

**NATIONAL ACTION PLAN
ADDRESSING CLIMATE CHANGE**

**Republic of Indonesia
2007**

National Action Plan Addressing Climate Change

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PRESIDEN
REPUBLIK INDONESIA

Keynote Speech

President of the Republic of Indonesia

on the Publication of National Action Plan to Combat Climate Change

My fellow countrymen and women,

In recent years, humans have faced a global threat that was never faced by earlier generations. Global warming has led to climate change that is already impacting on the physical and biological systems of our earth. Higher temperatures have started to melt the ice-caps of the north and south pole. Sea levels have started to rise and to threaten coastal areas and their inhabitants. In some places in Indonesia, this rise measures 8 mm per year. Our country consists of not less than 17,500 islands with a coastline of 81,000 km. The majority of our population lives in coastal area – around 65% of the population of Java lives in coastal regions, for example. Indonesians are therefore vulnerable to the impacts of climate change. Climate change has also changed the pattern of rainfall and evaporation with the potential to cause floods in some places and drought in others. This issue therefore threatens livelihoods in our country – both agriculture and fisheries.

As a country that is vulnerable to their impacts, it is important for Indonesia to mitigate global warming and climate change. Indonesia would therefore reduce greenhouse gas (GHG) emissions from the energy sector, and from land use, land-use change and forestry (LULUCF), while also increasing carbon sequestration. Indonesia recognises that we cannot achieve this by ourselves. To avoid or slow climate change Indonesia calls on developed countries to fulfil their commitments to reduce GHG emissions. In this way, Indonesia is ready to work together bilaterally or multilaterally with other countries to tackle climate change.

Efforts to control climate change cannot be separated from economic development and poverty alleviation. People that have met their economic needs will be better placed to protect the environment. Because of this a development strategy that focuses on economic growth (*pro-growth*), poverty alleviation (*pro-poor*), and employment



opportunities (*pro-job*), combined with environmental protection (*pro-environment*) creates the basis for sustainable development.

My fellow countrymen and women,

It is now the time to reform the patterns of development that we are used to. The environmental paradigm should be internalised in all development sectors, including the energy sector, forest and resource management, agriculture and farming, spatial planning and infrastructure. Those institutions that are responsible for climate change mitigation and adaptation must coordinate rapidly and systematically. We must leave old patterns of development and change to sustainable development. We cannot blame nature's response if we do not take action to avoid atmospheric damage and thus exacerbate climate change.

This National Action Plan is a dynamic policy instrument that will therefore periodically need evaluation, renewal and improvement, in response to the dynamic of climate change itself. I hope that this National Action Plan can be implemented well and serve as a guide for all sectors, in the centre and the regions, in implementing development, now and in the future. Because of this the National Action Plan must be incorporated into the Long Term Development Action Plan 2005-2025 and the Medium Term Development Action Plan.

I hope God gives strength and ability to the Indonesian people to strive to combat the impacts of climate change, working together with the people of other nations to tackle its causes. Amen.

Jakarta, November 2007
President of the Republic of Indonesia

Dr. H. Susilo Bambang Yudhoyono

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CHAPTER I

BACKGROUND

The most recent report from the Inter-governmental Panel on Climate Change (IPCC 2007) shows that eleven of the twelve hottest years since 1850 have occurred during the last twelve years. The increase of average temperature from 1850-1899 to 2001-2005 has been 0.76°C. Global sea level increased at an average rate of 1.8 mm per year over the period 1961 to 2003. The increase of sea level recorded over the 20th century is estimated at about 0.17 m. The IPCC report also stated that human activities have contributed to global warming since the middle of 20th century. This global warming will continue to increase at a faster rate in the 21st century if there is no effort to address it.

Global warming causes climate change and increases the frequency and intensity of extreme weather events. The IPCC concluded that global warming could cause significant change to biological and physical systems, such as an increase in tropical cyclone intensity, changes in precipitation pattern, salinity of the sea, wind pattern, the reproductive period of animals and plants, species distribution and population, epidemics, and also influence various ecosystems in high latitude (including the Arctic and Antarctic), high altitude locations, as well as coastal ecosystems.

Based on the occurrence of disasters recorded in OFDA/CRED International Disaster Database (2007), the ten biggest disaster events in Indonesia over the period 1907 to 2007 occurred after 1990 and most of these disasters were weather-related, particularly flooding, followed by drought, forest fire and the increase of endemic diseases. These show that weather-related disasters have been increasing in terms of their frequency and intensity. Economic losses from the ten biggest disasters were almost 26 billion USD, around 70% of which can be attributed to the climate.

According to the World Disaster Report (2001), global economic losses due to climate disaster events have increased 14 times compared to the 1950s, reaching 50-100 billion USD per annum. Similarly, the number of deaths because of climate-related disasters have also increased 50% per decade. If global warming continues and no adaptation effort is made, then it is expected that by the year 2050, economic losses due to climate change will increase to 300 billion USD per annum and the number of death could reach

100 thousand per year (SEI, IUCN and IISD, 2001). Early implementation of adaptation efforts could reduce significantly the losses caused by climate change. Research has shown that every 1 USD spent on adaptation could save about 7 USD cost that has to be spent on restoration because of the impact of climate disasters (Biemans et. al., 2006).

Climate change will also cause social, population and cultural change. Various social studies found that patterns of social relationship are related closely to climate patterns - in other words, social and cultural patterns are directly influenced by local climatic conditions.

The explanation above shows that a systematic and integrated effort by the global community to reduce the rate of global warming, combined with efforts to increase the coping capacity towards climate change has become necessary. Fundamental changes to the development planning system are therefore needed. The present and future climate should become one of the main factors in determining the basic plan of national development, for the short, medium and long term.

Addressing climate change in the context of development requires effective climate change mitigation, and also a development system that is resilient to long-term climate change impacts. This effort requires a cross-sectoral approach at national, regional and local level. Adaptation efforts must be combined with mitigation, because adaptation will not be effective if the rate of climate change exceeds adaptation capability. Mitigation is an effort to reduce green house gas emissions from various sources and increase their absorption by various sinks, thus reducing the burden of climate change impacts on future generations.

1.1 Objective

The objective in formulating a National Action Plan to address climate change is for it to be used as guidance to various institutions in carrying out a coordinated and integrated effort to tackle climate change. Addressing the impact of climate change should not be conducted by a few sectors only. Good coordination between sectors is essential to ensure the success of climate change mitigation and adaptation efforts in Indonesia. Climate change and its impacts are complex and dynamic problems. The National Action Plan

must therefore be continuously evaluated and improved periodically by various stakeholders.

1.2 Indonesia in the context of Climate Change

The Republic of Indonesia is the largest archipelagic state in the world, consisting of five major islands and about 30 smaller groups of islands, totalling some 17,500 islands. It is situated between 06°08' N and - 11°15' S, and between 94°45' - 141°05' E. Indonesia consist of 3.1 million km² of sea (62% of the total area) and about 2 million km² of land area (38% of the total area), with the shoreline length of 81.000 km. If the Exclusive Economic Zone with an area of 2.7 million km² is included than the total jurisdiction of Indonesia is 7.8 million km².

Most of the islands of Indonesia are vulnerable to earthquakes and high waves. This is due to the position of Indonesia, which is situated between two shelves, namely the Sunda Shelf, an extension of the Asian land mass and the Arafura-Sahul Shelf, part of the combined Australian and New Guinean land mass. These two shelves separate the Islands into three group of islands: Java, Sumatra and Kalimantan, which are located within the Sunda Shelf, that starts from the coast of Malaysia and Indo China. The depth of the seas on this shelf is not more than 233 m. The sea around Irian Jaya and Aru islands, which are on the Sahul –Arafura Shelf, has a depth of around 233 m. The sea surrounding the island groups of Nusa Tenggara, Maluku and Sulawesi, which are situated between the Sunda and Sahul- Arafura Shelves, has a depth of over 5000 m.

Indonesia, with its huge number of islands and vast coastline, has a very high coastal population - 65% of the population of Java live in the coastal region, for example. This makes them particularly vulnerable to climate change impacts such as sea-level rise. Indonesia also has extensive forest area but at the same time faces the threat of forest damage and is prone to natural disasters (volcanic and tectonic earthquake, tsunami, etc.) and extreme weather events (long dry season and floods). Furthermore, it also has high levels of urban pollution, fragile ecosystems such as mountain area and peat land, with economic activities that are still very dependent on fossil fuel and forest products and has difficulties in shifting to alternative fuels.

In general global climate change models forecast that all of the Indonesian region will face an increase of temperature (though at a lower rate than the

subtropical region). For example, Jakarta in July will experience temperature increase of 1.42°C every hundred years while in January this figure 1.04°C. Furthermore, in the Indonesian region south of equator (such as Java and Bali) the beginning of rainy season on average will retreat and the intensity of rainfall during the rainy season will increase, while during the dry season the rainfall will decrease. Therefore the risk of flood and drought will increase. The opposite is projected to occur for rainfall patterns north of equator. Sea levels are also changing. Research conducted in various locations in Indonesia shows that the sea level has risen 8 mm per year (Bakosurtanal, 2002). If greenhouse gas emissions are not reduced, then it is expected that the sea level could rise 60 cm by the year 2070 (ADB, 1994).

Over past four decades, weather-related disasters such as flood, drought, storm, landslide and forest fire have caused much loss of life and livelihood, destroying economic and social infrastructure as well as causing environmental damage. In many places in the world, the frequencies and intensities of these disasters have tended to increase (Sivakumar, 2005). Flood and storm winds cause 70% the total disaster and the remaining 30% is caused by drought, landslide, forest fire, heat wave damage, etc.

Based on the last 10 years (1993-2002) of monitoring of rice cultivation, conducted by the Department of Agriculture, the average area of agricultural land affected by drought has reached 220,380 hectare, with harvest failure over 43,434 ha, equivalent to the loss of 190,000 ton of dried grain. While the area impacted by flooding is 158,787 ha with the harvest failure in 39,312 ha (equivalent to 174,000 ton dried grain) (Rizaldi, 2003). According to the Agriculture Department, in January-July 2007, the area of agricultural land that experienced drought was 268,518 ha, with 17,187 of it suffering harvest failure. The result is a reduction of rice production of 91,091 ton of dried grain.

In Indonesia, there were 1,429 disasters in the period of 2003-2005 and 53.3% of these were related to hydro-meteorology (National Development Planning Agency and National Coordination Body for Disaster Management, 2006). Flooding is the most frequent with 34%, followed by landslide (16%). Climate change is likely to cause extremes of drought and rainfall that will create bigger risk of climate disaster (Trenberth and Houghton, 1996; IPCC, 2007; Indonesia Country Report, 2007). The United Nations Office for the Coordination of Humanitarian Affairs report (2006) indicates that Indonesia is one of the countries vulnerable to climate change related disasters.

The decrease of rainfall because of climate variability and seasonal variation with the increase of temperature, has significant effects on water reserves. In El Niño years, the water volume in reservoirs has decreased significantly (far below normal level), particularly during the dry seasons (June-September). Many power plants have produced electricity below normal capacity in these years. Data from 8 reservoirs (4 small reservoirs and 4 large reservoirs in Java) have shown that during the El Niño years of 1994, 1997, 2002, 2003, 2004 and 2006, most of the power plants operating with these 8 reservoirs have produced electricity below their normal capacities (Indonesia Country Report, 2007).



Long dry season

Photo Istimewa

The increase of sea surface temperature, particularly during the 1997 El Niño, has caused serious problems to coral reef ecosystems. Wetlands International (Burke et al., 2002) reports that the 1997 El Niño destroyed about 18% of the coral reef ecosystem in Southeast Asia. Coral bleaching occurred in many places such as East Sumatra, Java, Bali and Lombok. In the Seribu islands about 90 – 95% of coral reefs at the depth of 25 m have experienced coral bleaching.

Weather variation such as the El Niño – Southern Oscillation (ENSO) has contributed to the spread of diseases such as malaria, dengue fever, diarrhea, cholera and other vector-borne diseases. The World Health Organization (WHO) has found that the spread of malaria is triggered by above-normal rainfall and also influenced by unstable weather transitions such as rapid changes from heavy rainfall to hot sunny days. This condition increases the rate of mosquito breeding.

In Indonesia the increase of rainfall above normal level occur particularly during La Niña years (wet years). Dengue fever cases also increase significantly during these periods. The incidence of dengue fever in several big cities in Java has increased consistently, based on the 1992 to 2005 period data (Indonesia Country Report, 2007).

According to the Department of Marine Affairs and Fisheries, in just two years (2005-2007), Indonesia has lost 24 small islands: three in Nanggroe Aceh Darussalam (NAD), three in North Sumatra, three in Papua, five in Riau Islands, two in west Java, one in South Sulawesi, and seven in the region of Seribu Islands, Jakarta. Most of these islands are lost because of erosion, worsened by commercial mining activity. In addition, the Aceh tsunami in 2004 also destroyed three local small islands. The loss of these islands, particularly along the boundary with other States will have legal impact that will harm Indonesia. The loss of these islands (originally used as a reference point for the boundary between Indonesia and other States) will reduce the area of Indonesian seas.

The diverse ecosystems in Indonesia influence the cultural characteristics of the community. Highland and lowland communities have different characteristics, for example. These features are closely related to geographic and ecological characteristics. The fundamental changes to the micro climate pattern and the water availability will influence the social system and the patterns of interaction of the local community. The anticipation of climate change in various Indonesian regions should therefore become an important consideration in every step of adaptation and mitigation of climate change.

1.3 The State of Indonesian's Social – Ecological Crisis

The accumulation of ecological damage over the last generation has sent a dangerous signal. Economic management without any consideration of its social and ecological implications contributes to the loss of human safety and social security.

In addition, fundamental ecological changes are also influencing the basic patterns of social interaction. Agricultural land conversion to non agriculture land results in the development of public activities that do not have a

community economic historical base, and this has apparently accelerated ecological damage in various areas of Indonesia.

1.3.1 Management of Space and Natural Resources

Over this time the management of development processes has not yet used a strict accounting model that ensures the security of space, land, water and all its public resources. In addition, institutional and individual practices regarding land use and natural resources are subject to sectoral stipulations that are not well implemented or evaluated at local and central levels. With those two weaknesses, there has until now been a deepening and extension of the crisis that not only covers the Land Use, Land-Use Change and Forestry (LULUCF) as determined by Kyoto Protocol but also cover the scarcity and conflict of interest over rights and access to land, water and local natural resources including mining materials, forest and marine biomass, as well as regional infrastructures.

1.3.1.1 The Agrarian Crisis

Food production lands, for example continue to decrease because of conversion from irrigated lands to industry or urban functions. Forest land with its variety of land titles, and with its use defined by government regulations has become a complex field of conflict of interest. These are also mirrored in the worsening availability of social-economic requirement of food producers, because of the concentration of land title, pressure on the exchange value of rural product along with the indirect impact of the implementation of unsuitable sector policy, among other reasons. The scale of this agrarian crisis has become one of the most important contributory factors underlying the increase of environmental damage in general. For central urban settlements, particularly in big cities and secondary cities, the failure to control the utilization and ownership of the city's land and the city's fringe land have complicated efforts to allocate land to accommodate the need for extension of city and industry infrastructure. City expansion itself has cleared away areas with vital and critical ecosystems for the sustainability of local hydrology. The best example of this is the failure to control the



development in the green zone for water catchment in Puncak, Bogor, West Java. This is not an isolated case, in various forms it also occurs in other areas in Java and other main islands. The richness of natural resources themselves has created complex problems, such as has occurred in the islands outside Java. Their exploitation frequently creates an expensive social and ecological impact on the local community as well as to the integrity of local ecosystems. The form of extensive industrial forest exploitation that has occurred in the main islands such as Kalimantan and Sumatra has caused a crisis that is very difficult to restore. Although over this time it has been controlled with various regulations and monitoring and control instruments, the industrial-scale exploitation has an important role in the deforestation process and the emergence of illegal forest product production regimes that are more difficult to control.

1.3.1.2 Water Resource Crisis

It can not be denied that water is very important for livelihoods. Lack of access to drinking water and sanitation, along with bad environmental conditions have a dangerous impact on the human health. Similarly, the availability of water for food production is also a very important contributor to food security.

According to data from the Environmental Status Report (2002), Indonesian water consumption is around $3,169 \times 10^6$ m³, with projections that by 2000 consumption will be about $6,114 \times 10^6$ m³ and $8,903 \times 10^6$ m³ by 2015, with the percentage of its increase between 10% per year (1990-2000) and 6,67% per year (2000-2015). Based on calculations made by Directorate General of Water Resource, Java (with high population and high industrial activities), Bali and East Nusa Tenggara already suffer water deficit. This deficit will increase in line with the increase of population and economic activities.

The availability of water, for various needs of the domestic/human settlement sector, agriculture, fisheries, animal husbandry, industry and environment is very dependent on the climate, so it is very vulnerable to climate change. The total water collection facilities (reservoirs, ponds etc.), with total capacity of around 5% of run-off, is only able to guarantee supply to about 10% (700,000 ha) of the total area of the existing irrigated network. The supply of clean water through new piping system only covers about 37% of the urban population and about 8% of the rural population. The rest is supplied by the use of groundwater, particularly shallow ground water, thus it is vulnerable, both in terms of quantity and quality, particularly during the dry season. Because water supply from surface water is not sufficient to fulfill the water need of industrial activities, many industries use deep groundwater resources. The excessive use of ground water (over the supply capacity) causes land subsidence that creates areas vulnerable to flood and salt water intrusion. The key solution is sufficient budget allocation to build water resource infrastructure together with the policies to manage the use of groundwater consistently.

Fundamental changes to water resources will also cause change in social systems. The area that at present is recognized as having an abundance of water will experience major change. This will tend to increase the change in the pattern of activities from agriculture to non agricultural activity as well as an increase of migration rate from rural area to semi-urban and urban area.

Water resources are under threat because of the increased degradation of river watershed area that reduces the quantity and quality of river flow. In 1984 the number of critical water catchments was 22, and now it is 62. This is due to factors including: forest clearing and land management practices in the upper river areas that creates sedimentation in the downstream river area; pollution and industrial, domestic, agriculture and solid waste, as well as pollution and mining practices on land as well as on the water/river body.

This results in flooding during the rainy season and drought during the dry season.

Pollution of river water is already at a dangerous level. Based on the water quality criteria in year 2001/2002, none of the rivers in Indonesia satisfy the 1st-Class and 2nd-Class of the quality standard, especially in the downstream section which was dominated by the 3rd Class. The low discharge of the river during the dry season also results in poor water quality because of pollution. This condition will be worsened by the impact of climate change that tends to increase the intensity of the rainfall during the rainy season and decreases the rainfall sharply during dry season, as well as lengthening the period of dry season.

In general, climate change will influence a number of weather parameters including: temperature, rainfall, pressure, humidity, wind speed and direction, cloud condition and solar radiation. The change of rainfall will effect water-related sectors, such as water resources, agriculture, infrastructure (include settlement, transportation, hydro power plant and spatial planing), fisheries, swamp and peat as well as coastal areas.

The impacts of climate change on water-related sectors are, among others:

- Increasing the occurrence of extreme weather that has the potential to cause flood, landslide and drought. These will increase the damage to infrastructure; reduce food production, lead to individual property loss and human casualties, including the threat of storm and high waves that will endanger the safety of shipping. The threat of storms could also create refugees from populations living in low-lying areas, coastal areas and small islands;
- Decrease the contribution of hydro power to the total supply of energy;
- Increase the coastal length that experience erosion;
- The threat of salt water intrusion could cause:
 - Reduced quality and quantity of fresh water supply during dry season that will increase the processing cost for drinking water;
 - Threat of salt water intrusion to the sources of drinking water (water intake sites in rivers) because of sea level rise;
 - Damage to the function of rice field as agriculture land and also damage the function of the river as fresh water resource;
 - Damage to the structure of buildings;
 - Reduced fishery production due to lack of fresh water supply, especially during dry season;

- Social, economy and environmental problems in the affected area.
- Disruption to inland water transportation in Kalimantan, because the decrease of river water level during dry season will prevent the passage of large ships;
- Increased probability of fire on peat land because of higher temperature and lower rainfall during the dry season;
- Threaten mangrove habitat and coral reef as well as fish population in Indonesian waters.
- Increase the threat to biodiversity because of changes in land use and vegetation coverage and the increase of human population.
- Increased threat of disease such as malaria, dengue fever, cholera and others.

