

# CLIMATE CHANGE

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**Mitigation, Vulnerability, and  
Adaptation in Developing and  
Transition Countries**

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*U.S. COUNTRY STUDIES PROGRAM*

*SUPPORT FOR CLIMATE CHANGE*

*STUDIES, PLANS, AND TECHNOLOGY ASSESSMENTS*

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This report has not been subjected to official technical or policy review. It does not necessarily represent the views of the U.S. Government, other governments, or multilateral bodies.

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Nine climate change specialists in U.S. Country Studies Program (USCSP) countries served as technical editors of the report: Leoncio Amadore (Philippines), Saleemul Huq (Bangladesh), Wilfred D. Kipondya (Tanzania), Alexey Kokorin (Russian Fed-

eration), Julia Martinez (Mexico), Francis Mkanda (Malawi), Olga Pilifosova (Kazakhstan), Cecilia Ramos-Mañé (Uruguay), and Wu Zongxin (China). Many of the Country Study Coordinators in Program countries also offered comments on the draft versions of this document. Additional technical review was conducted by Ron Benioff and Brandon Owens at NREL, and Jayant Sathaye and Steve Meyers at Lawrence Berkeley National Laboratory.

This effort, and more broadly the U.S. Country Studies Program, owes its success to the hundreds of researchers in the 56 countries participating in the Program who are responsible for the body of work upon which this document is based. They have made an invaluable contribution to the international field of climate change science and policy.



# Executive Summary

This report provides an overview of the work conducted by developing and transition countries participating in the U.S. Country Studies Program (USCSP, or the Program). Under this Program, participating countries evaluated climate change mitigation options, assessed their vulnerability to climate change, identified methods for adapting to climate change, and developed plans for responding to climate change.

Since its inception, the USCSP has facilitated:

- ◆ a high level of participation of developing and transition countries
- ◆ increased capacity of climate change researchers in developing and transition countries
- ◆ a better understanding of current emissions and projected growth in individual countries
- ◆ a better understanding of high greenhouse-gas-emitting sectors, mitigation options, costs of mitigation, and barriers to implementing mitigation options
- ◆ a better understanding of countries' vulnerability to climate change, and their potential for adaptation.

Additionally, the Program has offered training and technical assistance through workshops and publications.

## Mitigation Analysis Results

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Many of the countries participating in the USCSP conducted analyses of options for mitigating greenhouse gas (GHG) emissions. These mitigation analyses model the climate change impacts of these options alone and in combination with other options, and in some cases, provide quantitative assessments of the costs of mitigation. Thirty-five of 56 USCSP participants have initiated mitigation studies. Almost all of these countries have completed these studies. The country participants that conducted mitigation assessments considered emission reduction options in the energy, forestry, agriculture, waste, and industrial (non-energy) sectors. The energy sector was the highest priority for participants, followed by the forestry sector.

Despite population pressures and economic growth that suggest that emissions from developing countries will increase in the future, more than two-thirds of the USCSP participants conducting mitigation assessments demonstrate the ability to reduce CO<sub>2</sub> emissions by at least 10 percent below projected baselines by 2010. In addition, most transition countries expect to achieve emission levels close to their 1990 levels in 2010, even without considering mitigation options.

The key findings of the mitigation analyses are summarized below by sector. In addition, the participating countries analyzed barriers to the development and implementation of new technologies, and mechanisms for implementation of mitigation options. These findings also are presented below.

## ENERGY SECTOR

### Energy Supply

- ◆ The energy supply sector offers the greatest mitigation potential. Countries participating in the USCSP identified a number of promising options in the power sector, including both short-term and long-term opportunities.
- ◆ Improving energy efficiency of power plants is the most important energy sector option in the near term.
- ◆ Installing renewable energy and energy-efficiency technologies and switching from carbon-intensive fossil fuels are long-term priorities.
- ◆ Considerable improvements in regional air quality may result from mitigation measures in the energy supply sector.

