

Mongolia's Approaches to Address the Climate Change Challenges in post-2012 period

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Background

The climate change is a global issue and so are the solutions to adapt to the change or mitigate the root causes that brought about this climate change phenomenon. Approaches and effects differ from country to country depending its specific circumstances. In this connection, each country, including Mongolia, has signed international agreements to address the issue as part of the global community. Failure to respond adequately, individually and collectively, will hamper efforts to reduce poverty, hunger and diseases and improve the access to basic services in any particular country.

Mongolia has joined the rest of the world in addressing the challenges of global climate change affecting its people and economy by affirming, among others, the United National Framework Convention on Climate Change (UNFCCC) in 1993 and its Kyoto Protocol in 1999. The Government of Mongolia has taken considerable steps toward the implementation of the UNFCCC, by accomplishing the required commitments such as the Initial and Second National Communications (INC/SNC), Technology Needs Assessment (TNA) and the National Action Plan on Climate Change (NAPCC) to address climate change and other legal commitments.

The global climate change and its impact in Mongolia is inextricably linked to the broader sustainable development agenda of the country. Climate change is already a real fact in Mongolia. Because of its specific geographical and climatic conditions, Mongolia is likely to be more heavily influenced by global climate change. The impact of climate change on the ecological systems and the natural resources would have a direct and dramatic affect on almost all sectors of the national economy and all spheres of social life. Climate change response measures will help to address the inevitable need to adapt to climate change and to mitigate greenhouse gas (GHG) emissions, in order to meet the requirements of Mongolia's sustainable development strategies. We must strengthen our ability to adapt to a changing climate. Adaptation is an essential investment in our common future, in making our communities more resilient and in reducing our vulnerability to climate change and its adverse impacts. It is also an investment in the ecosystems that sustain us.

The Government of Mongolia pays close attention to climate change issues and has been undertaking concerted actions to address the challenges posed by climate change, with a particular emphasis on both adaptation and mitigation. On 27 August 2010 the Government of Mongolia held its special meeting at Gashuunii Khooloi, Bayandalai soum, Umnugobi province located in a Gobi desert area 670 km from Ulaanbaatar, where the effects of rapid land degradation and desertification are being accelerated by climate change, and discussed climate

change challenges, including updated National Action Programme on Climate Change. The Cabinet meeting issued a Message from the Gobi Desert by the Government of Mongolia on Climate Change, addressed to the world community as well as to the citizens of the country.

With the aim of establishing and promoting sub-regional cooperation on climate change and of contributing to the efforts of the global community to deal with climate change, Mongolia has launched an initiative to hold a Northeast Asia Summit on Climate Change. Within this initiative, a series of preparatory meetings, including a Ministerial level one, were organized in 2009 in Mongolia. Mongolia is confident that the global and sub-regional dialogues and efforts will provide an excellent opportunity for policy and decision makers to gain a common understanding of the threats imposed by climate change and to reach a political consensus.

National circumstances

Geography and Climate: Mongolia has a severe continental climate due to the fact that it is landlocked and a great distance from oceans, surrounded by high mountains and has a high elevation of more than one and half km above sea level. Consequently, the main characteristics of the climate are its four distinctive seasons, high fluctuations of temperature, low precipitation and clear climate differences in latitudinal as well as in altitude zones. The annual mean temperature is about -8°C to 6°C and the annual precipitation varies from less than 50 mm in the Gobi desert to 400 mm in the northern mountainous area. About 85 percent of the total precipitation falls from April to September.

According to the land resource classification, about 73.9 percent of the territory of Mongolia is agricultural land, 15.9 percent is state special use land, 9.2 percent is forest resource land, 0.4 percent is land of water resources. Agricultural land consists of pastureland, crop farmland, hay mowing land and agricultural compounds. Pasture degradation has been substantially extended due to over exceeded livestock density and human carelessness as well as climate change. Desertification has affected more than 70 percent of grassland of the country and a significant proportion of surface and ground water, forest, soil and pasture resources have been exploited causing serious risks.

