

**CHAPTER ONE**  
**EXECUTIVE SUMMARY**

### 1.1 INTRODUCTION

Guyana signed the United Nations Framework Convention on Climate Change (UNFCCC) at the United Nations Conference on Environment and Development (UNCED) which was held in Rio de Janeiro in June 1992. The Convention entered into force for Guyana on November 17, 1994. Guyana, being a Non-Annex 1 and Non-Annex 2 Party to the Convention, prepared its Initial National Communication under the Guidance of Decision 10/CP.2 and Articles 4.1 and 12.1 of the Convention. An Enabling Activity Project, funded by the Global Environment Facility (GEF) and implemented by the United Nations Development Programme (UNDP) called for the preparation of an Initial National Communication and a National Action Plan to address climate change and its adverse impacts. The Action Plan will be a supplement to the Initial Communication.

The National Climate Committee (NCC), comprising several governmental agencies, the University of Guyana (UG) and the Guyana Manufacturers Association (GMA), established a National Task Force that prepared the Initial National Communication and the Action Plan under the guidance of an international consultancy. Several Workshops and working group and Task Force meetings were held in order to train local resource personnel, and to prepare the several chapters of the two reports. The base year for this communication is 1994.

### 1.2 NATIONAL CIRCUMSTANCES 1994

Guyana is a tropical country situated on the northeastern coast of South America. It is bounded on the north by the Atlantic Ocean, on the east by Suriname, on the south by Brazil and on the west by Venezuela. It is an English-speaking country with close ties with the English-speaking Caribbean Islands. It is a member of the Caribbean Community (CARICOM) which has its headquarters in Georgetown, the capital city.

Guyana has the following characteristics:

- It is a low-lying state with a vulnerable coastal strip 77 km wide in the east and 26 km wide in the western Essequibo region.
- Ninety percent (90 %) of the population resides in the coastal strip where the main urban centres and commercial activities are to be found.
- There is a wide range of geographic types with coastal, hilly sandy, highland, forested and savannah regions.
- There is no current tectonic activity in Guyana and indications are that the Guyana shield (and the coastal strip, in particular) will not be affected by convergence of the South and North American plates.
- There is a high level of rainfall variability in the country and the seasons and climate are determined mainly by this variability. There are two wet and two dry seasons.

First Dry Season (February to April);  
First Wet Season (April to July)  
Second Dry Season (July to November); and the  
Second Wet Season (November to January)

The country can be divided into climatic regions ranging from dry (annual rainfall less than 1788 mm) to extremely wet (annual rainfall greater than 4100 mm).

- The major weather system is the Inter-tropical Convergence Zone and the major climate system is the El Niño Southern Oscillation (ENSO). Large-scale floods and droughts are as a consequence of the

ENSO events impacting on Guyana's weather.

Guyana was a British colony prior to its independence on May 26, 1966. The population is approximately 750,000 and comprises five major ethnic groups: East Indian, Africans, Amerindians, Chinese and Portuguese. There is a land area of 216,000 km<sup>2</sup> and a very low population density of about four persons per km<sup>2</sup>. The major religions are Christianity, Hinduism and Islam.

With a Gross Domestic Product (GDP) per capita of US\$ 528 in 1990, the economy grew, as a consequence of structural adjustment measures, by 8.5 % in 1994. The positive growth rate was primarily due to the effects of price liberalization, market-determined exchange rate and the positive results of private sector investments in the gold, timber and rice industries.

Agriculture is the major economic activity in Guyana. In 1994, this sector increased by 11.2 % compared to 5.4 % in 1993. This was due to recovery of sugar output and expansion of rice, timber and other crop production. The forestry sector was influenced by new governmental policies which facilitated significant foreign investment. The fishing industry experienced an increase in production by 7 %. The manufacturing, services, construction, mining, (and quarrying) sectors also contributed to the healthy growth rate in 1994. Tourism, in the form of eco-tourism, has been expanding and is expected to be a major contributor to the economy in the future.

