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

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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 Spain 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 of Spain was carried out between September 1995 and March 1996 and included a visit to Madrid from 25 to 29 September 1995. The review team included experts from Cuba, Mexico and Portugal.
2. According to the National Energy Plan 1991-2000 (which assumes an average annual gross domestic product (GDP) growth rate of 3.6 per cent in the 1990s), Spain was initially committed to limiting to 25 per cent the growth in its energy-related carbon dioxide (CO₂) emissions in the decade. A "without measures" scenario points to a 45 per cent growth in the same period. Recent growth estimates provided during the in-depth review indicate that energy-related CO₂ emissions will rise by less than originally expected. A medium economic growth scenario assuming an average annual GDP growth rate of 3 per cent from 1995 to 2000 shows that energy-related CO₂ emissions could be 15 per cent higher than 1990 levels by 2000. This downward revision is explained by a lower than expected economic growth from 1991 to 1994, as well as by the early results of some of the programmes in the energy savings and efficiency plan (PAEE), the gradual replacement of low-quality domestic coal by higher quality imported coal and the increasing share of natural gas in total energy supply.
3. Spain's mitigation measures are mainly based on the increasing inroads of natural gas in total energy supply, on efforts to save energy in fuel combustion, including co-generation, and on attempts to increase energy efficiency in the energy and industrial sectors. In this respect, all measures being implemented or envisaged are "no-regrets" measures which target CO₂ emissions in the energy sector only. The fuel substitution programme within PAEE aims at enhancing the role of natural gas in energy production and use. By 1995, it had achieved less than 26 per cent of its potential. The entering into operation of the Maghreb gas pipeline from Algeria planned for late 1996 is expected to generate significant emission reductions in the second part of this decade. The PAEE projected a 12 per cent increase in energy efficiency in the Spanish economy for the period 1990-2000. By 1995, the actual increase achieved amounted to roughly 4.4 per cent.
4. Spain has not implemented measures to reduce CO₂ emissions in sectors other than energy production and use and none of the measures reported target methane (CH₄) or nitrous oxide (N₂O) emissions. During the review, however, additional information was provided on measures to increase Spain's sink capacity by 2000. Also during the review, a draft of the National Climate Programme was made available. This recently announced programme describes two new lines of action, namely support for climate change research and a mechanism to assess future mitigation policy options. It contemplates additional annual funding of US\$ 4 million for climate change research programmes, but it does not earmark funding for proposed mitigation measures.

¹ In accordance with decision 2/CP.1, the full draft of this report was communicated to the Government of Spain, which had no further comments.

5. The team agreed with the opinion expressed by government officials regarding the substantial potential for greenhouse gas (GHG) emission reductions in the urban transport, residential and waste sectors and suggested that information be provided in the next communication on measures that could be implemented in these sectors.
6. The in-depth review of inventories was prepared and conducted in a most transparent and facilitative manner. As a result, the presentation of Spain's GHG inventories was greatly improved during the review. The Spanish inventories were prepared based on the CORINAIR² methodology and covered the main GHGs and precursors. For most emission categories the emission factors used were estimated in accordance with national conditions following the CORINAIR method. Default factors of the Intergovernmental Panel on Climate Change (IPCC) methodology were used only in some cases for the land-use and forestry category. For all estimations, emission factors used were clearly reported in the supplementary documentation and activity levels obtained from official national statistics, allowing for the reconstruction of the inventory. A commendable effort has been made in Spain in overcoming inadequacies arising from the conversion of CORINAIR results into the IPCC reporting format. Most of the omissions and inadequacies originally detected in the inventories were rectified and clarified during the review. Major revisions were made to total CO₂ and fuel combustion emissions and in the estimated CO₂ sequestration capacity in 1990.
7. Important research and monitoring activities are under way in Spain with direct relevance to climate change monitoring and assessment. During the review, the team was informed that the need has been identified for promoting intersectoral studies on possible socio-economic impacts of climate change, especially the extent to which climate change could affect important sectors of the economy such as tourism.
8. Spain contributed US\$ 14.1 million to the pilot phase of the Global Environment Facility (GEF) and US\$ 17.3 million to its first phase. During the review visit, information was made available regarding Spain's official development assistance (ODA) for the period 1989-1994. The ODA/GDP ratio was 0.29 per cent in 1994 and 0.25 in 1995, although it was intended to reach 0.35 in 1995. The decrease in assistance was due to cuts in the State budget in order to comply with commitments made in moving towards a European monetary union. No new initiatives regarding technology transfer were reported during the review. The communication, however, mentioned existing programmes to promote technological innovation and the dissemination of technologies in developing countries. It also described Spain's initiatives in Bolivia and North Africa in the area of photovoltaic electricity production .

² CORINAIR is the component dealing with air emissions inventories of the European Economic Community CORINE (Coordination d'information environnementale) programme.

