INTENDED NATIONALLY DETERMINED CONTRIBUTION OF MONGOLIA

TO THE 2015 AGREEMENT UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC) AND SUBMITTED TO THE UNFCCC SECRETARIAT ON 24TH OF SEPTEMBER 2015

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Editor-in-chief: Batjargal Zamba
Project director: Batjargal Khandjav
National Working team: Tegshjargal Bumtsend (project manager),
Solongo Byambadorj (project administrative assistant),
Saruul Dolgorsuren (development of project proposal)

International consultants:
GIZ supported consultants:
Inga Zachow (Global INDC Support Programme, GIZ),
Koen Smekens, James Falzon,
Matthew Halstead (Energy Research Centre of the Netherlands, ECN),
Thomas Day (New Climate Institute, NCI)
Consultants from UNEP-DTU Partnership:
Sudhir Sharma, Prakriti Naswa

Leaders of the Thematic Working Groups:
Batimaa P., Natsagdorj L.

Members of the Thematic Working Groups:
Dorjpurev J., Namkhainyam B.,
Bolortsetseg B., Bynie B., Davaa G.,
Davaadorj G., Dorjsuren Ch., Gomboluudev P.,
Erdenetsetseg B.

Designed by: Batzorig.B

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ABBREVIATIONS

ADB	Asian Development Bank
BAU	Business as usual scenario
CC	Climate change
CHP	Combined heat and power plant
DTU	Technical University of Denmark
ECN	Energy Research Centre of the Netherlands
GCF	Green Climate Fund
GEF	Global Environmental Facility
GHG	Greenhouse gas
HPP	Hydro power plant
IPCC	Intergovernmental Panel on Climate Change
JCM	Joint Crediting Mechanism between Mongolia and Japan
LULUCF	Land use, land-use change and forestry
MEGDT	Ministry of Environment, Green Development and Tourism of Mongolia
NAMAs	Nationally appropriate mitigation actions
NAPCC	National action programme on climate change
NCF	Nature Conservation Fund
NMVOC	Non-methane volatile organic compounds
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

UNITS

°C	Degree celsius
CO_2-eq.	Carbon dioxide equivalent
Gg	Gigagram = 10^9 gram
ha	Hectares
km	Kilometre
MW	Megawatt = 10^6 watt
mln	Million
t	Tonnes

Foreword

According to Mongolia's Second Assessment Report on Climate Change 2014, the impacts and consequences of climate change are eventually visible in Mongolia through environmental degradation with the change in water resources and regimes, shrinking lakes, ponds and springs in non-permafrost areas, depletion of groundwater tables, pasture and soil degradation due to aridity and extreme heat in the summer, a loss of biodiversity, intensified desertification, the changes of wildlife habitat, and the increasing frequency of forest and steppe fires.

In the assessment report, issued by the international organization, Mongolia has ranked at 8 out of the 10 world's most vulnerable countries to the climate change by its long-term index, based on data between 1993 and 2012. Future climate change projections indicate that there is a higher possibility of increased intensification of drought and ddzud throughout the country. Such frequent occurrences of drought and ddzud and decline of livestock productivity will have adverse impact on livelihood of local communities, and thus migration might exacerbate the challenges faced by the urban settlements and cities.

The amount of machinery, technology, fertilizer, pesticides and herbicides in the arable farming has multiplied since the rapid development of agriculture sector in 1980s; however, the crop yield per hectare fluctuated around 50 percent depending on weather conditions. Current year's poor harvest shows that such situation is actual in nowadays as well. Moreover, climate change might have adverse impact on human health. For instance, due to climate zone shifts, outbreaks of new emerging infectious diseases might spread among the population.

In this respect, there is a strong need to develop long term strategies on response and adaptation to climate change, covering all possible impacts on livelihood of local communities, on the trend of economic development at the national and regional levels, as well on the urban planning and infrastructure development in the country. Considering the equality in mitigating global and regional climate change, Mongolia convinced that as a UN member country it has responsibility to make its contribution to the climate change mitigation activities, mobilizing own potential and with the financial and technical support from the international organizations and donor community.

As the world marches toward the United Nations Framework Convention (UNFCCC) Conference of the Parties (COP21) in December 2015, together with the move from the Millennium Development Goals to Sustainable Development Goals, governments have prepared their Intended Nationally Determined Contributions (INDCs) setting efforts towards limiting the rise of the global average temperature below 2°C above pre-industrial levels.

Reaffirming its commitment to support the efforts of international community in reaching the multi-lateral agreement to fulfil the main goal of the Convention, Mongolia has developed its INDC, which reflect Mongolia's endeavours towards the reduction of emissions. The INDC of Mongolia respectfully addressed both mitigation and adaptation challenges, and was officially submitted to UNFCCC Secretariat on 24th of September, 2015.

I strongly believe that, by implementing actions included in the INDC, Mongolia will not only strengthen the capacity of surmounting the adverse impacts of global climate change but also will contribute to global climate change mitigation actions.

Battsereg Namdag

Member of the Parliament, Minister of Environment, Green Development and Tourism

Preface

National context

Mongolia is a landlocked country located in the centre of the Eurasian continent in a temperate climate zone. The climate is characterised by high fluctuations and extremes in temperature and precipitation. The annual mean temperature ranges from -8°C to 8°C across regions and the annual precipitation varies from 50mm in the Gobi desert to 400mm in the northern mountainous area. Climate change assessments undertaken in Mongolia in 2009 and 2014, demonstrated that fragile ecosystems, a reliance on pastoral animal husbandry and rain-fed agriculture, and the growing population with a tendency of urbanization, all combine to make Mongolia's socio-economic development vulnerable to climate change.

Development of Mongolia's INDC

Mongolia's INDC has its conceptual roots in the Green Development Policy of Mongolia, approved by the Parliament in 2014, to which key sectoral action plans at the national level, including energy sector, are being adjusted. Key indicators for measuring progress in the implementation of the Green Development Policy include, among others, efficient use of energy, GHG emissions and ecological footprint per unit of GDP. The National Action Programme on Climate Change (NAPCC) endorsed by the Parliament 2011 includes concrete measures in response to climate change covering all principal sectors of the economy. These and other relevant national level policy documents served as a basis for the development of Mongolia's INDC, which was shaped and finalized through comprehensive consultation exercises with a broad range of stakeholders.

Adaptation component

The melting of permafrost and glaciers, surface water shortages, and soil and pasture degradation have been identified as particular challenges faced by Mongolia as a result of climate change. Due to a high degree of vulnerability to climate change, adaptation is particularly important for Mongolia, and as such a distinct adaptation component is therefore included in the INDC. The selection of priorities for the adaptation component is based on a detailed analysis of the expected impacts, potential solutions and challenges, and of possible synergies between adaptation and mitigation activities (Part I).

Mitigation contribution

In its INDC, Mongolia 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% 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 (Part II).

Acknowledgement

Development of this document was undertaken by experienced national teams of specialists and professionals lead by Dr. Natsagdorj L. (Adaptation team: Bolortsetseg B., Bynie B., Davaa G., Davaadorj G., Dorjsuren Ch., Erdenetsetseg B., Gomboluudev P.), Dr. Batima. P. (Mitigation team: Dorjpurev J., Namkhainyam B.) and Dr. Batjargal Z. served as a lead advisor on the content and methodology of the work and essential contributions were made by the Deutsche Gesellschaft fuer Internationale Zusammenarbeit GmbH (GIZ) supported international consultants: Inga Zachow (GIZ, Global INDC Support Programme), Koen Smekens, James Falzon and Matthew Halstead (Energy Research Centre of the Netherlands, ECN) Thomas Day (New Climate Institute, NCI) and the consultants from the UNEP-DTU Partnership Sudhir Sharma and Prakriti Naswa.

Preparation and compilation of this document were coordinated by the Climate Change Project Implementing Unit (CCPIU) of the Nature Conservation Fund (NCF) under the Ministry of Environment, Green Development and Tourism (MEGDT) of Mongolia with technical and financial support from the Global Environmental Facility (GEF) and United Nations Environment Programme (UNEP).

Ms. Tegshjargal B. (project manager) and Ms. Solongo B. (project administrative assistant) were responsible for overall coordination activities on the implementation of the project under general guidance Mr. Batjargal Kh., director of the NCF. The rest staff of the CCPIU of NCF have provided invaluable support and contributed significantly to the success of the work. The policy support from the MEGDT and the Ministry of Foreign Affairs (MFA) and guidance of the relevant departments of these and other ministries have played an important role in the successful completion and authorization 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.

Batjargal Zamba

National Focal Point for the UNFCCC

II

Climate Change Adaptation

CHAPTER 1. RATIONALE AND PROCESS FOR DEVELOPING INDCs ON ADAPTATION

1.1. Adaptation Rationale

Mongolia is a landlocked country located in the centre of the Eurasian continent and in a temperate climate zone. Because of its location, ecosystems in Mongolia are unique and fragile to the livelihood of people. Therefore, socio-economic development of the country is highly vulnerable to climate change.

In the last 50 years, Mongolia faced challenges such as pasture degradation and desertification, shrinkage of habitats, decrease in the number of plant species and wild live, regular outbreaks of fires and water resource deficit in the steppe region as well as increased frequency and magnitude of climate disasters including drought and dzud. As a result, socio-economic negative impacts have been visible in ways of unstable variations in crop production, animal loss, increased migrant or "ecological refugees" from rural to urban, outbreaks of new diseases, epidemics and public health issues.

Apparently, adaptation strategies are required to be aligned with the country and sector development policies and planning under such climate change impacts on the environment, natural resources and socio economic sectors.

Although, separate laws do not regulate climate change issues, the concept and principles related to climate change are streamlined in the Comprehensive national development strategy. The "Technology Needs Assessment for Adaptation" emphasized 8 strategies and policies of development at national and sectoral level including climate change related chapters and articles (TNA, 2013). One of the framework documents is the National Action Programme on Climate Change (NAPCC, 2011), which was updated and endorsed by the Parliament. The programme has defined 5 strategic objectives in two phases covered 2011-2021. Action plan for the first phase for 2011-2016 was approved by the Government Resolution No. 317. Within second strategic objective of the NAPCC, 13 actions have been reflected to improve adaptation capacity, ensure environmental sustainability and reduce vulnerability and risks of socio-economic sectors. Furthermore, Green Development Policy approved by the Parliament in 2014 includes climate change adaptation issues is one main target of the country development (MARCC, 2014).

The Long term Development Strategy (2015-2040), where climate change adaptation has been greatly emphasized, is under consideration for an approval by the Parliament. Fourth strategic direction of the strategy is entirely focusing on eco-friendly society through adapting to the climate change and risks prevention.

As above strategic documents and policies highlighted, adaptation requires more focus rather than mitigation because of high vulnerability of natural resources and socio-economic sectors to climate change. Accordingly, adaptation chapter has been included in the INDC report based on existing studies, analysis of adaptation processes, challenges faced and gaps. Through the gaps and barriers, corrective/priority actions and the support required to execute them in terms of finance, capacity and human resources has been defined. As a result, it will contribute to reduce vulnerability of the country to climate change and improve resilience of the nation.

CHAPTER 2. SUMMARY OF CLIMATE CHANGE TRENDS, IMPACTS AND VULNERABILITIES

2.1. Current climate change and future scenarios

The climate in Mongolia has a distinct four seasons, a wide range of temperature variation and low precipitation. Clear geographical pattern of climate variables can be seen depending on latitude and longitude. The annual mean temperature is -8°C to 8°C, the summer average is 10°C to 26°C and the winter average is -15°C to -30°C. The annual precipitation is about 50-400mm and 85% out of it falls in the warm season when intense rainfalls occur from convection process.

The climate change (as observed in the last 70 years) in Mongolia has the most intensified changes in thousands of years while Mongolians herd pastoral livestock. Consequently, these changes will cause serious risks and damage into socio-economic aspects that are highly dependent on weather and climate.

Observation records of 48 meteorological stations evenly scattered over Mongolia between 1940 and 2014 show that the annual mean temperature of the surface layer of the atmosphere has increased by 2.07°C, whereby more warming has occurred in mountainous areas and less increase in temperature has been observed in steppe and the Gobi desert. The warmest 10 years in last 74 years have occured since 1997 (Figure 2.1.a). Furthermore, average seasonal temperatures increased and summer warming has been in its highest rate (MARCC, 2014).

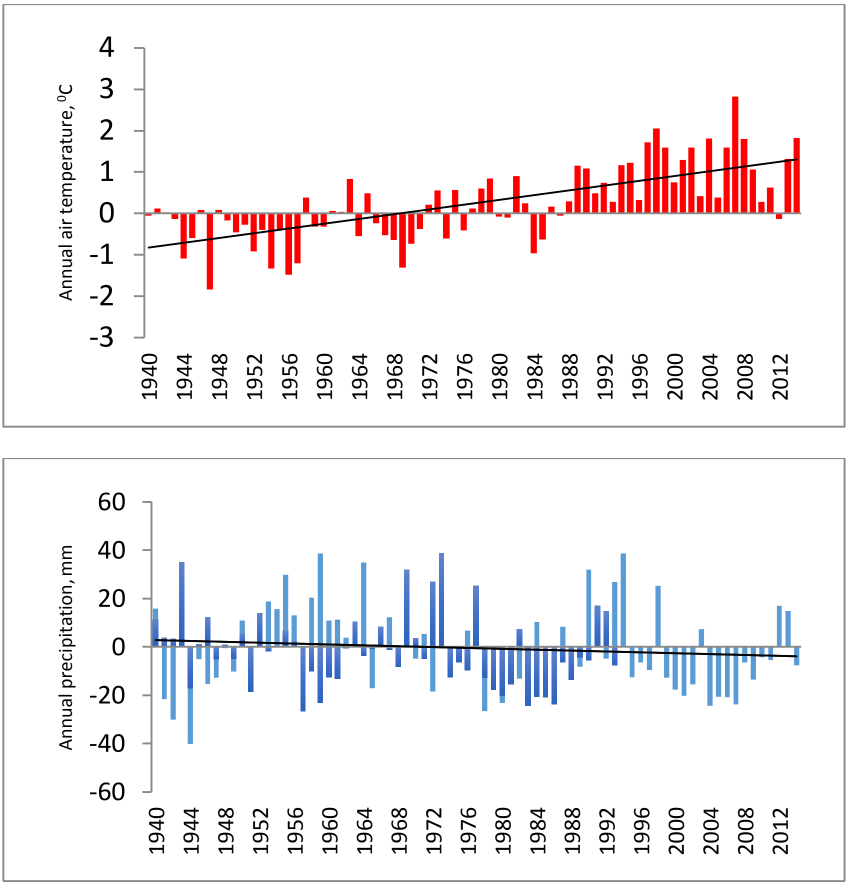

Figure 2.1. Changes in a) annual mean temperature, and b) annual precipitation in Mongolia between 1940 and 2014

For the same time period, the annual precipitation has experienced little decrease while winter precipitation has gradually increased and summer rain has slightly dropped (Figure 2.1.b). The highest precipitation decrease has been recorded in the central region of the country. Percentile of intensive rainfall has risen in the total precipitation of the growing season.