Guyana is very dependent on imports of fossil fuels for its energy needs. Fuel and lubricants accounted for 16 percent of total imports in 1994. Bagasse is used for the co-generation of steam and electricity in the sugar and rice industries. There is the potential for substantial use of renewable energy sources such as hydropower, solar, wind and biomass.

The preparation of Guyana's National Greenhouse Gas (GHG) Inventory for 1994 showed that Guyana was not sufficiently strong institutionally, to address its commitments under the UNFCCC. There is the need to address capacity building in the government (including local government), the sector agencies and the private sector. The establishment of a Climate Unit with adequate staffing will allow for effective coordination of climate change activities.

### 1.3 NATIONAL INVENTORY OF GREENHOUSE GASES

As required by the Second Conference of Parties (COP 2) the GHG inventory for Guyana encompasses the following greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). Emissions of the indirect GHGs such as carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>) and non-methane volatile organic compounds (NMVOC) are reported as well. The emissions of these gases are grouped into sectors according to the Inter-governmental Panel on Climate Change (IPCC) Guidelines, as follows: *Energy, Industrial Processes, Agriculture, Land Use Change and Forestry, and Waste.*

The IPCC Revised 1996 Guidelines was used by Guyana to develop the inventory for 1994 with data for other years being used to indicate trends. CO<sub>2</sub> emissions from *international bunkers* and *bio-mass* are not included in the national totals but are reported separately as other sources of emissions.

In summary, the national inventory revealed that Guyana is a Net Sink country for CO<sub>2</sub> where removals (26,664 Gg) greatly exceed emissions (1446 Gg), that is, a removal balance of 25, 218 Gg in the base year 1994. The Energy sector (fuel combustion activities) is the major emitter of CO<sub>2</sub> having CO<sub>2</sub> emissions of 1446 Gg in 1994, while the Land Use Change and Forestry sector is the major sink for CO<sub>2</sub>, with net removal/sink of 26,664.47 Gg in 1994, refer to table 1.1.

It also revealed in the inventory that CO<sub>2</sub> is the major GHG being emitted, which accounted for 96.5 % (1446 Gg) of the total emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in 1994.

**TABLE 1.1: SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES, YEAR 1994.**

SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (Gg)						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES						
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC
<b>Total National Emissions and (Removals)</b>	<b>1446 (-26,664)</b>	<b>51</b>	<b>1</b>	<b>17</b>	<b>208</b>	<b>23</b>
<b>1 All Energy</b>	<b>1446</b>	<b>1</b>		<b>11</b>	<b>45</b>	<b>6</b>
<b>A Fuel Combustion</b>	1446	1		11	45	6
1 Energy Industry	602			3	9	
2 Industry (Manufacturing)	191			1	3	
3 Transport	203			2	22	4
4 Other Sectors (commercial, residential, agri. etc.).	450			6	10	1
<b>B Fugitive Emissions</b>	Nil	Nil	Nil	Nil	Nil	
<b>2 Industrial Processes</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>	<b>16</b>
A Mineral Products (asphalt use on road)	NO	NO	NO	NO	NO	10
B Chemical Industry	NO	NO	NO	NO	NO	
C Metal Production	NO	NO	NO	NO	NO	
D Beverages and food production						6
<b>3 Solvent and Other Product Use</b>	<b>N.E.</b>	<b>N.E.</b>	<b>N.E.</b>	<b>N.E.</b>	<b>N.E.</b>	<b>N.E.</b>
<b>4 Agriculture</b>		<b>41</b>	<b>1</b>	<b>4</b>	<b>95</b>	
A Enteric Fermentation		14				
B Manure Management		1				
C Rice Cultivation		22				
D Agricultural soils			1			
E Prescribed Burning of Savannah		1			28	
F Field Burning of Agri. Residues		3		4	67	
<b>5 Land-Use Change and Forestry (a)</b>	<b>-26664</b>	<b>8</b>		<b>2</b>	<b>68</b>	
A Changes in Forest & Woody Biomass	-29195					
B Forest and Grassland Conversion	2531	8		2	68	
<b>6 Waste</b>		<b>1</b>				
A Landfill		1				
<b>Memo Items (b)</b>						
(i) International Bunkers, total	<b>28</b>					
- Aviation	24					
- Marine	4					
(ii) Biomass Emissions	<b>1200</b>					

**Key:** 1. (NO) - Not occurring  
2. (NE) - Not estimated  
3. (NA) – Data not available

**Note:** (a) - Emissions value indicated is the net of emissions and removals.

(b) - Not included in national emissions and removals.

