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

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

1. Italy ratified the UNFCCC on 21 December 1993. Its first national communication (NC1) was submitted to the secretariat on 4 April 1995 and the second national communication (NC2) on 27 May 1999. The in-depth review of the NC2 was conducted between September 1999 and December 1999 and included a visit to Rome from 13 to 17 September 1999. The team comprised Ms Rola Nasreddine (Lebanon), Mr. Taha Mohammed Zatari (Saudi Arabia), Ms Kristin Rypdal (Norway) and Ms June Budhoom (UNFCCC secretariat, coordinator). The in-depth review of the NC2 of Italy was coordinated by the Ministry for the Environment (ENPA) with the technical support of the National Agency for Environmental Protection (ANPA), and the National Agency for New Technologies, Energy and the Environment (ENEA). The review also included discussions with officials in government, members of the scientific community and key stakeholders in the business community and non-governmental organizations (NGOs). During the review a wealth of information was provided to the team, which greatly improved the understanding and comparability of information contained in the NC2.
2. Environmental legislation in Italy is anchored in the Constitution and further elaborated in acts of Parliament. Legislation can be initiated by parliament, the Government and regional authorities. There are also various types of decrees which can be enunciated by the President of the Republic, the President of the Council of Ministers or an individual ministry, upon delegation from parliament. Most environmental legislation takes the form of decree-laws (Decreto-Legge). A significant proportion of the country's environmental legislative activity is driven by the European Community (EC), whose directives are progressively being incorporated into Italian law.
3. Italy consists of 20 regions, 103 provinces and 8,102 communes. While most decisions and laws are made at the central government level, regional and local authorities play an important role in implementing and monitoring the law. Five regions have a high degree of autonomy and one of them, Trentino Alto Adige, is made up of two autonomous provinces to carry out the responsibilities delegated to them by national legislation. The response to these responsibilities varies widely from region to region, due to differences in size, resources and administrative capacities.
4. With a population density estimated at 190 persons/km² in 1997, including the islands of Sicily and Sardinia, Italy is listed as one of the densely populated countries among members of the Organisation for Economic Co-operation and Development (OECD). However, with a birth rate of one child per woman, it is also the country with the lowest birth rate among OECD countries. Most of its population, of 57 million in 1997, live in the north and along the coast. Differences among regions are particularly pronounced in Italy, especially between the industrialized, affluent north and the less developed south, the Mezzogiorno. This trend is directly related to factors such as per capita gross domestic product (GDP), education, housing conditions, services and the availability of infrastructure, and explains the high reliance on road transport for goods and services.

5. The economy of Italy, which is closely integrated into that of Europe, has been growing at an average rate of 1.1 per cent annually. The service sector grew to 50 per cent of GDP in 1995, resulting in a reduction in carbon intensity in recent years. Industry and manufacturing are Italy's main source of foreign income, accounting together for nearly 45 per cent of GDP in 1997. Growth in per capita GDP, a factor which partly explains trends in GHG emissions, is higher than the European average but lower than in countries such as Germany and France. Compared with other OECD countries, Italy has achieved a low energy intensity in terms of emissions per unit of output which has been declining since 1970, although at a slower rate since 1985. More recently, the Italian economy has experienced difficulties of relatively high unemployment, inflation and budget deficits. This has prompted the Government to adopt new and stronger policy measures, which are expected to create favourable conditions for growth in the economy.
6. The Italian economy is highly dependent (around 80 per cent) on imported oil, natural gas, coal and electricity to meet its growing energy needs and this situation is not expected to change in the foreseeable future, although the dependence on oil fell from 80 per cent to 50 per cent between 1980 and 1997. A 1987 referendum resulted in the imposition of a five-year moratorium on nuclear power generation, which expired in 1992, but which triggered the dismantling of Italy's nuclear industry. Domestic energy resources consist of natural gas, some oil, hydropower and geothermal energy. Renewables contributed over 6 per cent to the total energy supply in 1997.
7. In an effort to strengthen its efforts to address climate change issues, a national plan was adopted by the Government in November 1998, which identifies inter-sectoral policies and measures which would help Italy reach its national target of reducing GHG emissions by 6.5 per cent during the commitment period 2008-2012 compared to 1990 levels under the EC burden-sharing arrangements of the Kyoto Protocol. The plan, which contains strategies to strengthen both the monitoring of GHG emissions and the performance of GHG reduction programmes, is based on four main criteria, namely, compliance with the environmental directives and regulations of the EC; identification of low-cost measures, taking into account secondary environmental benefits; reduction of fossil fuel subsidies and taxes which contradict the efficient use of energy; and promoting more international economic and technological cooperation.
8. An Inter-Ministerial Working Group was established in December 1997 to coordinate climate change policies. It is chaired by the Ministry for the Environment and includes representatives of the Ministry of Industry, the Ministry of Public Works, the Ministry for Agricultural Policies, the Ministry of Transport, the Ministry of the University, Scientific and Technological Research, the Ministry of Foreign Affairs, the Ministry of Foreign Trade, the Ministry of Treasury, Balance and Economic Planning, the Ministry of Finance and representatives of the Regions. This Group provides support to all relevant administrations with a view to fulfilling domestic and international commitments, updating statistics, carrying out research and analysis and facilitating the timely implementation of the national plan. The team felt that, even though the Ministry for the Environment is to be commended for its efforts in moving climate change initiatives forward, it is clear that inter-ministerial coordination in the implementation of the UNFCCC could be improved. The Inter-Ministerial Committee for

Economic Planning (CIPE), which is chaired by the Treasury, will continue to make decisions regarding Italy's climate change strategy and approve all associated initiatives.

9. Italy is a member of the European Community. As such, it is a party to the "internal burden-sharing" arrangements as foreseen by Article 4 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change. As a whole, the EC is reported to be on course to keep its carbon dioxide (CO₂) emissions in 2000 below 1990 levels, but according to its own forecasts in the NC2, Italy's CO₂ emissions are likely to be about 5 per cent higher. Italy's greenhouse gas (GHG) emissions were estimated at 13 per cent of total EC GHG emissions in 1998. Italy accounted for 13.5 per cent of total EC CO₂ emissions and 13.4 per cent of the three main greenhouse gases (GHGs).

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

10. The review of Italy's GHG inventory was based on information presented in the NC2 and additional information provided during the review visit. The NC2 contains inventory data for the period 1990-1995 for all direct greenhouse gases, including emissions and removals by sinks of carbon dioxide, methane (CH₄) and nitrous oxide (N₂O), as well as the indirect gases such as carbon monoxide (CO), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO₂). Included were data for the new gases, substitutes not controlled by the Montreal Protocol, such as hydrofluorocarbons (HFCs), perfluorinated hydrocarbons (PFCs) and sulphur hexafluoride (SF₆). The team noted that there was a marked improvement over the NC1 in the coverage and completeness of the inventory. During the review, the Italian experts provided the team with an updated inventory series 1990-1997 which is contained in this report and forms the basis of the discussion which follows.

11. The Ministry for the Environment has full responsibility for the Italian national inventories. In the past, ENEA was assigned the task of preparing the national inventory. Most of the staff involved previously in inventory preparation were transferred to ANPA and recently this task was assigned to this new entity, thereby ensuring continuity. Experts explained the Government's plans to reorganize even further the task of preparing GHG inventories. In the future, draft inventories will be prepared at local and regional levels by government authorities which will serve as input into the national compilation of inventory data. While the review team felt that this process will enhance the quality and transparency of Italy's GHG inventories, the team emphasized that this task will require capacity at both the local and regional levels and strong coordination and harmonization at central level, to ensure consistency and adherence to inventory reporting guidelines. This approach also requires a long lead time and substantial funding for implementation.

12. The Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories were used for estimation of most emission sources. Emissions of CO₂ and other main pollutants were estimated using the CORINAIR methodology. Emissions from land transport were estimated using the COPERT model. National emission factors were applied for some sources, particularly for CO₂ and CH₄ and N₂O emissions from agriculture. In the future, and in order to account for abatement measures, Italy will need to

better reflect its national circumstances, particularly for the GHG emissions from industrial processes.

13. The review team commended the national inventory experts for remedying most of the shortcomings in the inventory identified during the review of the NC1. Methodologies were improved and also well documented in the NC2, for the main sources of emissions. Improvements made in methodologies since the NC1 are very clearly explained and these changes have led to recalculations of the entire time-series 1990-1997. The team felt that the inclusion of more detailed information on source data (technical documents and spreadsheets) would be helpful in analysing the inventory data. The main changes which enhanced the transparency of the inventories presented in the NC2 are for land-use change and forestry (LUCF), industrial processes, air transport, agriculture and waste. Estimation methodologies for HFCs, PFCs and SF₆ were also developed and improved. These changes imply that the inventory is largely complete.