In general, climate extreme events such as number of days and duration of hot spells has grown and the number of cold days has reduced. Accordingly, the recorded maximum temperatures have changed in the recent years at meteorological stations.

The aridity index, defined as the ratio of precipitation to potential evapotranspiration (UNEP, 1992), estimated with 41 meteorological station's data, shows a decline by 0.003 in the last 74 years. A declining aridity index signifies that the aridification has intensified in Mongolia.

Based on scenarios estimated by global models (10 Global Climate Models), air temperature in all four seasons continue to grow in the country. In comparison with the base period (1986-2005), temperature increases are expected to be 2.2°C in the near future (2016-2035); and 2.5°C, 3.5°C and 6.0°C in the future period of 2081-2100 depending on low, medium and high emission scenarios respectively. Figure 2.2 shows future changes in winter and summer temperatures under three emission scenarios.

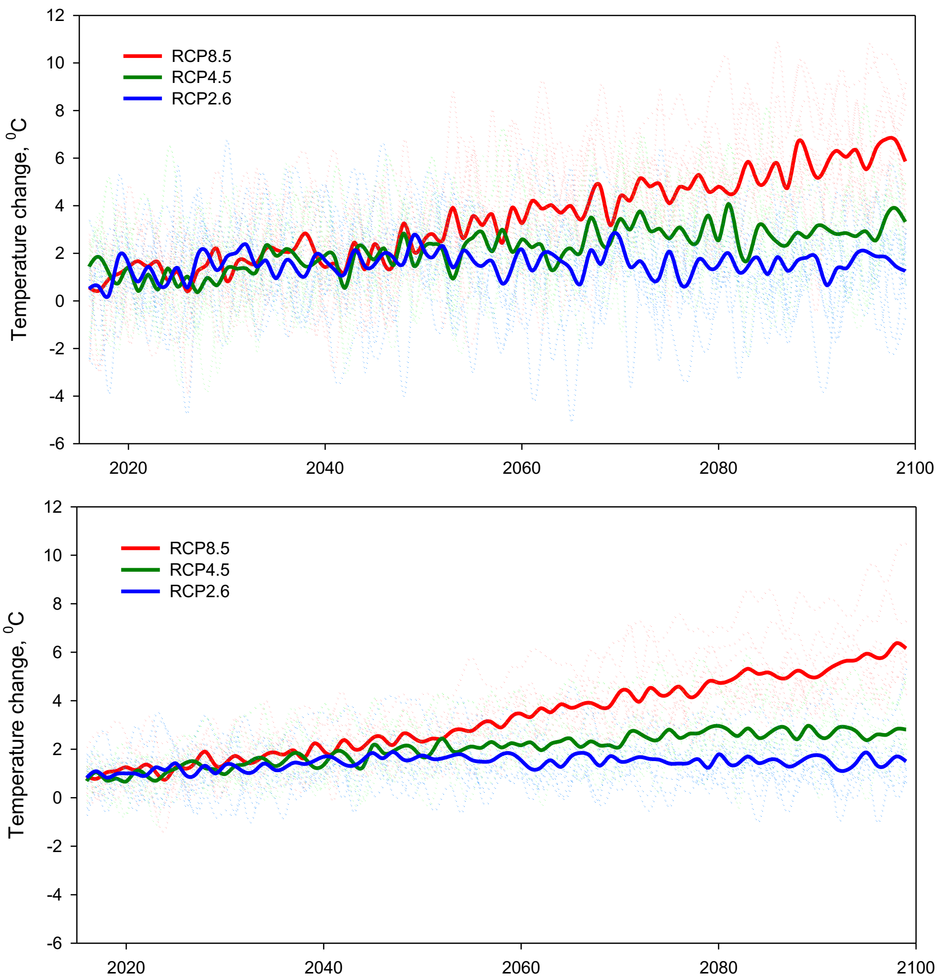

Figure 2.2. Future temperature changes in a) winter and b) summer seasons, °C (in comparison with the average temperatures during 1986-2005)

In the near future the seasonal precipitations will increase by 12% in winter, 9% in spring, 3% in summer and 7% in autumn. This trend will continue to grow in the end of the century and is estimated to be 15-50% increase in winter, 12-28% increase in spring, 5-8% increase in summer and 8-24% increase in autumn depending on emission scenarios.

Winter and summer seasons precipitation changes under three future emission scenarios are displayed in Figure 2.3.

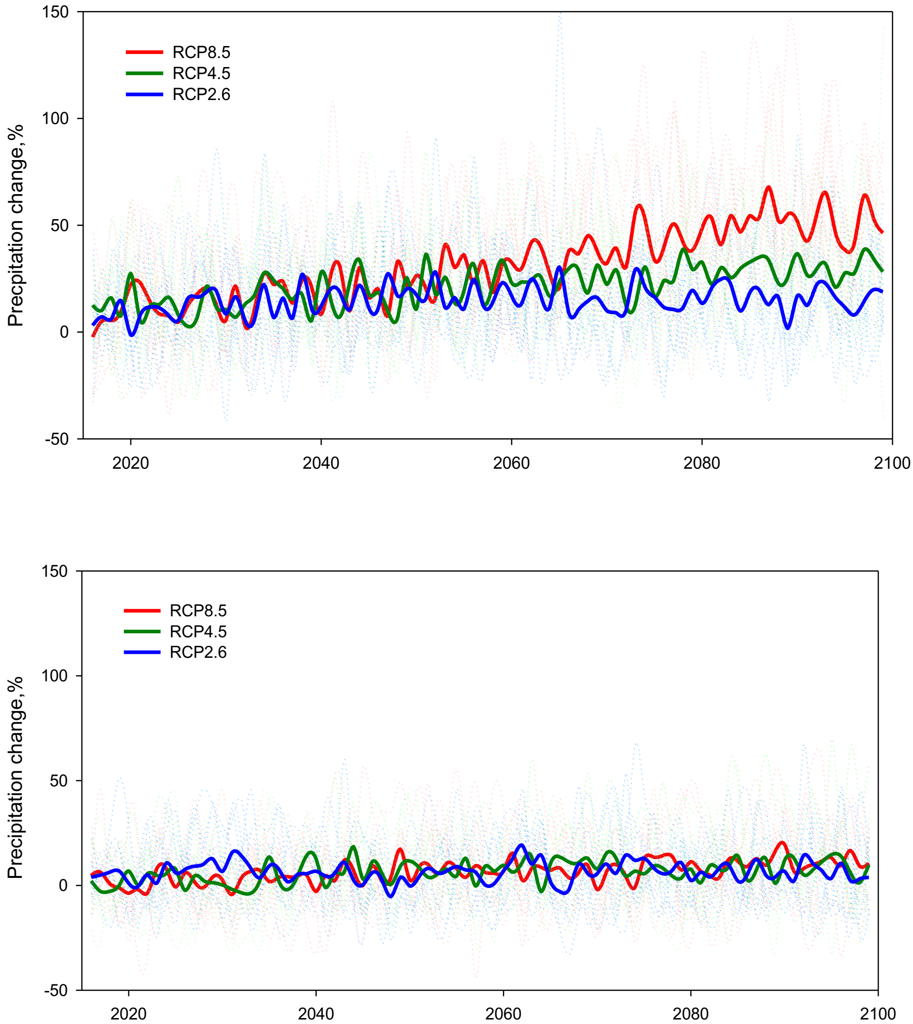

Figure 2.3. Future changes in precipitation in a) winter and b) summer seasons, % (in comparison with the average of period of 1986-2005)

2.2. Impact of climate change, vulnerability and risks

The second Assessment report on climate change (MARCC, 2014) summarized current observed climate change, future estimation, and impact of climate change on nature, socio-economic sectors, vulnerability and risk assessment in Mongolia.

Although, there could be some positive impacts of climate change for Mongolia, the negative impacts are likely to dominate and pose serious threats to the sustainability of the socio-economic systems. Table 2.1 summarizes impacts and risks caused by climate change on natural resources and socio-economic sectors and addresses the following:

- Change of climate variables under current climate change
- Key changes and impacts in the sectors
- Major results of expected impacts, vulnerability and risks assessment
- Actions and measure required to be taken

Based on the assessment, continuous warming in all seasons and decreased precipitation (especially in summer season) will lead to intensified droughts and dryness, which will adversely affect environmental and socio-economic sectors.

Ultimately, adaptation goal, objectives and actions should aim to reduce vulnerability and climate-induced risks of these sectors in alignment with development strategies, policies and plans of the country as well as international development directions.

Assessment of current and future impact of climate change confirms that animal husbandry, arable farming, human health, and natural resources including water, forest, pasture and soil are the most vulnerable sectors in Mongolia, and also reinforces the importance of natural disaster management.

Table 2.1. Summary of climate change impacts, vulnerability and risk assessment

No	Changes in climate and risk factors	Affected area/ sector	Current and past impacts in related areas/ sectors	Future impacts, vulnerability and risk assessment	Actions required
			1. Natural resources and ecosystems		
1.1	-Increased temperature in warm season which led to higher potential evapotranspiration and decreased precipitation, -Extended number of days and duration of hot spells, -More intensity and magnitude of droughts and longer dry spells.	Pasture and soils	-Pasture production has decreased by 20-30% in the past 40 years based on pasture observation data, -About 70% of pasture has changed in certain aspects, -Pasture plants composition has changed, ecosystem zones have shifted and plants tolerant to droughts have become dominant, -Soil fertility and quality has degraded.	-Results from “Century” ecosystem model showed that for aboveground biomass, net primary production and pasture biomass would decrease by 10-40% from current levels in natural zones, -Soil organic carbon is estimated to be reduced by 6.3-9.5% in the 2050s in the forest steppe and the steppe regions.	-Pasture management, -Ecosystem based adaptation measures, -Pasture restoration.
1.2	-Decreased precipitation in warm seasons and increased evapotranspiration rates, -Extended dry periods, and intense and longer droughts, -Warmer soil depth temperatures, -More visible warming in the high mountains zones.	Forest eco systems	-Area covered by forests has decreased by 4.1% in the period of 1999-2012, -Frequency of forest fires has increased and area burnt by forest fire has expanded by 13.3% in 1999-2012, -Recurrent drought and dry spells affect negatively the forest biomass accumulation and biomass annual growth tend to be slower, -Forest insects and pests tend to cover more areas.	-In 2050, area affected by harmful forest insects will expand by 1.4–13 times higher than current level, -Forest fire will cover more areas by 512 thousand hectare in 2030 without any measure against fires, -Areas of the high mountains and the forest steppe will decrease by 70-80% and 8-41% respectively, -Permafrost will continue to melt and forest strips border in the high mountains would shift toward the top of mountains.	-Forest management, -Expand forest plantations.

1.3	-Increase in average temperature in the cold season, -Decreased number of cold days, -Reduced precipitation in warm season and increased evapotranspiration, -Snow cover and ice melting occur earlier and river ice duration has shortened, -Decreased ice depth in rivers, -An intensity of rainfall increased.	Water resources, glacier, permafrost	-Surface water regime is being changed. Lake areas are decreasing and drying up small lakes, springs and even some rivers, -Negative mass balance and shrinkage of glaciers occur and total glacier area has reduced by 27.8% in last 70 years, -Ice thickness of rivers, draining from glaciers has increased by 4oCm and consequently duration of ice cover period has increased by 10-20 days and decreased its water temperature, -Duration of ice cover period and ice thickness have decreased by 20 days and by 35cm respectively in rest of rivers draining from no glacier areas. Water temperature has increased by 2°C, - A ground water table is tending to decrease.	-The average water temperature of the period of April to October will increase by 3.1-4.2°C by 2080, -River run-off would increase by 8-13 mm in 2080, while potential evaporation will increase several times, -The annual glacier melt rate or narrative mass balance will increase by 67% compared to melt rate of 1982-2010 period, -Temperatures in the ground depth of 10 and 15m have been increasing in the northern permafrost region and it tends to decrease and disappear in the southern region of the country.	-Construction of water reservoirs for river flow regulation, -Integrated water resources management of river basins (Water law, 2012).
1.4	-Intensified atmospheric phenomena caused by convection, -Re-current anomalies of atmospheric circulation.	Natural disasters	-Frequency of disastrous phenomena in the last two decades were compared: annually, about 75 phenomena were observed in the previous ten years and it has doubled in the last decade, -Rapid onset phenomena such as heavy rain, flash flood, strong wind, thunderstorm, and hail have been more frequent and intense and economic loss due to disasters has doubled, -Frequencies of drought and dzud are incresing and the biggest ddzud occurred in winters of 2002/2003 and 2009/2010 when GDP has decreased by at least 6%, -About 77.8% of the total land of Mongolia has experienced degradation and desertification at the certain extent.	-Frequency of atmospheric hazardous phenomena will increase by 23-60% than current level in the middle of the century, -Livestock loss due to drought and dzud is expected to increase by 9.4% in 2050 which is about 2.1% as of 1981-2000, -Land degradation and desertification would lead to increased evapotranspiration and decreased rainfall as a result of reverse feedback mechanism.	-Early warning system of natural disasters, -Index based insurance, -Contingency plan/ Guideline for Emergency Evacuation.