(c) - Because the IPCC software rounds off values, the “Total National Emissions”, shown in the table, may

not represent the actual summing of values in the sub-headings of the table.

The Agriculture sector is the major source of CH<sub>4</sub> and N<sub>2</sub>O emissions, with emissions totaling 51 Gg and 1 Gg respectively in 1994. Under this sector, rice cultivation and enteric fermentation in animals are the main sources of CH<sub>4</sub> while that of N<sub>2</sub>O emissions are from the use of synthetic nitrogen fertilizer on agricultural soils.

As for the indirect GHG's, NO<sub>x</sub> and NMVOC, the major source sectors are the Energy and Industrial Processes sectors respectively while CO seems to be having several main source sectors, Agriculture, Land Use Change and Forestry, and Energy, with Agriculture being the major sector for emissions of this GHG. See table 1.1 for emissions and direct sources of these greenhouse gases for the year 1994.

There are many data gaps that will have to be addressed in future inventories. GHG specific data collection in the Energy and other sectors will have to be done. Current data collection procedures are not adequate even to satisfy sector needs. Hence there is the need to address data collection as a national issue.

As a consequence of the crude estimations, which were made due to inadequate data, uncertainty exists in the inventory analysis. However, a greater uncertainty exists in applying default emission factors. In some cases, factors used in other countries were applied. This indicates that Guyana needs to develop the capacity to prepare emission factors for local conditions and not rely on defaults. This applies to all sectors and all GHGs.

### 1.4 IMPACTS AND VULNERABILITY ASSESSMENT

#### Climate Change and Sea Level Rise

*While Guyana is a net sink country for greenhouse gases, it is most vulnerable to the impacts of climate change.*

The records in Guyana suggest an increase by 1.0°C of the mean annual temperature in Georgetown over the period 1909 to 1998. Cooling periods in the record appear to be due to the influence of major volcanic eruptions in several parts of the world. Prior to 1960, annual rainfall amounts were generally above or about normal. From 1960 and onwards, there has been a tendency for below normal rainfall. ENSO events have severely affected Guyana especially in the last decade of the twentieth century.

The atmosphere-ocean global circulation model (A-OGCM) of the Canadian Climate Centre (CGCM 1) was used to develop predictions of rainfall, temperature, evaporation and water deficit for two scenarios of carbon concentration: doubling and tripling. For a doubling scenario, temperature is expected to rise by 1.2°C in the period 2020 to 2040 from present. Highest increases in excess of 1.5°C, are expected in southern Guyana in the Second Dry Season (August to October). Rainfall is expected to decrease by an average of 10 mm per month but the decrease in the First Wet Season and Second Dry Season (May to October) will be 12 mm per month or higher. Evaporation, however, appears to show insignificant increases (less than 3 mm per month). Water deficit will be about 8 mm per month on average with larger deficits in southern Guyana.

With a tripling of CO<sub>2</sub> concentration in the latter part of the twenty-first century, Guyana could experience a temperature rise of 4.2°C on average. Here again, southern Guyana may experience highest increases. Rainfall can decrease by an average of 21 mm per month with higher decreases in the First Wet Season (FWS) and Second Dry Season (SDS). Again, southern Guyana could be influenced by the highest decreases. Evaporation is likely to increase by about 3.3 mm per month. Here, however, it is northern Guyana, which may be affected by evaporation rates in excess of 12 mm per month. Southern Guyana may experience large water deficits in the First Wet Season and Second Dry Season while northern Guyana is

likely to be affected by deficits in excess of 22 mm per month.

