Mongolia's Initial Biennial Update Report

Under United Nations Framework Convention on Climate Change

August 2017

MINISTRY OF ENVIRONMENT AND TOURISM

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FOREWORD

I am pleased to present the Initial Biennial Update Report (BUR) of Mongolia under the United Nations Framework Convention on Climate Change (UNFCCC).

As one of the most vulnerable countries to the impact of climate change, Mongolia demonstrates a strong solidarity to contribute to the ultimate objective of UNFCCC by submitting its Intended Nationally Determined Contribution (INDC) and ratifying Paris Agreement in 2015 and 2016 respectively. Mongolia has been actively communicating to regional and international dialogues to resolve the financial, technical and capacity challenges, along with strengthening the institutional capacity to build the robust mechanism to combating climate change.

The Initial BUR has updated the information contained in Mongolia's Second National Communication (SNC 2010) and National Inventory Report is being developed. First time Mongolia has set up the project management unit and permanent staff to develop this report. This report is prepared genuinely by national expert teams.

I believe that the information provided in this report will be practical resources for both national and international policy makers, donors and private sectors to mobilize potential resources of global climate initiatives.
Mongolia's initial BUR would not have been possible without hard work and dedication of the BUR project team and national experts in articulating the report. Also, the other key ministries, agencies, stakeholders, research institutions and nongovernmental organizations contributions were essential for successful completion of the report,

Finally, I would also like to take this opportunity to thank the Global Environment Facility, Secretariat of UNFCCC and United Nations Environment Programme for providing the funds and methodological support for producing this report.

OYUNKHOROL Dulamsuren
Member of the Parliament,
Minister of Environment and Tourism

PREFACE

This report was compiled by the Climate Change Project Implementing Unit (CCPIU) of Environment and Climate Fund (ECF) under the Ministry of Environment and Tourism (MET) to meet Mongolia's obligation to prepare and submit Biennial Update Report (BUR) to the United Nations Framework Convention on Climate Change (UNFCCC).
The BUR has been prepared in accordance with the UNFCCC Biennial Update Report guidelines for Parties not included in Annex 1 to the Convention.

This Initial BUR includes updated information on:
a). National circumstances and institutional arrangements,
b). National Greenhouse gas inventory from 1990 to 2014,
c). Mitigation actions and effects,
d). Domestic measurement reporting and verification
e). Financial, Technology and Capacity Needs and
f). Other related information.

Moreover, the BUR is presenting the projections of the climate change mitigation measures and their assessment up to 2030 considering the country's development priorities, objectives and capacities.
In addition, the National Inventory Report (NIR) has been developed and presented as an annex of the initial BUR.

In the BUR, the inputs and reviews of related sectorial ministers, agencies and municipality have been considered to ensure the relevance of the priorities of different stakeholders.

Special note of appreciation and gratitude is extended to the thematic working groups leads Dr. Erdenesukh Sumya and Dr.Batima Punsalmaa. Ms. Saruul Dolgorsuren was responsible for overall implementation of the project under the general guidance of Dr.Batjargal Zamba, National Advisor of CCPIU and Mr.Batjargal Khandjav, National Project Director. The rest staff of CCPIU of ECF have provided invaluable support and contributed significantly to the success of the work. The valuable contribution of every entity and individual to this time consuming task and the skill and knowledge they have provided is highly appreciated.

Climate Change Project Implementing Unit

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Acronyms and abbreviation

BAU	Business as Usual
BUR	Biennial Update Report
CDM	Clean Development Mechanism
CERs	Credit of emission Reductions
CHP	Combined Heat and Power
COMAP	Comprehensive Mitigation Assessment Process for forestry
GDP	Green Development Policy
GEC	Global Environment Centre Foundation
GHG	Greenhouse Gas
GDP	Gross Domestic Product
ERC	Energy Regulatory Commission, Mongolia
EPR	Environmental performance review of Mongolia
HOB	Heat Only Boiler
HPP	Hydro Power Plant
HPP	Hydro Power Plan
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
JCM	Joint Crediting Mechanism
JICA	Japanese International Cooperation Agency
LEAP	Long-range Energy Alternative Planning
LULUCF	Land-use, land-use change and forestry
MASM	Mongolia's Agency of Standard and Metrology
MEGD	Ministry of Environment and Green Development
MET	Ministry of Environment and Tourism
MOU	Memorandum of Understanding
MNET	Ministry of Nature, Enviroment and Tourism
MRV	Monitoring, Reporting and Verification
MDG	Millennium Development Goals
MOFALI	Ministry of Food and Agriculture and Light Industry
NAPCC	National Action Programme on Climate Change
NAMA	Nationally Appropriate Mitigation Action
NREC	National Renewable Energy Centre
NSO	National Statistics Office
NTC	National Transportation Center
OIE	The World Organization for Animal Health
PPR	Peste des Petites Ruminants
TPE	Third Party Entity
UB	Ulaanbaatar
SGKh	State Great Khural
UNFCCC	United Nations Framework Convention on Climate Change
UN	United Nations

UNITS

%	Percent
Gg	Gigagram
GWH	Gigawatt Hour
Km	kilometer
Mln	Million
MW	Mega Watt
T	Ton

EXECUTIVE SUMMARY

The initial Biennial Update Report of Mongolia under the United Nations Framework Convention on Climate Change (UNFCCC) offers updated information on climate change mitigation actions from Mongolia's Second National Communication submitted to the UNFCCC in 2010. Furthermore, it acknowledges Mongolia's efforts to mitigate Greenhouse Gas (GHG) emissions after the submission of the Intended Nationally Determined Contributions (INDC) to UNFCCC on September 24, 2015. The initial BUR has the comprehensive information on mitigation scenarios of GHG emissions from 2010 till 2030 by assessing the key national policy documents in the contexts of sustainable development and environment that the Government of Mongolia has approved.

National circumstances

Mongolia is the 19th largest country in the world with a surface area of 1,564,116 square kilometers. It is also the world's second-largest landlocked country with mountains covering the northern and western regions and the Gobi Desert located in the south. Mongolia is one of the most sparsely populated countries in the world, as of January 2015 with a 3,057,778 population with average growth rate of 2.1 percent. About (2,096,180) 69% of total population lives in cities, out of which (1,396,288) about 67 percent accounts for Ulaanbaatar only. Ulaanbaatar is the capital and the largest city of Mongolia.
Mongolia's economic growth has been based on the production in mining and agricultural sectors. The Gross Domestic Product (GDP) in Mongolia was 11.8 billion US dollars in 2015. The GDP value of Mongolia represents 0.02 percent of the world economy. GDP in Mongolia averaged 3.79 Billion USD from 1981 until 2015, reaching an all-time high of 12.55 Billion USD in 2013 and a record low of 0.77 Billion USD in 1993 at the beginning of transition the market economy.

Since 1992, the Parliament has passed several laws, regulations and policy on environmental protection and most of them were amended in 2012 as a package. Some of the policy and legal documents related to climate change are listed below:

- the Law on Environmental Protection (1995, amended in 2007, 2012),
- the Water Law (1995 amended in 2004, 2010 and 2012),
- the Forest Law (1995, amended in 2012 and 2013),
- the Law on Air (1995, amended in 2012),
- the Energy Law (2001, renewed in 2015),
- the Law on Waste, 2012,
- The Law on renewable energy, 2015,
- National Action Programme on Climate Change, 2000 (updated in 2011),
- Green development policy, 2014 (for the period 2014-2030),
- Sustainable development vision, 2016 (for the period 2016-2030),
- National agriculture development policy, 2010 (for the period 2010-2021),
- State policy on energy, 2015 (for the period 2015-2030),
- State policy on forest, 2015 (for the period 2016-2030),
- State policy on Industry, 2015 (for the period 2015-2030).

The other important document pursuant to climate change is INDC. Mongolia INDC has outlined a series of policies and measures that the country commits to implement up to 2030in the energy, industry, agriculture and waste sectors. The expected mitigation impact of these policies and measures will be a 14% reduction in total national GHG emissions excluding Land use, land-use change and forestry (LULUCF) by 2030, compared to the projected emissions under a business as usual scenario. Those and other potentially more ambitious commitments are contingent upon gaining access to new technologies and sources of finance through internationally agreed mechanisms and instruments under the auspices of the UNFCCC.

The **energy** system is considered to be a major branch of the economy and infrastructure sector of Mongolia and it strongly influences the social and economic viability of the country. About 96% of domestically generated electricity is from coal-fired power plants while only 3% by renewable energy sources.

Mongolia has an abundance of mineral resources and ranks as one of the world's leading mining nations. The mining **industry** plays an important role in the country's economy, accounting for 17% of GDP and 83% of export value in 2014. Over the last few years, mineral products have consistently accounted for more than 80% of total export revenues, with copper and coal being the drivers of revenue.

Key **manufacturing industries** are the Cement and Lime industry and the major contributors to GHG emissions. From 2011 onwards, the Cement and Lime production technology was changed from wet production technology to dry method technology.

The **construction industry** is also closely linked to other parts of the Mongolian economy, such as manufacturing, wholesale, retail, finance and insurance.
According to the National Statistical Office (NSO), works carried out in 2014 totaled MNT2.2trn ($1.3bn), up 16.3% from the level in 2013. Much of this growth took place in the residential segment, which has been the focus of an increasing number of large-scale, state-led development projects in recent years. Despite the rapid year-on-year jumps in construction output, the sector's share of total GDP has remained relatively constant, at around 5%.

Due to a sparse population and geographically complex and large territory, the Mongolian **transportation** sector is of a strategic importance and it consists of road, rail, air and water transportation and other sub-sectors.

As of 2014, the total cargo traffic rail freight turnover was 63%, transportation 37%, total passenger automobile circulation 55%, while 22% and 23% was for rail and for air transportation accordanly.

Mongolian **crop-agriculture** is primarily rain-fed which is possible in the short raining period in summer time. The extreme fluctuation in temperature and precipitation provides limited potential for agricultural development. Crops produced in Mongolia are wheat, barley, potato and about 30 other types of vegetables. The agriculture sector, therefore, remains heavily focused on livestock husbandry with about 80% of the land allocated to pasture. Only 1% of the land in Mongolia is cultivated with crops, amounting to the potential of 1.3 million

hectares in 2016. Depending on the climate, soil structure and fertility the cultivation area is divided into five regions of different size.

The **livestock-agriculture** system has proven itself to be an efficient and sustainable means of utilizing available resources within the severe constraints of climate and limited natural productivity of the region. Livestock production is still the dominant economic activity for a majority of residents. The extensively managed pasture based livestock production system as practiced by herders is a viable system, well adapted to local conditions.

Institutional Arrangements

The Ministry of Environment and Tourism (MET) of Mongolia is the key ministry to develop, update and implement climate related policies. Thus, the MET is the national entity with the overall responsibility for organizing and coordinating the compilation of National Communications, Biennial updated reports, GHG inventory and submitting them to the UNFCCC Secretariat to integrate climate change-related issues in various sectors.

In 2015, the MET has set up Climate Change Project Implementation Unit (CCPIU) at the Nature Conservation Fund (name has changed as Environment and Climate Fund since 2017) engaging experienced professionals to facilitate smooth implementation of commitments under UNFCCC. The CCPIU supervised by National focal point for the UNFCCC. There are three sectoral experts to conduct GHG inventory. The major data provider is NSO (National Statistics Office). A number of other entities provide more specific data which is not available at National Statistics and required for GHG estimation. Such national entities include the Ministry of Energy (MoE), Ministry of Road and Transport Development (MRTD), Ministry of Agriculture and Light Industry (MoFALI), Ministry of Construction and Urban Development (MCUD), CDM Bureau, the National Renewable Energy Centre, Ulaanbaatar Municipality, and National Customs Office.

National Greenhouse Gas Inventory

The main sources of GHG emissions have been divided into the following sectors: Energy (CRF 1), Industrial Processes and Product Use (IPPU, CRF 2), Agriculture (CRF 3), Land use, Land use change and Forestry (LULUCF, CRF 4) and Waste (CRF 5).

Total GHG emissions in Mongolia in 2014 were 34,482.73 Gg CO_2e (excluding LULUCF). This represented 57.09% increase from the 1990 level of 21,950.73 Gg CO_2e and 5.49% increase from the 2013 level with 32,687.27 Gg CO_2e. Net GHG emissions in 2014 were 10,030.80 Gg CO_2e (including LULUCF). This represented 1,034.44% increase from the 1990 level of -1,073.46 Gg CO_2e and 23.23% increase from the 2013 level with 8,139.60 Gg CO_2e.

In general, emission and removal from each sector increased in 2014 comparing to the base year and differences are showed in the Table by percentage changes and absolute values of each GHG inventory sectors.

Table Mongolia's GHG emissions/removals by sectors in 1990 and 2014

Sector	Emissions, (Gg CO_2e)		Change from 1990 (Gg CO_2e)	Change from 1990 (%)
	1990	*2014*		
Energy	11,091.14	17,267.79	6,176.64	55.69
IPPU	218.66	328.06	109.39	50.03
Agriculture	10,585.30	16,726.98	6,141.68	58.02
Waste	55.62	159.91	104.29	187.49
Total (excluding LULUCF)	21,950.73	34,482.73	12,532.00	57.09
LULUCF	-23,024.18	-24,451.93	-1,427.75	6.20
Net total (including LULUCF)	-1,073.46	10,030.80	11,104.26	1,034.44

GHG emissions in 2014 from the energy sector were 17,267.79 Gg CO_2e accounting for 50.08% of total national emissions. The second highest sharing of the total emission were from the Agriculture sector with 16,726.98 Gg CO_2e accounting for 48.51%. Emissions from IPPU and Waste sector contributed 328.1 Gg CO_2e (0.95%) and 159.91 Gg CO_2e (0.46%) respectively to the national total in 2014

Comparing to the 1990, sectoral emission increase for the Energy sector were 55.69%, for the IPPU sector were 50.03%, for the Agriculture sector were 58.02, for the Waste sector 187.49% and removal for the LULUCF sector were 6.2% in 2014.

Two main sources of the total emission were Energy and Agriculture sector for all years of the inventory. However, percentage share of emission sources were varied year by year depending on economic and climatic factors such as demand increase in energy sector and natural disaster occurrence in agriculture sector.

Mitigation Actions and Effects

To assess overall mitigations actions to identify the future trends, the actions, policies and programs implemented or will be implemented through the national and sectorial policy framework and counter measures are considered. The assessment is based on the implementation of policies and programs which are implemented from 2007 to 2015. The key policies and actions are outlined to assess the future projections and current status of GHG mitigation actions and their effects.

If the actions described on the national policies and programs are implemented completely, GHG emissions can be reduced about 25 percent in 2025 and about 28 percent in 2030. Due to lack of data availability on certain sectorial GHG emissions, the projected emission reduction could be higher.

In 2030, GHG emissions in BAU scenario using 2010 as the base year is projected that 2.7 times of reduction in energy sector, 5.0 times of reduction in cement production, 2.4 times of reduction in livestock sector, 1.5 times of reduction in agriculture, 1.9 times of reduction in waste sector, while removal of follow land decreased by 2.1 times and forest removal potential is expected to increase.

In 2030, GHG emissions by gases in BAU scenario using 2010 as the base year is projected that 3.3 times increase of carbon dioxide (CO2), 2.3 times increase of methane (CH4), 2.6 times increase of Nitrous oxide (N2O).

Mongolia put the goal to reduce the GHG emissions by two percent from the current levels in 2020, by seven percent in 2025 and by 14 percent by 2030 by promoting the use of renewable energy sources and advanced technologies in liquefying and carbonating coal

and shale. Increase energy efficiency and share of renewable energy are the two main approaches to policies and actions to mitigate GHG emissions.

GHG emissions in 2030 expected to increase 2.4 times in energy need, 3.0 times in energy production, 2.7 times in overall energy sector compared to the level of 2010.
The share of renewable energy percentage reflected by net energy production and goals identified in the energy policies and programs. It is possible to reach the goals identified in the policies and programs if all planned activities of the projects implemented in their fixed timeframes.

GHG emissions will be reduced in 2015, 2020, 2025 and 2030 by 0.4, 2.7, 4.7, 7.2 mln tCO2e respectively if projects are fully implemented in the energy sector.
Net GHG emission is projected to be reduced by 1.5 mln tCO2e in 2020 and by 2.8 mln tCO2e in 2030 through the improvement of energy efficiency.

Domestic MRV mechanism

Recognizing the role of mitigation actions in reducing GHG emissions while simultaneously promoting country's sustainable development objectives, Mongolia will advocate for a broader approach to MRV that establishes a robust mechanism in line with its commitment under the UNFCCC .The initial experience with different elements of the MRV for GHG emissions has already been gained through the implementation of Clean Development Mechanism (CDM) projects under the Kyoto Protocol. Moreover, significant effort has also been done under the preparation of the national GHG inventories, a crucial element of the overall MRV system. Mongolia has approved through its Agency of Standard and Metrology (MASM) ISO14064 and ISO 14065 standards as a national standars for MRV between 2012 and 2013. National renewable energy center (NREG) had become the first nationally accredited entity for MRV in 2014.

Further, the MRV methods for project based activities is expected to evolve and be simplified, allowing the necessary information for emission reductions from individual activities to be collected from the already existing information in the GHG inventory and statistical data.

Constraints and gaps, and related financial, technical and capacity needs

Mongolia, as many other developing countries, has specific barriers for the implementation of adaptation and mitigation measures such as financial and technical resources, human and institutional capacity, and public support. The biggest problems facing the electricity and heat production sectors in reducing GHG emissions are the use of obsolete techniques and technologies, the low coal quality, and insufficient funds.

The implementation of mitigation measures requires a high level of technical capacity and effective coordination across different sectorial agencies, which are currently a challenge for Mongolia. Most of the technologies applied in Mongolia's energy sector are still out of date and have low efficiency and high energy losses. The heat content of the feedstock coal is

low and variable, which leads to combustion problems and poor plant performance. A lack of appropriate technologies and know-how is the most urgent technical problem.

Other key financial, technical and capacity barriers include a lack of support by financial institutions for renewable energy investments (particularly hydro-power plants); lacks of domestic technological and technical resources for clean fuel production; and Carbon capture and Storage-CCS plant.

Moreover, reporting of National Communications including GHG inventory and BUR is financed by GEF enabling activities through UNEP. In other words, there was no substantial government financing (except in kind contribution) for these reporting requirements because of the economic difficulties in Mongolia, as the country is undergoing a transition period and the Government fails to resolve financing issues as required national circumstances and needs.

CHAPTER 1

National Circumstances and Institutional Arrangements

1. NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1.1 National circumstances

1.1.1 Country profile

Mongolia is the 19th largest country in the world with a surface area of 1,564,116 square kilometers. It is also the world's second-largest landlocked country with mountains covering the northern and western regions and the Gobi Desert located in the south. Ulaanbaatar is the capital and the largest city of Mongolia.

Generally, average altitude in Mongolia is 1580m above the sea level. The highest point is the Khuiten mountain peak (4653m) in the west and the lowest is the Khokh Nuur Lake in the east - 518m above sea-level. Ulaanbaatar, the capital city is located at about 1310m above sea level. The country is located in a transition zone at the crossroads of the northern Asia and Boreal Arctic regions where the Siberian Taiga meets the Asian deserts and steppe (**Error! Reference source not found.**). Therefore, Mongolia has diverse geographical eatures such as high mountains, forest steppe, the steppe and the Gobi desert regions. The unique features of these ecosystems are widely recognized in comparison with those of other countries in the same latitude of the northern hemisphere. Geographical features and the dry and cold climate are associated with fragility of natural ecosystems. The nature and the environment, the flora and fauna of the country are being changed significantly due to socio-economic stress as well as climate change.

Figure 1.1 Location of Mongolia

The Constitution and the 1992 Law on Government Administration proclaims Mongolia as a unitary state with three tiers of local government. Governance of the administrative and territorial units is based on the principle of centralized authority as well as a gradual transition toward a system of local governments. The country is divided into 21 administrative units known as "*Aimags"*. *Aimags* are further divided in to smaller administrative units "*Soums"*,

accordingly Soums are also divided in to smaller groups known as *"Bags"* which is the lowest administrative unit in the country.

Demography

Mongolia is one of the most sparsely populated countries in the world, as of January 2015 with a 3,057,778 population with average growth rate of 2.1% (**Error! Reference source not ound.**). Average life expectancy rate at birth is 69.9 (75.8 for women and 66.0 for men). While Mongolia as a whole is famously known as the world's most sparsely populated nation, with a density of fewer than two people per square km, according to the 2010 census, in Ulaanbaatar the figure is nearly 250 people per square km. Urban area in Mongolia is defined in the Mongolia Law for Legal Status of Towns and Villages, as a settlement of over 15,000 people. *Aimag* centers inhabit about and more than 15,000 populations compared to the urban category. About (2,096,180) 69% of total population lives in cities, out of which (1,396,288) about 67% accounts for Ulaanbaatar only.

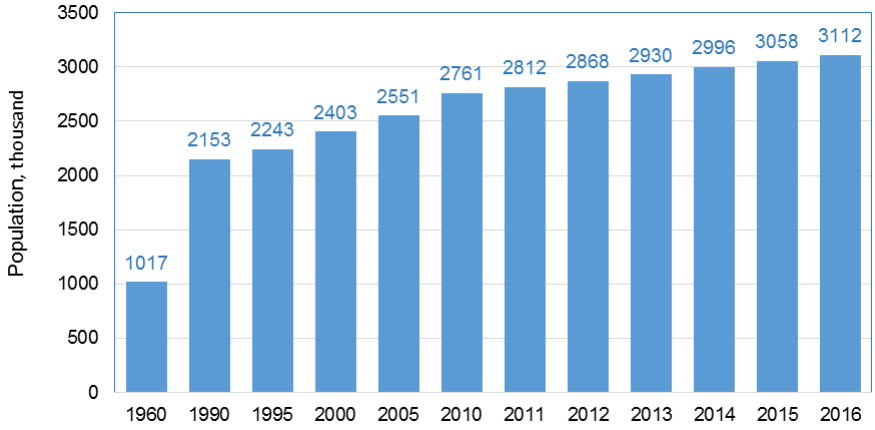

Figure 1.2 Population trend of Mongolia

Government

Mongolia is a democratic parliamentary republic. According to the 1992 Constitution, the President of the State is directly elected by all residents for a four-year term, eligible for a second term, and he/she presides over the army and the National Security Council.

The unicameral legislature (State Great Khural) has 76 members, elected for a four-year term. After the legislative elections, the leader of the majority party or coalition chairs the Government. The Cabinet is established by the Prime Minister in consultation with the President and approved by the State Great Khural. Mongolia has four levels of governance – one central and three subnational tiers.

Economy

Mongolia's economic growth has been based on the production in mining and agricultural sectors. While these sectors are still important, the services sector, including the banking, finance, and retail sectors, is making an increasing contribution to the growth in country's economy. This trend mirrors the industrial profiles of most developed economies over recent decades.

The Gross Domestic Product (GDP) in Mongolia was 11.8 billion US dollars in 2015. The GDP value of Mongolia represents 0.02% of the world economy. GDP in Mongolia averaged 3.79 Billion USD from 1981 until 2015, reaching an all-time high of 12.55 Billion USD in 2013 and a record low of 0.77 Billion USD in 1993.

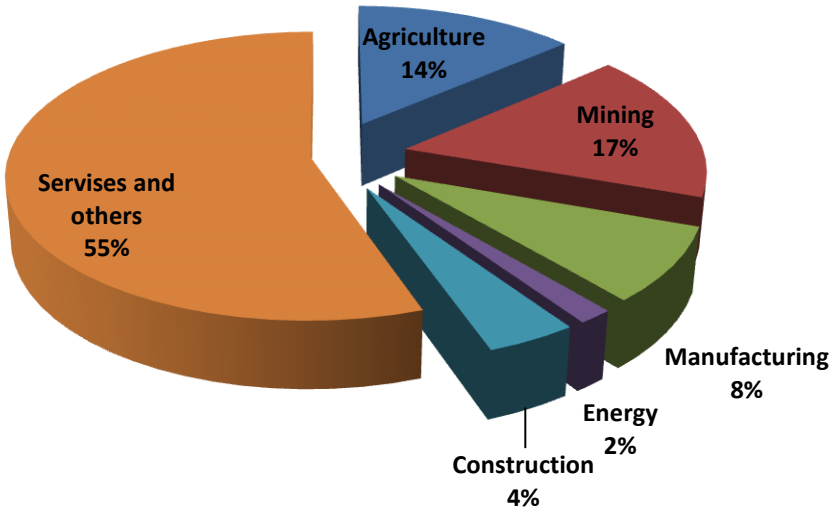

Figure 1.3 GDP by sectors in 2015

Table 1.1 Some socio-economy data of Mongolia

Parameters	2010	2011	2012	2013	2014	2015
Population (million)	2.7	2.8	2.8	2.9	2.9	3.0
GDP per capita	2,650	3,783	4,377	4,598	4,166	3,971
GDP (USD billion)	7.9	10.5	12.4	13.3	12.2	11.8
Share of industry in GDP	28.3	26.1	25.2	26.4	29.3	21.0
Share of agriculture in GDP	11.7	10.0	10.7	11.5	12.2	14.0
Agricultural land, thousand ha	1,155	1,155	1,154	1,154	1,150	1,150
Urban population, percent of total	69.2	67.4	67.2	68.1	66.4	68.6

Energy

Energy is one of the important aspects of the modern economy which makes the energy policy inseparable from the overall national developmental strategy. Per capita electricity in 2014 was 1850 GWh which is 18% less than the Asia Pacific average (2280 GWh/capita). In Mongolia, 60% of households are connected to the grid and 318 out of 330 soums are connected to transmission lines. Therefore, households of all *aimags* and 96% of *soums* are connected to the grid.

The power system is considered to be a major branch of the economy and infrastructure sector of Mongolia and it strongly influences the social and economic viability of the country. About 96% of domestically generated electricity is from coal-fired power while only 3% by renewable energy sources. Three centralized power grids and two isolated systems supply electricity: (i) Central Energy System (CES); (ii) Eastern Energy System (EES); and (iii)

Western Energy System (WES). The two isolated systems are (i) Dalanzhadgad CHP plant and local grid, and (ii) Zhavhan and Gobi-Altai aimags.

There are seven main coal-fired power plants in Mongolia with a total installed capacity of 856.3 MW. Three large sized coal fired power plants are located in Ulaanbaatar. Coal demand of these power plants is met through state-run operations at Shivee-Ovoo and Baganuur coal mines.

In 2015, 5.3 billion kWh of electricity was generated by thermal power plants and 5323.5 million kWh of electricity was generated by hydropower plants, 59.4 million kWh of electricity was generated by Wind Park, 5.8 million kWh of electricity was generated by solar PV (Table1.2). Moreover, 1.3 billion kWh of electricity was imported.

Table 1.2 Electricity production

Energy Sources		**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
CHP	Electricity production, million kWh	4256	4450	4778	5014	5191	5323.5
	Percentage	98.7	98.4	98.4	97.7	97.6	96.2
Diesel	Electricity production, million kWh	21.40	20.2	28.7	5.4	8.2	0.545
Power	Percentage	0.50	0.45	0.59	0.11	0.15	0.01
Hydro	Electricity production, million kWh	20	35.3	52.6	59.9	66.3	59.4
Power	Percentage	0.46	0.78	1.08	1.17	1.25	1.07
Solar PV	Electricity production, million kWh					0.6	5.8
	Percentage					0.01	0.10
Wind Park	Electricity production, million kWh				52.3	52.9	152.5
	Percentage				1.02	0.99	2.75
Total	Electricity production, million kWh	4312.7	4522.8	4856.3	5131.6	5318.4	5536.0
	Percentage	100	100	100	100	100	100

Currently, use of renewable energy sources for power generation has initiated the “100,000 Solar Ger” national program. Herders living in rural areas use solar panels for their electricity. In 2013, new wind park with a capacity of 50 MW has been constructed and providing electricity to the central grid.

