

## **GREENHOUSE GAS MITIGATION STRATEGIES: THE PHILIPPINE EXPERIENCE**

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**Abstract:** *The Philippines, being a non-Annex I Country Party to the UNFCCC, does not have any responsibility or commitment to reduce or limit its anthropogenic emissions of greenhouse gases. However, as early as 1991, the country has already started its efforts to address the issue of climate change as clearly seen in its thrust to achieve sustainable development. Such efforts consist of policy and institutional developments which significantly respond to the ultimate objective of the UNFCCC.*

*In 1990 and 1994, the Philippines was able to conduct its national greenhouse gas emissions inventory. Equally important, the government has formulated and started to implement mitigation strategies to limit its greenhouse gas emissions. The strategies are reflected in the various sectoral plans particularly those of energy, transport and agriculture sectors.*

*Major programs of the energy sector center on energy efficiency and promotion and use of new and renewable energy (NRE) sources. Under the Philippine Energy Plan (PEP) – 1999-2008, the NRE sources are envisioned to contribute significantly to the country's electricity requirements. Total installed capacity from NRE over the next ten (10) years is projected to be about 410 MW. Demand for environment-friendly new and renewable energy sources such as solar, wind, micro-hydro and biomass would increase from 71.2 MMBFOE in 2000 to 92.3 MMBFOE in 2009.*

*The energy efficiency program is focused on the major energy-intensive sectors such as the industrial sector, residential sector and commercial sector. Twelve (12) sub-programs have been identified for the period 1999-2008. These programs are projected to generate energy savings and an average reduction in electricity demand of 491 MW. The conduct of energy management training, energy efficiency information campaigns, development of linkages among energy research and development entities and energy efficiency measures for industrial equipment and facilities and household appliances will be the main focus of these programs. On the other hand, focus on demand-side management of power generation and distribution utilities will likewise be covered.*

*The growing contribution of the NRE and energy efficiency programs will be intensified by the passage of energy policies that will address some of the gaps and barriers in the promotion and implementation of these programs.*

*The Transport Agenda under the 1999-2004 Medium Term Development Plan primarily focuses on the road system wherein the national road network is to be maintained and developed. The Agenda would include elements such as maintenance,*

*rehabilitation, improvement, among others. The railway is likewise seen as essential to the country's transport system where it can help decongest major road networks.*

*The agricultural and forestry sectors have likewise integrated in their development plans measures on greenhouse gas mitigation.*

*Recently, the Philippine Clean Air Act of 1999 had been enacted. The Act provides that the Department of Environment and Natural Resources, together with concerned agencies and local government units, shall prepare and fully implement a national plan consistent with the UNFCCC and other international agreements, conventions and protocols on the reduction of GHG emissions in the country.*

*Apart from the government initiatives, various programs and projects have likewise been undertaken in cooperation with concerned international entities. These include the Asia Least Cost Greenhouse Gas Abatement Project (ALGAS) which identified mitigation options; the formulation of the National Action Plan on Climate Change which designed mitigation measures which are "no regrets" in character; and the "Enabling Activity on Climate Change" which intends to build the capacity of various government institutions to prepare its initial national communication to the UNFCCC.*

*While the Philippines has successfully undertaken a considerable number of activities and programs addressing the issue of climate change, it is still faced with many issues and constraints. Such concerns, therefore, serve as new challenges for the country to explore more possibilities to improve its efforts toward greenhouse gas mitigation and abatement in line with its thrust on sustainable development.*

## I. THE 1994 PHILIPPINE NATIONAL GHG INVENTORY

### Summary

The Philippines being an archipelagic country is highly vulnerable to climate change impacts. Recognizing this threat, the country was one of the countries that signed the Convention in Rio de Janeiro and ratified it in August 1994. As a non-Annex I Party, the Philippines is committed to prepare its national communication of greenhouse gas emissions sources and sinks, three years after it ratified the Convention or the availability of financial resources.

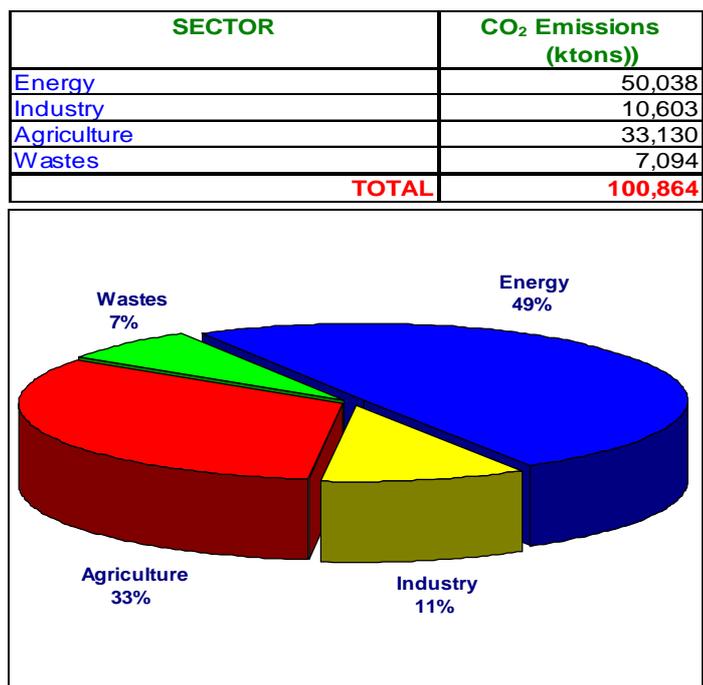
In December 1999, the Philippines prepared and submitted its Initial National Communication on Climate Change. The National Communication contains a national inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases, a description of steps taken or seen by the country to implement its commitment and other information to the achievement of the objective of the Convention.

The presence of human-induced or anthropogenic greenhouse gases (GHGs) in our atmosphere can be attributed to activities and processes associated mainly with five important sectors namely: Energy, Industry, Agriculture, Land-Use Change/Forestry (LUCF), and Wastes.

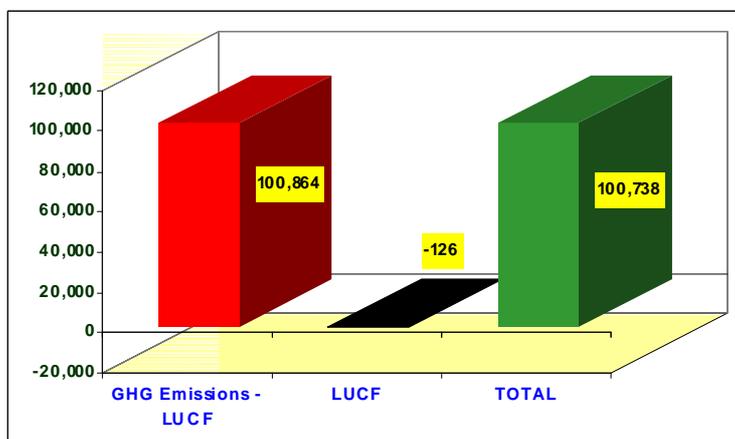
In 1994, the Philippines released a total equivalent amount of 100,738 ktons of CO<sub>2</sub> into the atmosphere. This is due to the combined effect of GHG emissions from the four sectors of Energy, Industry, Agriculture, and Wastes, and the net uptake (sink) of GHGs from the LUCF sector. In the global context, this national amount is still minimal relative to the GHG emissions of other nations, especially those of developed country parties to the UNFCCC.

Without the contribution of the still controversial LUCF sector, the national GHG total amounts to 100,864 ktons of equivalent CO<sub>2</sub>. Of the four non-LUCF sectors responsible for the country's sources of GHGs, the Energy sector is the most significant, accounting for about 49% of the national total. This is trailed closely by the Agriculture sector's contribution of about 33% Industry and Wastes follow with respective contributions of 11% and 7% of the total. **Figure 1** shows the relative contributions of these four non-LUCF sectors to the national GHG emissions total.

In contrast with these four sectors which act as GHG sources, activities and processes associated with the LUCF sector are estimated to sequester about 126 ktons of CO<sub>2</sub>, which is seemingly insignificant (0.1%) when compared with the national total (**Figure 2**).