The Hadley Centre A-O GCM showed somewhat similar projections except that, for the tripling CO<sub>2</sub> scenario, lower temperature increases are projected and more severe decreases in rainfall are expected especially for the First Wet Season.

Tide gauge data in Guyana for the period 1951 to 1979 indicated a mean relative sea level rise of 10.2 mm yr<sup>-1</sup>. This is about 5 times the global average and suggests a mechanism other than sea level rise may be operating on Guyana's coast.

The global circulation models (GCMs) indicate average rises of 2 to 4 mm yr<sup>-1</sup> in the first half of the twenty-first century and rises of 3 to 6 mm yr<sup>-1</sup> in the latter half. Therefore, in Guyana, sea level is projected to rise by about 40 cm by the end of the twenty-first century. If meltwater contribution from land ice is considered, then the rise can be about 60 cm.

The predicted sea level rise coupled to extremes in rain events and storm surges and increased wave action can exacerbate an already critical situation where water accumulation off Guyana's coast has been resulting in breaching and overtopping of the sea defences.

### Climate Change Impacts

The impact of climate change on **water supply** is not very clear. Decreasing rainfall and increasing evaporation can lead to lower water levels in the rivers. Extreme rainstorm events can allow for flood conditions especially during cold phase ENSO events. Sea level rise can result in salt-water intrusions further up in the rivers. Ground water can also be vulnerable to this effect. Demand for water is expected to increase with increasing temperatures and the relative value of water for alternative uses would likely change as priorities are determined on the basis of urgency of needs.

The **energy sector** will also be affected. Demands for interior space cooling and possibly decreased hydro-generating potential supply from some river basins can pose some problems. Shifts in the seasonality of river discharges and reduced rainfall will have to be considered in determining hydropower sites and periods of water storage.

In the **agriculture sector**, using analyses based only on changes in climate variables, yield losses will affect sugar and rice. These losses may be triggered by increased water demands from crop transpiration and greater respiration losses as a consequence of higher temperatures. There may be changes also in yield quality due to a decreased diurnal temperature range resulting in, for example, decreased sucrose content. There is uncertainty in assessing the effect of fertilizers and pesticides on crop yield due to the projected increase in temperature. It is possible that adjustment of levels of fertilization may be an effective stabilizing response in extreme years.

Spatial shifts may have to be considered as climate change takes effect. There may be the need for a substantial switch of crops or species of crops in particular areas. In addition, changes in farm profitability can be expected to affect non-agricultural sectors of the Guyanese economy.

Major studies will have to be done to examine the advantages of increased CO<sub>2</sub> concentration and the effects of increased temperature, rainfall and evaporation on the major crops in Guyana. Also, it must be noted that the sensitivity analysis done in this Communication merely identifies the vulnerable areas and should form the basis for further evaluation and planning.

A CO<sub>2</sub>-induced climate change can impact on the **forestry sector** in a similar way to those for agriculture. However, there will be the need to consider the impact of increased CO<sub>2</sub> fertilization on forest growth. If the dry seasons get drier, then this may impose severe constraints on forest growth and may be critical in determining species response.

The Holdridge classification system was used together with the climate scenarios to determine the possibility of change in the sector. With a doubling CO<sub>2</sub> concentration, indications are that the forests in southern Guyana may be affected with the *shrub savannah* spreading southward to replace *tall evergreen forest*. With a tripling CO<sub>2</sub> concentration, the same areas can be affected. However, the northwest may also be affected by a change to *shrub savannah* types. Again, the sensitivity analysis must be guided by further studies.

The **Coastal Zone** is identified as being the most vulnerable part of Guyana because sea level rise will be expected to add to the direct climate impacts of temperature rise, rainfall decrease and evaporation increase. It is also the part of Guyana where adverse impacts will directly affect a large percentage of the Guyanese population.

