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

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Under Articles 4 and 12 of the Convention, Parties are required to prepare national communications on their implementation of the Convention. Guidelines for the preparation of national communications and the process for their review were agreed on by the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change, by its decisions 9/2 and 10/1, and by the Conference of the Parties, at its first session, by its decisions 2/CP.1 and 3/CP.1 (see FCCC/CP/1995/7/Add.1). In accordance with these decisions, a compilation and synthesis of the first 15 national communications from Annex I Parties was prepared (A/AC.237/81).

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

Summary¹

1. The in-depth review was carried out between June and October 1995 and included a country visit by the team from 26 to 30 June 1995. The team included experts from Egypt, Slovakia, the United Kingdom of Great Britain and Northern Ireland and the International Energy Agency.
2. Australia is in many respects unique; it is a continent in the southern hemisphere with a very low population density and with various ecosystems quite different from those of other Annex I Parties. It has a young dynamic economy in which exports, particularly of primary and energy goods, play a major role. There has recently been a clear trend towards integration in the world economy through an increase in trade in manufactured products and enhanced economic cooperation with the Asia and Pacific region.
3. The team recognizes the complexity of Australia's system of government where the federal Government has limited constitutional powers to implement measures, and where progress depends on establishing partnerships with state and local governments. In the light of this fact, it is relevant to note the institutional structure established under the leadership of the Council of Australian Governments to implement commitments under the Convention. Australia, as the world's largest coal exporter and with 80 per cent of electricity generated with coal, realizes that energy-related mitigation measures could impact on the national economy and its trade balance. The team noted the broad range and quality of a number of climate-related research activities being carried out in the country. Equally important has been research in the pure and applied sciences on climate change issues, including expected impacts of and adaptation to climate change. This clearly indicates that Australia is in a position to make important scientific and research contributions to the efforts of other Parties to the Convention. In a way, the first national communication does not reflect the thoroughness of efforts being carried out in Australia. This fact, however, was overcome during the review, when substantial additional information was made available.
4. The country has developed its own greenhouse gas (GHG) inventory methodology based on the Intergovernmental Panel on Climate Change (IPCC) default methods and emission factors. In preparing it, a bottom-up approach was adopted, and in many areas emission factors were developed to reflect specific Australian conditions, often based on actual field measurements. Six working groups were created and have produced very detailed inventory work which could be an important contribution to the IPCC process and to other Parties with similar conditions located in the southern hemisphere.

¹ In accordance with decision 2/CP.1 (see FCCC/CP/1995/7/Add.1), the full draft of this report was communicated to the Australian Government, which had no further comments.

5. In developing its response strategy, Australia is applying a dynamic and phased process, focusing up to now on no-regrets measures. Concerning the major sources of carbon dioxide (CO₂) emissions, Australia has decided to direct measures in particular towards fuel combustion and fugitive fuel emissions, which account for roughly 70 per cent of national CO₂ emissions. Key elements in the strategy to mitigate these emissions include the structural reform of the electricity sector, the removal of barriers to interstate trade and use of gas, the promotion of co-generation, the stimulation of fuel switching, and increased use of renewables and natural gas. In end-use sectors, key measures relate to the continuing improvement of energy efficiency, including voluntary agreements with industries, appliance labelling and the setting of minimal energy standards.

6. In the land use and forestry sectors, which account for 30 per cent of current CO₂ emissions, measures focus on sustainable land management (grassland conversion and managed forests), monitoring and control of land clearing and enhancing CO₂ uptake, in particular through the One Billion Trees Programme.

7. The "without measures" scenario indicates a 14 per cent increase in 1990 GHG emissions by 2000. If, however, the current rate of implementation of measures introduced in the National Greenhouse Response Strategy (NGRS) is sustained, an increase of 7 per cent in 1990 emission levels is projected for 2000. Subsequent to submission of the national communication in 1994, the federal ("Commonwealth") Government announced in March 1995 the Greenhouse 21C programme, containing a range of new mitigation and sink enhancement measures. It is estimated that, if fully implemented, the programme would further reduce the increase in GHG emissions by 2000 to 3 per cent above 1990 levels. At the time of the review visit, these additional measures were still at the planning stage.

