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Zambia: Enabling activities for the preparation of the initial national communication related to the United Nations Framework Convention on Climate Change

Final evaluation report

by

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Abbreviations and acronyms

CEEEZ	Centre for Energy, Environment and Engineering in Zambia
DANIDA	Danish International Development Agency
DSSAT	decision support system for agrotechnology transfer
ECZ	Environmental Council of Zambia
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDL	Geophysical Fluid Dynamics Laboratory
GTZ	German Agency for Technical Cooperation (Gesellschaft für Technische Zusammenarbeit)
IBSNAT	International Benchmark Sites Network for Agrotechnology Transfer
IPCC	Intergovernmental Panel on Climate Change
LEAP	long-range energy alternative and planning system
SO_X	oxides of sulphur
UCCEE	UNEP Collaborating Centre on Energy and Environment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USCSP	United States Country Support Programme
ZESCO	Zambia Electricity Supply Company

Executive summary

A. Background

1. The evaluation starts by introducing Zambia's national circumstances. Its economy is based on copper mining, which accounts for over 95 per cent of its foreign exchange earnings. Zambia derives its electricity mainly from hydroelectric power, which provides about 13 per cent of the country's total energy needs. Sources of greenhouse gases are found in the form of woodland, charcoal, petroleum and coal.

2. Zambia's interest in environmental issues dates back to 1985, when the country developed its first environmental policy – the National Conservation Strategy.

3. The Zambian national environmental action plan was a milestone document in providing guidance on the environmental management of Zambia. The country is party to 30 environmental conventions, including the United Nations Framework Convention on Climate Change.

4. Climate change studies in Zambia were first carried out in 1994 under the financial sponsorship of the German Agency for Technical Cooperation (GTZ). This first project identified mitigation options in the energy sector (residential and industrial), as well as forestry issues (charcoal production). Other studies (vulnerability and adaptation assessments) and mitigation options were sponsored by the United States country studies programme (USCSP).

5. The evaluation looks at the objectives of this Global Environment Facility (GEF)-funded project, which are to enable Zambia to fulfil its obligations under articles 4, paragraph 1, and 12, paragraph 4, of the Framework Convention on Climate Change.

6. The project was carried out by the Environmental Council of Zambia (ECZ) under the policy guidance of the national climate change steering committee, which is chaired by the Permanent Secretary of the Ministry of Environment and Natural Resources.

7. The Director of ECZ is the national coordinator of climate change activities and is assisted by the climate change coordinator in carrying out the various climate change programmes, while a national team of experts carries out individual aspects of the studies.

8. The evaluation looked at the activities of the project, which were divided into nine segments whose outputs were eventually synthesized to produce the initial national communication. These activities were classified as in table 1:

Table 1: Activities and outputs classification

Activity	Output
(a) Establishment of project management and national study teams	To facilitate the elimination of operating problems
(b) Preparation of greenhouse gas inventories	Inventory of greenhouse gases
(c) Creation of a programme to assess climate change and its adverse impact	Identification and assessment of mitigation options – mitigation strategies workshop report
(d) Comprehensive climate change assessment	Policy options for monitoring systems and response strategies
(e) Establishment of a policy framework for implementing adaptation measures	Identification and assessment of adaptation options
(f) Capacity-building to integrate climate change concerns into planning	Enhanced capacity for decision makers to integrate climate change concerns into planning
(g) Promotion of programmes related to sustainable development, research and public awareness.	Enhanced public awareness at all levels – information packages and videos
(h) Provision of other relevant information	Adequate information on obligations under the Convention
(i) Preparation of national communication	Initial national communication to be submitted to the Convention secretariat.

9. Although the actual work was carried out by teams of experts, the results were discussed by stakeholders in a series of workshops held at different stages of the project. This helped with capacity-building for future climate change activities.

10. While the project succeeded in achieving most of the objectives laid out in the project document, particularly the initial national communication, one of the major weaknesses was the failure to establish the national climate change steering committee at the beginning of the project. This timing was necessary so that the steering committee could give policy guidelines for the execution of the project, but it was only formed in February 2000 and met once in April, two years after the project had started.

11. Other weaknesses associated with project performance and outputs included:

- Failure to establish regular updating of the greenhouse gas inventory;
- Lack of local emission factors, necessitating the use of the Intergovernmental Panel on Climate Change (IPCC) default factors, which compromised the quality of emissions data.

12. The UNEP task manager monitored the progress of the project through technical back-up visits, e-mails and quarterly reports submitted by the project coordinator.

13. The Director of ECZ ensured overall supervision of the project, while the project coordinator's role was to harmonize the previous studies with the results from the current project.

14. The project activities assisted Zambia in preparing greenhouse gas inventories, identifying mitigation options, carrying out vulnerability and adaptation assessments as well as improving its

observation network for climate-change-related parameters. These activities all contributed to the preparation of the initial national communication.

15. Some of the major recommendations put forward by the evaluation are:

- Zambia should prepare a national action plan soon after submission of its initial national communication so as not to lose momentum in its climate-change-related activities;
- Project proposals distilled from the initial national communication should be prepared for submission to the donor community;
- Zambia should set up a mechanism for the regular collection of activity data on greenhouse gas emissions, which should facilitate the future preparation of national communications;
- There is need for expedited capacity-building in climate change issues, particularly in mitigation and vulnerability and adaptation studies;
- There is need for more research, particularly into the derivation of local emission factors.

B. Conclusion

16. This GEF enabling activity has assisted Zambia to produce its initial national communication for submission to the secretariat of the Framework Convention on Climate Change as required by the Convention. Furthermore, this activity helped Zambia in its capacity-building efforts, since all the work was done by local consultants.

I. Background information

A. National circumstances

1. Zambia has a population of almost 10 million people, and 43 per cent of this population is urbanized. The country's economy is based on copper mining, which accounts for over 95 per cent of its foreign exchange earnings, followed by the agricultural sector which accounts for about 20 per cent of gross domestic product (GDP).