I. NATIONAL CIRCUMSTANCES

9. Spain ratified the Convention on 21 December 1993. The secretariat received Spain's first national communication on 28 September 1994. The in-depth review of the national communication was carried out during the period September 1995 to March 1996, including a country visit from 25 to 29 September 1995 to Madrid. The review team consisted of Mr. Roberto Acosta Moreno (Cuba), Mr. Omar Masera (Mexico), Ms. Maria Gabriela Martins Borrego (Portugal) and Mr. Lucas Assunção (UNFCCC secretariat, Coordinator). The team met with representatives of several ministries as well as with members of the scientific community and representatives of business and non-governmental organizations.

10. In Spain, the State Central Administration is responsible for the coordination and promotion of environmental policies and for issuing basic environmental policy guidelines and strategies. Its direct action, however, is circumscribed to a few sectors such as the management of public water resources, nationwide transport and energy. The next level of government is composed of 17 Autonomous Communities. The actual implementation and monitoring of environmental policies falls under the responsibility of these Autonomous Communities which, through their legislative bodies, can independently issue "additional laws" to determine how natural resources at the provincial level should be used. In addition to the Autonomous Communities' representation in parliament, policy coordination with the Central Administration is also exerted through thematic "sectoral conferences". Local communities form the third level of administration with responsibility for direct management and implementation of environmental policies having local impacts, such as waste management.

11. Created in May 1992, the National Climate Commission is co-chaired by the State Secretary for Environment and Housing and the Institute of Meteorology, both part of the Ministry of Public Works, Transport and Environment. It provides the mechanism for coordination of climate change related policies and sets the general framework for the implementation of Spain's National Climate Programme. During the visit, the team was presented with an advanced copy of the National Climate Programme (March 1995 draft) which is still pending approval by the Council of Ministers. Although the review team has not had the chance to analyse it thoroughly, the Programme describes two main lines of action, namely support for climate change research and the assessment of mitigation policy options to be considered by the Central Administration. The Programme's components dealing with climate-related research and development (R&D) have been included in the new R&D programme on climate (1995-1999) with funding of roughly US\$ 4 million for R&D projects, while no funding has been earmarked for mitigation measures proposed in the National Climate Programme. This programme is co-chaired by the State Secretary for Environment and Housing and the Secretary General for the National R&D Plan.

12. With a population of 39 million in 1992, Spain has the second largest territory in Western Europe and a per capita GDP of US\$ 12,500, roughly 20 per cent lower than the average for European Community (EC) countries. Spain's energy balance has as its main features a high dependence on fossil fuels (coal and oil) for electricity generation, an

increasingly limited hydropower potential due to recurrent droughts, and a moratorium on the increase of nuclear power which has limited its share as a primary energy source to roughly 14 per cent. The fact that almost all oil and most coal is imported has been a key determinant in Spain's energy policy. In its efforts to enhance energy security, Spain has followed an active subsidy policy for its limited national coal production and, most recently, strengthened the promotion of co-generation and the use of renewables for electricity generation.

13. Additionally, the Government has made an important effort to promote natural gas as an energy source, increasing its share in total primary energy supply from 2 per cent in the 1970s to over 6 per cent in 1992. While the current limited use of renewables and biomass is expected to increase by 2000, most impressive is the expected substitution of natural gas for coal and oil until the end of the decade which would virtually double the share of gas in total energy supply. This development depends largely on the entering into operation of the gas pipeline from the Maghreb region expected in 1996 and the establishment of gas networks.

14. Spain has a relatively low level of per capita energy-related CO₂ emissions which in 1990 amounted to roughly 6 tonnes compared to an average of 12 tonnes in the countries of the Organisation for Economic Cooperation and Development (OECD) and 8 tonnes for OECD-Europe. The significant expansion projected in the transport sector, the high dependence on oil, the low price elasticity of the national energy consumption and the gradual pace in discontinuing subsidies to coal production [the phasing-out of coal-fired plants has been delayed by social and employment concerns] imposes a certain rigidity on mitigation efforts in the country. Moreover, although the national energy policy has given priority to the promotion of more efficient use of energy sources, with a 12 per cent increase planned by 2000, an increase of only 3 per cent had been achieved by 1994.

15. Spain has endorsed the introduction of a CO₂/energy tax at the EC level, especially if implemented in the transport and residential sectors. It is felt that the implementation of this tax must be based on the differentiated national circumstances (i.e. on a burden-sharing policy) within the EC. Government officials, however, doubt that an EC-wide CO₂/energy tax [at the levels currently being proposed] would have much effect on emissions in Spain, due largely to the inelastic demand for fossil fuels there. In this regard, the team noted that tourism plays an important role in the economy, accounting for roughly 9 per cent of GDP in 1994. The sector's heavy reliance on private transportation may partially explain the oil demand inelasticity.

16. As part of the ongoing energy policy, several measures which have been adopted have contributed to the reduction or limitation of GHG emissions, even when this was not their explicit objective. The basic elements of Spain's energy policy are established in the national energy plans adopted by the central Government and approved by the parliament. The current plan, adopted in April 1992, defines as priorities for the national energy policy from 1991 to 2000 the security of energy supply, enhancement of domestic energy sources, energy diversification, cost minimization and investments in the electricity sector, promotion of energy savings and adaptation of the energy sector to the European market.