So far more than 70 large and middle-sized dams are proposed to be constructed in Mongolia, but only 2 of them have been built to date, namely, Durgun (12 MW) and Taishir (11 MW). At present, hydroelectricity is produced by other 10 small plants. Most of the existing small hydropower plants have been constructed using water diversion channels; the installed capacity is relatively small. As none of these plants can operate in winter due to ice formation, the quoted production values are for the summer months only from May to October. Other two large hydro-dams such as “Egiin gol hydro-dam” and “Shuren hydro-dam” are under a plan to be constructed for more than ten years and have not been implemented due to transboundary water debate.

Mongolian **forest**, which covers 8.1% of the territory, is located in the southern border of the Siberian taiga. However, Mongolian forest stretches for 2000 km from the Altai Mountains in the west to Soyolz Mount of Ikh Khyangany Mountains in the east and also from Khuvsgul Mountains in the north to the Gobi steppe area in the south.

Industry

Mongolia has an abundance of mineral resources and ranks as one of the world's leading mining nations. The mining **industry** plays an important role in not an only industrial sector but also the country's economy, it is accounted for 17% of GDP and 83% of export value in 2014. Over the last few years, mineral products have consistently accounted for more than 80% of total export revenues, with copper and coal being the drivers of revenue.

Key **manufacturing industries** are the Cement and Lime industry and the major contributors to GHG emissions. The Cement and Lime production is shown in **Error! eference source not found.**. From 2011 onwards, the Cement and Lime production technology was changed from wet production technology to dry method technology.

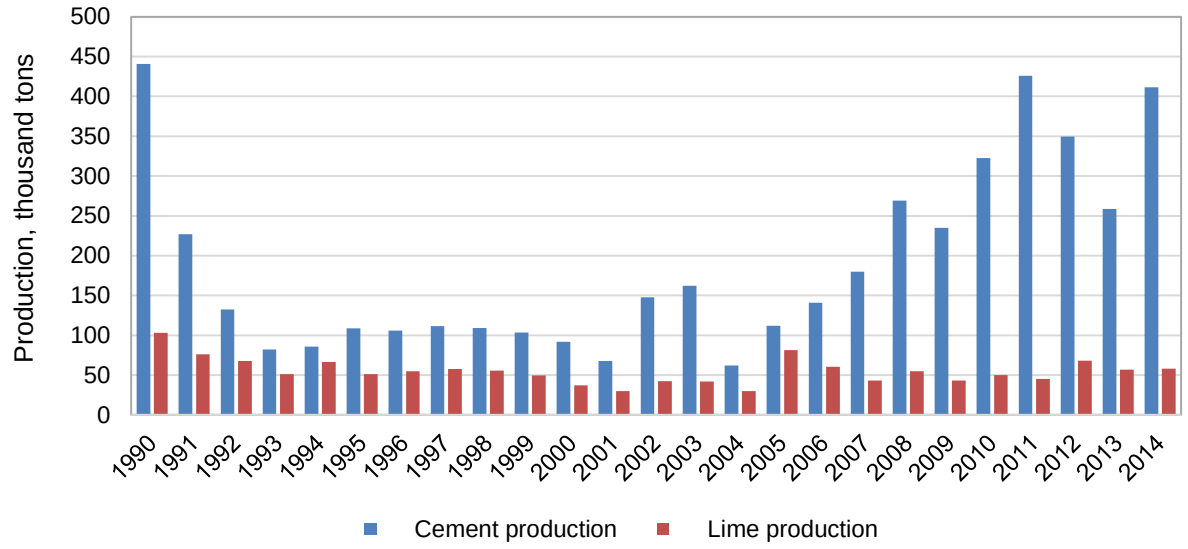

Figure 1.4 Cement and lime production

The **construction industry** is also closely linked to other parts of the Mongolian economy, such as manufacturing, wholesale, retail, finance and insurance. The construction industry undertakes activities related to three main categories: residential building such as apartments, and houses; non-residential building such as offices, shops, hotels, schools etc. and engineering construction like roads, bridges, water supply, sewerage, and mines. Construction activities are mainly carried out by private sectors.

According to the National Statistical Office (NSO), works carried out in 2014 totaled MNT2.2trn ($1.3bn), up 16.3% on 2013. Much of this growth took place in the residential segment, which has been the focus of an increasing number of large-scale, state-led development projects in recent years. Despite the rapid year-on-year jumps in construction output, the sector's share of total GDP has remained relatively constant, at around 5%.

Transportation

Due to a sparse population and geographically complex and large territory, the Mongolian transportation sector is of a strategic importance and it consists of road, rail, air and water transportation and other sub-sectors.

As of 2014, the total cargo traffic rail freight turnover was 63%, transportation 37%, total passenger automobile circulation 55%, while 22% and 23% was for rail and for air transportation accordanly (Table 1.3).

Table 1.3 All types of cargo transport turnover and passenger turnover

No.	Specifications and types of transport	2010	2011	2012	2013	2014
1	Cargo turnover, million t/km:	12,124.8	16,336.7	16,613.4	16,400.0	19,757.0
	rail transport	10,286.7	11,418.7	12,142.7	12,076.5	12,473.7
	automobiles	1,834.0	4,910.3	4,461.0	4,314.0	7,274.0
	air transport	4.2	7.7	9.7	9.6	9.4
2	Passenger turnover, million passenger per km:	3,607.4	4,695.4	4,971.8	4,625.7	5,395.8
	rail transport	1,220.0	1,399.7	1,485.4	1,394.4	1,194.5
	automobiles	1,480.2	2,321.6	2,263.1	1,941.9	2,965.3
	air transport	907.2	973.9	1,223.1	1,311.8	1,235.7
	maritime transport	0.044	0.252	0.198	0.265	0.307

Source: Mongolian Statistical Yearbook, 2014.

As given in Table 1.4, in 2014, amongst the total vehicle fleet 10 and more years old cars are accounted for 72.5%, while 4-9 years old cars are accounted for 20.6%. In 2010, the number of cars less than 3 years old are accounted for 3.4%, increasing to 6.9% by 2013.

Table 1.4 Number of cars, types and used period

No.	Specifications and types of transport	2010	2011	2012	2013	2014
1	Type of car:	254,486	312,542	345,473	384,864	437,677
	seat/sedan	172,583	208,514	228,650	259,309	303,724
	Truck	61,841	75,090	83,718	89,473	96,581
	Buses	16,366	22,547	21,642	20,400	20,650
	special Purpose	3,696	6,391	11,463	15,682	16,722
2	Used period:					
	3 years	8,585	10,770	20,325	26,492	21,430
	4-9 years	54,283	46,114	79,022	79,470	86,337
	10 and above	191,618	255,658	246,126	278,902	329,910

Source: Mongolian Statistical Yearbook, 2014.

In recent years, the government has invested heavily in improving infrastructure, particularly, the national road network. As of late 2013, approximately 3000 km of new roads were either under construction or in the midst of refurbishment, according to the NSO. The government is also in the final planning stages of an initiative aimed at extending the national rail system, which at present, consists of only a handful of major cross-country lines. By the end of 2018, the state hopes to have completed projects on 1800 km of new lines, which will be dedicated, at least initially, to carrying freight.

Agriculture

Mongolian **crop-agriculture** is primarily rain-fed which only occurs in the short raining times in summer. The extreme fluctuation in temperature and precipitation provides limited potential for agricultural development. Crops produced in Mongolia are wheat, barley, potato and about 30 other types of vegetables. The agriculture sector, therefore, remains heavily focused on livestock husbandry with about 80% of the land allocated to pasture. Only 1% of the land in Mongolia is cultivated with crops, amounting to the potential of 1.3 million

hectares in 2016. Depending on the climate, soil structure and fertility the cultivation area is divided into five regions. Cereals can be cultivated in 75% of total land and the yield per hectare (1,647ton) is almost two times less than the world average (3,886ton). National cereal production meets about 90% and vegetable production meets more than 60% of demand. The agriculture sector engages with 1190 companies, and 34.5 thousand family-owned enterprises. Also more than 60% of investment comes from the private sector (MoFALI, 2014).

The **livestock-agriculture** system has proven itself to be an efficient and sustainable means of utilizing available resources within the severe constraints of climate and limited natural productivity of the region. Livestock production is still the dominant economic activity for a majority of residents. The extensively managed livestock production system as practiced by herders is a viable system, well adapted to local conditions. It also presents both advantages and disadvantages relative to economic development and conservation of wildlife and natural ecosystems. Animals raised commercially in Mongolia are horses, cattle, goats, sheep and camels. Livestock population is given in **Error! Reference source not found.**. They are aised primarily for their meat, milk and traditional dairy products. Additionally, they are valued for their hair and skin. The livestock sub-sector accounts for almost 10% of export earnings, approximately 80% of total agricultural production. About 26% of the work force and about 20% of households, more importantly, over 70% of employments in rural areas are directly engaged in the livestock sector providing food and goods to the remaining 3 million people. Livestock population is increasing from year to year.

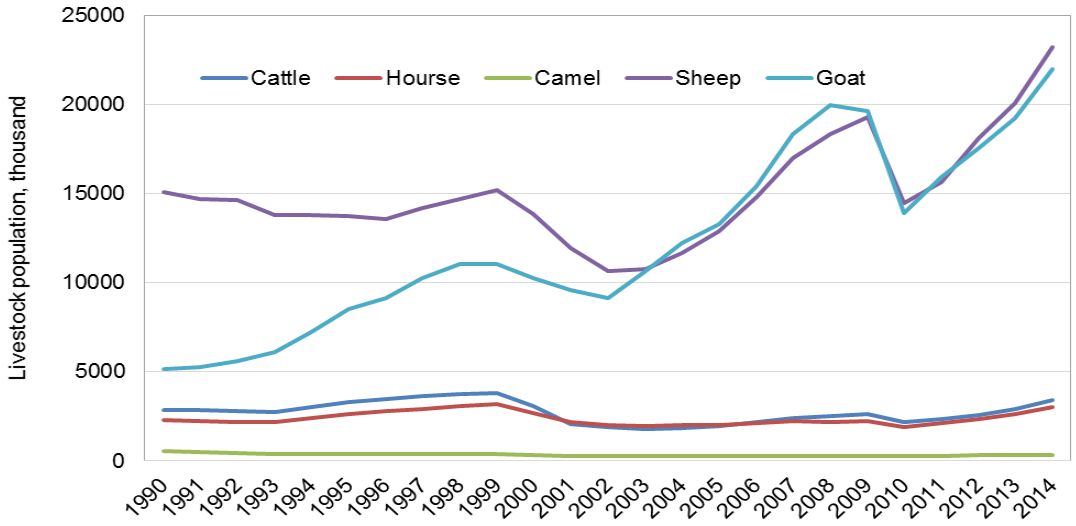

Figure 1.5 Livestock population

1.2 Institutional Arrangements

Preparation of the BUR

Pursuant to the COP decisions on reporting requirements for Non-Annex I Parties to the UNFCCC, Mongolia has prepared its first Biennial Update Report (BUR) as an update to the information provided in Mongolia's Second National Communication.

Policy dimensions

Since 1992, the Parliament has passed several laws, regulations and policy on environmental protection and most of them were amended in 2012 as a package. Some of the policy and legal documents related to climate change are listed below:

- the Law on Environmental Protection (1995, amended in 2007, 2012),
- the Water Law (1995 amended in 2004, 2010 and 2012),
- the Forest Law (1995, amended in 2012 and 2013),
- the Law on Air (1995, amended in 2012),
- the Energy Law (2001, renewed in 2015),
- the Law on Waste, 2012,
- The Law on renewable energy, 2015,
- National Action Programme on Climate Change, 2000 (updated in 2011),
- Green development policy, 2014 (for the period 2014-2030),
- Sustainable development vision, 2016 (for the period 2016-2030),
- National agriculture development policy, 2010 (for the period 2010-2021),
- State policy on energy, 2015 (for the period 2015-2030),
- State policy on forest, 2015 (for the period 2016-2030),
- State policy on Industry, 2015 (for the period 2015-2030).

The **Environmental Protection Law** says that the citizens, economic entities and organizations shall compensate for direct damage caused to the environment and natural resources as a result of their unlawful conduct. The law imposes stricter sanctions against officials for their non-compliance with certain provisions and requirements. It means that the subject liable to pay compensation for damage caused to the environment will undergo an assessment by an environmental inspector who will decide the value of the compensation.

The renewed **Law on Air of Mongolia** clearly recognizes the power of the state and local self-governing bodies, the right of citizens, and the organization that is in charge of air quality matters to determine air quality, measure and test, as well as compile relevant data. Also, the law acted the actions to reduce air pollution.

The purpose of **Law on Forest** is to regulate the interrelation of protection, possession, sustainable use and reproduction of the forest and forest fire protection in Mongolia.

The purpose of the **Law on Waste** shall be to govern relationships related to the collection, transportation, storage, and landfill of waste and reusing of waste as a source of raw materials to prevent from and eliminate hazardous impact of wastes on public health and environment.

The new **Law on Soil Protection and Desertification Control** was adopted to combat desertification and mitigate the effects of drought, reduce environment pollution, improve land productivity and rehabilitation of land, enable human health and safety life, set up the liability mechanism.

In June 2014, the Parliament approved the Green Development Policy (GDP). The GDP was drafted by a working group within the Ministry of Environment and Green Development in

response to the Rio+20 Conference in 2012. Two high level documents were prepared to formally establish the GDP: the Green Development Concept, and the Mid-term Programme on Green Development. The concept paper determines the goals and purposes for green development until 2030, whereas the Mid-term Programme designs policy and strategies to ensure these goals and purposes are implemented.

The National Renewable Energy Programme (2015) established a long term goal of total installed capacity generated from renewable sources by 2030. The Renewable Energy Law (2015) further regulates the renewable energy power generation. It provides a feed-in tariff for the grid and the independent power generation from renewable energy. The new Law on Energy and Renewable energy target is to increase the share of renewable energy in total primary energy sources up to 20% by 2020, 25% by2025 and 30% by 2030.

Parliament also approved the Law on Hazardous and Toxic Chemicals (2006), the Law on Technology Transfer (1998) and the Law on Science and Technology (2006) to improve legal conditions for the transfer of modern technology for different sectors including transportation.

The government has also introduced a number of action plans, including the National Action Programme on Climate Change, the Mongolian Environmental Action Plan, the National Action Plan to Combat Desertification, the National Biodiversity Action Plan, the Action Programme to Protect Air Quality, and the National Action Programme to Protect the Ozone Layer.

The **National Action Programme on Climate Change** (NAPCC) is the most relevant policy document addressing climate change. It was approved by Parliament initially in 2000 and upgraded in 2011 and aimed to meet UNFCCC obligations and commitments, establishing national policy and strategy to tackle the adverse impacts of climate change and to mitigate GHG emissions. The NAPCC is to be implemented in two phases. The first phase (2011-2016) aims to strengthen national mitigation and adaptation capacity, setting up the legal environment, structure, institutional and management system, and improving community and public awareness and participation in climate change activities. The second phase (2017-2021) aims to implement climate change adaptation and mitigation measures.

Mongolia has joined 14 environment-related UN conventions and treaties, including the UNFCCC. Mongolia has submitted two National Communications and now preparing the third one. Mongolia has submitted NAMAs at the Conference of the Parties (COP) 15 Meeting in Copenhagen, Denmark in December 2009. Mongolia expressed its intention to agree to the Copenhagen Accord, and subsequently Mongolia submitted a list of proposed NAMAs to the UNFCCC secretariat in January 2010. In its list of NAMAs, Mongolia submitted 22 mitigation options in six sectors towards reducing GHG emissions.

The other important document pursuant to climate change is INDC. Mongolia INDC has outlined a series of policies and measures that the country commits to implement up to 2030, in the energy, industry, agriculture and waste sectors. The expected mitigation impact of these policies and measures will be a 14% (**Error! Reference source not found.**) reduction n total national GHG emissions excluding Land use, land-use change and forestry (LULUCF) by 2030, compared to the projected emissions under a business as usual scenario. Those and other potentially more ambitious commitments are contingent upon gaining access to

new technologies and sources of finance through internationally agreed mechanisms and instruments under the auspices of the UNFCCC.

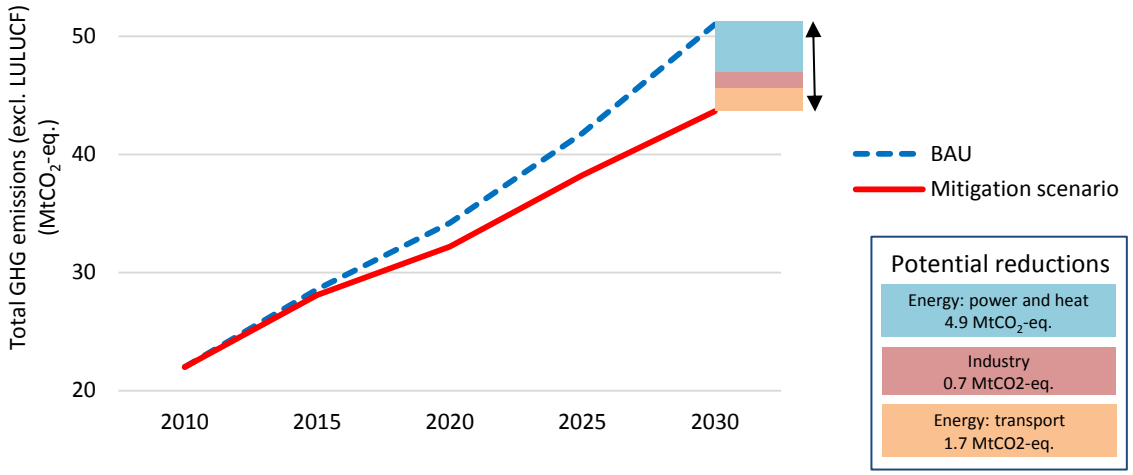

Figure 1.6 Indicative potential emissions reductions of the measures compared to BAU emissions

Institutional Arrangement

The Ministry of Environment and Tourism (MET) of Mongolia is the key ministry to develop, update and implement climate related policies. Thus, the MET is the national entity with the overall responsibility for organizing and coordinating the compilation of National Communications, Biennial updated reports, GHG inventory and submitting them to the UNFCCC Secretariat to integrate climate change-related issues in various sectors.

The former Ministry of Environment and Green Development has established interdisciplinary and inter-sectoral National Climate Committee (NCC), led by the Ministry of Environment and Green Development in order co-ordinate and guide national activities and measures to adapt to climate change and mitigate GHG emissions. High level officials such as Deputy Ministers, State Secretaries and Director-Generals of the main Departments of all related ministries, agencies and other key officials were designated as members of the NCC. However, due to frequent changes in the Government so far this Committee was not able to function as it was intended initially. There is a plan to create more simplified but more workable coordination mechanism with combined duties consistent with new government structure.

In 2016 given the importance of climate change adaptation and GHG mitigation, the MET has established “Climate Change and International Cooperation Department” merging mandate of the International Cooperation Division that was under State Policy and Administration Department of the MET and Climate Change Co-ordination Office to manage the implementation of the commitments and duties under the UNFCCC and the Kyoto Protocol, and to integrate climate change-related issues in other development programmes.

In 2015, the MET has set up Climate Change Project Implementation Unit (CCPIU) at the Nature Conservation Fund (name has changed as Environment and Climate Fund since 2017) engaging experienced professionals to facilitate smooth implementation of commitments under UNFCCC. The CCPIU supervised by National focal point for the

UNFCCC. There are three sectoral experts to conduct GHG inventory. The Institutional arrangement for climate change is shown in **Error! Reference source not found.**.

The major data provider is NSO (National Statistics Office). A number of other entities provide more specific data which is not available at National Statistics and required for GHG estimation. Such national entities include the Ministry of Energy (MoE), Ministry of Road and Transport Development (MRTD), Ministry of Food and Agriculture and Light Industry (MOFALI), Ministry of Construction and Urban Development (MCUD), CDM Bureau, the National Renewable Energy Centre, Ulaanbaatar Municipality, and National Customs Office.

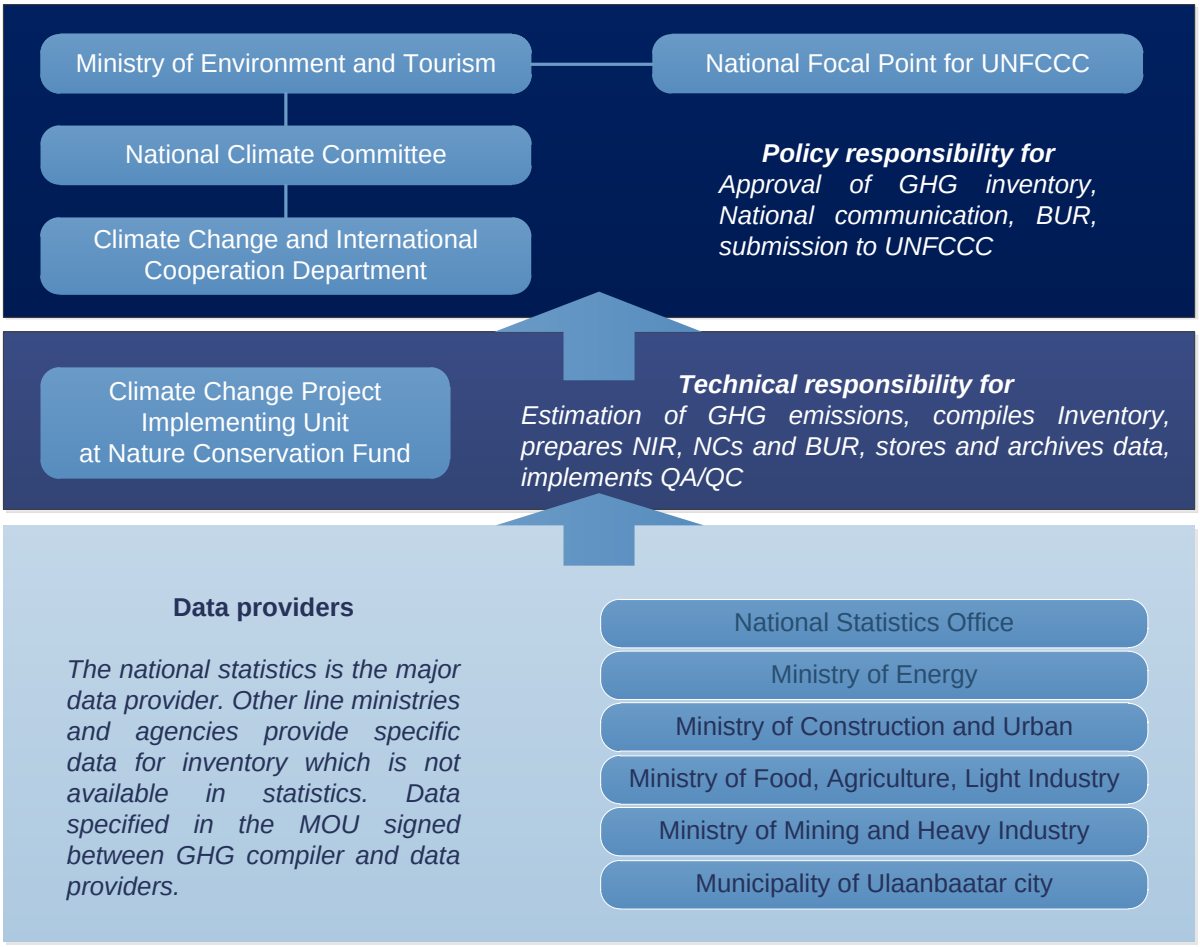

Figure 1.7 Institutional arrangement for climate change activities

Other entities involved in climate change and energy policy include the CDM Bureau, the National Renewable Energy Centre, and the Clean Air Foundation. The National Agency for Meteorology and Environment Monitoring (NAMEM) monitors the environment and climate, carrying out a range of climate change studies and research. In addition, the government is promoting activities to raise public awareness of climate change and its impacts through professional and civil society communities and media.

BUR Implementation Arrangement

The preparation of GHG inventory, national communications and Biennial Update Report are financed by GEF enabling activities through UNEP. Depending on activities or tasks, the MET appoints a project manager to undertake day to day coordination of the project. The

preparation arrangement of the first BUR of Mongolia is illustrated in **Error! Reference ource not found.**.

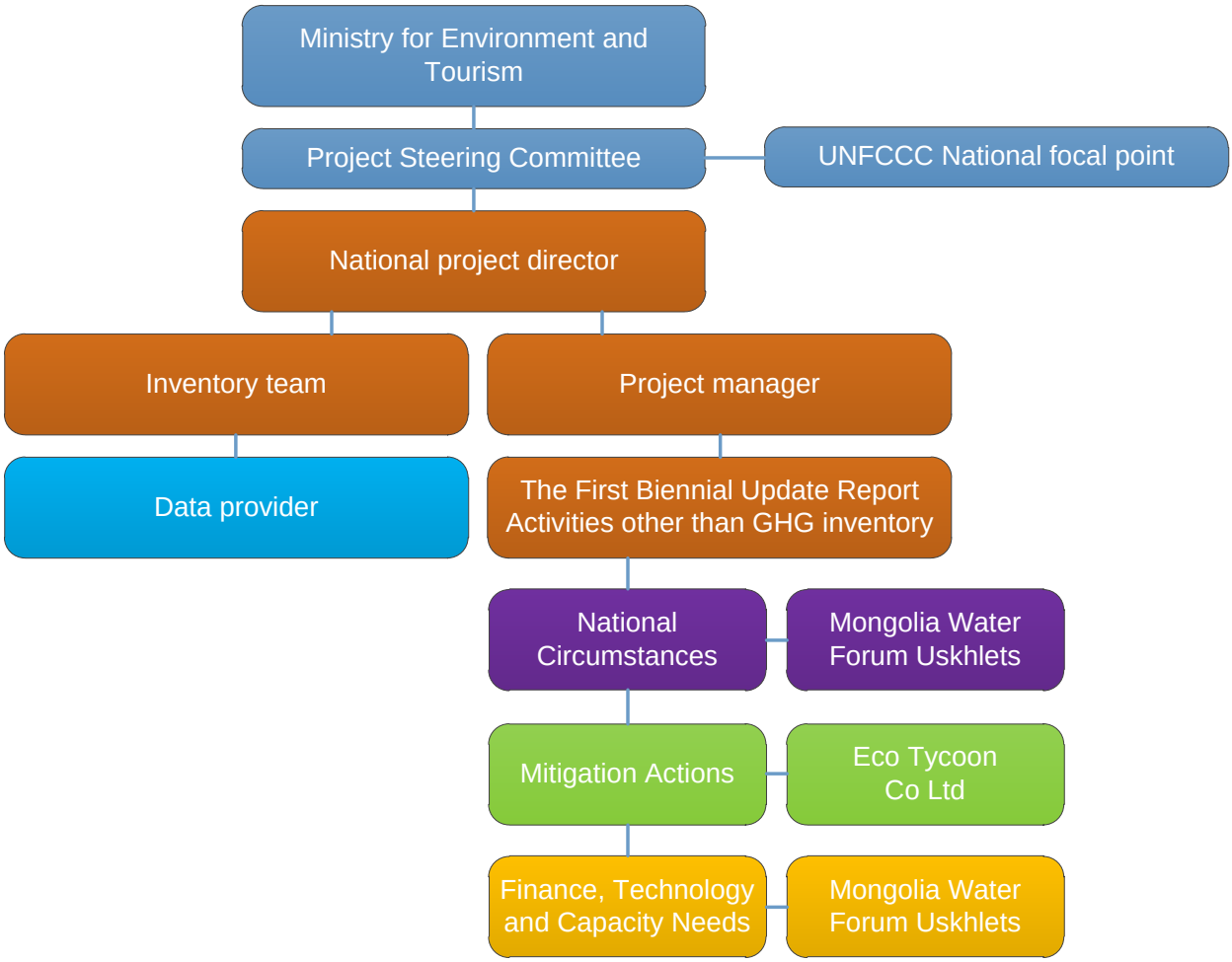

Figure 1.8 The First BUR implementation arrangement

For the improvement of the data collection and quality of GHG estimation, during the preparation of BUR, the MET of Mongolia signed a Memorandum of Understanding (MoU) on data exchange with major line ministries including MOE, MOFALI, MOI, MRTD, and MCUD. The Director of Nature Conservation Fund (Project executing organization) signed MoUs with major institutes and agencies such as CDM Bureau, the National Renewable Energy Centre, Ulaanbaatar Municipality, and National Customs Office in April, 2016.