### Industrial Sector

- ◆ The industrial sector offers the next largest energy-related mitigation potential after the energy supply sector. Increasing the use of cogeneration, improving boiler efficiency, and improving the efficiency of motors and lighting are attractive mitigation options, in terms of emission reduction potential and costs. Negative incremental costs were found for a number of these options by the majority of countries analyzing costs.
- ◆ Improving energy efficiency is the highest priority in the industrial sector. In both developing and transition countries, existing equipment is generally energy-inefficient and offers considerable mitigation potential. Significant reductions can be achieved by increasing the efficiency of supply-side and demand-side technologies.

## Residential/Commercial and Institutional Sector

- ◆ The residential/commercial and institutional sector has significant opportunities for cost-effective emission reductions. In general, installing energy-efficient lighting was found to be the most important money-saving option in a number of countries. Other opportunities for savings include increasing the efficiency of appliances and replacing traditional energy sources with renewable energy or electricity.
- ◆ Both transition and developing country participants generally reported that GHG emissions from the residential/commercial and industrial sector are likely to increase substantially in the future. This increase is due largely to a combination of population growth and increased energy consumption per capita, resulting from continued urbanization and improvements in the standard of living.

## Transportation Sector

- ◆ Further study is needed in the transportation sector. While the need to identify mitigation options in the transport sector was recognized by many countries, few countries provided a quantitative analysis of particular mitigation options.
- ◆ Transportation sector emissions are increasing rapidly in both transition and developing countries.
- ◆ The range of mitigation potential and costs for the transportation sector varied widely.

## FORESTRY SECTOR

- ◆ The three highest priority mitigation options in the forestry sector examined by USCSP participants were (1) afforestation, reforestation, and forest productivity improvements; (2) protection of existing forests; and (3) substitution of sustainably produced biofuel for fossil fuels and substitution of wood products for more emission-intensive, nonwood products.
- ◆ Reforestation and afforestation were determined to be the most promising mitigation options in the forestry sector of the transition countries because for-

est management is already fairly developed, annual rates of change in forest cover are negligible or positive, and fuelwood is not a major source of energy.

- ◆ Forest protection mitigation options were considered by participating countries in Asia and Africa. This may be due to pressure on forests from rapid population growth in those countries.

## AGRICULTURAL SECTOR

- ◆ Mitigating emissions from rice cultivation is critical for most Asian countries and in Côte d'Ivoire because rice cultivation is the largest source of agricultural GHG emissions in these countries. Mitigation options focused mainly on changes in water management practices and switching to alternative rice cultivars.
- ◆ Livestock production accounts for more than half of total methane and nitrous oxide emissions in all of the participating countries in Central and Eastern Europe, the Former Soviet Union, and Latin America, and in most participating African countries. Improving livestock productivity through improved nutrition was the most common mitigation option considered. Manure management options, such as methane recovery for use as energy, were also a priority.
- ◆ More research is needed to analyze emission reduction potential and costs associated with mitigation options in all areas of this sector.

## WASTE SECTOR

- ◆ For many USCSP participants mitigating GHG emissions from the waste sector was generally not a high priority because methane emissions associated with this sector are relatively low.
- ◆ For those that did analyze this sector, landfill methane recovery and utilization as energy, comprehensive waste management, and alternative waste management (recycling, composting, etc.) were priority mitigation options.

## INDUSTRIAL PROCESSES (NON-ENERGY)

- ◆ Process emissions from the industrial sector represent a small percentage of overall national GHG emissions in transition and developing countries, and were not a priority for mitigation analysis. The USCSP participants that evaluated mitigation options in this sector focused primarily on the cement, lime, pulp and paper, and iron and steel industries.