17. Spain, as a member of the European Community, has accepted the commitment to stabilize total CO₂ emissions at 1990 levels by 2000 in the Community as a whole. However, like other EC members such as Greece, Ireland and Portugal, it enjoys a differentiated treatment owing to its relatively lower level of economic development. This exception has been accepted by the EC for some of its members without prejudice to its overall stabilization target. Spain's national target was originally a commitment by its energy sector to limit the growth in CO₂ emissions to 25 per cent from 1990 to 2000, in contrast to a "without measures" scenario which would lead to a 45 per cent growth in these emissions. This commitment has been revised downwards and now envisages a 15 per cent growth in CO₂ emissions from 1990 to 2000. To reach its national target, the Spanish Government is committed to fully implementing the current national energy plan and its sub-programmes. Measures put in place to achieve the national target do not involve other sectors of the Spanish economy and do not target GHGs other than CO₂.

II. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS

18. In preparing the national GHG inventories, Spain has used the CORINAIR methodology, except for emissions under the category "land use change and forestry", particularly in its sub-category "logging/managed forests", where the IPCC default methodology was used. The inventory was presented using the IPCC format (summary table 7A for national greenhouse inventories) and according to IPCC instructions on how to report CORINAIR inventory results. However, in light of the reporting guidelines, several omissions and inadequacies were detected in the inventory during the review process. For instance:

- (a) IPCC minimum standard tables were not provided;
- (b) Emissions originating from international bunker fuels were not estimated in full and were not presented separately. Only the part of those emissions corresponding to ships' movement at ports and in territorial waters and to aircraft landing and take-off cycles were estimated. These were originally included in the fuel combustion category;
- (c) CO₂ emissions from biomass for energy were not presented separately and were also included in the fuel combustion category. The IPCC methodology states that this source is by definition renewable and therefore should not be added to the CO₂ total;
- (d) Contrary to the IPCC recommendations, CO₂ emissions from biogenic waste were included in the waste category;
- (e) Uncertainty levels associated with GHG emission levels were not reported in the communication;

- (f) Emissions from fuel combustion in the commercial/institutional, residential and agriculture/forestry sectors were reported jointly under one single category;
- (g) Data on emissions of perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs) were not provided.

19. Except for the presentation of the IPCC standard data tables and data on PFC and HFC emissions, all other points listed above were rectified by the Spanish Government during the review team's country visit. Of the inadequacies identified in the reporting of national GHG inventories, some were directly caused by discrepancies in the conversion of CORINAIR results into the IPCC format and difficulties in following the IPCC reporting instructions.

20. In addition to the methodological issues raised above, the Spanish Government made a few additional corrections to data provided in its communication. These include:

- (a) Estimates of emissions under the managed forests subcategory and data on the actual volume of existing forests were revised during the review using mainly the IPCC default methodology;
- (b) The estimates for CO₂ emissions under the industrial processes category, specifically for wine production, were made using a wrong emission factor. They too were revised during the review.

21. Corrections made to GHG inventories during the review practically did not affect emission levels of CH₄, N₂O and precursors. For nitrogen oxides (NO_x) and carbon monoxide (CO), the corrections implied in a decrease of 5 per cent in emission levels. In relation to net CO₂ levels, the following changes were made during the in-depth review:

- (a) Total emissions from fuel combustion (category 1A) were revised from 222,908 Gg reported in the communication to 209,012 Gg, because of the exclusion of biomass burning and part of the international bunker fuel emissions;
- (b) Total emissions from industrial processes were revised from 35,263 Gg to 17,696 Gg following a correction in emission factors for the wine production emissions reported under the industrial process subcategory. The team noted that the IPCC methodology does not request the reporting of CO₂ emissions from wine production and other biogenic industrial processes;
- (c) Total CO₂ absorption in 1990 was revised from 4,177 Gg reported in the communication to 23,170 Gg to take account of more recent data;
- (d) The waste CO₂ emissions included in the national total were reduced from 2,483 to 201 Gg since IPCC guidelines exclude biogenic waste emissions;

- (e) **As a result of the above-mentioned changes, total net 1990 CO₂ emissions were revised from 256,476 Gg to 204,152 Gg.**

22. The resulting correction in the 1990 total CO₂ emission level amounts to a 21 per cent reduction compared to the level reported in the communication. Over a third of this reduction corresponds to the increased absorption capacity reported during the in-depth review. Another third is due to the correction in the emission factor used for emissions in industrial processes. The last third is due to the improvement in adopting the IPCC methodology by excluding emissions from part of international bunker fuels and biomass burning from fuel combustion. The revised 1990 total of CO₂ emissions from fuel combustion, 209,012 Gg, is 4 per cent lower than the total energy-related CO₂ emissions estimated by the International Energy Agency (218,000 Gg), but is consistent with estimates made by EUROSTAT.