8. In preparing the projections of GHG emissions for 2000 a bottom-up approach was also used, with sectoral projections generated from a detailed analysis of individual sectors based in general on scenarios of low rates of implementation. For most sectoral projections, sensitivity analysis to key assumptions, such as world prices of energy and export goods and the recurrence of drought, was carried out, and uncertainty levels were clearly described. The team felt that the thoroughness and consistency in building up emission projections from sectoral analyses to an aggregate level for the year 2000 could be very useful as a reference for other Parties. The team noted the progress made in the One Billion Trees Programme, as well as the fact that the programme is expected to bring about 45 per cent of total CO₂ reductions under the NGRS. Other measures in the NGRS expected to result in significant reductions include the introduction of natural gas in energy production, promotion of co-generation, improved land management and the waste minimization strategy. The ongoing structural reform of the electricity sector is also expected to generate emission reductions as compared with the "without measures" scenario, although its specific effects have not been quantified. Under the Greenhouse 21C programme, most of the reductions (some 70 per cent) are expected to come from the introduction of cooperative agreements with industry. These agreements aim at improving energy efficiency and assessing

opportunities for emission abatement in industrial sectors. Greenhouse 21C also aims at expanding support for the gas market reform and existing sink enhancement programmes.

9. The team noted that Australia's ratio of official development assistance (ODA) to gross national product (GNP) has decreased to 0.33 per cent in 1995, although in absolute terms the total level of ODA for 1994/1995 has increased to roughly US\$1,069 million.² The Government has stated its commitment to increase this ratio in the medium term to 0.40 per cent, and its intention to reach the 0.70 per cent level in the longer term. Australia has made contributions to the financial mechanism under the Convention and has provided significant additional support to developing countries through multilateral, bilateral and regional programmes, mainly in the Asia and Pacific region. These programmes include technology development and encourage environmentally sound private sector development through creative incentive schemes.

I. INTRODUCTION AND NATIONAL CIRCUMSTANCES

10. Australia ratified the Convention on 30 December 1992. The secretariat received Australia's first national communication on 19 September 1994. The in-depth review of the national communication was carried out during the period June to October 1995, including a country visit from 26 to 30 June 1995 to Canberra. The review team consisted of Mr. Ibrahim Abdel Gelil (Egypt), Mr. Ivan Mojik (Slovakia), Mr. John Moss (United Kingdom), Ms. Ria Kemper (International Energy Agency), Mr. Aniket Ghai (UNFCCC secretariat) and Mr. Lucas Assunção (UNFCCC secretariat, Coordinator). In the course of the visit, the team met representatives of several federal (Commonwealth) departments as well as of state governments, members of the scientific and academic community and several representatives of non-governmental organizations.

11. A number of historical and geographical factors are important when considering Australia's climate change response. Australia is a very large country composed of eight self-governing states and territories [Victoria, New South Wales, Queensland, Western Australia, South Australia, Tasmania, the Capital Territory and the Northern Territory], with correspondingly large distances between urban centres and a very low population density of 2.5 inhabitants per square kilometre. In comparison with most member countries of the Organisation for Economic Co-operation and Development (OECD), it has a young economy with the majority of its trade partners outside the OECD and with industrial development having taken place only since the end of the Second World War. As a result, land clearing, for example, has not yet reached the level of other OECD countries.

² Henceforth, the June 1995 exchange rate of \$A1.39 to US\$1 will be used.

12. Certain structural features of Australia's economy are also pertinent. The country's comparative advantage in fossil fuel and other minerals is reflected in its trade patterns. It is the world's largest coal exporter, the third largest energy exporter among OECD countries and is also heavily dependent on the export of energy-intensive processed primary products, although there has been a recent trend to increase trade in value-added manufactured products. In this regard, the team took special note of the prevailing focus on economic cooperation with countries in the Asia and Pacific region as part of an overall effort to integrate Australia in the global economy. While the energy and energy-intensive sectors are sensitive to some policies and measures to mitigate climate change, agriculture - a sector which is particularly vulnerable to the impacts of climate change - also plays a key role as a major source of exports (10 per cent of total exports in 1990). No nuclear power is generated in the country, and there are very limited possibilities for hydroelectric power generation, except in Tasmania. The country shows a relatively high level of energy-related carbon dioxide (CO₂) emissions per capita of 16 t, compared to 12 t for members of the OECD and 8 t for OECD-Europe, as well as a level of energy-related CO₂ emissions per unit of gross domestic product (GDP) which is 60 per cent higher than the OECD average.

13. Constitutional arrangements in Australia are complex; the government system operates at three levels, with powers shared at the federal level (the Commonwealth Government), at the level of states and territories and at the local level. Jurisdiction and powers for implementing policies are divided between these three levels of government. The Commonwealth Government has jurisdiction over, *inter alia*, setting energy taxation arrangements, international trade policy, industrial policy, wage policy, foreign investment guidelines, funding of research institutes and payments to states and territories, including infrastructure programmes. Governments of states and territories have responsibility for land management, the development of energy and other natural resources, the provision of energy infrastructure, the setting of certain energy prices and taxes, the establishment and enforcement of a range of environmental regulations, environmental assessment procedures and monitoring and enforcement of laws. Local government also plays an important role in environmental matters in Australia, particularly in relation to urban planning, building control, land management, and waste management. Australia has stressed the role of national partnerships in dealing with climate change, between levels of government and between government and non-government actors, both in the national communication, the NGRS and in a recently released addition to the NGRS by the Commonwealth Government, entitled "Greenhouse 21C", which is considered further in chapter V of this report.