1.3.1.3 Infrastructure Crisis in Settlement Centers

Until now, the regional infrastructure development model has tended to put pressure on rural settlement and production areas in various ways as has been mentioned above. Mitigation efforts through control of deforestation will face conflict with local livelihoods. Rural poverty will put new pressure on forest regions, as well as the expansion of the exploitation of industrial forest products. Moreover, a similar crisis becomes the main driver of migration from agriculture and/or rural regions to the urban centers.

Urban areas, with limited institutional capacity, and without support from the policy framework or sufficient funding focussed on safety and welfare of the city population, are not well prepared to cope with this urbanization process. Problems of clean water, waste, building and housing codes, as well as public transportation infrastructure have pushed the systemic crisis in city centers.

On average, the Indonesian population produce about 2.75 liters of waste per person each day. For example, Jakarta with a population of 12 millions could produce up to 33,000 m³ of waste per day. Because the existing infrastructure is not sufficient, much waste is thrown directly into the environment, such as rivers, empty lots and into the sea, thus causing environmental pollution. Moreover, there have been incidents of social conflict related to the management of waste landfill sites that have even caused loss of life as the result of inappropriate management (the explosion of Leuwi Gajah landfill site, in Cimahi, West Java, for example).



Nature as source of living

Photo Istimewa

Cities are still using the open dumping waste management in landfill sites, so the methane gas produced by the anaerobic decomposition process will be released to the atmosphere and create global warming (global warming potential per molecule of CH_4 is 21 times greater than a molecule of CO_2).

Based on study of CH_4 gas emission conducted at waste dumping location at Jelekong-Bandung (Driejana, 2007), each kg of waste could release 0.0003335 kg of CH_4 to the atmosphere. The population of Indonesia in 2000 was 205.1 million with population growth of 1.33% (BPS, 2000). If it is assumed that the waste density is 196.4 kg/m^3 (Saptini, 2007), then the amount of methane gas released to the atmosphere in 2006 could reach 40 tons, equivalent to 841 tons of CO_2 .

The rapid increase of air pollution along with the increase of population activities in transportation, industry, service and household sectors, has caused an increase of lung infection, and other diseases such as cancer, reduced child intelligence, and children with autism born with heavy metals exceed the permitted limit. Moreover, fuel combustion in motor vehicle produces polycyclic aromatic hydrocarbons (PAH) which is a carcinogen. Acid rain also occurs in Indonesia with rainfall pH between 4.5 and 5. The general standard to determine acid rain is a rainfall pH below 5.6.

1.3.1.4 Land Use, Land-Use Change and Forestry (LULUCF) Sector

In the forestry sector, the highest decrease of land coverage occurred in the

period 1997 – 2000 which was 2.83 million ha (forest and non forest area) per year, with the highest rate occurring in Sumatra with 1.15 million ha per year, followed by Kalimantan with 1.12 million ha, Sulawesi with 692 thousand ha, Maluku 294 thousand ha and Papua with 156 thousand ha per year (see Figure 1).

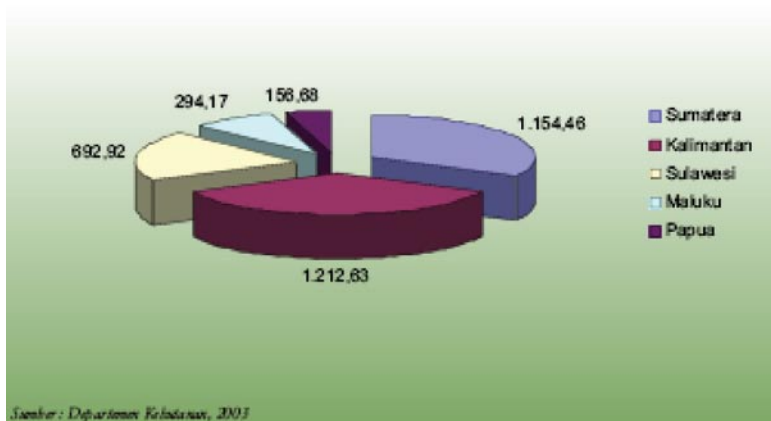


Figure 1. The rate of the decrease of forest coverage in 1997 – 2000 (thousands Ha per year)

The rate of decrease on forest coverage above has been smaller in the period of 2000-2005, reducing to 1.08 m ha per year.

About 60% of Indonesia's greenhouse gas emissions come from the LULUCF sector (Indonesia: The First National Communication, 1999). An international scientific publication stated that forest and peat land fire in Indonesia in 1997 contributed 13-40% of the global carbon emission (Page, et. al., 2002). Although the calculation techniques used are debatable among experts, Indonesia nonetheless must conduct efforts to reduce forest and land fires. CO₂ emission because of forest and peat land fire in Indonesia can be seen in the following Figure 2.

In the context of climate change forests play a key role as a carbon sink (absorb carbon), carbon storage (store carbon) and carbon source (emitting carbon). Deforestation and degradation can increase the role as sources, while afforestation, reforestation and other planting activities increase its role as a sink and storage site. Greenhouse gas emissions from the LULUCF in Indonesia come from deforestation (forest conversion to other use such

as agriculture, plantation, settlement, mining, regional infrastructure) and degradation (the decrease of forest quality because of illegal logging, forest fire, over-cutting, land clearance by slash and burn, and shifting cultivation).

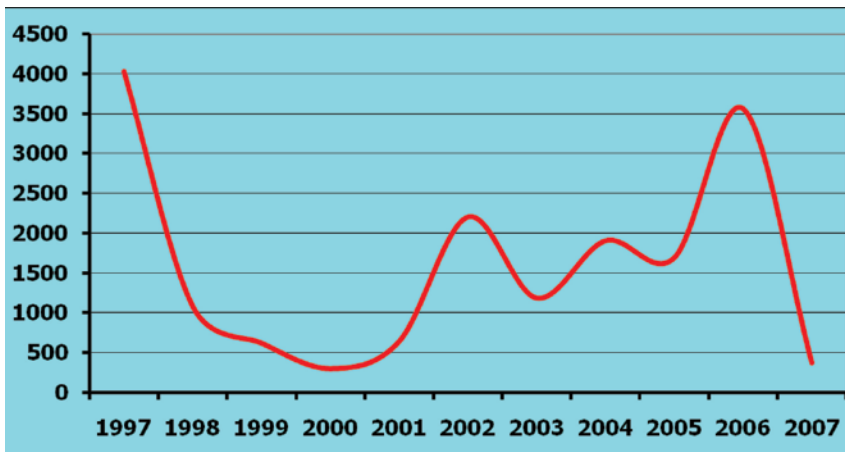
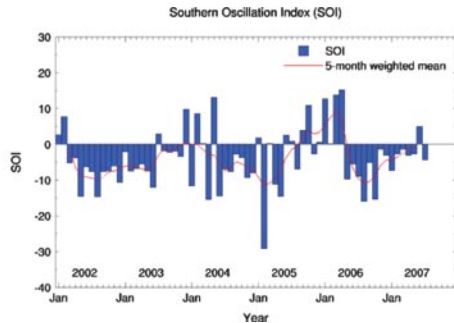
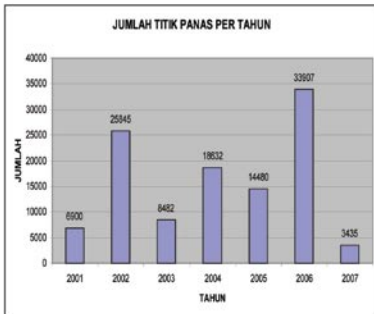


Figure 2. CO₂ emission (million ton) due to forest fire in Indonesia (from Heil et.al., 2007)

El Niño events, which result in dry conditions, are a stimulus for the occurrence of forest and land fire in Indonesia. In addition to El Niño, human factors also play a role in forest fire. Figure 3 shows the comparison between hot spot number and the phenomena of El Niño-La Niña in 2006-2007. In general, the picture shows the relationship between ENSO phenomena and the number of hot spots in Indonesia. Therefore there is a need to prepare mechanisms to anticipate the possibility of extreme climate event through accurate and informative early warning system to all parts of the community.



Positive value of SOI = La Niña; Negative value of SOI = El Niño

Source: Australian Bureau of Meteorology

Figure 3. The number of hot spot per year and SOI (Southern Oscillation Index) in Indonesia, 2002-2007

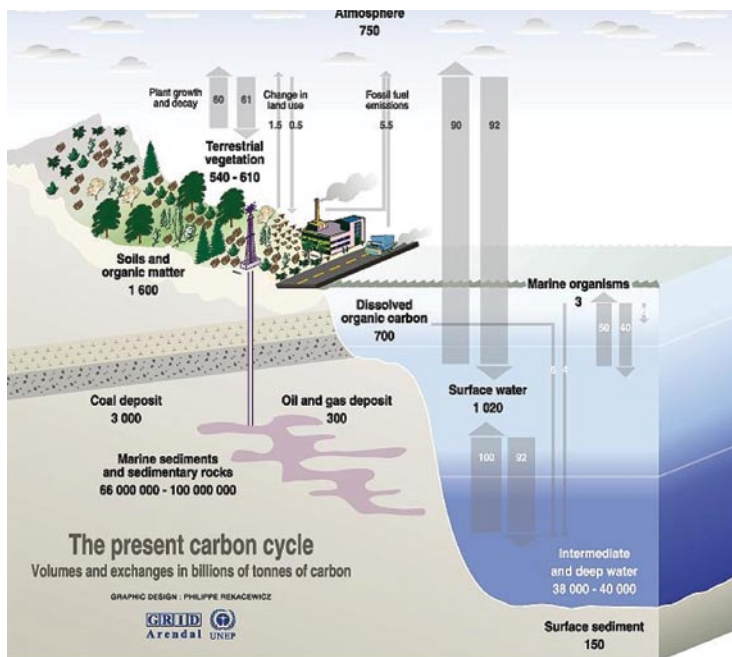
In the agriculture sector, according to calculation by Agriculture Department, emissions in 2005 were 96.42 million tons of CO₂e (Table 1). Most of it (62%) comes from rice field,

Table 1. Green house gas emission from agriculture sector

Agriculture Activities	GHG Emission (million ton CO ₂ e)
Rice field	61.781
Husbandry	19.338
Agriculture Land	3.750
Land fire (bush, savannah, shifting cultivation)	3.619
Burning of agriculture waste (straw, rice, corn, sugar cane etc.)	7.932
Total	96.420

1.3.1.5 Marine Sector

The seas play an important role in global carbon cycle. Almost half of the oxygen that we use comes from photosynthesis in the seas. Similarly with the forest, in the sea there are carbon storage and release processes. The total carbon store in the ocean is about 50 times the amount that exists in the atmosphere. As shown by Figure 4, the exchange mechanism of the ocean is very dynamic so the ocean could store and release significant amount of carbon. The carbon exchange value in the ocean is about 90 billion ton per year released to the atmosphere and 92 billion ton per year absorbed. The difference, which is about 2 – 3 billion tons per year is the carbon stored in the marine biomass living in the surface. The carbon store in the intermediate and deep sea amounts to 38,000 – 40,000 billion tons. As a comparison, land vegetation produces a carbon cycle of 60 billion ton of carbon released to the atmosphere and 61 billion ton of carbon absorbed (see the following Figure 4).



Sources: Center for climatic research, Institute for environmental studies, university of Wisconsin at Madison; Okanagan university college in Canada, Department of geography; World Watch, November-December 1996; Climate change 1995, The science of climate change, contribution of working group I to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Figure 4 Carbon cycle on land, atmosphere and sea.

The marine carbon cycle is conducted through two mechanisms, which are physics and biology (biological pump). CO₂ gas in atmosphere enters the sea because there are differences between CO₂ partial pressure in the sea and in the atmosphere, and the capacity of the sea to dissolve this substance. CO₂ gas in the air is absorbed by saltwater and used by phytoplankton at the sea surface. The contribution of phytoplankton to global carbon absorption is nearly 50%. Through photosynthesis and respiration, phytoplankton carries out carbon exchange during the day and night time. Part of the CO₂ gas produced by phytoplankton is released back to the atmosphere and part of it is stored or transfer to deep sea or sediment of sea bottom. Beside phytoplankton, other marine biota also conducts carbon exchange, such as coral reef, sea grass and mangrove.

In a similar way to land vegetation, phytoplankton has chlorophyll that can absorb the spectrum of solar radiation. In addition, solar energy is also absorbed by salt water that causes the variation of sea surface temperature. This mechanism can be recorded by satellite. Through this remote sensing technology, the amount of primary production and sea surface temperature can be calculated so the carbon flux can be estimated. Carbon flux estimation should be supported by continuing observation regarding the marine biota's capability to conduct biological pump and other factors that influence the quality of the marine environment.

Indonesia as an archipelagic state has 5.8 million km² marine area, with potential coral reef area about 61,000 km², sea grass of 30,000 km² and mangrove forest with an area of 93,000 km². Therefore, Indonesian seas have large potential to absorb (carbon sink) and release carbon (carbon emitter).

Climate change can influence ocean characteristics such as ocean circulation, marine biogeochemistry cycle and ecosystem dynamics. These factors are important element in ocean carbon cycle. Today, 48% of carbon that is released by combustion of fossil fuel is absorbed by the sea. CO₂ gas concentrations are increasing, causing an increase of hydrogen ion concentration in the sea. The effect is increasing acidity of the sea that will impact the marine ecosystem, through the mass death of coral reef, for example, that will degrade the Indonesian marine environment.

1.3.2 Management of Energy

In energy sector, Indonesian energy consumption has grown rapidly since 1970. In the period 1970-2003 the growth of final energy consumption in Indonesia reached 7% p.a., while the growth of global energy consumption was only 2% p.a. At that time energy conservation in Indonesia was not yet optimal and still limited to the development of renewable energy. Indonesian energy policy up to 2003 still placed fossil fuel as main energy source with 95% of the total energy, with renewable energy only 5%.

From National Communication data in 1994, energy consumption in Indonesia consisted of consumption in domestic (household) and commercial buildings, industry, transportation, and power plant that release around 170.02 million tons of CO₂. Emissions from energy consumption constituted 25% of the total Indonesian emission which was 748.6 million tons. However, total emissions from the Indonesian energy sector are still very small compared to developed countries. Data from the International Energy Agency shows that in 1994, global emission of CO₂ from energy consumption (combustion of fossil fuel) was around 21 billion tons. Therefore, Indonesian CO₂ emission from energy consumption in 1994 only contributed around 0.81% of global emissions.

Population and economic growth along with technology development will increase CO₂ emission. Without intervention to reduce this emission, the energy sector of Indonesia will emit about 1,200 million tons of CO₂ in 2025 (PE-UI, 2006). This can be seen in the following Figure 5.

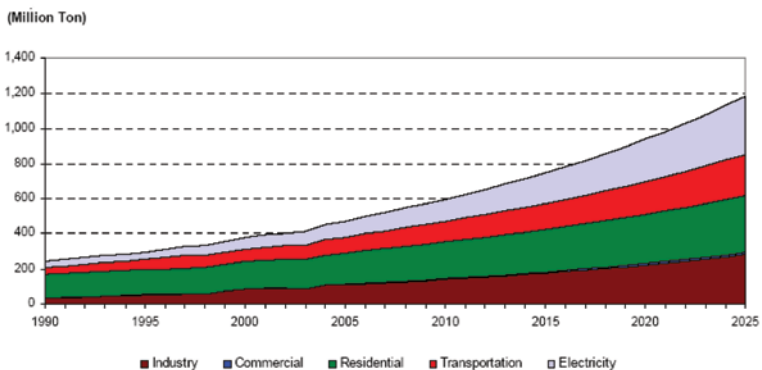


Figure 5. Projection of CO₂ emissions from energy sector of Indonesia without intervention (Business as Usual – BAU)

1.4 Indonesia's Commitment to Safeguard Global Climate

Indonesia has given special attention to environmental management since the early 1980s. The extent of social ecological damage up to now remains a real stimulus for Indonesia to take stronger initiatives in restoring and managing the environment.

Although Indonesia does not have any obligation to reduce its greenhouse gas emissions, it does have an interest in playing an active role in global efforts to tackle climate change. Indonesia ratified the United Nations Framework Convention on Climate Change through Act No.6, in 1994. Ten years later, Indonesia ratified the Kyoto Protocol through Act No. 17, in 2004. This commitment now requires a thorough effort and real action, covering all sectors that contribute to greenhouse gas emissions and carbon sequestration. This commitment must also be implemented along with efforts to improve welfare and environmental quality, which is reflected in the management of consumption and production priorities for mitigation and adaptation.

Indonesia has conducted several national strategy studies on the energy and forestry sectors in relation to the above commitment. In addition, through comprehensive studies, Indonesia has identified several potential programs to reduce emissions from the oil and gas, forestry, transportation, and solid waste sectors and from the application of new and renewable energy.

The formulation of national strategy along with its National Action Plan (NAP) for mitigation and adaptation to climate change represents guidance to that effort. The NAP is a dynamic instrument that must be examined periodically and revised and improved in its effectiveness accordingly. This guidance must also be clear to show to all relevant parties how to implement actions in managing the production and consumption sectors as well as socio-ecological change. The action plan with implementation methodologies, monitoring and control of the execution must be able to overcome the low degree of coordination between stakeholders and other existing institutions as well as social obstacles at the present time.

Therefore, the NAP as a dynamic document should systematically drive all parts of society toward a way of life that anticipates climate change. Social engineering should be conducted in a spatial approach in order to take into consideration the micro scale of local social characteristics. Through this approach it is expected that communities could adapt proactively to

government policies and programs in the NAP.

It is urgent to adjust public policy as well as the relevant legal instruments, particularly in mitigation and adaptation of development priority sectors, including energy consumers (such as power plant, industry, transportation and commercial and domestic), trade, forestry, agriculture, fisheries/marine, mining and infrastructure.

The large spatial scale and the implementation target of the NAP requires a new and shorter chain of control on monitoring and measurement, to evaluate performance in order to overcome the fragmentation of the tasks of all the main sectors. Therefore, public policy instruments to guide sustainable development along with NAP, including the supporting economic and fiscal instruments, should be accompanied with the means to integrate the implementation of the social-ecological targets of the NAP, in order to continuously monitor and measure the changes.

A series of integrated actions should be carried out to drive various changes to the nature and modalities of investment and the flow of goods and resources to restore the social-ecological damage throughout the Indonesian archipelago.

Indonesia has carried out several actions to implement the Convention and Protocol in anticipation of climate change, which cover the mitigation and adaptation effort, including, among others:

1.4.1 Mitigation Effort

Institutional development

- Establishment of the National Commission on the Clean Development Mechanism based on Ministry of Environment Decree No.206/05 as Designated National Authority (DNA) to give national approval to CDM project proposals that have satisfied sustainable development criteria. The National Commission on CDM consists of nine departments, and is chaired by Deputy III, State Ministry of Environment.
- In the two years since it was established (until August 2007), the National Commission on CDM has approved 24 CDM project proposals, and nine of them have been registered internationally by the UNFCCC executive board. From these 24 projects, total emissions of CO₂ could be reduce by 33,079,993 tons CO₂e.