14. Emissions from bunkers are reported separately as required by the Guidelines. Bunkers account for about 3 per cent of the national CO₂ emissions Italy has also reported problems with the data quality for bunkers. For aircraft bunkers, the reported value is based on total fuel sold and an estimation based on the domestic versus international Landing- and Take-off Operations (LTOs). The marine bunkers also include domestic freight which should have been reported and included as a part of the national totals. The national inventory team is aware of these problems and is working on revising these estimates accordingly.

15. The team noted a number of areas where data are not estimated or where there are some potential problems with estimation. Inventory experts explained that data on feedstock and storage of fossil carbon using the reference approach had been revised since the NC2. The new data now assumes that not all feedstock carbon is released into the atmosphere. N₂O from waste-water handling is reported as not estimated. Potential emissions of HFCs were not reported due to a lack of data. A few sources were reported as partly estimated (military, CH₄ from waste-water handling and waste incineration, PFCs from product use and SF₆ from metal production and other processes). CO₂ estimates were made by the reference approach, the sectoral approach and CORINAIR and all estimates are found to be compatible with the methodology for most years. However, for 1990, the reference approach gives an estimate 1 per cent lower than CORINAIR. The review team recommends that the reason for this discrepancy is clarified. At the same time, quality assurance and quality control (QA/QC) procedures are not systematically implemented and few resources are spent on verification (other than for using the IPCC reference methodology).

16. The NC2 included a qualitative assessment of the inventory uncertainties in terms of high, medium and low reliability, in line with the IPCC guidelines for indicating the quality of emissions data. CO₂ estimates of energy-related emissions are regarded as medium to high, while all estimates of CH₄ are considered low-medium and those of N₂O low. Italy is planning to do a quantitative assessment in the future to determine uncertainty intervals for all GHG emission estimates.

17. According to the updated inventory information presented, total GHG emissions based on IPCC 100 year-global warming potential increased by 2.9 per cent between 1990 and 1997. The revised inventory shows that in 1990 Italy emitted a total of 542 Mt of CO₂ equivalent, of which 443 million Mt were CO₂, 49 Mt were CH₄ and 50 Mt N₂O. On a gas-by-gas distribution, CO₂ accounted for 81 per cent, CH₄ 9 per cent and N₂O 10 per cent of the total in 1997. On an activity basis, 73 per cent of GHG emissions in 1997 came from production and 27 per cent from domestic consumption. Of the former, industry accounted for 36 per cent, services 10 per cent, transport 14 per cent and agriculture 13 per cent. Of the latter, the residential sector accounted for 18 per cent and transport 9 per cent.

A. Carbon dioxide

18. National net anthropogenic emissions of CO₂ in 1997 were 392,354 Gg (excluding the land-use change and forestry sector), an increase of 3 per cent over emissions in 1990. As seen in table 1, energy and transformation accounted for 34 per cent of total CO₂ emissions, followed by transport which accounted for 28 per cent. Transport emissions increased by 3 per cent from 1990 to 1997 whereas emissions from energy transformation decreased by 5 per cent, mainly due to a shift from oil and coal to natural gas. Emissions from industrial processes also decreased in the same period, mainly thanks to improved processing techniques in cement manufacture. CO₂ emissions from bunkers, estimated at 12,204 Gg in 1990 (aviation 3,737 Gg and marine 8,467 Gg), rose to 13,205 Gg in 1997, an increase of 8 per cent. Data on bunkers were reported as having a high degree of uncertainty.

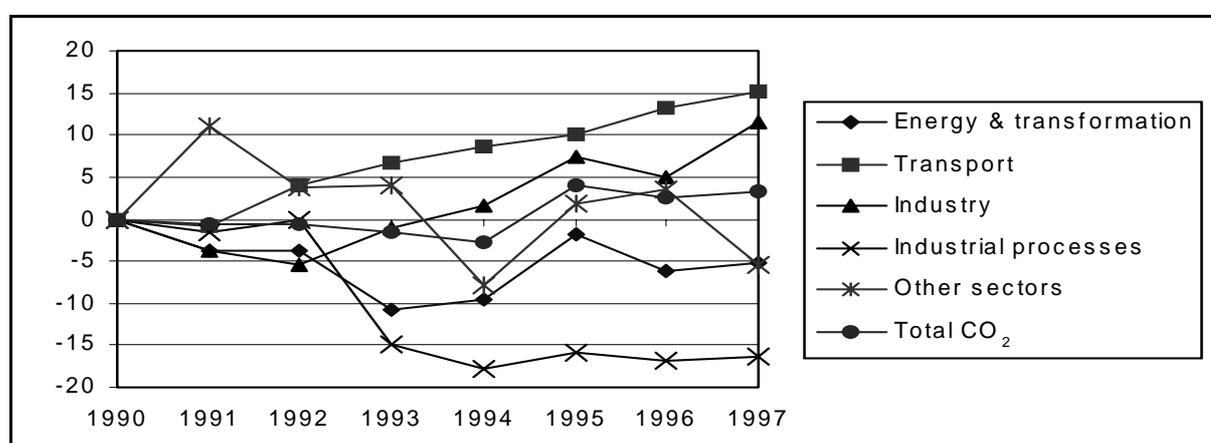
Table 1. Carbon dioxide emissions and removals by sector, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Energy & transformation	142 927	137 489	137 592	127 476	129 069	140 299	134 219	135 346
Transport	95 616	94 849	99 426	102 031	103 849	105 300	108 310	110 188
Industry	83 220	80 031	78 619	82 399	84 619	89 380	87 394	92 843
Industrial processes	27 532	27 106	27 502	23 451	22 618	23 169	22 877	23 052
Other sectors	75 553	83 867	78 459	78 500	69 661	76 878	78 280	71 372
Total	379 901	377 787	377 622	373 950	369 605	395 214	389 236	392 354
LUCF - emissions	10 539	10 969	11 890	11 938	14 282	14 826	12 734	12 763
LUCF - removals	- 25 614	- 25 854	- 25 084	- 23 370	- 23 494	- 23 225	- 24 287	- 23 633

19. Italy also provided data on annual emissions and removals from LUCF. The IPCC Revised 1996 Guidelines were used to estimate emission levels for the period. Estimates are based on an annual average increase of coppice (3 m³/ha/year) and high forest (7.8 m³/ha/year). Biomass densities are derived for Italian conditions. Data on forest area are taken from national statistics. The team was told that there are some data quality problems concerning the official statistics on forest area and growth. Removals for timber use and fuelwood may be underestimated. In spite of the improvement in estimates since the NC1, the uncertainties in estimates might be further reduced by improvement of the activity data and the adoption of emission factors based on local conditions. Italy has also estimated emissions from forest fires, abandonment of managed lands and biomass combustion and carbon reservoir in forest products.

20. The methodology for LUCF has been completely revised. The revision is based on more accurate data and research on LUCF at the regional level. Information on the LUCF sector was reported using the revised 1996 IPCC Guidelines. The removal of biomass from the forest for material and energy purposes was estimated from national statistics. Italy has also estimated its export of carbon in wood furniture and the storage in furniture, housing and landfills within the country, although this figure has not been included in inventory totals. The review team felt that this is a substantial improvement but that there may still be some potential for reducing the uncertainties in this sector. In 1990 removals were estimated at 25,614 Gg, while changes in forest contributed the bulk of emissions (22,000 Gg), and emissions from both forest and grassland conversion and biomass about 3,000 Gg. For 1997 removals were reduced to 23,633 Gg, while emissions rose to 12,763 Gg, with emissions from both forest and grassland conversion and biomass amounting to about 2,600 Gg.