## BARRIERS TO IMPLEMENTATION OF GHG MITIGATION OPTIONS

Program participants identified the following barriers to the development and implementation of new technologies and energy sources across sectors:

- ◆ Insufficient domestic infrastructure for supporting new technologies and new energy sources.
- ◆ Insufficient capital for investment in development of new technologies, energy sources, and infrastructure.
- ◆ A lack of data and methods for conducting comprehensive cost-benefit analyses of mitigation options.
- ◆ The high capital costs of purchasing more efficient technologies, and a lack of a mechanism for reducing the initial costs borne by consumers.
- ◆ A lack of domestic supply of renewable energy and energy-efficiency technologies and certain alternative fuel sources.
- ◆ Existing policies and regulations that favor current technologies and energy sources and discourage the development and implementation of new technologies and energy sources.
- ◆ A lack of people trained in the manufacture, installation, use, and maintenance of new technologies as well as in the implementation of new resource management practices.
- ◆ A lack of general education to improve public awareness and acceptance of new technologies and resource conservation opportunities.
- ◆ A lack of access to efficient technologies because of insufficient networks for equipment distribution and maintenance.
- ◆ General economic or political instability, leading to competing demands for scarce economic resources and political attention.

## ECONOMIC AND OTHER POLICY MECHANISMS FOR IMPLEMENTATION OF MITIGATION OPTIONS

- ◆ While countries generally recommended the use of tax incentives and subsidies to support emissions-reduction activities, countries did not reach firm conclusions about the ultimate effectiveness and feasibility of taxes on carbon or energy consumption.

## Vulnerability and Adaptation

Forty-nine of the 56 participating countries conducted assessments of the vulnerability of their climate-sensitive resources (i.e., the potential physical and economic impacts of climate change). Several countries also addressed adaptation (i.e., steps that countries could take to respond to the physical impacts of climate change). The vulnerability and adaptation assessments cover eight sectors that are sensitive to climate change: coastal resources, agriculture, grasslands/livestock, water resources, forests, fisheries, wildlife, and human health.

### VULNERABILITY

In general, it appears that more heavily managed systems are less at risk than relatively unmanaged systems. For the managed systems, the USCSP participants found the following:

- ◆ Sea level rise could cause substantial inundation and erosion of valuable lands, but protecting developed areas would be economically sound. Limited assessments of the ecological consequences of sea level rise were conducted.
- ◆ Across the 49 participating countries, there were mixed results for changes in crop yields. African and Asian countries, particularly southern Asian countries, tended to estimate decreases in yields. Many participating countries found mixed results, and some even estimated increases in yield of some crops, particularly in Europe and Latin America. Adaptation could significantly affect yields, but it is not clear whether these adaptations are affordable or feasible (e.g., whether farmers could afford fertilizers or pesticides).
- ◆ Impacts on water resources are unclear mainly be-

cause of uncertainty about regional changes in precipitation patterns. The studies show that runoff is highly sensitive to climate change, which could result in increases in droughts or floods. The ability of water resource systems to adapt was not thoroughly assessed.

- ◆ The impacts on grasslands and livestock are mixed, but for the few countries studied, there appears to be a large capacity for adaptation.

For the more unmanaged systems, the vulnerability assessments found the following:

- ◆ Climate change could result in increased human health problems, particularly for populations in low-latitude countries with inadequate access to health care.
- ◆ The composition of forests is likely to change. Many of the assessments found that biomass could be reduced.
- ◆ There are potentially negative impacts on wildlife, threatening the populations of some species.
- ◆ The effects on fisheries are indeterminate.

### ADAPTATION

- ◆ In coastal sector analyses, protection options for sea level rise scenarios up to 1 meter by 2100 were evaluated. The benefits (e.g., avoided land and infrastructure losses) generally exceeded the costs for most of the locations studied. However, researchers found that costs could outweigh benefits along less-developed shoreline segments.
- ◆ In the agriculture sector, seed banks were among the more cost-effective options in Kazakhstan and Uruguay. Egypt found that switching crops or cultivars was the best option. Other options in this sector focused on educational or outreach activities to alter farm-level management practices. This suggests that the first reaction in adaptation may be to examine technological- or operator-level changes that may enable activities such as farming or living in coastal areas to continue as before. Policy changes as a means of addressing these issues were not preferred. The results, however, are too preliminary to draw any conclusions about whether these trends indicate

that technological or educational/outreach options are the best adaptation approaches in these sectors.