Economy: In 1991, Mongolia began a rapid transition from central planning to a free market-oriented economy. Subsequently, the abrupt shift Mongolian economy caused many difficulties, resulting in a sharp depression and increasing poverty and unemployment in the first half of the 1990s. At the same time, progress was made in establishing the foundations of a market economy, such as price and trade liberalization, privatization and establishing of commercial banking system. In the last

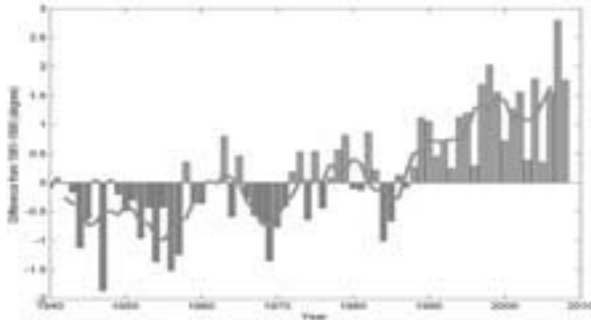


Figure 1. Average air temperature trend (anomaly from the average for 1961-1990)

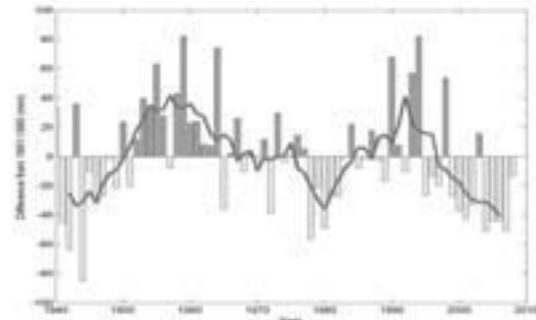


Figure 2. Annual precipitation anomaly from the mean 1961-1990

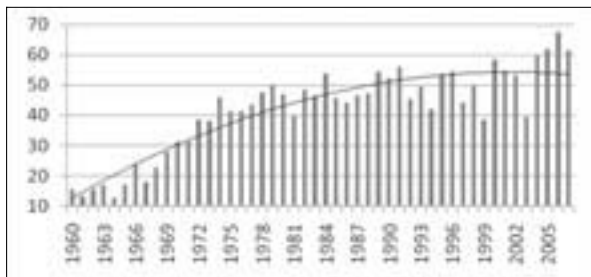


Figure 3. The annual number of days with sand-dust storms

few years, economic growth has been relatively buoyant and the prospects are good for the medium term due to increased revenue from mining, good prices of gold and copper, improved fiscal deficit and a stable inflation rate. Mongolia's GDP increased from 105 billion to 6,056 billion Tugrugs¹ between 1990 and 2009 and GDP per capita grew accordingly. However, the challenges which remain include a widening income gap, with more than 35.2 percent of the population living below the poverty line, rising underemployment, environmental degradation, and rural stagnation due to lack of access to basic services. Despite many challenges, the Government of Mongolia launched the Millennium Development Goals based Comprehensive National Development Strategy (MDGs-based CNDS) in 2008, which aims to increase GDP per capita, significant economic growth rate and improved economic structure of Mongolia.

The country's coal, gold and copper reserves are considered to be among the largest in the world. The mining sector accounts for about 20 percent of Mongolia's GDP and half the country's exports, and attracts the majority of foreign investment. The government emphasizes mining sector development as a stimulant of the country's economy. Coal is the primary energy source in Mongolia at present, comprising about 98 percent of total solid fuel consumption. This rapid growth in the coal and mining industry will lead to the significant increase GHG emissions in the country. Mongolia has considerable renewable energy resources with high potential including wind, solar and hydropower energy. Along with intensified industrial growth of livestock productivity, the mining sector and the

industry and energy sectors, consequences for pollution of air, land and water, and land degradation have been becoming real problems. Consequently, the effective integration of economic, social and environmental policies is required in order to ensure sustainable development.