The Government of Mongolia is continuously striving to improve national GHG estimation and reporting to the UNFCCC from INC to SNC and from SNC to the first BUR. To achieve continuous improvement in national reporting, Government of Mongolia has made institutional arrangements, specific for the nature and scale of the BUR preparation.

A number of institutions were engaged to conduct various studies for BUR, including those that especially carry out studies to identify constraints and gaps and related financial, technical and capacity needs, including information on financial support needed and received.

1.3 Financial, Technology and Capacity Needs

According to decision 2/CP.17, non-Annex I Parties are to provide updated information on constraints and gaps, and related financial, technical and capacity building needs, as well as updated information on financial resources, technology transfer, capacity-building and technical support received from the Global Environment Facility, Parties included in Annex II to the Convention and other developed country Parties, the Green Climate Fund and multilateral institutions for activities relating to climate change, including for the preparation of the current BUR.

Accordingly, this chapter presents information on the need for continued reporting of the GHG inventory under the Convention, and financial, technological and capacity building needs, constraints and finance received. The contents of this chapter should be read in conjunction with the information provided on technology and finance needs in SNC and TNC as the needs remain largely relevant for present reporting as well.

CHAPTER 2

National Greenhouse Gas Inventory

2. NATIONAL GREENHOUSE GAS INVENTORY

2.1 National Greenhouse Gas Inventory System

2.1.1 Overview of institutional arrangements for compiling GHG inventory

In accordance with Article 24 of the Law on Air (1995; 2012), the designated government authority shall estimate the emissions and removals of GHGs for Mongolia following the methodologies approved by the Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC).

The Ministry of Environment and Tourism (MET) of Mongolia is the key ministry to develop, update and implement climate related policies. Thus, the MET and its "Climate Change and International Cooperation Department" is the national entity with overall responsibility for organizing and coordinating the compilation of National Communications, Biennial updated reports, GHG inventory and submitting them to the UNFCCC Secretariat through the National focal point for the UNFCCC.

In order to facilitate smooth implementation of commitments under UNFCCC, the MET established climate change project implementation unit (CCPIU) at the Environment and Climate Fund (ECF) under the ministry. The CCPIU is also supervised by National focal point for the UNFCCC.

The inventory team of CCPIU, which consists of three sectorial experts, with the cooperation of relevant ministries, agencies and organizations, prepares the national GHG inventory and compiles supplementary information.

Figure 2.1 shows the overall institutional arrangement for Mongolia's inventory preparation. More detailed information on the role and responsibility of relevant ministries, agencies and organizations in the inventory preparation process is described in the Table 2.1.

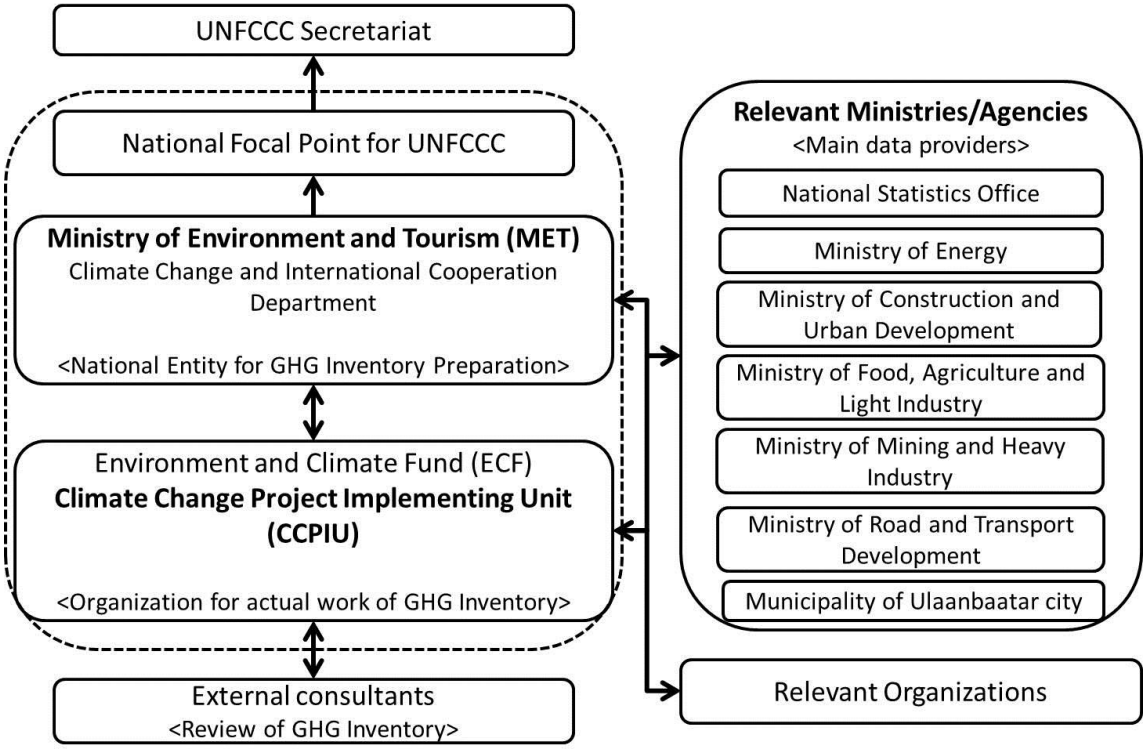

Figure 2.1 Institutional arrangement for the GHG inventory compilation of Mongolia

2.1.2 Overview of inventory preparation and management

As described above, the Mongolia's GHG inventory preparation system/institutional arrangement is not well developed, but in near future it is planned to establish a national system for sustainable inventory preparation. Currently the preparation of national GHG inventory is centralized and is being compiled at CCPIU of ECF under the ministry. The improvement should be made in near future is the decentralization of the inventory preparation process in terms of required activity data, and distribute the responsibilities of individual sectors fully under the external institutions and sectorial experts. Under the distribution of responsibilities can be understood activity data collection and its analysis on continuous basis, and provide activity data to GHG inventory team at CCPIU, so that the GHG inventory can be compiled. The main source of activity data collection is the National Statistics Office (NSO) of Mongolia and relevant institutions shown above in the figure. Additional statistics from international sources were used such as International Energy Agency (IEA), Food and Agriculture Organization (FAO) and World Bank (WB). Some assumptions were made for unavailable activity data in order to complete the time series.

The national system for sustainable inventory preparation is utmost important for the continuous, robust and decentralized preparation of a national GHG inventory. The next table provides more detailed information about the current preparation process of national GHG inventory. The GHG inventory team consists of three specialists of CCPIU, of each responsible for energy and IPPU, AFOLU, and waste sectors.

Table 2.1 Activities and responsibilities of each entity involved in the preparation process

Phase	Activities	Responsible entities	Description
Measurement & Reporting	Revision of relevant guidelines and previous inventory	CCPIU	- Revise the activity and input data, taking into consideration data gaps and areas, where needed improvements, identified in previous GHG Inventories

			- Identify the major sectors and institutions holding data and information required for inventory
	Gather activity data, emission factors and coefficients	CCPIU & Relevant entities	- Discuss, agree and sign MOU with line entities for the data request from relevant ministries, agencies and organizations - Collecting information required for GHG inventory
	Prepare initial estimates and draft report	CCPIU	- Conduct sectorial and national GHG estimation - Prepare draft of the National Inventory Report (NIR) and estimation tables (CRF)
	Expert and interagency review	CCPIU & Relevant entities	- Organize review and validation workshops with relevant ministries, agencies and organizations - Confirm data provided for the preparation of the inventory
Verification	Internal (QC)/External Review (QA)	CCPIU and external consultants	- Verification of the drafts of sectorial NIR and CRF - Preparation of the final draft of the NIR and CRF
Approval & Deliberation	Final review and approval	MET, CCICD	- Approval of the official version of the national GHG inventory
	Submission	MET, CCICD and NFP for the UNFCCC	- Submission of NCs/BURs and NIR to UNFCCC Secretariat
Publication	Archiving and publication	CCPIU	- Archiving of the relevant data and documentations - Publishing and distributing the national GHG inventory to the public

2.2 TRENDS IN GREENHOUSE GAS (GHG) EMISSIONS

2.2.1 Description and interpretation of emission trends for aggregated GHG emissions

The main sources of GHG emissions have been divided into the following sectors: Energy (CRF 1), Industrial Processes and Product Use (IPPU, CRF 2), Agriculture (CRF 3), Land use, Land use change and Forestry (LULUCF, CRF 4) and Waste (CRF 5).

Total GHG emissions in Mongolia in 2014 were 34,482.73 Gg CO_2e (excluding LULUCF). This represented 57.09% increase from the 1990 level of 21,950.73 Gg CO_2e and 5.49% increase from the 2013 level with 32,687.27 Gg CO_2e. Net GHG emissions in 2014 were 10,030.80 Gg CO_2e (including LULUCF). This represented 1,034.44% increase from the 1990 level of -1,073.46 Gg CO_2e and 23.23% increase from the 2013 level with 8,139.60 Gg CO_2e (Figure 2.2 and Table 2.2).

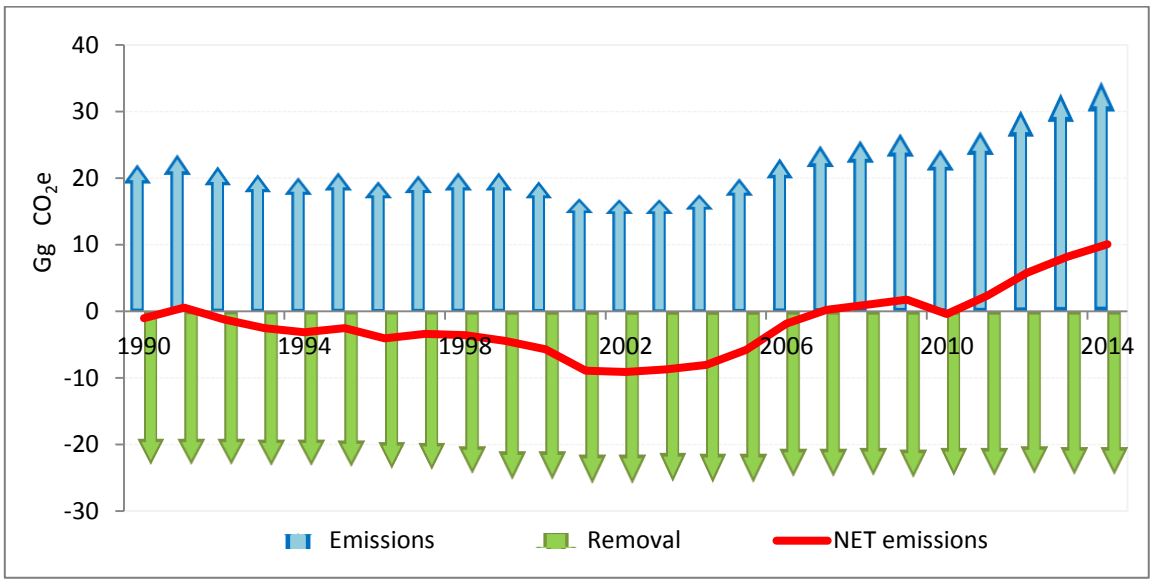

Figure 2.2 Mongolia's total and net GHG emissions and removals, 1990-2014 (Gg CO2e)

In general, emission and removal from each sector increased in 2014 comparing to the base year and differences are showed in Table 2.2 by percentage changes and absolute values of each GHG inventory sectors.

Table 2.2 Mongolia's GHG emissions/removals by sectors in 1990 and 2014

Sector	Emissions, (Gg CO_2e) *1990*	*2014*	Change from 1990 (Gg CO_2e)	Change from 1990 (%)
Energy	11,091.14	17,267.79	6,176.64	55.69
IPPU	218.66	328.06	109.39	50.03
Agriculture	10,585.30	16,726.98	6,141.68	58.02
Waste	55.62	159.91	104.29	187.49
Total (excluding LULUCF)	21,950.73	34,482.73	12,532.00	57.09
LULUCF	-23,024.18	-24,451.93	-1,427.75	6.20
Net total (including LULUCF)	-1,073.46	10,030.80	11,104.26	1,034.44

GHG emissions in 2014 from the energy sector were 17,267.79 Gg CO_2e accounting for 50.08% of total national emissions. The second highest sharing of the total emission were from the Agriculture sector with 16,726.98 Gg CO_2e accounting for 48.51%. Emissions from IPPU and Waste sector contributed 328.1 Gg CO_2e (0.95%) and 159.91 Gg CO_2e (0.46%) respectively to the national total in 2014 (Figure 2.3).

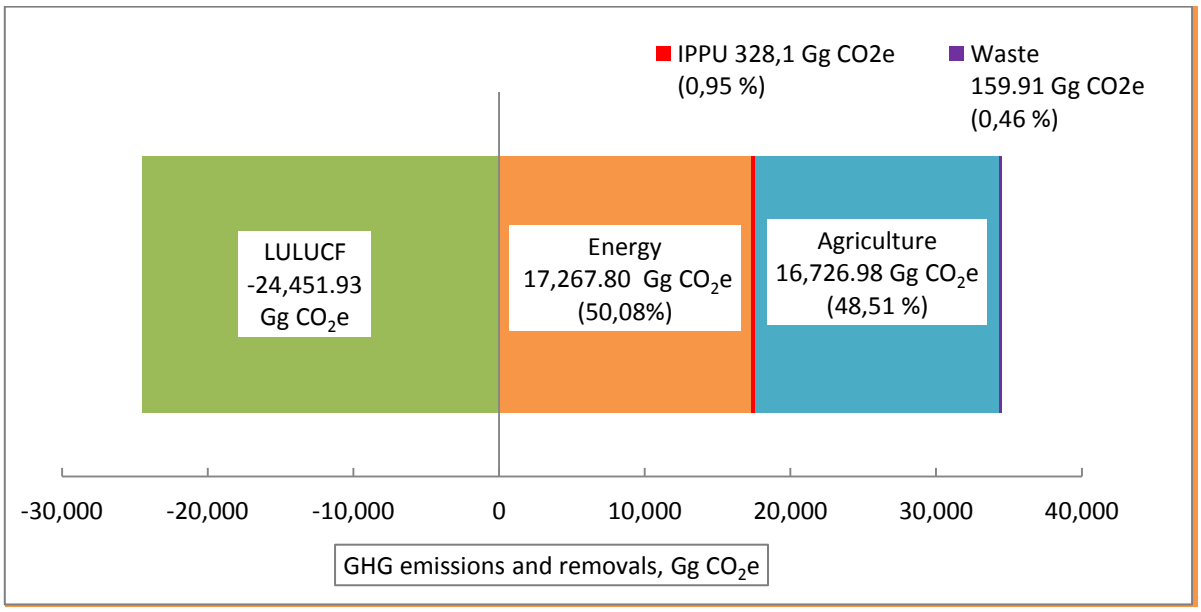

Figure 2.3 The composition of Mongolian GHG emissions by sectors in 2014

Table 2.3 shows that average annual growth rates (AAGR) of every 5 years within inventory period by sectors and by national totals. The average annual growth rates of Energy and IPPU sector were decreasing 1990-1995 and 1996-2000 subsequently and then increased up to 7.05% and 9.03% between 2011 and 2014. The agriculture sector's growth rate shows rise and decline between 1990 and 2014, the highest annual average growth rate percentage occurred from 2011 to 2014. On the Waste sector, the rapid increase of growth rate percentage observed from 1996 to 2014 continuously. In countrywide, from 1990 to 2014, the average annual growth in total emissions was 2.17% per year.

Table 2.3 Average annual growth rates, %

Sector	1990-1995	1996-2000	2001-2005	2006-2010	2011-2014	1990-2014
Energy	-3.71	-2.98	5.55	6.49	7.05	2.29
IPPU	-15.2	-4.69	24.23	14.82	9.03	5.50
Agriculture	2.18	0.38	-2.81	2.51	12.01	2.47
Waste	0.05	3.49	4.78	5.38	10.27	4.57
Total (excluding LULUCF)	-0.94	-1.21	0.77	4.39	9.26	2.17
LULUCF	0.29	1.53	0.38	-0.77	-0.22	0.26

The aggregated GHG emissions and removals by sectors between 1990 and 2014 are shown in Table 2.4 including national total emissions with and without LULUCF. The trends of emission and removal from the sectors were shows different pattern along the time series and main factors affected to trend fluctuation in each sector are written in the National Inventory Report.

Comparing to the 1990, sectoral emission increase for the Energy sector were 55.69%, for the IPPU sector were 50.03%, for the Agriculture sector were 58.02, for the Waste sector 187.49% and removal for the LULUCF sector were 6.2% in 2014.

Comparing to the 2013, sectoral emission for the Energy sector were -2.78%, for the IPPU sector were 37.72%, for the Agriculture sector were 15.05%, for the Waste sector 7.93% and for the LULUCF sector were -0.39% in 2014.

Table 2.4 The aggregated GHG emissions and removals by sectors, Gg CO2e

Year	Energy	IPPU	Agriculture	Waste	LULUCF	Total (incl. LULUCF)	Total (excl. LULUCF)
1990	11,091.1	218.7	10,585.3	55.62	-23,024.2	-1,073.46	21,950.73
1991	12,880.0	144.2	10,407.3	56.18	-22,950.7	537.04	23,487.74
1992	11,225.4	107.6	10,348.6	54.96	-22,992.0	-1,255.57	21,736.47
1993	10,407.6	70.2	10,021.9	53.66	-23,099.4	-2,546.15	20,553.30
1994	9,093.7	83.7	10,807.3	54.00	-23,212.8	-3,174.01	20,038.77
1995	8,920.7	82.8	11,719.8	55.71	-23,364.2	-2,585.18	20,778.97
1996	7,290.9	82.3	12,067.6	56.56	-23,596.9	-4,099.54	19,497.35
1997	7,094.5	86.9	13,093.5	58.27	-23,762.2	-3,429.03	20,333.19
1998	7,204.3	84.1	13,423.7	58.58	-24,407.4	-3,636.79	20,770.65
1999	7,174.9	78.4	13,525.3	62.71	-25,328.8	-4,487.43	20,841.39
2000	7,528.9	63.9	11,790.5	66.04	-25,188.4	-5,738.98	19,449.40
2001	7,547.5	50.4	9,224.5	68.45	-25,829.0	-8,938.13	16,890.83
2002	8,068.8	92.0	8,485.0	74.16	-25,884.4	-9,164.41	16,719.95
2003	7,967.0	97.0	8,646.2	76.52	-25,547.4	-8,760.70	16,786.74
2004	8,125.5	83.5	9,265.4	79.03	-25,639.7	-8,086.33	17,553.35
2005	9,738.3	140.5	9,881.3	83.33	-25,658.1	-5,814.68	19,843.41
2006	11,503.2	140.0	11,133.6	87.74	-24,750.2	-1,885.59	22,864.60
2007	11,930.8	155.7	12,729.7	92.25	-24,757.6	150.90	24,908.49
2008	11,919.8	182.3	13,451.4	97.65	-24,716.1	935.05	25,651.14
2009	12,491.4	157.6	13,909.4	103.10	-24,950.9	1,710.48	26,661.42
2010	13,227.3	251.6	10,635.7	108.26	-24,670.9	-447.93	24,222.94
2011	14,823.8	256.0	11,723.0	122.14	-24,636.3	2,288.64	26,924.97
2012	16,358.0	300.6	13,308.7	137.79	-24,377.0	5,728.00	30,105.05
2013	17,762.1	238.2	14,538.8	148.17	-24,547.7	8,139.60	32,687.27
2014	17,267.8	328.1	16,727.0	159.91	-24,451.9	10,030.80	34,482.73

Two main sources of the total emission were Energy and Agriculture sector for all years of the inventory. However, percentage share of emission sources were varied year by year depending on economic and climatic factors such as demand increase in energy sector and natural disaster occurrence in agriculture sector. Figure 2.4 shows that contribution of sectors to the Mongolia's total emissions for the period 1990-2014.

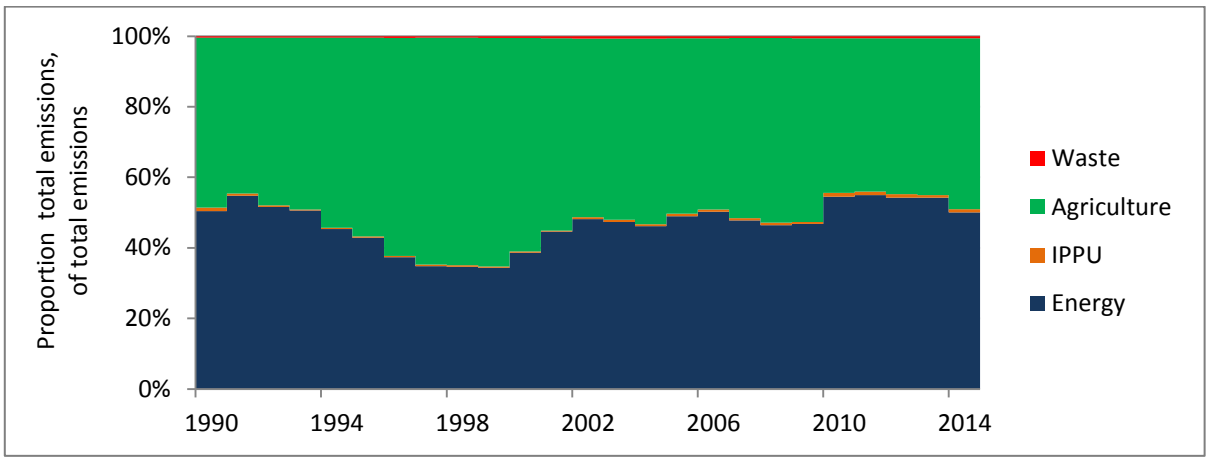

Figure 2.4 The contribution of sectors to Mongolia's total emissions for the period 1990-2014

CHAPTER 3

Mitigation Actions and Their Effects

3. MITIGATION ACTIONS AND THEIR EFFECTS

Mongolia has submitted its Intended Nationally Determined Contributions (INDC) to UNFCCC on September 24, 2015. On its INDC, Mongolia set the target to mitigate GHG emission by 14% in economy-wide range excluding agriculture sector by 2030 compared to 2010 level. To assess overall mitigations actions to identify the future trends, the actions, policies and programs implemented or will be implemented through the national and sectorial policy framework and counter measures are considered. The assessment is based on the implementation of policies and programs which are implemented from 2007 to 2015. The key national policy documents on GHG mitigations actions are Sustainable Development Vision 2030 (2016), State Policy on Food and Agriculture (2016), State Policy on Forest (2015), State Policy on Energy (2015), Green Development Policy (2014) and National Program on Waste Management Improvement (2014). The key policies and actions are outlined to assess the future projections and current status of GHG mitigation actions and their effects.

3.1 International Market mechanism

3.1.1 Clean Development Mechanism (CDM)

Mongolia has five registered projects under the CDM. In total, 699,177 CERs were issued to the four CDM projects in Mongolia. The tables 3.1 overview of CDM projects in Mongolia.

Table 3.1 The status of Clean Development Mechanism project in Mongolia

№	Project title	Scale	Host parties	Registration status	Project status	Emission reduction per year
1	Project 5977: Salkhit Wind Farm	Large	Mongolia Sweden	Registered 30 Mar 12	Based on the monitoring reports (7) between 24 Jun 2013 - 31 Dec 2016, amount of **505,740** CERs were issued	178,778 metric tons CO2
2	Project 0786: Durgun Hydropower Project in Mongolia	Small	Mongolia Japan	Registered 23 Mar 07	Based on the monitoring reports (3) between 01 Nov 2008 - 31 May 2012, **57,768** of CERs were issued.	30,400 metric tons CO2
3	Project 0787: Taishir Hydropower Project in Mongolia	Small	Mongolia Japan	Registered 16 Mar 07	Based on the monitoring reports (4) between 01 Nov 2008 – 31 May 2012, **19,182** of CERs were issued	29,600 metric tons CO2
4	Project 0295: A retrofit programme for tones38ralized heating stations in Mongolia.	Small	Mongolia	Registered 28 Jul 06	No issuance requests	11,904 metric tons CO2
5	PoA 8142: MicroEnergy Credits – Microfinance for Clean Energy Product Lines - Mongolia	Small	Mongolia, UK, Northern Ireland and Sweden	Registered 12 Nov 12	Based on the monitoring reports (2) between 01 Aug 2013 – 30 Apr 2016, **116,487** of CERs were issued	50,133 metric tons CO2

Source: https://cdm.unfccc.int/Projects/projsearch.html

3.1.2 Joint crediting mechanism (JCM)

The Joint Crediting Mechanism (JCM) is a program in which Japan's initiative in pursuit of the ultimate objective of the UNFCCC. On January 8, 2013, Government Mongolia and Japan signed in Ulaanbaatar, Mongolia, a bilateral document "Low Carbon Development Partnership" which concerning the JCM. Both countries are established a joint committee to operate the JCM. This Japan-Mongolia partnership is the first partnership signed by Japan for this purpose. Under the partnership, joint study has been taken in energy supply-improve Combined Heat and Power (CHP) Plant to identify Business as Usual (BAU) and NAMA scenario in the Energy Supply Sector. Total of 18 projects have been taken between 2013 - 2017 fiscal year with contribution of Ministry of Environment Japan's subsidy and Ministry of Economy, Trade and Industry Japan. Out of total projects, 14 feasibility studies and demonstration and model projects are conducted. As of fiscal year 2017, three projects are selected as model project under the financing scheme for JCM model projects by the Ministry of Environment of Japan.

Mongolia has four registered JCM projects in the energy sector. The four projects' total volume of expected emission reduction is 13,465 tCO_2 per year. In 2016, Mongolia issued its first CERs from registered projects under the standards MN_001 and MN_002 which are equivalent to 157 CERs in total (Table 3.2). Upon the discussion between each side, Mongolia received 32 CERs while Japan received 125 CERs.

Table 3.2 Issuance of credits under the JCM scheme of Mongolia

№	Project title	Host parties	Registration status	Project status	Emission reduction per year
1	MN_001: Installation of high-efficiency Heat Only Boilers in 118th School of Ulaanbaatar City Project	Mongolia Japan	Registered 29 Sep, 2016	50 CERs were issued	92 tones CO2
2	MN002: Centralization of heat supply system by installation of high-efficiency Heat Only Boilers in Bornuur soum Project	Mongolia Japan	Registered 29 Sep, 2016	107 CERs were issued	206 tones CO2
3	MN003: Installation of 2.1MW Solar Power Plant for Power Supply In Ulaanbaatar Suburb	Mongolia Japan	Registered 26 May 17	Monitoring period	1,946 tones CO2
4	MN004: 10MW Solar Power Project in Darkhan City	Mongolia Japan	Registered 26 May 17	Monitoring period	11,221 tones CO2

Source: https://www.jcm.go.jp/mn-jp.

3.2 Mitigation actions and their effects[1]

The key sectorial policies and measures toward to mitigate GHG emission are outlined in Figure 3.1. It includes the actions that reflected to previous assessments and updated documents at the national level to identify the status of current and future mitigation scenarios.

[1] Please see the Annex for the quantitative data used for estimating the mitigation actions and effects expressed by the figures in this section.