2. Major socio-economic sectors					
2.1	-Increased winter precipitation, -Frequent droughts and dzud, -Increased temperature and evapotranspiration in warm season and decreased precipitation, -Longer hot spells and heat waves.	Animal husbandry	-Current level of animal loss is about 2% and this rate has increased by 0.25% per year in the period of 1991-2011, -The average animal weight has decreased, -Pasture production has reduced and number of hot days which make grazing difficult for livestock have increased, -Dates for goat cashmere and sheep wool shearing have advanced by 5-10 days, -In the last years, 26 new diseases, 8 re-occurring and 6 extending diseases of animals have been recorded in the country.	-Animal losses caused by drought and dzud will increase and have been estimated at 8.2% and 9.4% in 2020 and 2050 respectively, -Snow in winter is predicted to increase by 40-50% and heavy snow will cause negative impact on grazing and decreased animal weight, -Due to animal weight loss, the total meat production is expected to decrease by 5.4% in 2050s, -Pasture water supplies will be challenging because of decreased small lakes and water ponds caused by intensified dryness.	-Improved animal breeds, -Regulate and manage animal numbers in alignment with pasture carrying capacity, -Integration of traditional pastoral livestock with intensified farming of animals, -Maintain appropriate ratio between types of animals and herds composition.
2.2	-Longer hot spells and heat waves, -Increased dryness and decreased soil moisture, -More frequent droughts.	Arable farming	-Hot spells (above 26^{o}C) inhibit photosynthesis process in crops and reduce production, -Dryness process has been intensified in the arable farming region in the last 70 years. Productive moisture in 1m layer of soil has reduced by about 30%, -Although, cumulative heat has been sufficient, moisture has become lacking for crop growth and development.	-Results of DSSAT 4.0 crop production model demonstrated that wheat production per hectare is estimated to decrease by 13% in the 2030s.	-Increase drip irrigation system coverage, -Appropriate crop rotation systems, -Increase minimum tillage for crops, -Introduce drought resistant crop varieties.

2.3	-Longer hot spells and heat waves, -Intensified heavy rains, -Longer growing season for crops.	Human health	-Cardiovascular disease has increased in the last 31 years (Burmaajav B. et al., 2010), -Cardiovascular diseases cases in Ulaanbaatar city has increased while the number of hot days above 30 ^{o}C has been increased, -A number of affected population by natural disasters tend to increase.	-Cases of cardiovascular diseases will continue to increase due to hot spells and hot waves, -Vector-borne infectious diseases would increase.	-Research and development (R&D) in health care system for climate related morbidity and mortality, -Early warning from hot spells and hot waves.
2.4	-Increased number of incidents of heavy snow and rains, -More frequent strong snow and dust storms.	Infrastructure	-Frequency of extreme events and their magnitude has increased significantly in the last 20 years.	-Increased heavy rainfalls and floods will cause damages to roads, buildings, bridges and constructions thereby reducing their useful lifespan, -Electricity transmission cables and systems can be broken down by heavy snow and ice freezes, -Flood protection canals, hydro plant constructions and normal working regime can be damaged by water regime changes.	-Renew construction anddevise appropriate technical standards, -Improved designs and retrofits for more resilient infrastructure.

CHAPTER 3. REPORTING ON LONG-TERM AND NEAR-TERM ADAPTATION VISIONS, GOALS AND TARGETS

3.1. Adaptation goals and targets

Adaptation aims to increase adaptive capacity and to reduce risk and vulnerabilities of the most vulnerable sectors of Mongolia. Therefore, vision, goal and objectives have been defined as followed. Here, infrastructure and human health are not considered, because there is a lack of future impact study.

Vision of adaptation

Increased adaptive capacity to overcome negative impacts of climate change, and to strengthen the resilience of ecosystem and socio-economic sectors. The climate change adaptation aims to reduce risks and vulnerabilities for the following sectors:

- Animal husbandry aims to maintain ecosystem balance through improving pasture management.
- Arable farming aspires to meet the total national need in crops by reducing bare fallow and soil moisture loss, introducing medium and long-term maturity varieties of crops, increased irrigation with water saving technologies including snow, and rainwater harvesting.
- Water resources sector's objectives are to expand state protected areas covering especially headwater areas of river basins, where 70% of total runoff are formed, to ensure proper use of water resources, and to strengthen integrated water resource management in river basins.
- Forest resource aims to reduce forest degradation, and to implement reforestation and sustainable forest management strategies.
- Natural disaster management seeks to build effective disaster management to prevent environmental and socio-economic losses.

3.1.1. National and sectoral adaptation goals and targets

Adaptation goals and targets for each sector have been defined based on outcomes, process and needs (Table 3.1).

Table 3.1. National and sectoral adaptation goals and targets

Goals types	Level	Targets	Timeframe
1. Animal husbandry and pasture			
Process based	National	-Reduce pasture degradation through regulating headcounts of animal and matching carrying capacity: • Create a legal environment and formulate pasture law for pasture relations regulation. -Develop intensified and traditional livestock in integrated and combined ways: • Formulate policy to develop traditional pastoral livestock in the western and the Gobi desert regions and gradual advance to intensified and industrial farming in the other regions.	2018-2025
	Sectoral	-Set up taxation mechanism for pasture usage depending on animal type and regional context and use financial resources for pasture improvement actions: • At least 70% of the above mentioned revenue should be spent for pasture restoration. • Improve local level coordination mechanism for animal migrating from other soums for better pasture.	2020-2025
Needs based	National	-Capacity building and awareness raising campaigns on policies and guidelines about pasture carrying capacity, forage capacity and good practices for pasture: • Increase citizen participation in usage and improvement for natural green pasture of Mongolia. • Build capacity of pasture specialists and experts and re-train them. • Develop pasture management courses and include in the curriculum for agriculture specialists training of related universities and institutes.	2018-2025
	Sectoral	-Maintain and control number of animals and herds composition according to local pasture capacity and context: • Train herders and local specialists about pasture condition and practices for appropriate usage in alignment with carrying capacity of pasture. • Develop guidelines for coordination of animals and local pasture carrying capacity and provide technical support. • Improve market access at national and international meat production. • Provide technical support and recommendations for restoring traditional best practices and maintaining herds composition in alignment with pasture condition.	2020-2030

2. Arable farming			
Outcome based	National	-Increase crop production to fulfil national consumption for crops (except sugar plants and rice) through protection of soil fertility: • Soil moisture maintenance, reducing bare fallow area down to 30%, applying proper irrigation methods and water saving technologies; and supply and produce animal forages. • Reduce soil degradation by at least 40%; re-usage of all abandoned agriculture land. • Increase irrigated cropland and reduce production variations by 40% for cereals and 60% for vegetables. • Increase irrigated areas by 2-2.5 times than current level; apply water saving technologies in at least 50% of potato planting and in 70% of fruit bushes and tree plantations and reduce water usage by 50% in arable farming.	2018-2030
Needs based	Sectoral	-Increase annual crop production at level of 100 thousand tonnes of millet, oil plants and rye for each and 30 thousand tonnes of beans and peas for food to meet population consumption: • Increase types of crops for rotation system. • Strengthen and support specialized entities who manufacture and import agriculture machinery, equipment, fertilizers and crop protection products. • Introduce winter crops such as wheat and rye in order to reduce reliance on only summer crops. • Introduce snow water harvesting technologies in order to ensure sustainable harvesting. • Expand production of forage plants, oil and legumes for food as well as forages at least twice than the current level. •Establish branches of Promotion Fund of Arable Farming (PFAF) in the eastern and the western agriculture regions and storage complexes with a capacity of 70-150 thousand tonnes for State Reserves of cereals.	2020-2030
3. Water resources			
Outcome based_	National	-Maintain availability of water resources through protection of run-off formation zones and their native ecosystems in river basins: • Increase state protected areas up to 25-30% of the total territory including upstream area of rivers in order to maintain natural ecosystems and water resources and ensure sustainable financial mechanism.	2020-2030
	Sectoral	-Introduce water saving and water treatment technologies.	2020-2030
	Cross cutting risks and impacts	-To enhance hydrological and water quality monitoring systems and services through introducing advanced monitoring techniques: • To establish flood and water shortage early warning system and protection, water allocating infrastructures to enhance risk management.	2020-2030

Process based	National	-Integrated water resource management and multi-stakeholder involvement will be enhanced through improved legal policies, efficient management and capacity building: • Implementation of Integrated water resources management programmes and plans in 29 river basins.	2020-2025
	Sectoral	-To conduct feasibility studies for the construction of hydropower stations at Selenge (380MW), Eg (315MW) and Orkhon (100MW) rivers and possible implementations.	2020-2025
	Cross cutting risks and impacts	-Conduct detailed assessment of water resources in the most vulnerable regions to climate change; align the regional and sectoral development policies and planning and implement ecosystem based adaptation strategies in river basins • Improve ecosystem services through taking measures for water allocation to drying lakes, located in floodplain areas and reforestation; facilitate awareness raising about benefits and results to public and increase funding for nature conservation and restoration by at least 20%. • Construction of water reservoirs of 20 cub.km for harvesting glacier melt water in Altai Mts. and river water in Arctic river basin in Mongolia.	2020-2025
Needs based	National	-Improve water supply • Water regulations of rivers (Orkhon, Selenge, Tuul, Khovd, Bulgan, Khalkh, Onon, Eg, Kharkhiraa, Turgen, Shishkhed, Eroo, Kharaa, Tamir and Bogd rivers), construction of water reservoirs and conduct studies on possibilities to transfer water to cover water demand in dry regions. • Improved water supply focused on being 90% and sanitation will be 60% of total population. • Construction of water ponds of 25.0 mln cub.m for irrigation of 10,000 ha of cropland. • To improve water supply to cover water demand for Ulaanbaatar city, industries in the Gobi region (coal mining of Shivee-Ovoo and Tavan Tolgoi, coal processing factory in Choir and Nyalga) and other food and construction industries.	2020-2030
	Cross cutting risks and impacts	-Encourage tourism development (hiking, biking and extreme tourisms) and required infrastructure in basins vulnerable to climate change and with high risks of agriculture and livestock breeding.	2020-2030
4. Forestry			
Outcome based	National	-Increase area covered by forest up to 8.3%. -Reduce forest fire affected areas by 30%. -Setting up monitoring and controlling system of forest pests and insects which cover at least 60-90% in affected areas. -Forest clearing logs/activities will be conducted in 30 thousand ha in order to increase especially relatively young forest production.	2020-2030

Process based	Sectoral	-Increase area of forest and conduct reforestation activities through tree nursery using high quality tree seeds and seedlings resistant to droughts and dryness and tree plantations in deforested areas. -Protect forests, its ecosystems and biological diversities from human inappropriate activities, forest fires, insects and diseases and reduce the rate of deforestation. -Increase forest production through plantations, clearance and nursery actions, and sustainable management in order to maintain proper composition and density adapted to climate change. -Improve forest resource usage through environment friendly technologies and management for local context and wood production efficiency. -Implement phased projects and programmes to reduce GHG emissions caused by forest decrease and degradation. -Fully implement forest sustainable management through sampling and gradual logging methods.	2020-2030
5. Natural disaster management			
Process based	National	-Ensure effective disaster risk reduction and response system through multi-stakeholder and cross-level integration and coordination.	2018-2025
	Cross cutting impacts and risks	-Improve coordination of key stakeholders through real time and reliable data and information sharing.	2018-2020
	Sectoral	-Strengthen policies, systems, capacity and resources to ensure better resilience to overcome disasters.	2018-2025
Needs based	Sectoral	-Ensure proper decision making in a timely manner using real-time and reliable information based on the assessment of hazards and vulnerabilities.	2020-2030
		-Ensure implementation of disaster risk reduction and management activities at national to local levels.	2020-2030

3.1.2. Prioritization of adaptation goals and targets

Sectors, adaptation goals and targets were prioritized based on impacts, urgency and likelihood defined in Fifth Assessment Report (AR5) of Intergovernmental Panel on Climate Change (IPCC) and scores were given by sector experts in discussions (see Annex 1). This prioritization is an integrated analysis of adaptation goals and targets considering adaptation needs and reasons based on future impacts and risks assessment.

3.1.3. Adaptation-mitigation benefits

Adaptation actvities under the goal and target may lead to the reduction in GHG emissions/sink as mitigation co-benefits and maintain ecosystem balance as keeping resilience and adaptive capacity. Table 3.2 shows possible co-benefits in different sectors.

In general, carbon sinks of natural ecosystems will be increased with a capacity to absorb almost a half of the CO_2 emissions from the energy sector in the country by implementing adaptation policies in agriculture, forestry, and water resource sectors.

Table 3.2. Possible adaptation co-benefits

Sector	Adaptation activities	Possible co-benefits
Livestock and pasture (land use)	Reducing pasture degradation through sustainable pasture management.	The sector targets to 29 million tonnes CO_2 or 1/3 of GHG emission reduction per year through applying effective regulation of animals headcounts based on pasture carrying capacity and improved pasture management.
Forest	Applying forest sustainable management, increase forest area up to 9% and reduce forest fire affected areas by 30%.	Increase forest carbon sink and reduce GHG emissions due to the fire by 2-5%.
Arable farming	Reduce bare soil fallow down up to 30% in /rain-fed/ none irrigated cropland through increasing species crops, zero tillage and crop rotation.	This practice exacerbates the loss of soil organic decomposition and increases carbon sink.
Water	Increase state protected areas up to 25-30% of the total territory.	Maintain natural wild ecosystems and water resources.

CHAPTER 4. CURRENT AND PLANNED ADAPTATION UNDERTAKINGS AND SUPPORT

Current and planned (until 2021) adaptation undertakings and support aim to maintain long-term ecological balance and to ensure streamlining economic and social development in alignment with climate change through reducing risks and vulnerabilities and improving adaptive capacity. Therefore, necessary adaptation undertakings have been included in National Action Programme on Climate Change (NAPCC) as cross-cutting actions and in strategies and plans, especially for vulnerable sectors.

In the following sections, current and planned undertakings and supports are summarized (Table 4.1 to 4.3).