- ◆ The adaptation options across sectors primarily affected domestic activities. However, there were some options pertaining to uses of international rivers that would benefit from international coordination. This suggests that it will be important to coordinate some adaptation assessments and activities at the international level. It

will also be important to ensure that adaptation options are consistent with other policy objectives such as greenhouse gas emissions reduction.



# 1. Introduction

This report presents an overview of the work conducted to date by developing countries and countries with economies in transition participating in the U.S. Country Studies Program (USCSP, or the Program) in evaluating climate change mitigation options, assessing their vulnerability to climate change, identifying methods for adapting to climate change, and developing plans for responding to climate change. Table 1 presents the work that participating countries have conducted under the Program.

## 1.1 U.S. Country Studies Program

The USCSP, first announced in 1992 at the United Nations Conference on Environment and Development in Brazil, provides developing countries and countries with economies in transition with financial and technical assistance in order to address the problem of global climate change. The main goal of the Program has been to enhance the capacity of developing and transition countries to conduct their own studies and develop country-specific strategies and priorities for understanding and addressing the problem of climate change.

Developing and transition countries have received assistance in:

- ◆ preparing inventories of their emissions and sinks of greenhouse gases (GHGs)

- ◆ identifying and evaluating options for controlling GHG emissions and for increasing GHG emissions sinks
- ◆ assessing their potential vulnerability to climate change and approaches for adapting to such change
- ◆ developing national action plans for addressing climate change
- ◆ assessing related technological needs that increase public understanding of climate change.

The USCSP has been a highly collaborative effort. Ten U. S. government agencies participate in the USCSP (see Box 1). Fifteen senior officials from participating countries helped to shape the Program by working for a number of months with the Country Studies Management Team in Washington, DC. The Program has also coordinated its activities with, and benefited greatly from, those of the Secretariat of the United Nations Frame-

### Box 1 U.S. Government Agencies Participating in the USCSP

- ◆ *Department of Agriculture*
- ◆ *Department of Energy*
- ◆ *Department of Health and Human Services*
- ◆ *Department of the Interior*
- ◆ *Department of State*
- ◆ *Agency for International Development*
- ◆ *Environmental Protection Agency*
- ◆ *National Aeronautics and Space Administration*
- ◆ *National Oceanic and Atmospheric Administration*
- ◆ *National Science Foundation*

**Table 1 Reporting Status**

Country	Inventory	V&A	Mitigation	Action Plan
<i>Bangladesh</i>	T	T	T	In process
<i>Bolivia</i>	T	T	T	T
Botswana	In process	In process	In process	NA
Brazil	T	NA	NA	NA
<i>Bulgaria</i>	T	T	T	In process
Central America*	NA	T	NA	NA
Chile	T	NA	NA	NA
<i>China</i>	T	T	T	In process
Cote d'Ivoire	T	T	T	NA
<i>Czech Republic</i>	T	T	T	T
Ecuador	T	T	T	NA
<i>Egypt</i>	NA	T	T	In process
Estonia	T	T	T	NA
Ethiopia	T	T	T	NA
Fiji	T	T	NA	NA
Gambia, The	T	T	NA	NA
<i>Hungary</i>	T	NA	T	T
<i>Indonesia</i>	T	T	T	In process
<i>Kazakhstan</i>	T	T	T	T
Kenya	T	T	NA	NA
Kiribati	T	T	NA	NA
Malawi	T	In process	In process	NA
Marshall Islands	T	T	NA	NA
Mauritius**	T	T	NA	T
<i>Mexico</i>	T	T	T	T
<i>Micronesia</i>	T	T	NA	T
Mongolia	T	T	T	NA
Mozambique	In process	T	In process	NA
Nepal	T	T	T	NA
Nigeria	T	NA	T	NA
Oman	T	NA	NA	NA
Peru	T	T	T	NA
<i>Philippines</i>	T	T	T	In process
Poland	NA	T	T	NA
Romania	T	T	T	NA
<i>Russian Federation</i>	T	T	T	T
Samoa	T	In process	NA	NA
Slovak Republic	T	T	T	NA
South Africa	T	In process	In process	NA
Sri Lanka	T	T	T	NA
<i>Tanzania</i>	NA	T	T	In process
<i>Thailand</i>	T	T	In process	In process
Uganda	T	T	T	NA
<i>Ukraine</i>	T	T	T	T
<i>Uruguay</i>	NA	T	NA	T
<i>Venezuela</i>	T	T	T	T
Zambia	T	T	NA	NA
Zimbabwe	T	T	T	NA