**Figure 1.** *1994 GHG Emissions from the Four Non-LUCF Sectors of Energy, Agriculture, Industry and Waste*



**Figure 2.** *Net GHG Emissions with the LUCF Sector*

The GHGs of concern in the Philippines from the 5 previous mentioned sectors are mainly Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous oxide (N<sub>2</sub>O), and Hydrofluoro-carbons (HFCs). To effectively compare the global warming impact of the non-CO<sub>2</sub> gases with that of CO<sub>2</sub>, global warming potential (GWP) calculations were applied to each of this non-CO<sub>2</sub> GHGs. The GWP takes into account the varying efficacy of different GHGs on warming the planet relative to that of CO<sub>2</sub>. For example, within a time horizon of 100 years, the current IPCC recommendation for the GWPs of CH<sub>4</sub> and N<sub>2</sub>O are 21 and 310, respectively. The CO<sub>2</sub> equivalents are computed by multiplying the actual emissions of non-CO<sub>2</sub> GHGs (e.g. of CH<sub>4</sub> and N<sub>2</sub>O) with their respective GWPs. Hence, for example, the potential global warming impact of 100 ktons of CH<sub>4</sub> is equivalent to that of 2,100 ktons of CO<sub>2</sub>. The total of GHG emissions cited above is in terms of equivalent CO<sub>2</sub> (to take into account the contribution of non-CO<sub>2</sub> GHGs).

GHG emissions from the Energy sector are dominated by power generation and transport while in Agriculture, rice paddy and domestic livestock are the primary sources of GHG release. Industry's GHG sources are found mainly in the cement and metal processing industries while CH<sub>4</sub> emissions are largely from solid wastes. The apparently low net emissions from the LUCF sector is due to the combined effect of large values in biomass growth and forestland use change/conversion.

### The Energy Sector

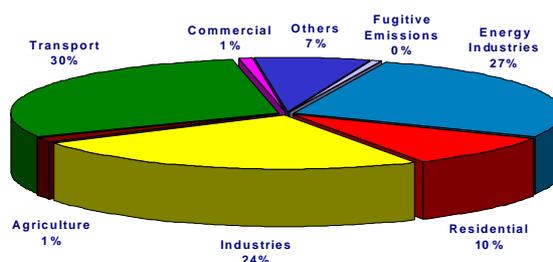
The GHG emissions in the energy sector (which is largely CO<sub>2</sub>) come mainly from fuel combustion. This sector alone emitted 50,038 ktons of equivalent CO<sub>2</sub> in 1994. The subsector's contribution to this total is tabulated and illustrated in **Figure 3**.

A significant portion of these emissions (about 82%) is from three major end users of fuel:

- the power generating industries
- transportation
- manufacturing industries

The main fuel types used in these subsectors are conventional fossil fuels such as oil and coal which are found to contribute substantially to GHG emissions. These conventional types continue to dominate the current and projected energy mix of the country: 76% in 1994 and 67.5% by the year 2008. New and renewable energy sources (NREs) such as hydroelectric power, geothermal, bio-mass, wind, and solar systems are projected to comprise 32.5% of the energy mix in 2008 [Philippine Energy Plan, Department of Energy, 1999]. Biomass contributes the greater share among these NREs. GHG emissions from these NREs are assumed to be insignificant.

Sub Sector	CO <sub>2</sub> Emissions (ktons)
Power Generation	15,508
Residential	4,359
Industries	9,497
Agriculture	1,189
Transport	15,888
Commercial	3,370
Fugitive Emissions	227
<b>TOTAL</b>	<b>50,038</b>



**Figure 3.** GHG Emissions from the Energy Sector

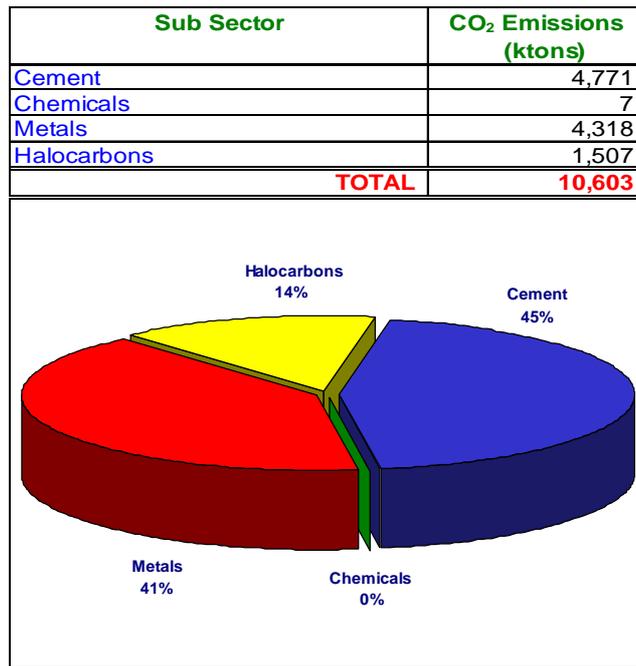
### The Industry Sector

In the Industry sector, 10,603 ktons of CO<sub>2</sub> were released in 1994. A major fraction (86%) of the industrial CO<sub>2</sub> emissions comes from the cement and metal industries (**Figure 4**). These emissions arise directly from industrial processes associated with manufacturing cement and metals, and are not due to the power generation activities of these industries which are already accounted for in the Energy sector. In 1994, the Philippines produced around 239 million bags of cement and 2,669 million tons of steel corresponding to CO<sub>2</sub> emissions of 4,771 and 4,318 ktons, respectively.

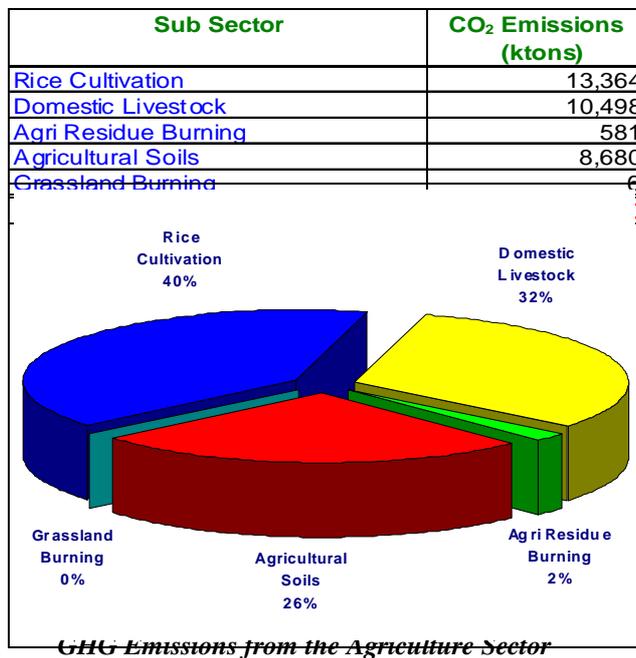
### The Agriculture Sector

In the other sectors of Agriculture and Wastes, CH<sub>4</sub> and N<sub>2</sub>O rather than CO<sub>2</sub> are the significant GHGs emitted. **Figure 5** shows the equivalent CO<sub>2</sub> emissions attributed to Agriculture.

In this sector, non-CO<sub>2</sub> GHGs are emitted mostly from rice cultivation, domestic livestock, agricultural soils. CH<sub>4</sub> emissions from rice paddies comprise about 40% and are due mostly to the anaerobic decomposition of organic matter in these aquatic environments. Emissions from domestic livestock are derived mainly from enteric fermentation and manure management of animals such as buffalo, cattle and swine. The total of 33,130 ktons of equivalent CO<sub>2</sub> released from Agriculture (about 33% of the non-LUCF total of GHG emissions) indicates that next to Energy, this sector is a significant source of GHG for the country.



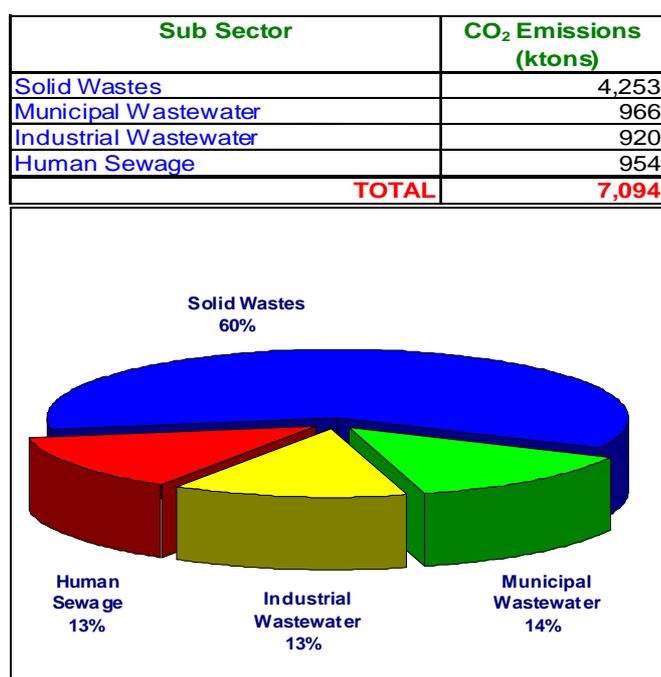
**Figure 4.** GHG Emissions from the Industry Sector



**Figure 5.**

## The Wastes Sector

GHG emissions from the Wastes sector come from solid wastes, domestic and industrial wastewater, and human sewage. About 60% of the CH<sub>4</sub> emissions in this sector is from solid wastes (*Figure 6*). In 1994, an estimated 4,200 ktons of solid wastes were brought to solid wastes disposal sites. This amount does not consider the wastes that were either uncollected or indiscriminately dumped in streams or urban waterways. The dumping of this amount of solid waste released about 203 ktons of CH<sub>4</sub>, equivalent to emitting around 4,253 ktons of CO<sub>2</sub> into the atmosphere (using current GWP assumptions). Industrial wastewater, municipal wastewater and human sewage share almost equally the other 40% of GHG emissions from this sector.