4.1. Financial

Table 4.1. Implementation of climate change adaptation undertakings and supports

Sector	Current and planned undertakings	Strategy or Programme name	Current status of implementation	Resource and funding	
				National	International
Livestock and pasture	To coordinate a number of animals and herds composition aligned with pasture carrying capacities at regional levels.	"Mongolian Livestock" National Programme, (2010-2021)	Government has proposed amendments in Law of Mongolia on Land and developed guidelines for pasture land usage taxation based on the number of animals, types and regional contexts.	Government	-
	To ensure an effective coordination of pasture usage and reserve at least 10% pasture for otor movement at provincial and local levels which can be used during disasters.	"Mongolian Livestock" National Programme, (2010-2021)	There are 7 sites of reserve otor pasture for a special purpose at provincial levels which occupy 679 thousand ha or 0.6% of the total pastureland. At soum (country subdivision) levels, there is 1.8 million ha pasture which can be used as reserve pasture during disasters.	Government	-
	To use environment, human and animal-friendly and advanced technologies against pasture insects and rodents.	"Mongolian Livestock" National Programme, (2010-2021)	Every year, the Government budgets 1 million USD and facilitate environment friendly measures based on monitoring and surveys.	Government	-
	To conduct water survey and exploration based on local herders initiatives and establish water wells with water reservoirs.	"Mongolian Livestock" National Programme, (2010-2021)	In the recent years, almost 1000 water wells were established by the Government budget and international projects funding and handed over to herders groups. In the steppe region, renewable energy, like solar and wind, are being used for ground wells operations which are financially efficient to save fuels and environment-friendly.	Government	International projects
Livestock and pasture	To breed high production cattle to increase meat production and ultimately to reduce the number of pastoral animal in winter.	"Mongolian Livestock" National Programme, (2010-2021)	In 2012, meat production cattle and sheep have started to breed in 10 soums and about 1200 cattle of high production were imported from France and Germany.	Government	-

Livestock and pasture	To introduce modern, advanced technologies in pastoral animal husbandry and herders livelihood, to scale up traditional best practices, to implement projects and programmes which aim to advocate for lifestyles and management skills aligned with ecosystem changes and climate changes and to raise public awareness and trainings.	"National Security Concept", 2010	Several international projects have been implemented in order to develop climate change adaptation knowledge and skills, to improve pasture management, to encourage to traditional best practices and modern advanced methods. As a result one third of herders households have joined herders voluntary groups and attended in trainings and awareness campaigns.	-	World Bank (WB), Asian Development Bank (ADB), Food and Agriculture Organization (FAO), United States Millennium Challenge Account (US MCA) and Swiss Agency for Development and Cooperation (SDC) projects
	To extend pasture and desertification monitoring system, to conduct systematic pasture pests and insects observation and to develop guidelines for pasture health assessment.	The first phase of NAPCC, (2011-2016)	National Agency for Meteorology, Hydrology, Environment and Monitoring has implemented projects funded by donor agencies and technical guideline for pasture and soil monitoring which is done at about 1500 points of the national monitoring network. The database has been established and National Pasture Status has been reported annually.	Government	400 thousand USD from international projects
	To plan population settlements in accordance with climate change, regional natural resources and their capacities to recover	"Green Development Policy", (2014-2030)	"New soum" project has started to be implemented in soum centres to construct integrated government buildings with central heating and water systems, to provide opportunities to have an access to water and sanitation facilities for households and to establish green gardens and areas.	Government	-

Arable farming	To introduce advanced agricultural and water saving technologies and to establish forest protection strips in order to improve soil fertility and re-store soils, to produce and meet national consumption of cereals and vegetables, and to re-use at least 70% of abandoned cropland.	"Green Development Policy", (2014-2030)	As of 2015, the total cropland has been accounted 750 thousand ha including 450 thousand re-used abandoned cropland. There is still a quite big amount of abandoned cropland. The Government though Agriculture Support Fund has given soft loans to farmers for wheat seeds, fuels, soil and crop protection products with repayment after harvesting and agricultural machinery with a repayment term of 3-5 years.	6.5 mln USD spent for soft loans by the Government	1.5 mln USD from Government of China
	To re-use the abandoned cropland (about 940 thousand ha) in order to increase production of wheat flour, potato and vegetables to fully meet national consumption demand.	"3rd campaign of crop production", (2008-2010)	As a result of the campaign, farmers and farming companies got soft loan for fuels, cereal seeds and imported and equipments and paid back after harvests. Consequently, crop production has increased significantly and 100% of wheat and potato have been produced locally and 57% of vegetables are produced.	Government	-
	To increase irrigated cropland in order to reduce harvest variation by 20% for cereals, 40% for vegetables by 2015 and to reduce irrigation water consumption by 50% in 2021 through introducing water efficient technologies.	NAPCC, (2011-2021)	Drip irrigation systems have been started to be used since 1997 and as of 2015, these systems have been applied to 280ha of vegetable farms. Mulches were started to be in practice in 2007 and have been applied to 50 ha of vegetable farms as of 2015. The Government provides household scale irrigation equipment with a capacity of 0.5-1.0ha to farmers free of charge. Projects such as"Mongolian potato" and desertification projects supplied grain producers and household gardeners with drip irrigation systems and plastic mulches.	Government	Government of Switzerland

Arable farming	-To develop irrigated crop production through increasing irrigation systems, and introducing advanced technologies such as drip irrigation, water reservoirs and precipitation harvesting. -To conduct water resource survey, exploration for cropland and pasture, design and establish water systems through public-private and individual funding.	"State policy on Food and Agriculture", 2003	Government funds about 30% of finances to renovate and construct public and private irrigation and water systems for cropland. Irrigated cropland increased by 7.2 thousand ha than in 2005.	8.75 mln USD in the last 10 years by the Government	4.9 mln USD
Water resource	To forbid mineral exploration and exploitation in 30% areas of upstream of rivers where at least 70% of water and run-off are accumulated.	"Law to prohibit mining exploration and exploitation in areas of upper streams of rivers and water sources and forestry", 2009	As of 2014, state protected areas reached up to 17.4% of the total land including the upper stream of rivers and water sources in order to maintain wildlives and ecosystems balance.	Government	-
	To improve water resource and usage management.	"Water" National Programme, (2010-2020)	Integrated water basin management plan have been implemented for 7 river basins.	Government	International projects
	To take ecosystem based adaptation measures.	Project of "Ecosystem-based Adaptations in highly vulnerable rivers basins", (2012-2017)	The project is being implemented in Kharhiraa-Turgen rivers basin in the western region and Ulz river basin in the eastern region and aims to strengthen national and local adaptation capacity through conservation of riparian and basin ecosystems in the areas.	-	Adaptation Fund for Kyoto Protocol
Forestry	To improve forest sector management, structure and coordination systems.	"National Forestry Programme", (2005-2015)	Community-based forestry resource management was introduced and as of today, about 20% of the forests is under the protection of community forestry groups.	Government	-

Disaster management	To integrate disaster risk reduction into climate change adaptation and sustainable development.	Plan for "State Policy on Disaster Protection" and National Programme for Strengthening Disaster Resilience", (2012-2021)	Certain amount of money is allocated to the Government Reserve Fund from the National budget in every year. For example, 25.7 million USD was spent from this Fund for disaster relief and recovery expenditure in 2013 and 2014.	Government	-

4.2. Capacity

Table 4.2. Capacity of current and planned undertakings

Sector	Individual level	Institutional level	System level
Livestock and pasture	-Local leaders, herders and other citizens have started to realize benefits of adaptation undertakings. -Local community participation is key in the pasture usage, protection and coordination as suggested by related projects.	-"Pasture usage contract" was initiated by pasture management and herders livelihood projects and is being developed by pasture and livestock specialists.	-"Pasture Law" has been drafted and discussed by related experts and members of the Parliament, but yet has not been passed. The bill was submitted in 2011 to the Parliament and survey poll from 15,060 herders in 118 soums was done according to the suggestion by the Parliament. 68% of the total participants in the survey agreed separate "Pasture Law" is required (18% responded that there is no need and 14% they don't know). But the bill was not discussed at the Parliament. Pasture related articles were included in the Land Law and submitted to the Parliament in 2013. Yet, amendments in the Land Law again have not been discussed. -Pasture law has been under an uncertain condition, pasture related articles such as pasture usage taxation, and using funds for pasture conservation were included in a draft of the "Asset Law" by experts and government officers of related ministries and agencies for the Parliament discussions.
Arable farming	-Due to remoteness from markets and lack of human resource and technical capacities there is still some abandoned cropland (about 420 thousand ha) in the eastern and the western regions.	-Government provides support to farmers through Agriculture Support Fund of the Ministry of Food and Agriculture, however in remote regions; access to the fund support is limited due to lack of structure and capacities.	-In remote regions, lack of infrastructure, distance from markets, science and research centres and low factory capacities for cereals and vegetable production hinders arable farming development and extensions.
Water resource	-There is a lack of knowledge and skills related to climate change in the curriculum of colleges, institutes and universities. Training and re-trainings are not sufficient.	-Dissemination of climate change study is limited, therefore, information and research on economic benefits of adaptation options are insufficient. These hinder efficient implementations and monitoring of adaptation options.	-

Forest	-Training private inventory companies to pursue better forest management practices, and forestry units and environmental agencies to conduct efficient monitoring of forestry measures.	-Piloting a comprehensive training system for sustainable forest management, and advising the Ministry of Labour on ways to improve the vocational training system for foresters.	-
Natural disaster management	-	-In Mongolia, there is 1 meteorological station per 11.8 thousand square km and the distance between observation stations is 200-300km from each other. There is only one radar station in Ulaanbaatar city which was set up by Japanese Government funding in 1998. These geographical gaps in observation network make a prediction and early warning of atmospheric disastrous phenomena difficult.	-Disaster management is carried out by the National Emergency Management Agency (NEMA) of the Government according to Disaster Management Law. However implementation is inadequate at provincial and local levels due to lack of knowledge and skills and dependency mindset of people. -Early warning of rapid onset hazardous and disastrous phenomena is delivered to people through public media in general ways.
Natural disaster management	-	Even though irrigated cropland is increasing, irrigation and water application is not being done based on research and scientific bases which reduce the benefit of irrigation. Numerical weather prediction especially for precipitation is not sufficiently accurate; river run-off forecast is based on flood wave transfer methods. Weather stations are located in settlements, so there are challenges to predict forest and steppe fires and river floods.	-

Natural disaster management	-	-Meso-scale model of numerical weather prediction has been introduced in the Meteorology Agency since 2006 and prediction accuracy has improved significantly. But the forecast of extreme events (atmospheric hazardous and disastrous phenomena) is not sufficient. Especially slow onset phenomena such as drought and dzud are challenging to predict even in objective ways.	-
	-	-Currently, risks of natural disasters are not being done due to lack of monitoring information of atmospheric hazardous and disastrous phenomena as well as unaccounted economic and natural losses. There is no integrated database, which includes information about human animal epidemic sources. Each institution has separate databases, which makes management and decision making challenging.	-

4.3. Technical

Table 4.3. Current and planned adaptation undertakings

Sector	Adaptation technology needs	Current status
Livestock and pasture	Seasonal to inter-annual prediction and livestock early warning system	-There is a lack of coordination and integration between monitoring, assessment, usage and management of pasture and soil. Information and conclusions are different, information is not exchanged and pasture issues are not sufficiently resolved at the policy level. -Early warning actions need to be improved through clarifying functions roles of related institutions. Information and dissemination structure should be clear and regular based on pasture condition and weather long term forecasts. (Implementation status is medium)
	Selective breeding of livestock	-Currently, building of National comprehensive centre for animal genetics fund is being constructed in Khongor soum and Darkhan-Uul aimag. As a result, laboratories for livestock production, genetics, biotechnology and animals breeds will be established according to international standards. -In the framework of maintaining genetics pool of breeds of livestock, National livestock genetics centre has replenished the fund with 7,429 portion of genes in 2012, 9,549 genes in 2013, 6,128 genes in 2014 and the total 20,402 genes according to technical standards. (Implementation status is medium)
	Livestock Disease Management	-Current practice is to develop a plan and budget for livestock health and prevention measures for every year. Within such practice, provincial governors and Ulaanbaatar city mayor approved plans and budgets for a number of animals, required veterinary medicines products to prevent epidemics and parasites. -In order to effectively diagnose epidemics and infections, four fully equipped laboratories costing 295 thousand USD have been handed over to veterinary departments of Arkhangai, Khovd, Dundgobi and Khentii provinces. (Implementation status is medium)
	Sustainable Pasture Management	-In order to appropriately manage pasture for winter and spring, information about drought, summer pasture production, pasture capacity, local context number of animals and predicted winter weather needs are analysed. Associated risks should be assessed and based on that public information, recommendations should be disseminated. These roles are required to be systemized, clarifying functions and responsibilities. Herders and local community participation should be ensured in pasture management at all levels. (Implementation status is medium)

Livestock and pasture	Producing supplement feed for winter and spring	-Fodder storages with a capacity of 100 tonnes were built in the western region Zavkhan and Gobisumber aimags. (Implementation status is good)
	Planting of forage perennials resistant to drought and cold winter for fodder production	(not implemented)
	Rain and snow water harvesting for herder groups	(not implemented)
	Producing supplement forage with bacterial enzyme for livestock	(not implemented)
Arable farming	System of wheat intensification through conservation tillage	Minimizing or zero soil tillage was piloted in the 1980s for cereals and forage plantations. Since 2008 this technology has been applied intensively and about 140 thousand ha of the fallow field has had zero-tillage and round-up herbicide against weeds as of 2014. This technology helps to minimize expenses, reduce soil moisture losses and wind erosion because the soil is still covered by straws. Farmers are lacking the financial capacity to buy imported machinery and herbicide. (Implementation status is medium)
	Vegetable production system with drip irrigation	Since 1997, drip irrigation system has been applied and as of today about 280 ha of vegetable field is using the technology. Farmers have limited financial capacity to buy drip irrigation and knowledge to apply the technology. (Implementation status is medium)
	Potato seed production system using aeroponics	(not implemented)
	Proper rotation system of cereals planting	Before the 1990s, livestock fodder was centrally planned and managed by the Government, so planting of forage plants such as barley, beans and other plants were higher than wheat and a rotation of “wheat – fodder plants” were used at least 33% of fallow fields. During the transition period after 1990, livestock were privatized and herders could not buy fodder for their animals. Therefore, rotation shifted to “wheat – fallow” turn which means 50% of crop land was under fallow processing. In the recent years, rye and oil plants have been planted and exported due to incapability to process in factories. (Implementation status is medium)
	Crop planting under plastic mulches	In the framework of international projects started in 2007, usage of plastic mulches was piloted for vegetables and potato fields. As of 2015, about 50 ha of a vegetable field has been applied with plastic mulches which help to save labor and water cost for irrigation. Farmers cannot afford imported products due to lack of understanding the benefits and financial capacity. (Implementation status is medium)

Arable farming	Integrated Nutrient Management	(not implemented)
	Forest strip protection of agriculture land	(not implemented)
	Planting winter crops	During 1970, research and experiment on winter crops such as wheat and rye were done in agricultural regions, but winter cropping is very limited in the country due to its low precipitation and very cold weather. Warming and expected winter precipitation increase after 2030 can give more opportunities to pilot some varieties of winter wheat and rye.
	Harvesting winter snow water to increase soil moisture	Currently, winter snow is very low which is limiting factor to test and apply snow harvesting. However, technologies to increase snow density through making delay in snow melting and reserving more snow in cumulative ways can be piloted and applied. (Implementation status is medium)
	Breeding of new varieties of crop using marker assisted selection (MAS)	(not implemented)
Water resource	Ecosystem based adaptation	Project “Ecosystem-based adaptation approach to maintaining water security in critical water catchments in Mongolia” is implementing in mountain and steppe ecosystems by internalising climate change risks within land and water resource management regimes, (2012-2017) (Implementation status is medium)
Forest	Biodiversity and adaptation of key forest ecosystems to climate change	Improvement of the legal and administrative framework’ is contributing to the creation of suitable conditions for sustainable forest management, (2012-2018) (Implementation status is medium)

CHAPTER 5. GAPS AND BARRIERS

Identified barriers per sectors were prioritized based on gaps between adaptation goals and targets, current status and required financial, capacity and technical supports. Two types of barriers which are very important and less important have been identified. Importance and easiness of removal of barriers were considered in the following four categories:

- High priority that require internal and external support
- High priority that require internal support
- Low priority that require internal and external support
- Low priority that require internal support

Sector barriers according to the above mentioned categories are listed in Table 5.1. Barriers such as financial capacity and resources, technology, research, development and human capacity are belong to high priorities external barriers for all sectors. At the same time, insufficient legal environment, lack of coordination and integration, poor law enforcement and weak detailed research are in the category of high priority and internal barriers.

