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from Bridget McIntosh and
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CLIMATE CHANGE AND THE CLEAN DEVELOPMENT MECHANISM

ភ្នំពេញ ២០០៤

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Front cover illustrations (from left to right, top-down): 2000 flood in Kandal province, dried up Srah Srong reservoir in Siem Reap in 2004, smoke from a Phnom Penh thermal plant, sunrise in Siem Reap, CRCD team testing wind turbine, and solar panels at the hybrid PV and biogas project near Sihanoukville (by Tin Ponlok).

Background photo: sunrise in Siem Reap.

Climate Change and the Clean Development Mechanism

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With Contributions from
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FOREWORD

This Climate Change/CDM booklet has been prepared with financial support from the Institute for Global Environmental Strategies (IGES) of Japan via a project entitled Integrated Capacity Strengthening for the Clean Development Mechanism (ICS-CDM). ICS-CDM has an overarching objective of enabling potential CDM host countries and Japanese investors to participate in CDM projects that contribute to sustainable development. It aims at strengthening the institutional and human capacities in host countries to implement CDM projects through: (i) information dissemination and awareness raising about CDM, (ii) network building among entities interested in CDM in host countries and Japan, (iii) training of personnel to implement CDM, and (iv) support of the finding, development and implementation of CDM projects.

This booklet aims to raise awareness on climate change and the Clean Development Mechanism (CDM) for staff from concerned ministries, private companies, academia, NGOs, and the general public. The initial draft of this booklet was compiled by Dr. Tin Ponlok. Dr. Thanakvaro De Lopez and Ms. Bridget McIntosh provided valuable suggestions and comments on the draft.

I. INTRODUCTION

In recent years, we have often heard of "climate change". What is it? What are the causes of climate change? What are its impacts? How has humankind responded? And what can developing countries like Cambodia do to help address climate change problems? This booklet will provide some answers to these questions.

II. GLOBAL WARMING AND CLIMATE CHANGE

The atmosphere surrounding our planet acts as a protective blanket for all life on earth. It provides carbon dioxide (CO_2) for plant photosynthesis and oxygen (O_2) for animal and human respiration. It also protects us from the effects of harmful cosmic rays and physical impacts of meteors from outer space by absorbing most of these rays and disintegrating meteors by friction with air.

Historically, the climate has always dictated the way people live: housing, clothing, diet, agricultural practices, and some even believe that people's temperament is determined by the climate. In turn, the climate is regulated by many factors: the radiation and angle of the sun, the rotation of the earth, the geographical coordinates, the chemical composition of air masses, the proximity and size of the oceans, the regional topography etc. In particular, these factors control air temperature and the amount and distribution of rainfall, which are the two most important aspects of the climate for a particular region. Changes in these factors will certainly lead to a change in global climate. This will subsequently cause an impact on the way we live.

For most of human history, changes in the earth's climate have resulted from natural causes over hundreds or even thousands of years. But since the industrial revolution over 200 years ago, human activities have come to affect the climate in serious and immediate ways – the increasing emissions of *greenhouse gases* (GHG) into the atmosphere are intensifying a natural phenomenon called *greenhouse effect*. This results in long-term rising of the average temperature of the earth, which is called *global warming*.

The Greenhouse Effect

A greenhouse is a house with transparent plastic or glass roof and walls that is built to grow vegetables, flowers or other plants in temperate and colder countries. A greenhouse protects and provides heat to plants: its roof and walls allow sunlight to enter and prevent heat from escaping. This effect is known as the "greenhouse effect".

The earth's atmosphere contains some gases known as greenhouse gases, which occur naturally: water vapor, carbon dioxide, methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). The layers of these gases naturally present in the atmosphere acts as the roof of a greenhouse and trap heat close to the earth's surface. As a result, it maintains the mean temperature of the earth's surface at around 16°C, which is crucial to ensuring climatic conditions that can support life of animals and plants on earth.

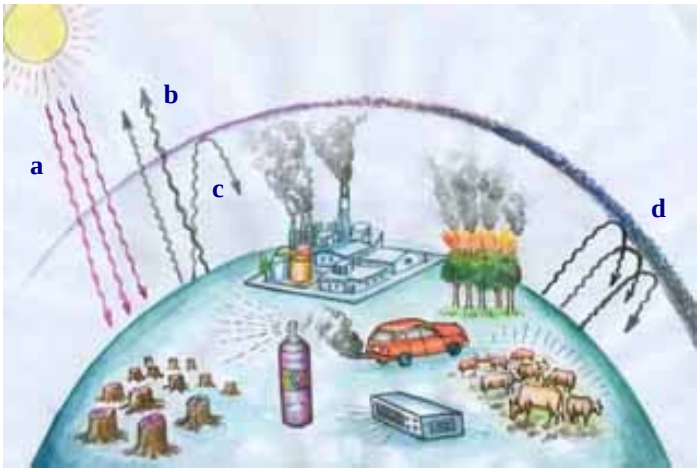
Since the industrial revolution, human activities have caused substantial increases in concentrations of greenhouse gases in the atmosphere. The main GHGs and their emission sources are:

- Carbon dioxide from burning fossil fuels (coal, oil, natural gas), and from deforestation;
- Methane from rice paddies, livestock, waste dumps, domestic sewage, coal mining;
- Nitrous dioxide mainly from chemical fertilizers used in intensive farming, and from fossil fuel combustion;
- Ozone in the lower atmosphere indirectly from automobile exhaust fumes;
- Chlorofluorocarbons (CFCs) from aerosol sprays, air conditioner and fridge coolants.

The increased concentrations of greenhouse gases in the atmosphere make the blanket or the "roof" around the earth thicker, which in turn prevents more and more heat from escaping into space. This disturbs the balance of heat exchange and causes the air temperature to rise and that of the earth's surface to rise.

In 1990, the Inter-governmental Panel on Climate Change (IPCC), which consists of about 2,500 international scientists, confirmed

that human activities have contributed to climate change. It also concluded that if current greenhouse gas emission trends continue, the mean global temperature will increase by 3°C before the end of the 21st century.



The Greenhouse Effect

a) Solar radiation passes through the atmosphere and warms the earth's surface; b) The earth's surface reflects heat back to the atmosphere. Some of the heat escapes into space; c) The GHGs absorb some of the heat and re-emit back to the earth's surface; d) As more GHGs are accumulated in the atmosphere, more heat is trapped in the atmosphere causing global warming.

Climate change is having serious impacts on agricultural production, water resources, human health, coastal areas, forest and ecosystems. Increasing floods, droughts, windstorms and other climate change related disasters, both in frequency and intensity, have caused enormous damages to many countries throughout the world.

III. THE IMPACTS OF CLIMATE CHANGE

Global Impacts

The impacts of climate change do not recognize national boundaries, i.e. both developed and developing countries suffer from them. However, developing countries will bear the brunt of climate change impacts. This is because poverty makes people more vulnerable to climate change impacts. The poor do not have adequate capacity and resources to deal with and to adapt to climate change.

For example, rising sea levels will threaten millions of people living in island states and in low-lying deltas in countries like Bangladesh, Egypt and China. Most of the endangered areas are in South and South East Asia, where some 30 of the world's largest cities are located. Global warming will affect water supplies and reduce food production in the tropics and subtropics, where most developing countries are, putting millions of people at risk of hunger in the future. It will also damage non-tropical forests, lead to loss of species, and spread tropical diseases towards temperate regions.

Some Facts about Climate Change:

- ☞ The world is heating up – fast. Temperatures are rising more quickly than they have done for 10,000 years
- ☞ The 1990s were the warmest decade on record, and 1998 was the hottest year
- ☞ The earth's average surface temperature has warmed between 0.3 and 0.6 degrees Celsius in the last 100 years. It may rise by two degrees in the next 100 years, if we go on producing greenhouse gases at the present rate
- ☞ Sea levels have risen by between 10-25 centimetres in the last 100 years, as polar ice caps have melted. They are projected to rise another 50 centimetres by 2100
- ☞ There have been unpredictable and extreme weather patterns – freak weather disasters such as hurricanes, storms, and floods.

Source: Just a Lot of Hot Air? The Panos Institute, 2000. London, UK.

Climate change consists of three key effects: changes in regional rainfall patterns, sea level rise, and increased average temperature. These in turn will have impacts on:

Water Resources

Climate change will lead to changes in the hydrological cycle. Precipitation will increase in some areas and decline in others. This will change flood and drought frequency and intensity. Changes in seasonal patterns may affect the regional distribution of both ground and surface water supplies. Water quality may also respond to changes in the amount and timing of precipitation. Changes in water temperatures could affect the survival, diversity and productivity of fresh water ecosystems. Rising sea levels will affect coastal freshwater supplies due to seawater intrusion.

Reduced water supplies would put additional pressure on people, agriculture, and the environment. Climate change will probably exacerbate the stresses caused by pollution, population increase and economic growth. The most vulnerable regions are arid and semi-arid areas, low-lying coasts, deltas and small islands.

Agricultural Production

Higher temperature and changes in rainfall patterns will have impacts on crop yields and productivity. Yields will probably decrease due to excessive irrigation demand, increased rainfall, which will cause soil erosion and soil leaching, and crop damages caused by increasing extreme climate events. Sea level rise will also cause losses in cropland in low-lying coastal areas.

The most vulnerable groups are the landless, poor, and isolated people of developing countries. These countries normally have weak infrastructure, limited access to technology and information, and some also experience armed conflict. These factors will make it more difficult for people to cope with the agricultural consequences of climate change.