**Figure 6. GHG Emissions from the Wastes Sector**

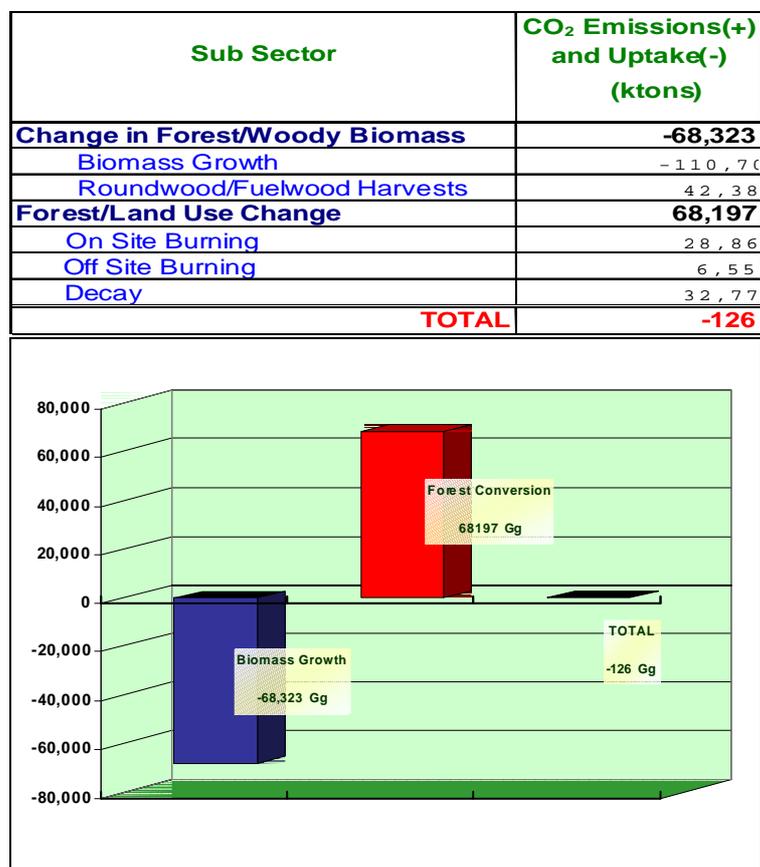
## The Land Use Change and Forestry Sector

The 126 ktons of CO<sub>2</sub> estimated to be sequestered by the LUCF sector is attributed to the net impact of non-negligible changes in biomass growth and land use/forest conversion (*Figure 7*).

Biomass growth alone from the country's forest lands and other land use categories is cited as a major factor in bringing GHGs from the atmosphere back into the biosphere. This sink, however, is offset by biomass loss associated with forest harvest and deforestation. In 1994, the total land use area was about 16 Mha and the biomass growth of these land areas resulted in an estimated cumulative uptake of 110,704 ktons of CO<sub>2</sub>. However, carbon sequestered by the annual growth of these different vegetative types is offset by the yearly removal of biomass via harvest and

deforestation. Roundwood/fuelwood harvests in 1994 account for 42,381 ktons of CO<sub>2</sub> emitted. Additionally, forest loss and land use conversion released a total of 68,197 ktons CO<sub>2</sub>. This includes emissions from activities such as on site burning (for clearing purposes), off site burning (for domestic/industrial fuelwood), and biomass decay.

The net LUCF contribution is still not complete since biomass growth and loss are not the only determining components of this total. The still unknown impact of Philippine soil carbon and biomass growth in abandoned lands, together with uncertainties in local biomass densities and growth rates make it difficult to obtain a more complete value for the contribution of LUCF sector to the national GHG emissions total. Despite the uncertainties, present calculations suggest that for the Philippines in 1994, LUCF is an insignificant sink rather than a source of GHG in the atmosphere.



**Figure 7. GHG Emissions and Sinks in the LUCF Sector**

*Table 1. 1994 Philippine GHG Inventory Results*

SECTOR and SOURCE CATEGORIES	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>
<b>I. ENERGY</b>							
A. Fuel Combustion Activities							433.36
1. Energy Industries	15,458	0.51	0.13	38.47	2.83	0.91	
2. Manufacturing Industries	8,980	8.08	1.12	60.93	986.71	13.81	
3. Transport	15,801	2.15	0.14	167.37	719.44	136.77	
4. Commercial/Institutional	3,368	0.06	0.00	0.63	0.13	0.03	
5. Residential	2,544	72.83	0.92	29.22	1,356.21	133.02	
6. Agriculture	1,185	0.11	0.01	1.08	0.22	0.05	
B. Fugitive Emissions from Fuels							
1. Coal Mining		10.32					
2. Oil		0.47		0.62	16.83	7.61	8.94
C. Biomass Emissions*	48,490						
<b>TOTAL EMISSIONS FROM ENERGY</b>	47,335	94.53	2.31	298.00	3,082.00	292.00	442.00
<b>CO<sub>2</sub> EQUIVALENT</b>	47,335	1,985.22	717.16				
<b>TOTAL CO<sub>2</sub> EQUIVALENT</b>	<b>50,038</b>						
<b>II. INDUSTRY</b>							
A. Cement	4,771						2.87
B. Chemicals		0.33		0.01	0.22	1.46	9.81
C. Asphalt				0.00	0.00	0.00	0.00
D. Food and Beverages						16.35	
E. Pulp and Paper				0.12	0.44	0.29	0.56
F. Metals	4,318			0.11	0.00	0.08	2.99
G. Halocarbons	1,507						
<b>TOTAL EMISSIONS FROM INDUSTRY</b>	10,596	0.33	0.00	0.24	0.66	18.18	16.22
<b>CO<sub>2</sub> EQUIVALENT</b>	10,596	6.95	0.00				
<b>TOTAL CO<sub>2</sub> EQUIVALENT</b>	<b>10,603</b>						
<b>III. AGRICULTURE</b>							
A. Domestic Livestock		333.47	11.27				
B. Rice Cultivation		636.40					
C. Grassland Burning		0.30	0.00	0.14	7.94		
D. Agriculture Residue Burning		20.30	0.50	18.10	427.30		
E. Agricultural Soils			28.00				
<b>TOTAL EMISSIONS FROM AGRICULTURE</b>		990.47	39.77	18.24	435.24		
<b>CO<sub>2</sub> EQUIVALENT</b>		20,799.89	12,329.63				
<b>TOTAL CO<sub>2</sub> EQUIVALENT</b>	<b>33,130</b>						
<b>IV. WASTES</b>							
A. Solid Wastes		202.53					
B. Domestic/Commercial Wastewater		46.02					
C. Industrial Wastewater		43.83					
D. Human Sewage			3.08				
<b>TOTAL EMISSIONS FROM WASTES</b>		292.38	3.08				
<b>CO<sub>2</sub> EQUIVALENT</b>		6,140.06	953.94				
<b>TOTAL CO<sub>2</sub> EQUIVALENT</b>	<b>7,094</b>						
<b>V. LAND USE CHANGE AND FORESTRY</b>							
A. Change in Forest/Woody Biomass	-68,323						
B. Forest/Land Use Change	65,549	114.41	0.79	28.43	1,001.11		
<b>TOTAL EMISSIONS FROM LUCF</b>	-2,774	114.41	0.79				
<b>CO<sub>2</sub> EQUIVALENT</b>	-2,774	2,403.00	245.00				
<b>TOTAL CO<sub>2</sub> EQUIVALENT</b>	<b>-126</b>						
<b>TOTAL NAT'L GHG EMISSIONS</b>	<b>55,157</b>	<b>1,492.00</b>	<b>46.00</b>	<b>317.00</b>	<b>3,518.00</b>	<b>310.00</b>	<b>459.00</b>
<b>EQUIVALENT CO<sub>2</sub></b>	<b>55,581</b>	<b>31,335.00</b>	<b>14,246.00</b>				
<b>TOTAL NAT'L EQUIVALENT CO<sub>2</sub> EMISSIONS</b>	<b>100,738</b>						

## GHG Emission Projections for 2008

### Energy

The energy sector plays a dominant role in determining the GHG emissions of the country. In 1994, Philippine energy activities alone emitted about 50, 038 ktons of CO<sub>2</sub>, approximately half of the national GHG total from the four non-LUCF sectors. The amount of CO<sub>2</sub> that is forecast for 2008 is based on the projected energy mix reported in the Department of Energy's Philippine Energy Plan (PEP, 1999). On the basis of this energy mix, future national consumption of coal, oil and natural gas will emit 122,344 ktons of CO<sub>2</sub> by 2008 (**Table 2**). This is more than double the 1994 CO<sub>2</sub> emissions associated with energy.