Table 5.1. Gaps and barriers

National priority: **high** Nature of support: **external+internal**	National priority: **high** Nature of support: **internal**
1. Pastoral livestock -Inadequate investment and financial support; -Lack of facilities of veterinary centres and laboratories; -Not established an early warning system that prevent from drought and dzud.	1. Pastoral livestock -Lack of laws, policies and coordination; -No existence of pasture usage coordination/otor movements in alignment with local contexts to overcome risks; -Poor enforcement of land use contracts and responsibilities at soum levels; -Pasture is more cross-sectoral issue and there is no integrated coordination; -The most importantly, pasture in Mongolia has no ownership and no value.
2. Arable farming -Lack of financial resources for building of drip irrigation system; -Collaborative research work on new varieties of crops with drought and heat wave resistant; -All machinery, equipment and fuels are fully dependent on import; -Weak exchanging experiences and practices from other countries due to finance.	2. Arable farming -There are no legal requirements to use water efficiently by central and local government institutions and no water tariff which cause inefficient usage of water; -There is a low demand of other crops at national markets. Poor infrastructure to process, unavailability of appropriate varieties of alternative crops and related agricultural technologies are prevailing; -The current amount of winter precipitation is not enough for winter cropping. Winter rye is only a crop which can be planted in winter. Alternative crops do not exist, farmers have no knowledge and experience in winter cropping.
3. Water resource management -Lack of financial support to implement water resource, usage and protection actions; -Products, equipment, materials and machinery are all imported; -Limited research and evidence of climate change studies and economic benefits.	3. Water resource management -Lack of human capacity and being non producers; -Limited access to soft loans and bank loans have usually high interest rates; -Ineffective taxation policies, weak support to national productions and poor coordination on imports and exports; -Lack of monitoring of climate change adaptation implementations.
4. Natural disaster management -Low financial capacity to equip with advanced techniques and equipment; -Lack of research and development; -Poor infrastructure to disseminate disaster early warning to the public.	4.Natural disaster management -Lack of human resource capacity and trainings; -Non existence of integrated database of natural disasters, separate databases per agencies and institutions and no coordination between them; -Disaster management actions have poor implementation especially at provincial and local levels; -Rapid onset atmospheric disasters' warnings are delivered in very general way without details to public through media.
National priority: **low** Nature of support: **external+internal**	National priority: **low** Nature of support: **internal**
1.Pastoral livestock -Cultural barriers of acceptance of pasture usage and protection issues.	1. Pastoral livestock -Low understanding about appropriate pasture usage and overgrazing. -Lack of knowledge and understanding of long term sustainability of pasture and prevention of soil degradation and social acceptance.

CHAPTER 6. SUMMARY OF NEEDS

Based on current adaptation undertakings and gaps, the needs to achieve adaptation goals and targets for 2021-2030 are given in (Table 6.1).

Rough estimations of adaptation measures, listed in Table 6.1, shows that in the future Mongolia will need around 3.4 billion USD for funding in technology and capacity building. Up to 80% of total need expected to be financed from international sources and donor institutions.

Table 6.1. Adaptation needs (2021-2030)

Sector	Adaptation goals	Adaptation targets	Needs		
			Capacity	Technology	Financial (international, investments), million USD
Animal husbandry and pasture	-To implement pasture sustainable management.	-Reduce rate of degraded pasture, -Regulate headcounts and types of animals including wild animals to match with pasture carrying capacities.	-To create legal regulation for pasture use, -To set up taxation system for pasture use, -To increase community participation in the proper use of pasture, its monitoring and conservation.	-To build up early warning system for drought and dzud to prevent animal loss, -To improve livestock quality and breeds, -To improve livestock health (epidemic and infectious diseases) management.	46
Arable farming	-To increase irrigated cropland, reduce soil water loss and decrease soil carbon emissions.	-To reduce bare fallow up to 30%, -Crop rotation system with 3-4 routes and 3-5 species crops will be introduced, -Irrigated cropland will be expanded by 2-2.5 times.	-To create legal regulation on soil protection (soil texture and moisture).	-To diffuse zero tillage technology, -To increase species of crops and rotation, -To transfer effective drip irrigation technology reducing water loss by 2.5-5.0 times.	150
Water resources	-To maintain the availability of water resources through protection of run-off formation zones and their native ecosystem in river basins.	-30 % of the territory will be state protected by 2030 and the sustainable financial mechanism will be introduced.	-To implement Integrated water resource management systems, -To coordinate multi-stakeholder relations through improved legal policies and efficient management, -Strengthen human resource capacity to deal with technical issues.	-To implement ecosystem- based technologies, -To support ecosystem services through hydrological monitoring, construction of water diversion canals to drying lakes located in flood plains and re-forestation actions.	5

Water resources	-To construct reservoirs for glacier melt water harvesting, -To regulate river streams and flow.	-To create water reservoirs at rivers and at outlets of lakes, and to construct multipurpose systems of water usage.	- To enhance hydrological monitoring and research for river flow regulation, -To construct water reservoirs and water diversion facilities to transfer water resource to dry regions.	-	1800
	-To introduce water saving and water treatment technologies.	-To find solutions for sustainable water supply of Ulaanbaatar city and industries and mining in the Gobi region, and subsequently implement.	- To conduct a study and introduce sustainable water supply with closed systems preventing evaporation loss.	-To introduce new technologies for water saving, and treatment.	605
Forest resource	-To increase the efficiency of reforestation actions.	-Forest area will be increased to 9% by 2030 through reforestation activities.	-To build the capacity of community forestry groups to conduct modern technologies for forest seedlings and tree plantations.	-To introduce technology to plant seedlings.	11
	-To reduce forest degradation rate.	-To reduce forest degradation rate caused by human activities, fires, insects and diseases.	-To set up fully equipped stations fighting forest fires and insects outburst and capacity building.	-To use airplanes to fight fires, -To introduce biological technologies against insects and pests.	13
	-To improve the effectiveness of forest management.	-Resilient forests which are adapted to climate change, highly productive and have appropriate composition and structure will be created.	-To provide equipment and machinery to carry out forest cleaning activities, -To train human resources for forest management practices.	-To improve the efficiency of forest cleaning technologies.	7
Natural disaster manage-ment	-To enhance early warning and preven-tion systems for natural disasters.	-Strength-ening early warning system for natural disasters.	-To establish early de-tection and prediction system, -To conduct disaster risk assessment at the local area.	-To improve forecast-ing quality through increasing super computer capacity, -To establish Doppler radar network cover-ing the entire territory of the country.	65.4

CHAPTER 7. MONITORING AND REPORTING PROGRESS

Monitoring of climate change adaptations will be conducted in integrated ways of adaptation actions and measured included in “Long-term strategy of Mongolia development”, “Sustainable development programme”, “National action programme on climate change”, “Water” national programme, “Green development policy” and other sectoral strategies.

Required funding for adaptations implementation will consist of State budget, Government special funds (such as environment protection fund, special tax revenue, proposed funds for natural disaster risks, pasture fund and climate change adaptation etc), international funds and through other financial mechanism.

Monitoring will be based on achievements on adaptation goals and targets. Baselines and targets for indicators will be assessed quantitatively and qualitatively at every phase of implementation.

ANNEX I

Annex 1. Prioritization of adaptation goals and targets (Scores: Very high-3, High-2, Medium-1)

Category	Sector	Sub sectors	Prediction of impacts	Significance	Urgency	Confidence	Adaptation goals and targets
Agriculture, water resource, forestry and disaster management	Arable farming	Wheat	Decrease of crop production and increase of water consumption due to droughts and climate dryness.	3	3	3	-Use water efficient and water saving technologies. -Improve crop rotation and increase crop types in the system. -Plant winter wheat and rye to reduce reliance on summer crops. -Introduce snow water harvesting technologies though keeping snow coverage on croplands and absorbing snow water into soils. -Protect soil fertility and reduce percentiles of bare fallow areas. -Plant drought-resistant variety of crops. -Support and strengthen specialized entities who manufacture and import agriculture equipment and machineries, soil and crop protection products.
		Potato, vegetable, and berries		2	3	3	
		Oil plants and forage		1	2	2	
	Animal husbandry	Pasture	Reduction of pasture biomass due to drought and climate dryness.	3	3	2	-Establish a legal environment for pasture relations. -Control animal numbers in alignment with pasture carrying capacity. -Develop co-existing pastoral livestock and intensified farming. -Improve balance between animal types and herds composition. -Set up taxation policies for pasture usage and financial support for improving degraded pastures. -Improve public and herders awareness on proper usage of pasture through civic participation and restoring traditional best practices.
		Livestock	Increase of animal loss due to droughts and dzud	3	2	3	-Strengthen early warning system for droughts and dzud prevention. -Improve livestock breeds.
			More water deficit due to river water regime changes	2	3	2	-Regulate river flow and construct surface water reservoirs and closed water distribution systems.

Agriculture, water resource, forestry and disaster management	Water resource	Population	Water resource decrease and water regime changes	3	2	1	-Introduce water regulation, transport, diversion systems for water supply.
		Industry and mining		3	3	2	-Contribute water saving and re-using technologies water diversion and transport systems and protection of water resources.
		Ecosystem services	Glacier melting intensifies	2	3	2	-Establish water reservoirs, control river streams and implement ecosystem-based projects.
		Renewable energy	Changes in water regime and storage	1	2	1	-Establish water reservoirs, control river streams and implement ecosystem-based projects.
							-Establish water harvesting and river flow regulation systems which will contribute to reducing GHG emissions and having co-benefits of adaptation and mitigation.
	Forestry	Forest ecosystems	Intensified dryness and droughts	2	2	2	-Implement forest management. -Increase forest plantation areas.
	Disaster manage-ment	Risk management	Increased frequency and magnitude of atmospheric disasters	3	3	2	-Strengthen forecasting system capacity. -Implement disaster risk reduction and management actions at national to local levels. -Ensure integration between sectors and cross levels. -Improve coordination and sharing of real-time and reliable data and information. -Ensure decision making based on correct information based on risk and vulnerability assessment.

III

Climate Change Mitigation

CHAPTER 8. GHG MITIGATION

8.1. Existing national GHG emissions and BAU projections of GHG emissions

8.1.1. National GHG inventory for the latest year available

8.1.1.1. Energy sector

The GHG inventory for the energy sector has been prepared for the period from 1990 to 2012 (MARCC, 2014). Three main gases were considered: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Indirect gases like carbon monoxide (CO), nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOC) and sulfur oxide (SO_2) were also included. The GHG inventory considered the emissions resulting from fossil fuel combustion and fugitive emissions from the extraction of solid fossil fuels.

The activity data for the energy sector was taken from coal balances as well as data on imports of liquid fuels, which are issued annually by the National Statistical Office (NSO) of Mongolia. The energy balances and consumption data was taken from country statistics of the International Energy Agency (IEA) and other relevant ministries and organizations of Mongolia.

The energy sector is the most significant source of CO_2 emissions in Mongolia. The contribution of different sectors to solid fuel combustion is illustrated in Table 8.1. In 1990, CO_2 emissions from solid fuel combustion were 8,135.04Gg; with energy industries the largest contributor at 63.2%. By 2012, CO_2 emissions from solid fuel combustion were slightly higher than 1990 levels at 8,771.49Gg, however with a larger share of 76.9% from the energy industry, due to declining emissions in manufacturing, transport, commercial, residential, and agricultural sectors.

Table 8.1. CO_2 emissions from solid fuel combustion, Gg

Years	Sectoral Approach							
	Energy Industries	Manufacturing Industries	Trans port	Commer cial	Residen tial	Agricul ture	Other	TOTAL
1990	5,143.28	1,387.31	127.87	338.75	746.36	178.35	213.12	8,135.04
1995	4,599.77	850.56	108.80	265.79	176.50	31.41	257.99	6,290.82
2000	5,079.94	267.04	81.88	262.09	256.78	3.37	112.17	6,063.27
2005	5,254.11	132.56	112.50	216.74	443.15	20.53	132.12	6,311.71
2010	6,457.17	387.66	56.08	3.37	686.47	11.22	581.03	8,183.00
2011	6,302.89	423.01	59.45	2.24	717.88	10.10	538.41	8,053.97
2012	6,751.67	624.90	47.11	12.34	702.17	4.15	629.15	8,771.49

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

CO_2 emissions from liquid fuel combustion result mainly from imported liquid fuels such as gasoline, diesel oil, fuel oil, jet kerosene and LPG. In 1990, CO_2 emissions from liquid fuels were 2,518.17Gg, which accounted for 18.8% of total fuel combustion. While in 2012 CO_2 emissions from liquid fuel combustion were 3,523.08Gg, which is 21.2% of the total (see Figure 8.1). CO_2 emissions from fossil fuel combustion are consequently rising.

Figure 8.1 shows the CO_2 emissions by fuel type for the period of 1990-2012. The largest percentage of CO_2 emissions from fuel combustion is from solid fuel, approximately 49-61%, liquid fuel, approximately 10-21%, and 20-32% from biomass. The CO_2 emissions from biomass are relatively constant, but emissions from liquid fuel are tending to increase.