2. Zambia derives its electricity mainly from hydroelectric power generation. The installed power generation capacity is 1,700 MW, which provides about 13 per cent of the country's total energy needs. Wood and charcoal are mainly used for household energy, providing about 66 per cent of the national total energy needs. Most industries use petroleum products (imported) for their energy needs. Coal accounts for 9 per cent of the energy needs. These three sources of energy lead to relatively high greenhouse gas emissions.

3. Zambia's concern for the environment goes back to 1985, when the country developed its first environmental policy – the national conservation strategy – which eventually led to the formation of the Environmental Council of Zambia (ECZ), under which this enabling activity falls. Zambia is party to 30 environmental conventions, including the United Nations Framework Convention on Climate Change.

B. Climate change studies before the GEF enabling activity

4. In August 1994 the Ministry of Energy and Water Development, with the help of a GTZ grant, commenced work on greenhouse gas emissions and mitigation assessment. Under this project, options for mitigating climate change were identified in the residential and industrial energy sector and in the forestry sector (charcoal production). A local non-governmental organization – the Centre for Energy, Environment and Engineering in Zambia (CEEEZ) – conducted the studies.

5. In October 1994, Zambia undertook some climate change studies on greenhouse gas inventories, mitigation and vulnerability assessments, as well as adaptation options. This work was performed by ECZ with financial support from USCSP. The final results of these studies were submitted to the Zambian Government in December 1997.

6. Again in 1994, Zambia was included in a regional (United Republic of Tanzania, Zambia and Zimbabwe) study on climate change mitigation, supported by the Danish International Development Agency (DANIDA) through the UNEP Collaborating Centre on Energy and Environment, at the Risø National Laboratory in Denmark. The emphasis of this study was on capacity-building on the methodological side of mitigation analysis. The study was carried out by CEEEZ on behalf of the Ministry of Environment and Natural Resources. The country as a whole became involved through the holding of stakeholders' workshops to discuss the results of these studies.

C. Background material for the preparation of the initial national communication

7. Background literature for the associated studies was drawn from several sources, such as the 1996 revised IPCC guidelines for non-annex I parties for the preparation of initial national communications.

8. Initial national communications submitted to the Framework Convention on Climate Change secretariat by both annex I and non-annex I parties were also used in compiling the Zambian initial national communication. The considerable international exposure to climate change issues experienced by both the Director and the project coordinator before and during the execution of the project proved to be an asset during this exercise.

9. The table below shows the type of climate change studies that have been conducted thus far in Zambia.

Table 2: Summary of climate-change-related activities

Activity	Support	Components	Collaborating institutions
(a) Work on greenhouse gas emissions, inventory, vulnerability, adaptation and mitigation	USCSP	• Inventory • Vulnerability and adaptation • Mitigation • Public awareness	• Meteorological Department • Meteorological Department • Forestry Department • ECZ staff
(b) Measures to implement the Framework Convention on Climate Change	GTZ	• Inventories • Mitigation	• University • ZESCO • Dept. of Energy
(c) Climate change mitigation in southern Africa: Zambian national study	DANIDA	• Methodological development • Mitigation analysis • Macroeconomic assessment • Implementation issues	• Dept. of Energy
(d). Work on the preparation of the initial communication	UNDP/ UNEP	• Inventories • Mitigation • Public awareness	• Dept. of Energy • ZESCO • Met. Dept
(e). Energy efficiency and conservation: Survey of industrial boilers	World Bank	• Energy efficiency • Barrier identification	• Dept. of Energy

All these studies provided background support to the GEF enabling activity on the initial national communication.

D. Objectives of the GEF enabling activity

10. The GEF enabling activity was executed through UNEP under the direct supervision of the UNEP task manager. The objective of this study was to enable Zambia to fulfil its obligations under the Framework Convention on Climate Change, as required by articles 4.1 and 12.4 – the preparation of the initial national communication on the guidelines issued by the Conference of the Parties at its second meeting. The funds for this project were obtained under the GEF operational guidelines for expedited financing of initial national communications for non-annex I parties (February 1997).

11. The Convention entered into force in March 1994 and Zambia was scheduled to submit the initial national communication in 1997. Funds for this purpose, however, were not available until later in 1997. Accordingly, Zambia will submit its initial national communication in early 2001, thus meeting its commitments and obligations as required by the Framework Convention on Climate Change.

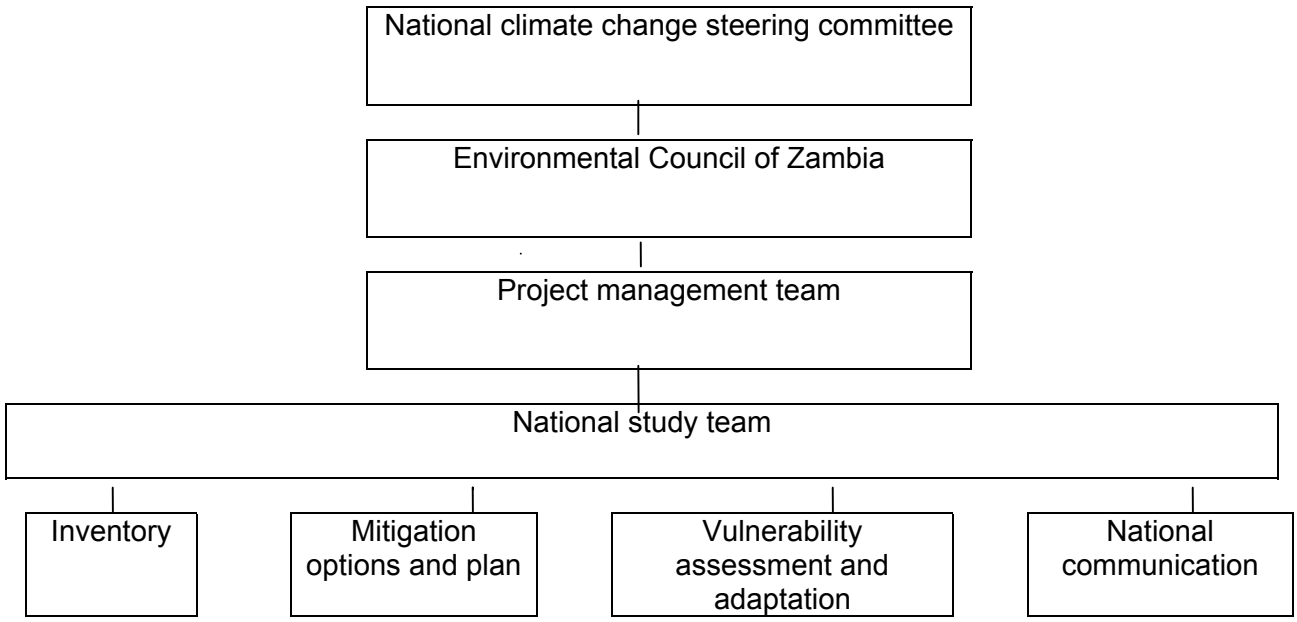
E. Institutional arrangements for execution of the study