14. In the light of Australia's system of government, the institutional and organizational structure for dealing with matters related to climate change plays a critical role. Climate change issues are addressed at the political level by the Council of Australian Governments (COAG), formed by the Prime Minister of the Commonwealth Government, the heads of governments of states and territories and the President of the Australian Local Government Association. The Intergovernmental Committee on Ecologically Sustainable Development (ICESD) is a committee of senior officials from all governments in Australia which reports to

COAG. It addresses cross-cutting complex environmental issues, including monitoring the implementation of the NGRS and providing recommendations for its further development. The ICESD is assisted in this role by a Greenhouse Working Group, comprising officials from all levels of government and by the National Greenhouse Advisory Panel. Debate and decision-making on climate change-related issues also takes place in other forums. A National Greenhouse Gas Inventory Committee was established to draw up Australia's greenhouse gas inventories. Ministerial councils on energy and on environment bring together the relevant ministers from states and territories to discuss pertinent issues and to set common state and territory policy.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

15. Pursuant to Article 12.1(a) of the Convention, the national communication provides an inventory of emissions by sources and sinks for 1990 of CO₂, methane (CH₄), nitrous oxide (N₂O), the precursors carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOC), and perfluorocarbons (PFC). Although the data were presented on a gas-by-gas basis as required, the information included in the national communication did not fully meet transparency requirements in that disaggregated activity data and emission factors were not reproduced. Supporting documentation, referenced in the communication, was however provided to the team during the country visit, giving full details and enabling the inventory to be reconstructed. Australia has used its fiscal year as the base period, which ran from 1 July 1989 to 30 June 1990. In this respect, Australia deviated from the IPCC recommendation because most inventory data are provided by government departments which only have data based on the fiscal year. Moreover, these government bodies have commitments in the NGRS to produce greenhouse gas inventories based on the official fiscal year. In the recently announced Greenhouse 21C programme, the Government committed US\$2.2 million (\$A3 million) for inventory compilation, expected to cover costs for approximately three years. Emissions by gas were aggregated using 1992 global warming potentials (GWPs).

16. The 1990 inventory shows that Australia emitted 572 000 Gg of CO₂ equivalent (1992 GWP values), of which 73.4 per cent is carbon dioxide. CO₂ emissions from energy production and use account for 67 per cent of the total. Uncertainty in the levels of these emissions is low. Forest clearing and on-site burning - the second largest source of CO₂ - result in net emissions of 156,296 Gg CO₂ per year. Uncertainty in calculations, however, suggests that real emissions could range from 25 per cent to 200 per cent of the reported value. The high degree of uncertainty from land-use estimates stems from deficiencies in data on vegetation cover and gaps in scientific understanding of biological processes. The issue of biomass burning is of key importance in Australia. Deliberate burning is used as a land management tool, as has been the practice for thousands of years, to reduce the total biomass expected to burn through natural processes in potentially catastrophic bushfires. The team took note of the Government's view that the question of whether or not to define such

emissions as anthropogenic needed further consideration. Australian officials pointed out that the IPCC guidelines "somewhat inconsistently" recommend the exclusion of CO₂ emissions from biomass burning in the inventory, but the inclusion of emissions of other gases arising from this activity. The quantity of CO₂ emissions from deliberate fires in Australia, although not included in the inventory, was reported to the review team as ranging from 290,000 to 917,000 Gg a year. Inventory data for 1988, with the total GHG emissions slightly lower than the 1990 level, were also provided during the visit.

17. The methodology underlying the compilation of the greenhouse gas inventory is based on IPCC guidelines, but has been enhanced considerably to cater for Australian conditions, as default emission factors in particular were felt to be substantially different, in some cases up to six times larger than national estimates. Emission factors specific to Australia were derived, often based on field measurements. Research was carried out through working groups set up to develop the methodologies in eight sectors, six of which were completed by the time the national communication was submitted. The methodology workbooks of the other two groups - on industrial emissions and solvent use and on landfill, wastewater and other waste activities - will be available shortly. Emissions calculated according to these methodologies are not expected to differ significantly from those reported in the national communication based on IPCC defaults. Another deviation from the reporting guidelines refers to emissions for solvents. These were not estimated in the national communication and will not be estimated after the last two workbooks are finalized, since, as before, these emissions are considered to be insignificant in Australia.

18. Methane emissions contribute 22.9 per cent of total GHG emissions (using 1992 GWP values), with over 50 per cent coming from the agricultural sector, especially enteric fermentation. This share of methane in total emissions is considerably higher than in most OECD countries. When calculating emissions from livestock, the Australian methodology has improved on the IPCC default factors, which consider only the total number of animals. The Australian methodology examines the effect of varying feed quality and quantity, animal size and animal type, thus broadening the scope of policies and measures that can be adopted to reduce emissions.