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



B. Methane

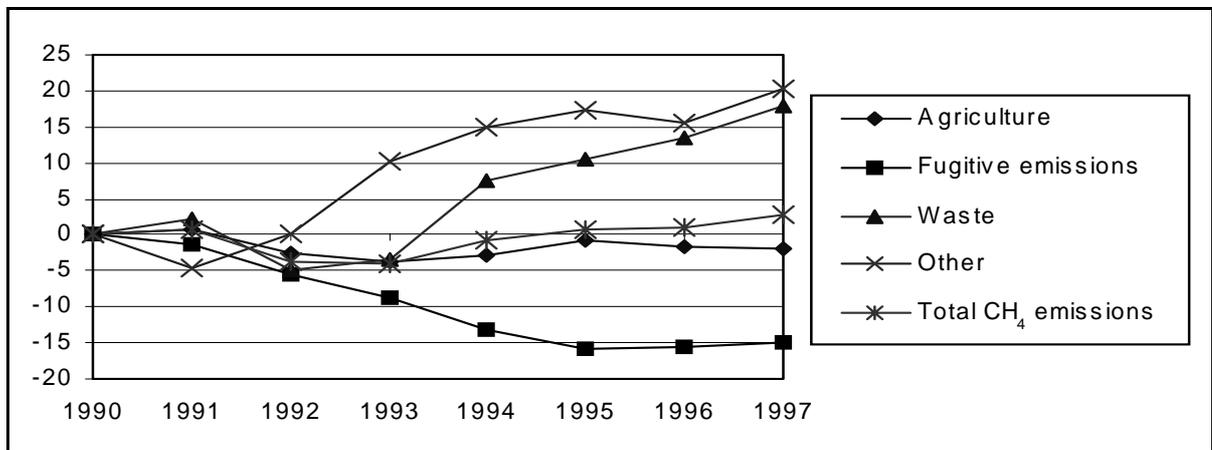
21. Total emissions of CH₄, as shown in table 2, were 1952 Gg in 1997, 3 per cent higher than in 1990. In 1997 agriculture was the main source of CH₄ emissions, accounting for 46 per cent of these emissions. The next largest contributor was the waste sector, which accounted for 35 per cent of the emissions, followed by fugitive fuel emissions (mainly from gas distribution), 15 per cent.

Table 2. Methane emissions by sector, 1990-1997 (Gg)

	1990	1991	1992	1993	1994	1995	1996	1997
Agriculture	910.2	916.5	886.0	877.0	883.7	903.2	895.5	892.8
Fugitive emissions	336.3	332.0	318.2	306.8	292.0	283.2	283.7	286.3
Waste	581.1	593.5	553.2	561.5	624.1	641.6	659.1	685.9
Other	72.4	69.0	72.6	79.7	83.2	85.0	83.7	87.0
Total	1 900.0	1 911.0	1 830.0	1 825.0	1 883.0	1 913.0	1 922.0	1 952.0

22. CH₄ emissions from landfills have increased since 1990. This can be explained by increased waste production as well as a scarcity of managed landfills with gas recovery equipment. Emissions from landfills are estimated using a kinetic model in agreement with the IPCC Guidelines, using national data as far as possible. CH₄ emissions from agriculture (enteric fermentation and manure management) are estimated using the IPCC tier II methods, but only partly using factors based on national conditions. Emissions from agriculture have decreased due to a reduction in the number of livestock between 1990 and 1997. The review team recommended that in future, estimates of CH₄ emissions from fugitive fuels be based on a methodology reflecting national conditions and that information be presented on changes in emissions over time in more detail.

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



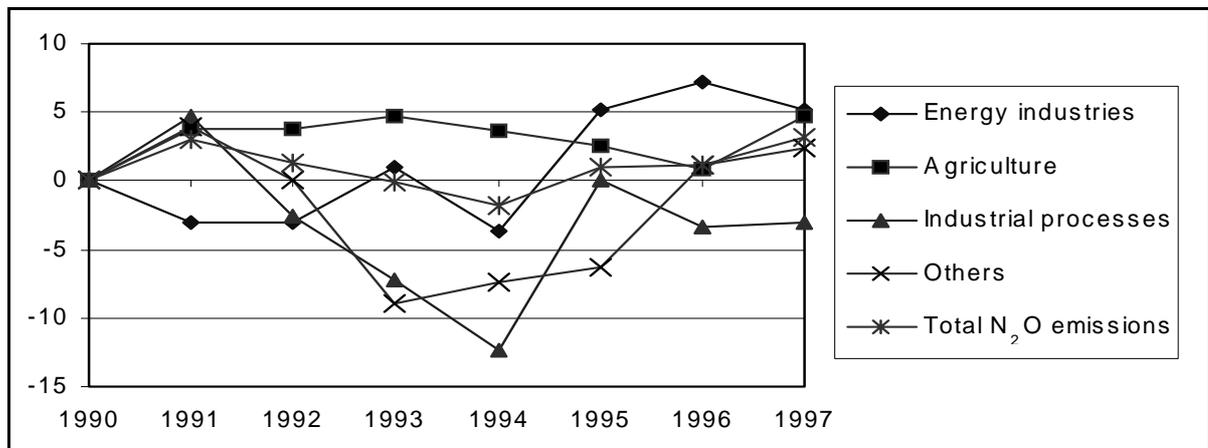
C. Nitrous oxide

23. Total emissions of N₂O, which were estimated at 151 Gg in 1997 (see table 3), rose by 3.4 per cent between 1990 and 1997. Most of this increase came from transport as a result of the widespread use of catalytic converters in passenger cars. These estimates were prepared using the COPERT model. Emissions from agriculture increased slightly owing to increases of N₂O in soils. It remained unclear after the review whether the estimates based on the IPCC methodology are complete with respect to indirect emissions. This should be clarified in future inventories.

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

	1990	1991	1992	1993	1994	1995	1996	1997
Energy industries	19.4	18.8	18.8	19.6	18.7	20.4	20.8	20.4
Agriculture	77.6	80.5	80.5	81.3	80.4	79.6	78.3	81.3
Industrial processes	23.5	24.6	22.9	21.8	20.6	23.5	22.7	22.8
Others	25.5	26.5	25.5	23.2	23.6	23.9	25.8	26.1
Total	146.0	150.4	147.8	145.9	143.3	147.4	147.6	150.6

Figure III. Nitrous oxide emissions, percentage change from 1990, by major source



D. The new gases

24. Actual emissions of HFCs, PFCs and SF₆ were reported in the NC2. Emissions of PFC mainly occur in aluminium production. These estimates are based on the Revised 1996 IPCC Guidelines, tier 1c, while the estimates of consumption of HFCs and SF₆ are based on a bottom-up method. Import and export data to estimate the potential emissions were not available in the NC2, but preliminary figures were provided during the review. Estimates of SF₆ were reported as incomplete, especially regarding emissions from magnesium production, due to lack of data. SF₆ emissions from other “insignificant” sources were also not reported.

25. HFC emissions were estimated at 0.030 Gg for 1990 and increased to 1.043 Gg in 1997. PFCs were estimated at 0.015 Gg in 1990 and 0.018 Gg in 1997 while SF₆ emissions almost doubled in 1997 to 0.017 Gg compared to 0.008 Gg in 1990. The review team recommended that the emission data for new gases be verified, so that estimates of HFCs and SF₆ could be presented in a more transparent manner. If measures are planned in industry for reducing emissions of the new gases, a methodology for PFCs that better reflects national conditions could be given priority.

III. POLICIES AND MEASURES

26. Policies and measures were in general well described in the NC2 for most sectors, in particular those relating to the energy and waste sectors. Most of Italy’s climate change policies focus on reducing the use of fossil fuels and the associated CO₂ emissions. Although policies may have the effect of reducing other GHG emissions in sectors such as agriculture and waste, they are not generally analysed in the context of climate change. Since the publication of the NC2, Italy has adopted several decisions and strengthened many existing policies related to climate change.

27. In 1994, the Inter-Ministerial Committee for Economic Planning approved and started implementing a national programme for containment of CO₂ emissions by the year 2000 to 1990

levels. Then in 1998, a Programme of measures to implement national policy for mitigation of climate change was formulated to support the 1994 programme, the aim being to extend its scope to 2010 and to include the six major GHGs, namely CO₂, CH₄, N₂O, HFCs, PFCs and SF₆.

28. This is part of Italy's action to lay a foundation for the Kyoto Protocol and reduce its national GHG emissions by 7 per cent between 2008 and 2012 compared to 1990 levels. It therefore coordinates a set of sectoral provisions already in place in the previous programme and adds new initiatives. At the time of the review, details of this new initiative were provided to the team and these are presented below in conjunction with the status of the 1994 programme. This programme contained measures which were already part of the 1988 national energy plan and did not include any additional measures with explicit CO₂ mitigation objectives. The 1998 plan outlined six 'national actions' to be implemented in order to achieve a substantial reduction in GHG emissions. These include: increased efficiency in electricity generation, reduction of fuel consumption in transport, reduction of energy use in industry, households and services, increased use of renewable energy, emission reduction in the non-energy sector and increased CO₂ absorption by forests. The overall investment to implement these six domestic actions is estimated at Lit 90-106 trillion by 2010.