12. The figure below illustrates the operational structure of the project, which consists of four hierarchical levels. The project was carried out by ECZ under the policy guidance of the national climate change steering committee chaired by the Permanent Secretary of the Ministry of Environment and Natural Resources.

13. ECZ houses the secretariat of the national climate change steering committee, which was formed to provide policies and strategic guidance for the implementation of the enabling activities for the preparation of the initial national communication, as well as policy guidelines in general. In addition, the steering committee reviews the quality of climate change reports. Its membership is made up of senior policy planners drawn from key economic sectors, and it is entrusted with the added responsibility of ensuring the successful integration of study results into national development plans. The composition of the national climate change steering committee is shown in annex I.

14. The Director of ECZ is the national coordinator of climate change activities and is assisted by a climate change coordinator to help streamline the various programmes. These programmes are conducted through studies by a national team of experts, as shown in the climate change organization structure below (figure 1).

Figure 1: Project management structure



II. Project activities

15. The execution of the project was strategically divided into groups of activities whose output was subsequently synthesized to produce the Zambian initial national communication.

16. These activities were carried out in the order dictated by project requirements. Established IPCC guidelines and methodologies, including lessons from past and contemporary climate change studies, formed useful reference material for the study. The nine activities and their relevance to the whole study are discussed in the following sections.

A. Activity 1: Establishment of the project management and national study teams

17. Under the auspices of ECZ, the project management team (director, coordinator and the national study team) undertook studies on greenhouse gas inventories, mitigation options, vulnerability and adaptation assessments and preparation of the initial national communication. A local non-governmental organization, CEEEZ, prepared the greenhouse gas inventories.

18. Each group of experts in the different segments was drawn from both the private and public sectors, including non-governmental organizations with experience in climate change issues. The project coordinator provided guidance to the hired consultants, assisted by a secretary and a project accountant.

19. The major objective of activity 1 was to get the organizational structure to produce the desired results with minimum hitches.

B. Activity 2: Preparation of greenhouse gas inventories

20. Initially, all existing activity data were collected and critically analysed to identify any gaps. Since greenhouse gas inventory studies had also been prepared under the USCSP and by GTZ, it was imperative to utilize all the results so as to produce a true picture of the sources and sinks of greenhouse gases.

21. The inventory group produced an updated inventory based on the latest version of the IPCC guidelines. On the recommendation of IPCC, 1994 was used as a baseline year to facilitate comparison. Decision 10/CP.2 of the Conference of the Parties at its second session was the basis for the preparation of these greenhouse gas inventories.

22. Under the USCSP and the GTZ project, the activity data were derived from the following sources: coal processing and use; mining; petroleum industry processing and use; petroleum use in transport; wood fuel including fuel wood and charcoal; harvesting conversion and consumption; illegal landfill waste dumps for both CH_4 and CO_2; the cement-processing industry; fertilizer manufacturing and use; agriculture and related activities; natural forest burning and land use change; and industrial and domestic waste water.

23. The major outputs from greenhouse gas inventories were, first, a streamlined and comprehensive greenhouse gas inventory based on new activity data, taking account of the work done under the USCSP and the GTZ project; second, identification of any shortcomings and gaps in the IPCC guidelines with respect to local conditions; third, the need for original research to come up with new emission factors for specific activities; and, fourth, the strengthening of the inventory team drawing on previous studies.

C. Activity 3: Programme to address climate change and its adverse impacts, including abatement and sink enhancement

24. The mitigation study team drew on the experience of previous studies (USCSP and GTZ/DANIDA/UCCEE) in conducting the mitigation analysis task. It was carried out using the long-range energy alternative and planning system (LEAP) model, which had been used for energy planning purposes in the country for the past 10 years and considered an appropriate tool for addressing the transport and biomass energy mitigation issues of Zambia. In any case, it was the tool used in the DANIDA regional study involving Botswana, the United Republic of Tanzania and Zimbabwe. The group also benefited from the LEAP training workshop in February 1997 following the UNEP/GEF guidelines. Results of the studies were reviewed at the appropriate stakeholders' workshops.

25. Outputs of this study were the following:

- Identification of mitigation options;
- Recommendations on reducing the intensity of emissions from various sources and the enhancement of sinks;
- Preparation of the national mitigation strategy for including in the initial national communication;
- A mitigation report for the stakeholders' conference.

D. Activity 4: Policy options and response strategies

26. USCSP made the first serious attempt to assess potential impacts and draft response strategies on agriculture and water resources. This study extended the assessments to other sectors, such as forestry, human health, wildlife, fisheries and livestock.

27. The IPCC technical guidelines were followed for this study, and use was also made of the methodology developed by the first phase of the UNEP country case studies on climate change impacts and adaptation assessments. This study helped to identify and develop response strategies. A stakeholders' workshop was convened to review the results.