19. Nitrous oxide emissions contribute 3.1 per cent of GHG emissions, with 87 per cent originating in the agricultural sector, in particular from animal wastes, use of fertilizers and biomass burning.

20. Inventory data were also provided for other gases, including the precursors NO_x, CO and NMVOCs, and PFCs. In accordance with the approved reporting guidelines, emissions from international marine and aviation transport fuels were reported separately and were not included in total national emissions.

21. During the visit, Australia made several recommendations for improving the default IPCC methodology for inventory compilation, which were identified during the process of

developing its own methodology. These recommendations ranged from aspects related to reporting guidelines, data collection and uncertainty estimates to specific technical issues regarding individual sectors of the IPCC methodology. The secretariat has drawn these concerns to the attention of the IPCC secretariat.

III. POLICIES AND MEASURES

22. Australia's national "interim planning target", while not legally binding, is "to stabilise greenhouse gas emissions based on 1988 levels by the year 2000 and to reduce these emissions by 20 per cent by the year 2005 ... subject to Australia not implementing response measures that would have net adverse economic impacts nationally or on Australia's trade competitiveness, in the absence of similar action by major greenhouse gas producing countries." This provides the basis for the NGRS, adopted by the Commonwealth Government and state governments in 1992. The strategy embraces a range of principles, measures and sectoral objectives at Commonwealth, state and local levels which are directed towards the national interim planning target, as well as providing the main vehicle for the fulfilment of Australia's commitments under Articles 4 and 12 of the Convention. Australia sees the process of developing the strategy as dynamic and phased, with progress being measured against the yardstick of the "interim planning target". In addition, ICESD is to undertake a major review of NGRS in 1996. In adding any new measures to the strategy, governments will assess their suitability for inclusion in NGRS on the basis of a number of criteria including their environmental impact and possible implications for Australia's international competitiveness. Only "no regrets" measures are currently being adopted.

23. The team found that in general the national communication did not provide sufficient information to assess the status of implementation of individual policies and measures in different sectors. Nor was it possible to assess, on the basis of the communication, their specific impact in terms of climate change mitigation.

24. Extensive supplementary documentation to clarify these points was, however, provided during the review visit. The team remarked that such additional information should, to the extent possible, be incorporated in future communications. In light of this additional information, there was a consensus that the process for monitoring policies and measures described in the national communication was reliable and transparent. The team recommends that progress in implementing these measures be reported in detail in the next communication.

A. Carbon dioxide

25. Around 40 per cent of all CO₂ emissions was generated in 1990 in the energy and transformation sectors. Another 24 per cent of total CO₂ was emitted in the industrial and transportation sectors. Fossil fuels provide for most of the energy needs, with approximately

80 per cent of electricity currently being generated with coal. The NGRS gives special emphasis to the energy sector in the first phase of measures implemented, given its importance for overall CO₂ emissions and the potential for "no regrets" measures in this area. The national communication describes a wide range of measures envisaged or undertaken for the energy sector, but lacks detailed information on their implementation.

26. Structural reform of the electricity sector is a key policy objective. Following a decision by COAG, states are restructuring their electricity industries to open the market up to competition within and across state boundaries, by separating generation from transmission and distribution. Progress on implementation varies from state to state and the target date for commencement has been put back from July 1995 to July 1996. Completion of the market reform, accompanied by increased involvement of the private sector, removal of subsidies, creation of a pricing structure reflecting full costs, increased interstate trade, non-discriminatory access to the grid and open entry to new sources of generation is expected to produce substantial energy efficiency gains and hence environmental benefits. The impact of the structural reform on the level of CO₂ emissions from the energy sector is expected to be substantial, although potential reductions have not been quantified. The team recommended that more information be provided on actual emission reductions as these measures are introduced.

27. A parallel decision to move towards a restructured natural gas market is also being implemented and a more competitive gas market is envisaged by July 1996. The Government expects these market reforms to produce a further increase in the use of natural gas, in particular in electricity generation and in industrial co-generation. It is hoped that 16 per cent of primary energy consumption will be provided by natural gas by 2000. It has been estimated that the net CO₂ impact of each megawatt of co-generation capacity installed equals a reduction of 5.2 Gg. The new co-generation capacity already committed or identified as potentially economic totals about 1000 megawatts, indicating a potential reduction of 5200 Gg of CO₂. A further impetus to natural gas use is given in the new Greenhouse 21C proposals (see chapter V below). While the national communication does not specify the reductions of CO₂ expected through increased use of natural gas, the Greenhouse 21C programmes anticipate a possible reduction of 2000 Gg of CO₂ emissions by 2000.

