of capacity, driven by energy demand, prices and policy-related factors, is obtained. The outcome of this method provides future

energy balances at national and regional level, with the relevant estimates of the future prices of fuels used in energy end-use sectors and prices for electricity and heat.

95. Assumptions on four key parameters underline the NC3 scenarios: economic growth, changes in energy intensity of the economy, growth in energy consumption and carbon intensity of the TPES. These assumptions are closely linked to the 2002 Energy Strategy and the relevant economic growth projections of the Ministry of Economic Development and Trade. Interestingly, the GDP growth in the “realistic” scenario is assumed as intermediate between the two other scenarios, but the improvement in energy intensity in this scenario is the lowest of the three scenarios. This leads to the highest growth of energy consumption of all three scenarios and, assuming a constant carbon intensity of the TPES, to the highest projected emissions. Table 10 shows the assumptions and the actual development of the key parameters.

**Table 10. Comparison of actual growth or values of some key parameters and assumptions for these parameters in the NC3 scenarios and 2003 Energy Strategy scenarios [a]**

| | Actual development | NC3 scenarios | | | 2003 Energy Strategy scenarios | |
|---|---|---|---|---|---|---|
| | | “Optimistic” | “Realistic” | “Unfavourable” | “Moderate” | “Optimistic” |
| Annual GDP growth (%) | Drop by 1997, followed by an increase [b] | 5.2 | 4.5 | 3.3 | 4.3 | 6.2 |
| Annual decrease of energy intensity of GDP (%) | Increase by 1998 followed by a decrease [c] | 3.7 | 2 | 2.5 | 2.8 | 4.2 |
| Annual growth of energy consumption (%) | Drop by around 1 per cent annually for 1995–2000 | 1.5 | 2.5 | 0.8 | 1.1 | 1.6 |
| Average world gas prices (USD/thousand $m^3$) | Average price for domestic consumption for 1995–2000 was 86 | NA | NA | NA | 118 | 138 |
| Average world oil price (USD/bbl) | Average price for 1995–2000 was 20 | NA | NA | NA | 18.5 | 30 |

[a] The carbon intensity of the TPES is not included in the table, because it was assumed to remain constant.
[b] When the economy revived after 1998, GDP grew by 5, 8 and 5 per cent in 1999, 2000 and 2001, respectively.
[c] After the economy recovered, energy intensity gradually declined by 1.5 and 6 per cent in 2000 and 2001, respectively.

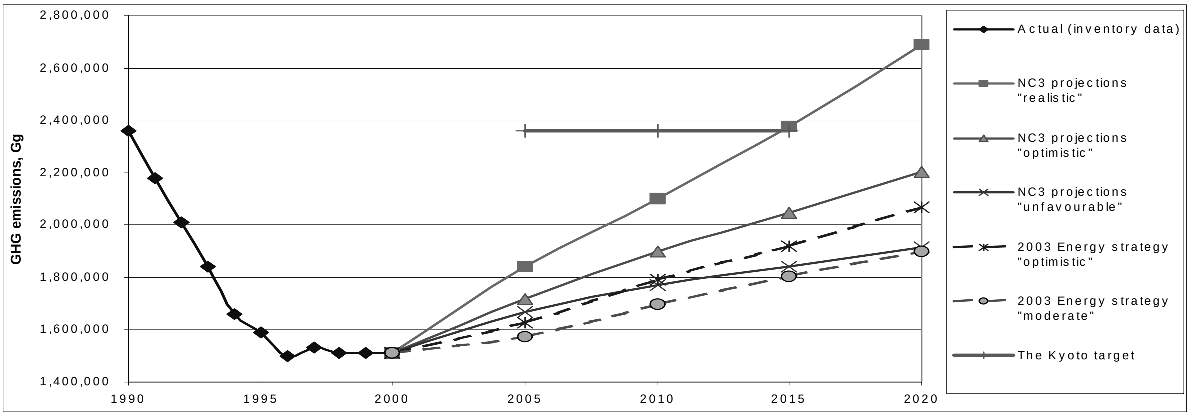
96. Projections included in the 2003 Energy Strategy rely on assumptions about external factors, such as growth of the world economy, demand for oil and gas exports, the accession of the Russian Federation to the World Trade Organization and repayment of the foreign debt. They also rely on assumptions on internal factors, such as the pace of economic reform, including in the monopolistic sectors of the economy, the stability of the national currency and the level of public expenditure. Some of these assumptions are also summarized in table 10. In particular, the most feasible “moderate” scenario assumes an almost steady growth of GDP of around 4 per cent from 2003 to 2020, resulting in a 2.3-fold increase in 2020 compared to 2003. The “optimistic” scenario assumes a steady increase in the GDP growth rate from 4.5 per cent in 2003 to 7 per cent in 2010, remaining thereafter at the same level until 2020. Accordingly, compared to 2003 the GDP will increase 2-fold by 2013 and 3.3-fold by 2020. This reflects the political goal to double GDP in 10 years.