T = completed report received

In process includes draft, draft final.

NA = not applicable or this work may have been funded by other donor organizations.

Countries in italics are in SNAP.

\*Central America includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

\*\*Mauritius assessed mitigation options in its Action Plan.

Note: Argentina and Malaysia are USCSP participants, but only engaged in technical cooperation.

work Convention on Climate Change (UNFCCC), the United Nations Environment Programme, the United Nations Development Programme, the Global Environment Facility, and numerous other multilateral and bilateral institutions and programs.

## 1.2 Major Results

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The major results of the USCSP include the following:

- ◆ A high level of participation of developing and transition countries: 56 countries have participated in the Program.
- ◆ Increased capacity of climate change researchers in developing and transition countries: hundreds of researchers in countries participating in the USCSP are capable of continuing research on climate change impacts, mitigation, and adaptation, and advising policy makers on the vulnerability of their countries to climate change and options for mitigation and adaptation.
- ◆ A better understanding of current emissions and projected growth in individual countries: 43 countries have prepared national greenhouse gas inventories.
- ◆ A better understanding of high GHG-emitting sectors, mitigation options, cost of mitigation, and barriers to implementing mitigation options in those sectors in participating countries: 35 countries have undertaken studies of mitigation options; 19 countries also conducted mitigation assessments and vulnerability and adaptation assessments under the Support for National Action Plans (SNAP) Program.
- ◆ A better understanding of countries' vulnerability to climate change, and their potential for adaptation: 49 have conducted vulnerability and adaptation assessments.

Earlier reports summarizing the results of the Program include:

- ◆ *Greenhouse Gas Emission Inventories: Interim Results from the USCSP* (Braatz et al., 1996).
- ◆ *Vulnerability and Adaptation to Climate Change: Interim Results from the U.S. Country Studies Program* (Smith et al., 1996a).

- ◆ *Global Climate Change Mitigation Assessment: Results for 14 Transitioning and Developing Countries* (Meyers et al., 1997b).
- ◆ *Climate Change Assessments by Developing and Transition Countries: U.S. Country Studies Program Support for Climate Change Studies, Plans, and Technology Assessments* (USCSP, 1998).

## 1.3 Technical Guidance, Training, and Assistance

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The USCSP has given great emphasis to the development and provision of technical guidance, training, and ongoing technical assistance during the conduct of countries' studies. An array of guidelines, state-of-the-art models, and other analytical tools for conducting climate change studies has been developed or disseminated. This analytical support is summarized in four primary guidance documents:

1. *1995 IPCC Guidelines for National Greenhouse Gas Inventories and Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC, 1995; 1997)
2. *Steps in Preparing Climate Change Action Plans: A Handbook* (Benioff and Warren, 1996)
3. *Vulnerability and Adaptation Assessments: An International Handbook* (Benioff et al., 1996)
4. *Greenhouse Gas Mitigation Assessment: A Guidebook* (Sathaye and Meyers, 1995).

To ensure that countries could use these tools most effectively, the Program has also provided extensive training in the adaptation of these tools to meet each country's unique circumstances and informational needs. This support included the provision of training at 10 global workshops and over 20 regional workshops, as well as more than 100 visits to the participating countries by technical experts.