29. In executing the 1998 plan, Italy will coordinate common actions in conjunction with other European Union (EU) member States. The intention is to identify and adopt "no regrets" or "low regrets" options, with sectoral strategies integrated into single EU programmes. Experts explained that the adoption of most programmes would be voluntary and accompanied by economic measures, instead of regulatory "command and control" type programmes. It includes a monitoring system which will periodically evaluate objectives and results in GHG abatement. If necessary, commitments under the programme may be increased in the long term by defining new sectoral objectives and further means of intervention.

30. At the time of the review, the plan was in parliament for its approval, after which each ministry will draw up measures and programmes for their implementation. For executing the programmes the Government has established a working group, which will have representation up to the level of local authorities and will monitor emission trends as well as the implementation of sectoral measures, and where necessary, provide annual budgets for any additional funds needed.

A. Energy sector

31. Energy-related CO₂ emissions in Italy amounted to 380 Mt in 1990 and the total anthropogenic emissions of the six GHGs have been estimated at 542 Mt CO₂ equivalent. Energy production, transport and distribution accounted for 33 per cent of all CO₂ emissions in 1990. Italy's energy sector is characterized by a high reliance on imports of oil and gas from countries such as Algeria, Libya and Norway. While the Government would like to increase the use of coal in power generation and coke for steel production and to reduce its dependence on foreign energy supplies, it claims that environmental considerations have posed some limitations to such a shift. As a result the Government is actively promoting the increased use of natural gas to take advantage of the major gas fields in North Africa and in response to tighter EU air quality standards. Italy's natural gas transmission and distribution infrastructure has been growing

significantly since 1995. At the same time domestic exploration and production of gas has increased and companies expect to increase natural gas imports and to diversify import sources substantially in the coming years.

32. Current energy policy is based in part on the national energy plan, which is implemented through specific legislation, in particular Law 9 on energy efficiency and renewables and Law 10 of 1991 on the supply of fossil fuels and fiscal rules governing the national energy market. The energy plan is constantly being reviewed and policies introduced in light of new developments nationally or at the EU level. The aim is to maintain intersectoral integration of policies and promote the market as the most suitable instrument for ensuring the efficient allocation of resources and setting standards for operators in all energy activities.

33. About 80 per cent of electric power in Italy is derived from thermal, mostly oil-fired, plants. The state company ENEL, which is currently undergoing privatization, still has a monopoly on the import of electricity and transmission, and it accounts for 80 per cent of total electricity production. Since the NC1, the most significant policy development in the power sector has been the creation of a competitive market for electricity and gas and the establishment of the Electric Power and Gas Authority to regulate energy services for public use, together with the privatization of previously state-owned firms and a revision of regulations in the waste sector. The Authority will create a competitive market through a system of tariffs based on predefined criteria for recovery of costs of operation and for optimal efficiency of the nation-wide distribution system. It will also promote demand-side management (DSM) investments for both electricity and gas. As part of the liberalization of the power sector, the Government approved plans in 1992 for ENEL to improve the efficiency of electricity production and, as new power plants are needed, investigate the possibility of low emission plants.

34. The Italian oil sector and refining industry is operated by the Ente Nazionale Idrocarburi (ENI), which has been partly owned by the Government (36 per cent) since partial privatization in 1998. It is an integrated energy company operating in the oil, natural gas and petrochemical sectors, and one of the largest companies operating in the world. It is second in Europe in domestic gas sales and fourth in refining capacity. ENI has exclusive rights for exploration and production of oil and gas in the Po Valley, the industrial centre and natural gas production centre for Italy, and in the adjacent coastal areas of the Adriatic. The ENI company, Agip, also had monopoly control of storage facilities. SNAM, a subsidiary of ENI, is the main natural gas importer and distributor, accounting for 90 per cent of national gas sales. While refining is a major source of CO₂ emissions, the company has come to an agreement under the oil sector programme with the Government to reduce GHG emissions. The agreement forms part of the voluntary agreements between Government and industries.

35. Another important milestone in the energy sector was the approval of a bill (No. 448 of 23 December 1998) by the Italian parliament in June 1999, to introduce a carbon tax in Italy. With this tax, it will achieve a reduction of 12 Mt CO₂ annually of GHG emissions by 2010 and collect Lit 7 billion of revenue. Experts explained that the tax will promote the substitution of current technologies by more efficient and environmentally favourable ones while at the same time reducing the amount of energy services demanded by consumers. The main effect of the

new tax has been to increase coal and high-sulphur heavy oil prices slightly above the price of fuel oil and natural gas in the industry and energy sectors, where most GHG emission reductions are expected to take place.

36. With respect to renewable energy, under the National Solar Programme of 1995 there were 0.2 million sq m of solar panels installed in Italy. To promote the growth of solar energy use, the Government intends to promote the installation of 3 million sq m of solar collectors by 2010, replacing an estimated 0.5 million tonnes of petroleum equivalent a year in primary energy and reducing annual CO₂ emissions by 1.5 Mt. The entire project is estimated to cost Lit 1,000 million.

37. By 2001, 750 MW of new hydroelectric capacity, 750 MW of wind power, 7 MW of solar energy, 1,200 MW of biomass and solid waste power and 300 MW of geothermal are expected to be installed. The Ministry of Industry and the Ministry for the Environment also intend installing more renewable capacity, including an additional 2,500 MW of wind power, 1,800 MW of biomass and municipal waste capacity, 800 MW of hydroelectricity and 300 MW of geothermal energy by 2005.

38. To promote market penetration of renewables, the Government ensured as planned a fixed quota of electricity production from renewables as a result of the establishment of a green energy market (Decreto Bersani 1999). Further actions in the field of renewables include simplifying administrative procedures for setting up small-size energy installations in order to ensure timely approval. There will be an improvement in the certification of products for exploitation of certain renewable sources and special financial packages for development of renewable energy applications. At the time of the review, details of this package were still being clarified. The Government is hoping that with these additional incentives the development of renewable energy sources could play a strategic role in mitigating climate change and in sustainable economic growth. An important development after the preparation of the NC2 was the approval of a White Paper by the CIPE in August 1999 for the valorization of renewable energy sources. This paper sets individual goals, strategies and projects to achieve a reduction of around 24 Mt CO₂ equivalent in GHG emissions, by using renewables.

B. Transport

39. Transport contributed 28 per cent to overall CO₂ emissions in 1997, after a marked increase of 15 per cent between 1990 and 1997. During the same period, energy consumption increased by 17 per cent. Road transport accounts for 90 per cent of total transport energy use, and most of the increase in emissions was attributed to a sharp rise in petrol consumption. Total passenger-kilometres increased by 18 per cent while tonne-kilometres increased by 14 per cent.

40. Around 74 per cent of passengers are transported by car, and 8 per cent by motorcycle. Conversely, public road transport in general declined from 2.4 per cent in 1990 to 2 per cent in 1997. There number of vehicles on the road is also on the rise. Car use increased by 2 per cent

between 1990 and 1997, the vehicle fleet by 13 per cent and per capita car travel by 20 per cent. In 1993, there were 32 million cars or 57 vehicles per 100 inhabitants overall.

41. In 1990, the average car sold in Italy released 165g CO₂/km while in 1995, the average car sold produced 170g CO₂/km. Between 1970 and 1995, Italy's total road traffic increased by 132 per cent. Similarly, total land-based freight traffic increased by 150 per cent between 1975 and 1995. The share of road transport in land transport is one of the highest in OECD countries. These figures indicate that Italy is experiencing a high increase in mobility accompanied by a clear shift towards road transport for both freight and passenger traffic.

42. The structure of the total vehicle fleet is characterized by a large proportion of small cars and diesel vehicles and a relatively high proportion of old vehicles. The intensity of the use of the road infrastructure is high and road capacity is already considered to be insufficient. The development of transport infrastructure has concentrated mostly on motorways and pipelines while the rail network has remained relatively unchanged, although there are plans to develop a high-speed rail network to connect major Italian cities with the existing European network.

43. In Italy, several ministries are vested with responsibilities for transport policy, each being in charge of different aspects such as vehicles, fuels, traffic and infrastructure. These include the Ministry of Industry and Crafts, the Ministry of Transport and the Merchant Marine, the Ministry of Public Works, the Ministry for the Environment and the Ministry of Urban Areas. Until 1993, these responsibilities were coordinated by the Inter-Ministerial Committee for Economic Planning in Transport, comprising representatives of the various ministries involved. It was then abolished and the main tool for transport policy has since been the General Transport Plan, which is revised every three years. It should be noted that regional authorities have to develop their regional transport plans in accordance with the objectives of the General Transport Plan and traffic management is the responsibility of each municipality.