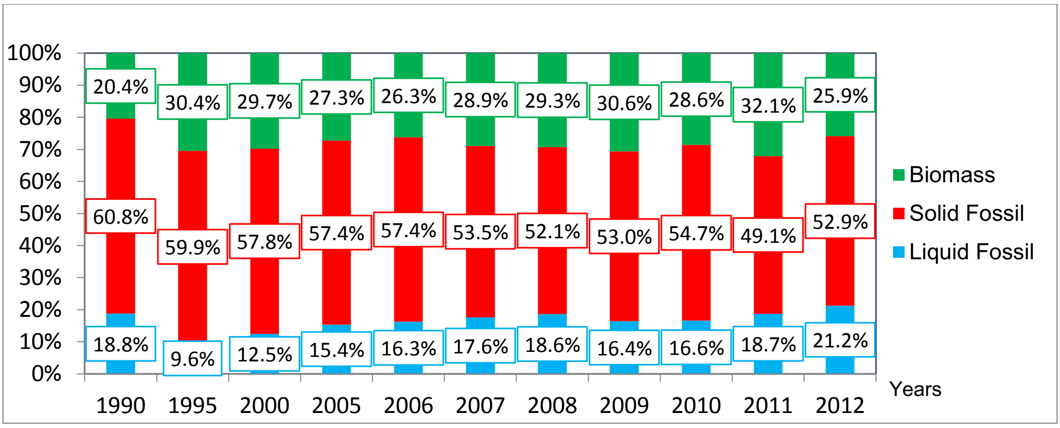

Figure 8.1. CO_2 emissions from fuel combustion in the energy sector, by fuel type
Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

The sources of methane emissions in the energy sector arise from fuel combustion activities and fugitive emissions from coal mining. The main sources of N_2O emissions are fuel combustion activities in the energy industry and the residential sector. In 1990, CH_4 emissions from the energy sector were 494Gg CO_2-eq. (23,520 tonnes) and decreased to 363Gg CO_2-eq. (17,270 tonnes) in 2000. CH_4 emissions have been increasing since 2001 and reached 997Gg CO_2-eq. (47,460 tonnes) in 2012.

Table 8.2 shows total CO_2, CH_4 and N_2O emissions in Gg CO_2-eq. unit by using the Global Warming Potential (GWP) provided by IPCC. As a result, the total emissions of GHGs from the energy sector were estimated at 13,661Gg CO_2-eq. in 2012, of which CO_2, CH_4 and N_2O accounted for 91.7%, 7.3% and 0.01% respectively.

Table 8.2. Total CO_2, CH_4 and N_2O emissions in Gg CO_2-eq. in the energy sector

Gases	1990	1995	2000	2005	2010	2011	2012
CO_2	10,653.21	7,301.87	7,371.49	7,999.67	10,671.26	11,124.59	12,530.81
CH_4	493.87	373.08	362.63	414.04	906.78	1141.56	996.66
N_2O	93.08	85.98	83.98	85.21	127.10	148.80	133.30
Total	11,240.17	7,760.93	7,818.11	8,499.93	11,705.14	12,414.95	13,660.77

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

Figure 8.2 shows the total GHG emissions from the energy sector by gases in Gg CO_2-eq. units for the period 1990-2012.

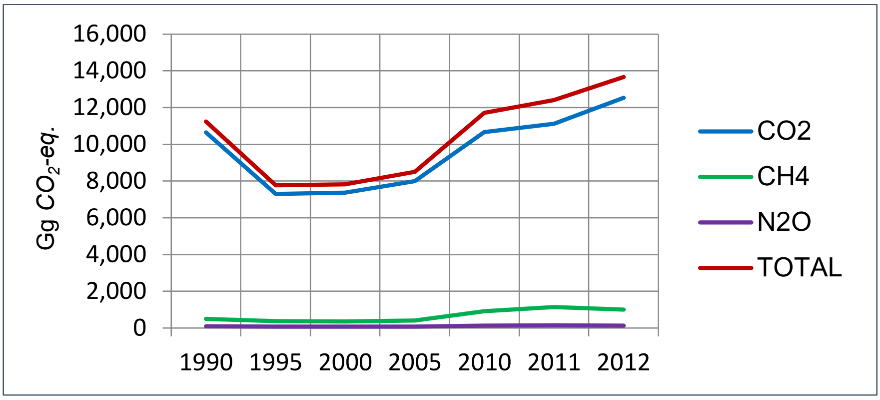

Figure 8.2. Total GHG emissions from the energy sector by gases in Gg CO_2-eq.
Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

8.1.1.2. Transport sector

Due to a sparsely populated, geographically large national territory, the Mongolian transport sector is of strategic importance and consists of road, rail, air and water transport sub-sectors.

All types of cargo transport turnovers as well as passenger turnover, are shown in Table 8.3. According to the table, in 2014, the total cargo traffic rail freight turnover was 63%, transportation 37%, total passenger automobile circulation 55%, 22% for rail transport, and 23% for air transport.

Table 8.3. 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	1485.4	1,394.4	1,194.5
	automobiles	1,480.2	2,321.6	2263.1	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, 2013.

Table 8.4 shows the total number of cars, their types, and classifications by used years. According to the table, in 2013 amongst the total vehicle fleet 10 and more years old cars accounted for 72.5%, while 4-9 years old cars accounted for 20.6%. In 2010 the number of cars less than 3 years old accounted for 3.4%, increasing to 6.9% by 2013.

Table 8.4. 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:	254,486	312,542	345,473	384,864	437,677
	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, 2013.

Table 8.5 shows the length of different types of the national road network in Mongolia. In 2010, 3,016km, or 45% of the total road length was paved road, increased to 5,838km, or 65% in 2013, and tending to increase in future.

Table 8.5. Improved roads by length

Indicators	2010	2011	2012	2013	2014
Improved road length, km	6,734.4	7,633.5	7,652.9	8,875.6	9,428.2
Paved road	3,015.6	4,063.5	4,082.9	5,838.2	6,461.0
Gravel top road	2,071.6	1,959.2	1,959.2	1,864.8	1,782.5
Improved soil road	1,647.2	1,610.8	1,910.8	1,172.6	1,184.7

Source: Mongolian Statistical Yearbook, 2013.

8.1.1.3. Industrial sector

GHG emissions in the industrial sector include CO_2 and SO_2 emissions from cement manufacturing, CO_2 emissions from lime manufacturing, non-methane volatile organic compounds (NMVOC) emissions from food and beverage production, as well as different halocarbons that are also consumed in various applications such as air conditioners and refrigerators (Table 8.6).

Table 8.6. CO_2 emissions from lime production, Gg

Production	Gases	Years							
		1990	1995	2000	2005	2006	2010	2011	2012
Cement	CO_2	219.74	54.24	45.71	55.78	70.19	160.77	212.26	174.18
	SO_2	0.13	0.03	0.03	0.03	0.04	0.10	0.13	0.10
Lime	CO_2	93.73	46.77	33.67	73.89	54.92	45.68	41.22	62.06

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

The relevant precursor gas emitted during food production is NMVOCs. They are produced during the processing of cereals and fruits in preparation for the fermentation processes. The estimates of emissions from food and beverages were made for the annual production of spirit, beer, wine, meat and meat products, bread, cakes and animal feeds. NMVOC emissions from beer production were not estimated in the period from 1990 to 1994 due to a lack of information on beer production. The NMVOC total emissions in 1990 were 1.208Gg and reduced to 0.802Gg in 2012. Table 8.7 shows the total NMVOC emissions by food and beverages categories for the period 1990-2012.

Table 8.7. Total NMVOC emissions from food and beverages production in the industrial sector, Gg

Products/Years	1990	1995	2000	2005	2010	2012
Beer	-	0.0005	0.001	0.003	0.016	0.023
Spirit	0.521	0.318	0.569	0.464	0.541	0.496
Alcohol, wine	0.005	0.003	0.005	0.006	0.016	0.022
Meat, fish and poultry	0.019	0.004	0.002	0.002	0.004	0.005
Cakes, biscuits	0.038	0.009	0.007	0.009	0.013	0.015
Bread	0.506	0.294	0.162	0.181	0.174	0.203
Animal feed	0.119	0.047	0.011	0.016	0.066	0.038
TOTAL	1.208	0.675	0.747	0.681	0.830	0.802

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

Potential product halocarbon emissions (HFCs) were calculated and contained in various products such as refrigeration and air conditioning, which are imported, using the Tier 1b methodology of IPCC guidelines. The number of total refrigerators and cars with air conditioners is available in the Statistical Yearbooks of Mongolia. The quantity of material per unit (emission factor) selected from default factors in Revised 1996 IPCC Guidelines for National GHG Inventories. Table 8.8 shows total emissions related to halocarbons.

Table 8.8. Total emissions related to halocarbons, Gg

Gases/ Years	1990	1995	2000	2005	2010	2012
HFCs	0.01	0.03	0.15	0.56	1.36	1.92

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

8.1.1.4. Agricultural sector

CH_4 and N_2O emissions from livestock are directly affected by the number of livestock and the manure management practices employed. The amount of CH_4 that is released depends on the type, age, weight of the animal, the quality and quantity of the feed, and the energy expenditure of the animal. Most Mongolian livestock is indigenous breeds that graze throughout the year on natural pastures with low productivity and a small size as compared to other breeds of animals in the world. Moreover, the climate of Mongolia influences the type of forage and the amount digested by livestock annually. Therefore, emission factors of CH_4 for enteric fermentation and manure management have been developed for Mongolian specific conditions using a Tier 2 approach.

N_2O emissions related to manure handling before the manure is added to soils are included in N_2O emissions from manure management category. According to IPCC guidelines (1996, 2006) on manure management system categorization and definition, only pasture/range/paddock and daily spread systems occur in Mongolia. Therefore, during storage and treatment of these two systems, N_2O emissions are assumed to be zero. N_2O emissions from the land application of Mongolian livestock are covered under the agricultural soil category.

Agriculture residues were calculated for wheat and potatoes as these are the most common crops in Mongolia. However, GHG emissions from the field burning of agriculture residues were very small compared to other emissions from agriculture.

N_2O emissions from agricultural soils are primarily due to the microbial processes of nitrification and denitrification in the soil. Direct soil N_2O emissions of from animal production include those induced by grazing animals. Cultivation of organic soils may increase soil organic matter mineralization and, in effect, N_2O emissions. Results of the GHG emissions calculation from the agricultural sector are shown in Table 8.9.

Table 8.9. GHG Emissions from the agricultural sector, Gg

Years	Methane Emissions from Domestic Livestock			Field Burning of Agricultural Residues				Agricultural soils
	Enteric fermentation	Manure Management	Total					
	CH_4	CH_4		CH_4	N_2O	NO_x	CO	N_2O
1990	274.89	7.04	281.93	0.22	0.0044	0.16	4.71	11.22
1995	296.93	7.73	304.66	0.08	0.0016	0.06	1.72	6.05
2000	296.69	7.64	304.33	0.05	0.0009	0.03	0.97	3.57
2005	257.50	6.24	263.74	0.03	0.0005	0.02	0.57	3.14
2006	286.84	6.81	293.65	0.05	0.0009	0.03	1.00	2.84

2007	326.14	7.58	333.72	0.04	0.0008	0.03	0.85	2.77
2008	344.73	7.83	352.56	0.07	0.0014	0.05	1.50	3.60
2009	356.39	8.04	364.42	0.13	0.0025	0.09	2.65	5.05
2010	276.29	6.47	282.76	0.12	0.0023	0.08	2.44	5.41
2011	301.58	7.08	308.66	0.15	0.0029	0.10	3.05	6.56
2012	340.99	7.92	348.91	0.16	0.0031	0.11	3.31	7.39

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

8.1.1.5. Waste sector

The GHG inventory of the waste sector is based on estimating CH_4 emissions from solid waste disposal sites, CH_4 emissions from wastewater handling, and N_2O from human sewage. The urban population is used for the waste sector calculation since waste in rural areas is typically scattered on the land rather than in solid waste disposal sites (SWDSs). Mongolia has experienced trends towards increasing solid waste output, mainly due to a concentration of the population in urban areas, increased consumption and changes in the economic structure. In 2012, Mongolia had a total population of 2,867,744 people and 45.96% of the total population living in Ulaanbaatar, the capital city.

Methane emissions from wastewater handling were calculated for two basic types of wastewater treatment systems: domestic and commercial wastewater and industrial wastewater. In Mongolia, about one-third of domestic and commercial wastewater is treated by sewer systems with aerobic treatment. 30% of the population lives in apartments connected with central sewer systems, and the annual per capita protein intake is used for the nitrous oxide emission calculation.

Total methane emissions from waste were estimated at 7.51Gg (157.71Gg CO_2-eq.) in 1990, and this amount increased to 11.27Gg (236.67Gg CO_2-eq.) in 2012. During the period of estimations, about 95% of CH_4 emissions came from solid waste disposal sites, about 1.7% came from industrial wastewater, and the leftover came from domestic wastewater. Total nitrous oxide from human sewage was estimated at 0.05Gg (15.5Gg CO_2-eq.) in 1990 and this amount increased to 0.08Gg (24.8Gg CO_2-eq.) in 2012. GHG emissions from the waste sector between 1990 and 2012 are summarized as Gg CO_2-eq. and shown in Table 8.10.

Table 8.10. GHG emissions from the waste sector, Gg

Year	Methane emissions from solid waste disposal sites	Wastewater handling				Total methane emission	Total nitrous oxide emission	Total GHG emissions
		Industrial wastewater	Domestic and commercial wastewater	Sub-total	Human sewage			
	CH_4	CH_4	CH_4	CH_4	N_2O	CH_4	N_2O	Gg CO_2-eq.
1990	6.94	0.31	0.25	0.56	0.05	7.51	0.05	174.49
1995	7.03	0.08	0.27	0.34	0.06	7.37	0.06	173.05
2000	7.80	0.10	0.28	0.38	0.07	8.19	0.07	193.55

2005	8.75	0.10	0.30	0.40	0.07	9.14	0.07	215.11
2006	8.95	0.12	0.31	0.43	0.07	9.38	0.07	219.94
2010	9.98	0.21	0.33	0.54	0.08	10.52	0.08	245.68
2011	10.31	0.24	0.33	0.57	0.08	10.89	0.08	254.31
2012	10.66	0.26	0.34	0.60	0.08	11.27	0.08	262.82

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

8.1.1.6. Net GHG emissions

Total GHG emissions in Mongolia (energy, industrial processes, agriculture and waste excluding land use land use change and forestry [LULUCF]) for the period 1990-2012 are presented in Table 8.11. In 1990, net GHG emissions were 21,145.5Gg CO_2-eq., and GHG emissions reduced to 15,786.4Gg CO_2-eq. in 2000. The reduction was mostly due to the socio-economic slowdown during the transition period from Mongolia's central planned economy to a market economy from 1991 to around the year 2000. After 2000, total GHG emissions have steadily increased to 26,276.9Gg CO_2-eq. in 2012.