Except in the greenhouse gas emission inventories, where all countries used the Intergovernmental Panel on Climate Change (IPCC) Guidelines, participating countries were encouraged to adapt these tools

and develop their own methods to meet their own unique circumstances and informational needs.<sup>1</sup> This approach has enabled countries to direct their effort and resources to the areas of greatest interest and importance to them and increased the breadth of the overall body of work. Therefore, the scope and depth of the assessments necessarily vary widely. Given this variation, it is not practical to aggregate the findings of the countries into a comprehensive statement of their climate change mitigation potential, cumulative vulnerability to climate change, or costs and benefits of adaptation. Emissions and cost information are presented in this report as provided by each country, unless noted otherwise.

## 1.4 Greenhouse Gas Emission Inventories

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The USCSP has provided financial and technical support to 43 developing and transition countries to assist them in preparing greenhouse gas emissions inventories. National inventories identify and quantify national GHG emissions from five key source categories, including energy, land use change and forestry, agriculture, industrial processes, and waste. Most countries developed their inventories using the *1995 IPCC Guidelines for National Greenhouse Gas Inventories*. However, some have begun to update their inventories using the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*.

The technical support provided by the Program has included:

- ◆ training in the preparation of GHG inventories
- ◆ guidance in inventory design and data collection
- ◆ review of preliminary and draft inventories
- ◆ organization and delivery of regional workshops to share results and discuss issues of regional significance
- ◆ assistance in the preparation and reporting of inventory results.

In most cases, the national greenhouse gas invento-

ries developed by countries participating in the Program, either with assistance from or independently of USCSP, have played a central role in the countries' mitigation assessments. The preparation of inventories enabled these countries to improve their understanding of the relationship between resource management activities and GHG emissions or carbon sequestration. It also enabled them to develop a base-year estimate of emissions and sequestration that could then be used to provide key inputs for scenario development and modeling. This report does not review the national inventory work undertaken by countries under the USCSP; a summary of the results of national inventories can be found in *Greenhouse Gas Emission Inventories: Interim Results from the USCSP* (Braatz et al., 1995). Provided below is a brief outline of the activities related to the development of the national inventories, and a summary of key findings from this effort (see Box 2).

The three basic elements of the inventory development process are as follows:

- ◆ **Preparatory work for inventory participants.** Training workshops for inventory teams from the participating countries were offered in each of the USCSP regions (Africa, Asia, Central and Eastern Europe, and Latin America) and in Washington, DC, and addressed various aspects of inventory development. In addition, the country teams held kickoff workshops after the training was completed and the inventory had been structured. The purpose of the kickoff meeting was to introduce the national inventory effort to the public and private sectors.
- ◆ **Development of three versions of the inventory.** The preliminary inventory is prepared solely using the IPCC Tier 1 Methods, and is compiled in order to identify significant sources of GHG emissions. Additional data gathering needs are also identified at this stage. After the country team and the USCSP have reviewed the preliminary inventory, and the additional data has been gathered, a draft inventory is prepared. This document is the first attempt at creating a complete inventory and includes more

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<sup>1</sup> The IPCC Guidelines already allow countries to adapt portions of the methodologies to meet national circumstances.

## Box 2 Main Conclusions from the USCSP National Inventories

### GENERAL

- ◆ *Of the participating countries, the most highly industrialized and highly populated countries produced the largest emissions.*

### ENERGY

- ◆ *Per capita emissions of carbon dioxide from fossil fuel combustion and per unit gross domestic product (GDP) carbon dioxide emissions were highest in the more industrialized and energy-intensive countries, and in the transition countries were comparable to, or higher than, emissions in the United States, United Kingdom, and Japan.*
- ◆ *The countries in each region reporting the greatest carbon dioxide emissions from fossil energy also had the highest GDP and, except for South Africa, the highest population.*
- ◆ *Carbon dioxide is the most important GHG in many industrialized countries of Africa, Asia, Latin America, and Central and Eastern Europe because they typically have energy-intensive economies and rely largely on fossil fuels. In other countries in Africa, Asia, and Latin America, carbon dioxide is the most important GHG because of land use change and forestry.*
- ◆ *Smaller countries and those using large quantities of biofuels are the smallest emitters of carbon dioxide. These countries produced a significant portion of the methane and nitrous oxide emissions from the energy sector.*