Energy Sector

- Act NO. 17/2006 concerning the change on Act No.10/1055 regarding custom regulations that give free or reduced import tax for clean technology equipment
- Act No.30/2007 concerning Energy
- Presidential Instruction No. 10/2005 concerning Energy Saving
- Presidential Instruction No. 1/2006 concerning Supply and Application of Biofuel as alternative fuel.
- Presidential regulation No. 5/2006 concerning National Energy Policy
- Department of Energy and Mineral Resource Ministerial Regulation No. 1122K/30/MEM/2002 regarding Small Scale Power Plant using renewable energy
- Department of Energy and Mineral Resource Ministerial Regulation No. 0002/2004 regarding policy on renewable energy development and energy conservation (green energy development)
- Department of Energy and Mineral Resource Ministerial Regulation No. 0031/2005 about guidance for the implementation of Energy Saving.
- Department of Energy and Mineral Resource Ministerial Regulation No. 002/2006 regarding Medium Scale Power Plant with renewable energy.
- Monitoring of Air Pollution emission from industry sector that has been conducted by State Ministry of Environment through Company Performance Evaluation Program (PROPER) and transportation sector through Blue Sky program on motor vehicle emission test.
- Rural Energy Self Sufficient Program for electric energy sources such as at Subang by using hydro power. Until 2006, almost all cities/districts in South Sulawesi have built more than 3000 units of solar energy power plant.
- Implementation of Cleaner Production Program (CPEE/Cleaner Production) and Energy Efficiency for energy intensive industry such as cement, steel, fertilizer, pulp and paper, textile, power plant etc.
- Regulate and Ban the import of environmentally unfriendly goods.
- State Ministry of Environment Minister Regulation No.7/2007 regarding static source emission standard for boiler

LULUCF Sector

- Addressing Forest Fire
 - Government Regulation No. 4/2001 concerning Environmental Damage Control and or Environmental Pollution related with Forest

- and Land Fire.
- o Preventive Forest Fire effort that consists of satellite monitoring, field monitoring of companies, air quality monitoring, and community empowerment to change the practice of land clearing from slash and burn to not using fire or controlling fire. The implementation of this preventive effort is conducted by increasing the community participation while at the same time is used to increase community income (related with poverty alleviation) of farmer in areas vulnerable to fire, among other through distribution of technical equipment to clear the land without fire, and training for farmer.
- o Establish Manggala Agni that has a duty to monitor, prevent and address the forest fire.
- Issued the Presidential Instruction No.4/2005 regarding the elimination of illegal tree cutting in forest area and its distribution throughout the Republic of Indonesia territory. In this decree, the President has ordered 12 ministries, prosecutor, police, the armed forces and the leader of local governments to accelerate the elimination of illegal tree cutting in forest area and its distribution throughout the Republic of Indonesia territory.
- Addressing flooded land and prevent the occurrence of flooding. The objective of this management is to prevent methane gas emission and the accumulation of domestic waste because of flood.

Capacity Building

- To encourage CDM project activities in Indonesia, CDM training activities have been conducted for key stakeholders, which are relevant government agencies, local government, communities, private sector, legislative, association, heads of companies, universities. These activities have been conducted in five regions, namely Sumatra, Java, Kalimantan, SUMAPAPUA (Sulawesi, Maluku and Papua, as well as Bali and Nusa Tenggara).

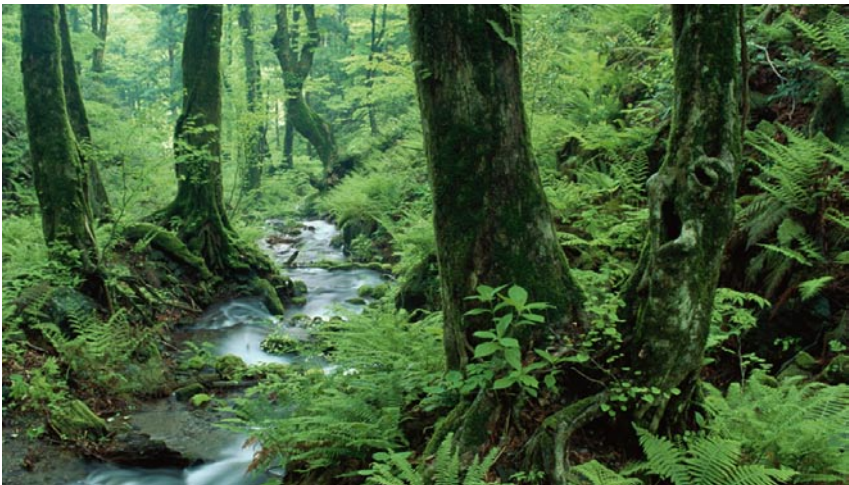
1.4.2 Adaptation

Institutional Development

- Formulation of National Adaptation Strategy which functions as part of the stakeholder commitment process in implementing adaptation to the climate change. In the process of document formulation the awareness of the staff which are involve in policy making in their own department was also increased.

LULUCF Sector

- Integrated Coastal Management has been conducted through mangrove forest planting activities in the north of Java (Pemalang, Batang, Brebes, Pekalongan, Tegal), east coast of Sumatra and several provinces (Nangroe Aceh Darussalam, North Sumatra). The purpose of this program among others are to empower the community including women, to prevent the degradation of coastal vegetation that also functions as carbon sequestration. This is also conducted to develop economic potential such as ecotourism, coconut charcoal production for coastal area to prevent the used of mangrove as source of energy. For example the mangrove planting in Ulujami regency (Pemalang District), that also supports soft shell crabs farming.
- Formulation on draft Guidance for Water Conservation (absorption well and water reservoir) and National Water Saver Partnership Movement.
- Coral reef management has been conducted by transplantation method such as in Sabang waters. Coral transplantation is a method by transplantation and cutting of live colony of coral reef to be moved or planted in other places, for the purpose of accelerating the regeneration of the damage coral reef.
- Breakwaters are used to reduce erosion in coastal areas such as implemented in Tanah Lot by using Tetrapod model. However, not all sites can use the same model, because the technology used in one location is dependent on the pattern of local currents and waves.



Deep forest in Indonesia

Photo Istimewa

Capacity Building

- Plans to establish climate field schools in 25 provinces (150 districts/cities) to increase farmers' understanding of climate information and its application. A climate field school has been established in Indramayu since 2003. The establishment of Climate Field School is cooperation between Department of Agriculture, Meteorological and Geophysics Agency, local government and Institute Pertanian Bogor (IPB) with funding from National Oceanic and Atmospheric Administration.

1.4.3 Efforts to Support Mitigation and Adaptation Simultaneously

Institutional Development

- Established National Committee for Climate Change through Environmental Ministerial Decree No.53/2003. The members of this National Committee are representatives from departments and institutions related to climate change.
- Revision on Act No.23/1997 concerning Environmental Management to include climate change issue.
- Formulation of Presidential Regulation concerning Climate Change that will be function as umbrella to all activities related with climate change impact, both in term of mitigation and adaptation.

LULUCF Sector

- Land Rehabilitation and Reforestation
 - o National Movement for Land rehabilitation (Gerhan) is a movement to replant forest over 59 million ha of critical land in Indonesia. This program will be focused on 3 million ha of river watersheds in Indonesia. In the period of 2003-2007 an area of 4 million ha has been planted.
 - o Toward Green Indonesia (MIH), is a program of supervising the performance of districts in enforcing natural resource conservation regulations and controlling environmental damage. This program has run from 2006 with classification of highland areas, lowland areas, and small islands. The targets of MIH are the increase of vegetation coverage (improvement of water management, soil and coastal stabilization), increased energy conservation and increased atmospheric protection. This is in accordance with Government Regulation NO. 47/1997 regarding National Spatial Plan and Act 27/2007 regarding Spatial Plan.

- Management of Peat Land
 - Presidential Instruction No. 2/2007 concerning Revitalization and Rehabilitation of Sustainable Peat Land.
 - Draft formulation on Sustainable Peat Land Management.
 - Ministry of Environment has conducted an inventory and mapping of peat characteristics. This information has been presented by State Ministry of Environment to the related local government and institutions for spatial planning formulation and permit requirement.
 - Conduct peat environment restoration by damming channels to increase and maintain the water level of the peat land.
- River watershed programs based in Forestry and Plantation Ministry No.284/Kpts-II/1999 stated that 472 river watersheds should be addressed, consisting of 62 priority 1 river watersheds, 232 priority 2 river watersheds and 178 priority 3 river watersheds.
- The Heart of Borneo is a name given to 22 million ha of tropical rain forest in Kalimantan that extends through Indonesia, Malaysia and Brunei Darussalam. This region consists of conservation and cultivation areas that are managed for sustainability. The Heart of Borneo declaration was signed on 12 February 2007 and included the three countries' commitment to manage the Kalimantan forest region in a sustainable way.
- Improvement of land policy. Effective land policy could indirectly result in the reduction of emissions through the decrease of forest degradation and deforestation. The certainty of rights and duties particularly related to land title can reduce negative impacts and make land users more capable to adapt the climate change.

Marine Sector

- The APEC Marine and Fisheries Ministerial Meeting in Bali in September 2005 adopted the "Bali Plan of Action". This document is a reference for Asia-Pacific countries in marine resource sustainable management to anticipate the impact of climate change to national development.
- In September 2007 in the APEC Summit at Sydney, Australia, the 21 leaders of the APEC members supported the marine initiative proposed by Indonesia, namely "Coral Triangle Initiative" (CTI). The Indonesian proposal was submit together with 5 other countries, which are Malaysia, Philippines, Papua New Guinea, Timor Leste and Solomon Islands. One of the main agenda of the CTI program is the mitigation and adaptation

of the climate change impact at the regional level through conservation and preservation of 75,000 km² coral reef in the six countries (CT-6).

- For “*semi-enclosed water*”, according to United Nations Convention on the Law of the Seas 1982 (UNCLOS-1982) paragraph 122-123, the “Arafura and Timor Seas Expert Forum” (ATSEF) program supports cooperation between Indonesia, Australia and Timor Leste for protection of the ecosystem and marine conservation in the Arafura and Timor Seas. Likewise in the northern Indonesian waters, cooperation with Malaysia has been initiated for marine conservation through the Sulu-Sulawesi Marine Eco-region (SSME) program.

CHAPTER II

THE OBJECTIVE AND STRATEGY FOR NATIONAL DEVELOPMENT IN THE ANTICIPATION OF CLIMATE CHANGE

As an archipelagic state, Indonesia is particularly vulnerable to the impacts of climate change. Furthermore, as a developing country, it does not have the capacity to adapt to climate change as well as a developed country. Therefore, it is a concern that development conducted by the government will be hampered by the impacts of climate change. The poor are the group most vulnerable to the impacts of climate change, and they are also the most impacted group because of the obstruction of national development. Therefore any response to climate change should include poverty alleviation. The triple track strategy which is pro-poor, pro-job and pro-growth should become an integral part of the national strategy to address climate change.

The national strategy addressing climate change should therefore also be directed to social engineering development, so communities can have a systematic, planned and thorough social change in order to get social and ecological benefit.

2.1 The Past and Present of Development Pattern

The socio-economic transformation to improve the quality of life of the Indonesian people in the post-independence period took place in the context of dynamic domestic and foreign political economy, that was not always in accordance with the national interest. The focus of development that centers on economic growth, political stability, and equity takes place on a base of natural resource exploitation without consideration of its sustainability. Therefore, the triple track strategy mentioned above, should be expanded with the fourth track, namely pro-environment, which based on the sustainable development.

The improvement of production infrastructure and the extension of production sectors particularly in the last generation have also created social ecological pressures to the livelihood support systems throughout the archipelago. Social security needs, which are very important for improving

and maintaining the environment have not yet become the principle of development.

To integrate the triple track strategies, which are pro-poor, pro-job and pro growth with sustainable development principles, the community should received necessary information and be actively involved. In this way community willingness to accept change becomes a very important aspect that should be considered. In addition, an integrated development pattern to deliver sustainable development should be devised.

2.2 The Objective of National Development with the Climate Change Anticipation Agenda

2.2.1 Mitigation Agenda

Management of the economic performance and quality of life of the people should be strongly linked to the reduction of greenhouse gas emissions and reduced energy intensity of economic growth, to be consistent with Indonesia's commitment to global efforts to tackle climate change. Mitigation targets will remain difficult to achieve as long as the barriers to the achievement of wellbeing and social security, and the maintenance of sustainable natural services are also not reduced. The extension of deforestation and land degradation particularly in the last decade is an expensive lesson in the failure of economic management based only on the three fundamental principles above.

At the level of social livelihoods, mitigation and adaptation objectives will interact with public attitudes. The promotion of attitudes and life-style patterns which are consistent with the impact of climate change should therefore be developed in a systematic and planned way

The strategy to deliver mitigation targets in the priority economic sectors¹ should therefore be formulated not only to take into account each sector on its own, but also to consider a broader framework including human wellbeing, productivity and the sustainability of natural services. Although this approach is not primarily driven by Indonesia's commitment under the

¹ Namely energy (which includes industry, power plant, transportation, as well as domestic and commercial energy use), forestry, agriculture, and infrastructure sectors)

UNFCCC and Kyoto Protocol, it nonetheless is a part of the strategy of national development that also plays a role to ensure the achievement of climate change mitigation targets.

2.2.2 Adaptation Agenda

Adaptation to climate change is a key aspect of the national development agenda, in order to achieve development patterns that are resilient to the impacts of current and future climate change. The long term objectives of the climate change adaptation agenda is the integration of climate change adaptation into national development plans.

Today, Indonesia is already vulnerable to the risk of natural disaster such as flooding, landslide, erosion, tropical storms and drought, and in the future it will have greater risks because of climate change. If concrete action is not taken immediately, then the Millennium Development Goals related to poverty, hunger and health will be difficult to achieve. Even those target that have been achieved over past decades will also be threatened.

Therefore the climate change adaptation agenda should be implemented through a sustainable development framework that integrates economic, social and ecological aspects. Development that only focuses on economic targets without consideration of natural resource sustainability will increase Indonesian vulnerability to climate change. The implementation of adaptation activity should be parallel with poverty alleviation efforts and economic development targets for poor communities, which are the group most vulnerable to the impact of climate change.

The development of capacity to adapt to climate change in the future should be based on experience and capacity building to address the present climate risk. Therefore, the adaptation agenda to address climate change should be linked to the National Action Plan on Reduction of Disaster Risk (RAN-PRB). This RAN-PRB has been established by the Government of Indonesia as a commitment to United Resolution 63/1999. The RAN-PRB objective is to reduce risk factors that cause disaster including those related to environment and natural resources such as climate change.

Adaptation efforts should be conducted through a number of approaches: (1) integrating the climate change adaptation agenda into national development

plans such as Medium and Long Term Development Plans; (2) Review and adjust the existing initiatives or programs, so they will be resilient to climate change; (3) Institutionalize the use of climate information in order to have capability to manage climate risk; (4) encourage local autonomy to integrate consideration of climate risk into local development plans; (5) strengthen the information and knowledge to reduce present and future climate risk; (6) ensure the availability of domestic resources and funding for adaptation activity and maximize the use, probably with the international support; (7) choose no regret option, which is conducting adaptation action with or without climate change so the benefit receive could be used to reduce the vulnerability to climate change, but also could be used for national development benefit; and (8) encourage a national dialog to accelerate implementation process of adaptation agenda to climate change in Indonesia.

2.3 The Principle of National Development Management

To achieve the above target and its multiple benefits, the National Action Plan should be monitored and improved continuously based on the principle of public national development as follows:

First, harmonize all policies and legal instruments to broaden economic activity and maintain the competitiveness of the main production system following the three requirements of socio ecology national development (human/ natural wellbeing, productivity and sustainability of natural services);

Second, the main instrument for compliance is the integration and harmonization of spatial use along with the utilization of public resources to overcome the “status quo” that prevents the implementation of sustainable development in Indonesia;

Third, the achievement of climate change mitigation targets along with social ecology targets should be achieved through adaptation of consumption pattern and sustainable production from all agents of change;

Fourth, integration of all mitigation and adaptation targets with social-culture aspects through social preparation and social engineering that is conducted based on the specific characters of local community and environment.



Energi saving is very important

Photo Istimewa

2.4 Time frame for the implementation of the National Action Plan

IMMEDIATE ACTION: 2007-2009

Over this period, the required instruments with their institutional support of the National Action Plan should be achieved, as well as harmonization between sectors. In addition, minimum requirements for information infrastructure required for collaboration between various key actors is to be achieved. Information that should be collected includes the latest social mapping so its development can be followed periodically. Social mapping could be used for a policy base that integrates population dynamics (quality, quantity and mobility) with climate change.

SHORT TERM ACTION: 2009-2012

Until the end of the first commitment period of the Kyoto Protocol in 2012, the implementation of NAP in each of the mitigation and adaptation priority sectors, particularly energy, forestry, agriculture, mining, public works (infrastructure) and health should be voluntary, to anticipate the new regime of climate change mitigation and adaptation in effect after the end of the first commitment period. The new modalities of public affairs must be measured,

especially the performance of investment development and economic expansion that could improve social ecology conditions throughout the country, and could maintain productivity and vital production systems such as food and other basic requirement. The level of restoration of their degradation will determine the achievement of Indonesian mitigation of the climate change, because of the Indonesian social ecology condition as set out above.

From a social angle, it is also expected that the integration of basic culture-social engineering to a new way of life has been carried out, particularly in the mitigation and adaptation sectors in forestry, agriculture and health that will most influence communities. The integration of social aspects into mitigation and adaptation of climate change is directed to integration of social/ population dynamics which are: quantity (growth, birth/mortality), quality (degree of health, productivity and cohesively) and mobility (distribution/ migration) with environment factor (the availability of resource/ level of damage and pollution)

MEDIUM-TERM ACTION: 2012-2025

The performance of short term National Action Plan implementation which will be concluded in 2012 with all its evaluation results will become one of the main inputs to programming and implementation of the medium-term action plan. During the period of this medium term implementation, the achievement of those mitigation targets from priority sectors along with the achievement of adaptation target throughout the welfare sectors, from the negative impact of climate change to the welfare supporting system and the sustainability of the natural services throughout Indonesia. In addition, the basic social culture appropriate to the long term anticipation of climate change must be developed. Specifically, it should achieve disaster risk reduction that can easily be measured, expressed in terms of public knowledge and awareness of the climate change risks, the availability of life supporting infrastructure and vital production systems, among others.

LONG-TERM ACTION: 2025-2050

A long term learning period for mitigation and adaptation of climate change, that covers one generation until 2050, should not only ensure the resilience and endurance of the Indonesian nation, but should also be able to improve in a sustainable way all the three socio-ecological requirements as discussed in the previous sections.

2.5 Specific Strategies in Key Policies Areas

The guiding principles of national development, especially those that should be achieved through the implementation of the NAP, should be executed and expressed in the key policies that have hampered the achievement of national socio-ecological improvement in the past. These aspects are as follow:

- A. Reforming the implementation protocol for the management of public affairs and adjustment of the function and role of public institutions in general.
- B. Reforming the fiscal, monetary, and budget policies to make these three aspects of policies as the main supporter to the climate change mitigation and adaptation, including its socio-ecological targets. In particularly, these policies should maximize the possibility of social-ecology cost from all production and consumption sectors.
- C. Reforming the investment policy and creating new investment actors which focus on social-ecology improvement along with climate change mitigation and adaptation, to push the economic expansion which is flexible and responsive to climate change.
- D. Vitalization of development policies and screening the technology to guarantee the achievement of climate change mitigation and adaptation targets along with the socio-ecological improvement throughout Indonesia.
- E. Regional implementation of management and utilization of public resources, including natural and man made resources, with consideration of population migration and changes as the result of climate change. Integration of development sectors should be based on spatial planning that is suitable to the demand for restoration of the environment and enrichment of natural resources.
- F. The two most important policy areas in mitigation and adaptation (energy sector and LULUCF) should follow the above development guidance which until now remains fragmented into five policy portfolios (agriculture, forestry, public works, land and spatial planning).
- G. Development of information that integrates all actions, purpose, targets and policies in all sectors.
- H. Stressing in development plans to restore the environment quality which is adjusted to triple track strategy (pro-poor, pro-growth, and pro-employment) and based on sustainable development.
- I. Social-culture transformation in addressing climate change, consistent with local characteristics and in accordance with local ecosystems.

- J. Implement development policy that limits natural resource exploitation and encourages the effort of natural & human resource enrichment.

2.6 Production and Public Services Sectors

The priority economic sectors in the implementation of the sustainable development strategy through the National Action Plan are as follows:

- a. Agriculture;
- b. Forestry;
- c. Water resource;
- d. Marine and Fisheries;
- e. Energy;
- f. Mining;
- g. Processing & Manufacture;
- h. Public works;
- i. Tourism.
- j. Population (quantity, quality, and mobility of distribution)

From both a mitigation and adaptation perspective, the NAP should be capable of pushing the integration and sharpening of the purpose, target and policy instrumentation of the following policies area:

- a. Health;
- b. Education;
- c. Labor/employment;
- d. Population;
- e. Regional and settlement management, spatial planning;
- f. Capacity Development on science and technology;
- g. Capacity development on disaster impact management.

The NAP is a dynamic policy instrument that will be evaluated, renewed and improved periodically in stages, and will require policy integration from mitigation and adaptation priority sectors for its implementation until the medium period (2025).

2.7 The NAP spatial scale and time limitation of and the coverage of the need for policy integration

There is not much time available for the implementation of sustainable development strategies through the implementation of the NAP. Therefore,

the NAP should be implemented with full commitment from the Government of Indonesia and all other stakeholders.