23. The new CO₂ sink total for 1990 is closer to estimates found in the international literature with respect to carbon sequestration in Spanish forests. The new sink estimates were made possible by the availability of data from the new forest inventory which covers the period 1990-1995, by improvements in the estimation of harvesting of forest products and by the use of a dynamic model for carbon sequestration.

24. The Spanish inventory for the managed forests subcategory was done applying the IPCC default methodology and by separating emissions from removals. However, the team felt that the procedure used in the re-estimation could still be improved and recommended that it be carefully documented in future communications. In particular, the team suggests that:

- (a) Data be provided on annual growth increment and wood harvesting by main forest types following IPCC instructions and using their minimum standard tables;
- (b) A table be presented with the area of managed and unmanaged forests, since the IPCC default methodology is only applicable to managed forests. If forest growth is assumed in unmanaged forests, a justification should be provided;
- (c) All woody biomass used as fuel be considered in national statistics as part of biomass harvested.

25. Moreover, despite the fact that the IPCC methodology does not consider emissions caused by natural fires and taking into account the importance of these events in Spain, it could be useful to estimate GHG emissions from fires. It would seem that these emissions have already been estimated using CORINAIR methodology.

26. Finally, considering that around 1,600,000 ha of agricultural land have been abandoned in the last 10 years, the team also suggests that, to the extent possible, an estimation of carbon uptake in abandoned agricultural lands be provided following IPCC instructions.

27. Using global warming potential (GWP) 1994 values and assuming a 100 years life horizon, GHG had the following distribution in Spain's total emissions in 1990, in CO₂ equivalent:

CO ₂	204,152 Gg	71,2 per cent
CH ₄	52,675 Gg	18,3 per cent
N ₂ O	30,080 Gg	10,5 per cent
1990 total	286,907 Gg of CO ₂ equivalent	

28. In the amended inventory it is possible to determine the amount of CO₂ emissions related to biomass use as fuel which, in 1990, amounted to 12,304 Gg. It represented 5.8 per cent of total energy-related CO₂ emitted that year, but as recommended by the IPCC methodology this amount was not included in the total.

29. During the review, the team was provided with an inventory of emissions from international bunker fuels reported separately for GHG and precursors. A total of 18,024 Gg of CO₂ were emitted from international bunker fuels in 1990, amounting to roughly 9 per cent of total CO₂ emissions. The relative importance of emissions of the other gases from these sources was not significant in 1990.

Emissions from international bunker fuels, 1990
(CO₂ in Gg and all others gases in tonnes)

	CO ₂	CH ₄	NO ₂	CO	NO _x	NMVOC
Ships	12,076	553	304	7,190	248,256	11,237
Airplanes	5,948	1,473	n.a	9,822	23,612	188
Total	18,024	2,026	304	17,012	271,868	11,425

30. In the process of making the two methodologies compatible, Spain opted to add a new category 7 to the IPCC summary table. It reflects the part of CO₂ emissions resulting from the small portion of non-renewable organic wastes, estimated to amount to 10 per cent of total CO₂ emissions from waste, as well as emissions from flares in oil refineries and petrochemical plants.

31. The review team was also provided with documentation on the uncertainty levels associated with GHG emission estimates. The data quality labels established in the CORINAIR methodology were used.

32. Data on PFC and HFC emissions were not provided. Magnesium is not produced in Spain, which indicates that sulphur hexafluoride (SF₆) emissions may be insignificant. The review team was provided with data on activity levels of aluminium production in the country. However, since neither default nor national estimates of emission factors for tetrafluoromethane (CF₄) and hexafluoroethane (C₂F₆) are available, PFC emissions could not be estimated. The team was also informed that at present there is no monitoring of HFC imports, which makes it impossible to assess the national consumption and emission levels. Spanish officials expressed their determination to present emission data on other GHGs in the next national communication.

33. In order to facilitate future reviews of Spain's GHG inventories, the Government committed itself to presenting IPCC minimum tables with inventory updates. The review team was informed that the IPCC minimum tables had not been prepared this time because the CITEPA³ programme does not automatically produce them. Government officials also expressed concern that there are differences in the definition of some activities in the CITEPA "software" compared to the IPCC guidelines.

34. The in-depth review of inventories was prepared and conducted in a most transparent and facilitative manner. As a result, the presentation of Spain's GHG inventories was greatly improved during the review. A commendable effort has been made in Spain in overcoming inadequacies arising from the conversion of CORINAIR results into the IPCC format. The Spanish officials followed the methodology proposed by the CORINAIR-IPCC interface working group and used the standard CITEPA software to report emissions in the IPCC format, including the modules for air and sea traffic and fishing vessels. The team felt that this software for the conversion of CORINAIR results into the IPCC format could be useful to other Parties which have been using the CORINAIR methodology.