97. Comparison of the key assumptions and the actual development of parameters linked to these assumptions in the NC3 and the 2003 Energy Strategy suggests that the assumptions are internally consistent and broadly consistent with historical data. The “optimistic” scenario from the 2003 Energy Strategy assumes a GDP growth rate that is much higher than historical growth rates and also higher than the growth rates of most countries with economies in transition after their economies revived in the mid-1990s. As noted in the 2003 Energy Strategy, such economic growth is possible under conditions of accelerated economic reform and liberalization of prices and tariffs, together with an enhanced role of markets. Importantly, energy efficiency plays a major role in this strategy, as the rate of improvement of energy intensity in the “optimistic” scenario by far exceeds the rate in the “moderate” scenario. This may result in comparable growth rates in energy consumption in the two scenarios.

## C. Results of projections

98. According to the NC3 "realistic" scenario and the inventory estimates, the energy-related $CO_2$ emissions are projected to reach 2,076,800 Gg $CO_2$ in 2010. The corresponding values for the "optimistic" and "unfavourable" scenarios are 1,888,000 Gg and 1,770,000 Gg. Results from these scenarios are shown on figure 5, together with projections from the 2003 Energy Strategy and historical emission figures. Given the nature of the NC3 modelling approach, it is difficult to estimate the effect of policies and measures, mainly energy efficiency, by comparing the emission levels in different scenarios. The difference in the scenario results reflects the combination of assumptions for GDP growth rate and assumptions on the rate of autonomous energy efficiency improvement.

**Figure 5. Projections of energy-related $CO_2$ emissions in the NC3 and the 2003 Energy Strategy**




99. Since the NC3 did not contain projections for non-$CO_2$ gases from non-energy sources, the team made a conservative assumption that the rate of increase of these gases could be in line with the growth in $CO_2$ emissions.[18] Under this assumption, the target for the Russian Federation under the Kyoto Protocol (the Kyoto target) could be translated into a target of 2,360,000 Gg for energy-related $CO_2$ emissions, which account for around 78 per cent of base year emissions (without LUCF). The analysis of projections of the $CO_2$ emissions compared to this target suggests that only in the "realistic" scenario could $CO_2$ emissions even come close to the target in the first commitment period; for other scenarios they remain well below this target.