28. Replacement of fossil fuels by non-carbon renewable energy sources, such as hydroelectric power, solar and wind energy, results in an immediate reduction of CO₂ emissions, while the use of biomass on a sustainable basis can produce net reductions. While there is only limited potential for further expansion of hydroelectric power in the national strategy, solar energy is more promising and has already become economically viable in certain niche markets, for example, solar water heating in households and stand-alone photovoltaic systems in remote areas. Although a target has not been set for the use of renewable sources of energy, there is a range of instruments to create financial incentives for the use of renewable technologies, including tax exemptions, bonus buy-back rates for electricity produced from renewable energy sources. It is estimated that the average impact of

each megawatt generated through small hydroelectric power plants, landfill and biomass projects corresponds to a reduction in emissions of about 6.1 Gg of CO₂ per year. Given the status of implementation of hydroelectric power, landfill and biomass projects and their total economic potential of 200 megawatt by 2005, a reduction of 1220 Gg of CO₂ per year could be expected by that time. The potential emission reductions through the promotion of wind and solar energy projects have not been estimated.

29. The residential and commercial buildings sectors together account for only 2 per cent of CO₂ emissions associated with energy use and 20 per cent of total final energy consumption. Measures applied in these sectors aim at the continuing improvement of efficiency in energy use, key measures being labelling and introduction of minimum performance standards of electrical efficiency; the National House Energy Rating Scheme; the Energy Audit programme for private, government and commercial buildings; the National Commercial Building Energy Code; and mandatory insulation standards for new houses. There have, however, been some delays in their adoption and implementation. Domestic appliance labelling has been introduced by most Australian states. Agreement on minimum energy performance standards for certain domestic appliances has only recently been reached by Australia and New Zealand and expansion beyond refrigerators, freezers and electrical storage heaters is currently being examined. Australia expects CO₂ reductions of nearly 2000 Gg by 2000 from the continued application and expansion of these measures. Special efficiency targets set for new Commonwealth Government buildings have been in operation since 1992. While these measures cannot be expected to achieve substantial early results because of the extended turnover time, they should eventually make a significant contribution to the climate policy. Overall, the Government expects a reduction of 2500 Gg from the envisaged response measures in the household sector and a contribution of 1000 Gg from the commercial sector by 2000.

30. In the industrial sector, voluntary measures are an important component of the response strategy, aiming mainly at improving energy efficiency. Although significant results have been achieved so far in the aluminium industry, with a 2 per cent energy efficiency improvement reached over the last five years, the non-ferrous sector in Australia accounts for a much larger share of CO₂ emissions than in other OECD countries. Furthermore, the Australian Government has put in place additional incentive schemes to encourage industry to invest in new plant and equipment. These measures can be expected to increase indirectly the uptake of new and more energy efficient technology. The direct effects of these measures on CO₂ emissions, however, have not been estimated. Altogether, the Australian Government projects a reduction of CO₂ emissions by 2000 of 1100 Gg as a result of the full implementation of these response measures in the industrial sector. Major additional improvements in energy efficiency in industry are expected over the next five years as a result of cooperative agreements being promoted under the "Greenhouse 21C" initiative (see chapter V).

31. Contrary to the usual view that Australia has high emissions because of the dispersion of its population and size of its territory, the contribution of the transport sector to total CO₂ emissions is lower than the average for OECD countries. Despite the fact that gasoline prices are the third cheapest in OECD countries, the number of private cars is believed to be approaching saturation, with nearly 0.52 cars per person. The only increases in demand are expected in domestic aviation for tourism and in truck transportation as economic activity increases. Government proposals and measures aimed at reducing CO₂ emissions in the transport sector include a limited rail reform, road upgrades, road transport reform, technical innovation, control of vehicle emissions, use of alternative fuels, urban planning, improving the efficiency of public transport and private car use, and specific measures for the government fleet. A total reduction of 3000 Gg of CO₂ is expected from the proposed measures in the transport sector by 2000. In addition to excise tax exemptions to promote switch to natural gas, liquified petroleum gas (LPG) and ethanol fuels, change in driver behaviour and modal shifts are seen as the most promising among the response measures.

32. Land use change and forestry sectors in Australia are responsible for a disproportionately large amount of CO₂ emissions, estimated - albeit with a high degree of uncertainty - at around 30 per cent of total CO₂ emissions. Improving the effectiveness and coverage of government controls on land clearing is the central approach to minimize CO₂ emissions from this source. A system for granting permits for clearing land for pasture and, in some cases, permits for deliberate burning of forests and bush have been used as a means of controlling land clearing. Responsibility rests with state and local governments but regulations vary from state to state. Monitoring of results has been particularly difficult because permits issued do not necessarily correspond to amount of land actually cleared. This may occur due to illegal land clearing and the fact that some permit holders may not clear their land immediately. Furthermore, the scientific uncertainties involved and considerable difficulty in primary data collection make it difficult to quantify the potential reductions in CO₂ emissions from improved management of land clearing in Australia. However, funds have recently been allocated to introduce remote sensing to assess the extent of land clearing and monitor deliberate burning.