III. POLICIES AND MEASURES

35. The cornerstone of Spain's contribution to the mitigation of climate change is the implementation of its national energy plan 1991-2000, the first national energy plan which specifically identified the environment as a priority. Spain's mitigation measures are mainly based on the increasing share of natural gas in total energy supply and in efforts to save energy in fuel combustion, including co-generation, and to increase energy efficiency in the energy and industrial sectors. These measures are contained in the energy savings and efficiency plan (PAEE) established under the national energy plan 1991 and composed of four programmes dealing with energy savings, substitution, co-generation and renewable energies. All measures implemented or envisaged are "no-regrets" measures which target CO₂ emissions in the energy sector. The Government does not envisage measures to reduce CO₂ emissions

³ CITEPA (Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique) has developed a method which converts CORINAIR inventory data into IPCC inventory tables.

in sectors other than energy production and use, and none of the measures reported target CH₄ and N₂O.

36. The overall assessment of the PAEE in the period 1990-1995 is that promising results have been achieved in the co-generation and renewable energies programmes, while results on the energy savings and substitution programmes have not met expectations. Realistic targets have been set for each of the programmes and their progress has been closely monitored by the Ministry of Industry and Energy. Since 1990, energy savings, mainly in the industry, transport and services sectors, have reached roughly 20 per cent of the target agreed under the PAEE. The substitution programme, measured in tonnes of oil equivalent that could be produced by natural gas use instead of coal and petroleum products, has reached roughly 26 per cent of its potential. This result should be greatly improved with the entering into operation of the gas pipeline from Algeria. On the other hand, the target established for energy/heat co-generation in industry has been surpassed by roughly 35 per cent and the penetration of renewable sources of energy has achieved roughly 93 per cent of the PAEE target. Estimates indicate that co-generation capacity has increased from 1 GW in 1990 to 2.7 GW in 1995. In sum, it has been estimated that, thanks to the PAEE, roughly 4,900 Gg of CO₂, 138 Gg of SO₂ and 18 Gg of NO_x have not been emitted since 1991. The programmes have been implemented by the Ministry of Industry and Energy in cooperation with private and state-owned enterprises with a view to identifying technical options which are cost-effective and economically sound. Government contributions to PAEE activities, partially funded through European Union (EU) structural funds, have played a modest catalytic role. No binding regulatory measures have been envisaged and economic incentives are being used to a limited extent. As an example, the PAEE programme on co-generation offers a reduced tax scheme for participating firms.

37. Other mitigation measures not included in the PAEE have not had their emission reduction potential estimated. These measures include a programme promoting the uptake of environmental technologies and improved emissions monitoring in small and medium-sized industrial firms and attempts to reduce energy demand by monitoring energy consumption in more than 100 industrial sectors and promoting the shift of consumption to off-peak periods. During the review, however, the Government announced that estimates of the effects of these measures will be prepared and included in the second communication.

38. In addition to the early but mixed results of the PAEE mentioned above, several developments in the energy sector have had an important impact on Spain's GHG emissions, which explains why total emissions may grow less than expected by the end of the decade.

39. In June 1993, *Gas Natural*, the gas distribution company, acquired 91 per cent of *Enagas*, the gas import and transportation company. Together, the two publicly-owned companies account for more than 90 per cent of gas sales in Spain, which makes the combined entity one of the largest gas companies in Europe. There are no plans to open the gas market to competition. Provisional data for 1994 show a sharp 11 per cent increase from 1993 in gas consumption, mainly in power plants, in co-generation plants and in industry. A

domestic gas pipeline is being built by *Enagas*. By 2000, the share of gas in electricity production capacity is expected to rise to 15 per cent.

40. The share of coal in total primary energy supply has decreased slightly since 1990 and the national energy plan envisages that it will be less than 20 per cent by 2000. The national production of both brown lignite and hard coal has decreased considerably since 1990, while imports have remained stable. Since 1989 the Government has encouraged the closure of high-cost underground mines, which has resulted in the closure of 71 companies and the major restructuring of two public companies. More than 95 per cent of Spanish hard coal production is sold to the electricity sector. These restructuring efforts together with substantial changes in coal subsidies and the significant inroads of natural gas in electricity production and co-generation are responsible for the relative stabilization in the use of coal as an energy source in Spain. By early 1997, subsidies to coal producers will come directly from the state budget or other strictly equivalent source and be clearly separated from coal prices, while at the same time more strict cost-related conditions will be imposed on mines. Since 1995, duties on coal imports have also been abolished and an authorization is still required to import coal from non-EC producers.

41. A new law (Ley 40/1994) enacted in 1994 will enable the Government to promote competition in the distribution, generation and transmission of electricity through a bidding system. Although specific decrees are still needed to fully implement it, some modest results have been achieved in energy generation where new producers, with state agreement, will shortly be able to sell electricity to large consumers at a contract price using the national high-voltage grid. Moreover, in January 1995 a ministerial directive by the Ministry of Industry and Energy launched a demand-side management (DSM) programme in order to promote energy efficiency and savings in electricity consumption. Incentives for this programme are provided through electricity charges. In 1995, a total of Ptas 5 billion was allocated to some 10 projects in the DSM programme. Another Ptas 31 billion are expected to be allocated to additional projects in the 1995-2000 period. The projects are formulated on a voluntary basis by utility companies, and submitted to the Ministry of Industry and Energy.