	Coal	Oil	Natural Gas	Total
Consumption (MMBFOE)	56.99	195.3	28.74	281.03
CO <sub>2</sub> Emissions (ktons)	31,055	80,840	9,699	122,344

**Table 2.** *Projected Consumption of Coal, Oil and Natural Gas and the Corresponding CO<sub>2</sub> Emissions by the Year 2000*

### Industry

Greenhouse gas emissions for 2008 from the industry sector are calculated using production data from 1991 to 1995 as the baseline and extrapolated using regression methods. For each of data set, linear trends were evaluated against annual production trends and gross domestic product (GDP) values. The averages of these two trending mechanisms are taken as the forecast values for this sector. **Table 3** summarizes the results of the GHG projections to 2008 for cement and steel.

	Projections to 2008		
	Based on Annual Trends	Based on GDP Trends	Average
Cement	7,665	7,399	7,532
Iron and Steel	12,877	12,902	12,890
Ferro-Alloys	65	92	78

**Table 3.** *Projected CO<sub>2</sub> Emissions from Cement and Steel Industries By the Year 2008 (in ktons)*

## *Agriculture*

For the year 2008, the Philippines is predicted to have 3,451, 933 hectares of irrigated rice fields and 1,232,676 hectares of rainfed rice fields. The statistics for the two types of rice ecosystems are estimated using linear regression on existing BAS statistics (Bureau of Agricultural Statistics) on the harvested area of rice (1981-1997). Applying IRRI's method for approximating CH<sub>4</sub> emissions from rice paddy cultivation, the projected values correspond to a net emission of 960.8 ktons of CH<sub>4</sub> (905.1 and 55.7 ktons for irrigated and rain-fed, respectively). This corresponds to an equivalent amount of 20,177 ktons CO<sub>2</sub> in 2008 which is a 51% increase relative to the 1994 value of 13,364 ktons of equivalent CO<sub>2</sub> from rice cultivation.

## *Land Use Change and Forestry*

The LUCF sector is projected to be a net source of 4,492 ktons CO<sub>2</sub> by the year 2008. This is a noticeable increase of emissions from the 126 ktons of CO<sub>2</sub> sequestered in 1994. The projection is based on an exponential extrapolation procedure applied to estimate land use areas for various years beyond the 1987-1996 range that is official available from the Forest Management Bureau (FMB) statistics book. In the procedure, the progressive decrease in total forest land area suggests a depletion rate of 2.02% per year that agrees well with a previous study carried out by the Asian Development Bank (ADB).

## *Wastes*

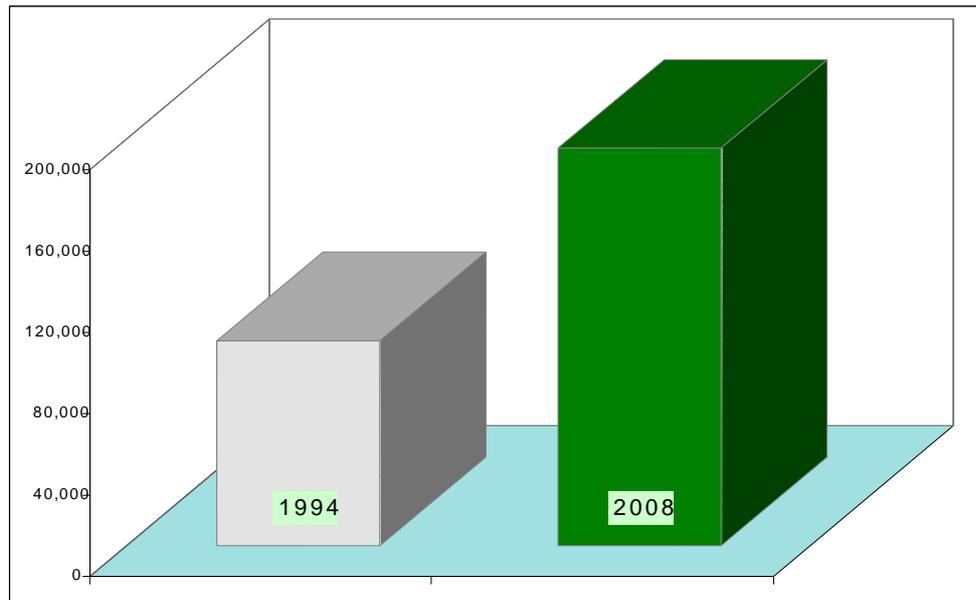
Urban population in 1994 was estimated by the Food and Agriculture Organization (FAO) to be 53.29% of the national population. By 2008, this fraction is estimated to increase to 68.83%. Using the projections of the National Statistics Office (NSO) of 88.72 million people by 2008, [1995 Census-based National and Regional Population Projections of the NSO], urban population will correspondingly increase from 35.6 million in 1994 to 60.6 million by the year 2008.

This increase in urban population will lead to an increase in CH<sub>4</sub> emissions from solid wastes, domestic/commercial wastewater, and human sewage. **Table 4** shows the 1994 equivalent CO<sub>2</sub> emissions from these three subsectors and the projected increase in emissions by the year 2008.

<b>Wastes Subsector</b>	<b>1994</b>	<b>2008</b>
Solid Wastes	4,253	6,727
Domestic/Commercial Wastewater	966	1,658
Human Sewage	954	1,259
Total	6,173	9,644

**Table 4.** *Baseline and Projected Waste Emissions (in ktons)*

The country's future GHG emissions for 2008 were calculated by projecting only those subsectors that had significant contributions to the sectoral sub-totals. With all other emissions from the other subsectors pegged conservatively at their 1994 values, the national GHG emissions total from all five sectors is projected to increase to 195,091 ktons of equivalent CO<sub>2</sub>. This constitutes a rise of 94% relative to the 1994 total of 100,738 ktons in a matter of 14 years, or an annual growth rate of 4.8%. Baseline and projected GHG emissions are shown in **Figure 8**. Because various subsectors were held constant at 1994 levels, this 2008 projection may be a conservation estimate.



**Figure 8.** *Philippine GHG Emissions for 1994 and 2008 (ktons equiv CO)*

## **II. MITIGATION STRATEGIES**

Under the United Nations Framework Convention on Climate Change, the developed country Parties or the Annex I countries have the primary responsibility to adopt policies and measures to limit their anthropogenic emissions of greenhouse gases and to report these to the Conference of the Parties for its review. Developing country Parties have no such obligation to reduce greenhouse gas emissions.

However, the Philippines formulated and started to implement mitigation measures to limit its GHG emissions. These measures are reflected in the various sectoral plans, particularly those of the Energy, Transport and Agriculture sectors.

They have likewise fed into the assessment processes in initiatives like the Asia Least Cost Greenhouse Gas Abatement Strategy (ALGAS) and the National Action Plan (NAP) on Climate Change. The ALGAS drew up the least cost mitigation options for the Philippines while the NAP identified the gaps and recommended strategic thrusts.

Some of the Philippines' policies and strategies on the abatement of its greenhouse gas emissions, in the context of the above, are contained in the most recent update of the Philippine Energy Plan (PEP), 2000-2009. In line with the government's pursuit of economic development, improvement in the quality of life, and the alleviation of poverty down to the countryside, the PEP indicates that of the total investments of \$32.5 billion needed to ensure sufficient and efficient energy supply over the planning period, 90% will be accounted for by the private sector.

The government has been instituting reforms to enhance the country's investment climate and to level the playing field for those willing to invest in our country. Efforts toward liberalization, deregulation and privatization are being worked out.