Human Health

The direct impacts of climate change on health include an increase in heat stress and in cardiovascular, respiratory, allergic and air borne diseases. Increase in frequency and/or intensity of extreme weather events could result in death, injuries, psychological disorders, and damage to public health infrastructures. Tropical diseases such as malaria and dengue fever are also likely to increase as the habitats for mosquitoes and other vectors (insects) expand when the temperature rises. Food- and water-related diseases will also increase due to warmer temperatures, reduced water supplies and proliferating microorganisms.

The poor will be more vulnerable to the health impacts than the rich. However, richer countries will also be increasingly vulnerable as their populations age.

Coastal Areas

Observations show that the global average sea level has risen by 10 to 25 cm over the last century, which is mainly related to an increase of 0.3-0.6^{o}C in the global average air temperature since 1860.

If the current trend in global warming continues, sea level is predicted to rise another 15 to 95 cm by the year 2100. This will occur due to the thermal expansion of ocean water and an influx of freshwater from melting glaciers and ice.

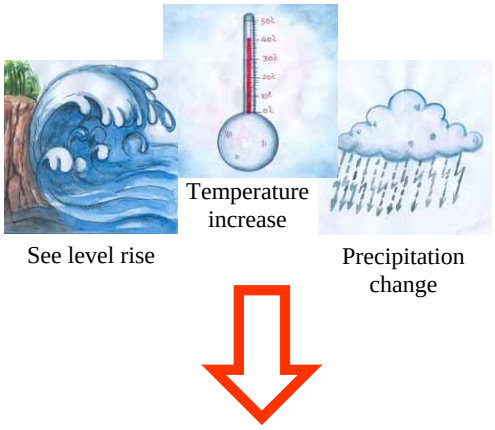
The low-lying coastal zones and small islands are extremely vulnerable to sea level rise. It is projected that a 1 m sea-level rise would cause estimated land losses of 6% in the Netherlands, 17.5% in Bangladesh and over 50% for some small island states.

Forest and Ecosystems

Forests play an important role in the climate system. They are a major reservoir of carbon. They also directly affect local, regional, and continental climate by influencing ground temperature, evapo-transpiration, heat reflectivity, cloud formation, and precipitation.

The composition and geographic distribution of ecosystems will change as individual species respond to new climate conditions. At the same time, habitats will be degraded and fragmented by the combination of climate change, deforestation, and other environmental pressures. The extinction of some plant and animal species that are unable to cope with climate change impacts would likely occur.

An increase of just 1°C in the global average temperature would affect the functioning and composition of forests. Entire forest types may disappear, while new combinations of species, and hence new ecosystems, may be established. Global warming may also cause more pests, pathogens and fires in forest ecosystems.



Potential Impacts of Climate Change

Climate Disasters and Extreme Climate Events

Scientists believe that human-induced climate change is partly responsible for the more frequent climate extremes and disasters that occurred in the last several decades: heat waves, floods, droughts, severe storms, and other climate extremes. These have caused thousands of deaths and billions of US dollars in damages to agriculture, housing, infrastructure, industry, etc.

Regional Impacts: South-East Asia

Poverty and high population densities in most South-East Asian countries would mean that even small changes in land or crop productivity would have serious social and economic consequences. Additional heat stress, shifting monsoons, rising temperatures, changing rainfall patterns, and drier soils may reduce agricultural yields in regional countries.

The most severe threat to livelihoods would perhaps come from coastal flooding due to sea level rise. Densely populated coastal areas and low-lying plains of South-East Asia would be particularly vulnerable to flooding. These include some of the most productive lands in the region, such as the Mekong and Chao Phraya river deltas, and the Central Plain around Tonle Sap Great Lake in Cambodia.

The disappearance of beaches due to inundation would have a negative impact on the tourism industry, which is an important source of income in many South-East Asian countries.

Rapid population growth and expanding economic activities in the region already put enormous pressure on water resources. Reduced water supply caused by climate change would place even greater stress on people, agriculture and the environment. Conflicts over water resources will probably worsen in a fertile river basin like the Mekong and in regions with rapid population growth and increasing drought.

In brief, climate change would create additional struggles for many of South-East Asia's farmers and the poor, who have limited resources to adapt or to re-locate. Climate change impacts such as

reduced water resources, degraded soils and impoverished forests and fishing grounds may thus result in the destruction of people's livelihoods.

Impacts on Cambodia

As a poor agrarian country, Cambodia is highly vulnerable to the impacts of climate change. The country's agriculture, a major sector of the national economy, is dependent on the natural rainfall and the annual flooding and recession of the Mekong River and the Tonle Sap Lake. The Cambodian agriculture is therefore particularly sensitive to potential changes in local climate and monsoon regimes. Data from the past five years indicate that more than 70% of rice production loss in Cambodia was primarily due to flooding while drought was responsible for about 20% of the losses.