28. Major outputs of the study included:

- Development of the necessary baseline data for assessing climate change vulnerability and adaptation;
- Establishment of procedures for comprehensive vulnerability;
- Holding of a stakeholders' workshop to review the results.

E. Activity 5: Policy framework for implementing adaptation measures and response strategies

29. Activity 5 consisted of a critical review of the identified adaptation options in USCSP. The areas included were agriculture, water resources, forestry, wildlife, fisheries, livestock and human health. The project identified the potential stage I adaptation options and suggested strategies for integrating climate change information into national planning processes. As with the other activities, a stakeholders' workshop was held to review the results of the study.

30. The major outputs of this activity were:

- Identification of adaptation (stage I) options;
- Creation of a policy framework for implementing adaptation measures and response strategies.

F. Activity 6: Building capacity to integrate climate change into planning

31. The process of preparing the initial national communication involved elements of capacity-building to integrate climate change concerns into national planning, both medium-term and long-term. This included a workshop on education and training on climate change for national development planners.

32. The major output of this workshop was the building of capacity in climate change issues.

G. Activity 7: Programme related to sustainable development, research and public awareness

33. This activity identified and developed programmes on climate change that are related to sustainable development, research, systematic observations, education and public awareness, etc.

Furthermore, the successful implementation of the Framework Convention on Climate Change in Zambia hinges on public involvement. Two training workshops for media personnel and government planning officers were held, in which the participants worked towards developing a cost-effective public awareness programme. Campaigns were conducted in both the public and private media (radio and newspapers) through feature articles and radio interviews on climate change. The project coordinator participated in a regular radio programme on the topic of environment for sustainable development and produced a quarterly newsletter covering climate change issues in Zambia.

34. The major outputs of the activity were information packages, video aids and other relevant publications.

H. Activity 8: Provision of other information

35. The aim of this activity was to provide any other information that would help fulfil the objectives of the Framework Convention on Climate Change; for example, it identified financial and technical needs associated with the proposed projects and response measures included in article 4 of the Convention.

I. Activity 9: Preparation of national communication

36. The preparation of the initial national communication is the culmination of activities 2-8.

37. This task involved all members of the project management team and the national study team, each of which prepared relevant sections of the initial national communication. A draft document was reviewed by the relevant technical institutions and will also be reviewed by the national climate change steering committee, before it is submitted to the Government and finally to the secretariat of the Framework Convention itself.

38. This activity helped in the selection of the Ministry of Environment and Natural Resources as the focal point for national climate change.

39. Major outputs were as follows:

- A Zambian national focal point was designated for the Framework Convention, thus enabling Zambia to participate fully in global programmes on climate change and to benefit from such programmes;
- The initial national communication will soon be submitted to the secretariat of the Framework Convention.

III. Project implementation

A. Institutional framework

40. Under the auspices of the Ministry of Environment and Natural Resources, this project was supported by the national climate change steering committee and carried out by ECZ, with the support of the ministries of energy and water development, agriculture, food and fisheries, commerce, trade and industry; the Department of Natural Resources; the National Commission

for Development Planning; the Department of Transport and Telecommunications; the Department of Forestry; the Department of Meteorology; and the National Institute for Scientific and Industrial Research;

41. Rather late in the day a national climate change steering committee was formed to guide the implementation of the project and to provide overall policy advice. This committee is chaired by the Permanent Secretary of the Ministry of Environment and Natural Resources – now designated the national focal point for climate change. To ensure continuity and speedy implementation of the project, a project coordinator was appointed in accordance with the recommendation in the project document.

42. At a lower level, each segment of the project management team had a director, coordinator and group leader. The project management team liaised with the national study teams as reflected in the project's organizational structure.

43. Experts from the University of Zambia, research institutions, the private sector and non-governmental organizations (e.g., CEEEZ) were employed where appropriate; one of the objects of the project was to strengthen the existing institutional framework for project management where necessary.

44. As the GEF implementing agency for this project, UNEP, through its Atmosphere Unit, with the support of the Nairobi-based Regional Office for Africa and the UNEP Collaborating Centre on Energy and Environment based in Denmark, gave technical support and acted in an advisory role to ensure the successful implementation of the project. The project coordinator expressed to the evaluator his high appreciation of the UNEP task manager's willingness to assist at every stage of the project. The GEF evaluation team also visited the project for an on-the-spot assessment in April 2000.

B. Project budget

45. Since the operations of the project are standard enabling activities as defined by the GEF operational criteria, so the incremental cost for undertaking these activities is also calculated at the standard rate. The project budget of $256,000 reflected the extent of the proposed activities, as well as the specific needs and concerns of Zambia. The size of the project budget was arrived at by taking into account the number of activities to be accomplished – i.e., institutional strengthening, training and education components, greenhouse gas inventories, vulnerability assessments, mitigation assessments, adaptation and response strategies. The budget was given an estimate by various stakeholders and ECZ and fully endorsed by the GEF focal point for Zambia. The contribution of the Government of Zambia (both in cash and in kind) amounted to $60,000, which covered salaries for technicians and other supporting staff, vehicles for field trips and their maintenance, office rentals, communication, etc.

C. Financial disbursement

46. UNEP disbursed the funds to run the project in three tranches. The procedure followed was that the project coordinator would write a memorandum on the expenditure (workshops, payment of consultants, etc) to the director, and the director would respond. The approved funds would be paid by the accountant of the project.

D. Training

47. Training activities were at the heart of the project. These included training workshops within the country as well as international workshops organized by the National Communication Support Programme, the secretariat of the Framework Convention on Climate Change and UNEP. Among these was a greenhouse gas inventory training workshop which was held in Nairobi in January 1999 and attended by the project coordinator and a member of the inventory group of the national study team. Another training workshop on mitigation assessments held in Nairobi in March 2000 was also attended by a member of the mitigation group of the national study team.

48. The project coordinator trained the mitigation analysis team on the use of the LEAP mitigation model, on which he and two other members of the national study team had attended a training course before the implementation of the project. The project also benefited from the training associated with the GTZ, USCSP and DANIDA studies.