Mitigation along with adaptation action to climate change, particularly that which is related to land use, water and bio-energy resources, food agriculture and forestry will be sensitive to the spatial scale or the region. The optimization for these policies is often only effective at the scale of the authority boundary of the administrative area, such as river water catchments, segment of coastal area that is sensitive to the climate change or the agriculture area for the main food production in one island. The NAP requires the willingness of nearby local government or related policy sectors to cooperate, and if needed to renegotiate the existing authority boundaries.

CHAPTER III

NATIONAL ACTION PLAN TO ANTICIPATE CLIMATE CHANGE

As a response to the existing climate change, which is expected to continue in the future, this National Action Plan is focusing on mitigation and adaptation efforts. Basically, the mitigation is an effort to prevent the worsening of climate change, while adaptation is a technique to adjust the way of life and its means toward climate change.

To support the activities of climate change mitigation and adaptation, then it requires strong enforcement of law and regulation, good governance, socialization and intensive education.

3.1 MITIGATION

The purpose of mitigation is to reduce the emission rate of Green House Gas (GHG), so it is still on the level that could be tolerated. Carbon dioxide gas is the largest in the current global emission composition is. Although, Indonesia is not yet obligated to reduce its GHG emission, but because it is vulnerable to the climate change, then it is feel that it is necessary to conduct mitigation in energy sector and LULUCF. Along with data improvement, than it is possible to include other sectors in the mitigation effort.

To measure the effectiveness of the implementation of various mitigation activities in various sectors, the capacity development and institutional system in conducting green house gas inventory will receive special attention.

3.1.1 Energy Sector

In 2003, the composition of Indonesian energy consumption consist of oil, with 54.4% followed by natural gas with 26.5%, coal with 14.1%, hydropower plant with 3.4%, geothermal with 1.4% and other renewable sources with 0.2%. In this year, the CO₂ emission reaches 258.67 million tons. The energy crisis which is triggered by the increase of global oil price that passes the level of US\$ 70 per barrel in August 2005 in 2004 has force the Government of Indonesia to increase the fuel price in October 1st 2005. In the beginning of 2006, the government issued Presidential Regulation No.5/2006 concerning

national energy policies. In this regulation, it is expected that there will be an increase of new and renewable energy consumption percentage as well as energy conservation effort.

The mix energy composition expected to be achieved in 2005 as instructed by the presidential regulation is as follows: oil, 20%, coal, 33%, natural gas, 30%, bio fuel, 5%, geothermal, 5%, other new renewable energy sources, 5% and liquefied coal 2%. Figure 6 below show the effort to reduce CO₂ emission through various programs, namely diversification and conservation (in accordance with Presidential Regulation No.5,2006),construction of nuclear power plant, geothermal power plant (outside the target of Presidential Regulation No.5, 2006), and the implementation of Carbon Capture and Storage – CCS.

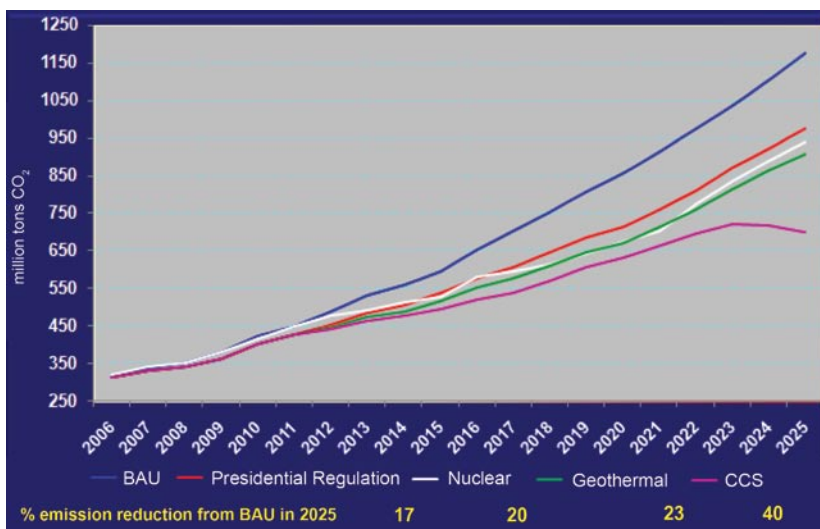


Figure 6. The effort to reduce CO₂ emission in energy sector through various programs, which are diversification and conservation (Presidential Instruction), nuclear and geothermal electric power plant and the implementation of CCS.

Without the effort to reduce emission, then it is estimated that CO₂ emission from energy sector in Indonesia could reach 1,200 million tons in 2025. With diversification of energy source (with the target for new and renewable energy is 17% from national energy composition) and conservation effort, then the target for CO₂ emission reduction is 17% from the business as usual (BAU)

scenario. If nuclear electric power plant (exceed the Presidential Instruction's target of 2%) could reach 11.5% then the CO₂ emission could be reduced further to 20%. Optimization of geothermal electric power plant to 8.4% of national energy could reduce further to 23%. While the implementation of *Carbon Capture and Storage* (CCS) technology on power plant sector will reduce 40% of the CO₂ the emission in 2025.

To support the mitigation effort in energy sector and to achieve the optimal energy mix as plan, then three main things have to be executed, as follows:

- Energy diversification;
- Energy conservation; and
- Implementation of clean technology (such as Carbon Capture and Storage – CCS).

Looking at the above statements, there are several problem solutions that should immediately be taken as policy in energy sector, among others are:

1. Energy Diversification

- a. Mapping the potential, research and development on new energy and renewable energy that appropriate with the Indonesian characteristic
- b. Giving incentive to the development and utilization of new energy and renewable energy.
- c. Encourage for more reasonable price (commodities, technology and fuel) by calculating and include the social costs and environmental costs (internalizing the external cost) in the production cost and/ or the selling price of that product and technology. For example, Nordhaus (2007) propose the amount of carbon tax is 30 USD per ton emission of CO₂.
- d. Increase the local role in renewable energy development.
- e. Encourage the economic growth based on low pollution energy growth by increasing the new energy and renewable energy utilization, with eradication of fossil fuel subsidy gradually in stages.
- f. Conduct decentralized energy system, among others through island space grid system where the generation system, transmission and distribution of electric power is not totally centralized, but it is arranged based on network per island with utilization of existing local grid system. The decentralized energy generation should use local new energy and renewable energy
- g. Build more infrastructures for low emission technology.

2. Energy Conservation
 - a. Dissemination of Information about energy conservation to the energy consumers.
 - b. Incentive and disincentive through financial mechanism
 - c. Regulation to implement energy conservation to all user sector and implement saving energy standard
 - d. Reduce energy intensity, among other with implementation of carbon labeling in production of industry.
 - e. Utilize science and technology to develop light weight, functional, efficient and have good quality products.
 - f. Formulate and implement energy saving building standards.

Implementation of the above programs, need a strong commitment, a real realization program with its legal infrastructure. For these reasons it needs the participation of developed countries to help developing countries in energy technology transfer along with its financial need. In this matter one of the ways is to make use the Clean Development Mechanism (CDM) program.

Considering the weakness-strength and the existing opportunities, then the achievement of energy technology development program should be based on geographic position, population growth, economic growth, pattern and standard of living and environmental along with other important aspects, that as a whole should be implemented in the form of long-term energy plan that be executed wisely. Beside that the factor of social readiness will decide the anticipation of energy consumers to address climate change. Community readiness to change the pattern of energy consumption should be conducted in every steps of energy policy. Household base as social analysis unit in the change national energy policy that anticipative to climate change should be consider as one strategic approach.

With the limitation of non renewable energy sources, then to fulfill future energy need, then it should implement an integrated and optimal energy mix and have to be in the direction to environmentally friendly energy base, compare to the non renewable energy resource base. Therefore, technology improvement and knowledge transfer in energy field become very important to be developed.

Considering the above explanation, then the mitigation work plan on energy sector should be as followed:

ENERGY CONSERVATION

Part of the main target of the implementation of national action plan for climate change is to reduce energy intensity through the efficiency improvement and clean technology implementation with optimal social ecology benefit from investment throughout all priority production system.

By issuing the Presidential Instruction No. 10, 2005 regarding Energy Saving and Ministry of Energy and Mineral Resources Regulation No. 0031, 2005 concerning the way to implement energy saving, then since 2006, it is easier to implement the energy conservation. The government of Yogyakarta has replaced street light with energy saving light bulb and install the electric meter for every ten street light bulb. This activity has impacted the electric cost significantly (up to 500 million IDR per year). This type of activity that has reduce the green house gas emission from the energy saving activity should be socialize to other local government by Ministry of Environment and could be proposed as CDM program.

Government, through Ministry of Environment will prepare the guidance for inventory and determine the target for green house gas emission reduction. This guidance will be used by provincial and city/district local government, so they could save the energy from various activities, such as household, office, hotel, street light and other activities. At present, the energy saving light bulb and other equipment related with the energy saving still expensive, so to compete with the light bulb without energy saving, it needs incentive and fiscal reduction in accordance with paragraph 6 of Presidential Regulation No. 5, 2006.

The importance of energy saving way of life should be campaigned continuously to all layers of community. Besides using various media and facilities, the energy saving education should also be entered in education activities, from the level play ground to the university.

The implementation of energy conservation and renewable energy also receive push from global energy price since 2005. Sectors that use the energy start to implement energy conservation and utilize renewable energy although they face several obstacles, as follows:

- Deficiency of information regarding conservation method and technology and the appropriate renewable energy.
- Capital problems.

- Limited incentive pattern that support the implementation.
- Externalities cost of the environmental impact is not yet included in the fossil fuel price, so the price of new energy and renewable energy is not yet competitive to the fossil fuel.

According to the National Energy Conservation Master Plan (RIKEN), there are still many opportunities to save energy. The opportunity to save energy in those various sectors is as follows:

Industrial sector	:	15 - 30%
Transportation sector	:	25%
Household and commercial building	:	10 – 30%

Energy conservation is the first thing that could be immediately implemented and with clear output that reducing the emission. Next effort is the utilization of new energy and renewable energy along with fuel switching (replace the energy sources with lower CO₂ emission). One of the obstacles for optimal energy conservation and new energy and renewable energy is the subsidized fossil fuel price.

Things that should be executed in short term for energy conservation are as follows:

- Dissemination of information regarding energy conservation from its technology to the change of life style throughout all user sectors.
- Standardization of energy saving equipment and applied incentive and disincentive to the energy saving equipment, including related fiscal mechanism.
- Applied related regulation for example for the energy audit and implementation of energy management in certain scale of industries and facilities.

If various energy saving programs is succeeded, then it is expected that Indonesia could save energy around 10 – 30%. Therefore, the demand side management, with the objective to increase the energy consumers awareness to conservation and energy efficiency should received priority in national energy management.



Sun is a main energy source

Photo Istimewa

Transportation

Reducing the GHG could be achieved through implementation of emission standard, inspection and maintenance, and environmentally sustainable transport. Development of environmental friendly mass transportation, such as electric train or bus using gas, is urgent to be developed in various regions to reduce the green house gas emission (either emitted by private cars or the increase of emission because of traffic jam because of the density of private and public cars). To reduce green house gas emission from transportation sector, the way of walking for short distance should be encourage. For example walking for 1 km could reduce the CO₂ emission about 222 gram compare to using car. For that reason, facilities for pedestrian should be constructed. More over, the facilities for bicycles and electric motor cycles should also be constructed complete with battery charging facilities in metropolitan cities. Incentive and fiscal policy should be given to encourage investor to make electric vehicles. Hybrid vehicle is also one of the solutions to reduce energy consumption.

Industry

Implementation of energy saving, clean technology and 5R principles (rethink, reduce, recycle, recovery, and reuse) in industrial sectors, that have potential to emit a large number of CO₂, such as cement industry, textile, pulp and paper, ceramic, cooking oil and sugar. Similar things should also be implemented in power plant sector. It needs to develop and implement technology to change

waste to energy in various industries that produce organic waste that could be change to electric, such as tapioca and palm oil industries. Beside that the consumption of energy should be directed to clean and renewable energy.

Similar principle should also be implemented to micro, small and medium scale business. This is because base on 2007 statistic there are 225 thousand micro, small and medium scale business' in Indonesia that as whole have potential to emit CO₂.

Power Plant

In power plant sector, the implementation of energy saving and environmentally friendly technology should be increased. To encourage this it needs various incentive in the buying process of energy saving/ environmentally friendly technology, for example by not applied import tax and encourage the exporter country not to applied export tax, so the transfer technology could be implemented. New and renewable energy sources should become the energy sources priority for the new electric power plant that will be constructed.

Household and Commercial

Japan estimates that by energy saving in household sector it could reduce the GHG emission by 1 kg CO₂ /person/day. If similar calculation is implemented for Indonesian condition, then the city population in Indonesia could reduce CO₂ emission as much as 13,29 million tons of CO₂ (about 4.4% of Indonesian CO₂ emission from energy sector in 2007). That emission reduction could be achieved if there is community willingness to participate in CO₂ emission reduction through executing the following: set the temperature at least 25°C, save the water consumption, buy environmental friendly product, reduce the hour of driving the car in one day, reduce using plastic bag for shopping by bringing shopping bag from home, and separate household waste to ease the next process.

Significant energy saving in household and commercial sector could also be achieved by using energy saving air condition (for example using the hydrocarbon refrigerant) and energy saving light bulb. For that, it needs incentive to use energy saving electric equipment.

In education sector, the energy related education needs to support the energy

saving program, such as in architecture and civil engineering department, the course of energy saving building should be teach to the students

ENERGY DIVERSIFICATION

The utilization of new and renewable energy is in accordance with Presidential Regulation No. 5, 2006, regarding the national Energy Policy not yet working as expected, because of the price is not competitive. Therefore, the incentive policy and fiscal dispensation should be applied as stated in the Presidential Regulation No. 5, 2006, paragraph 6 articles 2 and 3. According to the Presidential Regulation No. 5, 2006, the target of new and renewable energy utilization in 2025 is 17% of the national energy consumption. Furthermore, it is expected that the ratio of new and renewable energy to the total national energy consumption will reach 30% in 2050. The development of bio fuel should not be in conflict with food interest. Therefore, the development of bio fuel should use non food plant (such as castor oil plant) and directed to be planted in critical land.

Power Plant

Solar energy is a renewable energy that has large potential in Indonesia. According to Mulyo Widodo, one square meter of solar cell could produce 900 to 1000 watt, while according to Wilson Wenas, one square meter solar cell could produce 4500 watt-hour (Brian, 2006). Therefore, research and development of solar energy utilization is one of the urgent matters that should be conducted soon.

Indonesia has methane gas potential from the waste collection in the amount of 404 cubic meters per year from 70 big cities in Indonesia that could produce electricity 79 MW. At present, many investor of CDM project are interested to do these programs, however, it still prevented by the existence of regulation that require the auction process for investor in the field of waste management. Therefore, there should be a review of the implementation of Presidential Regulation No. 67, 2005, regarding the government cooperation toward government's CDP projects. Beside that to increase CDM project in Indonesia several aspects should be reviewed, namely: (i) administrative obstacle; (ii) formulation of good proposal; and (iii) funding issues.

Wind energy potential in Indonesia is around 9.29 GW (blue print of National

Energy, 2005) and the cost of investment is significantly low compare to bio mass energy of 1000 USD per kW. The region that have enough wind speed for wind energy installation are located in the south of Java, NTT, NTB and several location in the west of Papua. It is expected that wind energy power plant could be build in NTT in 2008 and in NTB in 2009.

The geothermal energy potential in Indonesia is 27 GW, while the install capacity now is only 817 MW. Since 1994 there is no geothermal development on new location, except the development on the same site. The utilization of geothermal should not in conflict with the interest of conservation areas. Therefore geothermal energy mapping should be overlay with the protected area. Geothermal energy development should be constructed outside the conservation area and/or use environmental friendly conservation technology that does not damage the conservation area.

The implementation of mix energy policy should consider each local potential, for example area that significantly have wind energy potential, than wind energy power plant should be given priority in those area. In 2025 Indonesian population that receive electric supply will reach 100% by prioritize the development of power plant that using new and renewable energy such as solar cell, wind energy, bio mass energy and bio energy

The utilization of environmentally friendly technology on fossil energy in power plant should be implemented, for example gasification and liquefied coal and the utilization of carbon capture storage technology that has been used in the developed countries. To encourage the implementation of these technologies, then government should give incentive and other facilitation.

Power plant companies that still using energy source that emits a large number of CO₂, should be directed to replace its fuel with natural gas. Beside low emission, the availability of natural gas in Indonesia is expected could stabilize the electric selling price to the consumers.

Various effort on energy saving and emission reduction above should be introduced into CDM program, so it could receive fund from carbon trading. It should be aim so the number of industry that receive fund from CDM mechanism is increase minimum 400% in 2009 from the baseline of 24 projects that have been agreed by DNA. In the utilization of gas flare, the adjustment of regulation should be conducted to use gas flare to electric energy so this field could contribute in reducing the GHG emission.

Household and Commercial

Waste produce by household and commercial building should be well managed, so it will minimize the release of green house gas to atmosphere. Waste management principle of waste to energy should be supported, because it is a form of new energy and renewable energy that could play a role in fulfilling energy need to the community. Domestic waste management should be based on 3 R (reduce, recycle and reuse) principles as well as small and medium scale business, which many of it still be managed as part household activities. Waste selection should be conducted in an integrated way, start from household, transportation and to the end management. Waste from household and commercial building should be well manages to minimize the release of green house gas to the atmosphere. For slum area, an incentive should be given to local community in order to have environmental friendly waste management.

Support for utilization of gas for household consumption should be increase, for example by constructing gas pipe to household and or making gas tank and its stove with the price that could be reached by community. Facilities should be given to ease the investor in the gas distribution business. Socialization of the change of application from kerosene stove to gas stove should be conducted systematically and extensively.

Transportation and Industry

The program for bio fuel supply for transportation sector should be maintain continuously and improved. The number of bio fuel filling station facility should be increased. Automotive industry should be encouraged to develop vehicle that compatible with bio fuel.

Support for utilization of gas fuel should be increased, for example by increasing the number of gas fuel filling station facility for vehicle. Beside that support for electric vehicle should be given in the form of availability of battery charging in various locations.

Industry

The application of new energy and renewable energy (such as bio fuel and the utilization of waste for energy) should continuously encourage in industry

sector, particularly in the field that all along emit green house gas in a large number. Shifting from fuel material with high emission to material fuel with lower CO₂ emission should be conducted by industry. Incentive is needed to implement clean technology and disincentive to unfriendly environment technology.

3.1.2 LULUCF Sector

Based on the Department of Forestry data, at the end of 1960 or at the beginning of 1970 the Indonesian forest area is 144 millions ha. For several decades, this forest area has decreased 23.45 millions ha, and become 120.55 millions ha (or about 60% of Indonesian land area) in 2005. From that area about 53.9 millions ha of them has been degraded in various level and spread at conservation forest (11.4 millions ha), protected forest (17.9 millions ha), and production forest (24.6 millions ha)

Forest area that has been converted to other purpose and 53.9 millions ha of degraded forest area are estimated to make less carbon absorption potential in the amount of 2.1 Gton CO₂e per year in 2005. While the available carbon stocks at present from the natural forest (conservation forest, protected forest and production forest) both the primary forest and the logged over area or degraded forest are in the amount of 115 Gton CO₂e in 2005

Forest vegetation coverage continuously decrease from time to time because of forest land conversion for other purpose (development of new district, agriculture, plantation, human settlement and regional infrastructure), forest clearance, over cutting, illegal logging and forest fire. Land conversion causing deforestation; while forest clearance and others cause the degradation of the forest (reduce the quality). The decrease of forest vegetation coverage gives contribution to low absorption and storage of green house gas. The complete data of the decrease of forest area from 144 millions ha, until today is not available, however the trend in 6 years start from 1999 to 2005 could be seen in Figure 7 below.

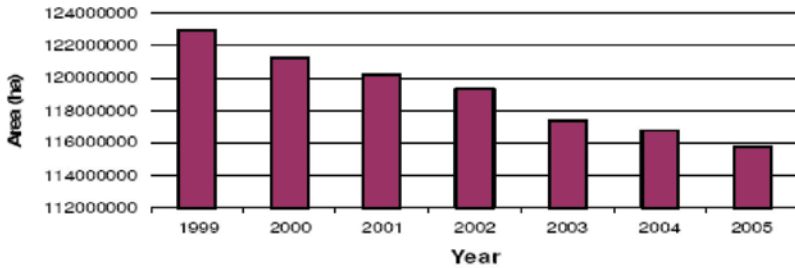


Figure 7 Forest area change in Indonesia in 1999- 2005

The above reduction of forest vegetation coverage area is occurs in 8 big islands, namely Sumatra, Kalimantan, Sulawesi, Maluku, Papua, Java, Bali and Nusa Tenggara . The change of forest vegetation in five islands could be seen in the following Figure 8.