Table 3.3 Mongolia's' climate change mitigation policies and actions

Total	**Year**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2025**	**2030**
	Projected emissions level [BAU] (mln tons CO2eq.)	**19.4**	**21.2**	**23**	**24.6**	**25.5**	**27.4**	**31.1**	**32.8**	**34.6**	**36.4**	**38.2**	**47.4**	**57.6**
	Emission target (mln tons CO2eq.)	**19.4**	**21.1**	**22.9**	**24.5**	**25.2**	**26.5**	**28.7**	**29.3**	**29.9**	**30.6**	**31.3**	**36.6**	**42.5**
	Reduction rate, %	**0.3**	**0.4**	**0.5**	**0.5**	**0.9**	**3.2**	**7.6**	**10.7**	**13.5**	**16**	**18.2**	**22.7**	**26.1**
Energy	**To increase the share of renewable energy in the energy production**										20% by 2020		30% by 2030	
	To reduce system loss in distribution and delivery and ineffective consumption									Internal usage of CHP 11.2% and loss 10.8% in 2020			9.1% and 7.8% by 2030	
	To decrease heat loss in buildings and increase energy efficiency											20% by 2020		40% by 2030
	Reduce fuel consumption of vehicles and engines						Reach length of tarmac road at 8000km by 2015				Reach length of tarmac road at 11000km by 2021 and electrify main rail roads			
	Increase number of gas and fuel efficient vehicles											Increase share of public transportation 13% by 2030		
Industry	**Introduce dry technology in cement production**												Fully introduced by 2030	
	Increase productivity through advanced technology									Share of processing industry in export 15% by 2020			25% by 2025	
	Supply fuel demand by domestic production								Euro 4 standard 20% by 2020		Euro 5 standard 70% by 2025		Euro 5 standard 100% by 2030	
Livestock	**To decrease livestock number**					43288.0 thous by 2008 and 35298.9 thous by 2015				36475.6 thous by 2021		1.5 times in 2021 and 5 times increase in export		
	To improve livestock productivity and to increase the export of raw materials						In 2015 increase total supply of meat production by 1.6 times compared to the level of 2008, increase export three times							
	To retain the proper ratio of the number, type and structure of the herd				Increase number of camel by 0.2%, horse by 1.7%, cattle by 3.8%, sheep by 3% and decrease number of goat by 8.7% in herd stucture by 2015 compared to the level of 2008						Increase number of camel by 0.3%, horse by 3.1%, cattle by 8%, sheep by 2.7% and decrease number of goat by 14.1% in herd structure by 2021 compared to the level of 2008			
Agriculture	**To establish forest strip zone in arable land**	To ensure legal framework, to build enclosure to protect soil from erosion of wind and water												
	To increase the yield of 1 ha										17.3 centner/ha yield of 1 ha by 2020		Yield 20.0 centner/ha by 2025	
	To reject traditional technology of plough	Encourage and support zero and reduced tillage technology												
Forest	**To increase naturally regenerated and planted forest area**										310 thous.ha by 2020		1500.0 Thous.ha by 2030	
	To decline forest area affected by fire and insect										30% fire and 60% insect by 2020		70% fire and insect 100% by 2030	
Waste	**Reduction**	To reduce depletion of resources and raw materials, to reduce waste through effective production, to introduce zero waste technology												
	Recycling								To increase four times by 2018 compared to 2013		To increase 7.6 times by 2022 compared to 2013			
	Reproduction											20% of waste in 2020	30% of waste in 2025	40% of waste in 2030
	Incineration										To reduce by 20% in 2020		To reduce by 40% in 2030	

The projected GHG emissions and removal by sources/sinks in BAU scenario is outlined in Figure 3.2. If the actions described on the national policies and programs (Figure 3.1) are implemented completely, GHG emissions can be reduced about 25% in 2025 and about 28% in 2030. Due to lack of data availability on certain sectorial GHG emissions, the projected emission reduction could be higher.

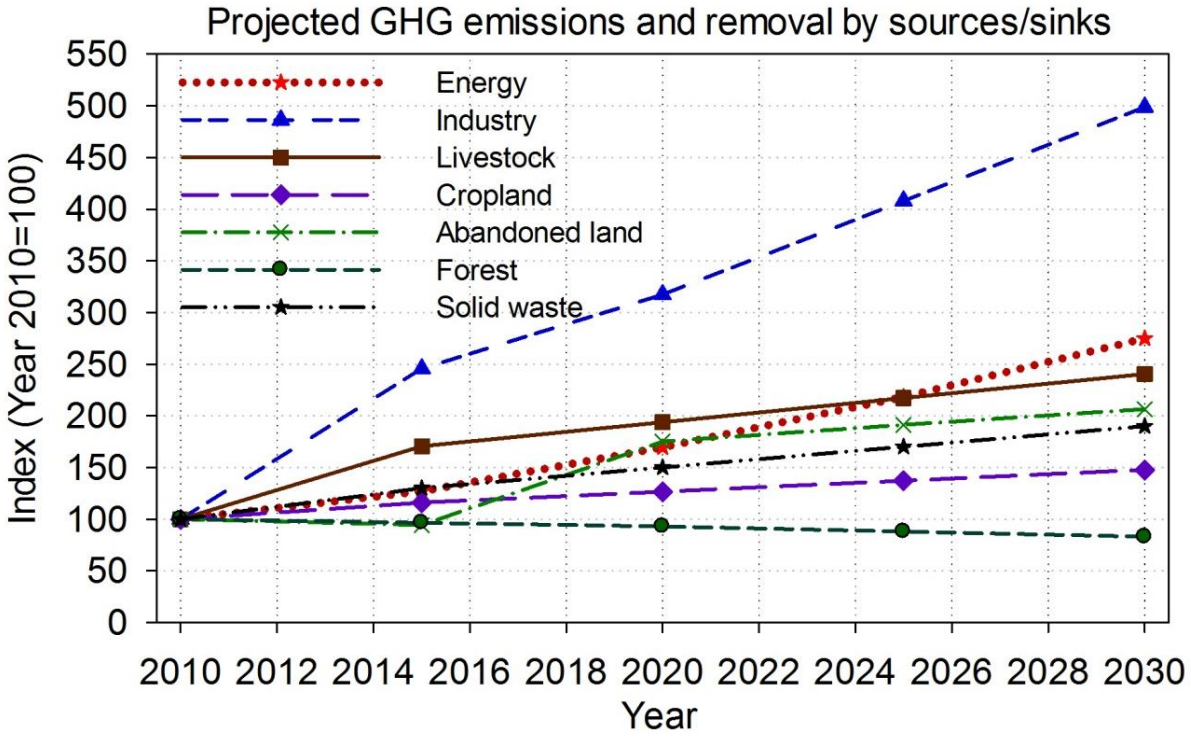

Figure 3.1 Projected GHG emissions and removal by sources/sinks by sectors, BAU

In 2030, GHG emissions in BAU scenario using 2010 as the base year is projected that 2.7 times of reduction in energy sector, 5.0 times of reduction in cement production, 2.4 times of reduction in livestock sector, 1.5 times of reduction in agriculture, 1.9 times in of reduction waste sector, while removal of follow land decreased by 2.1 times and forest removal potential is expected to increase.

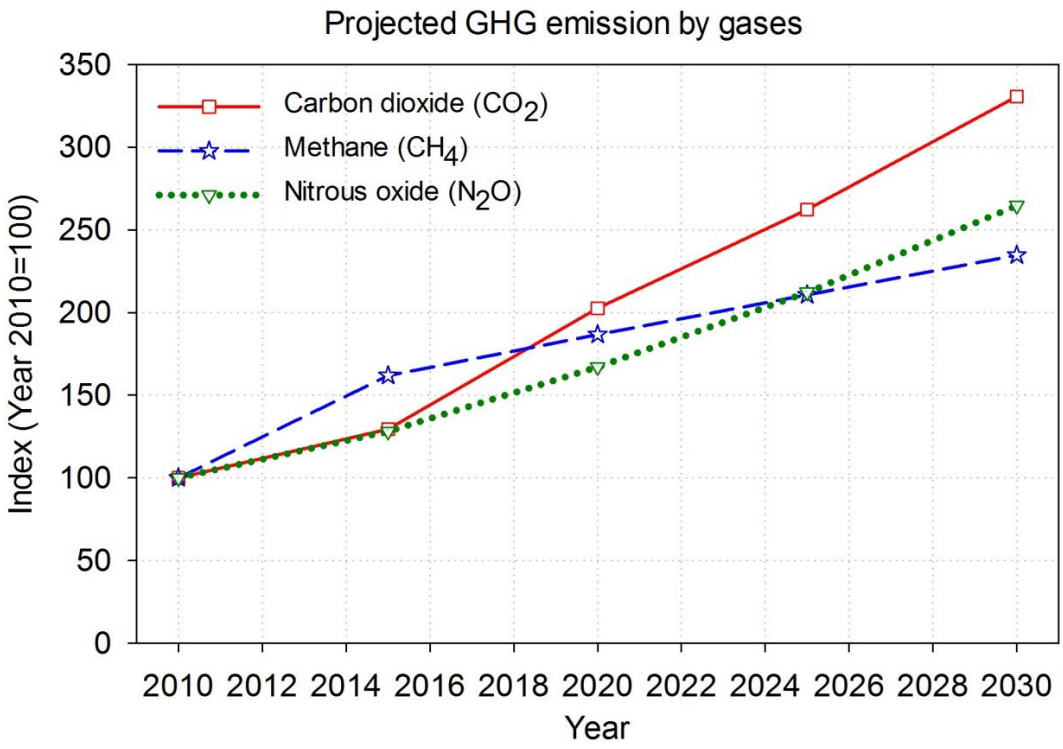

Figure 3.2 Projected total GHG emissions by gases, BAU

In 2030, GHG emissions by gases in BAU scenario using 2010 as the base year is projected that 3.3 times increase of carbon dioxide (CO2), 2.3 times increase of methane (CH4), 2.6 times increase of Nitrous oxide (N2O).

3.2.1 Energy

The key policies toward to mitigate GHG emissions in energy sector includes “Law on Energy” (approved on 2001, updated on 2015), “Law on renewable energy” (approved on 2007, updated on 2015) and “Law on energy saving” (2015). Green Development Policy, State policy on energy and Sustainable development vision 2030 are also considered as the key policy documents. Mongolia put the goal to reduce the GHG emissions by 2% from the current levels in 2020, by 7% in 2025 and by 14% by 2030 by promoting renewable energy sources, introduce advanced technologies in liquefying and carbonating coal and shale. Increase energy efficiency and share of renewable energy are the two main approaches to policies and actions to mitigate GHG emissions. Table 3.3 outlines the policies and measures on mitigation and its status of implementation.

Table 3.4 Policies and measures to mitigate GHG emissions in energy sector

1. To increase share of renewable energy in total energy generation		
National Renewable energy program		Implementation
2005-2010	2011-2020	Three large scale and six small scale hydropower plants are in operation. Total power generation capacity is 25,975MW (GM, 2015). 11MW Taishir Hydro Power Plant is in
-To be commissioned Durgun and Taishir hydro power plants	-To connect and operate Durgun and Taishir hydro power plants to Western	

<table>
<tr><td>-To launch construction of Orkhon Hydro Power Plant

-To fully implements the national photovoltaic program “100,000 Solar Ger[2]”

-To study the wind energy resources of Salkhit mountain and other potential sites</td><td>Energy System

-To commission Orkhon hydro power plants

- To fully supply renewable energy sources to remote settlement areas

-To build 30-50MW wind parks and connect to Central Energy System (CES)</td><td rowspan="11">operation since 2008, due to scarcity of water current power generation is from 3.5MW to 4.1MW (GM 2015). Annual production is 12.4GWH and total energy production was 87.2GWH by 2015 (ERC, 2015). From November 2008 to May 2012, 19,182tCO2e of CERs are issued (UNFCCC, 2016b).

12MW Durgun Hydro Power Plant is in operation since 2008, total energy production was 200.2GWH by 2015 (ERC, 2015). From November 2008 to May 2012, 57,768tCO2e of CERs are issued (UNFCCC, 2016b).

50MW Salkhit wind Park is in operation since 2013, total energy production was 330.8GWH by 2015 (ERC, 2015). From June 2013 to June 2016, 437,538tCO2e of CERs are issued (UNFCCC, 2016b).

From 2000 to 2012, 100,146 photovoltaics with 5MW capacity has been distributed to rural households through the “100,000 Solar Ger” program (IEA, 2016).

Since December 2016, solar PV with capacity of 10MB is operationalized in Darkhan city (GEC, 2016).

In 2014, the share of renewable energy in installed energy generation is 7.62% (State Great Khural 2015c).</td></tr>
<tr><td colspan="2">National Action Program on Climate Change</td></tr>
<tr><td>2011-2016</td><td>2017-2021</td></tr>
<tr><td>Renewable energy will account for 10% of total national energy production</td><td>Renewable energy will account for 20% of total national energy production</td></tr>
<tr><td colspan="2">Green Development Policy
(State Policy on Energy)</td></tr>
<tr><td>2014-2020 (2015-2023)</td><td>2021-2030 (2024-2030)</td></tr>
<tr><td>Share of renewable energy will account for 20% of total national energy production</td><td>Share of renewable energy will account for 30% of total national energy production</td></tr>
<tr><td colspan="2">Sustainable Development Goal of Mongolia</td></tr>
<tr><td>2016-2020</td><td>2021-2035</td><td>2026-2030</td></tr>
<tr><td>Share of renewable energy will account for 20% in total installed capacity of energy production</td><td>Share of renewable energy will account for 25% in total installed capacity of energy production</td><td>Share of renewable energy will account for 30% in total installed capacity of energy production</td></tr>
<tr><td colspan="3">2. Reduce inefficient use of energy and loss in transmission and distribution</td></tr>
<tr><td colspan="2">State Policy on Energy</td><td>Implementation</td></tr>
<tr><td>2015-2023</td><td>2024-2030</td><td rowspan="2">In 2015, following actions are executed: build a 17km transmission line for 1,200 households, build new power substations and reduce overloads of five feeders in suburban areas of Ulaanbaatar (MET 2015b).

The internal energy use of CHP plants reduced from 14.4% in 2014 to 14.1% in 2015; electricity transmission and distribution losses are reduced from 14.7% in 2014 to 14.2% in 2015 (NSO,</td></tr>
<tr><td>Reduce internal energy use of CHP plants to 11.2% and electricity transmission losses to 10.8%</td><td>Reduce internal energy use of CHP plants to 9.1% and electricity transmission losses to 7.8%</td></tr>
</table>

[2] Ger- Yurt, *Mongolian* traditional dwelling

<table>
<tr><td colspan="2"></td><td>2015).</td></tr>
<tr><td colspan="3">3. Reduce building heat loss and increase energy efficiency</td></tr>
<tr><td colspan="2">Green Development Policy
(State Policy on Energy) Construction NAMA, 2016</td><td>Implementation</td></tr>
<tr><td>2014-2020 (2015-2023)</td><td>2021-2030 (2024-2030)</td><td rowspan="8">In an effort to contribute to air pollution reduction in Ulaanbaatar and in frame of CDM, Xac Bank initiated Eco Product Distribution Program in 2009, and have provided energy efficient stoves and Ger insulation blankets with discount rate to ger area residents in Ulaanbaatar. As a result, 31,767tCO2e of CERs are issued from 2013 to 2016 (UNFCCC, 2016b).

By 2016, “Heat innovation of panel apartment buildings in cities of central region technical project” unit is established with the purpose to reduce heat loss in substantial amount and to reduce heat consumption by 30%. However, due to lack of secure funding the implementation is in stagnation.

By the decision of the Government to support the usage of electric heat, reduced night tariff of electricity by 50% in December of 2015 and 120,000 households involved (MET 2015).
Construction NAMA project has been registered to NAMA Registry (UNFCCC, 2016a).</td></tr>
<tr><td>Reduce building heat loss by 20%</td><td>Reduce building heat loss by 40%</td></tr>
<tr><td colspan="2">National Action Program on Climate Change</td></tr>
<tr><td>2011-2016</td><td>2017-2021</td></tr>
<tr><td colspan="2">Improvement in energy saving and efficiency through the introduction of policies, measures and environmentally friendly technologies</td></tr>
<tr><td colspan="2">Construction NAMA</td></tr>
<tr><td colspan="2">To remove barriers to increased adoption of energy efficiency technology in construction sector through establishment of baseline energy consumption and GHG emission in the construction sector, development and implementation of Measuring, Reporting and Verification (MRV) system</td></tr>
<tr><td colspan="3">4. Reduce consumption of solid and liquid fuels through improvement in infrastructures of road and transport</td></tr>
<tr><td colspan="2">Millennium Development Goals (MDGs)-based Comprehensive National Development Strategy of Mongolia</td><td>Implementation</td></tr>
<tr><td>2007-2015</td><td>2016-2021[4]</td><td rowspan="4">The length of paved roads reached from 2597.2km in 2007 to 7125.3km in 2015. Implementation status is 89.1% (NSO, 2015).
Made railway embankments in Aimags[3] of Gobi region. Due to lack of secure funding the construction work is in stagnation (MET 2015b)

NAMA Urban Passenger Transport Ulaanbaatar project has been registered to NAMA Registry (UNFCCC, 2016a) with focus to mitigate air pollution of Ulaanbaatar and thereby reducing GHG emissions.</td></tr>
<tr><td>The length of paved roads reached 8,000 km. Construction of railroad in Gobi and Eastern region accomplished by 60% and 70% of the construction work of the second railroad completed. Electrification of the main railroad ensured</td><td></td></tr>
<tr><td colspan="2">Mongolia Sustainable Development Vision 2030</td></tr>
<tr><td>2016-2020</td><td>2021-2035</td><td>2026-2030</td></tr>
</table>

[3] Aimag- Prefectures of Mongolia

[4] In pursuant with the approval of the resolution, the Mongolian Parliament Resolution No. 26 dated May 3, 1996 on the approval of “Mongolia’s Development Vision,” and the Mongolian Parliament Resolution No. 12 dated January 31, 2008 on the approval of “Millennium Development Goals (MDGs)-based Comprehensive National Development Strategy of Mongolia” shall be nullified.

Build transportation and logistics centers at Zamiin-Uud, Khushigiin Khundii and Altanbulag, extend asphalt roads for international and domestic travels by 1600 km, build and use the railroad from Ukhaa Khudag to Gashuun Sukhait, initiate construction of railroads from Erdenet-Ovoot to Bogd khaan, and develop transit transportation	Build and use transportation and logistics centers to serve the agricultural, industrial and mining sectors, develop new forms of transportation; extend the domestic asphalt roads length by 800 km, complete the construction of railroads from Erdenet - Ovoot to Bogd khaan, and initiate the railroad construction work in the regions	Develop new transportation and logistics centers, extend asphalt roads for international and domestic travels by another 470 Km, and complete the construction of railroads in the regions	

5. Increase hydrogen and low fuel consumption vehicles

National Action Program on Climate Change		Implementation
2011-2016	2017-2021	The decision made to shift 400 buses into hydrogen and hybrid fuel use with the support of "Clean Air Fund". Installed the equipment for gas fuel for 21 buses of "Bus 1" company, 22 buses of "Bus 3" company, 50 trolleybuses of "Electric transportation" company. In total 98 buses equiped with gas fuel as of 18 of January, 2015 (MET, 2013). As of 2016, the total number of vehicle is 763,998 including 86 electric cars, 96,068 hybrid cars, 14,396 gas fuel cars (NTC, 2016) .
Increase hydrogen and hybrid fuel use in vehicles and encourage low fuel consumption cars. Extend the number of buses and trolleybuses used for public transportation in cities	Expand the liquid gas distribution network. Begin initial research into building an underground metro in Ulaanbaatar.	
Intended Nationally Determined Contribution of Mongolia (INDC), 2015 NAMA Urban Passenger Transport Ulaanbaatar**,** 2016		
Increase the share of private hybrid road vehicles from approximately 6.5% in 2014 to approximately 13% by 2030.		

A Long-range Energy Alternatives Planning system (LEAP) model was used to estimate projections of GHG emissions between 2010 and 2030 in Mongolia. The assessments are made using social-economic data before 2010 to 2015. Population, number of households, GDP and their future changes are the key indicators to estimate energy intensity and to plan energy (Table 3.4).

Table 3.5 Baseline scenario of social and economic indicators

Indicators	2010	2015	2020	2025	2030
Population, mln (NSO, 2015)	2.739	3.004	3.262	3.488	3.688
GDP, bil $	7.11	12.2	17.3	22.7	28.5
Household number, 1000 household	742.3	808.5	880.5	959	1044.4
Household income, $	2650.3	4061.2	5303.5	6508.08	7727.8

Table 3.5 outlines the capacity of current and planned CHPs. This is information is significant to estimate GHG emissions from the energy sector to the baseline scenario.

Table 3.6 CHPs currently under operation and planned

№	Name	Installed capacity, MW	Commissioning year	Energy Source	Remarks	Annual energy production, GWH
1	CHP2	21.5	Operating	Coal		Installed capacity of CHP 905.7MW, 4312.8GWH in 2010 and 1078.7MW, 5323.5GWH in 2015
2	CHP3	148	Operating	Coal	Increased the capacity by 50MW in 2014	
3	CHP4	580	Operating	Coal	Increased the capacity by 123MW in 2014	
4	Darkhan CHP	48	Operating	Coal	Will be increased the capacity	
5	Erdenet CHP	28.8	Operating	Coal	Will increase the capacity	
6	Erdenet factory CHP	5	Operating	Coal		
7	Choibalsan CHP	36	Operating	Coal	Will increase the capacity	
8	Dalanzadgad CHP	6	Operating	Coal		
9	Uhaa Hudag CHP	18	Operating	Coal	Since 2011	
10	Diesel	14.4	Operating	Diesel	Will decrease the capacity	
11	CHP5	450	2020	Coal		New 1690MW, 7670.9GWH and 2768.7MW, 12878.4GWH in 2030
12	Baganuur CHP	700	2019	Coal		
13	Oyutolgoi/Tavan tolgoi CHP	450	2020	Coal		
14	Telmen CHP	90	2023	Coal		

Source: "Preparation of an Investment Plan for Scaling up Renewable Energy in Mongolia" project", 2015; NSO, 2016; "Energy Statistics 2015", ERC.

The current capacity, production, efficiency coefficient of the renewable energy source is used as the baseline scenario for estimating the GHG emission of the energy sector. Figure 3.4 outlined the baseline scenario of energy sector. Energy sector GHG emissions are expected to increase by 17.4, 23.2, 29.9 and 37.7 mln tCO2e in 2015, 2020, 2025 and 2030 respectively.

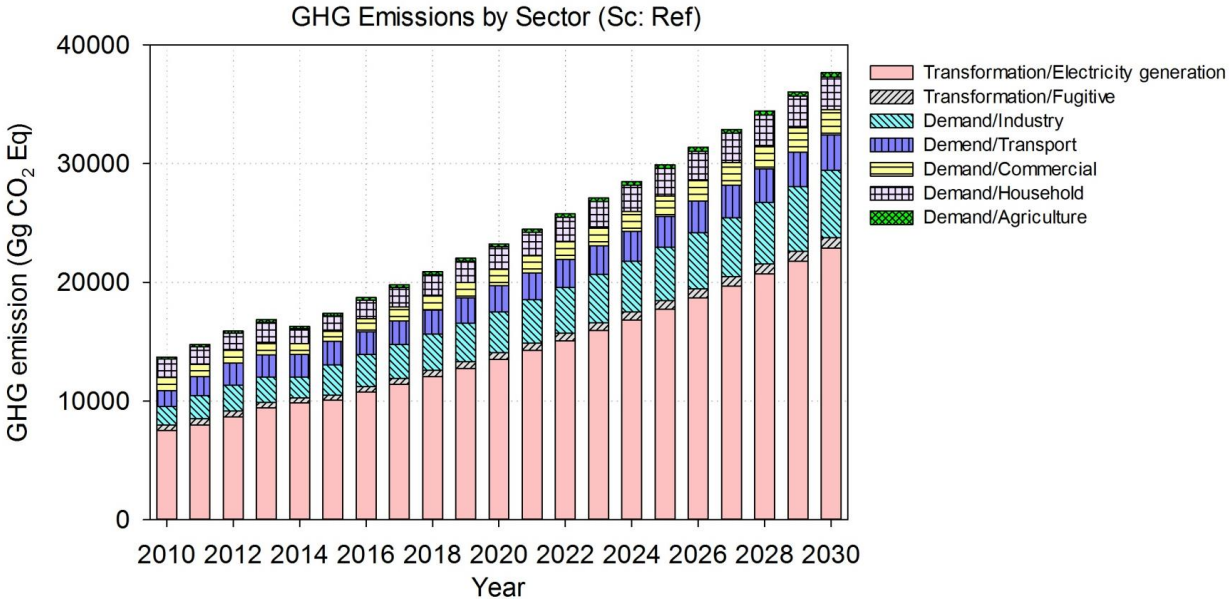

Figure 3.3 GHG emissions in energy sector

By the energy demand of the sectors, heat and electricity production and industry sectors are dominant and continue to increase intensively until 2030. The share of the net emissions in the energy sector will be decreased although GHG emissions from other sectors will be increased (Figure 3.5). The rising demand for energy reflects to the production intensity thus GHG emissions will increase (Table 3.6).

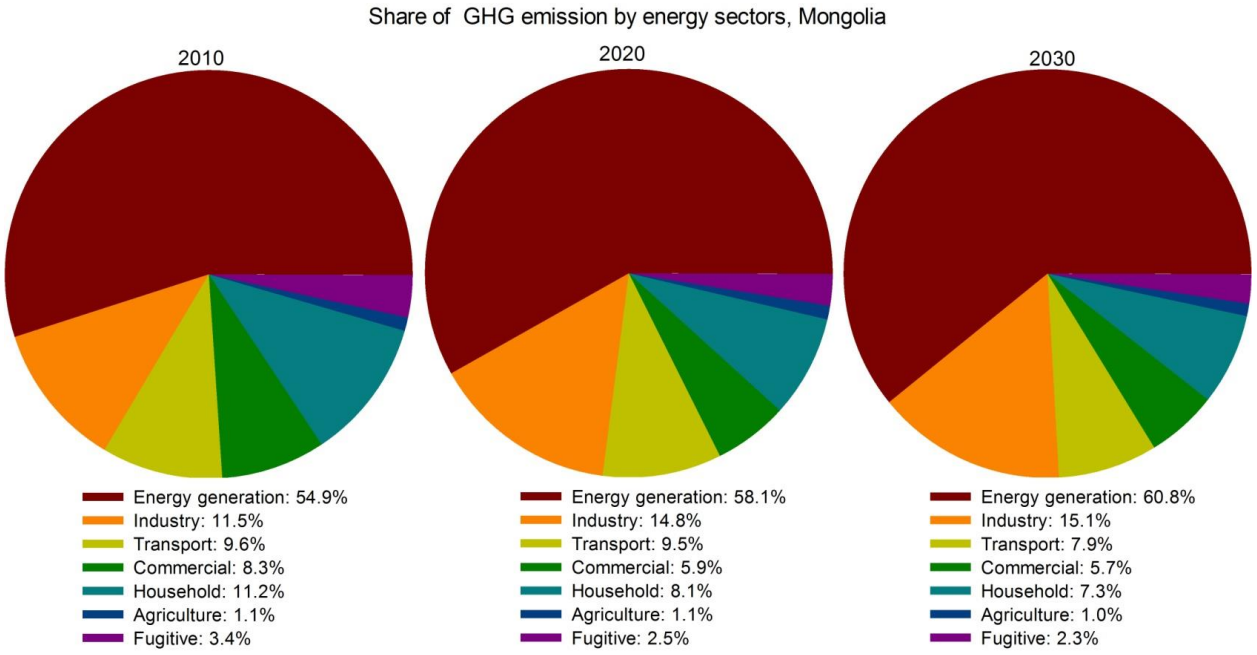

Figure 3.4 Share of GHG emissions by energy sectors

Table 3.7 GHG emissions energy demand and energy transformation

Branch	2010	2015	2020	2025	2030
Energy transformation, 1000 Gg CO_2 Eq	8.0	10.5	14.1	18.5	23.8

Energy demand, 1000 Gg CO_2 Eq	5.7	6.9	9.2	11.4	13.9
Total emission, 1000 Gg CO_2 Eq	13.7	17.4	23.2	29.9	37.7
Emission index (2010=1)	1	1.3	1.7	2.2	2.7

GHG emissions expected to increase 2.4 times in energy need, 3.0 times in energy production, 2.7 times in overall energy sector compared to the level of 2010 in 2030. Renewable energy plants that are not commissioned are not included in the projection GHG emissions of the energy sector. Information of solar, wind and hydro power plants in last part of Table 3.7 is a reference for the actions to increase renewable energy generation.