E. Monitoring progress of the project

49. The first disbursement of funds was received in October 1997, after which a workshop was held to allocate tasks to different working groups. The task manager from UNEP attended this workshop.

50. Draft summaries of project progress were sent on a quarterly basis to UNEP, the GEF implementing agency. UNEP took advantage of modern technology to send its responses largely through e-mail, a cost-effective and speedy channel.

51. Locally, the progress of the project was monitored mainly through a series of stakeholders' workshops held after each segment of the study. The rationale for these workshops was to present the results to the stakeholders for critical review and also to disseminate information on climate change. This proved to be an effective way of monitoring the project.

52. The final draft of the initial national communication was sent to the UNEP task manager for comments.

53. The stakeholders' technical workshops were designed to review the progress made by the different teams. This included checking for consistency among the different teams as well as among the different tasks undertaken, the preparation of greenhouse gas inventories, mitigation options, vulnerability and adaptation, public awareness, education and training and finally the synthesis of all these segments in the initial national communication.

IV. Technical aspects

A. Greenhouse gas inventories

54. The greenhouse gas emissions and their sinks reported in Zambia's initial national communication used 1994 as a base year. The source categories of these emissions were energy, industry, agriculture, land use, changes in land use, forestry and waste management. The major greenhouse gases considered were carbon dioxide, methane and nitrous oxide.

55. Non-CO_2 gases whose emissions have a direct effect on climate change are oxides of nitrogen, carbon monoxide and non-methane volatile organic compounds. These emissions were also considered under this project. The methodology used for these computations was based on the revised IPCC guidelines for 1996. Most of the emission factors used were the IPCC default values.

56. Emissions from agriculture - methane, nitrous oxide, carbon monoxide and nitrogen oxides - were determined from five sources: domestic livestock (entric fermentation and manure management); rice cultivation (flooded rice fields); prescribed, savanna burning; field burning of agricultural residues; and agricultural soils.

57. Emissions from land use change and forestry in Zambia originate mainly from on-site forest biomass burning, forest biomass decay and off-site burning of firewood and charcoal. The amount of biomass burning in Zambia depends on the type and purpose of forest clearing, which include shifting cultivation, permanent cultivation, selective logging in natural forests and clear-cut logging in managed plantation forests. From the determination of these emissions it was found that most of the emissions from Zambia are from land use and land use change and forestry, with 69 per cent of the total emissions, followed by energy (16 per cent) and agriculture (13 per cent).

B. Mitigation options

58. Mitigation options to reduce greenhouse gas emissions were identified. They were classified into energy supply and demand mitigation options.

1. Energy supply mitigation options

59. The supply-side mitigation options are as follows:

- The traditional energy supply subsector consists of wood fuel, mainly consumed by rural dwellers. Mitigation measures in this subsector include improving the charcoal production process through the use of charcoal burners and other projects in biomass conservation;
- Under the commercial energy supply subsector, the consumption of coal, hydro-electricity and petroleum are pre-eminent. The relevant mitigation option under this sector includes the development of a mini-hydropower station to replace diesel generators;
- Mitigation options for the petroleum industry include the streamlining of operations in order to increase energy efficiency. This could be achieved by sealing leakages along the Tazama pipeline and boosting the efficiency of the Indeni oil refinery.

2. Energy demand mitigation options

60. The three mitigation options in the household sector are:

- First, employing energy-efficient cooking stoves to reduce greenhouse gas emissions as well as conserving wood fuel and charcoal;
- Second, switching to cleaner fuels like solar energy – this includes the promotion of wider applications of technologies using new and renewable sources of energy. Some 400 housing units in Eastern Province will be provided with solar energy;

- Third, within the transport sector, the mitigation options include improving the technical efficiency of vehicles by enforcing the legal certification of vehicles as well as introducing regulations governing vehicle emission levels. Other programmes, such as pooling of transport among commuters and use of fuel blended with ethanol, would reduce emissions of greenhouse gases. The use of blended fuel would also save foreign currency, calculated at 15 per cent of the total petroleum bill.

3. Mining mitigation options

61. Mitigation options in the mining sector include rehabilitation of the Nkana copper mine smelter. Some of these options include:

- *Replacing the reverberatory smelters with flash smelting furnaces*. Studies have shown that the flash melting technology has a calculated energy intensity of 4.352 GJ/ton of copper. This is lower than that for the reverberatory smelting technology quoted at 17.406 GJ/ton of copper;
- *Switching from diesel fuel to electricity in load-haul-dump machinery*: A fleet of heavy dump trucks at Nchanga open-pit mine, previously using diesel, have been adapted to take electric power from a trolley mine system – thereby saving diesel fuel. Zambia draws most of its energy supply from hydroelectric power generation;
- *Switching from the use of kerosene acid plant heaters to electric heaters*: Replacement of kerosene with electric heaters with an estimated energy intensity of 0.789 and 0.567 GJ/ton of copper would result in fuel saving.

62. Besides the expected CO_2 emission reductions arising from the implementation of the above-mentioned mitigation options, there would also be major foreign exchange savings.

4. Manufacturing industry mitigation options

63. Mitigation options identified in this sector include:

- *Improving the efficiency of coal-fired and diesel-fired boilers.* The city breweries of Lusaka and the Indeni oil refinery have improved the energy efficiency of their boilers. The Indeni oil refinery installed a pre-heat exchange unit which led to a 30 per cent reduction in SO_x emissions;
- *Conversion of cement production from wet to dry process.* Although this would be an energy-saving mitigation option, it has not yet been implemented because of the prohibitive cost;
- *Replacing diesel power generators with mini-hydro* wherever doing so is economically feasible. This option is suitable for remote areas that are not connected to the grid system but have suitable rivers that could be harnessed for power generation. Two potential areas for such developments include the Kabompo and Mwinilunga districts in North-Western Province.