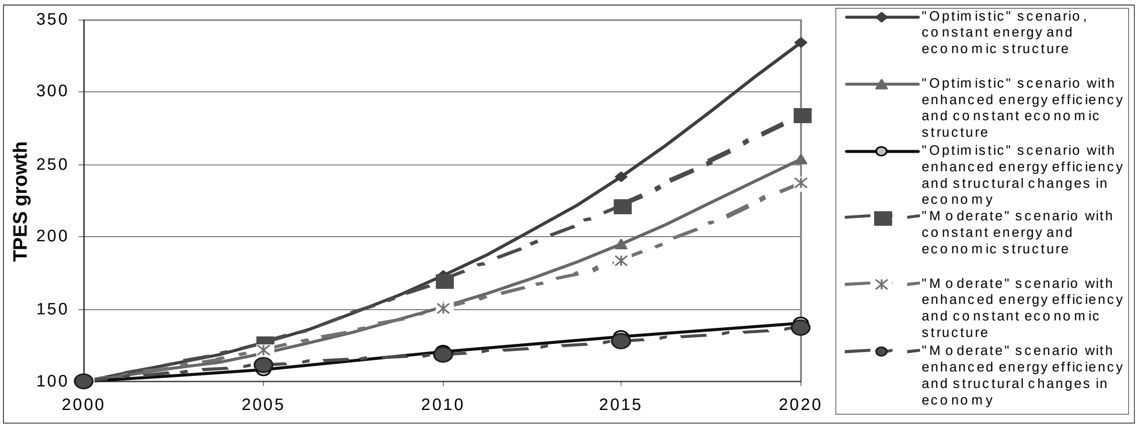
100. The growth of $CO_2$ emissions is underpinned by the economic growth, and associated energy demand growth in the energy end-use sectors and the TPES. To match the growth in energy demand, the TPES according to the 2002 Energy Strategy is projected to grow from 614 Mtoe (920 Mtce) in 2000 to 720 Mtoe (1075 Mtce) in 2010 and 844 Mtoe (1260 Mtce) in 2020. Importantly, changes in the TPES mix are projected, as a result of reducing the share of natural gas from 48 per cent in 2000 to between 42 and 45 per cent in 2020. This will occur at the expense of increasing shares of fuels with high carbon content, e.g. coal from 20 per cent in 2000 to between 21 and 23 per cent in 2020. This will also occur at the expense of changes in shares of carbon-free energy, such as nuclear from 5 per cent in 2000 to 6 per cent in 2020 and non-traditional renewable energy from practically zero to between 1.1 and 1.6 per cent in 2020. The impacts of these changes on the carbon intensity of the TPES mix are expected to offset each other, so the carbon intensity will remain broadly unchanged, as assumed in the NC3.

101. However, this assumption will hold true only if the necessary investments for the 2002 Energy Strategy, totalling USD 550–700 billion, are ensured, together with investment for energy efficiency improvement, and the safety issues related to operation of nuclear plants and their public acceptance are addressed. Otherwise, the carbon intensity of the TPES and the overall $CO_2$ emission levels are likely to increase if all other assumptions remain valid.

[18] The assumption is conservative because the analysis of historical emission trends of the Russian Federation, some projections of non-$CO_2$ gases from non-energy sectors provided to the review team during the visit, and projections of emissions for other countries with economies in transition suggests that non-$CO_2$ gases from non-$CO_2$ sources tend to grow at a much slower rate than energy-related $CO_2$ emissions.

102. According to the "optimistic" scenario from the 2003 Energy Strategy, the energy-related $CO_2$ emissions are projected to reach 1,814,000 Gg $CO_2$ in 2010. According to the "moderate" scenario, this value would be 1,696,000 Gg (figure 5). Between 2010 and 2020 these scenarios remain below the "realistic" and "optimistic" scenarios from the NC3 and only the "unfavourable" scenario from the NC3 remains within the bounds delineated by the 2003 Energy Strategy scenarios. Therefore, the analysis in paragraph 99 on the possibility for emissions remaining within the Kyoto target remains valid. It remains valid also for the energy sector as a whole, taking into account all energy-related emissions. According to the 2003 Energy Strategy, total emissions from this sector are projected to remain below 1990 levels by 2020: in 2010 they are expected to be at 78 and 85 per cent of the 1990 level for the "moderate" and "optimistic" scenarios and in 2020 they are expected to be at 84 and 92 per cent respectively.

**Figure 6. Projected growth of the TPES for the "moderate" and "optimistic" scenarios under three different sets of assumptions: percentage change compared to the year 2000**




103. As in the NC3, the growth of emissions in the 2003 Energy Strategy is underpinned by economic growth, and the associated growth in energy demand in the energy end-use sectors and the TPES. Possible pathways of TPES growth are illustrated in figure 6 for the "moderate" and "optimistic" scenarios under three different sets of assumptions: (a) maintaining the energy intensity and economic structure of the year 2000 unchanged until 2020; (b) improving energy efficiency, while maintaining the economic structure of the year 2000 unchanged; and (c) improving energy efficiency and assuming some changes in the economic structure.