Table 3.8 Information of implemented and planned renewable energy stations

№	Name	Installed capacity, MW	Commissioning year	Energy Source	Remarks, cost, mln USD	Annual energy production, GWH
1	Salkhit wind park	50	Operating	Wind	2013 since	168.5
2	Durgun CHP	12	Operating	Hydro		38.0
3	Taishir CHP	4 (11)	Operating	Hydro	Due to water scarcity	37.0
4	Darkhan CHP	10	Operating	Solar		14.2
5	Eg river	315	2022-2023	Hydro	827	606.0
6	Ulaanbaatar water accumulating power station	100	2020	Hydro	285	300.0
7	Shuren HPP	245	2020	Hydro	780	930.0
8	Maikhan HPP	12	2017	Hydro	14.2	57.0
9	Chargait HPP	24.6	2023	Hydro	95.6	116.0
10	Orkhon HPP	100	2023	Hydro	160	216.0
11	Khovd HPP	88.7	2023	Hydro	160	418.8
12	Sainshand wind park	52	2016 construction	Wind	110	200.0
13	Oyutolgoi wind park	102	2016 construction	Wind	200	370.0
14	Choir wind park	50.4	2016 construction	Wind	100	123.0
14	Tsetsii wind park	50	2016 construction	Wind	118	142.0
15	AB Solar Wind	100	2016 construction	Wind		200.0
16	Taishir Solar PV	10	2017	Solar	22-24	14.0
17	Altai Solar PV	10	2016 construction	Solar	26.8	15.0
18	Desert Solar power one	30	2017	Solar	70	52.0

19	Bayanteeg Solar PV	8	2016	Solar	24.2	13.2
20	Sumber Solar PV	10	2016	Solar	22.5	17.5
21	Galbiin Gobi	50	2017	Solar	140	94.2
Total installed renewable energy station 23MW, 75GWH in 2010 and 73MW, 257.682GWH in 2015.			**Planed installation of 912.4MW from 2017 to 2023, 1555.6GWH in 2020 and 1440.7MW, 4142.4GWH from 2025 to 2030.**			

Source: "Preparation of an Investment Plan for Scaling up Renewable Energy in Mongolia" project", 2015; NSO, 2016; "Energy Statistics 2015", ERC.

Table 3.8 outlines the share of renewable energy percentage reflected by net energy production and goals identified in the energy policies and programs. It is possible to reach the goals identified in the policies and programs if all planned activities of the projects implemented in its timeframes.

Table 3.9 Share of renewable energy percentage

Indicators	2010	2015	2020	2025	2030
Total energy production, GWH	4312.8	5541.7	7737.4	10169.9	13122.6
According to policies and measures, GWH	75	554.2	1547.5	2542.5	3936.8
Implemented and planned renewable energy project, GWH	75	243.5	1555.6	2785.6	4142.4
Share of renewable energy, %	1.7	4.4	20.1	27.3	31.6

GHG emissions will be reduced in 2015, 2020, 2025 and 2030 by 0.4, 2.7, 4.7, 7.2 mln tCO2e respectively if projects are fully implemented in the energy sector. See Figure 3.6 for the details.

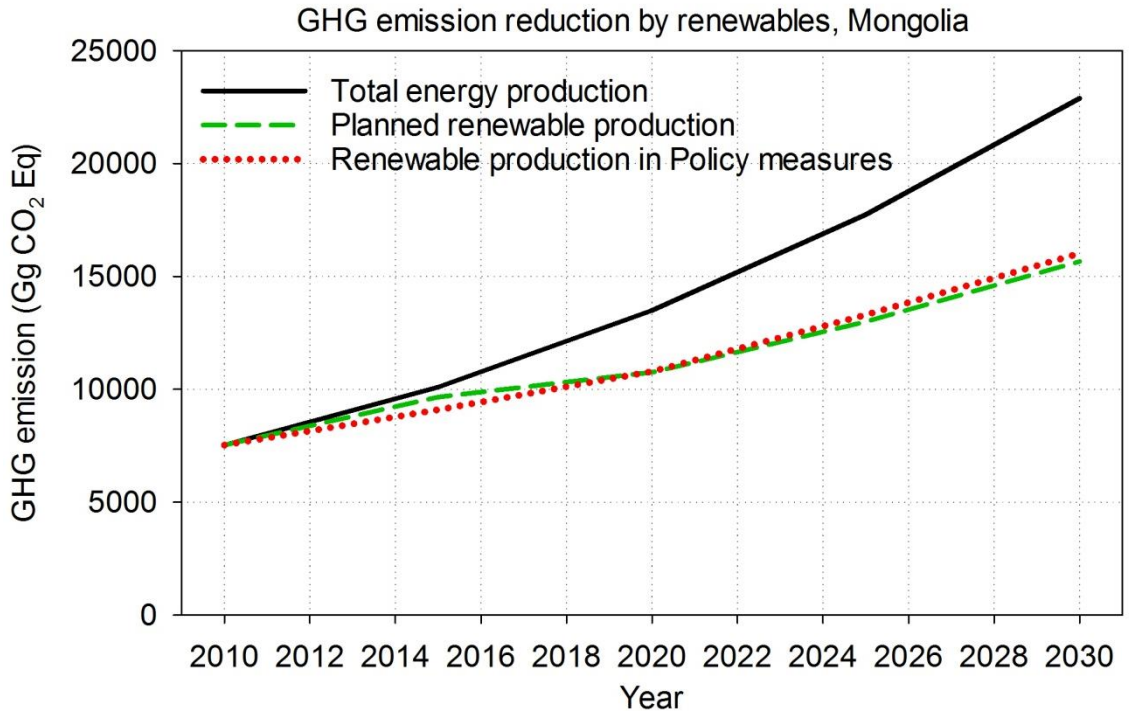

Figure 3.5 Potential emission reduction of energy production by increasing share of renewable energy

Actions described from two to five in Table 3.3 used as a reference to project the scenario. The loss in distribution and transmission and internal energy use of CHP plants are projected in BAU scenario without any actions referenced in policies and programs.
Net GHG emission is projected to reduce 1.5 mln tCO2e in 2020 and 2.8 mln tCO2e in 2030 through the improvement of energy efficiency (Table 3.9).

Table 3.10 Baseline scenario of GHG emission reduction through increase of energy efficiency

Indicators		2010	2015	2020	2025	2030
Transmission and distribution loss	Total resource electricity %	13.5	14.2	10.8		7.8
	Reduction, 1000 Gg CO2Eq	-	-	0.1		0.3
Internal energy use of CHP plants	Produced electricity %	15.6	14.1	11.2		9.14
	Reduction 1000 Gg CO2Eq	-	-	0.3		0.9
Insulation of building and apartment	Apartment number, %			50		90
	Reduction 1000 Gg CO2Eq	-	-	0.9		1.3
Number of households with LED light	Urban households, %			60		90
	Reduction 1000 Gg CO2Eq	-	-	0.1		0.1
Share of low fuel consumption vehicles in total number of vehicle, %	Hybrid, gas and electric transportation, %	-	6.5	8.7		13
	Reduction 1000 Gg CO2Eq	-		0.1		0.2
Total GHG emission reduction, 1000 Gg CO2Eq				1.5		2.8

Total GHG emission reduction from energy sector is expressed in the Figure 3.7.

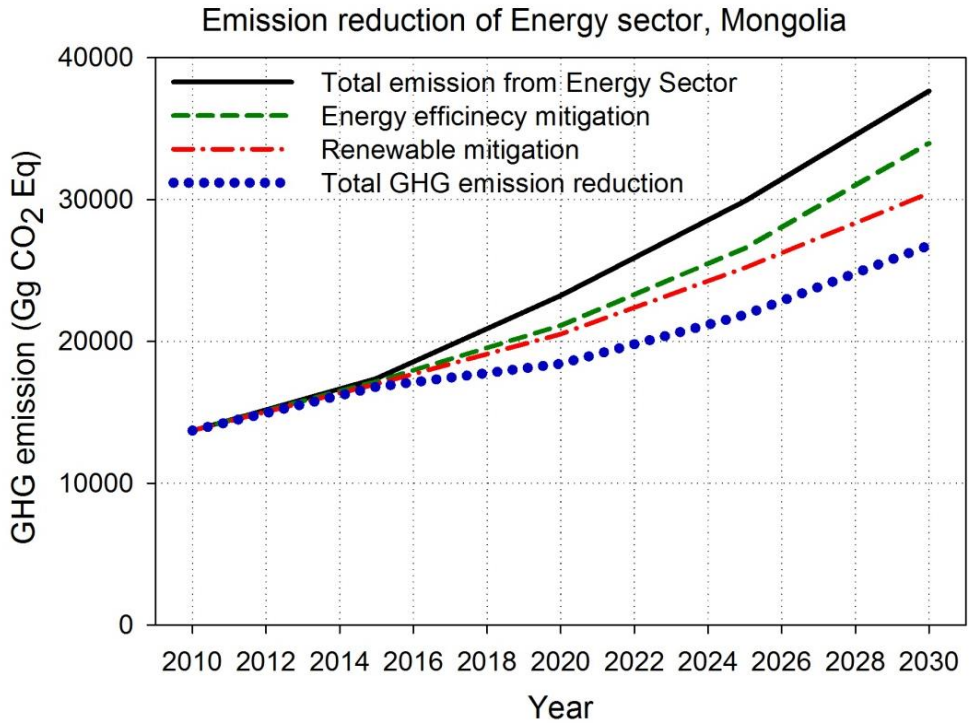

Figure 3.6 Total GHG emission reduction from energy sector

GHG emissions will be reduced potentially in 2020, 2025 and 2030 by 4.2, 6.9, 10.0 mln tCO2e respectively if policies and measures are fully implemented in the energy sector.

3.2.2 Industry

State Great Khural has approved “State Policy on Industry” in 2015. A key measure to mitigate GHG emission is to convert cement production from wet to dry processing. Cement production accounts for 70% of import even domestic cement production increased between 2007 and 2015. In 2015, net production of cement was 410.1thous tons equals to 10% of the installed capacity of the production. The cement factories that have the capacity to fully meet domestic demand have commissioned since 2016. Total installed capacity reached to four million tons but unable to work in full capacity due to a poor sale and purchase in the market and import from China.

Table 3.10 outlines the current status of implementation of policies and measures to mitigate GHG emissions in the industry sector.

Table 3.11 Policies and measures to mitigate GHG emissions in industry sector

1. Adopt dry processing technology in cement production		
National Action Plana on Climate Change		Implementation and outcome
2011-2016	2016-2020	
Programme to support construction material production: - Adopt dry processing technology	Fully adopt dry processing technology in cement	**Implementation:** -“Cement and Lime” Co.ltd., in Khutul fully adopted dry processing technology in 2014 and amount of production dramatically increased. Reduced 8,400t CO2 in 2014 and

in cement production - Fully converted into dry processing technology, reduce consumption of fuel, electricity, water consumption and reduce price by 30 to 40%. - By 2015, an annual capacity of cement production will reach four million ton and fully meet domestic need.	production and reduce price by 30% to 40%.	10,200t CO2 in 2015 respectively. - In 2016, installed capacity in cement production reached four million ton. It include: "Cement and Lime" Co.ltd., in Khutul, "Moncement" of Monpoliment Co.ltd., "Munkhin bayan gal" Co.ltd., and "MAK Cement" Co.ltd., with an installed capacity to produce one million ton cement per year respectively. **Expected outcome:** In 2020, cement production will reach 3.6 million ton and GHG emission reduction is 664,000 tCO2e by technology improvement and 91,000 tCO2e by energy saving. In 2030, cement production will reach 6.2 million ton and GHG emission reduction is 1,147,400 tCO2e by technology improvement and 157,000 tCO2e by energy saving.

2. Develop chemical industry and supply demands of petroleum by domestic product meeting international standard

Mongolia Sustainable Development Vision 2030		Implementation and outcome	
2016-2020	2021-2025	2026-2030	
Meet up to 20% of the national demand for main fuels from domestic production meeting the Euro-4 standards	Meet up to 70% of the national demand for main fuels from domestic production meeting the Euro-5 standards	Meet up to 100% of the national demand for main fuels from domestic production meeting the Euro-5 standards	Mongolia Sustainable Development Vision 2030 is approved by State Great Khural by 2016 and thus no information is available on its implementation. **Expected outcome:** Decrease fuel consumption, an increase in GDP and labor force.

3. Develop the processing industry and reach full coverage of processing of raw materials such as leather, cashmere and others

Mongolia Sustainable Development Vision 2030		Implementation and outcome	
2016-2020	2021-2025	2026-2030	
In 2020, increase the share of processed produce in leather, wool and cashmere up to 60% in the total raw material produced	In 2025, increase the share of processed produce in leather, wool and cashmere up to 70% in the total raw material produced	In 2030, increase the share of processed produce in leather, wool and cashmere up to 80% in the total raw material produced	Mongolia Sustainable Development Vision 2030 is approved by State Great Khural by 2016 and thus no information is available on its implementation. **Expected outcome:** Transfer clean and advanced technology, decrease energy intensity per unit of GDP, increase domestic revenue. Reduce the unemployment rate.

The future demand projection is based on the estimation of demand that will reach to 3.5-4.4 mln ton by 2020 in line with implementation of infrastructure policy and "Taliin Zam" mega project.

To select emission factor used these calculation (*energy consumption 0.05/ton + de-carbonization 0.4985/ton + 0.335/ton) [Source: technology/energy-saving-cement]* for one ton of cement production. The calculations suggest that this will reduce energy consumption by 50% in the first scenario, by 30% in the second scenario and reduce fuel consumption two times by adopting dry processing technology.

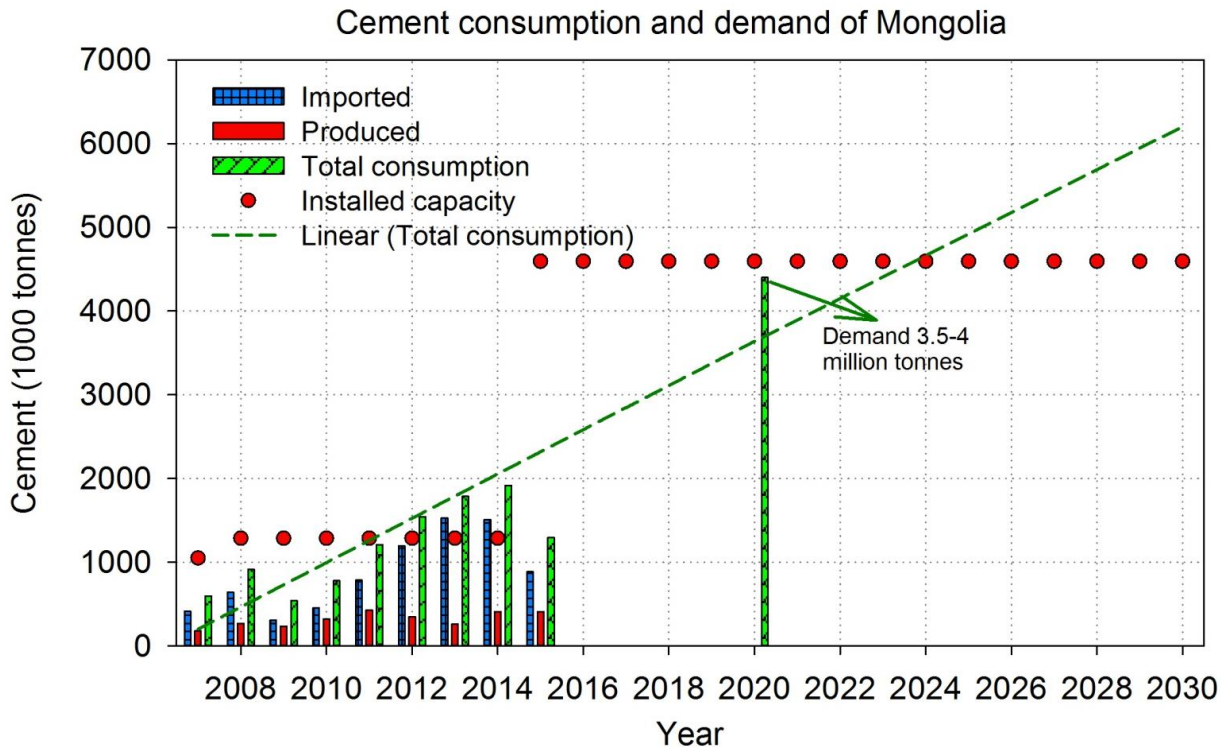

Figure 3.7 Cement consumption and demand

Source: NSO, 2016 and Activity report of factories

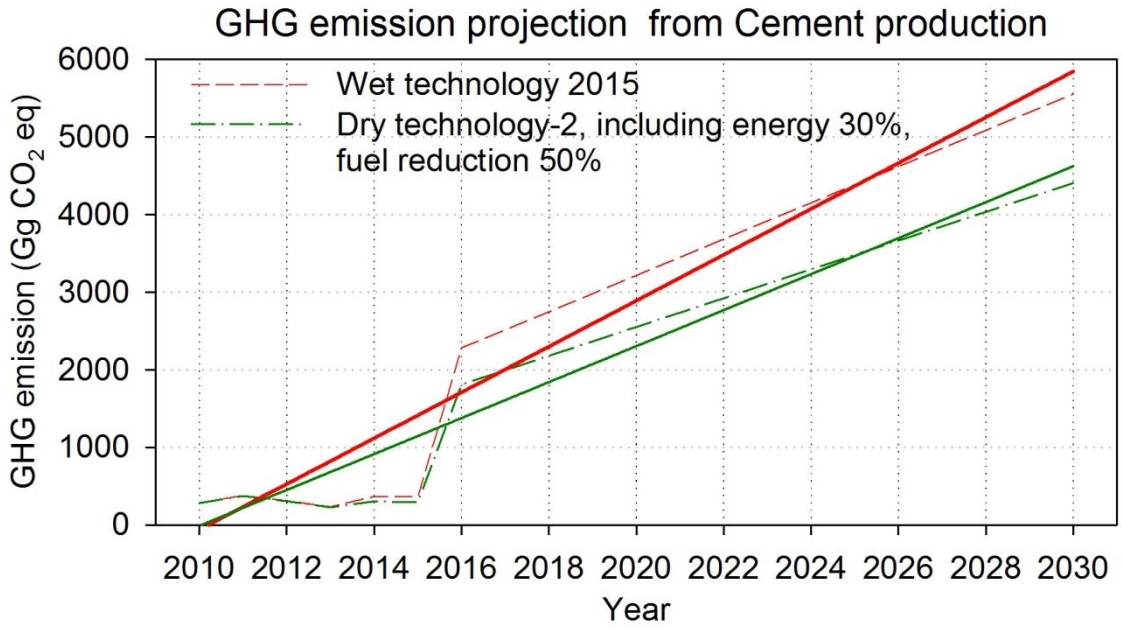

Figure 3.8 CO_2 emission projection from cement production

In early 2016, Mongolia was able to supply its gross domestic product by cement produced by dry technology. “Cement and Lime” Co.ltd, in Khutul adopted dry processing technology in 2014 with the capacity to produce one million ton cement in dry technology and stopped production of the two plants with wet technology. It made possible to fully meet the domestic needs by the end of 2016 by operationalizing four factors in dry processing. This will have an effect on the increase of labor force, decrease the price of cement and energy consumption of cement production by 30%, fuel consumption by two times. By shifting to dry processing technology, GHG emission reduction will be 664,000tCO2e in 2020 and 1,147,400 tCO2e in 2030 respectively.

3.2.3 Livestock

The State Great Khural has approved “Mongolian Livestock” National Program in 2010 and the measures to be implemented through 2010-2021 are identified.
The State Great Khural has approved “State policy on Food and Agriculture” in 2015. The goal of the policy in livestock sector is to promote intensified livestock production in crop cultivated regions, suburban and settled areas while preserving traditional animal husbandry patterns, improve livestock sector economic growth, productivity and competitiveness, and ensure openness of domestic and foreign trade.

The State policies and measures to mitigate GHG emissions in livestock sector are outlined in Table 3.11 below.

Table 3.12 Policies and measures to mitigate GHG emissions in Livestock sector

<table>
<tr><td colspan="3">Adjust the composition and number of livestock through improving the productivity of livestock</td></tr>
<tr><td colspan="2">National Action Program on Climate Change 2011</td><td>Implementation and expected outcome</td></tr>
<tr><td>2011-2016</td><td>2017-2021</td><td rowspan="11">The livestock loss was 25% or more than 10 mln between 2009 to 2010 compared to the level of 2008.
The livestock number increased by 29% and increased milk production by 1.9 times from 2008 to 2015.
Increase the head of pure breed cattle and sheep and decreased number of goat.
Increased number of hybrid cattle, sheep, and goat, the all types of livestock number in selected species increased by the previous year.
Mongolia received Peste</td></tr>
<tr><td>Improve traditional pastoral livestock management and reduce the number of deaths in large animals (cattle, camel etc.)</td><td>Establish animal husbandry systems with a balance of traditional pastoral and intensive farming techniques</td></tr>
<tr><td colspan="2">Mongolian Livestock National Program 2010</td></tr>
<tr><td>2010-2015</td><td>2015-2021</td></tr>
<tr><td>Decrease number of livestock from 43288.0 thous. to 35298.9 thous. between 2008 and 2015.
Increase percentage of large livestock number. Make herd ratio; camel 0.2%, horse 1.7%, cattle 3.8%, and sheep 3.0%. Reduce number of goat by 8.7%.
Increase meat and milk production.</td><td>Number of livestock 36475.6 thous by 2021.
Make herd ratio; camel 0.3%, horse 3.1%, cattle 8%, and sheep 2.70%. Reduce number of goat by 14.1%.</td></tr>
<tr><td colspan="2">State policy on food and agriculture 2015</td></tr>
<tr><td>2015-2020</td><td>2020-2025</td></tr>
<tr><td colspan="2">Adjust the number, type, and composition of livestock based on assessment of pasture carrying capacity and status</td></tr>
<tr><td>Composition of cattle from 6.7 to 8% and processed meat 16.8 thous. ton to</td><td>Composition of cattle from 6.7 to 10% and processed meat 16.8</td></tr>
</table>

<table>
<tr><td colspan="2">100 thous. ton compared to 2014</td><td colspan="2">thous. ton to 200 thous. ton compared to 2014</td><td rowspan="11">des Petites Ruminants (PPR) free status in 2005, and PPR undisturbed status in 2006 from the OIE respectively.
Composition of large animals in herd increased in 2015 compared to 2008 level: camel 0.1%, horse 0.6% cattle 0.5%, sheep 0.9% and goat number was decreased by 2.2%.

Production of milk and meat increased but not yet reached to targeted outcome

Expected outcome:
Adjust the number and type of livestock through improving the productivity of livestock, decrease number of livestock 36475.6 thous by 2021.

Effectiveness:
Ensures sustainable development of livestock sector, increase livestock productivity and improve herders' livelihoods.
Increase domestic production of raw material processing and volume of exports</td></tr>
<tr><td colspan="4">Millennium Development Goals (MDGs)-based Comprehensive National Development Strategy of Mongolia</td></tr>
<tr><td colspan="2">2007-2015</td><td colspan="2">2016-2021</td></tr>
<tr><td colspan="2">Develop a combination of pastoral and intensive livestock husbandry considering the region's unique features, reduce dramatically infectious diseases, promote livestock health, and increase exports of production and processing of animal husbandry products</td><td colspan="2"></td></tr>
<tr><td colspan="4">Mongolia Sustainable Development Vision 2030</td></tr>
<tr><td>2016-2020</td><td>2021-2025</td><td colspan="2">2026-2030</td></tr>
<tr><td>Ensure appropriate numbers and flock structure in the total livestock, have no less than 10% of Mongolia’s territory as disease free, for trade and quarantine, confirmed by the World Organization for Animal Health (OIE), develop veterinary services that are compliant with animal health standards for the export of livestock and livestock products to the neighboring countries, and increase the head of pure breed cattle to 100,000 in intensive livestock farming</td><td>Ensure appropriate numbers and flock structure in the total livestock, have no less than 30% of Mongolia’s territory as disease free, for trade and quarantine, confirmed by the OIE, develop veterinary services that are compliant with animal health standards for the export of livestock and livestock products to the neighboring countries, and increase the head of pure breed cattle to 150,000 in intensive livestock farming</td><td colspan="2">Ensure appropriate numbers and flock structure in the total livestock, have no less than 60% of Mongolia’s territory as disease free, for trade and quarantine, confirmed by the OIE, develop veterinary services that are compliant with animal health standards for the export of livestock and livestock products to the neighboring countries, and increase the head of pure breed cattle to 200,000 in intensive livestock farming</td></tr>
</table>

For forecasting GHG emission of the livestock sector, the historic data on livestock number from NSO, indicators of “Mongolian Livestock” National Program and “State Policy on Food and Agriculture”, the actual number of livestock before the start of “Mongolian Livestock program” in 2010 and until 2015 were used. Three different estimations of change of livestock number (Figure 3.10-13) and methane emission of internal fermentation (Figure 3.13-14) were estimated using IPCC guidelines 2006 TIER 1 emission factors[5].

The results of projection suggested that if the “Mongolian Livestock Program” is fully implemented number of livestock will be 36475.6 thous thus GHG emission from the

[5] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

livestock sector will be decreased by 15% or 1,700 Gg CO_2 eq in 2020 and 21% or 3,070 Gg CO_2 eq in 2030 from BAU scenario respectively.

By implementing these policies and programs, a certain increase of production can be expected by 2021 from the 2008 level: meat supply by 1.4 times, meat export by 1.5 times, and cow milk per year 1.8 times (SGKh, 2010a). Furthermore, herders' revenue estimated to increase by 80% in 2020 and carrying capacity of the pasture could be improved.