44. The team was informed that some policies implemented to date have been successful in reducing emissions from transport of freight. Italy's transport policy has not been very successful in controlling passenger traffic and hence in reducing CO₂ emissions. Discussions are in progress with car manufacturers in Italy to produce more efficient cars. On average, cars in Italy have a consumption of 7.4 litres/100 km, compared to the EU average of 8.5 litres/100 km and 9.5 l/100 km in Germany. It should be noted that the EC is aiming, with the help of car manufacturers, to achieve a consumption of 5lt/km in 2010 for all cars in the European Union. In addition, the Italian Government is proposing regulations to periodically control vehicle efficiency and to encourage the use of biofuels such as ethanol in transport.

C. Industry

45. The industrial sector contributed 33 per cent of national income and accounted for 25 per cent of GHG emissions in 1997, namely 92,843 Gg of CO₂, 7 Gg of CH₄ and 7 Gg of N₂O. The NC2 outlines the range of measures in place and planned to reduce GHG emissions for high and low-medium energy-intensive industries, including information exchange to

promote energy saving practices, application of regulations and standards, voluntary agreements between the Government and industries and sectoral industrial associations. In addition, Italy being a member of the EC, its industries are also subject to restrictions related to EC air and water quality legislation, such as the large combustion plant directive to limit emissions of acidifying substances. Overall, the industrial sector in Italy reduced GHG emissions between 1990 and 1997, as a result of major reductions in energy intensity per unit production and fuel substitution, particularly in high energy-intensive industries such as steel, building materials, petrochemicals, chemicals, glass, ceramics and paper. Experts explained that a further increase in efficiency through technological changes is possible in some industries such as glass production, and action to this effect is planned. The paper and chemical industries plan to increase their efficiency through further cogeneration and combined heat and power plants (CHP). However, these additional efficiency gains would require considerable capital.

46. In the low-medium energy-intensive industries, energy consumption does not significantly affect production costs. The Government concluded agreements with these industries to promote the adoption of new, efficient electro-technologies such as microwave and infrared ovens, and thermocompression of vapour, with a payback period of less than three years. These technologies are expected to replace fuel-driven industrial processes. The Government is also considering regulatory measures to improve electrical motors and other equipment standards and demand side management for these industries. The NC2 listed several examples of innovative efficiency improvements in industrial processes such as cement, glass and lime production.

47. Regarding voluntary agreements with industry, officials explained that Italian industries are giving vigorous support to measures aimed at protecting the environment and participate actively in the formulation of national environmental policies. As early as the 1970s, the Emilia Romagna region signed voluntary agreements with industry for environmental reasons. More recently, the Government has signed agreements with many industries to reduce their GHG emissions. It is also encouraging industries to participate in the EC ecomanagement and environmental diagnosis system (Ecoaudit). Following a decree (No. 413 of 2 August 1995), the Government has set up the Ecoaudit system for Italy, with the appointment of a 12-member Ecolabel and Ecoaudit Committee. The Government also plans to extend the Ecoaudit scheme to provide all major industrial firms with a diagnosis of their GHG emissions and conduct feasibility studies on policy options for their mitigation.

48. A survey was conducted during 1997 to estimate the consumption of the new gases by industries and their forecasts for 2000. The survey showed that HFCs are important in the production of insulating foams, in refrigeration and in aerosol production for pharmaceutical use. Already industries using electrical equipment containing SF₆ recover and reuse this gas. In 1997, Law 179 came into effect, prohibiting the use of HFCs, PFCs and HCFCs in fire extinguishers as of 31 December 2008. At the same time, research is in progress on the security and health problems associated with HFC alternatives for refrigeration. The Ministry for the Environment is preparing guidelines for doctors who in turn can provide patients with alternatives to HFC as propellants in aerosols for medical use. These alternatives are already on the market.

49. In June 1997, the Government amended Law 549 of 28 December 1993 on measures to safeguard stratospheric ozone and the environment, establishing a deposit on durable goods containing the new gases, and obliging companies and the public to hand in used appliances and equipment to authorized centres for disposal. In 2000, this law is to be amended further to include HFCs, PFCs and SF₆. The Ministry for the Environment has also signed a protocol of intent with CISPEL-Federambiente to set up platforms for waste storage of the new gases and processing to recover recyclable and harmful materials contained in electrical equipment.

D. Agriculture

50. The NC1 presented several initiatives in the agricultural sector which, though not specifically targeted at reducing GHG emissions, do have this effect. Such initiatives include regulations on the use of fertilizers, livestock production and manure management. Experts from the Ministry of Agriculture explained that most of their agricultural policies are guided by the Common Agricultural Policy (CAP) of the EU. One notable measure was the introduction of incentives provided through Regulation 2078/92 of the EU for promoting organic agriculture, which have reduced not only energy consumption and hence CO₂ emissions but also releases of N₂O in agriculture.

51. With regard to the use of fertilizers, there was an increase in the use of chemical fertilizers in agriculture in the early 1990s from 59.9 kg/hectare in 1990 to 74.7 kg/hectare in 1993. After 1994, this trend was reversed with overall use of nitrogen fertilizers falling to 66.6 kg/hectare in 1997. Approximately 30 per cent of the Italian land area is utilized for farm crops, 9.4 per cent for woody crops (fruit trees, grape vines and olive trees) and 14.3 per cent for grazing while forests cover 29 per cent. Fertilizer is required for the arable land, which makes up 41 per cent of the territory, one of the highest percentages in Europe (average 36 per cent among the OECD countries). In an effort to reduce the use of fertilizers, the Italian Government harmonized the rate of value added tax on nitrogenous fertilizers with the rates currently applied in the rest of the EU, by raising it from 4 per cent to 10 per cent. To complement this measure, the Government drew up a 'Code of Good Agricultural Practice' for improving the use and optimizing the performance of fertilizers.

52. CH₄ production from livestock is influenced by two main factors. The first is the EU restraint on livestock population and the second is the nature and extent of dairy cattle production. While livestock numbers have been declining, the productivity of dairy cattle for meat and milk has increased considerably as a result of genetic improvement. As far as CH₄ emissions from digestion in ruminants are concerned, the Ministry of Agriculture in collaboration with research institutions is currently carrying out studies to assess the effects of factors such as the use of mixed forage, additives to silo feed, and mincing and pelleting forage, in decreasing the production of CH₄ during digestion. In an effort to further reduce CH₄ emissions from livestock, there are several projects in the pipeline for collecting and using livestock waste as biofuels and for biogas production at the local and regional government levels.

E. Land-use change and forestry

53. The area of forest, which constituted about 29 per cent of the total land area in 1997, has been increasing gradually over the past 10 years, mainly due to the conversion of arable land to forest. The potential to increase forest coverage is substantial in Italy, although this is not driven by specific climate change related policies in the sector. Experts explained that forest expansion has resulted from a reduction in the demand for agricultural products as well as an increase in the productivity of farmland. The latest forestry inventory, which was conducted in 1985, indicates that 66 per cent of forests are privately owned. The forestry industry is important for Italy with a turnover of about Lit 1,000.billion annually and a workforce of about 10,000 employees.

54. The National Forestry Plan is the most important guideline for forestry policy in Italy. This document, approved in 1987, outlines some important policies in the sector such as the development of wooded areas which have become degraded, and reforestation with broadleaved species to enhance CO₂ sequestration. In addition, Italy's forestry sector benefits from the reform of two regulations under the CAP concerning land use and carbon sequestration by biomass and organic matter in soils. An important measure under the reform is the provision of financial aid to EU members to enhance reforestation and improve forested areas. To this end, regional administrations in Italy have drawn up multi-year plans for improving existing forests and establishing new farm woodlands and improving forestry practices. With financial assistance from the EU, marginal areas such as pastures and meadows have also been converted to woodlands, by planting slow-growing broadleaved species such as walnut, cherry and maple. Some funds are also used to conduct campaigns to raise environmental awareness among foresters. Forestry experts noted that they are currently evaluating the effects of these policies on CO₂ emissions.