Current Climate Change and Its Projections for 21st Century

Current Climate Change: Observation records for the period 1940 to 2008 show that the annual mean air temperature of Mongolia has increased by 2.14 °C (Figure 1) that much more higher than global average. In the high mountain areas higher temperatures increase have been observed than in the *Gobi* and the steppe regions. Due to global warming, the frequency of extreme high temperatures has increased. In terms of precipitation, there is an increasing trend of winter precipitation and a decreasing incidence of summer rainfall (Figure 2). As precipitation intensity increases, the extent of the damage it causes also increases. The number of days with dust storms has been increasing significantly during the last decades from 18 days to 57 days between 1960 and 2007 (Figure 3). Apparently, climate dryness is intensified in Mongolia in relation to the pattern of global climate change. The atmospheric drought index in multi years confirms intensified drought in the country.

Nomadic livestock fully dependent on nature and weather conditions and the *zud*² causes the death of hundreds, thousand even millions animals and does enormous damage to the economy of the country. The *zud* index dramatically increased in the latter years due to the intensified drought index from the 1990s and the colder snowy winters in the 2000s.

Climate Change Projections: Results of the multi model ensemble showed that air temperature will be increased more significantly in the summer season in the new Century. The results of the HadCM3 climate model of the HADLEY center show that the annual precipitation will generally increase. However, there will be small decline in the summer season between 2011-2030 according to A2 and A1B GHG emission scenarios. Precipitation in the summer season will increase by less than 10 percent, which is smaller than the rise in winter precipitation compared to

¹ National currency. 1,230 Tugrugs = 1US\$ as of 23 December 2010

² Severe winter weather condition

Table 6. 1. Results of HadCM3 model by HADLEY center

Period	Future GHG Scenarios	Temperature change, °C			Precipitation change, %		
		2011-2030	2046-2065	2080-2099	2011-2030	2046-2065	2080-2099
Annual	A2	1.0	2.7	5.0	2	9	15
	A1B	0.9	3	4.6	0	7	16
	B1	0.8	2.1	3.1	3	6	11
Winter	A2	0.7	2.3	4.2	14	19	55
	A1B	0.2	2.5	3.8	0	23	41
	B1	0.2	1.6	3.0	7	14	32
Summer	A2	1.1	3.1	6.3	-2	4	7
	A1B	1.4	3.6	5.6	-4	3	11
	B1	1.2	2.7	3.7	2	0	8

the normal climate. Due to climate change, it is anticipated that winter is becoming milder and snowy, while summer is becoming hotter and drier even though there will be a slight increase of precipitation based on overall climate change assessment. Results of the *HadCM3* model are presented in Table 6.1.

Impacts, Vulnerability and Risks

The impacts of climate change on the ecological system and natural resources are already in place and will dramatically affect almost all sectors of the national economy, human and animal life and therefore, i.a. all aspects of the life support system. Climate change will directly influence achievement of the Millennium Development Goals (MDG) in Mongolia. Mongolia's fragile ecosystems, water resources, pastoral animal husbandry and rainfed agriculture are extremely sensitive to climate change. As such, Mongolia's traditional economic sectors and its herders' nomadic way of life are highly vulnerable to climate change.

A significant portion of the economic activity has always been based on natural resources such as pasture, animal husbandry, arable land and water resources. Today, Mongolia faces not only the same problems as developing countries caused by the global climate change, but it also has specific concerns related to Mongolia's unique geographical and climatic conditions. For instance, melting of permafrost and glaciers area caused by global warming will have very adverse effects on agricultural practices, water resources and infrastructure development like bridge and road constructions, buildings, etc.

In the last forty years, Mongolian ecosystems have been notably altered as a result of climate change and variability. These changes have affected the environment, water supply, permafrost and glaciers and natural disasters, and lead to desertification, financial, environmental and human losses. However, global warming could bring some benefits to countries that endure harsh weather like Mongolia. These benefits might include, for example, a milder climate and more pleasant temperatures which will lead to a decreased need for energy consumption. However, the benefits are outweighed by the drawbacks for the country. As global temperatures rise, atmospheric circulation patterns are likely to change with alterations in the frequency and seasonality of precipitation. This

will cause a variety of secondary effects such as increased extreme weather events, and potential effects upon the biosphere, which will affect health, comfort, life style, economic activity and the environment in negative ways. Therefore, we need to reduce the adverse impacts of climate change and adapt to these changes.