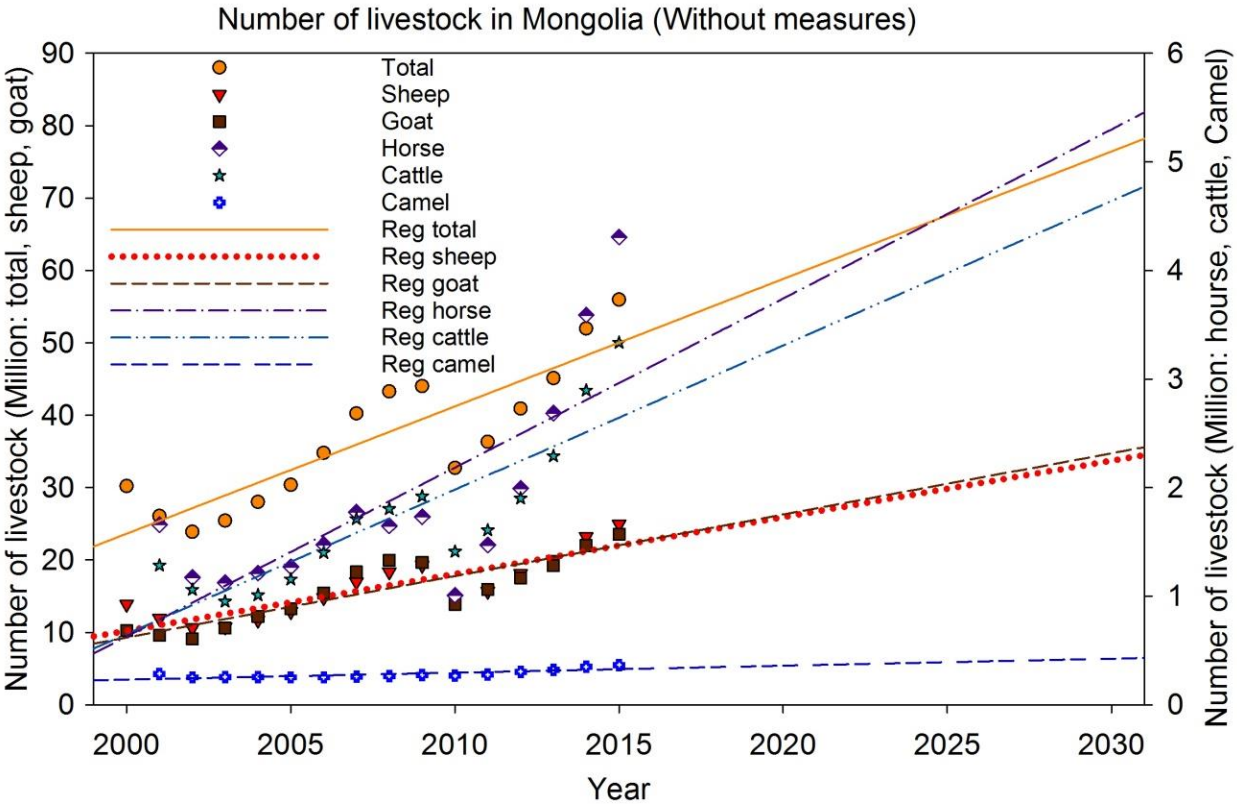

Figure 3.9 Number of livestock in BAU scenario

Source: NSO, 2015

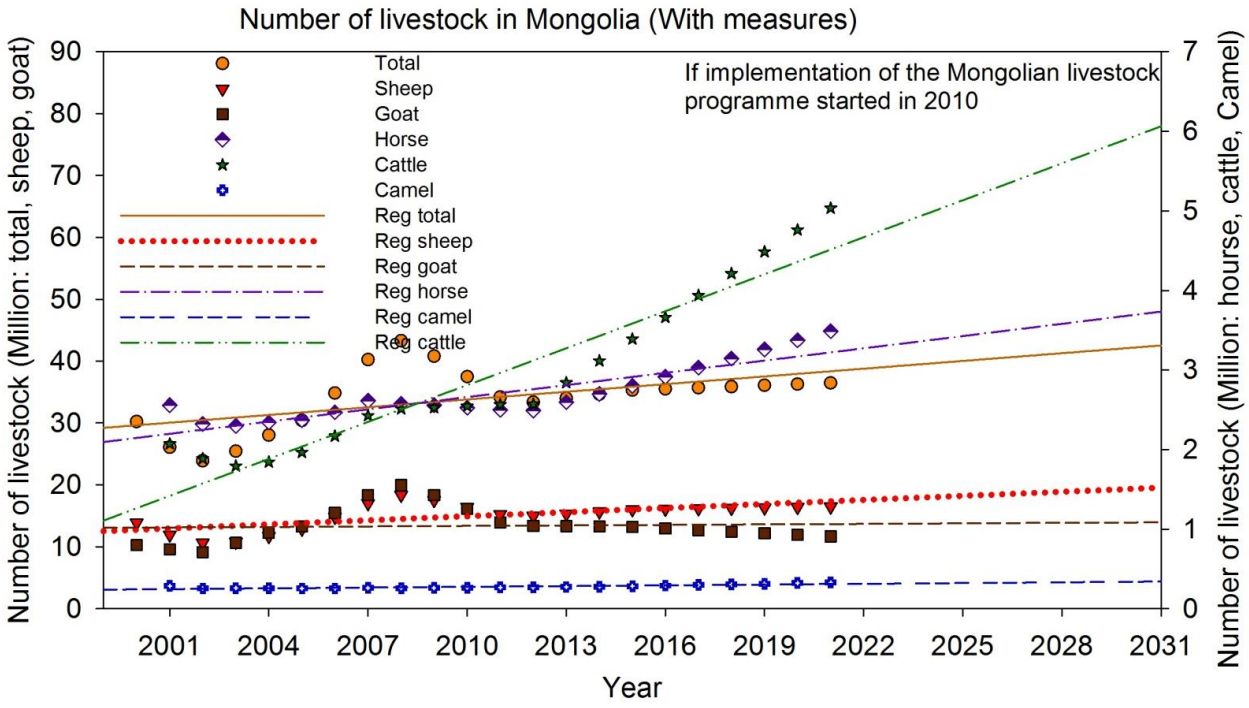

Figure 3.10 Livestock number in scenario of "Mongolian livestock" program 2010 targets assumed to be fully implemented and reached

Source: NSO, 2015

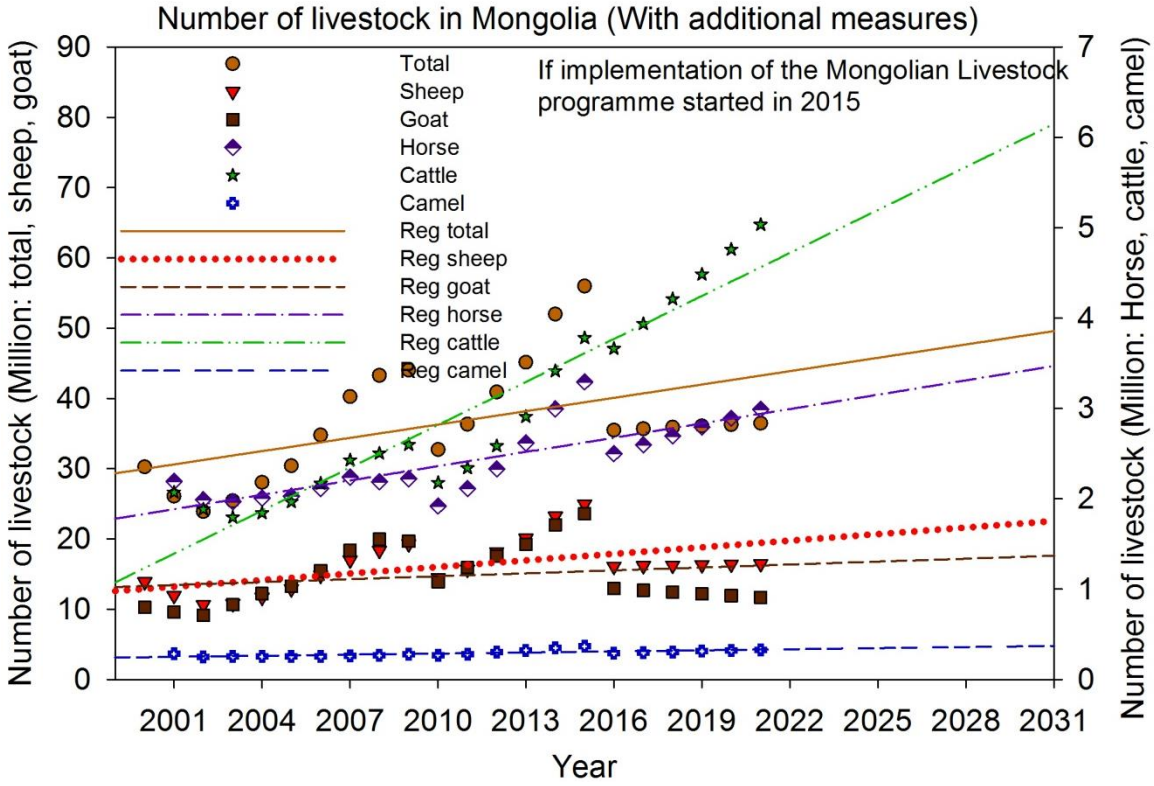

Figure 3.11 Livestock number in scenario of "Mongolian livestock" program targets since 2015 are fully implemented and reached

Source: *NSO*, 2015

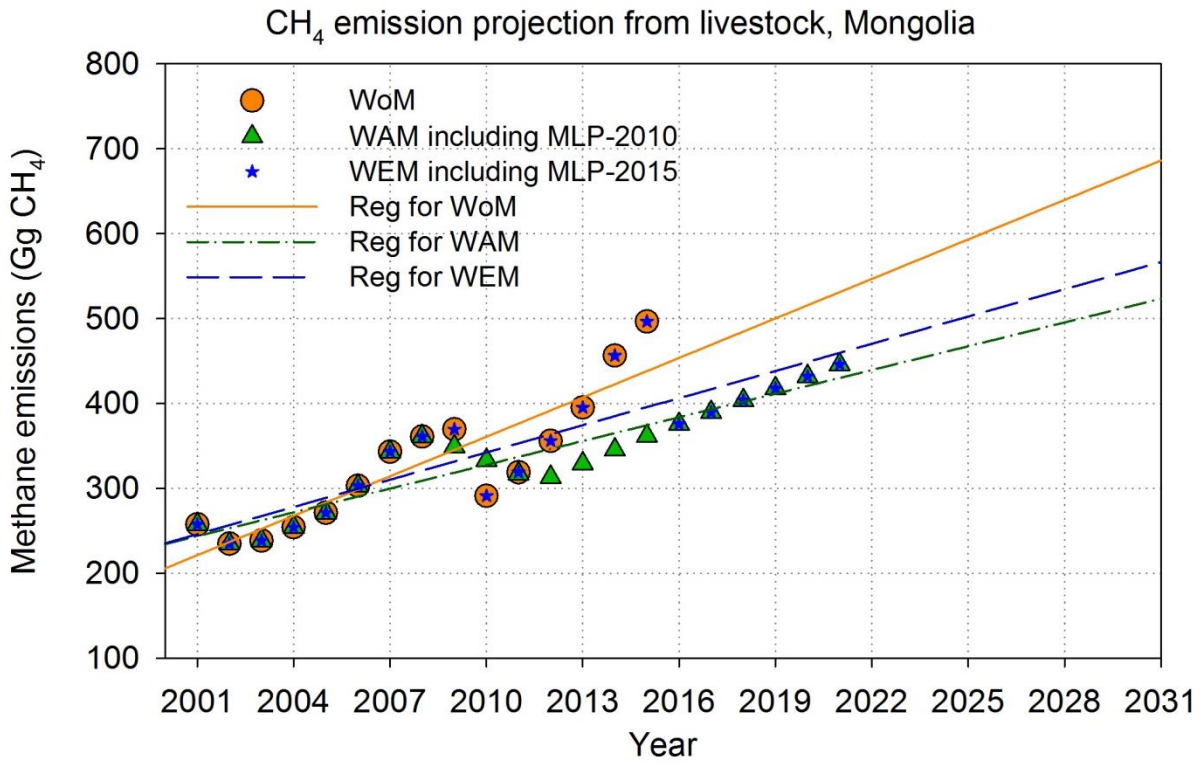

Figure 3.12 CH4 emission from Livestock (in three different estimation scenarios)

Source: IPCC guidelines 2006 TIER 1 emission factors

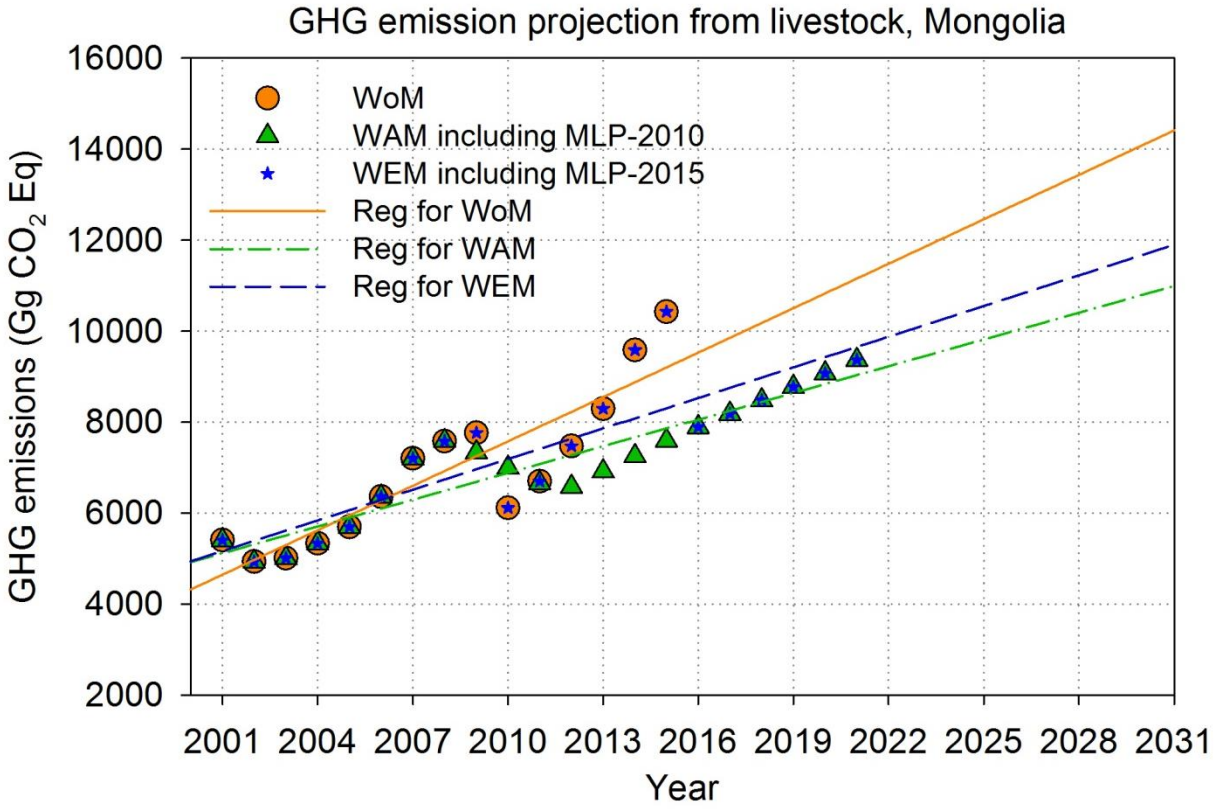

Figure 3.13 GHG emissions from Livestock (in three different estimation scenarios)

3.2.4 Agriculture

The State Great Khural has approved “State policy on food and agriculture” in 2003 and the steps to be implemented through 2003-2015 are identified.

The State Great Khural has updated and approved a new “State policy on food and agriculture” in 2015. The goal of the policy is to promote sustainable development of crop production based on advanced technologies for climate change adaptation. State policies and measures to mitigate GHG emissions in agriculture sector are outlined in Table 3.12 below.

Table 3.13 Policies and measures to mitigate GHG emissions in Agriculture

<table>
<tr><th colspan="3">Sustainably develop and promote production of cultivation based on the advanced technologies for climate change adaptation</th></tr>
<tr><td colspan="2">State policy on food and agriculture 2003</td><td>Implementation and expected outcome</td></tr>
<tr><td>2003-2008</td><td>2008-2015</td><td rowspan="15">Implementation:
Fully implemented “Third Campaign for Reclamation” National Program for development of crop production, cultivated area increased 2.3 times, volume of yield increased 3.2 times in 2010 from the level of 2007.
Irrigated farming area reached to 54 thous ha, increased 2.1 times in 2010
In 2014, domestic demands of wheat and potato are fully supplied.
Croplands cycle have reached 769 thous ha.
In the implementation framework of the campaign, three type of power range tractors (501), harvest combine (144), grain wagon and cars (620) were purchased with state budget and granted to businesses and citizens with a favorable conditions.</td></tr>
<tr><td>Break the crises of the agriculture sector, increase irrigated areas 2.5 times compared to 2003.
Create condition to supply domestic demand of 50% flour, no less than 70% of vegetable and 5-7% of fruit and oil through introducing proper technology that support efficient use of snow and rain water in non-irrigated areas.</td><td>Production intensifies, yield 25-30% of wheat and crop production from irrigated area
Fully supply domestic demand of flour, potato and vegetable and supply 40% of cereal, 10-15% of fruits and oil.
Create opportunity to compete for eco-products in the foreign market.</td></tr>
<tr><td colspan="2">National Action Program on Climate Change 2011</td></tr>
<tr><td>2011-2016</td><td>2017-2021</td></tr>
<tr><td>Extend irrigated agriculture through the use of drought resistant crops, and water saving and soil protection technologies</td><td>To extend irrigated agriculture through the use of drought resistant crops, and water saving and soil protection technologies</td></tr>
<tr><td colspan="2">Green Development Policy 2014</td></tr>
<tr><td colspan="2">Share of the agriculture and manufacturing sector in total GDP 28% in 2020 and 30% in 2030</td></tr>
<tr><td colspan="2">“Third Campaign for Reclamation” National program for development of crop production (2008-2010)</td></tr>
<tr><td colspan="2">Expand the area of cropland no less than 600.0 thous ha:
- 50.0 thous ha in 2008
- 80.0 thous ha in 2009
- 100.0 thous ha in 2010 convert abandoned land into cultivated land</td></tr>
<tr><td colspan="2">State policy on food and agriculture 2015</td></tr>
<tr><td>2015-2020</td><td>2020-2025</td></tr>
<tr><td colspan="2">Increase efficiency and economic value of agriculture land</td></tr>
<tr><td>Increase cropland from 769thous</td><td>Increase cropland from</td></tr>
</table>

<table>
<tr><td colspan="2">ha to 960thous ha by 2014. Increase crop yield 0.845 ton to 0.865 ton per ha.</td><td colspan="2">769thous ha to 1050thous ha. Increase crop yield to one ton per ha.</td><td rowspan="8">Expected outcome:
The harvest rate is expected to reach 0.865t ha in 2020 and 1t ha in 2025.
The zero tillage technology used 70% in 2020, 85% 2025, 90% in 2030 and improve soil fertility and quality, decrease erosion. By the result, amount of CO2 in the crop will be increase and CO2 emission from soil will be decrease.
By rejecting traditional technology and introducing planned zero and reduced tillage technology, and re-use abandoned area, GHG emission will be reduced by 323Gg in 2020, 400Gg in 2025 and 485Gg in 2030.
Benefit:
Improved food supply and increased opportunities to export crops</td></tr>
<tr><td colspan="4">Millennium Development Goals (MDGs)-based Comprehensive National Development Strategy of Mongolia</td></tr>
<tr><td colspan="2">2007-2015</td><td colspan="2">2016-2021</td></tr>
<tr><td colspan="2">Increase agricultural production by improving land farming, developing irrigated cultivation and introducing biotechnology</td><td colspan="2"></td></tr>
<tr><td colspan="4">Mongolia Sustainable Development Vision 2030</td></tr>
<tr><td>2016-2020</td><td>2021-2025</td><td colspan="2">2026-2030</td></tr>
<tr><td>Increase the use rate of zero-tillage farming technology to 70% in grain fields, adopt new and efficient irrigation technologies, increase the area of irrigated arable land to 65 thous hectares, increase the supply of fertilizer demand to 50%, raise the supply of high quality local seeds to 75%, increase the fertility of farmlands, and reduce soil degradation and erosion.</td><td>Increase the use rate of zero-tillage farming technology to 80% in grain fields, adopt new and efficient irrigation technologies, increase the area of irrigated arable lands to 100 thous hectares, increase the supply of fertilizer demand to 70%, raise the supply of high quality local seeds to 90%, increase the fertility of farmlands, and reduce soil degradation and erosion.</td><td colspan="2">Increase the use rate of zero-tillage farming technology to 90% in grain fields, adopt new and efficient irrigation technology, increase the area of irrigated arable land to 120 thous. hectares, increase the fertilizers demand to 100%, raise the supply of high quality local seeds to 100%, increase the fertility of farmlands, and reduce soil degradation and erosion.</td></tr>
</table>

The projection of GHG emissions of agriculture sector is estimated by absorption of abandoned land and GHG emission amount from the soil due to plowing. Biomass change of cultivated area is estimated by COMAP model (Sathaye et al., 1995) using data of NSO and objectives of key policies in Figure 3.15.

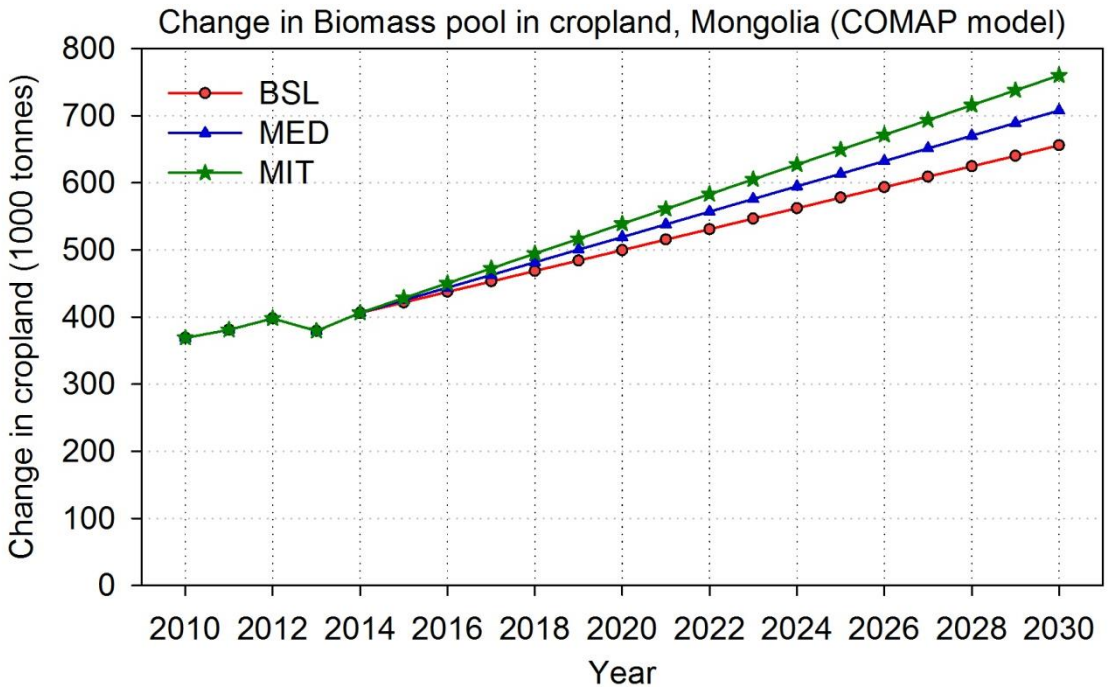

Figure 3.14 Change in Biomass Pool of Cropland (COMAP model)

Source: NSO, 2015

The projection of GHG emission is made in crop lands based on the progress of implementation of "Third Campaign for Reclamation" National program for development of crop production in 2008 and strategic objectives of State policy on food and agricuture.

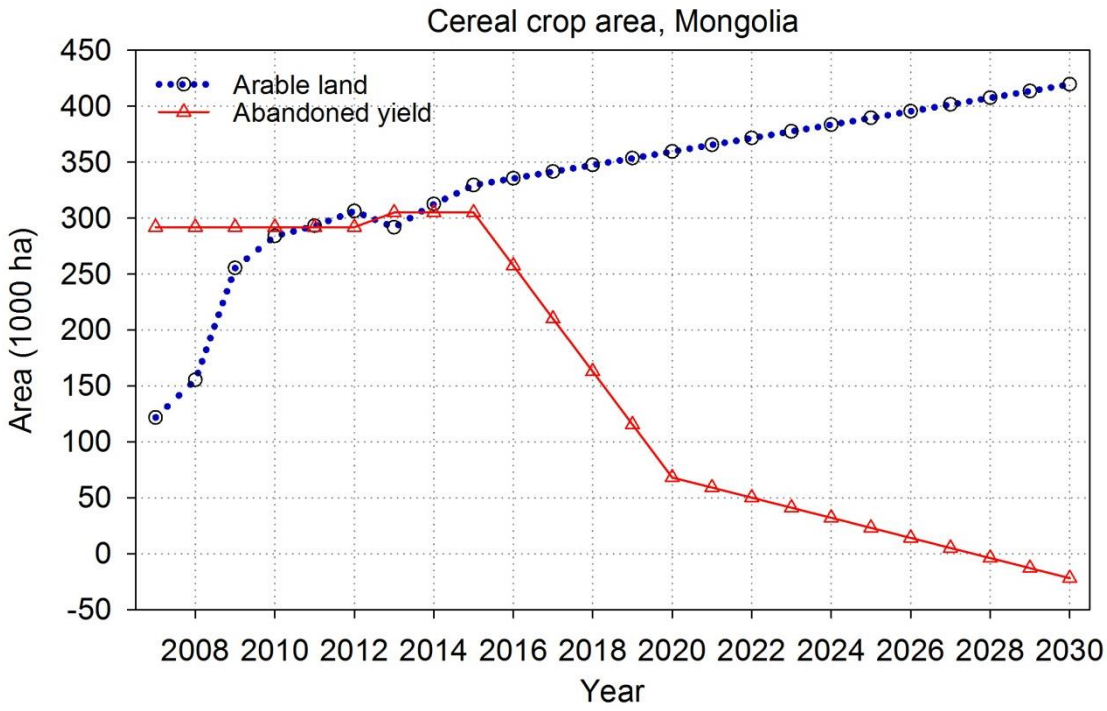

Figure 3.15 Change of arable land area and decrease of abandoned yield

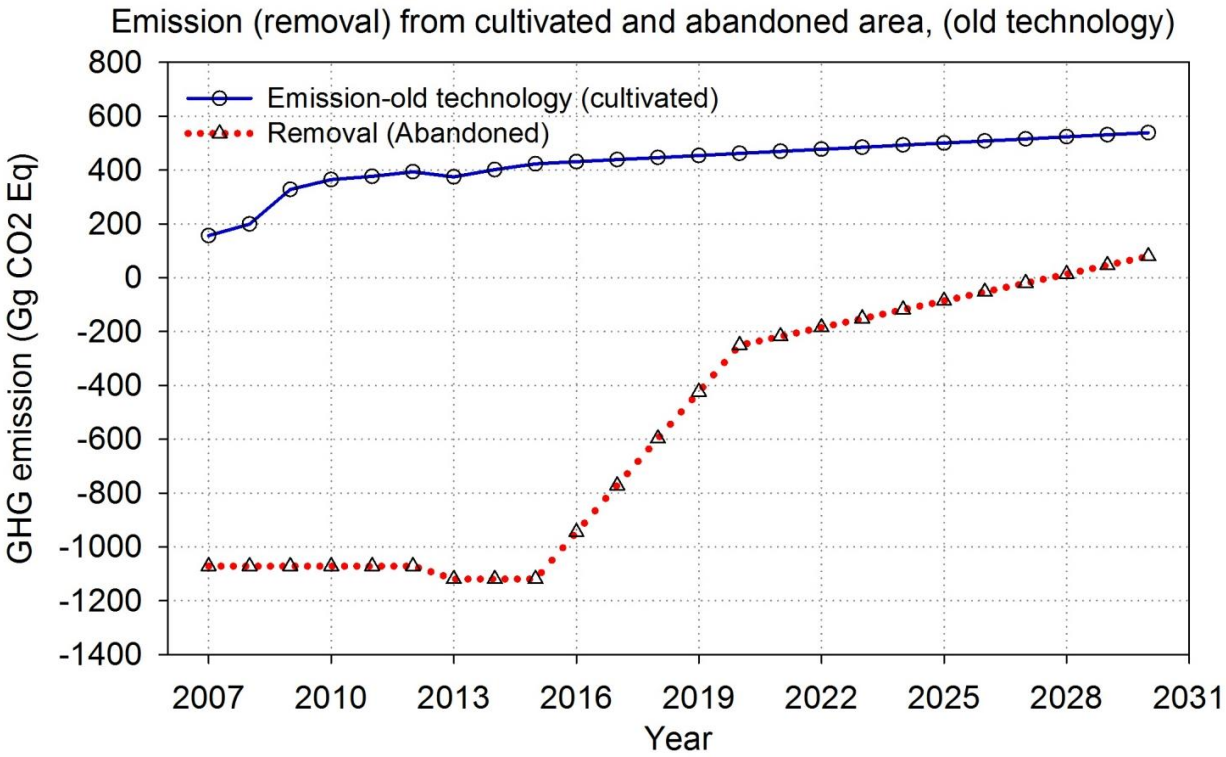

Figure 3.16 GHG emission, cultivated by old technology and removal (abandoned land)

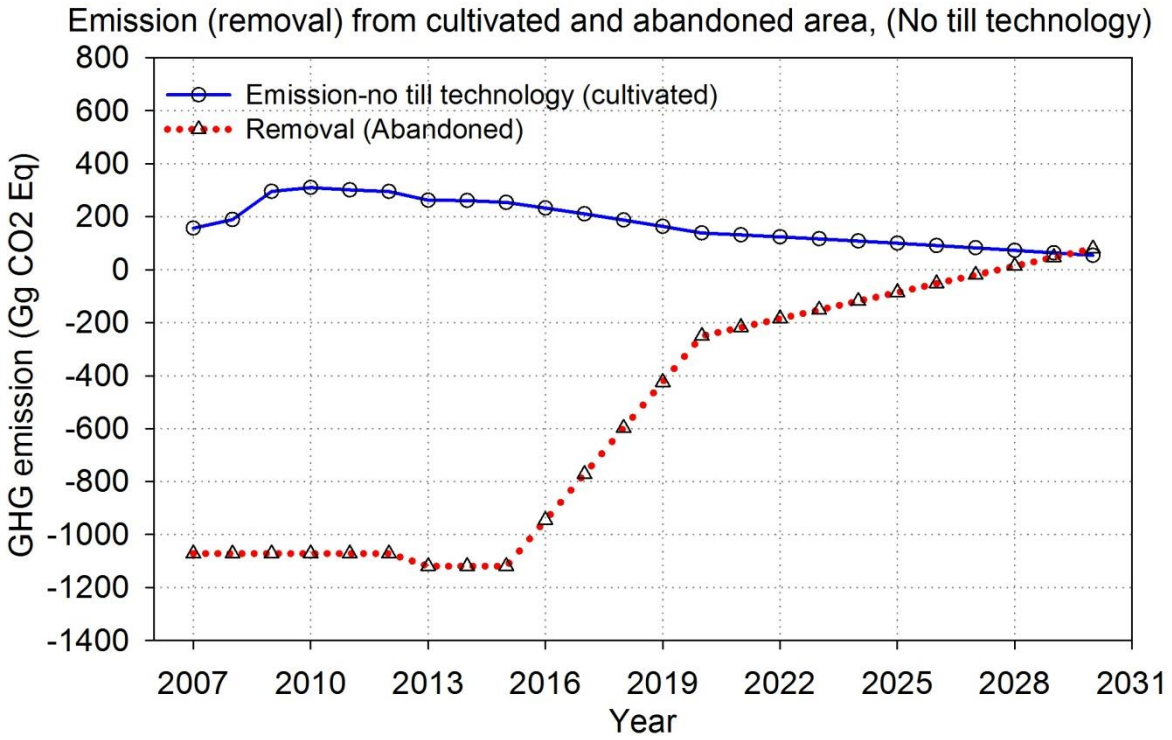

Figure 3.17 GHG emission and removal, cultivated by new technology (abandoned land)

GHG emission and removal are projected based on the objectives of Mongolia Sustainable Development Vision 2030 as introduced new technologies.