Over the last decade Cambodia has experienced social, economic and environmental impacts caused by irregular, severe and more frequent floods, droughts and windstorms, which are believed to be related to changes in local and global climate.

A study conducted by the Cambodian Ministry of Environment (MoE) in 2001 suggests that by 2100 rainfall in Cambodia would increase by 3% to 35% from the current condition, while temperature increase would be in the range of $1.3^{o}C$-$2.5^{o}C$. These conditions may result in the increased occurrence of extreme climate events.

In addition, sea level rise will severely affect the 435 km-long coastline, large parts of the Mekong River flood plain and the Tonle Sap ecosystem, which is the heart of Cambodia's economy, culture and environment. The above-mentioned study indicates that a sea level increase of one meter would inundate many costal areas of Cambodia, specifically the province of Koh Kong. In Koh Kong City, a total area of approximately 44 km^2 would be permanently underwater. The mangrove ecosystem is the widest area to be submerged and about 56% of the settlement area would also be flooded.

The country is also vulnerable to the health impacts of climate change due to its geographical location, the poor healthcare system, poverty predomination among the majority of people, and low awareness of people about healthcare measures.

IV. HUMAN RESPONSES TO CLIMATE CHANGE: THE UNFCCC AND THE KYOTO PROTOCOL

Increasing concerns over climate change have led to global efforts to respond to the issues. Scientific observation of climate change began in the mid 20th century. The First World Climate Conference took place in 1979 and called on governments around the world "to foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity". In 1988, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) to provide a credible assessment of the state of scientific knowledge on global warming. IPCC released its First Assessment Report in 1990, which confirmed the scientific evidence for climate change.

Four years later, in 1992, 154 countries at the Earth Summit in Rio de Janeiro signed the United Nations Framework Convention on Climate Change (UNFCCC), which entered into force in 1994. It establishes an international legal framework to address global climate change. The ultimate objective of the convention is *to stabilise greenhouse gas concentrations in the atmosphere, at a level that would prevent dangerous changes to the climate.*

The Convention set out some ruling principles, such as:

- The "common but differentiated responsibilities and respective capabilities" of countries, which take into account countries' different levels of emissions and different capacities to take action. This means that developed countries, as the main offenders to date, must take the lead in cutting emissions;
- The "specific needs and special circumstances of developing country parties, especially those that are particularly

vulnerable to the adverse effects of climate change" (for example, island or low-lying states);
- The precautionary principle which allows actions to be taken in the "absence of full scientific certainty";
- The "right" to promote sustainable development.

In addition, the Convention requests parties to prepare and report on their national inventories of GHG emissions and removals and promotes technology transfer and programmes to mitigate and to adapt to climate change.

The Convention also says that developed countries shall provide financial support to developing countries to meet their obligations under the Convention.

However, the Convention does not make specific and binding commitments to cut GHG emissions: these are made in the Kyoto Protocol. The Kyoto Protocol was adopted at the 3rd Conference of the Parties (C0P-3), held in Kyoto, Japan, in 1997. It commits 39 developed countries to reduce their GHG emissions of about 5% below their 1990 levels during the period between 2008 and 2012.

The Kyoto Protocol allows developed countries to reach their targets in different ways through three "Flexibility Mechanisms". These include: Emissions Trading (trading of emission credits between developed nations); Joint Implementation (transferring emission credits between developed nations, linked to specific emission reduction projects); and *the Clean Development Mechanism (CDM).* The CDM is the only Mechanism that involves developing countries. It allows developed countries to meet part of their reduction obligations through projects in developing countries that reduce emissions or sequester CO_2 from the atmosphere. It is important to note that these projects must result in sustainable development, as defined by the host country.

STEPS TOWARDS ACTION ON CLIMATE CHANGE		
Event	**Date and Place**	**Principal Achievements/Events**
IPCC - First report	1990	Broad international scientific consensus that human actions are influencing the climate
UNFCCC	1992, Rio de Janeiro, Brazil	• Committed the global community to stabilising the level of GHGs in the atmosphere • Recognised the primary responsibility of industrialised countries, and the differentiated responsibilities of developing countries
CoP-1	1995, Berlin, Germany	• Established UNFCCC Secretariat • Established pilot phase of "Activities Implemented Jointly" to reduce greenhouse gas emissions • Agreed timetable for setting specific reduction targets for industrialised countries
IPCC - Second report	1995	• Confirmed human influence on the climate • Stated that risk from climate change is severe enough to justify preventive actions
CoP-2	1996, Geneva, Switzerland	• Endorsed IPCC2 and CoP-1 agreements • Geneva Ministerial Declaration - a further impetus to the negotiations
CoP-3	1997, Kyoto, Japan	Agreed the Kyoto Protocol, with targets for industrialised country greenhouse gas reductions
CoP-4	1998, Buenos Aires, Argentina	Agreed a Plan of Action for following up on the Kyoto Protocol, including processes for stimulating technology transfer
CoP-5	1999, Bonn, Germany	Further progress on implementing the Kyoto Protocol
CoP-6 Part I and CoP-6 Part2	2000, The Hague, The Netherlands (part I) 2001, Bonn, Germany (part II)	• US withdrawal from the Kyoto Protocol • Reforestation and afforestation for CDM • Modalities and procedures for small-scale CDM projects • Special climate change fund adopted
IPCC - Third report	2001	Confirmed that global warming has happened faster than expected and mainly due to human activities
CoP-7	2001, Marrakech, Morocco	The Marrakech Accords were agreed outlining modalities and procedures for CDM