42. Although a moratorium established in 1984 has stabilized the share of nuclear power at roughly 14 per cent of total energy supply, this share may be reduced with the phasing-out of obsolete plants. On a much smaller scale, the share of renewables (mostly biomass) has been 1 per cent of total energy supply. As a consequence of PAEE support to small hydropower and solar photovoltaic projects, renewables together with large-scale hydropower may represent as much as 6 per cent of energy supply by 2000.

43. A series of measures are being drafted by the Ministry of Public Works, Transport and Environment to promote energy savings and efficiency in the residential and commercial sectors. These include a requirement that any new construction or rehabilitation of government-owned housing will be submitted to energy savings standards. Also under discussion are the strengthening of insulation standards for new buildings, the promotion of solar energy use in parts of the country with particularly high potentials and the improvement of energy consumption metering. Finally, as a result of the recent inroads of natural gas in

Spain, a gradual substitution of natural gas for coal and oil has been observed in the domestic heating and cooking gas markets.

44. The transport sector consumes roughly 38 per cent of total final energy in Spain and is the second largest source of CO₂ emissions, accounting for roughly 30 per cent of the total in 1990. Although some modest sectoral initiatives have been reported, CO₂ emissions are expected to increase significantly from transport. [IEA estimated that in 1993 the sector already represented 33 per cent of energy-related CO₂ emissions.] In Spain, a number of factors have made reductions in these emissions particularly difficult. The dependence on road transport for both imports and exports has increased significantly since the late 1980s. In 1993, 36 per cent of total exports and 20 per cent of total imports were transported by road. Moreover, the geographical distribution of the population, which is mostly concentrated in the Mediterranean and Cantabrian belts, coupled with the apparent reduced potential for long-distance rail transport, has made the use of cars, for both freight and leisure, the obvious alternative. Existing railways are, in general, obsolete and appear competitive with road transport only in the very densely populated interurban belts. On the other hand, the number of cars per person is still lower than the European average and far from saturation level. The review team was informed, however, that the railway authorities have a programme to build a Mediterranean rail corridor before 2000.

45. Past experience has also confirmed that demand is very inelastic in response to changes in gasoline prices. The Government has estimated that only very significant increases in fuel prices could effectively lower current demand. On the other hand, such price increases seem very unlikely because of their inflationary impacts and Spain's commitment to a strict fiscal and monetary policy within the EC.

46. Urban transport is estimated to account for 60 per cent of total energy consumption in the transport sector. In addition to mitigation benefits, a reduction in urban transport could be expected to provide tangible local benefits such as reduced local air pollution and traffic congestion. Specific measures being implemented in the urban transport sector include a limitation on the number of parking places in new buildings, increased parking space close to public transport stations, the creation of preferential bus lanes in some cities, the introduction of liquefied natural gas as fuel for buses and the promotion of biofuel through subsidies from the EC. Their effectiveness in terms of mitigating CO₂ emissions has not been ascertained since estimates were not provided on their individual or collective effects. The team strongly recommended that an attempt be made in this regard with a view to assessing current efforts and assisting policy-making.

47. The team noted that gasoline prices in Spain are among the lowest range in the EC, which could partly explain the preference for transport by private car. The team also confirmed that transport measures mentioned in the communication have continued to be applied in 1994 and 1995. These include a tax exemption on fuel used in the railway system, some limited credit benefits for bus companies and investment programmes to promote railway use around big cities. A quantification of their specific effects in terms of GHG emission reductions was not provided. Although some of the measures seem promising, all

are still incipient in their implementation phase and little information was provided on their monitoring.

48. The policies in the forest sector are part of an overall strategy to control erosion and prevent desertification. Currently, there is an ambitious programme of soil conservation, forest protection and conservation and afforestation activities. The programme targets include the afforestation by 2000 of 1,600,000 ha and the conservation of another 1,330,000 ha. In addition, an active programme aimed at controlling forest fires is in place. Since 1977 forest fires have consumed roughly 67,000 ha of Spanish forests each year, or 1 per cent of total forest area. In 1994, 400,000 ha were affected whereas in 1995 less than 40,000 ha were damaged by fires. It is projected that the total forest cover will increase from 11,200,000 ha in 1990 to 12,400,000 ha by 2000, increasing the CO₂ uptake by Spanish forests from 23,170 Gg in 1990 to 25,700 Gg in 2000.

49. The implementation of these programmes comes under the aegis of the Autonomous Communities and is coordinated at the national level by the Central Administration. There are two basic programmes to support afforestation and forest conservation activities: FEDER and FEOGAR (agriculture), both described in the national communication. The undertaking of these programmes depends heavily on access to EU restructuring funds. For 1995, Ptas 23,700 million has been approved under FEDER and Ptas 16,000 million under FEOGAR. There are no data available on the degree of achievement of the targets planned for the year 2000.