F. Waste

55. Of total CH₄ emissions, approximately 35 per cent came from waste in 1997. The NC2 contained a comprehensive description of waste policies, many of which have been implemented with the objective of reducing CH₄ emissions. Improved waste management measures were first introduced in Italy in 1982 through its Waste Law (Decree 915) and later in 1991, through Law 10, which introduced incentives for the conversion of waste to energy. Since then, the parliament has adopted a number of overall goals in the waste management field, the most important being legislative decree No. 22 of 1997. This concerns waste processing in general, and includes minimization of waste at both the production and consumption levels, maximization of waste recycling, and the disposal of non-recyclable waste. The decree also obliges regional administrations and operators to prepare sectoral plans to reduce, recover and optimize the waste stream. While most waste policies in Italy are in line with the EC programme on waste reduction, incineration and recycling, it should be noted that the latter is not legally binding for its member States. However, there is a voluntary EC ecomanagement system which requires that firms adopt environmental policies in order to join.

56. A number of new policy instruments were adopted by the parliament in 1997 to broaden producer responsibility for waste, simplify waste recovery procedures, and stabilize the annual waste production. A waste tax on municipal solid waste going to landfills was transformed into a tax on the production of waste in 1999. This tax is applied to packaging material and is expected to increase recovery of this type of waste from current levels of 50 per cent to 65 per cent in the next five years. This waste will be used for energy production.

57. Most of the CH₄ emissions from waste in 1997 (23 per cent) originated in landfills. This is not surprising, given that Italy still depends on landfills to dispose of 81 per cent of its waste. In 1996, a tax on landfill waste was introduced by the central Government. This tax, which is collected by regional governments who are directly responsible for waste plans, is used to fund programmes for waste recovery. The 1997 legislative decree also established targets for differentiated recycling: 15 per cent of total waste by 2000, 25 per cent by 2004 and 35 per cent by 2006. It also requires that all organic waste is processed in composting or stabilisation plants and, as of 1 January 2000, only materials of certain specifications may be discharged into landfills. As a result of agreements between the Ministry for the Environment and regional governments since 1982, requiring that all existing landfills have devices to capture and utilize CH₄ emissions, the percentage of captured CH₄ has been increasing. Funds from the three-year plan for environmental protection have also assisted regional governments to build plants with CH₄ recovery devices. Officials expect a 300,000 tonne reduction in CH₄ emissions annually as a result.

58. About 8 per cent of solid waste currently produced in Italy is used to produce energy, either by incineration or by recovery in landfills. The electricity generating capacity of the 20 incinerators in use is about 50 MW, producing 350 GWh of electricity annually. There are plans to increase the quantity of waste incinerated by 30 per cent in 2005, and this is expected to increase electricity generation by 500 MWh.

59. At the time of the review, discussions with local and regional administrators were in progress regarding the most efficient methods of conducting information campaigns and training managers and technicians in the application of current legislation. Officials recognized that these initiatives will entail a significant increase in costs for their timely implementation.

G. Regional and local initiatives

60. Action by regional and local authorities in Italy has an important role to play in ensuring the success of policies and measures outlined by the central Government. Although regional authorities have a limited role in decisions regarding energy planning, they have been officially decreed since 1991 to have total responsibility for energy management. Regional authorities are obliged to prepare energy budgets and draw up regional energy plans and waste strategies. All towns must also prepare a local plan for utilizing renewable energy. Officials explained that since 1991, the objectives of co-responsibility and coordination have been only partially achieved, given that plans differ from region to region and that the scarce technical and administrative capabilities of some regions put these at a disadvantage.

61. Already, fifteen town councils have prepared local council energy plans. These include Turin, Rivoli, Moncalieri, Milan, Sesto San Giovanni, Padua, Rovigo, Bologna, Florence, Livorno, Grosseto, Rome, Caserta, Potenza and Palermo. Many of these are members of the International Council for Local Environment Initiatives, which encourages its members to reduce CO₂ emissions by 20 per cent by 2005 compared to 1990 levels.

IV. PROJECTIONS AND ESTIMATES OF THE EFFECTS OF MEASURES

62. The NC2 includes projections of GHG emissions for CO₂, CH₄ and N₂O, for both energy and non-energy sources for the years 2000, 2005 and 2010. Projections for PFCs, HFCs and SF₆ were included, but were based on less sophisticated projection techniques. A baseline scenario and three reduction scenarios were presented. The NC2 also provided a comprehensive set of figures on underlying assumptions, including GDP growth rates, fuel prices, social and economic indicators. The starting points for the projections were the 1990 emission levels estimated in the national GHG inventory. During the review, the team received additional information on modelling procedures and detailed insights into scenario definition. In general, the review team felt that the projections presented in the NC2 had improved in coverage and quality compared to the NC1 and the supporting information provided a better understanding of Italy's projection methods.

63. The projections contained in the NC2 were prepared by ENEA, as Italy does not have official projections, forecasting tools or institutions. However, many government agencies provide technical support to the projection exercise. Projections are updated periodically as circumstances change or new information becomes available. ENEA produces projections for CO₂ emissions from energy production and consumption. In the baseline scenario, projections are based on policies which are either already implemented or fully committed to. No prospective measures are included.

64. The projections of CO₂ emissions were made using a Market Allocation (MARKAL) model, while projections of CH₄, N₂O and the new gases were based on a combination of expert knowledge and extrapolation, based on current trends using electronic spreadsheets. This MARKAL model was developed 20 years ago by the International Energy Agency and used by member countries to project developments in the energy sector. It was chosen for this exercise since it provides an easy way of calculating the costs associated with technology choices for certain mitigation options over the long term. To support the work of the MARKAL model, deterministic simulation models are used for preparing bottom-up projections for specific sectors. A separate bottom-up industry model is used by ENEA together with the Ministry of Industry to estimate energy consumption and emissions growth for the various sub-sectors. ENEL prepares projections of electricity consumption and sectoral emissions in a similar manner. Separate forecasts are done for the growth in transport emissions and the results from all sectors are subsequently checked with output from the MARKAL model. Both the MARKAL model and the engineering simulation models are driven by detailed activity growth data (demand for materials, products, mobility and energy services) derived by standard macroeconomic top-down models.

65. The CO₂ projections were prepared in two stages. First, MARKAL was used to analyse energy technologies and systems. The bottom-up model incorporates data for different technologies and chooses among them based on cost-minimization parameters. The scenarios produced from this exercise were subsequently fed into an econometric top-down model for determining the effects on some important economic and energy indicators. Those updated indicators were checked with several economic models, the discrepancies analysed and, if there were major shortcomings, the process was started again. An emissions module was also incorporated into the MARKAL modelling procedures for calculating the GHG emissions associated with the technological options involved in each of the projection scenarios.

66. The assumptions and basis for the projections were clarified considerably during the review. Projections presented in the NC2 included baseline estimates of GHG emissions growth for each sector, including measures financed or approved. Three other scenarios of future emissions were developed by changing key input parameters and taking into account the impacts of further GHG mitigation measures. The first, scenario A, shows the effect of policies and measures very likely to be implemented, that is, the least-cost options. The next, scenario B, presents further measures in order to achieve Italy's target under the EU burden-sharing arrangements. The most ambitious, scenario C, assumes that all further measures are implemented. These are measures that are either less cost-effective or difficult to implement from an EC perspective. The baseline projections were presented at the level of IPCC summary tables, while the reduction scenarios were provided in an aggregated manner. The assumptions in the projections are consistent with the common and coordinated policies and measures within the EU. Base data for the engineering simulation models and the MARKAL model were provided from ENEA database, while data on energy conversion industries came from national statistics. The ongoing work on monitoring the impact of approved policies and measures on emissions is performed using the Enerdata database and the OECD/IEA paper "Indicators of energy use and efficiency", 1997, was used as a guide to prepare a minimum set of energy use indicators from which information on the effects of policies and measures can be quantified. Official government publications such as the three-year government plan and population statistics from the Central Statistical Office were also used in this exercise.

67. The key assumptions used in estimating GHG emissions growth are well documented in the NC2. Macroeconomic assumptions include very little growth in population and a substantial increase in disposable income, from Liras 1,093 billion in 1995 to Liras 1,471 billion in 2010. Assumptions in the energy sector include a GDP growth of 2 per cent annually between 2000 and 2010; oil prices rises of 1.2 per cent annually and a gradual increase in energy efficiency levels. It is assumed that energy demand will not grow at the same rate as in the past, even in the presence of stable nominal prices and increased disposal income. The main assumptions for economic development were given, but these data are not necessarily consistent as they are derived from different sources. Electricity prices are assumed to remain unchanged over the projection period.