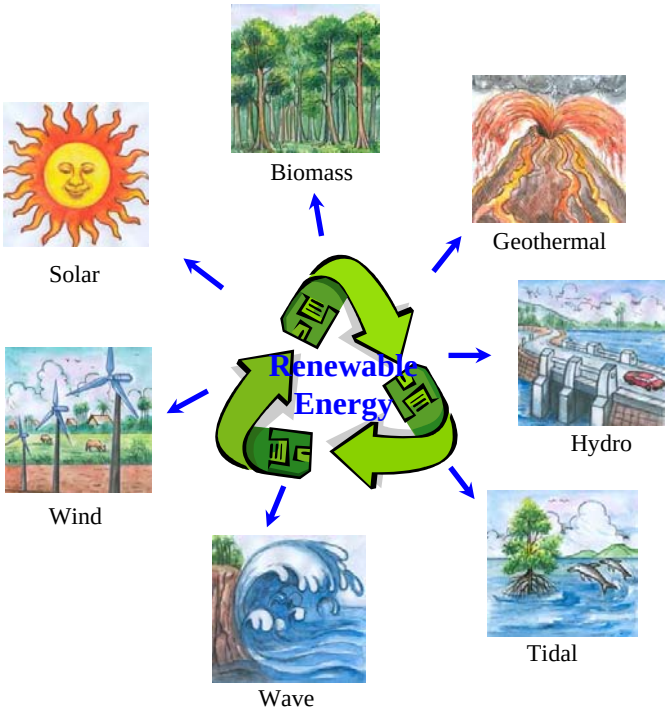
STEPS TOWARDS ACTION ON CLIMATE CHANGE		
Event	**Date and Place**	**Principal Achievements/Events**
CoP-8	2002, New Delhi, India	• Adopted the Delhi Declaration on Climate Change and Sustainable Development • Adopted the rules and procedures for the CDM Executive Board
"Rio+10" Earth Summit	2002, Johannesburg, South Africa	The hope that the Kyoto Protocol would be ratified and enter into force by this the time was not materialised
CoP-9	2003, Milan, Italia	Adopted modalities and procedures for CDM forestry projects

Adapted from: *Just a Lot of Hot Air?* The Panos Institute, 2000. London, UK; *A Guide to the Climate Change Process*, UNFCCC Secretariat; and *Earth Negotiation Bulletin*, IISD.

V. MITIGATION OF CLIMATE CHANGE

Chapter II explains the causes of climate change: an increase in GHG emissions that are trapping too much heat in the earth atmosphere. Therefore, reducing GHG emissions will be a solution that can help address climate change.

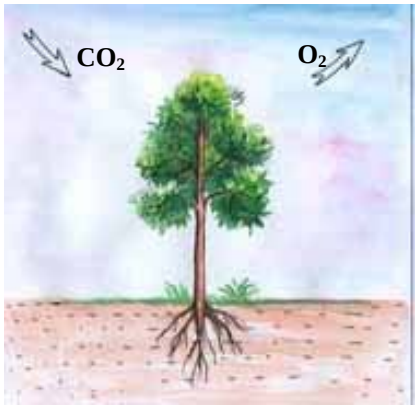
Mitigation involves measures that reduce GHG emissions such as switching to renewable energy sources (solar, wind, hydro, biomass, biogas, geothermal, wave, tide, etc.), increasing energy efficiency and conservation, and reversing deforestation. It is particularly beneficial to use measures that have other benefits besides the reduction of global warming. For example, re-forestation, shift to renewable energy, or energy efficiency and conservation measures will have many environmental, economic, and social benefits. This is crucial for developing countries, which need to develop their economies to improve people's livelihoods without degrading their environment.



Types of Renewable Energy

In many countries throughout the world, research has been conducted to develop new products and practices that are less GHG emission intensive and more environmentally friendly. Examples include:

- Hybrid and electric cars;
- Improved public transport;
- Development of renewable energy technologies;
- Recycling and reuse;
- Developing of more efficient engines and appliances;
- Appropriate land use practices;
- Forest conservation and environmental protection.