33. The Australian Government in 1989 introduced the National Landcare Programme aimed at an integrated approach to natural resource management. Landcare programmes, which are characterized by cooperative action between all levels of government, the community and the agricultural sector, promote improved soil and pasture management techniques to minimize carbon loss from cultivation. The Government expects significant contributions to CO₂ abatement in particular from two programmes - improved tillage systems (with an envisaged CO₂ reduction of 2500 Gg by 2000) and additional hardwood plantation (providing a CO₂ reduction of 400 Gg by 2000).

34. The One Billion Trees Programme is the main initiative launched under the umbrella of the National Landcare Programme. (Other initiatives address grassland conversion and managed forests.) Although originally conceived to promote soil conservation, it has

increased considerably the sink capacity in the country. It was estimated that by the time of the country visit approximately 550 million trees had been either planted or protected and that another 100 million trees will be established or protected each year until 2000. The CO₂ uptake achievable from implementing the One Billion Trees Program is estimated at 124,000 Gg, by far the largest single contribution to the country's mitigation efforts. The Greenhouse 21C initiative proposes to expand this sink enhancement programme and to address the programme's high vulnerability to drought and bushfires. If implemented, the expanded programme would generate an additional annual CO₂ uptake of 2000 Gg by 2000.

B. Methane

35. Methane emissions in Australia are proportionally higher than in most OECD countries as a result of the large share of the livestock industry in the national economy. Methane emissions in Australia originate mainly from enteric fermentation in animals, landfills and fugitive emissions from coal mining and oil and natural gas production and distribution systems. Expected reductions in methane leakage from the rehabilitation of low pressure gas pipelines are modest, while black coal production is expected to increase by over 45 per cent between 1990 and 2000. Methane from certain sources, principally coal mining and landfill sites, has been used to a certain extent as a commercial energy source. Thirty per cent of expected reductions in methane (175 Gg) will result from technological advancement in animal breeding, improved efficiency in livestock production and animal waste processing systems. The largest reduction (51 per cent, or 300 Gg) is expected to come from the community-based Waste Minimization Strategy which aims not only at drastically reducing the amount of waste disposed of in landfills, but also at reducing domestic per capita waste by 50 per cent by 2000. Only limited information was made available on the status of implementation of these measures and their effects have only been estimated partly, owing to difficulties encountered in technical measurements.

C. Nitrous oxide and other gases

36. Response strategies with regard to land clearing can be expected to have a similar effect on N₂O emissions. Australia's use of nitrogenous fertilizers per hectare is very low, allowing little scope for further reduction. The most significant measure aimed at reducing N₂O emissions promotes improved efficiency of nitrogen uptake from legume nitrogen and nitrogen-based chemical fertilizers. This measure is expected to have a limited effect on total N₂O emissions, which are expected to grow by some 10 per cent between 1990 and 2000. Very little information has been provided on the status of implementation of measures to reduce other sources of N₂O emissions.

D. Perfluorocarbons

37. The major source of these greenhouse gases is the aluminium industry. The Australian aluminium industry has in the past made considerable technological improvements, resulting

in an almost 70 per cent reduction in perfluorocarbon emissions since 1990. Aluminium smelters continue to work towards further improvements, mainly through modified processing, training and research activities. A reduction of projected emissions from 4400 Gg to 1500 Gg of CO₂ equivalent is expected, although emission estimates and emission factors have so far a high uncertainty level.

IV. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES

38. In accordance with Article 4.2(b) of the Convention, Australia presented projections of CO₂, CH₄, N₂O and PFC emissions and CO₂ removal levels for the year 2000. Their effect was aggregated using 1992 GWPs with a 100-year time horizon. Both with and without measures scenarios were prepared. Removals of CO₂ by sinks were clearly indicated and were listed separately. The communication on its own, however, did not provide enough information for a full understanding of the projections analysis. Information on the effects of measures was restricted to aggregate sectoral figures presented by gas, and was not provided for individual measures as recommended. During the country visit, however, these gaps were satisfactorily filled by supplementary documentation and presentations by national experts.