5. Agriculture sector mitigation options

64. Mitigation options in this sector include:

- *Promotion of intermittent flooding and drainage of rice paddies to reduce CH_4 emissions;*
- *Use of organic fertilization without recourse to vegetation burning under the Chitemene system*: The activities that come under this mitigation option include use of livestock dung in place of chemical fertilizers, conservation, tillage and promotion of agroforestry. Studies have shown that conservation tillage would result in potential energy savings of 0.058 and 0.577 petajoules by the years 2010 and 2030 respectively.

65. Mitigation options for methane and nitrous oxide from livestock - the use of mechanical and chemical feed processes and providing strategic supplementation - were also identified.

6. Waste management mitigation options

66. Identified mitigation options in this sector include:

- *Establishing engineered landfills* where greenhouse gas missions could be reduced by piping;
- *Use of forests as sinks* – to ensure adequate protection of forests, by empowering local communities and promoting the development and use of forest products.

C. Vulnerability and adaptation

67. Both USCSP and the initial national communication enabling activities project identified the most vulnerable sectors as: agriculture (crop farming and livestock raising), wildlife, forestry, water resources and the health sector. In this section the overall objectives of the GEF enabling activity were to evaluate how climate change affects human activities and natural systems, to evaluate sensitivities, thresholds and vulnerabilities of natural systems, as well as to identify possible technological improvements and practical adaptation measures designed to minimize the effects of climate change.

1. Agriculture

(a) Vulnerability studies

68. In the agricultural sector, the vulnerability studies were carried out on maize, sorghum, groundnuts and livestock. The methodologies used were the general circulation models, i.e., the Canadian Climate Change Centre model and that of the Geophysical Fluid Dynamics Laboratory, under a doubling of the CO_2 scenario. The DSSAT3 ("decision support system for agrotechnology transfer") software system, together with the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) application programme, was used to simulate crop growing lengths and yields under rainfed and irrigated conditions.

(b) Adaptation

69. The identified adaptation measures include development of drought-tolerant and early maturing crop varieties, crop diversification and improvement of crop management through information dissemination to farmers and construction of supporting infrastructure like dams for water storage in drought-prone areas of the country.

2. Livestock

(a) Vulnerability studies

70. The vulnerability and adaptation study addressed livestock susceptibility to meteorological variables depicting climate change in specified agro-ecological zones. Efforts were directed towards determining the effect on livestock production of climatic factors such as temperature, rainfall, relative humidity and solar radiation, day length and wind speed. The meteorological-variable-versus-livestock-population correlation analysis was conducted with an empirical approach.

(b) Adaptation

71. Adaptation measures included encouraging farmers to use crop residues of groundnuts, cotton and beans and urea molasses and minerals to supplement livestock nutrition during droughts as well as sinking wells and boreholes at community level to boost water supply in vulnerable areas.

3. Wildlife

(a) Vulnerability studies

72. The vulnerability and adaptation study focused on wildlife found in protected and ecologically sensitive areas. Attempts were made at estimating potential adverse impacts of temperature, rainfall and soil moisture content on wildlife.

73. The objective was to develop a relationship between drift in vegetation and its impact on wildlife habitat, using analogue scenarios of drought and excessive rain conditions.

(b) Adaptation

74. Adaptation measures included the culling of game to create conditions for wildlife sustainability.

4. Forestry

(a) Vulnerability studies

75. The vulnerability studies were carried out using an SPSS/PC statistical programme to establish correlation between vegetation types and climatic variables. The results from the study showed that the proportional distribution of miombo and chipya are positively correlated to mean seasonal rain days, while the opposite was true for mopane, munga and Kalahari vegetation types.

Projected vegetation distribution patterns indicate that miombo woodland would suffer a 50 per cent reduction across the country whereas mopane and munga would predominate.

(b) Adaptation

76. Adaptation measures include promoting the use of alternative sources of energy in order to reduce pressure on miombo woodlands that are predominantly harvested for charcoal production, especially in peri-urban areas.

5. Water

(a) Vulnerability studies

77. An estimation of surface water potential was conducted from the knowledge of water resources in the country. Projected water demands for the years 2005 and 2015 were computed using baseline social and economic scenarios, namely, population growth rate, agriculture expansion and industrialization growth.

78. The results show that water balances between water demands and the water resources for drought years with a 10-year return period showed that Southern Province is extremely vulnerable and does in fact experience critical water shortages during drought.

(b) Adaptation

79. Adaptation measures include improvement of water resources management through the development and implementation of well-costed and phased integrated river basin management plans.

6. Health

(a) Vulnerability studies

80. The studies in this sector addressed malaria morbidity and mortality rates as a function of the impacts of climate change. These studies centred on malaria incidence, distribution and transmission as functions of temperature, rainfall and relative humidity. The relationship between malaria incidence and temperature, rainfall and humidity was obtained by using a simple correlation analysis.

81. The results showed that high temperatures above the mosquito survival rate (20^{o}-25^{o} C) would reduce the incidence, transmission and distribution of malaria. Generally, correlation was low between malaria incidence and humidity when compared to temperature and rainfall.

(b) Adaptation

82. Adaptation measures included creation of a malaria database – for various components of the malaria programme, i.e., parasitological, entomological, epidemiological and sociological aspects. This database will form the basis for a surveillance system whose components would

include remote sensing and verification procedures. Programmes for promoting malaria awareness should also be strengthened.

D. Systematic observations and research

83. Climate change is detected through systematic observation of climate variables. This initial national communication project assisted with the strengthening of the observation network. The limitations in the way of a comprehensive observation network include:

(a) Limited number of observations in the country;

(b) Irregular inspection of existing observation stations owing to lack of transport;

(c) Shortage of basic equipment and skilled human resources.