Forest Absorbs CO_2 from the Atmosphere

While most of these technologies and practices are economically competitive, proven and reliable, their successful implementation would require new policies, political commitments, adequate technical and institutional capacity, and wide public support.

Individuals have roles to play in reducing GHG emissions in day-to-day life. Most measures to reduce GHG emissions also help conserve natural resources and reduce the emissions of substances contributing to other environmental concerns, such as smog, acid rain and depletion of the ozone layer. Some relevant examples for Cambodia include:

- Reduce air conditioning demands by installing window blinds and by shading your house with trees or awnings;
- Use solar water heaters for hot water;
- When shopping for new appliances, compare energy consumption rates and choose the most efficient one. Even if it is more expensive initially, it may help you save money in the longer run;
- Use compact fluorescent lamps instead of incandescent bulbs. This can reduce electricity consumption by 75%;
- Turn lights off when they are not needed;
- Proper car maintenance: clean/change the air filter, correctly inflate tires, avoid unnecessary load;
- Drive reasonably: drive at the optimum speed limit, avoid abrupt stops and starts, plan your trips for the most efficient routes, avoid excessive idling;

- Consider taking public transport;
- Walk or ride a bike for short-distance travel;
- Participate in recycling and environmental protection campaigns;
- Plant trees;
- Inform responsible policy makers of your concerns for the environment and encourage the planning of better urban transit, cycling routes;
- Plant trees near your house for fuelwood rather than cutting from forest;
- Participate in community forestry or other conservation campaigns;
- Consider using biogas (gas from animal manure) for cooking rather than fuelwood;
- Ask relevant government agencies or NGOs for more energy saving tips.

VI. ADAPTATION TO CLIMATE CHANGE

Adaptation is possible adjustments, spontaneous or planned, of people, plants, ecosystems, etc. to climate change to reduce adverse impacts, to take advantage of opportunities or to cope with the consequences of climate change.

While reducing GHG emissions is vital for addressing climate change, in particular in a long-term perspective, adaptation allows immediate coping with climate change impacts to minimize damage. Even if GHG concentrations in the atmosphere were reduced, climate change would still occur due to the inertia of the climate system, and the already large quantities of GHG emitted over the past 200 years.

There are six general strategies available for adapting to climate change:

- *Prevent losses*, for example building barriers against sea-level rise;
- *Reduce losses* to a tolerable level. An example could include the use of appropriate crops to ensure a guaranteed minimum yield under even the worst conditions;

- *Spreading or sharing losses* to ease the burden on those directly affected by climate change, for example through government disaster relief;
- *Change a use or activity* that is no longer viable under new climate conditions;
- *Change the location* of an activity to the more suitable one, for example re-siting a hydro-electric power plant in a place where there is more water; and
- *Restore a site*, such as a historical monument becoming vulnerable to flood damage.

For some specific sectors, adaptations measures can be:

Water Resources

Improved and more efficient management of water resources can help reduce vulnerabilities of water users to negative climate change impacts. Some of the available adaptation measures include: development of regulations and technologies for direct control of land and water use, economic incentives to change users' behaviour, development of new sources, improvements in water-management operations and institutions, watershed protection, protection of waterside vegetation, restoring river channels to their natural form, and reducing water pollution.

Agriculture

Implementation of effective adaptation policies and plans can help reduce potential impacts of climate change on agricultural productivity or help improve food security. Adverse effects of climate change can be limited by: changes in crops and crop varieties, improved water management and irrigation systems, adapted planting schedules and tillage practices, and better watershed management and land-use planning.

Human Health

Risks of human health to climate change can be reduced through various adaptation strategies. For a country with limited adaptation capacity and resources like Cambodia, it is crucial that preventive measures be given a high priority to minimise the needs

for implementing reactive and more expensive curative measures. Adaptation measures to address negative impacts of climate change on human health may include: improved medical care services (especially for infectious diseases), health surveillance and sanitation programmes, public education and awareness raising, improved environmental management, disaster preparedness, improved water and pollution control, professional and research training, and protective technologies (such as housing improvements, water purification, and vaccination).

Coastal Areas

Possible response options to climate change impacts in coastal areas include protection sea walls and dikes, wetland creation, adoption of new building codes, protection of threatened ecosystems, regulations and plans for new coastal development, improving design standards, and strengthening fisheries management. Integrated coastal zone management, which considers social, economic, legal, institutional, and environmental measures, can offer a wide range of potential response options to choose from.

Forest and Ecosystems

In the forestry sector, measures that can help natural ecosystems adapt to climate change may include: creating natural migration corridors and assisting particular species to migrate, reforestation and the integrated management of fires, pests, and diseases, proper selection of plant species for rangelands, controls on animal stocking, new grazing strategies, introduction of drought-tolerant species and better soil conservation practices.