68. In the NC1 an increase of 14 per cent in CO₂ emissions was projected from 1990 to 2000. In the NC2 this figure was revised to 3.8 per cent. Experts explained that this decrease is due to the fact that growth in the energy sector was much slower than expected because of the economic

recession and the shift from oil and coal to natural gas as an energy source. The projected growth in emissions of the three main GHGs is 2.6 per cent for 2000.

69. CH₄ emissions from the energy sector to 2010 have been projected by applying the joint EMEP-CORINAIR approach, using estimated consumption figures and leakage coefficients from the international literature and applying these to the Italian gas network. As all cast-iron pipes are to be replaced by 2010, a reduction of 180,000 tonnes in CH₄ emissions is expected annually.

70. Projections of non-energy emissions of CH₄ and N₂O are based on expert analysis of trends, activity data and assumptions about the effects of measures. The projections base year data were consistent with the 1990 inventory but the level of uncertainty associated with these figures was reported as being greater than for the energy sector. Both CH₄ and N₂O emissions from agriculture are expected to decline due to declining animal numbers and increased productivity. CH₄ emissions from waste are also predicted to fall substantially, following the implementation of the revised waste management policy.

71. Emissions of the new gases, not shown in table 4, are expected to be very low, especially PFCs, given that primary aluminium fusion plants were refurbished in 1992 and PFC emissions have since been declining due to recovery and recycling of the gas. According to the aluminium producers' estimate, baseline PFC emissions will fall from levels of 0.0118 Gg in 1995 to 0.0092 Gg by 2010 as a result of Law 22/97. With further intervention, officials believe that these emissions can be reduced further to 0.0066 Gg in 2010. For HFCs, total emissions in 2000 have been projected to be 0.2 Gg, and to be 0.24 Gg and 0.27 Gg in 2005 and 2010 respectively. Future estimates of SF₆ are associated with the installation and filling of this gas into equipment and some leakage from existing installations. A leakage rate of 0.5-1 per cent has been assumed, resulting in total SF₆ emissions of 0.0127 Gg in 2000, 0.0147 Gg in 2005 and 0.0166 Gg by 2010.

72. In the baseline scenario, emissions of two major GHGs are forecast to grow by 2010 over 1990 levels, the exception being N₂O. CO₂ emissions are expected to be 15.2 per cent above 1990 levels by 2010, and CH₄ emissions 7.3 per cent, whereas N₂O emissions are expected to drop by 1.5 per cent. Total GHG emissions in 2010 are estimated at 618 Mt of CO₂ equivalent. An increase in emissions of 12.8 per cent for all three gases is projected between 1990 and 2010 in the baseline scenario. In the other scenarios, the projections of the three GHGs show decreases of 1.3 per cent for scenario A, 7.1 per cent for scenario B and 12.5 per cent for scenario C. These may be compared with the target of a 7 per cent reduction in Italy.

73. Actions to modernize the Italian economy and their effect on GHG emissions which were taken into account in preparing the projections for scenario A, include policies to increase the efficiency in energy transformation and in the industry sector; an increase in the use of renewables, biomass and waste for energy production; adoption of measures to control urban traffic; replacement of about 50 per cent of the present car fleet with more efficient cars; deployment of rapid transit networks for mass transportation in the metropolitan areas and improving the inter-city railway system; expanding freight transport by rail; promoting the use of natural gas in industry, and in the residential and tertiary sectors; and electricity demand-side

management. It was estimated that with the implementation of these policies a reduction of 77 Mt of CO₂ equivalent could be achieved or an overall emissions reduction of 1.3 per cent by 2005. The investment required to implement these actions is estimated at Lit 71,000 billion between 2000 and 2005.

74. While other sectors stabilized or reduced their direct GHG emissions between 1990 and 1997 and are expected to continue this trend, most of the increase in future total emissions is expected to come from the transport sector. It is important to point out that transport projections provided by the Ministry of Transport for the year 2010 are based on three scenarios: low GDP growth, with a growth in mobility demand of 1-2 per cent; high GDP growth, with a mobility demand increasing by 2-4 per cent; and a transfer of freight and passenger demand from road to rail and sea, which is expected to reduce energy consumption by 10 per cent in 2010.

Table 4. GHG emission projections, 1990-2010 (Mt CO₂ equivalent)

	CO ₂	CH ₄	N ₂ O	Total
1990	442.5	52.0	53.9	548.3
2010 Baseline	510.0	56.0	53.0	618.0
Difference compared to 1990	+15.2	+7.3	-1.5	+12.8
2010 (scenario A)	453.0	39.0	49.0	541.0
Difference compared to 1990	+2.5	-24.8	-9.8	-1.3
2010 (scenario B)	425.0	35.0	49.0	509.0
Difference compared to 1990	-3.9	-31.7	-9.8	-7.1
2010 (scenario C)	397.0	35.0	49.0	480.0
Difference compared to 1990	-10.4	-33.7	-9.8	-12.5

75. The six national actions outlined in the 1997 national plan to achieve the CO₂ emission reduction goal combine the policies and measures foreseen in scenarios A and B and are expected to have the following reduction potential between 2008 and 2012 in terms of CO₂ equivalent: increased efficiency of electricity generation 20-23 Mt; reduced energy consumption in the transport sector 18-21 Mt; energy production from renewables 18-20 Mt; reduced energy consumption in industry, households and services 24-29 Mt; emission reductions in the non-energy sector 15-19 Mt; and increased CO₂ absorption by forests 0.7 Mt.

76. After extensive discussions with the projections team, it was generally concluded that the GHG projections are based on the best available data and sound forecasting methods, to the extent that they currently exist. The projections team mentioned that the combined effect of measures included in the 1997 national plan to address climate change, which was adopted by the Government in November 1998, and of the carbon tax introduced in 1999 are still being quantified. While the review team felt that the forecasting of GHG emissions has improved substantially since the NC1, it would recommend that Italy considers complementing its current work by applying a general equilibrium model for CO₂ in order to better assess the effects of policies and measures on the economy and in order to incorporate economic incentives and the effects of the newly introduced carbon tax.

V. VULNERABILITY ASSESSMENT AND ADAPTATION

77. The NC2 generally followed the UNFCCC reporting guidelines. It covered various aspects of Italy's vulnerability to climate change in addition to climate conditions since 1870 and the different scenarios in regional climate trends in the next century, using general atmospheric and ocean circulation models. The impacts of climate change were also presented for specific regions and conditions such as the upper Adriatic coast, the process of environmental degradation and hydrological balance in Italian agriculture, forestry and protected areas, glaciers, marine biodiversity and human health. The report also listed specific areas of risk in the event of climate change for several ecosystems including: (i) the mountain ecosystem, (ii) the Mediterranean ecosystem, mainly in southern Italy, (iii) the coastal ecosystem and marine biodiversity, (iv) the agricultural and freshwater resources and (v) human health. Specific studies were devoted to coastal zones, desertification, the Po delta and the Venice lagoon, agriculture and health and an economic assessment for each area.

78. Scientists also provided the review team with detailed information on climate evolution and an impact assessment in Italy based on scenarios of the IPCC, the IPCC special report on Europe entitled "Regional Impacts of Climate Change" and research work carried out within the EU framework. The results and findings of specific and regional studies and risk analysis for impacts were also presented.

79. Some possible effects cited were salt water intrusion in coastal zones, loss of coastal areas and an increase in erosion especially in coastal zones. Researchers explained that there are still great uncertainties associated with the balance between the increase of precipitation in high latitudes and ice melting in polar zones and between thermal expansion and ice melting at any latitude (glaciers). In order to address these potential risks, adaptation initiatives taken or planned include the Institutional Framework For Land Protection and Intervention, Land Protection and the Situation of Upper Adriatic Area such as analysis of marine incursion risk on the upper Adriatic coast and intervention for Po Delta and Venice Lagoon. A national plan for coastal zone management is expected to be initiated in 2000, to control coastal erosion in the upper Adriatic Sea.

80. Scientists involved in vulnerability studies explained that the utilization of modelling and risk assessment taking national, regional and international considerations into account presented some limitations and that the high level of uncertainty associated with the results may require further research. They also stressed the need for more specific studies on coastal areas in Italy and the timely allocation of funds for possible preventive measures.

VI. RESEARCH AND SYSTEMATIC OBSERVATION

81. The NC2 described the areas in which the Italian Government is engaged in climate-related research at national and regional level through the EU. The NC2 contains information on monitoring and systematic observation, digital climate simulation, impact studies, desertification, palaeoclimate, international programmes and a proposal for a national research plan on climate change.