V. Organizational, political and financial aspects

A. Stakeholders' workshops

84. Altogether seven stakeholders' workshops were held. The first workshop looked at previous studies, as well as the launching of the beginning of the current project in October 1997. At the second workshop, experts developed baseline scenarios for the project and brought them to the stakeholders for discussion and endorsement. This workshop also considered greenhouse gas inventories using 1994 as a base year. The UNEP task manager also attended this workshop. Three of the downstream workshops discussed inventories, mitigation and vulnerability and adaptation, while the other four discussed dissemination of results, as well as seeking endorsement of the project results. These workshops included two training workshops that were conducted for media and government planning personnel to increase awareness of climate change. In addition, the press was always invited to all the workshops to help in disseminating climate change news to the public at large.

B. Sustainability of the results

85. The Government of Zambia is fully committed to the implementation of the Framework Convention on Climate Change, hence the goals and objectives of this project. The past and ongoing activities on climate change and activities under this project will ensure that climate change mitigation strategies are in place so that the country can move towards achieving its goals of greenhouse gas reduction. Successful implementation of the project also ensured that Zambia has the scientific, technical and institutional capacities in the implementation of the Framework Convention on Climate Change on a sustainable basis.

86. Some of the benefits of the project were associated with the inherent capacity building in terms of expertise in climate change for both new and old staff.

87. This was achieved through on-the-job training in methodologies such as the LEAP mitigation model. Climate change awareness was also raised by the press, which reported the results of the different workshops. Sustainability was also enhanced through the development of links between climate change stakeholders in different fields such as water, agriculture, energy and hydrology. Potential investors were also exposed to new investment opportunities such as

mini-hydro projects which would be implemented under the clean development mechanism in the Kyoto Protocol.

88. Sustainability of results was also achieved through the comprehensive capacity-building programme. As mentioned in paragraph 47 above, the project coordinator also participated in a workshop on the preparation of greenhouse gas inventories in Nairobi in January 1999, as well as a mitigation workshop in March 2000. Links were also established with the national communication support programme.

C. Political endorsement of the project

89. The national climate change steering committee was formed in February 2000 and met in April 2000 for technical discussion of the project. Once the steering committee's comments are satisfactorily incorporated in the initial national communication, the document will be sent to the Cabinet for political endorsement. The national action plan was not prepared, because the steering committee had not met. The national climate change steering committee is now a permanent feature of climate change activities.

D. Adequacy of the project funds

90. The funds allocated to the project were not adequate because of the many activities scheduled under the original objectives of the project. For example, some of the workshops were held at locations outside Lusaka. This entailed transport and accommodation costs as well as fees for paying the consultants. It was found necessary to hold these workshops outside Lusaka so as to minimize disruptions when the workshop participants are asked to perform other duties at their offices simultaneously. Good workshop reports were also expensive to produce.

E. Delays

91. The project was considerably delayed for the following reasons:

(a) Procurement of activity data was rather slow, owing to poor record-keeping procedures. The national archives at the Central Statistical Office were not properly kept;

(b) The lack of local emission factors led to the use of the IPCC default factors, which compromised the quality of emissions data;

(c) The consultants were not familiar with some of the methodologies, such as the LEAP model. This necessitated some capacity-building through on-the-job training;

(d) Members of the national study team worked on the project on a part-time basis. Their official duties took precedence and most of the time they were assigned duties by their employers that made it difficult for them to work on the project.

F. Suggested future research activities

92. These include:

(a) Modelling of vegetation-climate interactions;

(b) Studying climate change impacts on crops, fish, game and animal production together with associated economic implications;

(c) Studying genetic improvement of crops which have higher water use efficiencies and are more tolerant to extreme weather events;

(d) Studying indirect effects of climate change on human health;

(e) Studying the wider application of renewable energy resources;

(f) Exploring ways of improving emission factors of land use change and forestry;

(g) Developing local specific emission factors in agriculture and waste management;

(h) Determining the extent of the effect of spontaneous combustion of coal waste at Maamba collieries on CO_2 and other greenhouse gas emissions.

G. Climate change data bank

93. This enabling activity has also highlighted the need to strengthen the climate data bank.

94. Proper data management is vital to address climate change impacts. The climate data bank and other services provided under the Zambia Meteorological Department fall short of meeting the needs of various institutions involved in climate change studies. There is a need therefore to reorganize the climate data bank and other services so that they fulfil users' data requirements.

VI. Project rating

95. The terms of reference of the evaluation require that the success or failure of the project implementation be determined using the elements outlined in table 3 below. This assessment is on a scale of 1-5, where 1 is the highest rating while 5 is the lowest. From the table it is clear that most of the elements indicated had good scores apart from "Timeliness", which scored low largely as a result of poor project planning.

Table 3: Rating of project implementation success

No.	Parameter	Rating	Comment
1	Timeliness	2.5	The project was punctuated by long delays due to problems in activity data collection, in-service training in methodological issues as well as the creation of the national climate change steering committee
2	Achievement of results and objectives	1.0	The initial national communication is now being finalized for political endorsement by the Cabinet at some future date
3	Attainment of outputs	1.5	Major outputs were attained
4	Completion of activities	2.0	Some outputs of activities 2 and 5 were not attained, i.e., the national action plan and "a mechanism for regular updating of the inventory" were not prepared
5	Project executed within budget	2.0	Some activities were not carried out owing to budgetary constraints
6	Impact created by the project	1.0	This was excellent
7	Sustainability	2.0	Though local experts did all the work, Zambia will need further assistance and capacity-building to continue climate change activities.

VII. Recommendations and observations

A. Recommendations

Recommendation 1: National action plan

96. One of the specific objectives in the project document was that Zambia should "prepare its national action plan to mitigate and adapt to climate change". This particular objective was not achieved. It is recommended that Zambia produce a national action plan on climate-change-related activities as soon as possible. Such a plan is expected to yield positive results in two ways: first, it is easier to get donor funding if a sound national plan is in place and, second, the country will not lose momentum which has been built through the activities of this project.

Recommendation 2: Follow-up activities

97. Having completed the initial national communication, Zambia should implement follow-up activities in the form of project proposals on different aspects of climate change - for example, the derivation of local emission factors, mitigation and vulnerability projects. These follow-up activities should form part of the output of this GEF enabling activity. These project proposals can be presented for funding to the donor community.