### LAND USE CHANGE AND FORESTRY

- ◆ *Land use change and forestry activities appear to be an important source of GHG emissions, especially carbon dioxide, in all Latin American countries, and in several African and Asian countries.*
- ◆ *Land use change and forestry are also important carbon sinks in several countries, especially Zimbabwe, where carbon sequestration from forestry far exceeds total gross emissions of carbon dioxide, methane, and nitrous oxide.*

### AGRICULTURE

- ◆ *Methane is most important in countries in which agriculture is the predominant source category. This is due primarily to heavy use of biomass as fuel, large emissions from livestock, rice cultivation, and savanna burning.*
- ◆ *Livestock account for 50% or more of methane and nitrous oxide emissions in all participating countries in Africa (except Uganda) and Latin America, and in the transition countries.*
- ◆ *Rice cultivation is the largest source of agricultural GHG emissions in all participating Asian countries except Bangladesh, where livestock and agriculture produce the same amount of emissions, and Mongolia, where rice is not grown.*
- ◆ *Per capita GHG emissions from agriculture are much more uniform across countries and regions than per capita fossil fuel carbon dioxide emissions.*

*Source: USCSP, 1998.*

refined estimation methods and a bottom-up estimate of energy sector emissions. This version is again reviewed by the USCSP and the final inventory is prepared based on the comments provided during reviews.

- ◆ **Presentation of results.** Results of the final inventory are presented to the public by the country participants at the national workshop, providing an opportunity to raise public awareness of GHG emissions and focus public attention on the future work of vulnerability and adaptation assessments and mitigation analysis.

## 1.5 The SNAP Program

The SNAP Program is assisting countries with developing climate change action plans that integrate the findings of their USCSP Country Study into a compre-

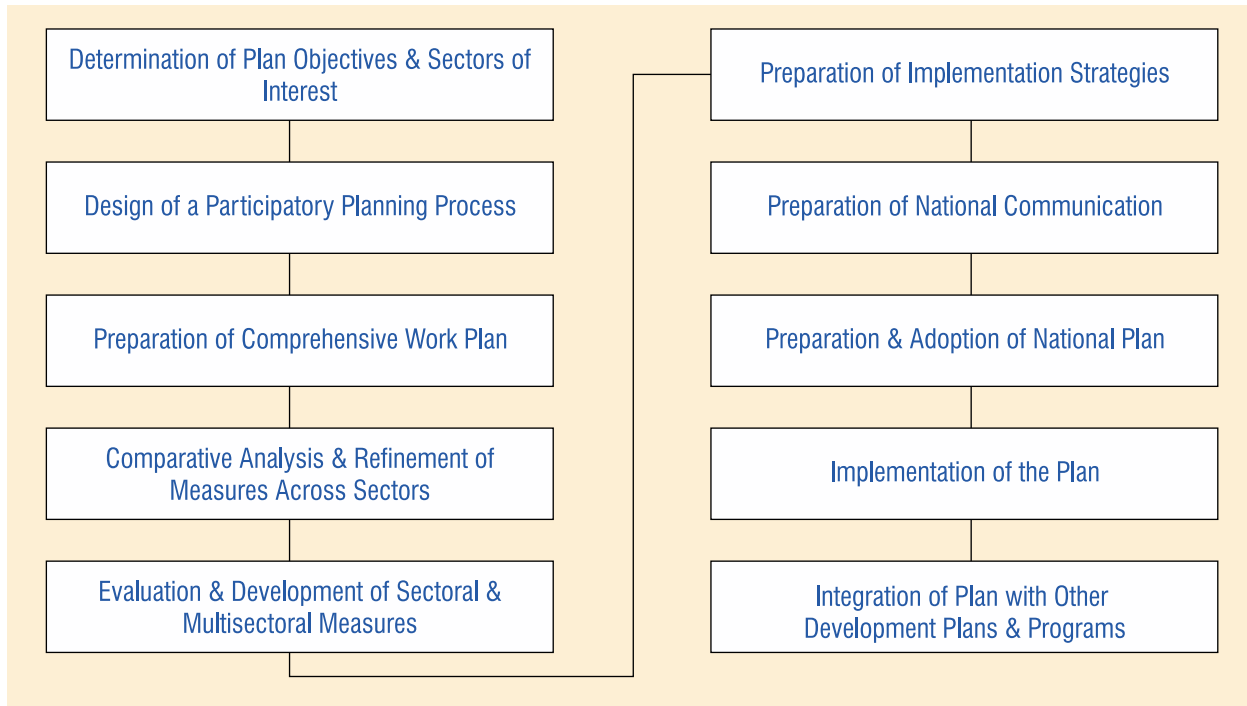
hensive national policy response to the problem of climate change (see Figure 1). Countries can use these plans as the basis for their National Communications to the UNFCCC. In this report, the work on assessing mitigation options and vulnerability and adaptation options undertaken through the SNAP Program has been integrated into each chapter and is not reported separately.