50. It was explained during the review that once funds are approved, the implementation of afforestation projects is very effective and approved schedules are strictly followed. This is partially because there is close monitoring, but also because afforestation activities represent a net income for farmers. The acute drought that is currently affecting the Mediterranean belt has slowed down the afforestation programmes planned for 1994 and 1995.

51. No measures targeting methane emissions in the waste sector were reported in the communication, although 23 per cent of the national total in 1990 originated in this sector. During the review, the team was informed that no charges are applied to promote better waste management and that several information campaigns have been introduced by some local authorities. Much potential has been identified for CH₄ removal from landfills and its use for energy purposes.

52. No information was provided on measures in the agriculture sector which could have an effect on N₂O emissions and no funds are available for improved cattle breeding. No explicit measures on N₂O emissions from the use of fertilizers were reported.

IV. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES

53. The review team noted that Spain has not followed the reporting guidelines in so far as projections for N₂O and CH₄ emissions in 2000 were neither reported in the communication nor provided during the review. Government officials explained that data on

current activity levels where these emissions originate are not reliable, which renders the estimation of future emissions very difficult. The team noted, however, that national inventories prepared with the CORINAIR methodology do contain basic data which could be a starting point for 2000 projections of these GHGs. During the review, it was felt that coordination among ministries concerned and the provincial and local levels of government could be enhanced for the preparation of future projections. The team strongly recommended that attention be given to these projections in the next communication.

54. CO₂ projections only included emissions from fuel combustion. No projections were provided for CO₂ emissions produced through industrial processes or in the agriculture, land-use change, forestry and waste sectors. Fuel combustion CO₂ projections were updated during the in-depth review to take into account additional updated information on growth rates in several sectors of the economy from 1990 to 1994. The Spanish economy grew by 2.2 per cent in 1991, 0.7 per cent in 1992, minus 1.1 per cent in 1993 and 2.1 per cent in 1994. As a result of this lower economic growth in the early 1990's, the adjusted projections indicate a smaller increase in emissions by 2000 than originally expected. The projections were made using the IEA figure for CO₂ energy-related emissions in 1990 (218,000 Gg) which differ from the fuel combustion CO₂ total reported in the national GHG inventory (209,425 Gg). No temperature or other statistical adjustments were made to CO₂ levels in the baseline year. The review team strongly suggested that future projections be based on 1990 emission levels estimated in the national GHG inventory to take account of emissions in all economic sectors. Assuming that the PAEE objectives are fully met in 2000, three scenarios were presented:

- (a) National energy plan scenario: with an annual GDP growth of 3.6 per cent from 1995 to 2000, fuel combustion CO₂ emissions would be 20.2 per cent higher in 2000 compared to 1990;
- (b) Intermediate scenario: GDP growth of 3 per cent from 1995 to 2000 would lead to a 15.8 per cent increase in fuel combustion CO₂ emissions by 2000;
- (c) Low growth scenario: GDP growth of 2 per cent from 1995 to 2000 would lead to a 9.8 per cent increase in fuel combustion CO₂ emissions by 2000.

55. The original projections presented in the communication were based on estimates formulated in the national energy plan, which indicated a 24.8 per cent increase in CO₂ emissions from 1990 to 2000. This scenario did not include emissions of GHGs other than CO₂ or of precursors, nor did it consider sources of CO₂ emissions other than fuel combustion. Also, it did not include the possibility of CO₂ sequestration in 2000.

56. In preparing the national energy plan scenario, the Ministry of Industry and Energy assumes full implementation of the PAEE and does not incorporate possible emission reductions resulting from measures being implemented or envisaged in the transportation, residential and commercial sectors since it is assumed that they are not expected to generate significant emission reductions. During the review, however, the team was informed that there is an ongoing attempt to assess the possible effects of such measures.

57. The team was informed that the Government used a MEDE/MIRAD energy model to produce the projections mentioned above. In so doing, the following assumptions were made:

- (a) Oil prices remain constant in real terms throughout the period;
- (b) Natural gas share increases from 6 to 12 per cent as a source of primary energy in Spain (assuming the opening of the gas pipeline from Algeria in 1996);
- (c) There is no change in the current moratorium on the construction of new nuclear plants (although some existing plants will become obsolete and will be decommissioned);
- (d) There is a gradual and slow-paced substitution of coal by natural gas and renewables (according to the PAEE, the share of coal falls from 7 per cent in 1990 to 4.8 per cent of total final energy consumption by 2000).

58. In the new projections revised during the review, GHG emissions in the transport sector are expected to increase from 16 per cent of the total in 1990 to 23 per cent in 2000, depending on the annual GDP growth rate assumed. The review team noted that oil accounted for 54 per cent of primary energy consumption in 1994 and that, in general, primary energy and final energy consumption have increased more slowly than projected in the national energy plan, although the growth rate in the consumption of oil products is significantly higher than what was estimated in the plan.

59. During the review, the team was provided with new information indicating that CO₂ sequestration is now projected to increase slightly, from 23,170 Gg of CO₂ in 1990 to 25,700 Gg in 2000. Preliminary projections were also provided for the year 2005 and 2010 indicating a CO₂ uptake of 26,800 Gg and 27,900 Gg, respectively.