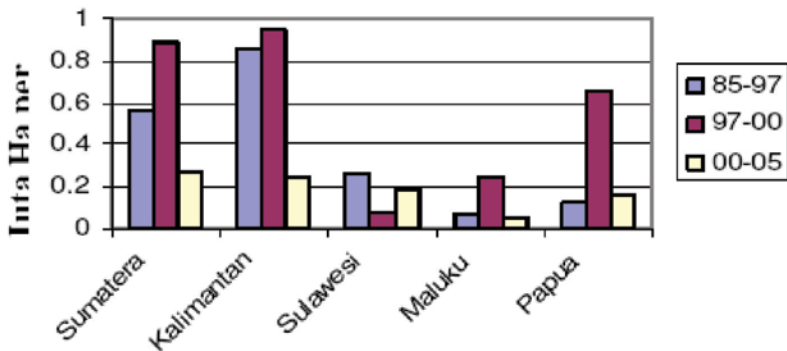


Figure 8. The rate of forest vegetation coverage area in three period years, 1985, 1997, 1997-2000 and 2000-2995 in five big islands in Indonesia

During the time period of 2005-2009 the mitigation effort in forestry sector is focusing on five priority policies, as follows:

1. Preventing illegal logging that will contribute to the reduction CO_2 concentration in atmosphere
2. Forest and land rehabilitation with conservation effort that will increase the carbon absorption capacity (sink enhancement) and maintain carbon conservation. Forest conservation is also contributes to resistance and adaptability to extreme climate related events.
3. Restructuring the forestry sector, particularly the industry and accelerate

the development of plantation forest (HTI and HTR) that will contribute to the increase of forest capacity in absorption of carbon.

4. Empowerment the community around the forest, that contribute to the improvement of the awareness toward the climate change issue and the capacity to adapt the climate related events.
5. Strengthen the forest area by clarifying the forest status and boundary with its institution, then the illegal activities could be reduced that at the end will contribute in the reduction of emission and conservation of carbon.

Besides that the mitigation effort in emission reduction is strengthened by the following policies:

1. Incentive and disincentive mechanism for local government in increasing the forest vegetation coverage, with monitoring and evaluation.
2. Tackling and preventing forest fire.
3. Sustainable peat land management

To support the mitigation effort in forestry sector, then there are three main subjects should be conducted, these are

A. EMISSION REDUCTION AND INCREASE THE CAPACITY TO ABSORB CARBON

Emission Reduction

In national scale, the emission reduction from deforestation and land degradation is executed through PHAL (such as combating illegal logging, preventing forest fire, implementation of environmentally logging practice), and strengthening the management of conservation area. In international scale it is conducted through formulation of Road Map dealing REDD in Indonesia with the implementation stage of study and preparation of COP-13, execution of pilot activities, testing, and lesson learn and the full implementation in the long-term.

In agriculture sector the utilization of environmental friendly organic fertilizer and pesticide refer to the Integrated Pest Management and utilization of efficient machinery should be encouraged continuously. Beside that, the high of water puddle should be reduced, other than could save water it is also reduce the bacteria activity that produces methane gas. The plant residue

should be put under the ground to add land organic material and reduce the methane gas production. Environmental friendly irrigation system should be developed, which is the irrigation system that do not use fossil fuel energy. Agriculture and agro industry waste could be processed to fertilizer to reduce green house gas emission. Related with fertilizer, the fertilizing efficiency and the utilization variety that responsive to nitrogen fertilizer should be implemented and application of variety that is responsive to nitrogen fertilizer. Beside that, food diversification also should be socialized.

In husbandry sector, bio gas technology from the use of husbandry waste as energy alternative should be implemented, all at once to reduce CH₄ emission.

Increase the Capacity to Absorb Carbon

According to Marakech accord (2001), the aforestation is a not forest land conversion into forest land trough planting activities (greening) with the native plant or introduce plant from outside in an area that 50 years ago is not forest area, while in reforestation the planting is conducted on damage forest area before 31 December 1989.

In national scale, the effort to increase the forest capacity to absorb carbon is conducted trough development of plantation forest (HTI/ Industrial Plantation Forest, HTR/People Plantation Forest, and HR/Public Forest), along with forest and critical land rehabilitation. While in international scope, in time frame of 2007-2009 should improved the regulation, procedure, and modalities of small scale A/R CDM (aforestation/reforestation Clean Development Mechanism).

According to department of forestry (2007) from the area of 53.9 millions ha of degraded forest, it is targeted to rehabilitate 36.31 millions ha until 2025, with three rehabilitation period as follows: in the period of 2007-2009 it is target to rehabilitate an area of 11.2 millions ha, in 2009-2012 an area of 16.71 millions ha, and 16.71 millions Ha in the period of 2012-2025. While the rest will be rehabilitate till 2050.

The effort to reduce deforestation and forest degradation to reduce emission is targeting an area of 23.63 millions ha in the period of 2007-2009, 6.15 millions in 2009-2012, along with 10 millions ha in the period 2012-2025. Beside this effort, the effort of combating illegal logging, forest fire prevention,

environmentally logging practice in an area of 23.12 millions ha will be conducted continuously in the period 2007 - 2025

To achieve the above target, it needs support from various scheme of national and international funding such as A/R CDM, REDD as well as other bilateral and multilateral scheme. Without international fund this target will be difficult to achieve.

Tree plantation activity by the community should be supported and facilitated, along with involvement of local government. Therefore it needs regulation to obligate the Indonesian citizen to plant one tree per year for each person. To cut a tree with diameter more than 10 cm it requires government permit and the cutter should plant two trees to replace the one tree that has been cut.

Indonesia could increase carbon absorption through development of forest plantation and sustainable forest management. Beside that it should prevent the occurrence of land and forest fire by implementing National Action Plan on Forest Fire Prevention and Sustainable Peat Land National Strategy with the target that compare to 2006 hot spot it will reduce 50 % of hot spot in 2009, 75% in 2012 and 95% in 2025.

In agriculture sector the effort to increase carbon absorption could be conducted by developing the agro forestry system to reduce CO₂ concentration in atmosphere. Beside that, land ex mining activity could be used as productive land so it could play a role in carbon absorption. Carbon absorption in plantation sector that cover coconut palm, rubber, and cacao plantation is estimated to reach 217 million of CO₂ in 2025.

B. IMPLEMENTATION OF INCENTIVE MECHANISM

Toward Green Indonesia (MIH) program should be continuously conducted as an effort to honor the districts that could maintain the vegetation in protected forest and increase the land coverage in their area. Incentive to the district should not limited to environmental allocation fund, but also an increase of fund to program of poverty alleviation, education and health, along with other infrastructure. By integrating various programs that give incentive to districts with good vegetation, then those areas will be encouraged to maintain the vegetation on protected area sustainable. Various incentive mechanism to

increase public participation in the effort to reduce the emission, increase the absorption and conservation of carbon will be developed continuously.

Management of peat land should be conducted in sustainable way with the utilization of known characteristic map. For that reason, spatial plan of peat land should be established thoroughly for each island, so the permit for plantation clearing and other activities could only be given by the head of district or the head of province or minister based on region spatial plan per island not per province. This is because peat land can not be separated by administrative approach.

The MIH program integrated with GERHAN program and other program that support the awarding of incentive should be continued and increased its implementation. Socialization along with education regarding planting and ecosystem introduction should be continued and expected to spread out. Planting program by community should be continued and try to put it into CDM program.

Preventive effort should be continued, because it is not easy to change the existing traditional farming pattern of slash and burn. Farming assistant, particularly on peat land should be given the information regarding this issue. The incentive system should be continued for farmers that clearing the land without burning.

In the time frame of 2009-2012, the incentive mechanism in management of forestry sector is expected has been implemented, particularly related with deforestation prevention. Arrangement of the incentive and disincentive mechanism of unused land that own by individuals, along with the withdrawal of business concession right on unused land in agriculture and forestry sectors.

C. SUPPORTING POLICIES

Spatial Planning as a Base for LULUCF Management

Spatial Plan based on the balance of ecosystem and environmental carrying capacity should be implemented correctly. Then there are no overlapping activity and pushing out the function of forest area. Consistency to agreed

spatial plan should be guarded and supervised by all stakeholders

Forest area map should be harmonized with regional development plan, agriculture land expansion plan with National Land Agency (BPN), along with consideration of protection area according to Government Regulation No 47/1977 regarding National Spatial Plan and Spatial Plan Act that regulate protected area and cultivation area. Act No.41/1999 concerning forestry, along with new administrative expansion, as well as the mining development and agriculture land expansion. Therefore, there is no regulation overlapping that will push the forest area for various interests.

Geo hydrologic mapping should be conducted, so it could be used for determination of environmental carrying capacity in spatial arrangement.

In 2009-2012 period it is expected that the implementation of the regulations concerning mining, agriculture and regional development have been harmonized based on spatial plan criteria. Beside for protection of fauna, flora and ecosystem, these also means to prevent environmental disaster, such as flood, land slide or other impact.

Law Enforcement

Law enforcement should be implemented fairly and without any special treatment to the permit issuer or permit requester on all activities that breakings the regional ecosystem spatial plan nor the formulation of local spatial plan that do not in accordance with the national spatial plan criteria. Law enforcement should be strictly implemented for cases that cause forest fore

Poverty Alleviation

Ecotourism should be developed in various region of Indonesia as one source for income and the effort to increase the income of the local community. An integrated environmental rehabilitation program that all in once also function as poverty alleviation should be conducted, for example with an approach of an integrated river watershed rehabilitation of water quality, coastal and marine and GERHAN program that was modified to increase community participation, MIH program, and incentive to increase local community income.

Program related with these activities is the implementation of family planning program so the population growth in Indonesia does not press the change of forest function area to become human settlement and other supporting facilities.

Education to all communities should be continued. Therefore, the communities will not only supported by natural resources, but they could develop their income through service activities and or more efficient natural resource management that will not disturb the balance of sustainable environmental function.

Research and Development, as well as Capacity Improvement

Cooperation with developed countries is needed to conduct research in LULUCF sector to produce lower GHG emission level and increase CO₂ absorption, as well as research cooperation and technology development on marine sector to increase the absorption of CO₂ in Indonesian seas.

Preparation and Social Engineering

In social perspective, climate change should be directed to the step for individual as well as community preparedness to address climate change. In individual level, behavioral change that conducive to mitigation and adaptation to environmental change could be conducted through various media (education, incentive/disincentive system, infrastructure engineering, etc.). In community level, integrative effort through community based approach should be implemented systematically. Therefore, National Action Plan addressing climate change is a strategic base to community development that pro environment and have preparedness to address the new era post the twentieth century.

Remembering that social preparedness need relatively long time, then in the period of 2007-2009, the expected region that will receive impact of climate change and its social implication should be already mapping. In term of social ecology, the vulnerable regions that have social implication are coastal area, water resource area, forest area and urban area. In demographic terms the populations that will receive direct or indirect impact reach 120 million people.

Policy that regulate ecology migration pattern should be prepared to anticipate the ecology change in the time period of 2009-2025. Population migration in the area that vulnerable to climate change should be anticipated by adjusting the population migration pattern and other policy such as spatial plan and regional development.

Population growth which is estimated will reach 315 million people will fill the space that vulnerable to climate change. In the view of social aspect population growth and climate change will influence the basic of social culture of the community. The change of social system from agriculture base to non agriculture base will become faster. Therefore, policy that considers the improvement of social quality that adjusted to environmental carrying capacity is needed.

Beside that, the prediction of migration pattern change from upstream areas to upstream become downstream to upstream should be anticipated. This change will increase if the prediction of climate pattern and the availability of water resource really happened. The increase of population in upstream area will not only change the social interaction pattern, but also the carrying capacity of the upstream area. Therefore strategic policy that give opportunity and option to develop non agriculture activity centre in the down stream area that is estimated will receive climate change impact is needed.

Empirically, various researches have found correlation between social/population dynamic and environmental factor in Indonesia closely related with:

1. The problems of water, air and land pollution;
2. The loss of biodiversity; and
3. Deforestation

To anticipate the increase of damage and pollution impact related with social/population dynamic, an assessment of social/population dynamic should be conducted based on the anticipation to climate change impact.

3.1.3 Marine and Fisheries Sector

The ocean has functioned as carbon sink. Each marine plant and biota has different capacity to absorb carbon. For the Indonesian seas the estimation of the amount of carbon (C) that could be converted to CO₂ equivalent that

could be absorbed is shown in table 2.

The total amount of pure carbon absorbed is 67 million ton per year or equivalent to 245.6 million ton CO₂ per year. These covers certain coral reef that could absorb 20 million ton carbons per year that equivalent with 73.5 million tons CO₂ per year and mangrove that absorb 20.6 million tons carbon each year that equivalent with 75.4 million ton carbons per year. While, carbons absorbed by phytoplankton at sea is about 40.4 million ton CO₂ per year. And from sea grass ecosystem is estimated about 15.3 million ton carbons or equivalent with 56.3 million ton CO₂ per year.

Climate change gives impact to coastal ecosystem, particularly related with:

- Sea level rise
- Change on surface temperature
- Change on the water acidity.
- Increase the frequency and intensity of extreme events such as tropical storm and high waves.

The continuation impact is the inundation of cultured fisheries area, loss of economic asset and infrastructure, increase erosion and damage to cultured site in coastal area along with coastal biodiversity and small islands.

No.	Ecosystem	Area (km ²)	Carbon Absorption (million ton C/year)	CO ₂ Absorption (million ton CO ₂ /year)
1.	Coral reef	61,000	20.0	73.5
2.	Mangrove	93,000	20.6	75.4
3.	Sea grass	30,000	15.3	56.3
4.	Open Sea	5,800,000	11.0	40.4
	Total		66.9	245.6

Table 2. Estimation of CO₂e total that has been absorbed by marine and coastal ecosystem in Indonesia

The loss suffered by coastal community and fisherman (both captured and cultured fisheries) is in the form of:

- The decrease of coastal and small islands environment quality because of coastal erosion, salt water intrusion, and pollution.
- The decrease of fisheries production because of the damage on mangrove and coral reef ecosystems as the result of the increase of sea surface temperature and the change of groundwater regime.
- Fisherman needs longer time and bigger coast to go to the sea because

- of fish migration as well as fisheries habitat and fishing ground damage.
- Damage to the cultured fisheries land because of inundation by sea water as well as flood as the result of sea level rise.
- Housing damage and the potential loss of life because of extreme events such as tropical storms and high waves

Today Indonesia has 400 thousands hectare of brackish water pond fisheries and various fisheries infrastructure. The impact of climate change to part of this land, for example inundation will disturb the fisheries production particularly shrimp which is the strategic export commodity. Beside that the impact of climate change will worsen the social economy condition of about 8,000 coastal villages with population about 16 million peoples.

Furthermore, the increase of erosion will threaten 12 of the 92 outer small islands that have function as reference point of the Republic of Indonesia territory. The loss of these islands, as well as the decrease of resources along with the community social economic condition will influence the national security and resilience.

Ministry of Marine Affairs and Fisheries Programs related with climate change and its impact to coastal and small islands is directed to increase the coastal and small islands capacity in absorbing carbon and the marine natural function to adapt to climate change.

The efforts to increase carbon emission capacity that could be conducted by marine sector covers:

- a. Mangrove and coastal vegetation planting with community involvement and at the same time to increase their income.
- b. Coral reef rehabilitation through transplantation and artificial coral reef.
- c. To expand the Marine Protection Area (MPA). In 2007, the extent of the MPA in Indonesia is 8.3 million hectares. The aim is to expand the MPA in Indonesia up to 10 million hectares and increasing it up to 20 million hectares in 2020.

Forest, agriculture land and marine management strategy is estimated to produce an increase on CO₂e net in 2025 as much as 947 million tons.

3.2 ADAPTATION

Indonesia which is situated on the equator is very vulnerable to the occurrence of climate change. Several environmental disasters related to climate changes such as floods, erosion, tropical storm and drought will threaten the availability of food, energy, water and the social security level of the community. Various studies (Schreider et al., 2007; Zhou, 2002; Barnett et al, 2006; Kitoh et al, 206) shows clearly that the coverage and intensity of climate changes on living space and livelihood that is most sensitive to the impact of climate change, including urban/settlement centers, agriculture area for food production, coastal zone and small islands, as well as geographical area of Indonesian archipelago based on model of climate change to the doubling of CO₂ concentration in atmosphere will have important change in air temperature, rainfall intensity and duration. The success in implementing adaptation agenda determine by the character of adaptation framework: is it belong to the group of "reactive adaptation" which is guided by the emerge of the latest changes in climatic variable or non climatic/social, or belong to the group of "anticipative adaptation" that is guided to the estimation of critical threshold of the two type of variables above that still could be supported by social ecology capacity along with local public institution, including the land/ space for mitigation purpose with adaptation demand in the other side.

The success of implementing an adaptation agenda is also determined by the character of the adaptation framework: is it classified into what is called an "adaptive reaction" which is guided by the appearance of more modern changes on a climatic or a non climatic/social, or "anticipative adaptation", which is based on a forecast of a critical limit from changes by the two variables mentioned above that can still be endured by a social ecological ability and local public institutions. It is important for all sides of adaptation to also consider the possibilities of encoring a competitive distortion while in use of public resources that includes space for mitigation to one side with a demand for adaptation.

National development with adaptation agenda toward climate change has purposed to create a resilience development system to the present climate variability and anticipate the future impact of climate change.

The climate change adaptation agenda will be focus on the area vulnerable to climate change, namely: water resource, agriculture, fisheries, coastal and marine, infrastructure and settlement, health and forestry. To achieve

development that resilient climate risk, then for each area focus should be know: 1) the objective of the climate change agenda that want to be achieved related with the achievement of Indonesian Millennium Development Goals; 2) existing condition in each focus area, in term of existing bio physic, program and initiatives as well as the responsible institution and the impact of climate change; 3) key changes needed for the existing program, investment or plan; and 4) additional or new investment and activity needed.

Four issues should be considered in each focus area, these are: 1) the effort to address poverty; 2) social and economic development; 3) investment; and 4) spatial planning

Based on the development goal, the adaptation agenda in the development strategy need to be arranged in three time periods, which are:

A. Immediate-Term

To build the capacity and the resilience toward present climate anomaly or climate variability, among others with:

1. Disaster Risk Reduction program related with climate through reforestation, aforestation, particularly in critical forest/land, in the upstream and downstream (coastal area) with community involvement;
2. Increase the awareness and dissemination of climate change information and adaptation information to various level of communities, particularly the vulnerable community as early preparedness and increasing the awareness regarding the increasing of climate disaster;
3. Improve the capacity of scientific study concerning climate change and its impact, as well as the effort to control it and develop climate change projection model of short, medium and long term period for local or regional scale, which is needed for evaluation of vulnerability and climate impact as well as formulation of adaptation plan and policy strategy to address short, medium and long term climate change.
4. Review the core policies that directly or indirectly will be influenced by climate change. Afterwards identify the adjustment needed to the program that was design according to that policies, with consideration to the direction of climate change and sea level rise as well as the change in social economic condition to obtain policies and programs that more resilient to climate change.
5. Increase the capacity to integrate the climate change by mainstreaming

climate change adaptation into the infrastructure planning and design, conflict management and ground water distribution for the water management institution;

6. Modification on standard criteria for design and planning as well as operating and maintenance water infrastructure and facilities (drinking water, irrigation, industry and others) and related infrastructure (drainage, flood control, etc.) for adaptation to the impact of climate change.
7. Mainstreaming the climate change adaptation into various sector's policy and program (with focus on disaster management, water resource, agriculture, health and industry);
8. Development of climate change issue into senior high school and universities curriculum;
9. Development weather, climate and hydrology monitoring, particularly outside Java and increase Meteorological and Geophysical Agency capacity for more accurate weather and climate forecasting throughout Indonesia.

B. Long and Medium Term

Development of resilient and perceptive infrastructure system and spatial plan as well as sectors to the climate disturbance and climate change and re-arrange the regional spatial plan, especially in coastal areas.