### **The Energy Sector**

As economic growth with social equity is the thrust that underpins the energy's sector's development blueprint, the energy plan framework, henceforth, drew up the following energy sector goals:

1. Stable, secure and efficient energy supply
2. Fair and reasonable energy prices
3. Completion of country-wide energization through rural electrification program
4. Protection of the rights of energy consumers in an increasingly deregulated sector

### **New and Renewable Energy (NRE)**

The overall NRE program of the Department of Energy (DOE) is to accelerate the development, promotion and commercialization of new and renewable energy systems.

Tracing its beginnings from pure research and development status in the 70s, NRE eventually evolved into the pilot and demonstration stage in the 80s. At present, NRE is considered both clean sources of energy and a viable alternative to providing electricity to off-grid barangays. It is likewise an option that coincides with the country's program to protect the environment while providing electricity to rural areas. Of the remaining unenergized barangays, about 4,000 are better served using NRE sources.

While some countries still consider NREs as exotic, the Philippines is already a major user of NREs. In fact, NREs as a group represent the country's single energy source contributing about 28% of the total energy requirements. Demand for environment-friendly new and renewable energy sources such as solar, wind, micro-hydro and biomass is seen to go up from 72.1 MMBFOE in 2000 to 92.3 MMBFOE in 2009. Biomass fuels such as fuelwood (56%), bagasse, charcoal, and agriwastes will account for the bulk of total NRE supply, a significant percent of which will be for domestic use such as cooking, heating water and ironing. Households particularly those in the rural and remote areas will continue to be the major consumers of fuelwood and biomass residues which are generally self-collected. Economic as well as cultural and behavioral factors will influence and sustain the preference of households to use fuelwood.

Various NRE projects are also being pursued for implementation which are geared specifically for livelihood generation in coastal, lowland, and upland barangays. These involve the provision of heat, mechanical energy and electricity to increase economic productivity in rural communities. On the other hand, hybrid power systems using a combination of diesel and NREs are also being considered for small island villages.

In the late 90s, the DOE launched the Energy Resources for the Alleviation of Poverty program which is anchored on the commitment to provide greater opportunities to the underprivileged. Under this program, energy is envisioned to uplift the socio-economic development of rural communities, particularly of those who are still without electricity. Under the Plan, new and renewable energy sources are envisioned to contribute significantly to the country's electricity requirements. Total installed capacity from NRE over the next ten (10) years is projected to be around 410 MW.

152,000 NRE systems shall be installed in areas not connected to the main electricity grid. The recently completed wind mapping study of the Philippines show that there are about 76,000 MW of potential capacity from wind energy sources. Micro-hydro sites, on the other hand, have power potential of about 28 MW. There are 51 existing mini-hydro installations with aggregate capacity of more than 82 MW and potential capacity of 1,780 MW from 888 sites.

Biomass fuel supply potential which is currently estimated to be 247.9 MMBFOE, is expected to grow annually by 2.2%, reaching 301.5 MMBFOE by 2008.

Of this total, municipal wastes will contribute 133.1 MMBFOE, wood/wood wastes, 97.7 MMBFOE, coconut residues, 26.2 MMBFOE, bagasse, 21.6 MMBFOE, animal wastes, 13.4 MMBFOE and rice residues, 9.6 MMBFOE.

For the period 1999-2008, solar PV systems, totaling about 19 MW, are likewise projected to be installed. Wind, meanwhile, is expected to contribute a maximum of about 145 MW to the grid by 2008. Off-grid wind turbine generators are projected to contribute 36.9 MW while micro-hydro installations, 8.52 MW at the end of the period. Ocean energy is hoped to contribute around 30 MW to the grid also at this time.

The incremental contribution of the NRE sector is expected to be brought about by the passage of policies and legislation like the Non-Conventional Energy Bill, which will try to address some of the barriers in the promotion and implementation of NRE measures and projects.

The DOE will continue to promote the commercialization of renewable energy technologies through such initiatives as the Decentralized Energy System (DES) which has established lending mechanisms to support the establishment of NRE networks like the Philippine Solar Energy Society (PSES), Biomass Energy Association of the Philippines (BEAP) and the Wind Energy Association of the Philippines (WEAP). Also, it will continue to provide technical support to the rural NRE clientele through the Affiliated Non-Conventional Energy Centers (ANECs). There are currently 20 ANECs in all the regions. In some regions, they are present at the provincial level.

Overall, the capital investments for the promotion, development and commercialization of new and renewable energy is estimated to cost PhP49.3 billion. Of this, 88.6% is expected to be put up by the private sector while the government will provide the remaining 11.4%.

### **Energy Efficiency and Demand-Side Management**

Total GHG emissions are the product of population, economic activity per capita, energy use per unit of economic activity, and the intensity of energy use. Reducing economic activity to limit GHG emission is obviously unacceptable even to developed countries, let alone the developing or poor countries. Technological improvements are therefore being looked into as they play an important role in reducing carbon emissions and in lowering the cost of those emission reduction. On the other hand, carbon intensity of energy can be reduced by substituting fossil fuels with renewable energy sources and through increases in energy efficiency.

Government-private sector partnership for the development and deployment of energy-efficient technologies and enhancement of energy conservation and management practices is being encouraged by the DOE through its Energy Efficiency Program.

Moreover, energy efficiency would be beneficial in reducing energy demand, lessen the environmental stress due to energy production and use, and will lead to competitive yet affordable costs of goods and services. Improvement in energy use in major energy-consuming sectors would result in the deferment or the need for new power generation facilities, and eventually reduce greenhouse gas emissions and other pollutants resulting from energy production and utilization.

The energy efficiency program is focused on the major energy-intensive sectors. The major users of electricity are the:

- industrial sector - 29.12%
- residential sector - 28.6%
- commercial sector- 21%

For the oil consuming sectors, the biggest is power (37%), industrial (23%), and transport (13%). Losses account for 15.2%.

Twelve (12) energy efficiency programs will be pursued for the period 1999-2008. These programs are projected to achieve around 70,600 MBFOE of energy savings by 2008, translating to around US\$1,129.2 M in foreign exchange savings and an average reduction in electricity demand of 491 MW.

These programs focus on energy management trainings, energy efficiency information campaigns, development of linkages among energy research and development entities, energy efficiency measures for industrial equipment and facilities and household appliances. Some of these programs likewise focus on demand-side management of power generation and distribution utilities.

The program(s) targeted at the industrial sector are expected to generate about 28,400 MBFOE energy savings by 2009 (equivalent to 40.2 % of the total savings). Transport sector programs will result in 16,300 MBFOE savings or 23% of the total, while those for the residential and commercial sectors will account for 15.5 and 3.6%, respectively.

Specifically, some of these programs are as follows:

### **1. Education/Training and Information Campaign**

The Department of Energy, in cooperation with concerned sectors, has launched the Power Patrol and Road Transport Patrol Programs. These programs promote efficiency in electricity and gasoline fuel use in the industrial, commercial, residential and transport sectors. The Power Patrol was launched nationwide in January 1994 to promote wise and efficient use of electricity using tri-media campaign and targets at least 10% reduction in power demand in the household, commercial and industrial sectors. Seminars on energy efficiency improvement are also conducted for

the commercial/industrial sector where energy conserving measures for equipment operation and technologies are discussed.

The Road Transport Patrol Program was launched in April 1998 through Executive Order No. 472 – Institutionalizing the Committee on Fuel Conservation and Efficiency in road Transport dated 25 March 1998. The program also aims to promote efficient utilization of fuel through the local chapters created for the purpose. particularly, involves a tri-media campaign for drivers, operators, vehicle and fleet owners, among others, on fuel conservation. Energy savings is estimated to be 23,800 MBFOE at the end of the plan period.

The DOE is presently conducting a study on Natural Gas Utilization in Transport to address the air degradation problem due to the use of conventional transport fuels like gasoline and diesel. The study is looking into the potential of compressed natural gas (CNG) as an alternative fuel to diesel in the transport sector to alleviate pollution problems in the metropolis.

## **2. Energy Audit**

To determine energy use patterns and energy efficiency opportunities that will yield savings, the Department of Energy provides advisory services, particularly on energy audits, for energy-intensive industries and establishments. Through the establishment of energy service companies (ESCOs), an average of 50 establishments are targeted for audit annually. Potential savings from this exercise is estimated at 24,000 MBFOE by 2008.

## **3. Energy Labeling and Efficiency Standards**

Through the Bureau of Product Standards (BPS) and the Association of Home Appliance Manufacturers (AHAM), energy efficiency standards for room air conditioners, refrigerators, freezers and lamp ballasts will be imposed. The DOE through its Fuels and Appliance Testing Laboratory implements the energy labeling and undertakes energy performance testing and certification of specific household appliances and energy equipment in the implementation of the energy standards and labeling program. Around 7,800 MBFOE is expected to be saved by the end of the planning period. To improve performance of industrial fans and blowers, a National Fans and Blower Certification Program will be developed and is expected to result in approximately 270 MBFOE energy savings.