The effects of climate change are most predominantly being seen by the pastoral animal husbandry sector in Mongolia because of the more frequent occurrence of drought and *zud*. The effects of climate change are evident in the animals' inability to gain the necessary live-weight during the grazing period because of the increase of the number of extremely hot days, thereby causing a decline in daily caloric intake.

Nowadays, more than 70 percent of the grassland of the territory has been affected by decertification to a certain extent. In particular, future temperature increases during the growing season, the increase of potential evapotranspiration, a precipitation decrease in most areas or a lack of precipitation increase to cover raised evapotranspiration needs, hot spells that cause crop stress, intensified heavy rainfall, drop in the total number of rainfall hours, early melting of snow cover, longer periods of bare soil from snow cover until the onset of greening and a growing number of dust storms are the major factors leading to desertification.

Surface water inventories conducted in 2003 and 2007 confirmed that many rivers, streams, lakes and ponds dried in the last years. Hydrological changes driving climate change impact and anthropogenic influences are very complex and reflect also the effects of melting glaciers and permafrost.

Pasture observation data analysis confirms that pasture biomass has dropped by approximately 20-30 percent and plant species have been impoverished in the last 40 years. According to biomass changes, the negative effect of high temperature increase of more than 3°C cannot be balanced even by 20 percent increased precipitation in the forest steppe and the steppe. The pasture biomass would decrease in almost all areas, especially in the forest steppe and the steppe. In recent decades, some insects and rodents have become more widespread due to significant climate change, drought and extreme weather events. Pests increased in crop lands leading to significant decrease in harvests.

Table 1. Major Indicators of Total Greenhouse Gas Emissions

Characters and Sectors	Annual GHG Emissions, Gg CO ₂ -eq			Average Annual Growth Rate, %		
	1990	2000	2006	1990-2000	2000-2006	1990-2006
Total Emissions (Emissions), Gg CO ₂ -eq	23,645	16,896	18,868	-3.3	1.9	-1.4
Energy, Gg CO ₂ -eq	12,529	8,865	10,220	-3.4	2.4	-1.3
Industrial Processes, Gg CO ₂ -eq	326	276	892	-1.7	21.6	6.5
Agriculture, Gg CO ₂ -eq	7,695	6,748	5,854	-1.3	-0.8	-1.1
Land Use Change and Forestry, Gg CO ₂ -eq	1,887	-1,762	-2,083	-	2.8	-
Waste, Gg CO ₂ -eq	96	120	138	2.3	2.4	2.3
Net Emissions (Emissions and Sinks), Gg CO ₂ -eq	22,535	14,247	15,628	-4.5	1.6	-2.3
Per capita GHG Emissions, tons CO ₂ -eq/person	10.72	5.92	6.02	-	-	-
Per GDP CO ₂ Emissions, kg CO ₂ /US\$	20.49	14.25	9.77	-	-	-

Greenhouse Gases Inventory

In 2006, Mongolia's net GHG emissions (source, sink) were 15,628 Gg in CO₂-eq. or roughly 6.02 tons per capita and showed a 7.6 percent increase from 14,519 Gg in 2005, as a result of the increased energy consumption. The energy sector was a major contributor of GHG emissions comprising 65.4 percent while the agriculture sector and land use change and the forestry sector contributed 41.4 percent and -13.3 percent, respectively. Other relatively minor sources include emissions from industrial processes (5.6 percent) and the waste sector (0.9 percent).