Climate Disasters and Extreme Climate Events

The risks posed by climate disasters and extremes can be mitigated through improved disaster preparedness planning, better information dissemination and awareness raising, improving technical and institutional capacity of responsible agencies, adoption of new technologies (buildings, transport, irrigation, etc.).

VII. CLIMATE CHANGE ACTIVITIES IN CAMBODIA

Cambodia and the UNFCCC

Cambodia, as a least developed country, clearly recognises that climate change is a serious environmental threat to the country and to the rest of the world. The Royal Government of Cambodia, with its limited capability and available resources, has actively worked with the global community to address this threat.

Cambodia signed the UNFCCC in 1995, just two years after the establishment of the Ministry of Environment and the first national elections since the 1970s. In September 2002, Cambodia released its Initial National Communication under the UNFCCC, which presents the findings of the national GHG inventory for 1994, GHG projections from 1994 to 2020, GHG mitigation options and a vulnerability and adaptation assessment to climate change.

The GHG inventory indicates that in 1994 Cambodia was a net carbon sink country with a net total carbon removal of 5.142 million tonnes of CO_2-equivalent. Land use change and forestry (LUCF) accounted for most of the emissions and removals of greenhouse gases in 1994. It represented 81.2% of GHG emissions, followed by agriculture with 15.5% and energy with 2.8%.

As a least developed country, Cambodia has received funding from the Global Environment Facility (GEF) to prepare a national adaptation program of action to climate change (NAPA). This project started in mid 2003 and is expected to be completed in late 2004. NAPA proposes priority activities to address the urgent and immediate needs and concerns of the country for adaptation to the adverse effects of climate change in agriculture, water resources, coastal zone, forestry, and human health.

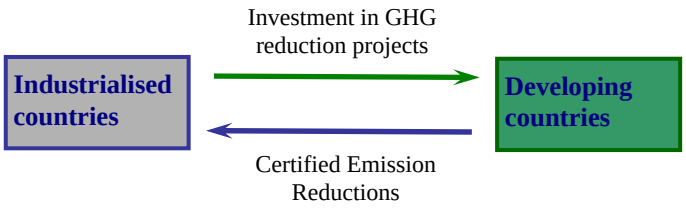
Cambodia and CDM

As a developing country or Non-Annex I party to the Convention, Cambodia does not have any commitments to reduce its GHG emissions. However, the country is committed to support the promulgation of the Kyoto Protocol, the first international

agreement that will lay the foundation to achieve the ultimate goal of the UNFCCC: stabilising of GHG concentrations in the atmosphere, at a level that would prevent dangerous changes to the climate system.

In this context, the Royal Government of Cambodia signed the Instrument of Accession to the Kyoto Protocol on 4 July 2002, indicating its commitments to the global efforts in addressing climate change issues. This makes Cambodia eligible for hosting emission reduction projects under the Clean Development Mechanism (CDM).

The CDM has two key goals: (i) to assist developing countries who host CDM projects to achieve their sustainable development objectives, and (ii) to help developed countries partially meet their GHG reduction commitments by allowing them to take credits from emission reducing projects undertaken in developing countries.



Simplified CDM Project Scheme

In order to participate in CDM, developing countries must meet 3 basic requirements: (i) voluntary participation, (ii) establishment of a Designated National Authority (DNA), and (iii) ratification of the Kyoto Protocol. CDM cannot divert Official Development Assistance (ODA). The Designated National Authority (DNA) is responsible for certifying that proposed CDM projects comply with national sustainable development objectives.

Some typical CDM project types that reduce, avoid or sequester the GHG emissions are:

- Renewable energy (hydro, wind, solar, biomass);
- Energy efficiency (production and end use);
- Fuel switching (bio-diesel, gas);
- Cogeneration (combined heat and power generation);
- Industrial processes (For example, CO_2 from cement production);
- Forestry (afforestation and reforestation for carbon sinks);
- Transport activities;
- Waste management.

Benefits of CDM to Cambodia

For Cambodia, CDM may be a source of new investment, environmentally friendly technology and capacity building in the fields of energy, forestry, agriculture and waste management. These are some of the key economic sectors Cambodia desperately needs to foster to support its sustainable development goals. In the energy sector, if designed and implemented wisely, CDM projects will offer the country opportunities to improve energy efficiency, to develop indigenous renewable energy, to transfer environmentally friendly technology and to help create new jobs.

In the forestry sector, CDM projects will help increase the amount of forests through reforestation and afforestation activities. These forests will subsequently help regulate local climate, mitigate climate change impacts such as floods and storms and absorb carbon from the atmosphere. Furthermore, they will provide many associated environmental benefits and services such as watershed protection, control of soil erosion and degradation, biodiversity conservation, provision of non-timber products. These are very important aspects for local communities and for the whole of Cambodia.