104. The comparison between the first two options indicates the possible effect on the TPES of new, more efficient technologies and energy-efficiency measures. To some extent it indicates the potential for energy saving and related emission reduction. The comparison between the latter two options indicates the effect on the TPES from further changes in economic structure, e.g. an increased share of services at the expense of industry, and, within industry, an increased share of less energy-intensive industries instead of intensive ones. To match the growth in energy demand, the TPES according to the "moderate" scenario of the 2003 Energy Strategy is projected to grow from 606 Mtoe (904 Mtce)[19] in 2000 to 685 Mtoe (1022 Mtce) in 2010 and 767 Mtoe (1146 Mtce) in 2020.

105. Also, the 2003 Energy Strategy contains detailed projections of the evolution of the energy supply sector and energy end-use sectors, including analysis of the evolution of different technologies such as energy-efficiency technologies, hydrogen technologies and fuel cells. This translates into options for sectoral improvements in energy efficiency and carbon intensity that might be used for projections of $CO_2$ emissions by sector, e.g. transport, under different hypotheses.

106. Comparison of projections results for 2010 reported in the NC1, NC2, NC3 and the 2003 Energy Strategy suggests that the NC2 (prepared before the 1998 economic crisis) tends to present a more optimistic view of the pace of economic growth and the associated higher level of emissions than did the NC1 (table 11). Accordingly, the NC3 suggests a lower level of emissions than the NC2. This

[19] The historical value of the TPES in 2000 is different in the 2002 and 2003 Energy Strategies.

comparison also broadly suggests a lower level of emissions in the 2003 Energy Strategy than in the NC3, notwithstanding higher assumptions for the GDP growth rate in this strategy.

**Table 11. Projections of $CO_2$ emission in the NC1, NC2 and NC3 and the 2003 Energy Strategy**

| Scenario | NC1 | | NC2 | | NC3[a] | | 2003 Energy Strategy[b] | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2000 | 2010 | 2000[c)] | 2010 | 2000[c] | 2010 |
| Baseline | 87 | 96 | 76 | 107 | 69 | 89 | NA | NA |
| Probable | | | 74 | 97 | 69 | 80 | 65 | 78 |
| Optimistic | 83 | 90 | 73 | 92 | 69 | 75 | 65 | 73 |

[a] Data in the columns for the NC3 correspond to the “realistic” (III), “optimistic” (I) and “favourable” (II) scenarios as described in the NC3.
[b] Data in the columns for the 2003 Energy Strategy in the row for “probable” and “optimistic” scenarios correspond to the “optimistic” and “moderate” scenarios as described in the strategy.
[c] Data for the year 2000 for the NC3 and 2003 Energy Strategy reflect inventory results, not projections as in the columns for NC1and NC2.

### D. Projections for fugitive emissions from the gas sector, and emissions from agriculture and land-use change and forestry

107. Projections for fugitive $CH_4$ emissions from natural gas extraction and distribution were provided during the review team’s visit by AO Gazprom (table 9). These projections suggest a considerable potential for reduction in these emissions at relatively low cost.

108. Three sets of projections were prepared for emissions from the agriculture sector. These include a “minimal” scenario, where emissions are assumed to remain broadly unchanged compared to their 2001 level of 77,600 Gg $CO_2$ equivalent, a “maximal” scenario, where emissions are assumed to increase gradually and to reach their 1990 level of 192,000 Gg by 2010, and a “medium” scenario, whereby emissions are assumed to remain intermediate between the two previous scenarios. The Russian experts regard the “medium” scenario as the most probable.

109. No special projections were developed for emissions and removals from the forestry sector. Instead, the current trend was extrapolated, a procedure which is associated with high uncertainties. The main assumption is that the level of harvests will remain broadly constant at least for a decade, which may imply that the forests will remain a net sink. A further expectation of the forests remaining a net sink is based on the possible continued fertilization effect of an increasing concentration of $CO_2$ in the atmosphere. However, the uncertainty of this effect is believed to be high by the Russian experts, who consider further studies on this issue in the framework of the IPCC to be very important.