The trend of net GHG emissions between 1990-2006 indicates an average annual reduction of 2.3 percent with per capita emission reducing by 3.6 percent per year since 1990 until 2006 (Table 1). The reduction of net GHG emissions is mostly due to the socio-economic slowdown during the transition period from a centrally planned to a free market economy. However, starting from 1995 the reduction of the net greenhouse gas emissions have stopped and from 2000 to 2006 the net greenhouse gas emissions increased with average annual increase of 1.6 percent. The total GHG emissions in Mongolia are comparatively low, but the per capita rate of GHG emissions is relatively high compared to other developing countries because of the cold continental climate and the long heating season, the use of fossil fuels for energy and the low efficiency of fuel and energy.

In the energy sector, which consists of fuel combustion and fugitive emissions, GHG emissions were reduced by 1.3 percent per year from 12,529 Gg CO₂-eq in 1990 to 10,220 Gg CO₂-eq. in 2006. However, the major reduction of emissions was only until 2000 and then the emissions increased by 2.4 percent per year from 2000 to 2006 (Table 1). Methane emissions from domestic livestock increased by 2.3 percent per year between 1990 and 1999 and emissions from industrial processes have increased since 1990. The total CH₄ emissions have gradually increased by 2.3 percent per year between 1990 and 2006.

The total carbon dioxide emissions reduced by 4.7 percent per year in the period 1990-2006 because of the economic decline during the transition period. However, the total carbon dioxide emissions increased since 2000 by an annual 2.6 percent until 2006. CO₂ emissions from fuel combustion comprised 88.5 percent of the total carbon dioxide emissions in 2006. Power and heat

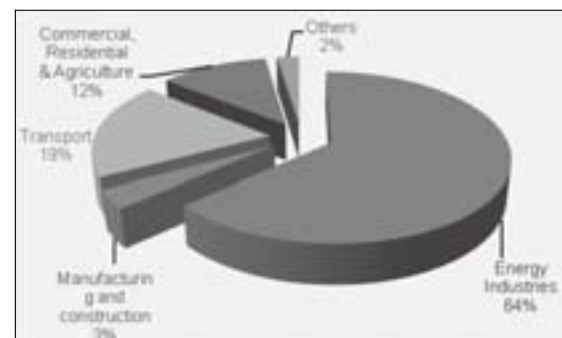


Figure 4 GHG Emissions from Fuel Combustion by sector in 2006

generation accounted for about 65 percent of the carbon dioxide emissions from fuel combustion in 2006, whereas transportation accounted for 19 percent, industrial processes 3 percent, residential, commercial and agriculture 12 percent and others (Figure 4).

Projections of GHG emissions

The total GHG emissions during the period up to 2030 are expected to gradually increase due mostly to the increase of energy industry and energy consumption by economic sectors. The total GHG emissions are expected to increase by 7.95 percent annually from 2006 to 2015 and 4.78 percent from 2015 to 2020. The projections indicate that Mongolia's GHG emissions would rise above 2006 levels by about 2.1 times in 2020 and 3.2 times in 2030 (Figure 5). During the same period, emissions from the energy sector are expected to increase by 4 times. The agriculture sector is expected to increase only 6 percent and emissions from waste by 3.6 percent annually, whereas removals from land-use change and forestry are projected to decrease by 3 times (Figure 6).

According to projections of gases, carbon dioxide, the main gas from energy related GHG, will experience a relatively modest increase from 2006 by 2.2 times to 2020 and by 3.5 times to 2030. Methane emissions will increase only 1.15 times from 2006 to 2030.

Climate Change Policies and measures

Climate change policy and response measures should address the need to adapt to climate change and to mitigate GHG emissions in order to meet the requirements

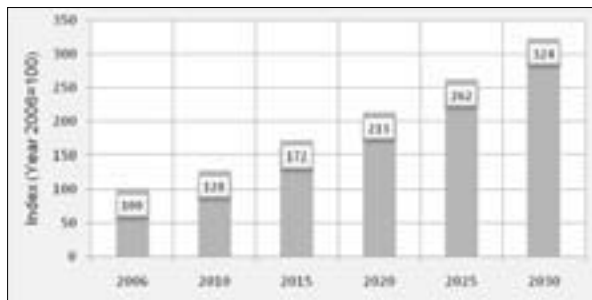


Figure 5. Projected GHG emissions trend

of Mongolia's sustainable development strategies. As a sustainable development strategy is implemented, the country is responsible for the formulation and implementation of an action programme which can promote equity and development in society and the economy that is more sustainable and that reduces vulnerability to climate change. The Government of Mongolia has prioritized the establishment of a safe and healthy environment for its people while sustaining a long term, comprehensive policy on socio-economic development with an emphasis on protecting the environment and the natural resources inherited from our ancestors who maintained the ecological balance, throughout hundreds of years. Mongolia has been developing and vigorously promoting various policies and measures to alleviate global warming at all levels of the economy.