Two **vulnerable zones** have been identified in the coastal zone. **Impact zone I** comprise the western Essequibo areas where the coast is not protected by man-made structures. **Impact zone II** is the densely populated regions comprising Berbice, Demerara and the eastern part of Essequibo that are protected by man-made structures. In both zones, drainage is a problem. The Government will have to develop a programme to address the issues of coastal stress taking into consideration the impacts of climate change and sea level rise. Decisions will have to be made, on the basis of detailed analyses, on areas that shall be protected or accommodated or perhaps abandoned in the face of accelerated sea level rise.

Since the coastal zone affects a large percentage of the population, it will be necessary to examine the implications of climate change for water resources (effects of salinity in estuaries and aquifers), agri-culture, fisheries, human settlements, human suffering and loss of lives, tourism and health. Many data gaps exist and institutional capacity to examine these issues is not adequate. These shall have to be addressed. The work started under the Caribbean Planning for Adaptation to Climate Change (CPACC) programme should be continued possibly as components of the next phase of CPACC.

## 1.5 ADAPTATION MEASURES

Adapting to the impacts of climate change will require substantial financial and technical assistance. The overall goals of adaptation are to promote sustainable development and to reduce vulnerability. Sustainable development will entail ensuring economic development of all administrative regions, protection of the environment and equitable distribution of the wealth of the nation. Reduction of vulnerability will require minimizing of the risks of the impacts, reducing economic losses and alleviating hardships while building the institutional response mechanisms for detecting and warning of the signals of the impacts and for responding to emergencies and other activities required to address vulnerable ecosystems.

The impacts of climate change are likely to exacerbate an already “stressed” situation. Already, coastal and estuarine defences are being eroded by the sea; the number of human settlements are increasing in vulnerable low lying areas; health services are overburdened; mining activities are changing the banks and bottom topography of rivers in the hinterland and droughts and floods affect parts of Guyana on an annual basis. It is therefore necessary that climate change measures be combined with measures already identified to deal with current problems. The goals and objectives of the National Development Strategy can be realised by considering climate change adaptation and abatement measures.

The response options will obviously depend on the level of vulnerability in the region, or part of a region which is affected. It is first necessary to ensure that the capacity to detect, plan and respond exists in all relevant sectors. It is therefore a priority that capacity building be addressed at all levels of government and in the sectors. Another necessity is for climate change adaptation options be incorporated into national and sectoral policies such as economic development policy, disaster prevention and management, and environmental management plans.

The governmental capacity to deal with climate related issues need strengthening. Local communities are sometimes not aware of their vulnerability to the effects of global warming. The uncertainties in the predictions and impacts often create a resistance towards policy development and capacity building to deal with future vulnerable situations. Currently, the response mechanism is a reactive one where the problem is dealt with when it starts.

Signals of climate change and its impacts in Guyana have to be observed and studied. The monitoring and research capabilities of the scientific agencies will need strengthening. A very important monitoring deficiency is in impact monitoring. There will be a need to effect a comprehensive monitoring programme which will provide the impact signals on erosion, inundation, changes in pest abundance, health problems, changes in fisheries, rice and sugar yields, etc.

Planning is essential for addressing adaptation options. The capacity to identify options must be in place as is the capacity to respond to the adverse impacts of climate change. Disaster-prevention agencies such as the Civil Defence Commission, the military, non-governmental organisations (NGO's) and local communities must be prepared to respond effectively to abrupt and prolonged adverse conditions. Communication with local communities is a necessity for timely adaptation responses.

The adaptation strategy must consider, on the basis of analyses of data, precautionary actions to prevent loss. A controlled programme of actions to protect, retreat and/or accommodate the rise in sea level and to respond to other impacts will be necessary. Several options and their costs/benefits can be considered for adoption, tolerating short term loss is one such option, which can be considered. Spreading or sharing losses, changing use or activity, changing locations and/or restoration of damaged systems are all options, which can be chosen depending on the area and the impact being considered.