ACTION PLAN

3.2.1 Water Resource Sector

In water resource sector, the objective of climate change adaptation agenda is to support the Indonesian water vision, namely "actualization of stable water utilization in efficient, effective and sustainable manners for the prosperity of the whole people"

At present the clean water demand at Java, Bali and East Nusa Tenggara has surpassed the water supply. This is because of high population, industrialization and urbanization growth along with low clean water supply in several locations as well as the excessive utilization. Remembering the more critical the condition of water resource in Indonesia, at the Global Water Day XII in 2004 the Government of Indonesia has decreed the water resource

management through signing “National Declaration on Effective Water Management in addressing Disaster” by eleven ministries under coordination of Coordinator Ministry of People Welfare. Following this declaration the President announce National Partnership Movement to save Water (GN-KPA) on 28 April 2005 in essence cover 6 strategic component, namely: (1) Spatial Planning, physical development, land and population; (2) forest and land rehabilitation along with water conservation; (3) Control of damaging by water ; (4) management of water quality and water pollution control; (5) consumption saving and management of water demand; and (6) utilization of water resource in a fair, efficient and sustainable way.

With climate change, drought event will become worse, groundwater become less along with sea level rise will trigger salt water intrusion that will pollute water resource quality for clean water and irrigation need. The above strategic action directly and indirectly related with climate change adaptation. To strengthened the existing program and initiative to become resilient to climate change, than the action that should be implemented among other are:

- Conduct inventory of raw water intake locations for drinking water in river and irrigation area that will be impacted by sea level rise and identify the effort to address it;
- Rehabilitation of hydrological network in each river region as detector the change of the availability of water supply as well as water resource and water management;
- Conduct inventory on river watershed that has experienced pollution, but at the same time have high water utilization in Java in order to decide the priority in addressing it;
- Implement reservoir and pond development program in Java, Sumatra, Sulawesi, Maluku, Bali, NTB and NTT as being programmed in RKP 2008. Those water collectors could be used as water storage facility during rainy season and the water could be used during dry season.
- Continue water saving movement for all necessity, such as for drinking water, domestic, agriculture, industry, power plant and others;
- Increase the river watershed carrying capacity by preventing the damage and rehabilitating water catchments area in various water absorption area through land conservation, by mechanic (for example terracing and absorption well) and vegetation methods;
- Develop technology of trench dam constructed along the river stream to increase the volume capacity of the river, reduce the flow speed and absorb the water to the ground (recharging). This technology is consider

effective because technically could collect a relatively large volume of water and watering a relatively large area because it could be constructed in a cascade series;

- Remembering that during rainy seasons, the flood is occurred, and drought during dry seasons, and water quality is polluted, than in phases restoration effort on river flow is needed with also considering the river water quality in an integrated way between the districts, provinces and other related institution. This also has to be connected to coastal development, for example the Ciliwung stream tills the Jakarta bay. For this case the Presidential Regulation has been issued concerning the environmental restoration of Ciliwung river catchments area to the Jakarta bay;
- Institutionalized the utilization of weather and climate forecasting information effectively for operating and management of reservoir/dam in order to reduce more effectively the risk of flood and drought
- Modified the operation and maintenance of reservoir and its supporting structures to adjust with the increase and decrease of rainfall intensity because of climate change.
- Conduct geo-hydrological research to know the ground water basin, so it could be developed and maintain water pond, lakes and construct water absorption as well as water collection in the building and in the ground. Supervision on the duty of the building owner to construct water absorption and water collection facilities should be conducted;
- The need to develop technology that could utilize salt water for drinking water. Also, the effort of water recycling should be implemented;
- The need to plan and implement the national sustainable strategy on peat land;
- Inventory of peat land according to its characteristics and formulate the peat land spatial plan according to those characteristics;
- Conduct rehabilitation to water management in the peat land area on the open channel by constructing the close-opened channel method to maintain a stable groundwater level.

3.2.2 Agriculture Sector

In the agriculture sector, the objective of climate change adaptation agenda is to support the Indonesian vision in agriculture sector, namely "actualization of competitive sustainable industrial agriculture system that could ensure the food security and farmer welfare". National development agenda have

prioritized “agriculture revitalization” agenda as one of priority in 2005-2009 economic development. This agriculture development program is formulated into three main programs, namely: 1) program to increase food security; 2) program to develop agro business; and 3) program to increase farmer welfare.

The impact of extreme climate which influenced by climate change have caused harvest failure, especially during drought and flood events. In the period of 1981-1990, harvest failure has reached 100,000 ton per district, while in the period of 1991-2000, has increased to 300,000 per district (Boer and Las 2003). Of course this will influence the achievement to the target of agriculture development in Indonesia. With the increase of the threat from climate change, several action plan should be implemented to strengthen the resilient of agriculture sector to climate change, these are:

- a. Data and information management
 - Increase the utilization of drought prone area map as initial information in monitoring drought.
 - Develop spatial and temporal early detection system for drought by utilizing the automatic climate station and telecommunication facility.
 - Institutionalized the utilization of climate information including weather and climate forecasting to increase the effectiveness management of farming business system, institution of farming business and partnership to support the agro business activity.

- b. Management of Farming Activity
 - Conducting water saving in farming activity by reducing the high of water puddle in rice field.
 - Put the plant residue inside the ground as additional land organic to increase land fertility.
 - Implement planting acceleration with appropriate technology among others minimum land processing (TOT) or direct seed spreading (TABELA).
 - Develop System Rice Intensification (SRI) and Integrated Plant Management (TPT) in the effort to save water in farming business.
 - Socialize saving water technology trough irrigation system: sprinkle irrigation, trickle irrigation, intermittent irrigation, etc.
 - Develop water saving technology by intensification of wet land during El Nino and dry land during La Nina.

- Implement good agricultural practices (GAP) to revitalize farming system with orientation of conservation to the function of environment
- c. Management of irrigation infrastructure
- Conduct rehabilitation and improvement of irrigation network with objective to increase cropping intensity and efficiency of water use (as being programmed in RKP 208). Restoration and improvement irrigation network could also extent the area of food crop with consideration of water availability and the willingness of the land owner to convert the land for food crop land.
 - Construction of irrigation channel (for fish pond and tidal rice field) should be adjusted to the regional development or regional spatial planning, including the prediction of sea level rise.
 - Increase the utilization of the potential of alternative water resource, either water surface or groundwater with water pump technology to increase plant intensity (IP).
 - Pump mobilization trough participative movement for area that still have available water resource.
 - Optimize alternating system in irrigation water distribution.
 - Design the harmonization of irrigation network system with infrastructure.
- d. Institutional Management
- Formation of working group on climate change and anomaly in Agriculture department and facilitate the institutional process of local utilization on climate information.
 - Formation of commanding post to control flood and drought disaster in Department of Agriculture.
 - Empower the P3A institution so it could conduct efficient water management in the effort to anticipate the impact of climate change.
 - Strengthened the institution of the water consumer farmer.
 - Empower farmer group in regulating the planting schedule and determine the beginning of planting season.
- e. Research
- Conduct climate change impact analysis toward the season shifting to decide the beginning of planting season.
 - Cooperation between, Agency for Assessment and Application of

Technology (BPPT), Indonesian Institute of Science, Universities and Department of Agriculture to conduct research on superior seed that resilience to climate change and have high productivity for constant land area. Therefore, there are no need to change the function of vegetation coverage's or forest area into agriculture land,

- Develop livestock that adaptive to weather and climate.
- Re-identification and rearrangement of areas that are prone to flood and drought.
- Consortium research program "government policy and strategy to address climate change in agriculture sector"

f. Socialization and Advocacy

- Advocacy and socialization to establish the right understanding to climate change and its impact on agriculture sector as well as the government policy in mitigation and adaptation.
- Socialization, appreciation and implementation of Planting Calendar Map to adjust the food crop planting pattern with climate condition and blue print anticipation of drought and flood to the community, particularly to farmer.
- Socialization of the regulation and Act that related with environmental conservation (as stated in Act No.23/1997 concerning environment, Act No. 18/2004 concerning plantation, Agriculture Ministerial regulation No 26/2997 concerning guidance for permit plantation business, etc.) to prevent deforestation and forest and agriculture land degradation. Socialization particularly for local government officials so it will be wiser in deciding location permit for agriculture land clearing in forest area, and region that is allocated for non agriculture used.
- Formation of information system to prevent the loss because of forest/land fire, among other with formation of working group team to prevent forest and land fire as well as to disseminate the information regarding hot spot (from or received by Website of National Space and Aviation Institute, Department of Forestry, State ministry of Environment and related institution) to the head of district agency as well as to planters/farmers.
- Development of agriculture information system and networking various levels and regions, including development of Agriculture Field School (SLP), as a replacement of Climate Field school (SLPHT and SLI)

g. Others

- Develop food diversification policy. The area where its population eat sago, corn or rice as its staple food, need to implement agriculture intensification to their main staple food.
- There is need for planning water supply for agriculture activities. During dry season, Java will experience drought therefore the restoration of watershed condition should be increase and in integrated way, with the related sector and local government. Indicator of the effort to restore the water catchments area will be based on achievement that the river water parameters are above the standard
- Formation of detail planning concerning the agriculture development policies with consideration on ecosystem in order that sustainable agriculture could be implemented. This has to be discussed together by Department of Agriculture, Department of Forestry, Nation Land Administration, State Ministry of Environment, Department of Public works, interior Ministry and National Development Planning Agency. Then the agriculture development could be executed in an integrated approach;
- Develop the program to improve the farmer's income and the effort to market the agriculture product. This could be done by giving easier access to market price information, easy access for credit application, and the availability of transportation access;
- Advocacy and socialization of climate change and the forecast impact
- Reevaluate/forecast land shrinkage because of the impact.
- Arrangement of production system particularly the food production in the context of food security.

3.2.3 Marine, Coastal and Fisheries Sector

In fisheries sector, the objective of the climate change adaptation agenda is to support the achievement of the vision of fisheries management in Indonesia, namely "Sustainable and Responsible Management of Marine and Fisheries Resource for Unity and Welfare of the Indonesian Citizen". This vision will be achieved by: 1) Improve the welfare of fisherman community, fish cultured farmer, and other coastal community; 2) Increase the role of marine and fisheries sector as a source for economic growth; 3) Maintain and increase the carrying capacity as well as the environment quality of fresh water, coastal, small islands and seas; 4) Increase the nation intelligent and health through

the increase of fish consumption; and 5) Increase the role of Indonesian seas as a nation unifier and increase the marine culture of Indonesia.

About 140 million or 60% of the total population lives inside the radius of 50 km from the shoreline and spread in 42 cities and 182 districts. About 48 million or about 23% of the population lives below the poverty line. The increase of only one meter will submerge 405,000 ha of coastal area and sink about 2,000 low lying island as well as the coastal reef area. Climate change is also change the sea temperature; change the current pattern, wind and rainfall pattern. Warmer sea water could prevent plankton breeding and reduce the availability of food for fish. Several fish species possibly will migrate to other area where the temperature condition and food is better. This certainly will have an impact to the achievement of development target in fisheries sector.

Climate change agenda is expected to be capable in deciding the save area for human settlement. Several action plans should be implemented to develop the resilient in this sector. These are

- Conduct inventory to all structures (building) in the coastal area to anticipate the impact to sea level rise and high tidal wave that could impact those building and planning the effort to rearrange the coastal area which have high risk to the impact of sea level rise. If needed, the reconstruction of building on the coastal area is conducted by considering the sea level rise and the occurrence of high waves. Take a notice to the average sea level rise in Indonesia is 0,8 mm/year and an area of 100-130 m times the highest wave is a protected area;
- Planting the mangrove or other coastal plants in the coastal area. This is conducted by involving the coastal community or fisherman. For example at Batang Pekalongan district, mangrove planting activity has been conducted by fisherman (including the supply of seeds, planting and maintaining). In those area at the same time small crabs has been spread so the fisherman will take cares the mangrove as well as the crab. After the mangrove well growth, the number of fish also increases so the fisherman does not need to sail far offshore.
- Implementing related integrated coastal management (ICM) with restoration of river water catchments area with the objective to increase the community's income. In planning and implementation of this ICM, the local government related with the coastal and river water catchments area should be involved.
- There should be guidance and awareness to the fisherman and coastal community in general about early warning system on the event of climate

change and the utilization of weather information for marine activities.

- Fishing ship that resilient to weather change and high wave as well as environmentally friendly equipment for capture fisheries has to be developed.
- The need to conduct research concerning the impact of climate change to the cultured fisheries. It is estimated that the climate change will reduce 20-30% of the fish species. In the other side there is need to develop fish species that resilient and adaptive to climate change.
- Fishermen housing should be constructed with consideration on the increase of sea level to its design (include sanitation and clean water system). The early warning system and evacuation place should be build also to prepare for sea water level increase and the occurrence of high wave.
- National research to study the potential and to increase the CO₂ absorption from marine sector by plankton, coral reef and sea weed etc.
- Formulation of a disaster strategic mitigation plan (related to extreme events such as tropical storms and high waves/ wave climate)
- The use of mapping and more accurate data and information of vulnerable and risks at coastal areas and small islands to exposure of climate change.

3.2.4 Infrastructure Sector

Infrastructure is an integral part of national development. Infrastructure is the rolling wheel of economic growth. Activity in transportation sector is the backbone of the distribution pattern for goods and passengers. Other infrastructure such as electricity and telecommunication related with the effort to modernize the nation and its availability constitutes as one of the important aspect to increase the productivity in the production sector. The availability of facilities for housing and human settlement, among others is drinking water and sanitation equally and extensive as well as sustainable water resource determines the level of welfare of the society.

Climate change require infrastructure that resilient to the extreme climate. The adaptation factor of the climate change should be entered into the planning process to develop infrastructure. Information on climate change such as temperature rise, the change of the process of evaporation, humidity and water content should be integrated into design, code and physical infrastructure standard.

Action plan for Infrastructure sector among others are:

- There is a need to modify the standard criteria for planning, implementation and operating as well as maintaining the infrastructure because of the increase of rainfall during rainy season and lower rainfall during dry season, such as the change in drainage module, standard irrigation water distribution and operational pattern of the reservoir.
- To anticipate high rainfall intensity, then the road construction should be accompanied by construction of the drainage system and well absorption or water collection under the road.
- There is a need to construct sidewalk and bike road as well as plantation shading trees along the road to persuade the community to use un-motorized vehicles or walking.
- Building design should consider the ability to cope with the tropical storm, high rainfall intensity and drought.
- Construct the community housing with vertical (stack) housing system particularly in the urban area in Java and to address the limited availability of land
- Road construction should consider spatial plan and prediction on sea level rise. The construction of this access road should be discussed with the department of transportation (which is responsible for port and train), together with the department of forestry and the department of marine affairs and fisheries

3.2.5 Health Sector

With the health development vision of "Healthy Indonesia 2010," it is expected that in 2010 the Indonesian community have reached the health level which is indicated by population that: 1) live in a healthy environment; 2) practice clean and healthy behavior; 3) capable to supply and use a quality health service; and 4) have a high health degree. To achieve healthy Indonesia in 2010, there are six health development programs, namely: 1) the program of healthy environment, healthy behavior and empower the community; 2) the program for health improvement; 3) program to improve the community nutrient; 4) the program for health resource; 5) the program for medicine, food and dangerous materials; and 6) the program for policy and management for health development.

With the increase of health risk to the human health because of climate change such as, spreading of malaria, dengue fever, diarrhea, cholera and

other vector disease, then it is important to integrate the consideration of climate change into the health development in Indonesia. The action plan in health sector, among others is:

- There is a need to conduct health guidance to all communities particularly for the preventive effort to improve the sanitation environment. Then, various diseases because of the impact of climate change such as malaria, dengue, and other tropical disease that spreading by wind could be anticipated.
- Conducting research to identify various diseases that could be born because of the impact of climate change. Also, there is a need to conduct research that could produce medicine that use material from domestic sources (utilize biodiversity) so the medicine for the diseases because of climate change could be ready earlier.
- Strengthened disease surveillance and health protection.
- Strengthened the readiness of health system.
- Increase the control on the vector that spread the disease.
- Improve communication, information and education to increase the community awareness.
- Develop early warning system and conduct an effective response to the disaster and extra ordinary events.

3.2.6 Forestry and Biodiversity Sector

As has been formulated in the Strategy and Action Plan of Indonesia Biodiversity, the vision for Indonesian biodiversity is “actualization of the Indonesian community that care, capable, independent and smart in conserving and utilizing the biodiversity in an optimal, fair and sustainable way trough responsible management to increase the community welfare”. The biodiversity action plan for 2003-2020 could be divided into five main themes, namely: (1) development of community and individual capacity to manage the biodiversity; (2) development of resource, technology and local wisdom; (3) increase the conservation and rehabilitation of biodiversity; (4) increase the institution capacity and policy instrument; and (5) increase the capacity to solve the conflict. In each theme, programs are proposed along with the success indicator and the institution in charge for the implementation. These all become measures to address biodiversity crisis and restore its role as the asset of the nation.

Climate change will greatly influence the existing ecosystem that directly impact to the sustainable of biodiversity. This of course will become a

challenge to Indonesia to achieve its biodiversity vision. The adaptation agenda on climate change is expected could reduce the pressure to ecosystem, such as pollution and excessive utilization of the resource, that could damage the system and extinct the species. Forestry and biodiversity action plan include:

- Forest regulate the micro climate and give nature service such as water to the community and the downstream user, location of various bio resource, and give the forest product as wood and non timber such as resin, rattan, honey and medicine material that could be used as means of livelihood for the community surrounding the forest. Climate change could give serious impact to its nature service as well forest damage (such as forest fire) if forest in not well manage. Protection to the forest ecosystem plays an important role in the continuity of the richness of forest product and the service of nature.
- Indonesia is a country with very high biodiversity. Climate change could give serious impact to these biodiversity. Therefore, there is a need to make inventory of the Indonesia biodiversity. Therefore, a genetic bank for plant species of Indonesia should be established. Then those the bio-richness could be maintain for the nation benefit.

3.2.7 Cross Sector

- Increase the institutional capacity to supply the climate and weather data and information (such as the Geophysical and Meteorological Agency) and the technology to predict accurate climate/weather
- Supply the information map on area prone to disaster and prepare the early warning system along with its standard operational procedure that regulates the response of the community and the officials if there is climate disaster because of climate change.

3.3 Institutional Capacity Improvement and Action to Develop and Implement Mitigation and Adaptation Programs

A long term problem for Indonesia that has to be resolved is the need of a basic plan or a long term sustainable development management regulation and a guarantee to rehabilitate the ecologic social condition. The mitigation and climate change adaptation agenda itself has to become an integrated part of the basic regulation, not a temporary or partial program without a connection

to the government sectors and other services. Basically, as a parallel action to the mitigation and immediate adaptation efforts, Indonesia has to actually invest to harmonize the key development management sectors. Included in this are the public finance, industry and other vital production divisions, and social service sectors which will need reinforcing with the anticipation of various impacts and the susceptibility due to climate change.

3.3.1 Harmonization and Revision of Regulation and Policy Framework for Sustainable Development Management

Mitigation and adaptation framework could not be treated as two separate independent branches. In economic sectors that are sensitive to the impact of climate change such as agriculture, vital services as well as energy industry, quality and sustainability of mitigation action will depend on the adaptation preparedness in the central and local government. Screening of new technology that is responsive to climate change and its impact should also become guidance to development process and technology transfer for mitigation and adaptation. The long term strategy to this large scale process should rely on public monetary model that has been harmonized with the demand for the rehabilitation to the social ecology damage along with the preparation of community adaptation capability to address the vulnerability and impact of climate change. Fiscal and monetary revision to ease public sectors managers, particularly in the local government to act on the emergency situation will be needed. The participation of all economic actors in adaptive development model should be monitored and guaranteed with the readiness of policy instrument institution and readiness for implementation in all levels of government officials.

To anticipate the mitigation and adaptation management regime after the end of the first commitment of Kyoto Protocol in 2012, the implementation of National Action Plan in the next three years (2008-2011) should also be an action to increase capacity to maintain the compatibility of model and information and data system that is used by key government with the model that is used by global accountants by the parties of Convention and Protocol.