60. The projections provided during the review substantially changed the information contained in the communication and offered first crude estimates of the potential future carbon sink capacity of Spanish forests. However, as with the estimates for the GHG inventory, it is suggested that a more comprehensive approach be used to include other GHGs and other sectors. Improvements in future reporting could include updated data on the average forest area affected by fires, estimates of emissions from deforestation and forest fires separate from carbon sequestration by forest growth and afforestation activities. Finally, the team felt that Spain has information available on possible impacts of climate change on its forests. As in the case of the impacts of fires on forests, it was suggested that a discussion of such impacts and the associated changes in CO₂ uptake be considered in future communications.

V. PROJECTED PROGRESS IN GREENHOUSE GAS MITIGATION

61. Although projections for CH₄ emission levels in 2000 were not provided, partly because of the admittedly high level of uncertainty associated with their estimates, the review team noted that some measures envisaged in the PAEE, especially in the coal mining sector, are likely to result in significant reductions in these emissions. The team strongly recommended that an attempt be made to assess the mitigation effects of these measures.

62. The fuel substitution programme within PAEE to enhance the use of natural gas had achieved less than 30 per cent of its potential by 1995, but the entering into operation of the gas pipeline from Algeria planned for late 1996 is expected to generate significant emission reductions in the latter part of this decade.

63. The PAEE projected a 12 per cent increase in energy efficiency in the Spanish economy (primary energy consumption per unit of GDP) for the period 1990-2000. By 1995, energy efficiency has increased by 4.4 per cent as compared to 1990.

VI. EXPECTED IMPACTS OF CLIMATE CHANGE

64. Spain has used the "regionalized" Hadley Centre model for South Europe to prepare scenarios of possible impacts of climate change on its territory. The results achieved have not been calibrated to the specific country conditions. The team was informed that a national climatic modelling group has been established to work on vulnerability studies in Spain. It was felt that this group could focus attention on issues such as interannual variability in precipitation levels, time series of days with maximum and minimum temperatures above average levels and precipitation levels in short time intervals. The team noted that these studies on Spain's vulnerability to climate change could play a useful role in improving land use planning and in the formulation of preventive adaptation (and mitigation) measures.

65. In relation to the climatic profile, the review team was provided with maps of annual average temperatures and precipitation levels. Extensive information was also provided on the correlation between those indicators and vegetation patterns found in different regions of Spain. Drought has been recognized as a very serious environmental and economic problem in Spain. Although the phenomenon is described as an important result of climatic changes, anthropogenic activities are not identified amongst the causes, except for unsustainable land use and excessive deforestation. The occurrence of drought has been typically associated with soil erosion resulting from intensive rainy periods and a decreasing water retention capacity of poor soils.

66. During the review, the team was informed that the need has been identified for promoting intersectoral studies on possible socio-economic impacts of climate change, especially the extent to which climate change could affect important sectors of the economy such as tourism. The studies undertaken so far are mostly of an academic nature with limited use to policy-makers.

67. In Spain, no adaptation measures as such are being implemented or planned.

VII. FINANCIAL ASSISTANCE AND TECHNOLOGY TRANSFER

68. In accordance with Article 4.5 of the Convention, Spain contributed US\$ 14.1 million to the pilot phase of GEF and US\$ 17.3 million to its first phase. During the review visit, information was made available regarding Spain's official development assistance (ODA) for the period 1989-1994. The ODA/GDP ratio was 0.29 per cent in 1994 and 0.25 in 1995, although it was intended to be 0.35 per cent in 1995. The unexpected decrease was due to cuts in the State budget necessitated by commitments connected with the creation of an European monetary union. Although the team was not informed of any further increase in the ODA/GDP ratio expected for the coming years, the Government stated that, in principle, there is an intention to increase it to 0.5 per cent, in response to an expressed wish by Spanish society that ODA be increased.

69. No new initiatives regarding technology transfer were reported during the review. The communication, however, mentioned existing programmes to promote technological innovation and the dissemination of technologies in developing countries. It also described Spain's initiatives in Bolivia and North Africa in the area of photovoltaic electricity production.

VIII. RESEARCH AND SYSTEMATIC OBSERVATION

70. Spain has a vast systematic observation network including over 100 main climate stations, 90 synoptic stations, 6 atmospheric pollution stations and thousands of pressurization, wind and precipitation stations. Most of the climate-related research described in the communication and its review refers to the improvement of climate observation and to Spain's contribution to international programmes such as the EC Global Change Research Network.

IX. EDUCATION, TRAINING AND PUBLIC AWARENESS

71. During the review considerable additional information was provided to the team on public awareness and the dissemination of information regarding climate change. The Government will be enhancing the existing programmes with a view to raising awareness about consumption patterns and industrial practices associated with anthropogenic climate change. In this regard, the team felt that meetings with non-governmental organizations (environmental, trade unions and business) were most useful in demonstrating their high level of analysis of the causes of climate change and its possible impacts in Spain.

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