The Millennium Development Goals-based Comprehensive National Development Strategy (MDG-based CNDS) of Mongolia identifies the need "to create a sustainable environment for development by promoting capacities and measures on adaptation to climate change, halting imbalances in the country's ecosystems and protecting them". In addition, the MDG-based CNDS includes a Strategic Objectives to promote capacity to adapt to climate change and desertification, and to reduce their negative impacts.

The Mongolia National Action Programme on Climate Change (NAPCC) aims to set priorities for response actions and to integrate climate change concerns into other national and sectoral development plans and programmes. This Action Programme includes a set of measures, actions and strategies that enable vulnerable sectors to adapt to potential climate change and to mitigate GHGs emissions. The starting point was that these measures should not adversely affect socio-economic sustainable development. In 2010, the NAPCC has been updated, taking into account the latest developments of policies, research and information on climate change in the country as well as in the world.

GHG Mitigation Policy and Measures: In particular, the strategies for sustainable development and reduction of GHG emissions in the energy sector are focused on renewable and other clean energy use, clean coal technologies, improving the efficiency of energy supply, and energy efficiency improvement in buildings and industry. In the transportation sector, GHG reducing strategies are to improve traffic conditions, use more fuel efficient vehicles and implement shifts from individual road vehicles to rail and public transport systems. GHG reduction strategies in agriculture focus on improving

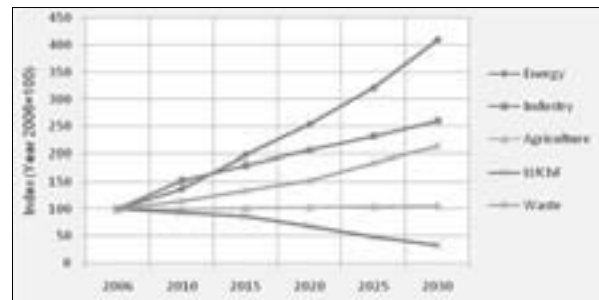


Figure 6. Projected GHG emissions and removals by sources/sinks

animal husbandry management and technology and increasing the productivity of each type of animal. As for the waste sector, policies and measures to establish a foundation to minimize waste, increase recycling and expand waste management processes should be implemented. Policies to increase removals and decrease emissions are also being implemented in the forestry sector through efficient management and maintenance of forests and afforestation.

Nationally appropriate mitigation actions: Mongolia associated with the Copenhagen Accord and submitted a list of Nationally Appropriate Mitigation Actions (NAMA) to the UNFCCC Secretariat in January 2010. The NAMA includes the general outlines of GHG mitigation measures that would be implemented with the support under the international mechanisms to strengthen national capacities; to transfer of advanced technologies; and to provide financial resources to developing countries Parties.

Adaptation Policy and Measures: Obviously, Mongolia is very vulnerable to climate change, the formulation and implementation of the policy on adaptation to climate change is vital for the sustainable development of the country. Also, new developments and amendments of policy and legal documents are required in order align with recent climate change and the latest socio-economic development updates.

First, adaptation and prevention measures for climate change must be taken at agricultural sector, including livestock and arable farming with immediate effect. Training and educating the public and the people in the agricultural sector on climate change adaptation measures, is essential. The climate change adaptation strategy in animal husbandry stimulates implementation of the goals to intensify the livestock and to increase the productivity of animals. The adaptation measures would decrease the adverse impact of climate change on animal weight and production and pasture production.