Potential to reduce GHG emissions is estimated based on the difference between these two projections.

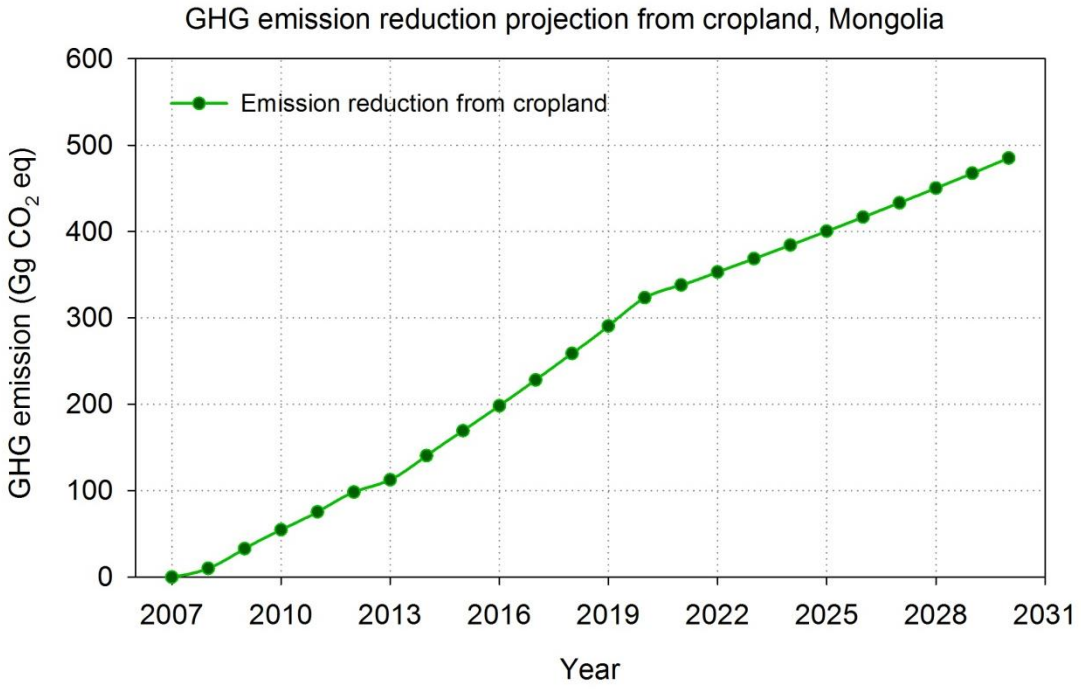

Figure 3.18 CO2 equivalent emission reduction projection from cropland

By rejecting traditional technology and introducing planned zero and reduced tillage technology, and re-use the abandoned area, GHG emission will be reduced by 323Gg in 2020, 400Gg in 2025 and 485Gg in 2030.

3.2.5 Forest

The key policy document on forest management is “State policy on forest” 2015 and objectives is focused to mitigate deforestation and degradation of the forest, reclamation of the forest, and to promote robust management of the forest. State policies and measures to mitigate GHG emissions in forest sector are outlined in Table 3.13 below.

Table 3.14 Policies and measures to mitigate GHG emission in Forest

National Action Program on Climate Change 2011		**Implementation and expected outcome**
2011-2016	2017-2021	**Implementation:** Rearranged in 14.2mln ha of forest from 2000 to 2010, took actions against forest pest and disease in 675thous ha, supported forest regrowth in 72.9thous ha and it reached 230.5thous ha in 2014 Overall sink of GHG is 172.5 thous ha. Parliament had approved “Forest Law” in 2007. By 2014, 1179 forest coalition or local community groups have been established and 3,034,744 ha forest land is owned and managed by them under the agreement. By the Environment Minister order to prohibit the usage of railroad sleepers, 25 thous m^2 or 225 ha forest is saved (EPR 2013-2014).
Forest plantation area will be increased by 30 thous ha compared to 2010	Forest plantation area will be increased by 60 thous ha compared to 2010	
State policy on forest 2015		
2015-2020	2021-2030	
Reduce area affected by forest fire by up to 30% in 2020. Increase naturally grown and cultivated forests areas by 310.0thous ha in 2020. Reduce GHG emission from deforestation and forest degradation by 2% in 2020. Reduce epicenters of forest pest and disease by 60% in	Reduce area affected by forest fire by up to 70% in 2030 Increase naturally grown and cultivated forests areas by 1500.0thous ha in 2030 Reduce GHG emission from deforestation and forest degradation by 5% in 2030.	

<table>
<tr><td colspan="2">2020.</td><td>Fully take control on epicenters of forest pest and disease in 2030.</td><td rowspan="11">Expected outcome:
Increase by 310thous ha forest and sink 232thous tons of CO2.
Increase by 1,500thous ha forest and sink 1,123thous tons of CO2.
Decrease forest fire area from 1,196.8thous ha to 359.0 ha in 2020 and 837.8 thous ha in 2030.

Decrease epicenters of pests and disease and reclaim the areas from 95.7thous ha to 38.2thous ha in 2020 and 95.7thous ha in 2030.
Logging area is accounted 124.1thous ha. Reclaim 2.5 thous ha in 2020 and 6.2thous ha in 2030.
Forest cover area will be increased by 1524.14hous ha in 2030 and share of forest area will reach 9% of the territory (GDP, 2014).</td></tr>
<tr><td colspan="3">Green Development Policy 2014</td></tr>
<tr><td colspan="2">2015-2020</td><td>2020-2030</td></tr>
<tr><td colspan="3">Enhance forest absorption of GHGs by intensifying reforestation efforts and expanding forest areas by 8.5% in 2020 and 9% in 2030</td></tr>
<tr><td colspan="3">Millennium Development Goals (MDGs)-based Comprehensive National Development Strategy of Mongolia</td></tr>
<tr><td colspan="2">2007-2015</td><td>2016-2021</td></tr>
<tr><td colspan="3">Create conditions for sustainable use and protection of forest reserves, reforestation and maintenance of ecological balance; Increase total forest area by 18 mln ha</td></tr>
<tr><td colspan="3">Mongolia Sustainable Development Vision 2030</td></tr>
<tr><td>2016-2020</td><td>2021-2025</td><td>2026-2030</td></tr>
<tr><td>Raise the forest cover to 8.5% of the country’s total territory</td><td>Raise the forest cover to 8.7% of the country’s total territory</td><td>Raise the forest cover to 9.0% of the country’s total territory</td></tr>
</table>

To estimate forest biomass change using COMAP model, data from NSO and objectives of key policy and programs were considered.

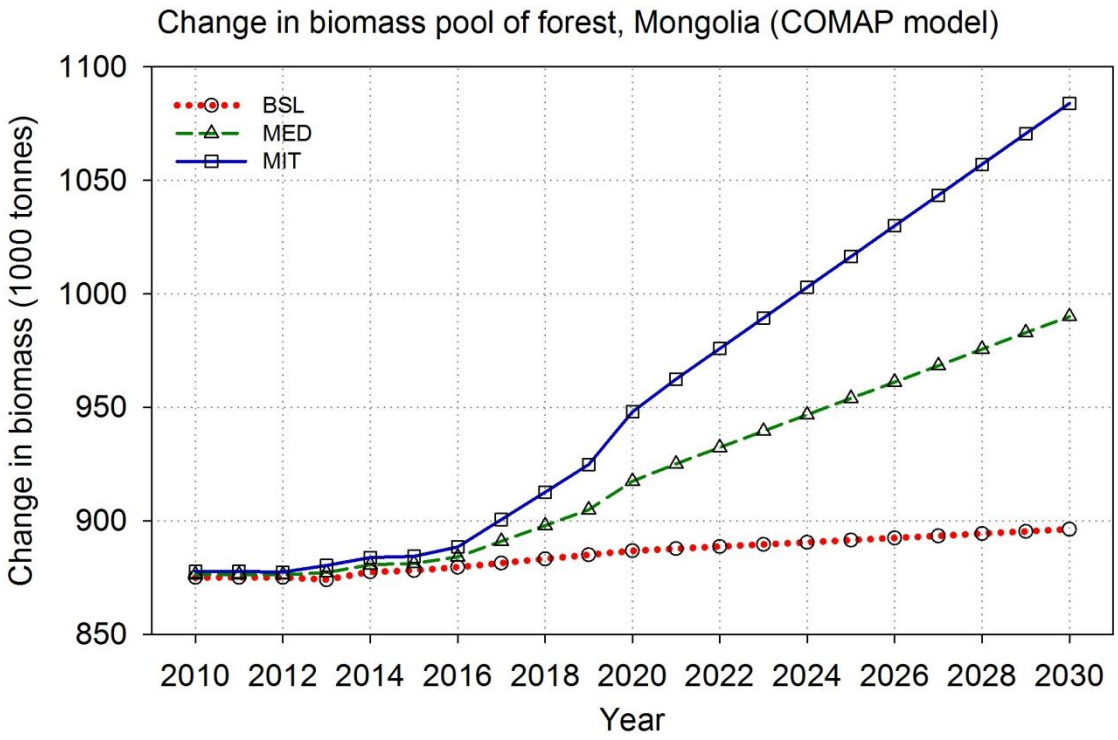

Figure 3.19 Change in biomass of forest, COMAP model

As indicated in the estimation, carbon sink potential will increase by 7% in 2020 and 17% in 2030 in BAU scenario.

3.2.6 Waste

The GHG emission from the waste sector is classified as solid waste and waste water from industry and municipality. Population growth, urbanization and industrialization lead to the increase of waste and change of components of the waste that average volume of waste is increased by 500thous ton per year in Mongolia. The State Greate Khural stated that the volume of the waste is tripled in four years period, 820 thous tons in 2009 and 2.4mln tons in 2013 (SGKh 2014). Based on the data of national GHG inventory, methane emission from solid waste disposal center accounts more that 45% of waste sector.
State policies and measures to mitigate GHG emissions in the waste sector are outlined in Table 3.14 below.

Table 3.15 Policies and measures to mitigate GHG emission in Waste

<table>
<tr><th colspan="3">Solid waste management improvement program, 2014</th><th>Implementation</th></tr>
<tr><td>2014-2017</td><td colspan="2">2018-2022</td><td rowspan="15">Constructed a solid waste classification, processing and recycling factory to produce solid fuel. To build a waste recycling industrial park in the waste landfill site is under discussion. Since 2010

Since 2010, the total waste generated at the central waste disposal site has been fully landfilled in accordance with technology. Average landfill area is 8-10 ha.

Recycled 338thous tons of waste which is 23.4% of a total waste from 2010-2015.</td></tr>
<tr><td>Construction of treatment plants; Introduce ISO 14000 standard</td><td colspan="2">Promote and increase recycling of packages by 135.0 thous ton or 7.6 times than a level of 2013</td></tr>
<tr><td colspan="3">National Action Program on Climate Change, 2011</td></tr>
<tr><td>2011-2016</td><td colspan="2">2017-2021</td></tr>
<tr><td>To build a solid waste classification, processing and recycling industry</td><td colspan="2"></td></tr>
<tr><td colspan="3">Green development Policy 2014</td></tr>
<tr><td>2014-2020</td><td colspan="2">2021-2030</td></tr>
<tr><td>Share of waste recycling by 20%.
Reduce solid waste in landfills by 20%</td><td colspan="2">Share of waste recycling by 40%.
Reduce solid waste in landfills by 40%</td></tr>
<tr><td colspan="3">Mongolia Sustainable Development Vision 2030</td></tr>
<tr><td>2016-2020</td><td>2021-2025</td><td>2026-2030</td></tr>
<tr><td>Increase the area of green facilities in urban areas and settlements to 15% of the total area, increase the amount of recycled waste to 20% of total waste, and have no air pollution (reduce the air pollution in Ulaanbaatar to a tolerable level of health standards) in Ulaanbaatar city, 40% of the population uses improved sanitation and hygiene facilities</td><td>Increase the area of green facilities in urban areas and settlements to 25% of the total area, and increase the amount of recycled waste to 30% of the total waste, 50% of the population uses improved sanitation and hygiene facilities.</td><td>Increase the area of green facilities in urban areas and settlements to 30% of the total area, and increase the amount of recycled waste to 40% of the total waste, 50% of the population uses improved sanitation and hygiene facilities.</td></tr>
</table>

The projection of GHG emission of solid waste (Figure 3.21) is estimated using data of total population and equation of multiple variables regression (regression coefficient 0.97). Future projections of GHG emission until 2030 is estimated using three different scenarios of population growth, main export products and value of GDP reflected to price stated by NSO.

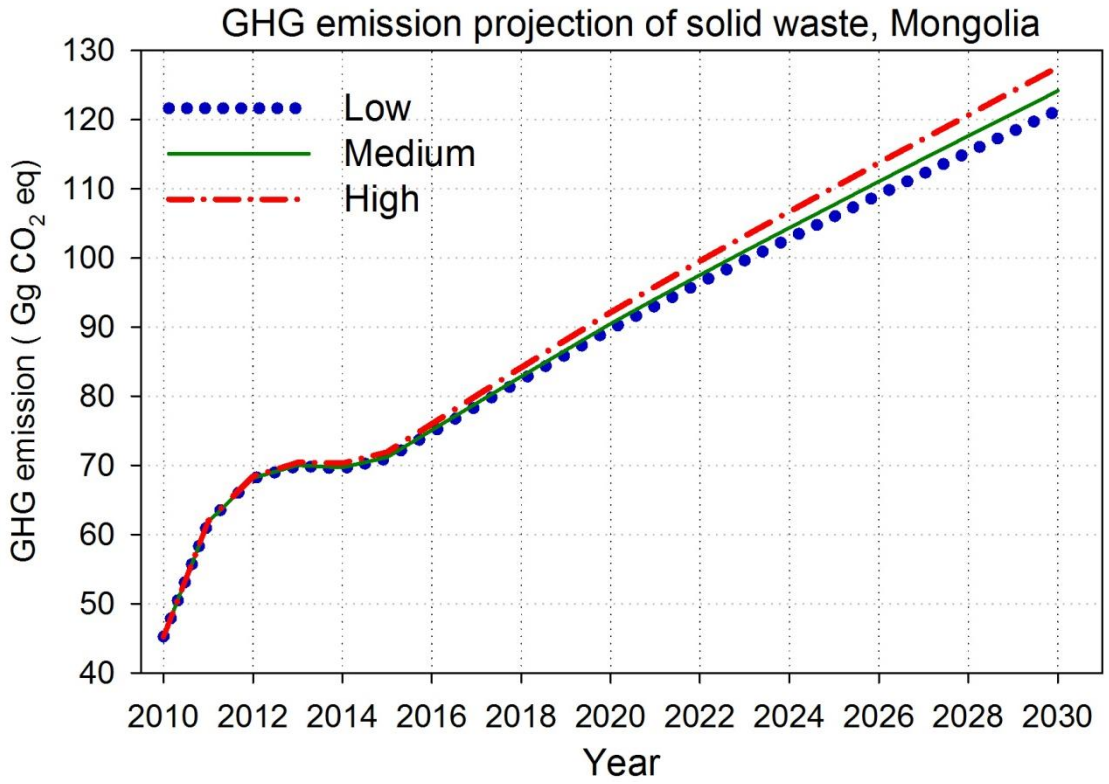

Figure 3.20 Projected GHG emission of solid waste

Figure 3.22 shows the future GHG emission reduction potential of solid waste in BAU scenario taking into account the outcome of actions to recycle and reuse reflected in national policies and programs. Based on the estimation, Mongolia is able to fully recycle and reuse solid waste by 2027.

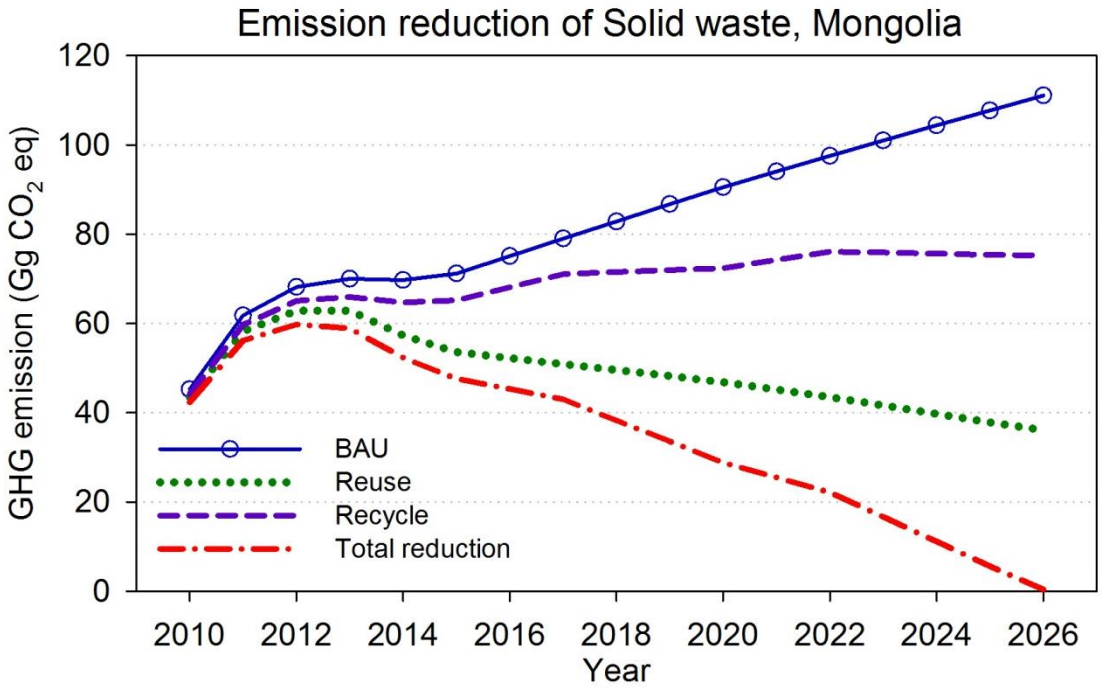

Figure 3.21 GHG emission reduction from solid waste

3.3 Domestic MRV mechanism

A critical requirement for mitigation actions is that actions be implemented in a measurable, reportable and verifiable (MRV) manner. Recognizing the role of mitigation actions to reducing GHG emissions while simultaneously promoting country's sustainable development objectives, Mongolia will advocate for a broader approach to MRV that establishes a robust mechanism in line with its commitment under the UNFCCC .The initial experience with different elements of the MRV for GHG emissions has already been gained through the implementation of Clean Development Mechanism (CDM) projects under the Kyoto Protocol. Moreover, significant effort has also been done under the preparation of the national GHG inventories, a crucial element of the overall MRV system.

Mongolia has approved through its Agency of Standard and Metrology (MASM) ISO14064 and ISO 14065 standards as a national standars for MRV between 2012 and 2013. National renewable energy center (NREG) had become the first nationally accredited entity for MRV in 2014.

Further, the MRV methods for project based activities is expected to evolve and be simplified, allowing the necessary information for emission reductions from individual activities to be collected from the already existing information in the GHG inventory and statistical data.

Under the JCM bilateral framework, third party entity (TPE) assesses the information and applies the means of validation and currently CERs is 107 tons of CO2.

CHAPTER 4

Constraints and Gaps, and Related Financial, Technical and Capacity Needs

4. CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS

Mongolia, as many other developing countries, has specific barriers for the implementation of adaptation and mitigation measures such as financial and technical resources, human and institutional capacity, and public support. The biggest problems facing the electricity and heat production sectors in reducing GHG emissions are the use of obsolete techniques and technologies, the low coal quality, and insufficient funds. The most widely recognized constraints are considered below:

In the second national communication, Mongolia has reported that in the near future, while coal will remain the basis of energy production, the following technologies need to be introduced and implemented:

- Clean coal technology and clean fuel production
- Establishing a power plant with integrated coal gasification combined-cycle
- Setting up a Carbon capture and Storage-CCS plant.

The above measures are subject to very high upfront investment and recurring operating costs. Particularly costs of technologies and infrastructures have been major constraints to successful implementation.

The implementation of mitigation measures requires a high level of technical capacity and effective coordination across different sectorial agencies, which are currently a challenge for Mongolia. Most of the technologies applied in Mongolia's energy sector are still old and have low efficiency and high energy losses. The heat content of the feedstock coal is low and variable, which leads to combustion problems and poor plant performance. A lack of appropriate technologies and know-how is the most urgent technical problem.

Other key financial, technical and capacity barriers include a lack of support by financial institutions for renewable energy investments (particularly hydro-power plants); lacks of domestic technological and technical resources for clean fuel production; and Carbon capture and Storage-CCS plant.

As mentioned before, reporting of National Communications including GHG inventory and BUR is financed by GEF enabling activities through UNEP. In other words, there was no substantial government financing (except in kind contribution) for these reporting requirements because of the economic difficulties in Mongolia, as the country is undergoing a transition period, the Government fails to resolve financing issues.

Further financial, technical and capacity-building needs of Mongolia for preparing and implementing mitigation projects are listed in NAMA is given in **Error! Reference source ot found.**.

Table 4.1 . Financial, Technical and Capacity-Building Needs

Activities	**Status** - **ongoing** - **planned**	**Support needed**	**Support received**	**Additional support needed**

-completed				
Technical and Capacity-Building Needs				
Improved insulation of 300 existing panel apartment buildings in Ulaanbaatar	planned	90,000,000	-	-
	planned			
	planned			
Financial Needs				
Transforming construction in Mongolia using Supplementary Cementitious Materials	planned	15,000,000	-	-
National Energy Efficient Lighting Program in Mongolia	planned	7,000,000	-	-
Installation of 675MW capacity large hydro power facilities	planned	1,350,000,000	-	-
Installation of 354MW wind power facilities	planned	584,000,000	-	-
Installation of 145MW solar PV power facilities	planned	573,000,000	-	-
Technology Transfer Needs				
Improved efficiency of coal-fired power plants.	planned	900,000,000	-	-
	planned	-		-
	planned			

4.1 Information on the Support Received

Financial support from the Global Environment Facility towards the preparation of BUR was received in December 2015, while as per UNFCCC decision 2/CP.17 as reported in document number UNFCCC/CP/2011/9/Add.1 clause 44, it should have been received as early as possible in 2012.

During 2011-2013, MET implemented project on Strengthening Carbon Financing for Regional Grassland Management in NE Asia/2011-2013 with a support of the Asian Development Bank (ADB). ADB supported regional cooperation among countries of Northeast Asia to combat dust and sandstorms resulting from desertification. ADB has strengthened the capacity of the government of Mongolia in accessing carbon financing to sustainably manage grassland. The project recognizes that healthy ecosystem are more productive, more resilient, and provides valuable ecosystem services, such as carbon sequestration (ADB, 2013).

Mongolia is seeking alternatives to replace fossil fuels such as coal that power its industry and mines. The Government has set a target to get 20% to 25% of its energy from renewables by 2020, whereas the reliance on energy from renewable sources is 2%. Coal contribution is about 80% of the nation's energy production.

The Salkhit wind farm with capacity 50MW is a flagship project for Mongolia's renewable energy sector and the energy sector as a whole. The project has introduced a new and advanced technology and knowhow to the industry. The wind farm will offset 180 thousand tons of CO2 emissions, save 1.6 million tons of fresh water, and reduce coal usage by 122 thousand tons annually.

Low-emission and energy-efficient approaches in Mongolia's construction and housing sector were implemented during 2009-2013. The objective of BEEP was to reduce the annual growth rate of greenhouse gas (GHG) emissions from buildings sector in Mongolia, by improving the energy utilization efficiency in new construction in the residential and commercial buildings.

In 2012, the Government of Mongolia announced that green development would be the new economic development strategy for the country. To facilitate this, the government established the MEGD. The Global Green Growth Institute (GGGI) is assisting Mongolia in developing and implementing a national green growth plan within the transport and energy sectors. The Strategies for Development of Green Energy Systems in Mongolia project was completed in early 2014 by the GGGI in collaboration with the Mongolian government, Stockholm Environment Institute, and the United States (GGGI, 2014).

A new initiative to develop and incentivize ecological, low-emission and energy-efficient approaches in Mongolia's construction and housing sector is being launched in 2016. The "Nationally Appropriate Mitigation Actions in the construction sector in Mongolia" (NAMA) Project will run until 2020. It aims to limit the need for coal-powered heating and reduce the country's winter air pollution.

The objective of the project is to facilitate market transformation for energy efficiency in the construction sector through the development and implementation of NAMA in Mongolia. This objective will be achieved by removing barriers to increased adoption of energy efficient technology in construction sector through three components; i) establishment of baseline energy consumption and GHG emission in the construction sector ii) development and implementation of NAMA in the construction sector iii) measuring, reporting and verification (MRV) system for NAMA. This project will be implemented over a 40 months period and is expected to achieve GHG emission reductions through the displacement of electricity heat generation from coal power plants and CHPs. Direct GHG emission reduction over the lifetime of the project is estimated to be 64,219 tCO2e. The estimated range of potential indirect emission reduction is 57,435 to 438,926 tCO2e that is cumulative for a 10-year period after the end of the project.

MET has also implemented project on Improving Energy Efficiency in Public Buildings in Khovd and Zavkhan aimags in 2014-2016 which supported by the German Federal Enterprise for International Cooperation (GIZ). The energy savings in the renovated buildings were estimated to be up to 50%. This study proved that large cross cutting benefits are achievable and result in improved health, energy savings, and reduce air pollution and CO_2 emissions (GIZ, 2016).

The Multipurpose National Forest Inventory (MPNFI) implemented in 2014-2016 is the first exercise of its kind in Mongolia. The inventory was supported by technical assistance from international expertise mobilized through a collaboration project between the MET and the GIZ and was implemented under the responsibility of the Forest Research and Development Centre (FRDC), which ensures the long-term sustainability of the MPNFI.

Japan initiated the Joint Crediting Mechanism (JCM) as a tool to complement CDM under the UNFCCC, with the aim of facilitating widespread applications of low-carbon technologies, and ultimately reduce emissions of greenhouse gases. Implementation in Mongolia has been focused on high-tech low carbon technologies that can be applied by the private sector in 13 identified sectors. Japan will cover 50% of the project costs and in return will take the carbon reduction credits generated from the subsidized projects till 2020. Three methodologies are approved such as Installation of energy-saving transmission lines in the Mongolian Grid, Replacement and Installation of High Efficiency Heat Only Boiler (HOB) for Hot Water Supply Systems and Installation of Solar PV System.