## V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

110. The IGCE coordinated work on climate change vulnerability, impacts and adaptation between research organizations and different ministries, including the Ministries of Agriculture, Natural Resources, Health, Transport, and Water Resources. According to the initial assessment, agriculture, forestry, water resources and the cryolite zone[20] of the Russian Federation seem to be potentially the most affected by climate change. With regard to human health, it is believed that vulnerable regions may exist, but these are yet to be identified.

111. During the last century, the Russian Federation as a whole, with the exception of regions around the Black Sea and polar zones, has experienced an increase in temperature. The average increase in temperature over the entire territory was about 1ºC. While a temperature increase was observed in almost all regions of the country, no homogenous spatial pattern of precipitations appeared. In general, climate change conditions throughout the country could be characterized as “warming accompanied by increased dryness”. For the cryolite zone, the observed annual increment in air temperature was from 0.02°C to 0.06°C. Such increases could shift the border of the solid cryolite zone northwards by 150–200 km by the end of this century. This will have major implications for the existing infrastructure built under permafrost conditions.

[20] The “cryolite zone” comprises of the upper layer of the earth’s crust that is characterized by negative temperature and possible underground ice. It encompasses the permafrost zone.

112. The impacts of climate change on agriculture were assessed using studies on observed changes in productivity related to climate change, e.g. change in productivity of cereals in Siberia. The assessment was also carried out using the Russian System Climate Soil Yield model with inputs from several general circulation models (CCC, GISS, UKMO) and of the Country Specific Model of Intermediate Climate (COSMIC). Assuming a doubling of $CO_2$ concentration and specific climate scenarios, a 13 per cent increase in productivity for forage crops and an 11 per cent increase for grain crops could be expected for the next 40–50 years. A displacement of boundaries of vegetation zones, along with improvement of agricultural outputs in some regions and deterioration in others, is also expected as a result of intensified desertification and an increase in extreme events. The overall balance is expected to be positive.

113. On the basis of the assumption that warming could increase net $CO_2$ removals, the Russian Federation can expect a major impact on forests in the long term, possibly leading to instability. These effects are not expected to be important in the European part of the country for at least the next 50 years. Currently observed changes in forests that could be attributed to climate change include changes in tree species composition (increased representation of deciduous species), drying of oak forests in the Central Chernozem Reserve, and the expansion of the upper forest boundary in alpine areas.

114. Climate change and associated increased precipitation have already influenced water resources, e.g. the Volga river and the Caspian Sea. With an increase in temperature of 3–5°C and an increase in precipitation of 10–20 per cent, the annual waterflow could increase by 25–40 per cent in the Volga and Dnepper river basins and by 15–20 per cent in the Enisei river basin. Nevertheless, some regions of Siberia may suffer from dryness.

115. The NC3 contains a list of potential adaptation measures, but a strategic approach for adaptation is yet to be elaborated. This is especially important for forestry, given the importance of maintaining and enhancing carbon stock. Possible adaptation measures in forestry centre on preservation of natural regeneration of conifers over cut areas; improvement of the quality of planting material to decrease damage by extreme events; improving tending and thinning of young stands; and decreasing the risk of fire, as well as pest control, and weakening the impact of these hazards on forests. Possible adaptation measures in agriculture centre on new highly productive crops and changes in agricultural practices.

## VI. RESEARCH AND SYSTEMATIC OBSERVATION

116. The Ministry of Industry, Science and Technology assumed responsibilities for financing, management and coordination of research on global change in the Russian Federation. Other agencies participating in research-related activities include the Russian Academy of Science; the Ministries of Economy, Education, and Natural Resources; and a number of universities and research centres. Most activities are implemented through the Federal Programme *Research and Development on Priority Areas of Science and Technology*, in particular the subprogramme *Global Change of the Environment and Climate*. This is a 15-year programme, launched in 1991. In 2003 alone, around 1.8 billion roubles (equivalent to USD 57.4 million) were disbursed under the programme. In contrast to the NC2, the NC3 does not contain information on energy-related research.