## **4. Vehicle Efficiency Standards and Testing Program**

The transport sector is the second highest energy-consumer next to the industrial sector. To address the increasing fuel consumption and carbon dioxide and pollution emissions from the sector, this

program was created with the aim of establishing fuel economy standards and passenger car labeling. Activities of the program include testing, rating and certification of passenger cars in a chassis dynamometer facility using a standard drive cycle where fuel economy will be measured in terms of fuel consumed in liters per 100 km.

The program is expected to generate energy savings of 410 MBFOE in 2005 and gradually increase to 830 MBFOE by 2009.

## **5. Systems Loss Reduction Program for Utilities (SLRP)**

The SLRP was established through Republic Act No. 7832, otherwise known as the Anti-Pilferage of Electricity and theft of Electric Transmission Lines/Materials Act which was signed in 1994. Rural electric cooperatives (RECs) are provided assistance by the Task Force on SLRP by recommending appropriate measures such as system review and evaluation, testing and calibration of kilowatt-hour meters, system load balancing, thermal scanning of lines and equipment load management.

The SLRP, which is an on-going program, is expected to continue through 2008, resulting in 870 MBFOE savings. The public utilities' system loss reduction of private utilities and rural electric cooperatives will be effected through various measures.

## **6. Heat Rate Improvement of Power Plants (HRIP)**

The HRIP is an on-going undertaking of the National Power Corporation (NPC) aimed at sustaining the operation of the old thermal, coal and diesel plants and enhancing their operational efficiency and provide sufficient power reserves of around 380 power plants over the planning period. This likewise reduces the amount of fuel consumed and minimizes the air pollutants emitted by the generating plants. In compliance with the rate standard set by the ERB, the oil-fired and coal-fired power plants will maintain heat rates of 10,850 Btu/kWh and 9,773 Btu/kWh, respectively. With the pending restructuring and privatization and privatization of NPC, generation companies are expected to pursue this program to enhance their competitive edge in a privatized industry. This is projected to result in accumulated energy savings of 4,100 MBFOE per year with a one-time investment cost of P1,946 million.

## **7. Demand-Side Management (DMS) Program**

The DSM Program aims at the electric utilities' activities designed to encourage and influence their customers' use of electricity in ways that will produce desired changes to both the timing and level of electricity demand or load shapes. It also aims to influence end use electricity consumption through the various

activities of the electric utilities. Cumulative energy savings by 2008 is projected to be 5,900 MBFOE from this program.

The Long Term Power Planning Study for the Philippines has designed practical and implemented DSM programs as follows:

#### Multi-Sectoral Programs

- High Efficiency Fluorescent Lamp Program (all sectors)

Lamp manufacturers are encouraged to switch from 40 and 20 watt lamps to 36 and 18 watt lamps, respectively. This would use less material and cost less to manufacture than the traditional lamps.

- Low-Loss Magnetic Ballast (all sectors)

Magnetic ballast uses approximately one-fifth of all energy required for fluorescent lighting. The DOE through its FATL shall test ballast performance and offer to manufacturers a voluntary labeling program such as wattage loss number printed on ballast. Standards will likewise be attached to discourage illegally manufactured ballast.

- High Efficiency Window Air-Conditioners (residential and commercial)

The recommended program design builds on existing energy conservation efforts. The existing minimum efficiency standards and labeling programs shall be continued and extended to duty-free goods. Minimum EERs for the units shall be increased to continue the trend of market transformation and to bring the country's standards in line with other countries.

- Interruptible/Curtailable Agreement (industrial and commercial)

The program calls for large customers to reduce load by turning on generators during peak-load hours or cutting their power requirements by shifting production schedules to non-peak periods.

#### Industrial Sector Program

This program is designed to maximize the utilization of electricity through the adoption of high efficiency motor and variable speed drives motors. Since energy-efficient motors and variable speed drives hardly penetrate into the local market a duty

import reduction (10 to 30%) shall be implemented as a form of incentive.

#### Commercial Sector Program

Building owners and designers are encouraged to construct buildings that exceed the standard code by offering incentives for better than 20% compliance. Eventual tightening of the building energy efficiency codes for large commercial buildings shall be enforced to achieve significant savings.

#### Residential Sector Program

- High Efficiency Refrigerator
- High Efficiency Fans
- Compact Fluorescent Lamps (CFL)
- Incandescent Lamp Replacement with Fluorescent Lamps

#### Public Sector Program

The installation of high pressure sodium street lamps was considered to replace the existing mercury vapor lamp which may also be applied to bigger roads and highways. Improved street lighting will incur lower maintenance cost but with higher lighting levels that would ensure safety on the streets.

The foregoing DSM programs are expected to generate 0.21 MW in 2000 increasing to as high as 40.7 at the end of the planning period (2008) in terms of peak demand savings.

### **8. Financing Energy Conservation Projects**

For this initiative, the government, through the DOE and with USAID assistance, established the Technology Transfer for Energy Management Demonstration Loan Fund (TTEM-DLF). Eligible projects involve process modification, boiler conversion and modification, upgrading of electrical supply, steam system improvement, electric loss reduction, rood installation, kiln conversion, and waste heat recovery system, and others. Up to 75% of individual project costs but not exceeding PhP5 million can be funded from this DLF.

For the planning period, the fund is projected to provide funding for around 134 projects representing about 1,070 MBFOE of energy savings.

### **9. Development and Use of Other Climate Friendly/Cleaner Fuels**

The Philippines is intent on developing cleaner indigenous energy sources like natural gas, hydro and geothermal. By 2008, the

Philippine domestic gas production is expected to reach 146 BCF. This is projected to be utilized for power plants like the Iligan and Sta. Rita, which will have a total installed capacity of 2,220 MW. From an almost nil percentage share in the total energy mix, natural gas is projected to comprise 6.9% of the total which is 416.5 MMBFOE.

Total installed hydro capacity is expected to double from 2,304 MW in 1998 to 4,025 MW in 2008. Hydro's share in the total energy mix will increase slightly from 3.7 in 1999 to 4% in 2008. Hydro projects in the pipeline and those being contemplated are a mix of 8 large, 2 small and 14 mini-hydro projects over the ten-year planning period.

Approximately 558 MW is projected to be contributed by geothermal power to the capacity mix for the period under consideration. Total cumulative installed generating capacity by 2008 is estimated at 2,450 MW. The country's total resource potential was estimated at 5,000 MW in 1995.

## **10. The Transport Agenda**

The Transport Agenda under the 1999-2004 Medium Term Development Plan was developed through the Philippine Transport Strategy Study, funded by the Asian Development Bank.

At the core of this agenda is the revitalization of the transport sector so that it could operate transport services. The Agenda primarily focuses on the road system because it serves a majority of passengers and freight transport in the country. Under the scheme, the national road network is to be maintained and developed. The Philippine Road Classification Study (PRCS) under the ADB 6<sup>th</sup> Road Improvement Project has made recommendations, which if implemented, would improve the national network.

The elements of the Road Transport Strategy/Agenda are as follows:

- a. Maintenance
- b. Rehabilitation, which would involve reconstruction of the road structure;
- c. Improvement, which would include upgrading pavement design and bridges for heavier traffic, road widening or realignment and junction improvements;
- d. Development of penetrator road, which are new roads meant to stimulate development; and
- e. Missing Links which are essentially new roads, especially port and airport access roads.

Rail is also considered essential to the country's transport system. In fact, it is envisioned to be its backbone. Within 100 kilometers of Metro Manila, particularly, rail has a strategic long term role because of the congested road networks. However, it must overcome a lot of hurdles, mainly institutional. Among the other issues to be examined are:

- a. future availability of rail route(s) through Metro Manila;
- b. possibility of running a cross city express service; and
- c. adoption of common technical standards to ensure contained operation of the railway as a system.

Multi-modal transport is considered appropriate to the country's topography. The Agenda, therefore, targets the development of "multi-modal corridors and establishment of multi-modal chains."

### **GHG Reduction and Energy Savings Potential**

Having the different programs on clean energy and energy efficiency, the Philippines will considerably reduce its GHG emissions. Although these programs are yet to be quantified in terms of the amount of GHG emissions reduced, avoided or mitigated, the same represent the energy sector's resolve to pursue its energy objectives without sacrificing the environment.