Recommendation 3: Activity database

98. Activity 2 of the project document stipulates the need to establish a mechanism for "regular updating of the inventory." It is recommended that Zambia implement this activity.

This recommendation is also practised by most annex I Parties on a routine basis. If this activity becomes routine, it will obviate the need to train people in handling greenhouse gas inventories when preparing future national communications. In order for the Central Statistical Office to add such a routine to its normal duties, however, some enabling finance will be required for the purchasing of the necessary hardware and software.

Recommendation 4: Capacity-building in vulnerability and adaptation

99. Despite the fact that some work on vulnerability was done under USCSP, there is still an urgent need for capacity-building and provision of support to relevant institutions participating in this segment of climate change studies. This is important because Zambia is situated in one of the most vulnerable regions in the world. Because of such factors as poverty, their weak economies and rapid population increase, developing countries are the least able to adapt to climate change.

Recommendation 5: Climate change awareness

100. Though Zambia spent a considerable portion of project resources on technical workshops, there is still a need for a higher level of climate change awareness. Therefore, more resources should be spent on education, training and public awareness programmes. Targeted workshops should be held for the staff of universities and research institutions, policy makers and practitioners, journalists and members of non-governmental and community-based organizations.

Recommendation 6: Emission factors

101. In the preparation of the initial national communication, Zambia used IPCC default values for emission factors. It is well known, however, that the IPCC default values are too global. They do not reflect local conditions. It is recommended, accordingly, that Zambia carry out research to determine local emission factors. More representative emission factors should improve the quality of the greenhouse gas emissions data in Zambia, assuming that the activity data are accurate.

Recommendation 7: CO_2 equivalent

102. The main table on total emissions of greenhouse gases does not have a column on CO_2 equivalent. It is normal practice to add an additional column for CO_2 equivalent. This facilitates comparison of greenhouse gas emissions across sectors.

Recommendation 8: Interim GEF financing

103. It was encouraging to learn at the fifth session of the Conference of the Parties to the Framework Convention that, in the interim, GEF intended to release $100,000 to those non-annex I Parties that had completed and submitted their initial national communication to the Framework Convention secretariat. These funds are meant for capacity-building in those areas that need strengthening. This is a very commendable gesture on the part of GEF. Besides serving the intended purpose, these funds will also help maintain the momentum of climate change activities while decisions are being taken by both GEF and the Conference of the Parties to finance the second generation of national communications of non-annex I Parties.

104. Zambia should approach UNEP or UNDP as soon as it has submitted its initial national communication and inquire how they can gain access to these funds. Access to this bridging finance will help in fulfilling activity 6 of the project document.

B. Observations

105. One of the major weaknesses in the implementation of the project was the non-existence of the national climate change steering committee, which was supposed to "meet on a quarterly basis to review project implementation and provide scientific, technical, policy and strategic guidance". The national climate change steering committee was only formed in February 2000 and met once in April. The inadequacies in the report could be partly attributed to the lack of guidance from the steering committee.

106. According to the project document, there was supposed to be a full-time project coordinator. Unfortunately, this post was not established and instead a part-time project coordinator was appointed to work for three days a week. This could have contributed to delays which led to the project overshooting its original time-line.

107. As for gender considerations, 30 per cent of the people who participated in the workshops were women and one of the consultants in the energy sector was a woman senior energy economist. The outcome could have been better if there had been more women participants.

VIII. Conclusion

108. Notwithstanding the delays and other administrative hiccups, Zambia has made maximum use of GEF funds in preparing the initial national communication as required by the Framework Convention on Climate Change. Furthermore, Zambia has accomplished this task using its own local expertise. This is a positive achievement in terms of Zambia's efforts in capacity-building in climate change issues.

109. That said, the stated goal of attaining "enhanced capacity for decision makers to integrate climate change concerns into planning" as well as establishing "a mechanism for regular updating of the inventory" was not achieved. Broadly speaking, this could be attributed to the non-existence of national climate change steering committee at the time of project execution.

Annex I

National climate change steering committee

A. Objectives

The objectives of the national climate change steering committee will be:

- To review climate change reports for quality;
- To provide technical, scientific, policy and strategic guidance to climate change studies;
- To ensure successful implementation of the project and integration of the findings in the national development plans.

These objectives if achieved will demonstrate the commitment of the Zambian Government to the implementation of the Framework Convention on Climate Change.

B. Purpose

The purpose of establishing the national climate change steering committee is to enable Zambia to fulfil its obligations under the Framework Convention on Climate Change.

C. Composition

The composition of the steering committee will be as follows:

Permanent Secretary, Ministry of Environment and Natural Resources – Chair
Director, Environmental Council of Zambia – secretariat

with representatives from:

Bankers Association
Nakambala Sugar Estates
Department of Forestry
Department of Meteorology
Department of Transport and Telecommunications
Ministry of Agriculture, Food and Fisheries
Ministry of Commerce, Trade and Industry
Ministry of Energy and Water Development
Ministry of Finance and Economic Development
Ministry of Foreign Affairs
Ministry of Health/Central Board of Health
Office of the Vice-President – Disasters Department
National Economic and Advisory Council
Centre for Energy, Environment and Engineering Zambia Limited
Chamber of Mines
Energy Regulation Board
National Institute for Scientific and Industrial Research
Wildlife and Conservation Society of Zambia
Zambia Association Chamber of Commerce and Industry
Zambia Consolidated Copper Mines Limited

Annex II

References

1. *Zambia: Enabling activities for the preparation of initial national communication* – Project document

2. National Environmental Trust 2000, *Confronting Climate Change: Economic Priorities and Climate Protection in Developing Nations*

3. Cheraw, B., M. Pirie and P. Mulling, *Vulnerability and Adaptation Assessment – Agriculture Sector,* 1998.

4. Mewed, A., *Personal communication*

5. United Nations Framework Convention on Climate Change

6. Environmental Council of Zambia, *State of the environment report*, 1994