117. Between the NC2 and the NC3, a few research programmes have been initiated, such as the *Technology of Forecasting and Assessment of Changes in Climate and Ecosystems Resulting from Anthropogenic Impact*, *World Oceans Programme* and *Federal Space Programme of Russia*. After the review team’s visit, the ICCC received the 2003 Climate Action Plan for approval. It replaced the 1996 programme *Prevention of Dangerous Climate Change and its Negative Impacts* which came to an end in 2002, and will facilitate better coordination of organizations involved in climate change research.

118. RosHydromet is responsible for systematic observations on climate, in cooperation with other organizations. Following the UNFCCC guidelines, the NC3 includes an annex with information on the Global Climate Observing System (GCOS). The review team was informed of the deterioration of the observation capacity due to shortage of financial resources. Nonetheless, plans are under way to put 14 new observation stations into operation in 2005, which would give 146 stations participating in the GCOS. The Russian Federation plans to increase by 2005 the number of stations participating in the

Global Oceanographic Observing System from 360 to 750. Terrestrial observations are conducted in conjunction with specific projects only, as there is not a permanent system required by the GCOS.

119. At one time the Russian Federation had an impressive National Space Programme, including the satellites Meteor, Electro, Ocean and Resource, which was used for systematic observations. However, by 2002, only one of the satellites remained in operation. By 2005, in the framework of a new Federal Space Programme, the launch of the new Meteor-3M and Electro satellites is planned, the latter being pursuant to the commitments under the World Meteorological Organization.

## VII. EDUCATION, TRAINING AND PUBLIC AWARENESS

120. The NC3 reports that experts on climate-related issues, such as climatology, hydrology and meteorology, are being trained at several universities in the Russian Federation. Between 1999 and 2002, more than 300 students graduated with degrees related to climate issues and about 30 per cent of them are working in the RosHydromet system. No information was available on the inclusion of climate change issues in school curricula. The team noted that climate change issues could be incorporated in the curricula, together with other environmental issues or disciplines.

121. The NC3 encompasses a wealth of information on climate change being provided in scientific and technical publications, as well as in popular journals and magazines. However, given that climate change is not a high political priority, little attention has been given to raising public awareness and it is mainly NGOs that are active in this area. The NGOs have initiated some projects to inform business, local authorities and the public at large of the link between climate change and energy efficiency, energy saving and renewable energy. In cooperation with RosHydromet and the Ministry of Energy, several NGOs organized a workshop for governmental officials, experts and the general public on the findings of the IPCC Third Assessment Report and the implications for Russian climate change policy.

122. The World Climate Change Conference, held in Moscow in September 2003, was seen as an opportunity to raise public awareness and increase the involvement of society in addressing climate change. The review team noted the need for further actions to raise public awareness of climate change, the links between climate change and other issues such as energy efficiency, and benefits from climate mitigation for human health and quality of the local environment. Cooperation between the Government and environmental NGOs could contribute to this goal.

## VIII. CONCLUSIONS

123. The review team’s overall assessment of the information contained in the NC3 suggests that this information reflects in an objective manner the steps taken to implement the UNFCCC and to prepare for implementation of the Kyoto Protocol, once it enters into force. Also, in very general terms the reporting of this information conforms to the UNFCCC guidelines.

124. Notwithstanding the limited financial resources available for inventory work, GHG inventories clearly represent an area where progress was made. The review team commended the IGCE, in particular, for its endeavours to improve the methodology and enhance transparency in reporting in terms of LUCF. More financial support for inventory preparation may help to complete the work on the national system for inventory preparation, to ensure improved data quality and completeness of the inventory, and to foster the cooperation between the IGCE and the relevant ministries and organizations involved in inventory preparation, e.g. the Ministry of Natural Resources and authorities at the regional level. This may also help to address the problems relating to inventories noted in this report, including completeness in coverage of emission sources and removals; using more detailed assessments of emissions in the energy sector following a sectoral approach; and recalculation and consistency of emission time series. The review team encouraged the Russian Federation to submit inventories on an annual basis, following the agreed UNFCCC reporting requirements (i.e. NIR and CRF).