#### **The Agricultural Sector**

The Medium Term Agricultural Development Plan (MTADP), 1993-1998 utilized the Key Production Area (KPA) approach for this plan period. Under this scheme, government support was focused on areas where land and water resources could be put to the best use.

Under the Plan, the main mitigation measures include:

1. The Balanced Fertilization Program, which provides location specific recommendation for organic and inorganic fertilizers aimed at sustaining high crop yields over long cropping seasons without depleting the natural resource base. It also provides guidelines for strategic distribution of appropriate fertilizers.
2. Reduction of programme area for irrigated rice fields;
3. Judicious use of pesticides through Integrated Pest Management; and
4. Utilization of low-water use crops.

#### **The Forestry Sector**

The Master Plan for forestry Development (MPFD), 1990 serves as the government's blueprint for managing the country's forest lands and resources. Programs to be implemented under the Plan are:

1. Program on Man and the Environment
2. Program on Forest and Forest Products Development; and

### 3. Program on Institutional Development

GHG mitigation measures are contained in the following sub-programs:

1. Soil and Watershed Conservation
2. People-Oriented Forestry
3. Forest Protection
4. Forest Plantation Establishment

#### **The ALGAS Proposed Mitigation Initiatives**

The Asia Least Cost Greenhouse Gas Abatement (ALGAS) is the analysis of the mitigation options of 12 countries, including the Philippines, under the guidance of the Asian Development Bank, with funding from the Global Environment Facility (GEF), through the United Nations Development Programme (UNDP).

Based in the greenhouse gas emissions inventory of 1990 and projections of GHGs to sectors: energy, forestry and agriculture. The projected emissions for these sectors were generated utilizing a number of tools. For the Energy Sector, the baseline scenario was developed using the Market Allocation (MARKAL) model. For the Forestry and Agricultural sectors, the Business-as-usual Scenarios utilized inputs from the sectoral master development plans but not based on any specific GHG abatement objectives.

Baseline and mitigation scenarios were projected to the year 2020. Mitigation scenarios for the Energy Sector were generated for both the Supply and Demand sides. Using the MARKAL model, twelve least cost options were generated. Factors utilized include availability of resources, market penetration and readiness of technology.

In the agriculture sector, use of low methane (CH<sub>4</sub>) emitting rice cultivators had the highest abatement potential, while use of sulfate fertilizers had the lowest.

The Forestry and Land Use Sector Mitigation Assessment under the ALGAS generated a number of options such as forests plantation, urban forestry and sustainable forest and sustainable forest management, among others.

#### **The National Action Plan (NAP) on Climate Change**

The National Action Plan is a framework aimed to identify the general thrusts to be focused on by the stakeholders, particularly the government, to address the issue of climate change. The prescribed mitigation measures are, therefore, largely directional, meant to provide guidance to sectoral agencies like the Departments of Energy, Agriculture and Trade and Industry, among others.

For the energy, transport and industry sectors, the following actions are proposed under the NAP:

1. Energy and Transformation
  - A. Shift the energy mix towards renewable energy

- Building of commercial proto-types to accumulate operating data
- Least cost planning and full cost accounting
- Research and technology cost trends of renewables (solar, wind, biomass, hydro)

#### B. Revise Efficiency Targets

- Supply-side efficiency improvements; power plants efficiency improvement; transmissions loss reduction; replacement of coal plants with natural gas combined cycle plants
- Demand-side efficiency improvements; energy conservation, use of energy efficient technologies
- Energy-efficient designs for new buildings

### 2. Transportation

#### A. Traffic Improvement Scheme

- Development and use of efficient mass transport systems
- Use/promotion of non-motorized transport modes
- Emission control schemes focusing on improved fuel and vehicle efficiency
- Parking facilities development by public and private sector
- Improvement of road markings and signages, as well as, intersection control

#### B. Travel Demand Management

- Traffic volume reduction measure such as the Unified Vehicular Volume Reduction Program (UVVRP)
- Road pricing or area licensing scheme for urban railway corridors (i.e. MRT and LRT)
- Staggered commuting scheme
- Fuel and vehicle tax policy
- Land use control and growth management

### 3. Industry

- Implementation of energy efficiency measures
- Promotion of energy conservation
- Use of alternative non-CO<sub>2</sub> emitting industrial processes

For the agriculture sector, the NAP proposed the following:

- Use of tubular polyethylene bio-digesters and urea-molasses mineral block as nutrient supplement in animal production
- Use of sulfate fertilizers to reduce methane emissions
- Use of rice straw, water management and low-emitting cultivars
- Upgrading of food storage and distribution systems
- Promotion and implementation of judicious land –use planning

Over-all, it can be seen that although the Philippines does not have any legally binding commitment to reduce greenhouse gas emissions, it is undertaking a considerable number of measures to abate the generation of such.

Total and sectoral mitigation potential(s) have been estimated and specific projects identified to realize these potential(s). At the moment, however, further analysis of these proposed options are being undertaken to ensure that those to be undertaken, in addition to measures already being implemented as contemplated under the various sectoral plans and the MTPDP, are in consonance with the country's sustainable development objectives.

The avowed policies, to promote the widespread use of renewable, maximization of energy efficiency opportunities, promotion of climate-friendly technologies and practices and protection/enhancement of the country's forest resources are expected to shape and guide the development of these mitigation activities and undertakings. These policies are enshrined in Executive Order (E.O.) No. 462 (on renewable, in particular, ocean, solar and wind), Republic Act (R.A.) 8749 or the clean Air Act and the various laws on forest protection, among others.

## **PHILIPPINE POLICY AND LEGAL INITIATIVES IN ADDRESSING CLIMATE CHANGE**

The Philippines signed the United Nations Framework Convention on Climate Change in Rio de Janeiro in 1992 and was ratified by the Philippine Senate on August 2, 1994, thus committing the country to its provisions as a non-Annex I Party.

It is noteworthy to mention that even before the official signing of UNFCCC, the Philippines has already started to undertake programs and activities to the pursuit of sustainable development and addressing climate change concerns. In fact, the country was among the first countries to respond to the challenge of the climate change phenomenon.

Specifically, most of these programs center on education and training, adaptation measures, mitigating measures and capacity building and are thus supported and strengthened by the formulation of related policies and legislation.

### **Institutional Developments**

#### **The Philippine Inter-Agency Committee on Climate Change (IACCC)**

The IACCC was established in May 8, 1991 by virtue of Presidential Administrative Order No. 220. It is tasked to coordinate various climate change related activities, propose climate change policies and prepare the Philippine positions to the UNFCCC negotiations.

The IACCC is chaired by the Secretary of the Department of Environment and Natural Resources (DENR) and co-chaired by the Secretary of the Department of Science and Technology. The Environmental Management Bureau of the DENR acts as the Secretariat to the IACCC.

## **The Philippine Council for Sustainable Development (PCSD)**

The Philippine Council for Sustainable Development was created in 1992 and coordinated the preparation of the Philippine Agenda 21 (PA 21). The PA 21 which embodies the partnership of government with the non-government organizations is likewise tasked to oversee the implementation of the country's commitments under the RIO summit.

The PCSD is chaired by the Director-General of the National Economic Development Authority (NEDA), and vice-chaired by the Secretary of the Department of Environment and Natural Resources (DENR). Some 14 government departments and seven (7) non-government organizations are members of the Council. A composite secretariat serves the PCSD, comprising of the NEDA, DENR, and the NGO group. For the last, the Civil Society Counterpart on Sustainable Development (CSSCSD) serves as the NGO counterpart secretariat to the PCSD.

The PCSD operates through its four committees, and their respective sub-committees. The Committees correspond to the major chapter concerns for the Global Agenda 21.

### **Legal Developments**

#### **The Philippine Strategy for Sustainable Development**

The Philippines was among the first countries to embrace the sustainable development paradigm, adopting the Philippine Strategy for Sustainable Development (PSSD) in 1989. The PSSD comprises of a ten-pronged strategy as follows:

- a. Integration of environmental consideration in decision-making
- b. Proper pricing of natural resources
- c. Property rights reform
- d. Conservation of biodiversity
- e. Rehabilitation of degraded ecosystems
- f. Strengthening of residuals management
- g. Control of population growth and human resources development
- h. Inducing growth in rural areas
- i. Promotion of environmental education
- j. Strengthening citizens' participation

#### **Philippine Agenda 21 (PA 21)**

Pursuant to the PSSD, the Philippine Agenda 21 (PA 21) which serves as the blueprint for the country's sustainable development efforts, was completed in September 1996. It "envisions a better quality of life for all, the development of a just, moral, creative, spiritual, economically, vibrant, caring, diverse yet cohesive society characterized by appropriate productivity, participatory and democratic processes and living in harmony within the limits of the carrying capacity of nature and the integrity of creation."