CDM Potential in Cambodia

Up to now, the development of the Cambodian energy sector has been based mainly on conventional, GHG-emission intensive, often out-of-date technologies such as heavy fuel or diesel generators. In the rural areas, fuelwood will remain the major energy source for years to come. The current efficiency of both commercial and non-commercial energy use is low. Therefore,

CDM has much to offer by facilitating the development of sustainable energy projects.

The Integrated Capacity Strengthening for the CDM project, which was funded by the Institute for Global Environmental Strategies of Japan, recently sponsored a study of the potential for sustainable energy projects (i.e. renewable energy and energy efficiency) in Cambodia. Most of the projects identified in this study are small-scale hydro, biomass, wind and solar installations. The study indicates that, if implemented, these projects would reduce almost 47 million tonnes of GHGs per year.

The Solar Energy Component of the 120 kW Hybrid PV and Biogas Project near Sihanoukville

In the forestry sector, no comprehensive study has been conducted to assess CDM potential. However, it is believed that this sector may provide a great opportunity for reforestation of areas that were deforested before 1990, as specified in the CDM forestry rules. Agro-forestry and community forestry are also eligible for CDM.

CDM Institutional Arrangement in Cambodia

The Cambodian Climate Change Office (CCCO) was established in June 2003 within the Cambodian Ministry of Environment. The Office is responsible for a wide range of climate change-related activities: planning and policy formulation, implementation of the country's commitments under the UNFCCC, assessment of new technologies to adapt to the adverse effects of climate change or to mitigate greenhouse gas emissions and capacity building and awareness raising. The Office also serves as the secretariat of the UNFCCC, the Kyoto Protocol and the CDM Focal Points for Cambodia.

In July 2003, the Cambodian Prime Minister appointed MoE as the Interim Designated National Authority (DNA) for CDM. As the Interim DNA, MoE is responsible for assessing proposed CDM projects against the sustainable development objectives of the country. In addition, MoE will be responsible for issuing a written letter of approval for each CDM project confirming that, as the host country, Cambodia's participation in CDM is voluntary, and that the proposed projects will assist in achieving national sustainable development objectives. In its capacity as the interim DNA, MoE works with all Government Ministries, the private sector and NGOs to assess and approve projects. MoE will also serve as the liaison office and focal point for national and international communications related to the CDM, and promote and facilitate investment in CDM projects in Cambodia.

CCCO is currently working with other concerned ministries to establish a more representative DNA, finalise its structure, operational guidelines and sustainable development criteria for assessing proposed CDM projects. It is expected that within the final DNA structure CCCO will act as the DNA Secretariat to co-ordinate the assessment of proposed CDM projects, work with energy/forestry inter-ministerial working groups, co-ordinate stakeholder consultation, and make recommendations to the DNA. The future Cambodian DNA will likely be cross- ministerial and will approve/reject proposed CDM projects based on recommendations from the Secretariat and its inter-ministerial working groups. The final recommendations on the structure of

the DNA is expected to be made to the Council of Ministers by the end of 2004.

To prepare for CDM, Cambodia is currently implementing a number of capacity building projects including support from the Japan Ministry of Environment through the Institute for Global Environmental Strategies (IGES).

Under these projects, Cambodia will raise awareness about CDM at the national and provincial levels, strengthen CDM capacity for policy makers, public & private sectors, prepare sustainable development criteria for assessing proposed CDM projects, establish the final DNA and assessment process for proposed CDM projects, develop a pipeline of potential CDM projects, and promote these projects among developers and investors.

The Interim DNA is located within the Climate Change Office at the Ministry of Environment at #48, Samdech Preah Sihanouk Blvd, Phnom Penh, Cambodia.

REFERENCE:

Climate Change Secretariat. A Guide to the Climate Change Convention and its Kyoto protocol. Bonn, 2002.

Climate Change Secretariat. A Guide to the Climate Change Convention Process. Bonn, 2002.

Foundation for the Philippine Environment. Cool Practices for Hot Climate. The Philippines, 2000.

Louise Aukland *et al*. Laying the Foundations for Clean Development: Preparing the Land Use Sector, A Quick Guide to the Clean Development Mechanism. London, 2002.

Ministry of Environment. Cambodia's Initial National Communication under the United Frameworks Convention on Climate Change, Phnom Penh, 2002.

Noelle O'Brien *et al.* Environment: Concepts and Issues, A Focus on Cambodia, Phnom Penh, 1998.

Peter Denton. The Climate in Crisis, WWF, 1997.

The Pembina Institute. A User's Guide to the Clean Development Mechanism, Canada, 2002.

UNEP. Climate Change information Sheets, Switzerland, 1997.

UNEP/WMO. Common Questions about Climate Change, Kenya, undated.

UNEP/WMO. Understanding Climate Change: A Beginner's Guide to the UN Framework Convention, Switzerland, 1995.