The performance quality of the National Action Plan is also determined by the consistency of management system concerning the problems that will be addressed through mitigation and adaptation, that require the readiness of the institution as follows:

- a. Integration of knowledge system concerning the coverage of mitigation and adaptation from key government branch.
- b. The integration of social accounting model that is used to measure changes that related with climatic and non climatic variable to improve and revise the forecasting and observation model for social-economic and monetary changes that is used by knowledge system concerning the coverage of mitigation and adaptation agenda from key government branch.
- c. The existence of clearing-house mechanism in determining and measuring various climatic and non climatic variables in the objective, target and implementation performance program from each responsible formal institution. The clearing-house mechanism will be effective only if it connected to coordination capacity of the economic compartment of monetary and industry sector with social welfare sector with the appropriate economic instrument.
- d. The existence of fiscal and funding mechanism for an integrated mitigation and adaptation action in the structure and cycle of public budget.
- e. The possibility for full and creative participation particularly in the level of community in the cycle of adaptation and mitigation through social and institutional practices that has been implemented. Only with participation model with full community involvement the learning process through NAP will produce adaptation readiness to address the risk from the impact and vulnerability because of climate change as well as sufficient mitigation level.

Activities that at the same time support the mitigation and adaptation effort in addressing the climate change are as follows:

- Formation the regulation that form and support the culture of environmental friendly, clean and law enforcement.
- Implementation of reprimand and penalty for local government that ignore national regulation regarding environmental conservation (including land conversion).
- Introduce education on sustainable environment and natural resource to the national curriculum.
- Appeal to foreign companies that have invested in Indonesia to avoid polluting Indonesia.
- Monitor the emission produce by energy consumption and LULUCF.
- Development of institution to the formation of green house gas inventory at local and national level.
- Monitor temperature change, sea level rise, coastal erosion, high waves

and other extreme condition.

- Strengthened the existing monitoring capacity of National Institute of Aeronautics and Space and Geophysical and Meteorological Agency.
- Transfer clean technology including low carbon technology and adaptation technology suitable with condition and Indonesia's climate characteristics

Remembering that at present time the forestry sector and energy sector (fossil fuel) is still the main income for foreign currency and at the same time is a main green gas house emission; therefore, the activities of those two sectors should consider the environmental impact that they create. In energy sector, the consumption of renewable energy should received priority, while in forestry sector utilization of forest and forest product should not damage the forest area; for example by developing community economy to tourism industry (ecotourism).

3.3.2 Technology

Efforts in mitigation and adaptation in conjunction to face climate change requires the use of technology. Considering the Indonesian condition is very vulnerable to climate change, and as what need to be done by developing country, Indonesia should form a list of detail necessity on environment sound technology from each related sectors.

Transfer of technology from developed countries to developing countries is important to significantly leverage the capacity and effectiveness of efforts to deal with climate change. The main criteria for priorities in technology transfer are:

- a. Conformity with national regulation and policy
 - Food Security
 - Natural Resource Security
 - Energy Security
 - Incentives for Participation
- b. Institutional and human development
 - Capacity Building (production and know-how)
- c. Technology Effectiveness
 - Reliability of technology
 - Easiness of wider use of technology, including local contribution

- support of technology application
- d. Environmental Effectiveness
 - Greenhouse gas (GHG) reduction
 - Improvement of local environmental quality
- e. Economic Efficiency and Cost Effectiveness
 - Capital and operational costs relative to alternatives
 - Commercial availability (market)

The formation of complete TNA explain the need for investment to conduct technology transfer based on sector approach that potentially could reduce the CO₂ emission from each sectors. The TNA refers to the main criteria for priorities as described above.

Reduction of GHG in the energy sector needs an energy saving and low emission technology in the power plant sector, industry, transportation and in household and commercial use. Controlling of forest fires requires monitoring technology that is real time and conclusive fire extinguishing technology. Reduction of GHG from the agriculture sector is also in need of agriculture technology (seeds, fertilization and irrigation) which in a whole perspective produces GHG emission on a lower level.

To increase the preparedness of various parties in addressing the condition of extreme climate, it needs weather prediction technology that could produce accurate result. With this technology, fisherman and farmer could have better planning for their activity; so they could reduce the loss that probably they will suffer because of the extreme climate/weather (drought, storm etc.). Beside that, early warning technology also should be implemented to avoid the general public to the negative impact related with extreme climate. Furthermore, for adaptation need in agriculture sector, technology to develop plant variety that resilient to climate change impact is needed. Agriculture technology that saves water also should be implemented to anticipate water scarce during long dry season.

Other Priorities, focusing on mitigation

- Energy sector (power electric sector: clean coal technology % hybrid system, nuclear energy, bio-energy, other new renewable energy: solar energy, wind energy, wave energy;; energy saving technology for building and industry).
- Transportation sector (hybrid vehicle, fuel replacement, development of fast and mass transportation)

- Industry and Manufacture sector: i) energy intensive (cement, pulp and paper, ceramic, fertilizer, palm oil, sugar, textile and steel); (ii) Agro industry (tapioca, coconut palm).
- Agriculture and husbandry sectors: Biomass reactor, peatland management
- Forestry sector: sink enhancement, forest plantation
- Gas and solid waste (utilization of gas flare, urban waste management, waste).
- Marine sector (as a new issue to calculate the absorption capacity of CO₂ from marine sector, so it could show there is balance between emission and absorption in various sectors in Indonesia)

Carbon capture and storage (CCS) technology through the geological storage can be considered as a mitigation technology in a large scale for use on a power plant, oil and gas sector and the industrial sector.

Other priorities, focusing on adaptation

- Agriculture sector (agriculture intensification) and fisheries (breeding technology).
- Meteorology and Geophysical sector (weather prediction technology, modeling technique).
- Infrastructure sector (clean water supply technology, rainfall water reservation).
- Energy conservation sector (replacement of chiller, boiler and furnace).
- Health sector (research and development to prevent tropical disease, identification the type of disease because of PI and the medication effort with phytopharmacy).
- Effects of climate changes on a regional and local sector and the development of adaptation technology to anticipate variables and climate change and the rise of sea level.
- In the government and community fields with a purpose to increase adaptation skills/capacity and to preserve local knowledge.

3.3.3 Funding

Strategic consideration in the issue of funding cover two side, namely (a) scoping or determine the frame coverage of adaptation agenda with all the study and estimation of the demand, and (b) initiate main idea for funding resource development from three type of resources, which are: establish

funding from public finance sector through new mechanism and creation of fiscal instrument dedicated specially for adaptation, as well as indirectly that strengthened positive social impact from mitigation and adaptation measures.

- a. Indonesia is a developing country with a financial ability which is limited by two things; one of them is the small amount of national product and the huge amount of public spending which is allocated for fulfilling the debt responsibilities. Although this happens, these dual limitations is not supposed to limit form what Indonesia can do to formulate the amount of demand of comprehensive adaptation needs and long term insights. Since 1999 the effort to model a social-ecological impact from climate change has pushed development " integrated assessment framework", which considers the connection between climate change impact with social-economic dynamic changes and the needs of public sector interventions to help the citizens adapt to fulfill changes of living pre requirements on the local level. Fathoming a social disaster impact model which has been developed by many international research bodies for example ECLAC and PAHO in the Latin American region or UNHCR and WHO on the climate change context wishes to increase its sensitivity appraisal reach by seeing "impact sectors" by analytical approach, as a climate impact response function. (Petschel-Held et al., 1999; Bruckner et al., 2003; Toth et al., 2003).

Model for adaptation funding management, include the development and technology transfer for adaptation and mitigation of climate change should be harmonized with comprehensive assessment, not adjusted to fresh funding available that could be access by Indonesia. With the specific geographic and population of Indonesia, it is vital for the actor main politic and economic change in Indonesia to approach climate change adaptation issue not as a minor activity but as guidance for cross sector public service. In its implementation, the sensitive economic sector to climate change should consider this response function. Infrastructure management of settlement, transportation, and food agriculture industry for example should consider the link of water, energy and food supply that will be disturbed, by the change in climatic variable as well as by social/non climatic variable such as level of income or the availability of source of income.

- b. In the limitation of funding capacity through national budget, Indonesia should try various schemes of funding, either from domestic sources as well as from abroad to support the effort of climate change mitigation and adaptation. Several funding mechanisms should be immediately tried, as follows:

A. Fiscal Instrument

Several funding schemes could be obtained from fiscal instruments are:

- Emission tax that covers carbon tax and environmental tax.
- Utilization tax that covers tax on natural resources and land.
- Tax exemption to develop saving energy and low emission technology transfer

B. Financial Instrument

Funding schemes through financial instruments cover:

- Under Kyoto Protocol: Adaptation Fund.
- Under United Nations Convention for Climate Change: Special Climate Change Fund (SCCF), Least Developed Country Fund (LDCF), and Global Environmental Fund (GEF)
- Other funding resources: Trust Fund, Bilateral Fund and Multilateral Fund.

C. Market Instrument

Funding schemes through market instruments cover:

- International payment for environmental services
- No compliance fee
- Performance bond
- Certificate trading system: Clean Development Mechanism (CDM) and Carbon Trade
- Various insurance and reinsurance models for the existence of services by nature, or the continuity of the flow of goods and services with the impact of climate change.

D. Non Conventional funding sources/instruments (could be a combination of new fiscal mechanisms, new financial instruments, as well as market establishment)

- Debt for adaptation/mitigation swap
- Bilateral adaptation/mitigation fund, as a compensation of delaying the transfer of technology in one main branch of industry that involves

two countries transaction. For example, the delay of introduction low/free carbon technology for automotive sector from Japanese automotive industry in Indonesia, because of the surplus margin of the main players in this industry.

- Funding for technology development or cross/compensatory industry. For example the establishment of fresh adaptation fund for settlement and food crop agriculture along with industry that develop water pump without engine, in which the economic cost and ecology saving compensate by technology development fund from its various consumers.

To effectively use the national budget that has been allocated to address environmental problem, then harmonization and integration of inter departmental/institution program related with environmental issue should be made, particularly related with climate change. As briefly discuss above the harmonization and integration will not achieve optimal result without a thorough new framework that cover development management planning along with national financial management so it could sufficiently support this grant effort.

CHAPTER IV

INTERNATIONAL COOPERATION IN ANTICIPATION OF CLIMATE CHANGE

Indonesia has geographical and geological characteristics that mean that it is highly vulnerable to climate change as discussed in Chapter 1. In accordance with the Climate Change Convention Article 4: 8, 9 and 10, such countries should receive financial support, insurance, and transfer of technology in order to prepare for the negative impacts of climate change. In addition, Indonesia also is a country with medium income within the low income group, so it also needs international support to help mitigate climate change.

Based on the conditions above, and having regard to the principle of common but differentiated responsibility, Indonesia will play an active role in the effort to control the impact of global climate change according to its role as Non Annex I country and will persuade the developed countries to lead the effort to reduce GHG emissions. International support will play an important role for the achievement to the target of this National Action Plan.

The Proposal for International Cooperation

Indonesia's need for technology transfer and other support to reduce the GHG emission as well as adaptation to climate change includes:

Mitigation

- Energy intensive industrial sector (cement, pulp and paper, ceramic, fertilizer, cooking oil, sugar, textile and iron and steel);
- Environmental management and environmental audit for industrial processes and industrial equipment (replacement of chiller, boiler and furnace);
- Agro-industry sector (tapioca and coconut palm process);
- Waste utilization sector (agriculture, husbandry and urban waste);
- Power plant (clean coal technology, new renewable energy, solar energy, wind energy, wave energy and carbon capture and storage-CCS);
- Transportation sector (fuel switching, low emission vehicle technology and energy saving transport technology);
- Oil and gas sector (carbon capture and storage – CCS - and gas flaring);

- LULUCF sector (technology to control forest fire, technology for to sustainable use of peat land, integrated tree planting programs and poverty alleviation through the Toward Indonesia Green (MIH) program).

Adaptation

- Development of technology and institutional systems that can use climate information (including forecasting) in an effective way to manage the present and future climate risk;
- Agriculture sector (agricultural intensification, spray and drip irrigation technology to save water) and fisheries (breeding technology);
- Water resources sector include among other: (i) rainfall and flood early warning systems;(ii) reservoir management based on weather forecasting; (iii) drought management based on satellite imagery; (iv) increased capacity in the field of hydro climatology; and (v) increased capacity in the efficiency of water consumption;
- Industry sector (energy saving, water saving technology);
- Weather prediction and climate modeling technology;
- Energy conservation sector (replacement of chiller, boiler and furnace)
- Health sector (R&D to prevent tropical disease, better identification of the health impacts of climate change, and improved use of phytopharmacy);
- LULUCF sector (recovery and reconstruction technology along with peat land, mangrove and coral reef monitoring.

Capacity Improvement

In order to prepare for the impact of climate change, efforts are needed to improve the capacity of central and local government, legislative bodies, and private and community sectors. These could be conducted through climate change training and education programs for the above stakeholders.

Positive Incentives to Maintain the Sustainable Forest (REDD)

Acceleration of the rehabilitation of degraded land in an area of 53.9 million ha requires international cooperation through afforestation and reforestation programs. Based on the evaluation of 120 million ha of forest area by the MIH program, there are several districts in Papua and west Papua, Aceh, North Sumatra, Bengkulu, Southeast Sulawesi, Central Kalimantan, East Kalimantan, and West Kalimantan which still function effectively as carbon stores and sinks. Therefore positive incentives are required to prevent degradation in those forests. Such an incentive should be calculated based on carbon stocks

and the opportunity costs of not opening that forest to be used for welfare improvement and economic growth.

Based on the study "Funding for the Conservation Area in Indonesia" the allocated budget available from all sources to implement the Heart of Borneo declaration is 53.37 million USD, while the optimal budget requirement is 135.51 million USD. Further support from bilateral and multilateral cooperation is required to cover this budget deficit of 81.94 million USD.

CHAPTER V IMPLEMENTATION OF ACTION

5.1 MITIGATION 5.1.1 LULUCF SECTOR

		Time Frames					
No	Activities	2007-2009	2009-2012	2012-2025	2025-2050	Responsible Institutions	
I. Forestry							
A	<p>Reduce Emission and increase carbon absorption capacities</p> <p>1. Reduce emission</p> <p>2. Increase carbon absorption capacity</p>	<p>Development of Plantation Forest:</p> <ul style="list-style-type: none"> - Industrial Plantation Forest (HTR) 1,06.5 million ha (106.5 CO2/year); - Social Plantation Forest (HTR) 3,6 million ha (105.5 million tons CO2/year) - Social Forest (HR) 2,0 million ha (637 million ton CO2/year) 	<p>Development of Plantation Forest:</p> <ul style="list-style-type: none"> - Industrial Plantation Forest (HTR) 2,0 million ha (210.9 million tons CO2/year) - Social Plantation Forest (HTR) 5,4 million ha (158.2 million tons CO2/year) - Social Forest (HR) 4 million ha (117.2 million tons CO2/year) 	<p>Development of Plantation Forest :</p> <ul style="list-style-type: none"> - Industrial Plantation Forest (HTR) 9,31 million ha (272.8 million tons CO2/year) - Social Plantation Forest (HTR) 9 million ha (263.7 million tons CO2/year) - Social Forest (HR) 8 million ha (234.4 million ton CO2/year) 	<p>Development of Plantation Forest:</p> <ul style="list-style-type: none"> - Industrial Plantation Forest (HTR) 11,62 million ha (340.5 million tons CO2/year) - Social Plantation Forest (HTR) 12,98 million ha (380.3 million tons CO2/year) - Social Forest (HR) 8 million ha (234.4 million tons CO2/yr) 	<p>Dept. of Forestry and Local Government</p>	<p>Dept. of Forestry and Local Government</p>
		<p>Forest and Land Rehabilitation:</p> <ul style="list-style-type: none"> - Protected Forest 0.5 million Ha - Conservation Forest 1.5 million ha 	<p>Forest and Land Rehabilitation:</p> <ul style="list-style-type: none"> - Protected Forest 1 million ha - Conservation Forest 2 million ha 	<p>Forest and Land Rehabilitation:</p> <ul style="list-style-type: none"> - Protected Forest 5 million ha - Conservation Forest 5 million ha 	<p>Forest and Land Rehabilitation:</p> <ul style="list-style-type: none"> - Protected Forest 179 million Ha - Conservation Forest 11.4 million ha 	<p>Dept. of Forestry, Ministry of Environment and Local Government</p>	<p>Dept. of Forestry, Ministry of Environment and Local Government</p>
		<p>Management of protected forest:</p> <p>13,39 million ha (19,643.1 million tons CO2/year)</p>	<p>Management of protected forest:</p> <p>14,39 million ha (21,110.1 million tons CO2/year)</p>	<p>Management of protected forest:</p> <p>19,39 million ha (28,445.1 million tons CO2/year)</p>	<p>Management of protected forest:</p> <p>31,29 million ha (45,902.4 million tons CO2/year)</p>	<p>Dept. of Forestry, Ministry of Environment and Local Government</p>	<p>Dept. of Forestry, Ministry of Environment and Local Government</p>

5.1.1 LULUCF SECTOR continue

No	Activities	Time Frames					
		2007-2009	2009-2012	2012-2025	2025-2050	Responsible Institutions	Responsible Institutions
		<p>Management of conservation forest: 10.24 million ha (15,022.1 million tons CO₂/h)</p> <p>Improvement on international regulations, procedures and guidelines of Small Scale A/R CDM</p>	<p>Management of conservation forest: 15.39 million ha (22,572.1 million tons CO₂/h)</p>	<p>Management of conservation forest: 20.39 million ha (29,912.1 million tons CO₂/h)</p>	<p>Management of conservation forest: 21.66 million ha (31,775.2 million tons CO₂/h)</p>	Dept. of Forestry and Local Government	Dept. of Forestry and Local Government
		<p>Proposal toward moratorium on expansion plan of Forest Concession Right</p>					
		<p>Prevention of forest fire in high risk spot</p> <ul style="list-style-type: none"> - 50 % of fire spot can be reduced compare to 2006 - PHAP: 23.12 million ha (3.39 million tons CO₂/h) <p>Preventive effort to change the slash and burn agriculture practices program by giving fire seeds and fertilizer to farmers</p>	<p>Forest and Land fire prevention program</p> <ul style="list-style-type: none"> - 25 % of fire spot can be reduced compare to 2006 - PHAP: 23.12 million ha (3.39 million tons CO₂/h) <p>Arrangement on community obligation to plant trees</p>	<p>Forest and Land fire prevention program</p> <ul style="list-style-type: none"> - 95 % of fire spot can be reduced compare to 2006 - PHAP: 23.12 million ha (3.39 million tons CO₂/h) <p>Continue the implementation of communities tree planting policy</p>	<p>Dept. of Forestry, Ministry of Environment and Local Government</p>	<p>Dept. of Forestry, Ministry of Environment and Local Government</p>	
		<p>Mapping the peat land former one million hectare project with satellite picture SPO14</p> <p>Stock taking GRK emission from the agriculture section.</p>	<p>A thorough peat land spatial plan management for each island</p>	<p>Continue the implementation of sustainable peat land management</p>	<p>Evaluation and monitoring the sustainable peat land management</p>	<p>Dept. of Agriculture, Ministry of Environment and Dept. of Forestry</p>	<p>Dept. of Agriculture, Ministry of Environment and Dept. of Forestry</p>