82. Monitoring and systematic observation data include a climatological time-series stretching back to 1700. Two stations have been installed for monitoring GHG emissions as part of the World Meteorological Organization (WMO) programme for the World Data Center for GHGs. Italy is also conducting studies using the global simulation activity models and oceanic circulation models for oceanic simulation and for basic studies on equatorial ocean patterns. Of particular importance is the Mediterranean oceanic circulation model developed in Italy for measuring the inter-annual variability of climate in the Mediterranean. Models have been developed for the Adriatic Sea and other areas in Italy. Work is also in progress on stratospheric simulations and climate data reproducibility and climate fluctuation statistics.

83. Italy is also actively involved in palaeoclimate studies and participates in international programmes in Greenland and Antarctica, for example, to study past climate change by means of ice cores; national and regional programmes to study Mediterranean sediment cores and the impacts of climate change in the past; and geological and stratospheric studies on coastal and continental areas. Under its international programmes, Italian experts participate in impact research funded by the EU or other international organizations. Italy is participating in about 100 EU programmes and is involved in experimental research on the gradual depletion of stratospheric ozone, through the Airborne Polar Experiment.

84. As mentioned above, most of the research carried out in Italy on climate change and related activities is part of international, regional and/or EU funded and programmed research. This is clear from the data on research funding provided during the review meeting, which revealed that the EU allocates approximately US\$ 3.5 million to Italy for climate change related research annually while Italy's own contribution is less than US\$ 100,000 annually.

85. Legislation to establish a national research programme on climate change was introduced at the end of 1999. The aims of the proposed programme are to strengthen Italy's role and to undertake targeted structural intervention in coordinating all climate change research activities in the country. The size of the budget for this programme is still under consideration.

VII. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

86. The NC2 provided a detailed and comprehensive description of the action taken by Italy in providing financial assistance and facilitating technology transfer related to climate change, through both multilateral and bilateral channels. The NC2 provided information on these contributions using the tables recommended by the UNFCCC guidelines. During the review, the Italian experts also provided a great deal of additional data about financial assistance. In 1994 and 1995, Italy allocated 0.27 and 0.14 per cent of GDP respectively to official development assistance, both bilateral and multilateral. Bilateral aid totalled US\$ 1,834.4 million and US\$ 805.7 million respectively. Most of the reduction was in funds allocated to technology transfer projects. According to data from the Development Assistance Committee of the OECD (DAC), Italy allocated US\$ 21 million in 1995 to bilateral environmental programmes and projects.

87. In 1992, Italy established a fund for bilateral aid to central and eastern European countries and the Community of Independent States. In 1996, a series of programmes was initiated amounting to US\$ 10.3 million to safeguard and rehabilitate environmentally damaged areas, including countries such as Bulgaria and Slovenia. Vocational and technical training is also conducted under these programmes.

88. In 1996, over US\$ 25.8 million was provided to the Global Environment Facility as a first instalment of Italy's contribution to this institution. In 1995, US\$ 816 million was contributed to multilateral organizations such as the European Union, the World Bank and the European Bank for Reconstruction and Development, for projects aimed at achieving the objectives of the UNFCCC.

89. Many Italian industries are also involved in technology transfer with positive environmental benefits. This has been made possible by the Institute for Foreign Commerce, which organizes several activities in developing countries interested in joint ventures with Italian partners. Mitigation measures have, inter alia, encompassed energy, agriculture and forestry, waste management in the Middle East, transport, and adaptation projects in climate change such as coastal pollution control systems in Brazil, hydrogeological and hydrological improvement in Turkey, and cooperation in water research and coastal management in Luanda, in addition to conducting many meetings, seminars and workshops on climate change and the environment in general.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

90. Italy's public information and training programme, as outlined in the NC2, was designed keeping in mind the requirements of Agenda 21, which intends to provide correct and balanced information and training in this field. Organizations playing a pivotal role in this process are: local authorities, ecological associations, national institutions such as the ministries of the environment and education, public associations and schools etc. The main objectives of this programme are: (i) dissemination of the most up-to-date information, (ii) teacher training, (iii) experimental initiatives, publications and other information materials and (iv) training up to the postgraduate level. The NC2 emphasized the need to develop an integrated training system in order to ensure better use of resources and coordination of strategies.

91. The report identified various difficulties encountered in its educational and training programmes for climate change, including 'addition and development of relevant topics for various categories of the public. The report also identified six contributing sectors for the dissemination of education: (i) the central government administration, especially the Ministry for the Environment, (ii) national research organizations, (iii) local, mainly municipal, authorities, (iv) non-governmental environmental associations, (v) the mass media and (vi) all types and levels of schools. Approval of the national programme on climate change on 30 April 1999, with the primary goal of developing programmes and promoting information through the public and private sectors, is an important step towards public participation in addressing climate change issues. However, the actual budget allocated to conduct these programmes and monitor their impacts is not specified in the NC2.

92. The review team felt that public participation in decision-making to achieve GHG reduction goals is at a very high level. However, it could be further strengthened by promoting concerted efforts to coordinate the various ongoing public awareness activities of different sectors in order to make these initiatives more effective. This may be achieved by encouraging cooperation and negotiations among various players in this field, namely, relevant ministries, school authorities, research institutes, local authorities, and professional and environmental associations, and by making greater use of the mass media.

IX. CONCLUSIONS

93. An assessment in 1997 of the 1994 national programme for containment of CO₂ emissions to 1990 levels by the year 2000, led the Government of Italy to conclude that its current action under that programme needs to be strengthened if it is to meet its aim under the Convention, and that enhanced and broader-based national responses are imperative to achieve its GHG reduction commitment under the Kyoto Protocol. To this end, a national plan was adopted by the Government in November 1998, containing a comprehensive package of measures for addressing all sectors and sinks.

94. The plan constitutes a step beyond the former “no regrets” approach by introducing regulatory measures, fiscal incentives and market-oriented action. Several policies were formulated by the Government in 1999 and early 2000 and should be implemented with the cooperation of all central and local administrative bodies. Among these policies was the introduction of a carbon tax, which will be enforced gradually over a five-year period and will be increased differentially according to the sector and the fuel, increased energy efficiency and diversification of energy sources. The Government hopes that, with a stable population of 57 million and a low birth rate, added to the fact that industry is relatively efficient, it may be possible to meet the country’s GHG reduction targets. This has prompted the Government to adopt new and stronger policy measures, which are expected to create favourable conditions for growth in the economy, which in turn can lead to the generation of more GHG emissions. A variety of factors may further hamper the task of mitigating GHG emissions, including tight fiscal measures, current levels of inflation, budget deficits, an unemployment rate of 12 per cent and the need to strengthen cooperation among government institutions at all levels and secure greater involvement of the private sector.

95. While it was difficult for the team to gauge the progress made in implementing the GHG reduction measures to date, due to the absence of a national system to monitor and report on the progress of initiatives in place (except in the energy sector, where there is rigorous analysis on an annual basis), the 1998 plan may address this deficiency in the near future. The plan includes the establishment of systems at the national, local and regional levels to review the accomplishments of programmes, so that adjustments can be made to improve their effects on reducing GHG emissions. Plans are also under way to improve the current system of data collection and activity data for certain sectors, and refine national emission factors.

96. Between 1990 and 1997, most sectors stabilized or reduced their GHG emissions. However, there was a considerable increase in CO₂ emissions from transport, industries and

waste. With some measures already in place, total GHG emissions are projected to increase by 13 per cent between 1990 and 2010. CO₂ emissions are expected to increase by 15 per cent and CH₄ emissions by 7 per cent while N₂O emissions should decrease by 2 per cent. The Italian Government in 1998 set a total GHG emission reduction path relative to its business-as-usual scenario. Within this context, reductions relative to 1990 in CO₂ equivalent are expected to be 20-25 Mt by 2002, 45-55 Mt by 2006 and 5-12 Mt by 2008-2012. Average CO₂ emissions are expected to be 3-5 per cent lower in the 2008-2012 period compared to 1990. Details of how this will be accomplished were unclear after the review, although national experts believe that most of the reduction will be accomplished through efficiency gains and fuel switching. Similarly, the team believes that measures outlined for GHG reduction in the transport sector may have to be strengthened to achieve expected emission reductions.

97. The team commends the research on GHGs that is being conducted by Italy in the Mediterranean region. While opinion polls show that public awareness and concern for the protection of the local, national and international environment remain consistently above the EC average, the review team believes that a concerted effort will be required to change consumer behaviour, especially to reverse emission trends in transport.