39. The background documentation presented to the team described detailed sectoral analyses that were used to assess the effects of individual measures, mostly using a bottom-up approach. The projections considered only measures already being implemented. Although the background studies examined scenarios of high, medium and low rates of implementation of policies, the projections that appeared in the national communication were based in general on the scenarios of low rates of implementation. The studies were conducted using a common set of plausible key "ground rule" assumptions on economic and population growth and expected structural change, as well as assumptions specific to each sectoral analysis. For most sectoral projections, sensitivity analysis of key assumptions, such as world prices of energy and export goods and the occurrence of drought, was carried out, and uncertainty levels were explicitly described. For some sectors such as land clearing, the activity data used in the projections have a high uncertainty level owing to difficulties in basic data collection and monitoring. The team was informed that the methodologies used in the projections analysis were being refined to reflect improved data and enhanced understanding of the processes. The team felt that the thoroughness and consistency of work being done in building up emission projections from sectoral analyses to an aggregate level for the year 2000 could be very useful as a reference case for other Parties. No adjustments for temperature fluctuations in base years or electricity imports were made in the projections.

40. The "without measures" scenario projects an increase of 14 per cent in total GHG emissions by the year 2000 (using 1992 GWPs with a 100-year time horizon). The largest increase arises from CO₂ emissions associated with energy production and transformation, and industrial processes such as iron, steel, aluminium and cement production. The assumptions underlying the "without measures" scenario are clearly mentioned in the background document, and include, *inter alia*, population growth, world prices and autonomous energy

efficiency. An increase of 7 per cent in total GHG emissions by 2000 compared with 1990 levels is projected if measures already undertaken continue to be implemented at the current rate.

V. PROJECTED PROGRESS IN GREENHOUSE GAS MITIGATION

41. In March 1995, the Commonwealth Government released a programme entitled Greenhouse 21C, which describes measures in addition to those mentioned in the national communication relating to further climate change issues. This new package of measures is expected to lead to increased reductions in GHG emissions, although it still falls short of stabilization. If fully implemented, these measures are projected to lead by 2000 to a GHG emissions level 3 per cent above the 1990 level. A proposal to include an environmental levy on CO₂ was not pursued on the basis of the support for a voluntary industry (cooperative agreements) approach from which significant emissions reduction are anticipated. The team was not provided with any analysis of emission projections for this package of measures and was informed that most of the measures were still to be refined by the Commonwealth Government, in coordination with the states, territories and local governments. For that reason, effects of the new measures could only be presented at a very aggregate level at the time of the visit. Financial commitments totalling some US\$45.3 million (\$A 63 million) have already been made by the Commonwealth Government to implement this range of measures.

42. As in the national communication, Greenhouse 21C underlines the importance of the partnership approach in reducing GHG emissions, and relies heavily on cooperative agreements between the Commonwealth Government and individual companies to achieve over 70 per cent of emission reductions (in CO₂ equivalent) expected from the new package. States, territories and local governments will also be involved in cooperative agreements. These agreements aim at promoting best practice and achieving additional energy efficiency gains. The process of liberalization and reform in the domestic gas market will be accelerated, with the Government aiming at making natural gas account for at least 20 per cent of primary energy consumption by the year 2000 compared to the current 9 per cent, thus achieving a reduction of 2 000 Gg of CO₂. The One Billion Trees Programme will be expanded, increasing the projected uptake of CO₂ by 2 000 Gg. Employment programmes for increased tree planting are projected to result in an uptake of CO₂ of 1 000 Gg. The ongoing deregulation and liberalization process in the electricity market is expected to lead to increased energy efficiency, more economical use of domestic energy resources and a gradual integration of climate change concerns in the power generation sector. Greenhouse 21C also includes Commonwealth support for an innovative programme to improve public transport and plans for enhanced integrated land use to reduce reliance on private motor

vehicle travel. Car fuel efficiency labelling and advertising is expected to bring about to a reduction of 450 Gg of CO₂ equivalent.

43. In accordance with decision 2/CP.1 of the Conference of the Parties (FCCC/CP/1995/7/Add.1), Australia confirmed its intention to submit a second national communication in 1997.

VI. EXPECTED IMPACTS OF CLIMATE CHANGE

44. During the country visit, information contained in the national communication was supplemented with details of ongoing efforts to assess the expected impacts of climate change, in particular with regard to climate change vulnerabilities and to climate change research and observation. A range of scenarios of future climate change has been analysed - covering precipitation, climate extremes, duration of snow cover and sealevel rise. They include estimates of possible impacts on ecosystems and on socio-economic variables, the latter focusing on agriculture, fisheries and forestry, coastal zones, infrastructure and human health. During the visit, the particular vulnerability of certain key economic sectors was emphasized. For example, Australia is highly dependent on the agricultural sector, whose normal vulnerability to climate extremes has been vividly illustrated by three consecutive years of the El Niño-Southern Oscillation phenomenon that periodically affects Australia. The resulting drought has inflicted serious economic loss on the agricultural sector in recent years, followed by consequent population movements. In its 1995-1996 economic outlook, the Government estimated that, owing to the severe drought which affected most of eastern Australia in 1994 and 1995, farm production, in particular grain crops, fell drastically. The decline in farm production may have lowered GDP growth in 1994 and 1995 by about 1 per cent.