The energy sector accounted for 53.2% of total GHG emissions in 1990 and 51.9% in 2012. The second largest source of GHG emissions is the agricultural sector, accounting for 44.5% of total GHG emissions in 1990 and 36.6% in 2012. The single largest emitter of CO_2 is the energy sector. In 2012, 98.2% of total CO_2 emissions were from the energy sector, which includes all types of fuel combustion activities (Table 8.11).

Total GHG emissions in Mongolia are comparatively low than other countries, but per capita GHG emissions are relatively high compared to other developing countries. This can be attributed to Mongolia's extremely cold continental climate, the widespread use of fossil fuels for energy, and the low efficiency of fuel and energy use.

Table 8.11. Mongolia's total GHG emissions by gases (excl. LULUCF sector) for the period 1990-2012 (Gg CO_2-eq.)

GHG source and sinks	CO_2 emissions	CH_4	N_2O	HFCs	TOTAL
	Gg CO_2-eq.				
1990					
Energy	10,653.21	23.52	0.30	-	11,240.17
Industrial processes	313.47	-	-	0.01	326.94
Agriculture	-	282.15	11.22	-	9,403.91
Waste	-	7.51	0.05	-	174.49
Total (excl. LULUCF sector)	10,966.68	313.18	11.58	0.01	**21,145.51**
2000					
Energy	7,371.49	17.27	0.27	-	7,818.11
Industrial processes	79.38	-	-	0.15	275.96
Agriculture	-	304.38	3.57	-	7,498.82
Waste	-	8.19	0.07	-	193.55

Total (excl. LULUCF sector)	7,450.87	329.84	3.91	0.15	**15,786.43**
2012					
Energy	12,530.81	47.46	0.43	-	13,660.77
Industrial processes	236.24	-	-	1.92	2,732.24
Agriculture	-	349.07	7.39	-	9,621.11
Waste	-	11.27	0.08	-	262.82
Total (excl. LULUCF sector)	12,767.05	407.80	7.90	1.92	**26,276.94**

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

Table 8.12. Mongolia's total GHG emissions by sectors (excl. LULUCF sector) for the period 1990-2012 (Gg CO_2-eq.)

Years/Categories	Energy	Industrial Processes	Agriculture	Waste	TOTAL
1990	11,240.17	326.94	9,403.91	174.49	21,145.51
1995	7,760.93	139.29	8,275.05	173.05	16,348.32
2000	7,818.11	275.96	7,498.82	193.55	15,786.43
2005	8,499.93	857.67	6,511.29	215.11	16,084.01
2010	11,705.14	1,974.45	7,618.51	245.68	21,543.77
2011	12,414.95	2,892.48	8,518.62	254.31	24,080.36
2012	13,660.77	2,732.24	9,621.11	262.82	26,276.94

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

8.2. National BAU GHG emission

Projections of GHG emissions between 2006 and 2030 in Mongolia have been estimated in Mongolia's Second National Communication in 2010 (MNET 2010). For the forecasting of emissions from energy sectors, which accounts for the majority of the GHG emissions and results from a Long-range Energy Alternatives Planing system (LEAP) model were used. LEAP is a scenario-based energy-environment modeling tool. Scenarios are based on a comprehensive accounting of how energy is consumed, converted and produced in a given region under a range of alternative assumptions on population, economic development, technology and other related measures. Projection of emissions from agriculture, land-use change and forestry (LULUCF), and waste sectors were calculated up to 2030 on the basis of previous trends, taking into account social and economic changes and currently implemented or adopted policies and measures. The aggregated projections of GHG emissions are shown in Table 8.13.

Table 8.13. Aggregated projections of GHG emissions by sector

Sectors	GHG emissions in Gg CO_2-eq.						Average annual growth rate,%			
	2006	2010	2015	2020	2025	2030	2006-2015	2015-2020	2020-2030	2006-2030
Energy	10,220	14,033	20,233	25,930	32,796	41,815	10.89	5.63	6.13	12.88
Industry	891	1,354	1,602	1,836	2,065	2,318	8.87	2.92	2.63	6.67
Agriculture	6,462	6,405	6,573	6,657	6,762	6,867	0.19	0.26	0.32	0.26
LULUCF	-2,083	-1,932	-1,785	-1,420	-1,000	-680	-1.59	-4.09	-5.21	-2.81
Waste	138	158	183	209	254	294	3.62	2.84	4.07	4.71
Total	15,628	20,018	26,806	33,212	40,877	50,614	7.95	4.78	5.24	9.33

Source: MNET, UNEP: Mongolia Second National Communication, Under the United Nations Framework Convention on Climate Change, 2010.

Total GHG emissions are projected to increase 3.25 times from 2006 to 2030. Generally, energy consumption is expected to increase rapidly due to economic and population growth. Energy consumption in the industrial sector is rapidly increasing due to the development of the mining and quarry industry in mining sectors. GHG emissions in energy sectors from 2006 to 2030 are expected to increase by 4 times.

According to the"Mongolian Livestock" National programme (State Great Khural 2010), the livestock population will be 36 million in 2021, in order to comply with the actual pasture carrying capacity and to prevent desertification. Therefore, GHG emissions are not expected to increase significantly. However, as of 2014, the total livestock population had already reached 50 million, causing a significant increase of GHG emissions, especially methane emissions, in the future.

In 2030, GHG emissions in the industry sector are expected to increase by a factor of 2.5, and in the waste sector by 2 times, compared to 2006. GHG removals in LULUCF will be reduced by a factor of 3 in the projected period (Figure 8.3 and Figure 8.4).

Several studies were undertaken to project GHG emissions after the publication of the Second National Communication in 2010. These include GHG emission projections in the energy sector prepared for a development of the national"Green Development Policy" (Dorjpurev, 2013), and also the energy sector projections prepared by Global Green Growth Institute (GGGI) in 2014. The comparison of those projections is shown in Table 8.14.

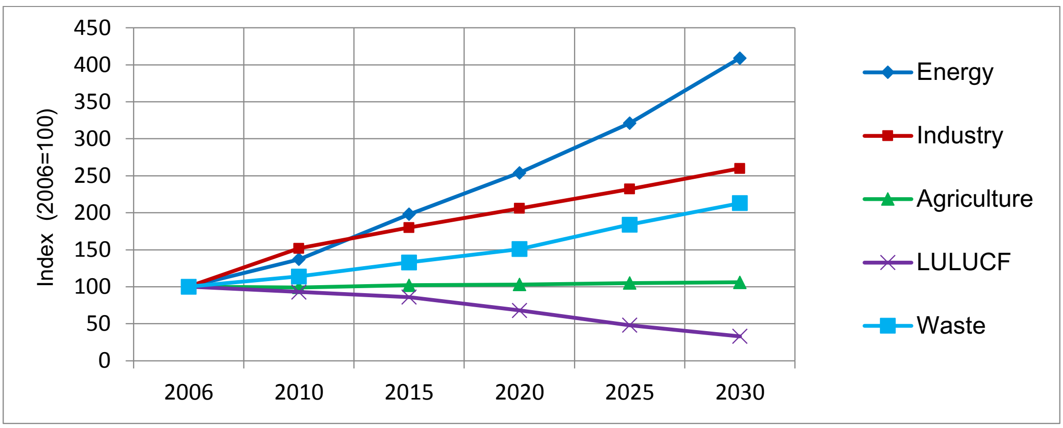

Figure 8.3. Projections of GHG emissions and removals (sector)
Source: Mongolia Second National Communication, 2010.

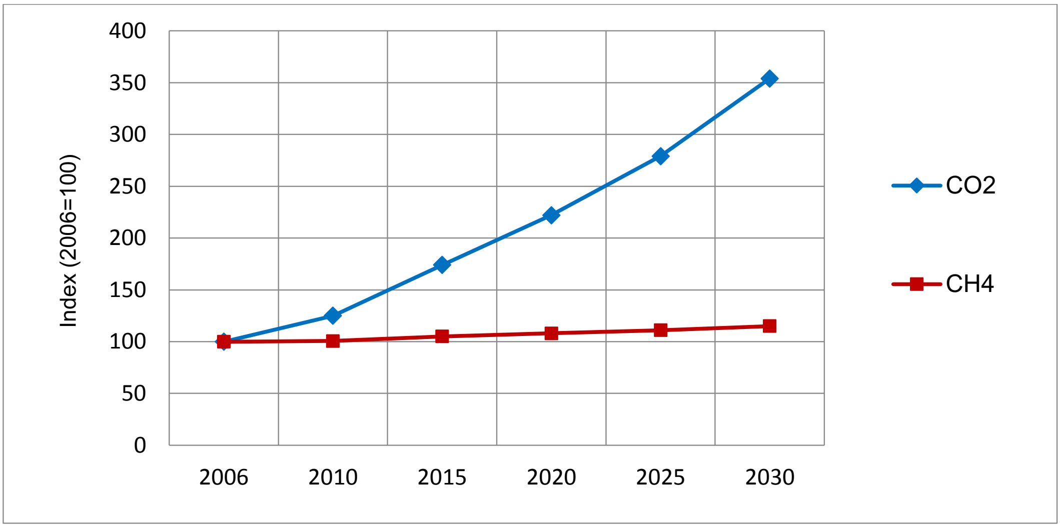

Figure 8.4. GHG emission projections (by gas types)
Source: Mongolia Second National Communication, 2010.

Table 8.14. GHG Emission projections from Energy sector prepared in three different studies, million tonnes CO_2-eq.

Documents		2015	2020	2025	2030	2035
SNC	Consumption	7,8	10,4	13,7	17,7	-
	Supply	12,5	15,6	19,2	24,1	-
	Total	20,2	25,9	32,8	41,8	-
Green Strategy	Consumption	6,9	8,9	11,3	14,0	-
	Supply	11,0	16,5	20,5	26,0	-
	Total	17,9	25,4	31,8	40,0	-
GGGI	Consumption	9,0	11,9	14,8	18,2	21,8
	Supply	11,4	24,8	27,8	30,1	33,8
	Total	20,4	36,8	42,6	48,3	55,6

Source: MARCC-2014, Mongolia Second Assessment Report on Climate Change-2014

Figure 8.5 shows that previously stated three different projections are rather similar. The average of those projections shows that energy sector GHG emissions will reach 20 million

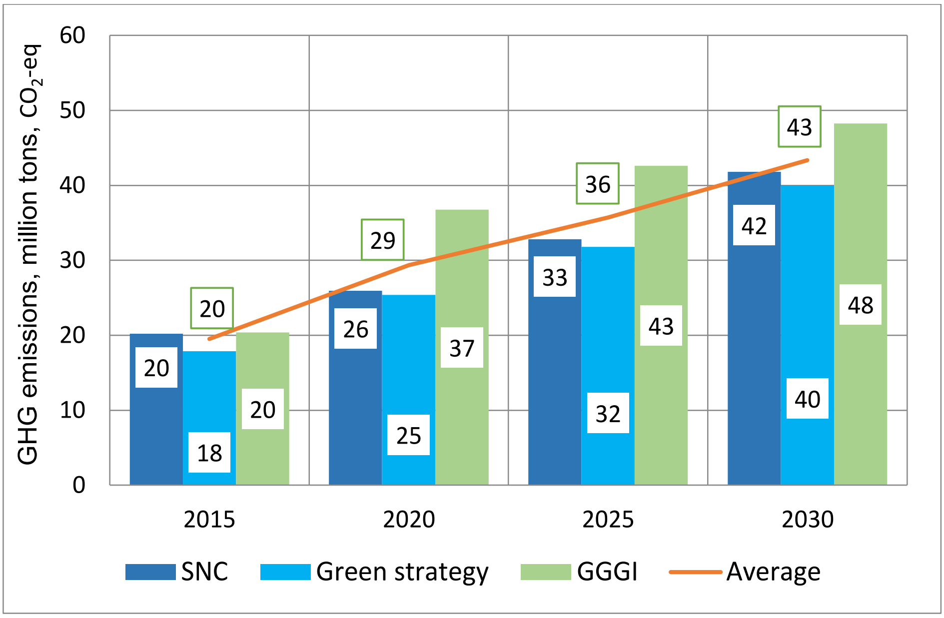

Figure 8.5. Comparison of GHG emission projections prepared in three different studies

8.3. Assumptions and methods for establishing BAU emissions in the energy sector

8.3.1. Method

The study of energy sector BAU emissions employs a bottom-up techno-economic analysis of energy and GHG-reduction scenarios. This type of analysis is commonly used by countries in their energy and climate change mitigation planning. In a bottom-up analysis, energy demand is specified according to assumptions on how underlying drivers (e.g. population, mineral production) may evolve, and does not take into account responses to economic changes (such as changes in consumer spending or other macroeconomic variables) that may result from the measures introduced. This approach is straightforward, and is more transparent to analysts and decision makers, than more complicated methods involving economic models. BAU scenarios were assembled in the LEAP model[1].

8.3.2. Assumptions

The energy consumption in the household sector depends on the growth rates of the population, the number of households and income level. GHG emissions from the residential sector are projected to increase, largely due to the increase of population with a growth rate of 3%. Energy consumption in the household sector will increase by a factor of 1.84 in 2020 and by 2.55 in 2030 from the base year of 2006. Energy consumption in the industrial sector is rapidly increasing due to the development of the mining and quarrying industry in mining projects such as Oyu Tolgoi, Tavan Tolgoi and other mining projects, especially from 2014 to 2020.

The transportation sector is also projected to exhibit a high growth rate of GHG emissions in the energy sector due to the relatively high increase in the number of vehicles and the demand for freight transport.