5.1.1 LULUCF SECTOR continue

		Time Frames					
No	Activities	2007-2009	2009-2012	2012-2025	2025-2050	Responsible Institutions	Responsible Institutions
B	Implementation of Incentive Mechanism	Development of Incentive Mechanism for REDD	Continue the implementation on incentive mechanism (for title land and concession of forest sectors)	Evaluate and monitoring the mechanism for REDD	Evaluate and Monitoring on the implementation of pilot project on quality improve program for REDD	Dept. of Forestry, Dept. of Finance and National Planning Development Agency	Dept. of Forestry, Dept. of Finance, National Planning Development Agency and National Coordination Body for Survey and Mapping
		Continue the MIH program integrated with GERHAN and other programs that support the incentive mechanism.	Continue and also evaluate MIH program integrated with GERHAN and other programs that support the incentive mechanism.	Continue and monitoring the mechanism for the implementation of spatial plan regulation.	Improve the program quality of integrated MIH, GERHAN and other programs	Ministry of Environment, Dept. of Forestry, National Planning Development Agency	Ministry of Environment, Dept. of Forestry, National Planning Development Agency
C	Supporting Policies	Spatial plan harmonize and/or review related spatial plan with the effort of mitigation in each sector.	Determine spatial plan that support mitigation and adaptation effort.	Evaluate and monitoring of spatial plan regulation.	Supervise the implementation of spatial plan regulation	National Planning Development Agency, Dept. of Public Works, National Land Agency and National Coordination Body for Survey and Mapping	National Planning Development Agency and Dept. of Public Works National Land Agency and National Coordination Body for Survey and Mapping
		Priority allocation incentive scheme for community around the forest area (ex. ecotourism).	Implementation of incentive scheme around forest area (through MIH, GERHAN, Ecotourism and other programs).	Evaluate and Contribution of the pilot project on welfare improvement of the community around forest area (through MIH, GERHAN, Ecotourism and other programs)	Evaluate and Contribution of the pilot project on welfare improvement of the community around forest area (through MIH, GERHAN, Ecotourism and other programs)	National Planning Development Agency, Dept. of Forestry, Ministry of Environment, Dept. of Forestry and Dept. Of Agriculture	National Planning Development Agency, Dept. of Forestry, Ministry of Environment, Dept. Of Forestry and Dept. Of Agriculture
		Law Enforcement: Forest fire prevention Illegal logging prevention	Forest fire prevention Illegal logging prevention	Forest fire prevention Illegal logging prevention Program evaluation	Forest fire prevention Illegal logging prevention	Police, Dept. of Forestry, Ministry of Environment and Local Government	Police, Dept. of Forestry, Ministry of Environment and Local Government

5.1.2 MARINE SECTOR

		Time Frames							
No	Activities	2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
1	To increase carbon absorption	Mangrove and coastal vegetation planting	Ministry of Marine Affairs and Fisheries, State Ministry of Environment	Mangrove and coastal vegetation planting	Dept. of Forestry and Local Government	Mangrove and coastal vegetation planting	Dept. of Forestry and Local Government	Mangrove and coastal vegetation planting	Dept. of Forestry and Local Government
		Coral reef rehabilitation through transplantation and artificial reefs	Ministry of Marine Affairs and Fisheries, State Ministry of Environment	Coral reef rehabilitation through transplantation and artificial reefs	Dept. of Forestry, Ministry of Environment and Local Government	Coral reef rehabilitation through transplantation and artificial reefs	Dept. of Forestry, Ministry of Environment and Local Government	Coral reef rehabilitation through transplantation and artificial reefs	Dept. of Forestry, Ministry of Environment and Local Government
		To extend the Marine Protected Area (MPA) up to 9.5 million hectare	Ministry of Marine Affairs and Fisheries, State Ministry of Environment	To extend the Marine Protected Area (MPA) up to 12 million hectare	Dept. of Forestry, Ministry of Environment and Local Government	To extend the Marine Protected Area (MPA) up to 25 million hectare	Dept. of Forestry, Ministry of Environment and Local Government		

5.1.3 ENERGY SECTOR

		Time Frames							
No	Activities	2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
A	Power Plant	1. Inventory of GHG and its reduction potential 2. fiscal dispersion for low GHG emission technology 3. Overlay mapping of geothermal energy and protected area 4. Planning the Implementation of CCS technology.	Ministry of Environment, Dept. of Energy and Mineral Resources, Dept. of Finance, Local Government	1. Follow up of the inventory and application of low GHG emission technology 2. Construct Power and Renewable Energy sources according to local characteristics 3. Develop CCS technology infrastructure	Ministry of Environment, Dept. of Energy and Mineral Resources, Dept. of Finance, Local Government	1. Continue activities from previous period 2. Overlay CCS technology 3. Target of emission reduction, 30% of BAU (by using CCS technology).	Ministry of Environment, Dept. of Energy and Mineral Resources, Dept. of Finance, Local Government	1. Continue activities from previous period of emission reduction, 50% of BAU	Ministry of Environment, Dept. of Energy and Mineral Resources, Dept. of Finance, Local Government

5.1.3 ENERGY SECTOR continue

Time Frames									
No	Activities	2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
		5. Planning for Development of Power Plant with fresh and Renewable Energy sources according to local characteristics. 6. Application of low emission energy sources (ex.: natural gas).		4. Continue replacing energy source with low emission energy sources (ex.: natural gas).					
B	Transportation	1. Inventory of GHG emission potential 2. Applies Incentive and fiscal dispensation for low GHG emission technology. 3. Application of New and Renewable Energy Sources 4. Develop the supporting facilities for the application of bio fuel. 5. Development of infrastructure for bikers and pedestrian 6. Planning mass transportation system with low GHG emission. 7. Development of transportation facilities with low GHG emission.	Ministry of Transportation, Dept. of Energy and Mineral Resources, Ministry of Environment, Ministry of Finance, Dept. of Public Works, Local Government	1. Continue application of low GHG emission technology. 2. Build mass transportation system with low GHG emission in big cities. 3. Develop electric and hybrid 4. Develop vehicles compatible with bio fuel	Ministry of Transportation, Dept. of Energy and Mineral Resources, Ministry of Environment, Ministry of Finance, Dept. of Public Works, Local Government	1. Continue activities in previous period 2. Operate mass transportation system in big and metropolitan cities 3. Target of Emission Reduction, 30% of BAU	Ministry of Transportation, Dept. of Energy and Mineral Resources, Ministry of Environment, Ministry of Finance, Dept. of Public Works, Local Government	1. Continue activities in previous period 2. Target of Emission Reduction, 50% of BAU	Ministry of Transportation, Dept. of Energy and Mineral Resources, Ministry of Environment, Ministry of Finance, Dept. of Public Works, Local Government

5.1.3 ENERGY SECTOR continue

		Time Frames							
No	Activities	2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
C	Industry	<ol style="list-style-type: none"> Inventory of GHG and its reduction potential. Implement energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. Implement clean energy audit and energy management. 	<p>Dept. of Industry, Ministry of Environment, Dept. of Energy and Mineral Resources and Dept. of Finance</p>	<ol style="list-style-type: none"> Follow up inventory and implementation of energy saving technology. Double the number of CDM projects from previous period. Efficient use for industry sector, so in 2010 could reach 9,2 million meter cubic. Increase the application of new and renewable energy in industry sector. Increase the application of waste to energy in industry sector. 	<p>Dept. of Industry, Ministry of Environment, Dept. of Energy and Mineral Resources and Dept. of Finance</p>	<ol style="list-style-type: none"> Continue activities from previous period Energy consumption has been reduced 22% of the BAU Double the number of CDM projects from previous period GHG emission reduction of 113 million ton CO₂e has been achieved. Target 30% GHG emission reduction of the BAU 	<p>Dept. of Industry, Ministry of Environment, Dept. of Energy and Mineral Resources and Dept. of Finance</p>	<ol style="list-style-type: none"> Continue activities from previous period. Double the number of CDM projects from previous period Target of emission reduction, 30% of BAU 	<p>Dept. of Industry, Ministry of Environment, Dept. of Energy and Mineral Resources and Dept. of Finance</p>

5.1.3 ENERGY SECTOR continue

Time Frames									
No	Activities	2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
C	Industry	10. Pollution Prevention and control through the implementation of prevention and control management system.							
D	Domestic (household) and Commercial	<ol style="list-style-type: none"> 1. Inventory of GHG and its reduction potential 2. Applies Incentives (fiscal dispensation for efficient and low GHG emission technology) 3. Utilize energy efficient air conditioning and light bulb. 4. Increase the application of gas energy in the residential sector (including for small and medium scale business). 5. Build gas pipe distribution facilities to for household consumption. 6. Integrated waste management from sources to the existing dumping facilities 7. Implement technology to use waste as energy sources 	<p>Ministry of Industry, Dept. of Energy and Mineral Resources, Ministry of Finance, State Ministry of Economic Devt. of Public Works and Local Government</p>	<ol style="list-style-type: none"> 1. Follow up inventory and implementation of energy saving technology (small and medium scale business). 2. 75% of government buildings have used energy saving air conditioning and light bulb. 3. Increase the utilization of gas energy in household sector. 4. 70% of population has access to electricity particularly from renewable energy sources 5. Target for 13 million ton of CO2 emission reduction by urban population 	<p>Ministry of Industry, Dept. of Energy and Mineral Resources, Ministry of Finance, State Ministry of Economic Devt. of Public Works and Local Government</p>	<ol style="list-style-type: none"> 1. All government buildings have used energy saving air conditioning and light bulb. 2. Waste to energy technology has been operated in big cities. 3. 100% of the population have access to electricity, particularly from renewable energy sources 4. Further emission reduction, 30% of BAU 	<p>Ministry of Industry, Dept. of Energy and Mineral Resources, Ministry of Finance, State Ministry of Economic Devt. of Public Works and Local Government</p>	<ol style="list-style-type: none"> 1. Target of emission reduction, 50% of BAU 	<p>Ministry of Industry, Dept. of Energy and Mineral Resources, Ministry of Finance, State Ministry of Economic Devt. of Public Works and Local Government</p>

5.1.3 ENERGY SECTOR

		Time Frames							
No	Activities	2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
D	Domestic (household) and Commercial	8. Encourage the implementation of 3 R principle (including for small and medium scale business)							
E	Others	<ol style="list-style-type: none"> 1. Energy saving campaign 2. Introduce energy saving topics in education curriculum. 3. Review the implementation of Presidential Regulation No. 67/2009 for CDM projects. 4. Implementa- tion of energy saving program in Central and local government(ex. Using energy saving light bulb for street lights) 	<p>Dept. of Energy and Mineral Resources, Ministry of Environment, National Development Planning Agency, Dept. of Communication and Information, Ministry of Finance, Dept. of National Education and Local Government.</p>	<ol style="list-style-type: none"> 1. Continue activities from previous period 2. Internalize the external costs (such as environmental impact) into the price of fossil fuel. 3. Increase the utilization of new energy to 10% of total energy consumption 4. Realization of the CDM Program.(ex. Adipura, Proper) 	<p>Dept. of Energy and Mineral Resources, Ministry of Environment, National Development Planning Agency, Dept. of Communication and Information, Ministry of Finance, Dept. of National Education and Local Government.</p>	<ol style="list-style-type: none"> 1. Continue activities from previous period 2. Increase the application of new energy sources to 17% of the total national energy consumption 3. Continue the CDM Program. 	<p>Dept. of Energy and Mineral Resources, Ministry of Environment, National Development Planning Agency, Dept. of Communication and Information, Ministry of Finance, Dept. of National Education and Local Government.</p>	<ol style="list-style-type: none"> 1. Continue activities from previous period 2. Increase the application of new energy sources to 50% of the total national energy consumption 	<p>Dept. of Energy and Mineral Resources, Ministry of Environment, National Development Planning Agency, Dept. of Communication and Information, Ministry of Finance, Dept. of National Education and Local Government.</p>

5.2 ADAPTATION

		Time Frames					
No	Activities	2007-2009	2009-2012	2012-2025	2025-2050	Responsible Institutions	
1	Water Resource	<ol style="list-style-type: none"> 1. Inventory of raw water intake 2. Rehabilitation of hydrology 3. Restoration of natural reservoir and river watershed area in stages. 4. Conducting in pond development programs of pond and reservoirs. 5. Water saving movement. 6. Inventory of peat land area 	<ol style="list-style-type: none"> 1. Restoration of river watershed area in stages. 2. Change in land use and maintenance of reservoir and its supporting structures to adjust to climate change. 3. Conduct geo hydrology research in order to know groundwater basins. 4. Water saving movement 5. Monitoring the watershed area land cover 	<ol style="list-style-type: none"> 1. Develop trench dam technology. 2. Develop technology like sand filter to become drinkable water 3. Rehabilitate water management in peat land area. 4. Restoration of river watershed area in stages. 5. Water saving movement 	<ol style="list-style-type: none"> 1. Conducting in pond development programs of pond and reservoirs. 2. Restoration of river watershed area in stages. 3. Water saving movement 	<p>State Ministry of Environment, Department of Public Works, Department of KKNMT and Local Government.</p>	
2	Agriculture	<ol style="list-style-type: none"> 1. Increase the utilization of drought prone map. 2. Conduct water conservation agriculture activities. 3. Implement good agriculture practices. 4. Implement the acceleration planting with appropriate technology. 5. Rehabilitate and create irrigation network 6. Optimize alternate system in water irrigation distribution. 	<ol style="list-style-type: none"> 1. Develop drought early warning system. 2. Increase the utilization of alternative water resource potential. 3. Empowered the PJA institution. 4. Strengthened the institution of water use farmer farmer group 5. Empower the planting schedule and decide the beginning of planting season. 6. Develop food diversification policy. 	<ol style="list-style-type: none"> 1. Conduct climate anomaly impact analysis toward seasonal shift to timing of planting season 2. Conduct research on superior seeds that resistance to climate change. 3. Development of adaptive track husbandry. 4. Research program on superior seed strategy and policy to address climate change in agriculture sector. 	<ol style="list-style-type: none"> 1. Improve various existing step and strategy based on evaluation to various strategies, efforts and technology that have been implemented in previous period. 2. Develop various innovative technology, particularly for superior adaptive variation management for land and water that have been produced in previous period. 	<p>Dept. of Marine Affairs and Fisheries, State Ministry of Environment, Dept. of Public Works and Local Government.</p>	
			<p>State Ministry of Environment, Department of Public Works, KKNMT and Local Government.</p>	<p>State Ministry of Environment, Department of Public Works, KKNMT and Local Government.</p>	<p>State Ministry of Environment, Department of Public Works, KKNMT and Local Government.</p>	<p>Dept. of Agriculture, KKNMT, State Ministry of Environment, Dept. of Public Works, Local Government.</p>	

5.2 ADAPTATION continue

No	Activities	Time Frames							
		2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	2025-2050	Responsible Institutions
		<p>7. Form working group on climate anomaly and climate change in Department of Agriculture.</p> <p>8. Form commanding post to control various projects in Department of Agriculture.</p> <p>9. Advocate and socialize the right understanding of climate change and its impact to the agriculture sector as well as government policy in mitigation and adaptation effort.</p>	<p>7. Develop agriculture climate information system and network in various level and region including the development of Agriculture extension a development of SLPHI and SLI (Climate Field School)</p>	<p>1. Implement Integrated Coastal Management.</p> <p>2. Develop fisheries facilities that resilient to climate change and high sea level rise.</p> <p>3. Research on the influence of climate change to cultured fisheries.</p> <p>4. Conduct national research on the potency and to increase the absorption of CO2 gas from marine sector.</p> <p>5. Install breakwaters.</p>	<p>Dept. of Marine Affairs and Fisheries; State Ministry of Environment, Dept. of Public Works and Local Government.</p>	<p>5. Formulate detail planning regarding agriculture development policy.</p> <p>6. Development program to increase farmer income.</p>	<p>Dept. of Marine Affairs and Fisheries; State Ministry of Environment, Dept. of Public Works and Local Government.</p>	<p>3. Continue the food diversification policy that has been evaluated.</p> <p>4. Increase the minimum income of farmer equivalent to average income in other provinces through various implementation of innovative technology and institution and development of various commercial commodities.</p>	
3	Marine, Coastal and Fisheries	<p>1. Inventory of all buildings in the coastal areas</p> <p>2. Mangrove planting and other coastal plant throughout the areas</p> <p>3. Guidance and introduction to fisherman and coastal community the general knowledge of early warning system.</p> <p>4. Install breakwaters.</p>	<p>Dept. of Marine Affairs and Fisheries; State Ministry of Environment, Dept. of Public Works and Local Government.</p>	<p>1. Implement Integrated Coastal Management.</p> <p>2. Develop fisheries facilities that resilient to climate change and high sea level rise.</p> <p>3. Research on the influence of climate change to cultured fisheries.</p> <p>4. Conduct national research on the potency and to increase the absorption of CO2 gas from marine sector.</p> <p>5. Install breakwaters.</p>	<p>Dept. of Marine Affairs and Fisheries; State Ministry of Environment, Dept. of Public Works and Local Government.</p>	<p>1. Construct the fisherman settlement with the design that already consider sea level rise.</p>	<p>Dept. of Marine Affairs and Fisheries; State Ministry of Environment, Dept. of Public Works and Local Government.</p>		

5.2 ADAPTATION continue

Time Frames						
No	Activities	2007-2009	2009-2012	2012-2025	2025-2050	Responsible Institutions
4	Infrastructure	<p>Dept. of Public Works, State Ministry of Environment and Local Government</p> <ol style="list-style-type: none"> 1. Construct drainage system and water absorption well and bikers facilities below the road. 2. Construct the pedestrian and bikers facilities with trees shaded along the road 	<p>Dept. of Public Works, State Ministry of Environment and Local Government</p> <ol style="list-style-type: none"> 1. Construct drainage system and water absorption well and bikers facilities below the road. 2. Construct the pedestrian and bikers facilities with trees shaded along the road 3. Establish human settlement with stack housing system. 	<p>Dept. of Public Works, State Ministry of Environment and Local Government</p> <ol style="list-style-type: none"> 1. Construct drainage system and water absorption well and bikers facilities below the road. 2. Construct the pedestrian and bikers facilities with trees shaded along the road 3. Establish human settlement with stack housing system. 		<p>Dept. of Public Works, State Ministry of Environment and Local Government</p>
5	Health	<p>Department of Health, State Ministry of Environment and Local Government</p> <ol style="list-style-type: none"> 1. Conduct health information to all communities, particularly for prevention effort to improve sanitation environment. 2. Strengthened the readiness of health system. 3. Increase communication and information and education to increase public awareness 	<p>Department of Health, State Ministry of Environment and Local Government</p> <ol style="list-style-type: none"> 1. Conduct health information to all communities, particularly for prevention effort to improve sanitation environment. 2. Conducting researches to identified the type of disaster that could arise from the impact of climate change. 3. Increase the control to the vector of contagious disease. 4. Develop early warning system. 	<p>Department of Health, State Ministry of Environment and Local Government</p> <p>Strengthened health surveillance and health protection.</p>		<p>Department of Health, State Ministry of Environment and Local Government</p>
6	Forestry and Biodiversity	<p>State Ministry of Environment, Department of Forestry, National Coordination Body for Survey and Mapping and Local Government.</p> <ol style="list-style-type: none"> 1. Inventory biodiversity in Indonesia (genetic bank). 2. Protection of forest ecosystem 	<p>State Ministry of Environment, Department of Forestry, National Coordination Body for Survey and Mapping and Local Government.</p> <ol style="list-style-type: none"> 1. Inventory biodiversity in Indonesia (genetic bank). 2. Protection of forest ecosystem 	<p>State Ministry of Environment, Department of Forestry and Local Government.</p> <ol style="list-style-type: none"> 1. Inventory biodiversity in Indonesia (genetic bank). 2. Protection of forest ecosystem 	<p>Protection of forest ecosystem</p>	<p>State Ministry of Environment, Department of Forestry and Local Government.</p>

5.2 ADAPTATION continue

No	Activities	Time Frames						Responsible Institutions
		2007-2009	Responsible Institutions	2009-2012	Responsible Institutions	2012-2025	Responsible Institutions	
7	Cross Sector	<ol style="list-style-type: none"> Increase the capacity of data supplier and weather information institutional Formulation of various regulations that support and encourage the development of environmental friendly, clean environment and law enforcement. Implementation of reprimand and penalty mechanism to local government, that ignore the regulation concerning the conservation of environment (includes land conversion). Introduce the environmental and natural resource conservation into national education curriculum. Attract foreign companies that have invested in Indonesia to avoid polluting Indonesia. Monitor temperature change, sea level rise, coastal erosion, high waves and other extreme condition. 	<p>KMNR, Ministry of Interior, State Ministry of Environment, Dept. of Public Works, Geophysical and Meteorological Agency, Dept of National Education, National Institute of Arid and Space, National Coordination for Investment, National Coordination Body for Survey and Mapping.</p>	<ol style="list-style-type: none"> Supply the information map on disaster prone area. Research or study on vulnerability and the impact of regional and local climate change Implement the National Strategy on Climate Change 	<p>KMNR, Dept. of Energy and Mineral Resources and State Ministry of Environment.</p>	<ol style="list-style-type: none"> Research in term of government and community science in order to increase the adaptive capacity. Develop early warning system. 	<p>Ministry of Interior and State Ministry of Environment</p>	

5.2 ADAPTATION

No	Activities	Time Frames					
		2007-2009	2009-2012	2012-2025	2025-2050	Responsible Institutions	Responsible Institutions
		7. Mapping the disaster prone areas. 8. Formulation of National Strategy on Adaptation of climate change to address its various impact in Indonesia					

CHAPTER VI

ATTACHMENT

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