The most effective method of adapting to climate change in the water sector is the formulation and stabilization of a water resource management policy. Building the structures that regulate the flow of rivers and lakes are not only the means of adapting to climate change but also the solution to the problems pertaining to water shortage, overcoming of water scarcity, and prevention of floods and so on. The current issue is not whether it is necessary to adapt to climate change, but how to adapt to it. Adaptation is primarily targeted on studies, assessments and evaluation of the impact of climate change, the harm

and risks associated with it and the formulation of methods and measurements to mitigate it.

The sustainable development of Mongolia is largely dependent on the beneficent cooperation of environment and economy, while the economy has a great deal to do with natural resources such as pastureland, animal husbandry, agriculture and natural resource utility. Adaptation technology usually requires a considerable amount of investment initially. On the other hand, the efficiency of adaptation measurements is not recognized in the short term and it takes a considerable time and tremendous effort to achieve visible results.

Technology needs: Advanced technologies play a vital role in the mitigation of GHG and adaptation to climate change. Particularly, the replacement of old, inefficient and outdated equipment, the improvement of efficiency in energy production and consumption, the application of renewable energy, water saving and harvesting technologies, the introduction of new crop varieties resistant to heat and drought etc. are required in order to enable the country to tackle the challenges of climate change. In 2005 to 2006, the Climate Friendly Technology Needs Assessment (TNA) was conducted for the first time for the energy sector. In terms of technology, Mongolia is not positioned at a satisfactory level. Per GDP CO₂-eq emissions were 9.77 kg CO₂-eq/US\$ in 2006, which is 10 times higher than the global average. Moreover, technological deterioration in the infrastructure, particularly in energy production, industry, transportation and construction sectors is the main reason for inefficiency and the negative impact on the environment.

Based on the technology needs assessment, highly prioritized advanced technologies were identified and have been incorporated into the sector's master plans and strategies. However, there are economic, financial and human resource constraints to introducing advanced technologies in the country. The implementation and introduction of these technologies require high investment and Mongolia is unable to be economically independent in implementing them. Consequently, as a developing country, Mongolia considers that international financial and technology transfer mechanisms and the assistance of developed countries are the basic prerequisites of introducing environment friendly technologies. The energy sector of the country has a high potential in terms of reducing GHG emissions. Therefore, technology of electricity and heat production of low fuel consumption, renewable energy technology, construction technology to reduce heat loss of buildings, regulation systems of building heating, and technologies to save electricity and heat energy consumption are urgently required in the country's near future. Therefore, renewable energy and nuclear energy are the central concerns of Mongolia's energy sector. Techniques and technologies towards saving of energy consumption provide an opportunity to utilize internal resources and potentials. In order to utilize the Clean Development Mechanism (CDM) under the

Kyoto protocol in the reform of technologies, the CDM Designated National Authority has been set up and a CDM projects evaluation committee has been established.

Mongolia highly emphasizes adaptation to climate change. Modern technologies are being implemented through projects of surface water and grassland conservation and reducing natural disasters risks to livestock, with international financial support.

Conclusion

The Government of Mongolia, the general public and the private sector have made significant progress in climate change research, awareness and planning since joining the UNFCCC and Kyoto Protocol in 1990s. In achieving goals, possible barriers that would hamper success should be addressed and possibilities that would stimulate the sustainable development strategy should be promoted.

Commonly, the implementation of measures and action taken, in the course of GHG mitigation and climate change adaptation, requires advanced techniques and technology, an adequate legal and institutional environment, sufficient human resources and high investment. However, Mongolia has limited capacity to provide such resources and assets. Under the UNFCCC, developed countries are obliged to fully support measures and actions of developing countries to cope with climate change challenges. In accordance with this principle, the new international agreements for the post-2012 period on long term cooperation of countries that ensure the comprehensive financial, technology transfer and capacity building mechanisms are being developed within the UNFCCC framework. For Mongolia, new, additional, sufficient and predictable financial resources and advanced environmentally sound technologies are essential to implement its climate change response policy and measures in all sectors at all levels.

[Original English version as written by author]

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