The PA 21 likewise details the initiatives needed to shift to sustainable development. These include creating the enabling conditions for sustainable development, implementing actions for the country's various ecosystems, and actions for critical resources.

### **The Philippine Clean Air Act of 1999**

Republic Act No. 8749, otherwise known as the Philippine Clean Air Act is a comprehensive air quality management policy and program which aims to achieve and maintain healthy air for all Filipinos.

The Act provides that the Department of Environment and Natural Resources, together with concerned agencies and local government units, shall prepare and fully implement a national plan consistent with the UNFCCC, and other international agreements, conventions and protocols on the reduction of GHG emissions in the country.

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) shall regularly monitor meteorological factors affecting environmental conditions including ozone depletion and GHGs, and coordinate with the DENR in order to effectively guide air pollution monitoring and standard setting activities.

### **The Ecological Solid Waste Management Act of 2000**

Republic Act No. 9003, known as the Ecological Solid Waste Management Act of 2000 was signed into law last January 26, 2001, with the aim of adopting and implementing a systematic, comprehensive and ecological solid waste management program nationwide.

The Act provides for the establishment of a National Solid Waste Management Commission to oversee the implementation of solid waste management plans and prescribe policies to achieve the objectives of the Act. It shall be composed of 14 members from the government and three representatives from the private sector.

Similarly, a National Ecology Center is also established to provide consultancy, information, training and networking services for the implementation of the Act.

A National Solid Waste Management Status Report containing an inventory of existing solid waste facilities, waste characterization, waste generation projections, and other pertinent information shall be regularly updated and published. Based on the said status report, a National Solid Waste Management Framework that will include medium and long term plans shall be formulated and implemented.

The Act declared the policy of the State to adopt a systematic comprehensive solid waste management program which shall:

- a. utilize environmentally-sound methods that maximize utilization of valuable resources and encourage resource conservation and recovery;

- b. set guidelines for solid waste avoidance and volume reduction including composting, recycling, re-use, recovery, green charcoal process, and others before collection, treatment and disposal in appropriate and environmentally sound solid waste management facilities;
- c. ensure the proper segregation, collection, transport, storage, treatment and disposal through the formulation and adoption of best environmental practice in ecological waste management.

### **Agricultural and Fisheries Modernization Act of 1997**

The Act provides that the Department of Agriculture in coordination with PAGASA and other appropriate agencies, devise a method of regularly monitoring and considering the effect of global climate change, weather disturbances and annual productivity cycles for the purpose of forecasting and formulating agriculture and fisheries production program.

### **Related Policies on Energy**

To date, there are pending bills in Congress relative to climate change. These include the “New and Renewable Energy Program Act”, “An Act to Institutionalize Energy Conservation and Enhance Efficient Use of Energy, and “An Act to Strengthen the National Program for the Development and Promotion of the Use of Non-Conventional Energy Systems.

### **The Philippines’ Initial National Communication on Climate Change**

In fulfillment of its commitments under Article 12 of the UNFCCC, the Philippine submitted in December 1999 its Initial National Communication to the Conference of the Parties. The document highlights the 1994 National GHG Emissions Inventory, a description of measures taken or planned, and other information relevant to the achievement of the objectives of the Convention.

## **Programs and Projects**

### **The National Action Plan (NAP) on Climate Change**

The National Action Plan is a framework aimed at formulating greenhouse gas mitigation and climate change issues as part of its thrust toward sustainable development. The action plan is designed to integrate climate change concerns into the country’s national development plans and programs, develop adaptation responses to climate change impacts, design mitigation measures which are “no regrets” in character, and catalyze consensus among the various sectors of the society to mobilize them for the implementation of the national action plan.

### **Enabling Activity on Climate Change**

The “Enabling Activity on Climate Change” was implemented by the IACCC with funding support from the Global Environment Facility through the UNDP. This intends to build capacity of various government agencies to prepare the country’s initial national communication to the UNFCCC. Emphasis was given to the preparation of the

1994 greenhouse gas inventory and the reporting requirements in accordance with the guidelines prescribed pursuant to Article 12 of the UNFCCC and decision(s) set by the Conference of Parties. A series of training courses are presently being conducted on greenhouse gas inventory to institutionalize the process among various agencies.

### **Asia Least Cost Greenhouse Gas Abatement Strategy (ALGAS)**

The ALGAS was launched in 1995, through the assistance of the Global Environment Facility and the United Nations Development Programme and executed by the Asian Development Bank. The ALGAS looked into GHG mitigation options in the energy, agriculture and forestry sectors.

### **Philippine Climate Change Mitigation Program**

The Philippine Climate Change Mitigation Program or Strategic Objective Grant Agreement 3 (SOAG) was implemented by the Department of Energy, in cooperation with its attached agencies and the Inter-Agency Committee on Climate Change (IACCC). The SOAG's basic strategy is to slow the growth of GHG emissions through the expanded use of clean fuels in power generation and by improving the efficiency of power generation distribution and use. Under the Program, the USAID provided technical assistance, training, and improve access to information and technology.

In its aim to enhance wide dissemination of international information on climate change and climate friendly technologies in the country, the Climate Change Information Center (CCIC) was also established in June 1999. The CCIC is currently housed at the Manila Observatory at the Ateneo de Manila University. The Center is regarded as symbolic of the government, academe, NGOs and international partnership (USAID) and is a testament of the academe's commitment to the climate change issues.

### **Country Study Program in Climate Change**

The United State Country Study Programme (US-CSP) was launched in 1995. The project came out with the 1990 greenhouse gas inventory and climate change impact studies on selected vulnerable areas such as coastal, agriculture and water resources.

### **GHG Abatement Awards**

The USAID together with the US Environment Protection Agency has provided assistance to launch GHG Abatement Awards. The awards program intends to recognize companies that voluntarily reduce GHG emissions through activities such as energy efficiency. The first GHG Abatement Awards were given last December 1988.

### **Asia and the Pacific Workshop on Transfer of Technology Consultative Process**

In cooperation with the UNFCCC Secretariat, the IACCC conducted the "Asia and the Pacific Regional Workshop on Transfer of Technology Consultative Process (Decision 4/CP.4) in Cebu City last 17-19 January 2001.

## **Other Ongoing Activities**

Other initiatives being undertaken to address the issue of climate change include the research being conducted by the International Rice Research Institute (IRRI) on methane emissions from the rice paddies, the socio-economic impact studies initiated by the International Geosphere and Biosphere Program (IGBP), public awareness campaigns and policy studies by the Philippine Network on Climate Change (PNCC) and studies being conducted by the Marine Science Institute of the University of the Philippines (UP), the College of Forestry also of UP, and other institutions.

### **III. CONCLUSION**

The Philippines has certainly gone a long way in its efforts in addressing the climate change issue. Having been able to conduct two greenhouse gas emissions inventories in 1990 and 1994, respectively is remarkable enough. More so, was its initiatives toward the formulation and implementation of GHG mitigation strategies as have been integrated in the concerned sectoral plans of the government.

However, the Philippines is still faced with many issues and constraints particularly, in its programs on greenhouse gas mitigation. Among which is the affordability of the technologies preferred such as the utilization of renewables in power production. In this view, interventions to overcome market barriers for the widespread use of renewables need to be undertaken. Likewise, more applications need to be implemented to gain field experience and additional operating data.

Although there have been previous assessments on the country's mitigation potential, additional initiatives on assessment and subsequent identification of greenhouse gas abatement projects should be carried out. The full potential of the energy sector, for instance, should be determined.

While there have been various undertakings on GHG mitigation and abatement, it has been proposed that an integration of such efforts stipulated in the sectoral plans and the Medium Term Development Plan as well as the those proposed by such projects as the ALGAS and the NAP to be able to come up with one mitigation strategy. This should be done in the context of the developments in the climate change negotiations.

There is a need to build and strengthen the capacity of implementing institutions whereby a policy and institutional framework should be drawn up. Training in the fields of energy efficiency and renewable energy as well as use of planning models such as the MARKAL is needed.

Enhancing information and data management is likewise considered to be very essential. Networks of information centers should be established to facilitate easy access and flow of information.

By and large, despite these constraints, the Philippines have somehow willfully exerted its efforts in the pursuit of sustainable development. This only shows the country's commitment to having a balanced, healthy and safe environment stated in the Philippine Constitution. Through cooperation and continuous interaction with the various related international conventions and conferences, such commitment would be

strengthened and intensified. Further, initiatives for partnerships among the government organizations, academic sector, business/industry sector and non-government organizations would be imperative.

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