It is recommended that response options be considered in terms of short term (2000-2005), medium term (2006-2020) and long term (2021 and beyond). Options are recommended for each sector. However, many of these options can also be said to be options for sustainable development and can therefore be addressed as national efforts within the framework of the National Development Strategy (NDS). However, the coastal zone will demand urgent necessary actions since it is here that the impacts will be most severe. Anticipatory actions will have to be a major part of the strategy to minimize the effects of rising temperatures and seas.

### 1.6 MITIGATION MEASURES

Guyana has an obligation, under the Convention, to implement measures to mitigate emissions of GHGs into the atmosphere. The major sectors are the Energy sector, the Agriculture sector and the Waste sector. Mitigation will involve technology transfer in order to make energy use more efficient, to change farm practices and to reduce emissions from waste management. The strategies that have been recommended are considered for short term (2000-2005), the medium term (2006-2020) and the long term (2021 and beyond).

In the Energy sector, modernization of the current electricity power generating plant is a necessary first measure to be considered. Leakages in the distribution system must also be considered. The use of renewable sources of power such as hydropower, solar and wind should be addressed in the short, medium and long terms. Policy issues in this sector have been examined and it is recommended that the Energy Sector Reform Act should be extended to include climate change mitigation issues

### 1.7 TECHNOLOGY TRANSFER

The relevant technologies are of two types: mitigation technologies and adaptation technologies. Mitigation technologies address the reduction of emissions of GHGs while adaptation technologies address the reduction or elimination of the consequences of the climate change impacts.



Mitigation technologies include fuel efficiency, renewable energy sources, climate-friendly agricultural and forestry practices. These are all technologies, which can be transferred to Guyana via the private sector and through business partnerships or linkages. However, the adaptation technologies, particularly the coastal adaptation technologies will mostly be transferred to government since the private sector may not consider sea defence, drainage and irrigation, etc. as activities for which investments will bear attractive financial results in the short term.

The government will have to review policy directives that are likely to impede technology transfer; it will also have to support capacity strengthening to accelerate such transfers. These areas include inadequate human and institutional capabilities and inability to access, select, import, develop and adapt appropriate technologies. The capacity of the Institute of Applied Science and Technology (IAST), National Agricultural Research Institute (NARI), etc. to play a major coordinating role in technology transfer will have to be strengthened.

### **1.8 MONITORING AND UNDERSTANDING CLIMATE CHANGE AND IMPACTS: Systematic Observation and Research; Education, Public Awareness and Training.**

Anthropogenic Climate Change and its impacts can affect all sectors of socio-economic development in Guyana. It is therefore essential that the people of Guyana be fully prepared to respond to the adverse impacts. This will require actions to be undertaken to observe the effects of global warming and to conduct studies into the possible future impacts and response mechanisms. The education system must be involved in acquainting students with the effects of global warming and the issues that are being addressed at the national and international levels. An aggressive public awareness programme and training from the university levels down to the primary school level and at the community level will be necessary to facilitate Guyanese with the skills to respond to the impacts of climate change

To detect climate change, long periods (over 100 years) of reliable and more sensitive climate data have to be available for a network of locations, which can indicate the regional variations in the climate. A relatively long period of impact monitoring is also required if accurate deductions, on the impacts, are to be made. Information must be generated from available data to provide inputs for the climate models. These models will output future projections on the details and choices of the responses that can be adapted to mitigate climate change.

The mandate for monitoring the climate system lies with the Hydrometeorological Service of the Ministry of Agriculture. However, many vacancies exist at the professional level; other constraints include inadequate training, lack of equipment, inability to attract field and office technicians, effecting proper maintenance, etc.. All these setbacks contribute towards an insufficient capacity in Guyana, to monitor climate and climate change.

The impacts of severe climate variability will affect socio-economic development. Responses may not be appreciated or understood by those who shall be affected at this time. Hence, education, public awareness and training will be essential tools to increase understanding and appreciation.

The Environmental Protection Agency (EPA) is promoting environmental education and public awareness in Guyana, especially by the already drafted National Environmental Education and Public Awareness Strategy (NEEPAS, 1999). However, Climate issues have not been directly addressed by the NEEPAS while related issues were addressed. As such, the EPA should include climate education as one of the major issues to be addressed by NEEPAS so as to avoid duplication of efforts.