The objectives of the SNAP Program are:

- ◆ to assist countries in preparing climate change action plans that may form the basis of their national communication
- ◆ to promote diffusion of mitigation and adaptation technologies
- ◆ to enhance support for the objectives and principles of the UNFCCC.

In addition, countries may have their own objectives for preparing climate change action plans, such as:

**Figure 1 National Action Plan Preparation Process**



Source: USCSP, 1998.

- ◆ integrating climate change concerns into other planning processes and programs
- ◆ catalyzing consensus and support for climate change mitigation and adaptation measures that will contribute to sustainable development
- ◆ developing a plan to achieve specific national mitigation or adaptation goals.

In almost all cases, priority was given to measures that will contribute to sustainable development and measures that will confer economic, social, and environmental benefits.

- ◆ Almost all countries focused on mitigation options in the energy sector, recognizing that increased efficiencies in energy production, distribution, and utilization will provide direct economic benefits and improve public health by reducing environmental pollution.
- ◆ Vulnerability and adaptation measures designed to preserve food security through improved agricultural productivity and water supply systems are high priorities in national action plans.
- ◆ There are certain problems and prospective solutions that countries have in common and may benefit from

addressing cooperatively. For instance, neighboring countries whose water resources and agricultural systems are vulnerable to increased incidence of drought and who share a common river could derive benefits from working together. Similarly, countries within a region could organize a regional seed bank to optimize crop variety and increase flexibility within their agricultural systems.

## 1.6 Report Structure

The main sections of the report focus on the mitigation assessments and the vulnerability and adaptation assessments conducted by the countries participating in the USCSP.

Section 2 contains a summary of the mitigation assessments conducted under the USCSP. The mitigation analyses are presented by sector: energy, forestry, agriculture, waste, and industrial processes. This section also addresses barriers to implementation of GHG mitigation options, as well as economic and other policy mechanisms for the implementation of GHG mitigation options.

Section 3 summarizes the vulnerability and adaptation work that participating countries performed under the USCSP. This section reports on the vulnerability and adaptation potential of coastal resources, agriculture, grasslands and livestock, water resources, forests, fisheries, wildlife, and human health.

Appendices A, B, and C of this report contain more detailed technical information on the methods used by participating countries to prepare their vulnerability and

adaptation assessments. Appendices D and E define terms and abbreviations used in the document, respectively. Relevant tables for the conversion of weights and measures are listed in Appendix F. Appendix G contains the bibliography.