VII. ADAPTATION MEASURES

45. The national communication describes activities undertaken to assess adaptation measures, including the identification of possible adaptation strategies in agriculture, coastal zone management and human health. During the country visit, the review team was informed that specific action was already under way to consider adaptation responses to climate change, in particular in coastal zone management. For example, information exchange occurs between local councils on adaptation, and, in some instances, the possible effects of climate change are taken into consideration when replacing infrastructure in coastal areas. While the communication does not explicitly refer to cooperation in preparing for adaptation under Article 4.1(e), the review team was informed that Australia recognizes the necessity to include capacity building for adaptation in its international cooperation efforts.

VIII. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

46. Australia made contributions to the pilot phase of the Global Environment Facility

(GEF) of US\$21.6 million (or \$A 30 million), which included the co-financing of a project on climate change. Its contribution to the first replenishment of the GEF amounted to over US\$30.2 million (\$A 42 million). This contribution was reported to the team as being "new and additional", indicating an increase in the funds for international environment-related programmes, without diversion of funds from existing international assistance programmes.

47. Australia has also provided significant additional support to developing countries through multilateral, bilateral and regional programmes, mainly in the South Asia and Pacific region. Programmes comprise adaptation, mitigation and capacity-building projects, as well as the development of national GHG inventories and IPCC activities.

48. The ratio of official development assistance (ODA) to gross domestic product (GDP) decreased from 0.36 per cent in 1992 to 0.33 per cent in 1995, although in absolute terms the total level of ODA for 1994/1995 has increased to roughly US\$1,069 million (\$A 1,486 million), a 3.5 per cent increase on the previous fiscal year. The Australian Government has stated its commitment to increase this ratio in the medium term to 0.40 per cent, and its intention to reach the 0.70 per cent level in the longer term. The team was told these targets have received wide public support.

49. Significant technology development and transfer occurs, with funds being provided for the adaptation of Australian technology to other countries, especially developing countries of the Asia and Pacific region. The Australian aid programme encourages environmentally sound private sector development through programmes such as the green development import finance facility established in 1994 with a core budget of US\$14.4 million (\$A 20 million) for 1994/95.

IX. RESEARCH AND SYSTEMATIC OBSERVATION

50. Efforts to carry out commitments under Article 4.1(g) and Article 5 pertaining to research and systematic observation are well documented in chapter 7 of the communication. Additional documentation, both on planned research and actual research publications, was made available to the review team during the visit. Because of the country's specific circumstances (such as impact of oceans, differences in flora and fauna), arising in part from its geographical location in the southern hemisphere, and because of the focus of much of the current research on northern hemisphere climate change phenomena, Australia has sought to develop its own capabilities in this area. The chief effort of the Commonwealth Government is channelled through the National Greenhouse Research Program, which, despite its small annual budget (\$A 6 million), has succeeded in attracting additional funds and expanding its programme areas through collaboration with other research institutes, state governments and international organizations. A number of initiatives for strengthening research capacities in developing countries exist, in particular in the South Pacific and South-East Asia. Several non-governmental research efforts were highlighted during the country visit, including studies

on changes in insect pest ranges and the greenhouse effect on cereal productivity. Research is under way in collaboration with private sector entities and state organizations, and workshops have been organized on range lands, involving farmers.

X. EDUCATION, TRAINING AND PUBLIC AWARENESS

51. The team found that Australia had satisfied the reporting requirements for commitments under Article 4.1(i) and Article 6. The provision of information on climate change and establishment of public awareness campaigns occur at two levels - targeting the general public, on the one hand, and focusing on specific groups, such as architects, engineers, students and the business community, on the other. Well-established long-running energy efficiency campaigns have been re-focused to highlight potential environmental, as well as financial benefits to the energy user and the community as a whole. A broad range of media have been used, including booklets, newsletters, educational kits and videos, to mention but a few.

52. A number of states, territories and local governments have also taken their own initiatives to develop and implement information programmes, including the establishment of energy information centres to distribute material on how to save energy and reduce greenhouse gas emissions. Some electricity utilities have also developed and distributed information on climate change.

53. In order to secure public participation, the National Greenhouse Advisory Panel was established to provide an input from non-governmental stakeholders in the formulation of Australia's response to climate change. In addition, the Australian inventory methodology was developed through extensive participation of experts from within and outside government departments, and was made available to the public for comment.

54. There is an information exchange with other countries through the International Energy Agency Cadet Network as well as an information flow to developing countries, in particular those in the South Asia and Pacific region. Training activities for developing countries take a variety of forms, ranging from the provision of scholarships to skills enhancement programmes carried out in the countries themselves.

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