### 1.9 MAJOR RECOMMENDATIONS

Guyana, based on the 1994 national inventory, makes only a minor contribution to emissions of greenhouse gases. However, increases in the global mean temperatures could have significant impact, especially on the coastal plain and on activities including the dominant agriculture sector. Policies and programmes to address climate change, and to further reduce emissions, need to be developed and implemented. The preparation of Guyana's Initial National Communication showed that Guyana is not quite prepared, due to inadequate human, institutional and financial resources, to address its commitments under the UNFCCC.

The recommendations below are pivotal for sustainable development and for response to the related climate change issues. They should be combined with the measures outlined for implementing the National Development Strategy.

**Establish a Climate Change Unit** in a government agency. This Unit should be responsible for delivery of Guyana's GHG programmes and will provide a central point of contact for industry and other stakeholders. The Unit will reflect the priority that the government is giving to domestic actions to reduce GHG emissions.

**Government should garner financial resources and support, to protect agriculture and other infrastructure on the coast** as a consequence of impacts and vulnerabilities predicted for this region. Therefore, planners should consider these likely impacts when considering further coastal development and encourage settlements in suitable interior locations.

**Update the inventory of coastal assets and quantify in terms of monetary values, and identify areas of great threat to the sea and future sea-level rise.** Upon completion of this survey, carry out sea defence work on areas that are most vulnerable to the sea and have substantial values in terms of assets for possible protection while discouraging major development in coastal areas that already have little or no value in assets and no sea defence.

**Carry out research** in the the agriculture sector to develop or acquire special plant species that will adapt to the predicted climate change, or to acquire the most appropriate technologies that will foster adaptation in all sectors of Guyana's economy, most importantly the agriculture, forestry, energy, water resources and buildings sectors.

**Boost the use of renewable energy:** The Government should continue to work with local Regional Authorities, private sector and communities to set a mandatory target to source a percentage of electricity from renewable sources. Solar and wind energy projects along with hydropower can drive the urban electrification programme by identifying whole villages for renewable energy applications.

**Calculate baseline emissions and local emission factors:** Due to lack of adequate activity data, the national inventory was calculated using estimations and application of indirect default emission factors. Guyana needs to develop the capacity to prepare emission factors for local conditions and not relying on indirect default factors. This should apply to all sectors and all greenhouse gases.

**Accelerate energy market reform:** Efficiency standards for fossil fuel electricity generation should be drawn-up and be put into Law to ensure that Guyana adopts the best practices. The reform will also deliver economic as well as environmental benefits to the nation.

**Improve fuel efficiency in land, sea and air transport:** Mandatory fuel efficiency measures, including acquisition of high grade fuel and highly efficient engines must be purchased, developed and implemented.

**Implement national efficiency codes and standards** for buildings, all appliances (locally produced and imported ) and a wide range of industrial equipment so that energy efficiency can be taken into the offices, the homes, the factories and the commercial houses.

**Foster local carbon sequestration programmes, including revegetation and soil carbon storage programmes** to increase sinks for GHGs. The Government can facilitate partnerships between the forestry, corporate sector and local communities through the funding of revegetation projects. Local Government can also be involved in projects to promote planting of trees, etc. in the communities.

**Develop a programme for climate protection** to be implemented in the municipalities and in the regions by fostering emissions reduction via energy efficiency, “clean” transportation , management of waste, climate consciousness and adaptation activities.

**Develop programmes to foster education, public awareness and training** in the field of climate change related issues.

**Extend the National Land Use Plan** to accommodate further development and thrust into new areas for agricultural expansion and potential settlements in the hinterland.

**Accelerate the development of a policy on the implementation of Geographical Information System and training** to strengthen the capacity, within the natural resources sector to provide reliable, timely and technical information to the government.

**Develop emergency programmes for civil defence and rescue** to adequately respond to emergencies that may arise from sea level rise, floods and droughts.