125. The review team encouraged the Russian Federation to adhere more strictly to the UNFCCC guidelines in reporting on policies and measures and projections. On policies and measures, this includes presenting information by sector, subdivided by gas, summarizing the key policies and measures in the

table recommended by these guidelines with a clear indication of policy objectives, level of implementation, type of instrument, implementing entities and, where possible, estimates of effects. On projections, it includes reporting on the methodology used, reporting by sector on a gas-by-gas basis, and in an aggregated format for each sector and for national totals using the GWP. It also includes assessment of the effects of policies and measures on the future emission trends, where possible. This further includes reporting projections for international bunker fuels and emissions and removals from LUCF. The review team noted that the 2003 Energy Strategy contains a great deal of detail on projections that could be used to follow the UNFCCC guidelines closely. Also, using the methodology for projections from the 2003 Energy Strategy for the future emission trends could help to overcome the limitations of the approach used for projections in the NC3 discussed in paragraphs 92 and 93.

126. The 1990s saw a large decrease in emissions in the Russian Federation (38 per cent between 1990 and 1999); in fact, one of the largest among countries with economies in transition. This decrease in emissions was underpinned by the decline of economic activities and the closure of many industrial enterprises, and also by natural gas becoming the most important element in the energy supply, and especially becoming the fuel of choice for electricity generation. The decrease in emissions suggests that the Russian Federation is likely to make an important contribution to meeting the aim of the UNFCCC. According to the NC3, the decrease in emissions created a basis for a low-cost strategy to implement the UNFCCC and the Kyoto Protocol, once the latter enters into force. Analysis of future emission trends suggests that although emissions are expected to rise in practically all NC3 and 2003 Energy Strategy scenarios following the revival of the economy, they are likely to remain below the Kyoto Protocol target for the first commitment period by between 11 and 28 per cent for these scenarios. They are also likely to remain below this target even in 2020, except for the most pessimistic of the three NC3 scenarios.

127. Given the importance of the energy sector in the economy and its high energy intensity, it is essential for the Russian Federation to achieve energy efficiency goals in order to maintain, let alone increase, rapid economic growth while seizing export opportunities, realizing its environmental goals and limiting GHG emissions. Most emissions originate from the energy sector, so it is well understood that energy and energy efficiency would continue to be a core element of climate change policy. Therefore, success in climate change policy will also depend on the success of overall reforms in the energy sector, including energy price reforms, electricity sector restructuring and possibly gas sector restructuring. This overall reform would help to sustain current economic growth and to enable the energy sector to keep pace with domestic energy demand growth, while seizing export opportunities. The outlook for strong economic growth, doubling GDP over the next decade is especially important in terms of guarding against negative impacts on the environment, and in particular in terms of growing emissions of GHGs. In this context, results achieved in the electric power sector are important and indicative as to what could be achieved further in this and other sectors.

128. An important development in climate change policy in mid-2003 was the preparation of the 2003 Climate Action Plan, which consolidates elements of climate policy into a single framework. This raises the importance of climate change in the national policy agenda and represents an encouraging step for climate policy development and implementation, given the importance of coordination of policies across all relevant ministries and economic sectors. This was expressed by the Prime Minister of the Russian Federation in the State Dumas in May 2000 and highlighted in the NC3: “The limitation of emissions growth and enhancement of removals should be implemented through coordinated technical, economic, and institutional arrangements and activities in all key sectors of the economy with priority consideration given to the government-set energy saving requirements, indispensable to ensure economic growth.”

129. At the sectoral level, it is a positive development that key companies such as RAO UES and AO Gazprom have already begun establishing inventories of GHG emissions from their facilities, in preparation for possible JI projects. This type of monitoring of emissions will be increasingly essential in order to assess priorities and to measure and evaluate the effectiveness of projects and programmes in specific sectors, as well as at the regional level. If the Russian Federation ratifies the Kyoto Protocol, an efficient domestic mechanism for monitoring and reporting of emissions will be essential to enable emissions trading and JI projects.

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