Table 4.2 Information on Financial Resources, Technology Transfer, Capacity-Building and Technical Support Received

Type		GEF	Annex II & other developed country Parties	Multilateral institutions	Green Climate Fund	Other sources
		Preparation of BURs				
Preparation of BUR	Financial resources	352,000				N/A
	Capacity-building					N/A
	Technical support					
	Technology transfer					
		Activities covered by BURs				
Capacity Building cooperation for NAMA's in a MRV manner	Capacity-building		√			
Building Energy Efficiency Project, 2009-2013	Capacity-building	975,000				340,000
Improving Energy Efficiency in Public Buildings in Khovd and Zavkhan aimags, 2014-2016	Technology transfer					1,200,000
Nationally Appropriate Mitigation Actions in the construction sector in Mongolia ()2016-2020)	Technology transfer		1.269.8			5,630,1
Green Public Transportation, 2012-2013	Technical support					√
Multipurpose National Forest Inventory	Capacity-building					

CHAPTER 5

Other

5. OTHER

UN-REDD

Mongolia is participating in the UN-REDD (Reducing Emissions from Deforestation and forest Degradation). A National REDD+ Roadmap Taskforce in Mongolia was established in September 2011 and consists of 20 members representing different government, private sectors and civil society.

The MET coordinates UN-REDD+ activities and thus is responsible for mitigation in the forestry sector. The UN-REDD National Programme for Mongolia was launched in February 2016 with the overall objective: “To support the Government of Mongolia in designing and implementing its National REDD+ Strategy and in meeting the requirements under the UNFCCC Warsaw Framework to receive REDD+ results-based payments”.

The UN-REDD Programme, an initiative jointly implemented by the Food and Agriculture Organization of the United Nation, the United Nations Development Programme and the United Nations Environment Programme, is providing support to the Government of Mongolia, to get ready for REDD+. It will work together with the Ministry of Environment and Tourism and other stakeholders over the next three years to assist Mongolia in meeting all the requirements to ultimately be eligible for results-based payments. Mongolia REDD+ national programme has four main outcomes.

Under Outcome One of the Roadmap, the National Programme will support the establishment of Mongolia’s REDD+Readiness management structure to oversee the delivery of the key results described in the Roadmap and to prepare its National REDD+Strategy.

Under Outcome Two of the Roadmap, the National Programme will support the preparation of Mongolia’s National REDD+ Strategy through which key drivers of deforestation and forest degradation in Mongolia will be analyzed through detailed studies, and specific policies and measures to address those key identified drivers.

Under Outcome Three of the Roadmap, the National Programme will support the establishment of national forest Reference Emission Level and/or forest Reference Level (REL/RL), with sub-national forest RELs/RLs as potential interim measures.

Under Outcome Four of the Roadmap, the National Programme will support the development of a national forest monitoring system, comprising a monitoring function and a Measurement, Reporting and Verification (MRV) function

Reduction of air pollution

In addition to long-term benefits of greenhouse gas (GHG) reductions in the form of avoided health and ecosystem damage, there are important near-term benefits resulting reduction of air pollution.

The Government of Mongolia has been taking a series of measures to reduce air pollution in the urban area, especially in Ulaanbaatar, such as low-smoke stoves, promoting electric cars setting “0” customs tax, and collecting air pollution fees from motor vehicles. For

implementation of air pollution reduction measures, the government is cooperating with international organization such as Millennium Challenge Account – Mongolia.

The Energy and Environment Project or as known Clean Air Project in Mongolian is implemented by the Millennium Challenge Account – Mongolia (MCA-Mongolia) and funded by the U.S. Government's Millennium Challenge Corporation (MCC). The energy efficient stoves subsidized by the project use 20% to 30% less fuel, and emit 70% to 90% less pollution than traditional stoves. During the course of the project, nearly 100,000 improved stoves, 20,000 Ger insulation kits, 4500 vestibules, and 100 energy efficient homes were subsidized.

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Forest Law
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ANNEX

The quantitative data used for estimations expressed by the figures in the section of Mitigation Actions and Their Effects

Projected GHG emissions and removal by sources/sinks, BAU by sectors							
Year	Energy	Industry	Livestock	Cropland	Abandoned Land	Forest	Waste
2010	100	100	100	100	100	100	100
2015	127	246	171	116	94	97	130
2020	170	318	194	127	175	93	150
2025	218	408	217	137	191	88	170
2030	275	499	240	148	206	83	190
							Index Year 2010=100

Projected total GHG emissions by gases, BAU							
Year	Gg CO2 Eq				Index: 2010=100		
	CO2	CH4	N2O		CO2	CH4	N2O
2010	12469.9	326.9	0.3	2010	100.0	100.0	100.0
2011	13534.4	358.6	0.3	2011	108.5	109.7	107.2
2012	14632.6	393.2	0.4	2012	117.3	120.3	117.8
2013	15440.5	432.9	0.4	2013	123.8	132.4	123.9
2014	15065.1	489.6	0.4	2014	120.8	149.8	120.3
2015	16144.5	529.2	0.4	2015	129.5	161.9	128.0
2016	19419.9	548.3	0.4	2016	155.7	167.8	136.3
2017	20820.6	563.8	0.4	2017	167.0	172.5	143.6
2018	22262.3	579.4	0.5	2018	178.5	177.3	151.2
2019	23749.8	594.9	0.5	2019	190.5	182.0	159.0
2020	25269.1	610.5	0.5	2020	202.6	186.8	167.2
2021	26660.5	626.1	0.5	2021	213.8	191.6	175.6
2022	28099.3	641.7	0.6	2022	225.3	196.3	184.3
2023	29585.4	657.4	0.6	2023	237.3	201.1	193.3
2024	31118.4	673.0	0.6	2024	249.5	205.9	202.7
2025	32697.7	688.7	0.6	2025	262.2	210.7	212.3
2026	34322.6	704.4	0.7	2026	275.2	215.5	222.2
2027	35992.1	720.1	0.7	2027	288.6	220.3	232.4
2028	37702.0	735.9	0.7	2028	302.3	225.1	242.9
2029	39449.1	751.7	0.8	2029	316.4	230.0	253.6
2030	41236.8	767.5	0.8	2030	330.7	234.8	264.7
							Unit: Gg CO2 Eq

GHG emissions in energy sector								
Year	Transformation/ Electricity Generation	Transformation/Fugitive	Demand /Industry	Demand/ Transport	Demand/Commercial	Demand/ Household	Demand/Agriculture	Total Energy Sector
2010	7523.8	461.2	1573.6	1320	1139.5	1540.3	146.5	13704.9
2011	7988.8	541.4	1936	1587.2	1048.8	1478.6	196	14776.8
2012	8684.9	483.1	2166.6	1884.1	1135.6	1354.7	198.4	15907.4
2013	9427.3	473.7	2123.2	1870.8	1076.7	1674.9	220.1	16866.7
2014	9846.1	412.4	1760.4	1900.2	945.3	1226.1	200.4	16290.9
2015	10095.9	398	2561.9	1962	851.6	1315.1	210	17394.5
2016	10767.6	476	2677.2	1907.3	1129.2	1559.4	208.9	18725.6
2017	11396	502.4	2858.4	1982.9	1188.8	1639.7	219.8	19788
2018	12060.3	529.1	3046	2054.7	1250.1	1720.7	230.8	20891.7
2019	12760.9	556.1	3239.6	2127.4	1313.2	1802.2	241.9	22041.3
2020	13498.2	583.5	3439.1	2200.8	1377.9	1884.3	253.1	23236.9
2021	14272.5	611.1	3644.2	2275.1	1444.4	1967	264.6	24478.9
2022	15084	639.1	3854.7	2350.2	1512.6	2050.1	276.1	25766.8
2023	15932.8	667.3	4070.3	2426.1	1582.7	2133.8	287.8	27100.8
2024	16818.9	695.9	4290.4	2502.8	1654.5	2218	299.6	28480.1
2025	17741.8	724.7	4514.8	2580.4	1728.4	2302.7	311.6	29904.4
2026	18701.3	753.9	4743	2658.7	1804.2	2388	323.7	31372.8
2027	19696.8	783.3	4974.3	2737.9	1882.3	2474	335.9	32884.5
2028	20727.6	813.1	5208.2	2817.9	1962.8	2560.6	348.3	34438.5
2029	21793.1	843.1	5444	2898.7	2045.8	2648	360.8	36033.5
2030	22892.8	873.5	5680.7	2980.3	2131.4	2736.3	373.4	37668.4
								Unit: Gg CO2 Eq

Share of GHG emission by energy sectors			
Sectors	2010	2020	2030
Electricity production	54.8992	58.0893	60.7746
Industry	11.4818	14.8001	15.0807
Transport	9.6316	9.4713	7.912
Commercial	8.3148	5.9298	5.6583
Household	11.239	8.1091	7.2641
Agriculture	1.0686	1.0894	0.9913
Fugitive emission	3.365	2.511	2.319
			Unit: Percent

GHG emission reduction by renewables							
Year	Baseline	Planned	Policy	Year	Baseline	Planned	Policy
2010	7523.8	7523.8	7523.8	2010	7523.8	7523.8	7523.8
2015	10095.9	9652.3	9086.3	2011	7988.8		
2020	13498.2	10760.9	10798.6	2012	8684.9		
2025	17741.8	13002.3	13306.4	2013	9427.3		
2030	22892.8	15666.3	16025	2014	9846.1		
			Unit: Gg CO2 Eq	2015	10095.9	9652.3	9086.3
				2016	10767.6		
				2017	11396		
				2018	12060.3		
				2019	12760.9		
				2020	13498.2	10760.9	10798.6
				2021	14272.5		
				2022	15084		
				2023	15932.8		
				2024	16818.9		
				2025	17741.8	13002.3	13306.4
				2026	18701.3		
				2027	19696.8		
				2028	20727.6		
				2029	21793.1		
				2030	22892.8	15666.3	16025
							Unit: Gg CO2 Eq

GHG emission reduction by renewables									
Year	Total energy sector emission	Energy efficiency	Renewable	Total emission reduction	Year	Total energy sector emission	Energy efficiency	Renewable	Total emission reduction
2010	13704.8	13704.8	13704.8	13704.8	2010	13.7048	13.7048	13.7048	13.7048
2015	17394.5	17194.5	16994.5	16794.5	2011	14.7766	14.7766	14.7766	14.7766
2020	23237	21136	20537	18436	2012	15.9074	15.9074	15.9074	15.9074
2025	29904.4	26586.9	25204.4	21886.9	2013	16.8668	16.8668	16.8668	16.8668
2030	37668.4	33980.4	30468.4	26780.4	2014	16.2909	16.2909	16.2909	16.2909
					2015	17.3945	16.9945	17.1945	16.7945
					2016	18.7256	17.6524	17.8136	16.7403
					2017	19.788	18.3103	18.4327	16.955
					2018	20.8916	18.9682	19.0518	17.1284
					2019	22.0412	19.6262	19.6709	17.2558
					2020	23.237	20.537	20.29	17.59
					2021	24.4789	21.4705	21.5494	18.541
					2022	25.7669	22.404	22.8088	19.4458
					2023	27.1008	23.3374	24.0681	20.3048
					2024	28.4801	24.2709	25.3275	21.1183
					2025	29.9044	25.2044	26.5869	21.8869
					2026	31.3729	26.2572	28.0656	22.95
					2027	32.8846	27.31	29.5443	23.9697
					2028	34.4385	28.3628	31.023	24.9473
					2029	36.0335	29.4156	32.5017	25.8838
					2030	37.6684	30.4684	33.9804	26.7804
									Unit: Gg CO2 Eq

Cement consumption and demand				
Year	Imported	Produced	Total consumption	Installed capacity
2007	415.3	179.9	595.2	1050
2008	643.7	269.3	913	1285
2009	307.7	234.9	542.6	1285
2010	455.9	322.5	778.4	1285
2011	785.9	425.7	1211.6	1285
2012	1192.3	349.2	1541.5	1285
2013	1525.4	259.04	1784.44	1285
2014	1506	411.3	1917.3	1285
2015	884.3	410.1	1294.4	4595
2016				4595
2017				4595
2018				4595
2019				4595
2020			4400	4595
2021				4595
2022				4595
2023				4595
2024				4595
2025				4595
2026				4595
2027				4595
2028				4595
2029				4595
2030				4595
				Unit: 1000 tonnes

GHG emission projection from Cement production		
Year	Wet technology	Dry technology
2010	284.9288	279.9648
2011	376.106	370.0105
2012	308.5182	301.6562
2013	228.8618	222.1203
2014	363.3836	301.3883
2015	362.3234	287.8451
2016	2282.1123	1810.7082
2017	2515.9571	1996.2489
2018	2749.8019	2181.7896
2019	2983.6466	2367.3303
2020	3217.4914	2552.871
2021	3451.3362	2738.4116
2022	3685.181	2923.9523
2023	3919.0258	3109.493
2024	4152.8705	3295.0337
2025	4386.7153	3480.5744
2026	4620.5601	3666.115
2027	4854.4049	3851.6557
2028	5088.2497	4037.1964
2029	5322.0944	4222.7371
2030	5555.9392	4408.2778
		Unit: Gg CO2 Eq

Number of livestock in Mongolia						
Year	Total	Horse	Cattle	Camel	Sheep	Goat
2000	30.2275				13.8764	10.2698
2001	26.0753	2.1918	2.0696	0.2852	11.9373	9.5913
2002	23.8976	1.9889	1.8843	0.253	10.6366	9.1348
2003	25.4277	1.9689	1.7928	0.2567	10.7564	10.6529
2004	28.0279	2.0053	1.8416	0.2566	11.6864	12.238
2005	30.3988	2.0291	1.9636	0.2542	12.8845	13.2674
2006	34.8029	2.1148	2.1679	0.2535	14.8151	15.4517
2007	40.2638	2.2395	2.4258	0.2606	16.9901	18.3478
2008	43.2885	2.1869	2.5034	0.2664	18.3623	19.9694
2009	44.0239	2.2213	2.5993	0.2771	19.2747	19.6515
2010	32.7295	1.9203	2.176	0.2696	14.4804	13.8832
2011	36.3358	2.1129	2.3397	0.2801	15.6685	15.9346
2012	40.9209	2.3304	2.5846	0.3058	18.1414	17.5587
2013	45.1443	2.6194	2.9095	0.3215	20.0664	19.2276
2014	51.9826	2.9958	3.4139	0.3493	23.2148	22.0089
2015	55.9798	3.2953	3.7804	0.368	24.9431	23.5929

Unit: Million livestock

Number of livestock in Mongolia (WAM) / “Mongolian livestock” program 2010 targets assumed to be fully implemented and reached						
Year	Total	Horse	Cattle	Camel	Sheep	Goat
2000	30.2275				13.8764	10.2698
2001	26.0753	2.1918	2.0696	0.2852	11.9373	9.5913
2002	23.8976	1.9889	1.8843	0.253	10.6366	9.1348
2003	25.4277	1.9689	1.7928	0.2567	10.7564	10.6529
2004	28.0279	2.0053	1.8416	0.2566	11.6864	12.238
2005	30.3988	2.0291	1.9636	0.2542	12.8845	13.2674
2006	34.8029	2.1148	2.1679	0.2535	14.8151	15.4517
2007	40.2638	2.2395	2.4258	0.2606	16.9901	18.3478
2008	43.288	2.207688	2.510704	0.259728	18.35411	19.95577
2009	40.80185	2.18926	2.524888	0.261483	17.50838	18.31784
2010	37.48698	2.16469	2.543801	0.263823	16.38074	16.13393
2011	34.17212	2.14012	2.562714	0.266162	15.2531	13.95002
2012	33.3434	2.133978	2.567442	0.266747	14.97119	13.40405
2013	33.99523	2.22276	2.841193	0.271962	15.32269	13.33663
2014	34.64707	2.311543	3.114944	0.277177	15.6742	13.26921
2015	35.2989	2.400325	3.388694	0.282391	16.0257	13.20179
2016	35.49502	2.498771	3.662851	0.290039	16.0965	12.94686
2017	35.69113	2.597217	3.937007	0.297688	16.1673	12.69192
2018	35.88725	2.695662	4.211164	0.305336	16.2381	12.43699
2019	36.08337	2.794108	4.48532	0.312984	16.3089	12.18206
2020	36.27948	2.892554	4.759476	0.320632	16.3797	11.92712
2021	36.4756	2.990999	5.033633	0.32828	16.4505	11.67219

Unit: Million livestock

Number of livestock in Mongolia (WEM) / "Mongolian livestock" program 2010 targets assumed to be fully implemented and reached						
Years	Total	Horse	Cattle	Camel	Sheep	Goat
2000	30.2275				13.8764	10.2698
2001	26.0753	2.1918	2.0696	0.2852	11.9373	9.5913
2002	23.8976	1.9889	1.8843	0.253	10.6366	9.1348
2003	25.4277	1.9689	1.7928	0.2567	10.7564	10.6529
2004	28.0279	2.0053	1.8416	0.2566	11.6864	12.238
2005	30.3988	2.0291	1.9636	0.2542	12.8845	13.2674
2006	34.8029	2.1148	2.1679	0.2535	14.8151	15.4517
2007	40.2638	2.2395	2.4258	0.2606	16.9901	18.3478
2008	43.2885	2.1869	2.5034	0.2664	18.3623	19.9694
2009	44.0239	2.2213	2.5993	0.2771	19.2747	19.6515
2010	32.7295	1.9203	2.176	0.2696	14.4804	13.8832
2011	36.3358	2.1129	2.3397	0.2801	15.6685	15.9346
2012	40.9209	2.3304	2.5846	0.3058	18.1414	17.5587
2013	45.1443	2.6194	2.9095	0.3215	20.0664	19.2276
2014	51.9826	2.9958	3.4139	0.3493	23.2148	22.0089
2015	55.9798	3.2953	3.7804	0.368	24.9431	23.5929
2016	35.49502	2.498771	3.662851	0.290039	16.0965	12.94686
2017	35.69113	2.597217	3.937007	0.297688	16.1673	12.69192
2018	35.88725	2.695662	4.211164	0.305336	16.2381	12.43699
2019	36.08337	2.794108	4.48532	0.312984	16.3089	12.18206
2020	36.27948	2.892554	4.759476	0.320632	16.3797	11.92712
2021	36.4756	2.990999	5.033633	0.32828	16.4505	11.67219
						Unit: Million livestock

CH4 emission projection from livestock Mongolia			
Year	Total/BaU	Including Mongolian livestock program	Mongolian livestock program-2015 -
2001	257.4858	257.4858	257.4858
2002	234.8573	234.8573	234.8573
2003	238.5565	238.5565	238.5565
2004	254.0762	254.0762	254.0762
2005	271.2657	271.2657	271.2657
2006	302.9527	302.9527	302.9527
2007	343.0007	343.0007	343.0007
2008	360.9369	361.23836	360.9369
2009	369.5281	349.2357449	369.5281
2010	291.057	333.2322581	291.057
2011	318.8982	317.2287713	318.8982
2012	355.9907	313.2278996	355.9907
2013	395.1547	329.3525769	395.1547
2014	456.564	345.4772543	456.564
2015	496.6022	361.6019316	496.6022
2016		375.6904536	375.6904536
2017		389.7789756	389.7789756
2018		403.8674976	403.8674976
2019		417.9560196	417.9560196
2020		432.0445416	432.0445416
2021		446.1330636	446.1330636
			Unit : Gg CH4

GHG emission projection from livestock, Mongolia Gg CO2eq

Year	WoM	WAM	WEM
2001	5407.202	5407.202	5407.202
2002	4932.003	4932.003	4932.003
2003	5009.687	5009.687	5009.687
2004	5335.6	5335.6	5335.6
2005	5696.58	5696.58	5696.58
2006	6362.007	6362.007	6362.007
2007	7203.015	7203.015	7203.015
2008	7579.675	7586.006	7579.675
2009	7760.09	7333.951	7760.09
2010	6112.197	6997.877	6112.197
2011	6696.862	6661.804	6696.862
2012	7475.805	6577.786	7475.805
2013	8298.249	6916.404	8298.249
2014	9587.844	7255.022	9587.844
2015	10428.65	7593.641	10428.65
2016		7889.5	7889.5
2017		8185.358	8185.358
2018		8481.217	8481.217
2019		8777.076	8777.076
2020		9072.935	9072.935
2021		9368.794	9368.794
			Unit : Gg CO2 Eq

Change in Biomass pool in cropland, Mongolia (COMAP model)			
Year	BAU	Mit	MED
2010	369.33	369.33	369.33
2011	381.16	381.16	381.16
2012	398.19	398.19	398.19
2013	379.47	379.47	379.47
2014	406.38	406.38	406.38
2015	421.98	428.48	425.23
2016	437.58	450.58	444.08
2017	453.18	472.68	462.93
2018	468.78	494.78	481.78
2019	484.38	516.88	500.63
2020	499.98	538.98	519.48
2021	515.58	561.08	538.33
2022	531.18	583.18	557.18
2023	546.78	605.28	576.03
2024	562.38	627.38	594.88
2025	577.98	649.48	613.73
2026	593.58	671.58	632.58
2027	609.18	693.68	651.43
2028	624.78	715.78	670.28
2029	640.38	737.88	689.13
2030	655.98	759.98	707.98
			Unit: 1000 tonnes

Cereal crops area		
Year	Arable land	Abandoned yield
2007	121.8	292
2008	155.4	292
2009	255.5	292
2010	284.1	292
2011	293.2	292
2012	306.3	292
2013	291.9	305
2014	312.6	305
2015	329.6	305
2016	335.6	257.64
2017	341.6	210.28
2018	347.6	162.92
2019	353.6	115.56
2020	359.6	68.2
2021	365.6	59.2
2022	371.6	50.2
2023	377.6	41.2
2024	383.6	32.2
2025	389.6	23.2
2026	395.6	14.2
2027	401.6	5.2
2028	407.6	-3.8
2029	413.6	-12.8
2030	419.6	-21.8
		Unit: 1000 ha

Emission (removal) from cultivated and abandoned area, Mongolia (by old technology)		
Year	Emission-old technology (cultivated)	Removal (Abandoned)
2007	156.4521	-1071.64
2008	199.6113	-1071.64
2009	328.1898	-1071.64
2010	364.9265	-1071.64
2011	376.6154	-1071.64
2012	393.4424	-1071.64
2013	374.9456	-1119.35
2014	401.5347	-1119.35
2015	423.3712	-1119.35
2016	431.0782	-945.539
2017	438.7852	-771.728
2018	446.4922	-597.916
2019	454.1992	-424.105
2020	461.9062	-250.294
2021	469.6132	-217.264
2022	477.3202	-184.234
2023	485.0272	-151.204
2024	492.7342	-118.174
2025	500.4412	-85.144
2026	508.1482	-52.114
2027	515.8552	-19.084
2028	523.5622	13.946
2029	531.2692	46.976
2030	538.9762	80.006
		Unit: Gg CO2 eq

Emission (removal) from cultivated and abandoned area, Mongolia (by no till technology)		
Year	Emission-old technology (cultivated)	Removal (Abandoned)
2007	156.4521	-1071.64
2008	189.6307	-1071.64
2009	295.3708	-1071.64
2010	310.1875	-1071.64
2011	301.2923	-1071.64
2012	295.0818	-1071.64
2013	262.4619	-1119.35
2014	260.9976	-1119.35
2015	254.0227	-1119.35
2016	232.7822	-945.539
2017	210.6169	-771.728
2018	187.5267	-597.916
2019	163.5117	-424.105
2020	138.5719	-250.294
2021	131.4917	-217.264
2022	124.1033	-184.234
2023	116.4065	-151.204
2024	108.4015	-118.174
2025	100.0882	-85.144
2026	91.46668	-52.114
2027	82.53683	-19.084
2028	73.29871	13.946
2029	63.7523	46.976
2030	53.89762	80.006
		Unit: Gg CO2 eq

GHG emission reduction projection from cropland	
Year	Emission reduction
2007	0
2008	9.980565
2009	32.81897
2010	54.73897
2011	75.32308
2012	98.36059
2013	112.4837
2014	140.5371
2015	169.3485
2016	198.296
2017	228.1683
2018	258.9655
2019	290.6875
2020	323.3343
2021	338.1215
2022	353.2169
2023	368.6207
2024	384.3327
2025	400.353
2026	416.6815
2027	433.3184
2028	450.2635
2029	467.5169
2030	485.0786
	Unit: Gg CO2 eq

Change in biomass pool of forest (COMAP model)

Year	BSL	MIT	MED
2000	874.8615	877.4768	876.1691
2001	874.9102	877.5254	876.2178
2002	874.9534	877.5687	876.261
2003	874.9913	877.6065	876.2989
2004	875.0237	877.639	876.3313
2005	875.0507	877.666	876.3584
2006	875.0724	877.6876	876.38
2007	875.0886	877.7038	876.3962
2008	875.0994	877.7146	876.407
2009	875.1048	877.72	876.4124
2010	875.1048	877.72	876.4124
2011	875.1048	877.7146	876.4097
2012	875.1048	877.4305	876.2677
2013	874.1379	880.421	877.2794
2014	877.508	883.909	880.7085
2015	878.0772	884.4247	881.251
2016	879.6367	888.5205	884.0786
2017	881.4281	900.6071	891.0176
2018	883.2252	912.7037	897.9644
2019	885.028	924.8105	904.9193
2020	886.8365	948.0714	917.4539
2021	887.7597	962.5172	925.1384
2022	888.6886	975.9889	932.3387
2023	889.6232	989.4727	939.5479
2024	890.5635	1002.969	946.7663
2025	891.5094	1016.478	953.9939
2026	892.461	1030.001	961.231
2027	893.4184	1043.537	968.4778
2028	894.3815	1057.088	975.7345
2029	895.3503	1070.652	983.0013
2030	896.3249	1083.929	990.1271
			Unit: 1000 tonnes

GHG emission projection of solid waste

Year	Low	Med	High
2010	45.2679	45.2679	45.2679
2011	61.793	61.8248	61.9221
2012	68.1099	68.1802	68.4113
2013	69.9091	70.0256	70.4177
2014	69.5474	69.7196	70.286
2015	70.9469	71.1861	71.9358
2016	74.7936	75.1126	76.0502
2017	78.6008	79.0138	80.1399
2018	82.3621	82.8845	84.1976
2019	86.0715	86.7197	88.2167
2020	89.7237	90.5139	92.191
2021	93.1105	94.0582	95.9111
2022	96.4318	97.5519	99.5763
2023	99.6885	100.993	103.1851
2024	102.884	104.3818	106.7391
2025	106.0225	107.7214	110.2435
2026	109.1577	111.0641	113.7536
2027	112.2497	114.3691	117.2317
2028	115.3078	117.6461	120.69
2029	118.3411	120.905	124.1407
2030	121.3569	124.1531	127.593
			Unit: Gg CO2 Eq

Emission reduction of Solid waste				
Year	BAU	Total reduction	Reuse	Recycle
2010	45.2679	42.3779	43.4979	44.1479
2011	61.8248	56.196	58.2848	59.736
2012	68.1802	59.8127	62.8702	65.1227
2013	70.0256	58.9193	62.9456	65.9993
2014	69.7196	52.3946	57.3896	64.7246
2015	71.1861	47.6423	53.6061	65.2223
2016	75.1126	45.35	52.2826	68.18
2017	79.0138	43.0324	50.9338	71.1124
2018	82.8845	38.3186	49.6205	71.5826
2019	86.7197	33.5694	48.2717	72.0174
2020	90.5139	28.7791	46.8819	72.4111
2021	94.0582	25.4601	45.2422	74.2761
2022	97.5519	22.0905	43.5519	76.0905
2023	100.993	16.6345	41.7143	75.9132
2024	104.3818	11.1264	39.8245	75.6838
2025	107.7214	5.5689	37.8853	75.405
2026	111.0641	0.3707	36.1561	75.2787
				Unit: Gg CO2 Eq