In order to meet growing energy demand, new energy sources such as a Combined Heat and Power Plant (CHP) in Ulaanbaatar with a capacity of 300MW, Wind farm in Salhit Uul near Ulaanbaatar with a capacity of 50MW, Mogoin Gol thermal power plant of 60MW, Hushuut thermal power plant of 36MW and Tavan Tolgoi thermal power plant of 300-600MW are expected

1 See http://www.energycommunity.org/default.asp?action=47 for a full description of the LEAP model.

to be established according to the infrastructure development programme of the Government planned to be realized in few years. It is also assumed to rehabilitate and increase the capacity of existing power plants.

8.3.3. Energy sector (power and heat) Business as Usual (BAU) or Reference Scenario

During the preparation of the INDC submission, Mongolia decided to use BAU projections from the Second National Communication as the official BAU scenario for its INDC. According to this, BAU projection total GHG emissions in the energy sector accounts for 25.94Gg CO_2-eq. in 2020 and 41.82Gg of CO_2-eq. in 2030 (Table 8.15).

Table 8.15. GHG emissions (million tonnes CO_2-eq.) from energy sector for BAU scenario

Specification	2010	2015	2020	2030
Demand	4.52	7.78	10.37	17.69
Transformation	8.10	12.45	15.57	24.13
Total	12.61	20.23	25.94	41.82

Source: LEAP calculation for Second National Communication

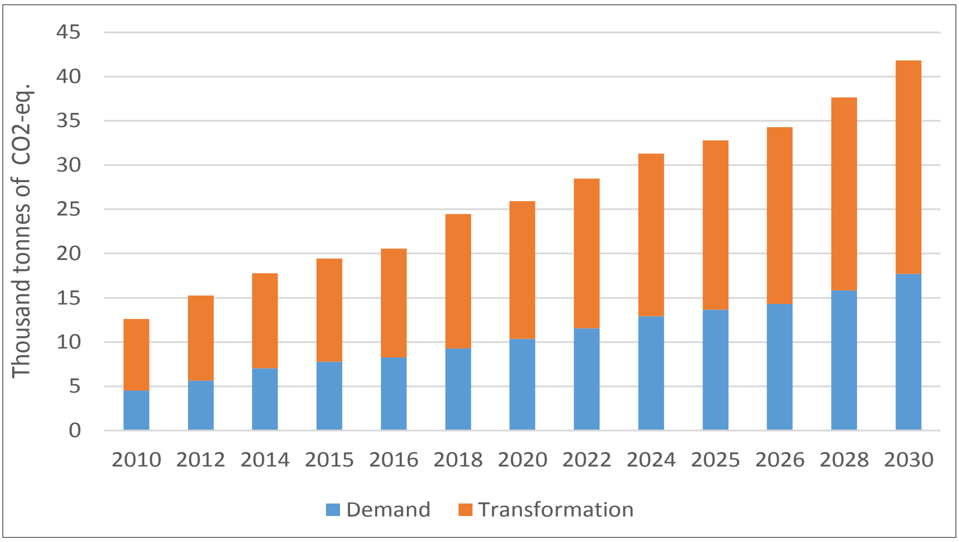

Figure 8.6. GHG emissions from energy demand and energy transformation
Source: LEAP calculation for Second National Communication

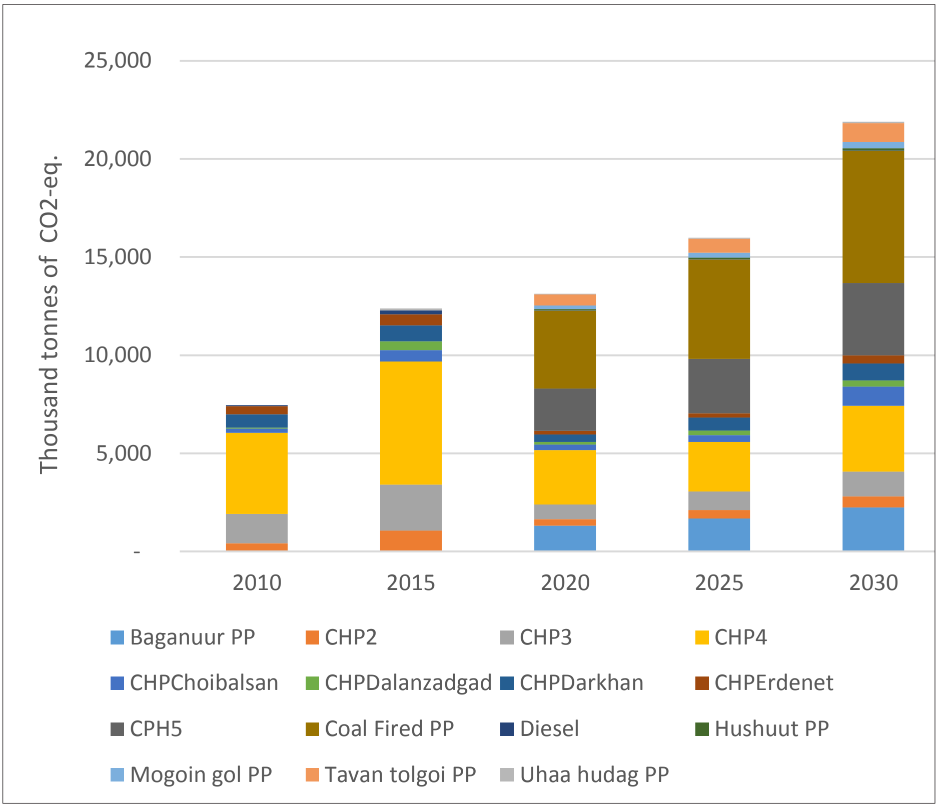

Figure 8.7. GHG emissions from power plants
Source: LEAP calculation for Second National Communication

8.3.4. Energy sector (transport) Business as Usual (BAU) or Reference Scenario

Table 8.16 shows expected growth of GHG emissions from the transport sector, caused by constant population growth and socio-economic development.

Table 8.16. GHG emissions caused from transportation sector, kt CO_2

Branches	2015	2020	2025	2030
Freight	1,167.0	1,572.0	2,118.0	2,854.0
Passenger	1,070.0	1,394.0	1,762.0	2,177.0
Total	2,236.0	2,966.0	3,880.0	5,031.0

Source: Second National Communication, LEAP model calculations

8.4. Non-energy sector

8.4.1. Industrial sector

Energy consumption in the industrial sector is rapidly increasing due to the development of mining and quarrying, as well as other industries. The projection of GHG emissions from these industries is included in the energy sector above. Therefore, in this sector cement and lime production as well as potential emissions from consumption of HFCs are presented. Due to an increase in construction, urban and industrial development, cement production is expected to increase by 4.1 fold in 2020 and by 6 fold in 2030 compared to the 2006 level. While the production of lime is projected to increase by 2 fold in 2020 and by 3 fold in 2030 compared to the 2006 level. It is assumed that the potential emissions from the consumption of HFCs will be increased by 2.3 in 2030 from the base year 2006, due to an increase of different kinds of refrigerators and cooling systems.

8.4.2. Agriculture

The most GHG emissions emitted from agriculture is methane. Enteric fermentation and manure management are major sources of methane. The projection of methane emissions from agriculture sector depends on changes of livestock population. According to Mongolia National livestock programme, the population of livestock is intended to be decreased from the 43 million in 2008 down to 36 million in 2021 to comply with the actual pasture carrying capacity and to prevent the desertification (State Great Khural, 2010).

8.4.3. Land use, land-use change and forestry

Crop cultivation plays an important role in sustaining self-sufficiency in foodstuffs. After the privatization of the large state-controlled farms in the 1990s, crop production fell sharply, a decline blamed on a lack of management skills, funds, and technologies. However, as a result of “Third agriculture campaign” launched by the Government of Mongolia, the production of cereals, potatoes and vegetables is being increased rapidly since 2008. In 2009, Mongolia produced 255 thousand tonnes of cereals while the production of cereals was 138.6 thousand tonnes in 2006. It is projected that cultivated land for the crop would increase from 162,040 ha in 2006 up to 400,000 ha in 2020. However, the total cultivated area including crop rotation area would not exceed 650,000 ha in 2020. It is assumed that the lands used for industrial mining would be increased by 12% annually. Also, the forest plantation between 2010 and 2020 is proposed to increase by 10% per year while annual biomass consumption from stocks would be reduced by 4% annually.

8.4.4. Waste

GHG emissions from solid waste, domestic and commercial waste water are expected to increase by 3% annually between 2000 and 2020. Population, lifestyle, water consumption level and other relevant measures would directly affect the amount of GHGs emitted from domestic sewage. However, future changes in lifestyle and increase of urban population are projected to result in a growth rate of methane emissions from domestic sewage. GHG emissions from industrial wastewater, which is influenced by the amount of industrial water converted into wastewater, are also estimated to growth at a rate of 5% annually.

CHAPTER 9. OPTIONS FOR MITIGATION COMPONENT OF THE INDC

The Lima Call for Action invited countries to submit their Intended Nationally Determined Contributions (INDC) in order to reach the achievement of the major objective as set out in Article 2 of the Convention. Article 2 of the Convention outlines the international agreement to achieve the stabilisation of GHG concentrations at a level which avoids dangerous anthropogenic climatic change. The INDC process, therefore, concerns itself first and foremost with climate change mitigation action; it is an opportunity for Parties to communicate what they consider to be their appropriate contribution to the achievement of the global goal, given their respective responsibilities and capabilities. It is also an opportunity, for Parties who wish to do so, to communicate the financial and technical support needs that are required in order to increase the contribution to emission reductions.

This chapter describes issues relevant to Mongolia on the possible types of INDC mitigation contributions, their format, and some technical and practical considerations relevant to the proposed INDC document.

9.1. Type and format of mitigation contribution

9.1.1. Type of mitigation contribution

Countries are free to propose any type of mitigation contribution that they consider to be most appropriate to their national circumstances.

The following list outlines the broadest categories of INDC types which Parties may consider using to structure their contributions. These types are explored in further details below:

- Economy-wide GHG emissions target: e.g. reduce national GHG emissions by 30% by 2030 compared to 1990 levels (e.g. EU target).
- Sectoral GHG emissions target: e.g. reduce emissions in the energy sector by 40% by 2030 compared to 1990 levels.
- Decarbonization indicator: e.g. reduce national emissions intensity in terms of emissions per unit of GDP by 35% by 2030, compared to 2005 levels; increase the share of renewable electricity generation to 40% by 2030.
- Policies and measures: e.g. develop and/or implement specific policies or specific actions with a climate change mitigation impact.

These formats may also be used in combination with each other to provide further details and transparency. Although most existing submissions to the UNFCCC INDC portal include economy-wide GHG emission targets, NewClimate Institute research indicates that fewer than half of countries worldwide are eventually likely to develop such targets, with either countries likely to present their contributions either in the form of sectoral targets or a list of quantified or unquantified policies and measures.

The type of INDC chosen should be based largely upon the respective capabilities of the country. In this context, the capability may refer to resources available for INDC preparation, data availability, the availability of existing analysis on mitigation scenarios, and, to an extent, the resources available for the implementation of mitigation measures. The type of format for the INDC is not necessarily linked to the degree of mitigation ambition; Parties with limited resources for the implementation of mitigation measures may still present economy-wide targets if they have the required capability to do so. On the other hand, it should be considered that carefully planned and clearly communicated policies and measures may have a greater mitigation impact and may attract more international support than hastily constructed economy-wide targets which are unclear and/or less efficient in their implementation.

9.1.2. Economy-wide GHG emission target

The use of an economy-wide target provides the clearest communication of the INDC impact, and as such it is generally preferred across the international community. However, such an expression requires the sufficient availability of data to create a reliable bottom-up calculation of emission scenarios for all sectors. Countries with limited capability in this regard are not expected to produce this type of target, as its formulation in the absence of sufficient baseline information may lead to INDCs that are unrealistic, unachievable, or incomparable.

The international community would consider the unconditional contribution fulfilled as long as the final result of the stated emissions reduction is achieved. Failure to reach the quantified target will result in the contribution being considered unfulfilled, regardless of the number of policies, measures and actions that have been implemented. Although this type of target provides the clearest information to the international community with regard to the 2°C goal, it was agreed that this was an unsuitable format for Mongolia by the national technical team for the following reasons:

- Mongolia is a country in transition; the future trajectory of the country's development is less predictable than for most developed countries. An absolute emission target may over-burden Mongolia if the development of the economy continues at a rate much higher than planned. Similarly, this type of target could lock-in lower than intended ambition in the case that the actual development trajectory falls short of the projections.
- Whilst the data availability is very good for some sectors in Mongolia, such as the energy sector, in some others sectors the availability of data and emission reduction potential is not fully comprehensive. Proceeding with an economy-wide target would present a risk given the uncertainty of the supporting information.

9.1.3. Sectoral GHG emission target

Sectoral targets may be used by countries who wish to express an aggregated target, but do not have sufficient capabilities to do so in all sectors. In this case, mitigation scenarios can be expressed as aggregated GHG emission targets for one or several sectors, whilst other sectors that the country still wishes to include in its INDC could be included through the expression of individual policies and measures or excluded altogether.

As per the economy-wide target, the international community would consider the unconditional contribution fulfilled only if the final result of the stated emissions reduction is achieved. Due to the good detail of information available for the energy sector, this type of INDC could be technically feasible for Mongolia. However, it was not deemed the most appropriate construction for Mongolia, since the uncertainty regarding the development of national circumstances entails a risk if bound to a specific quantified target.

9.1.4. Decarbonization indicator

Use of a decarbonization indicator, such as the share of renewables in the energy system, or emissions intensity of energy, may be a suitable expression of the INDC for Parties that are interested to put forward a specific quantified decarbonization target, but who do not wish to be bound to a specific GHG emission outcome due to the unpredictability of national growth and development in the coming decades. This type of target is particularly suitable for developing countries with a great potential for short and mid-term economic growth, especially those where the energy sector continues to rely largely on traditional fuels. It provides a statement of intent to continue to grow a more sustainable economy. However, it does not provide the international community with assurances on the actual GHG emissions outcome.

There could be several options for this type of target for Mongolia: energy emissions intensity target for the energy sector, emissions intensity per capita, emissions intensity per unit of GDP, or share of renewables in the electricity generation.

Fulfilment of the contribution in the eyes of the international community would be based upon reaching the decarbonization indicator target, not upon the implementation of the underlying policies from which is was calculated. This presents some potential risks/implications for Mongolia: if the complete implementation of these measures (e.g. new renewable capacity installation) does not create the anticipated effect in terms of the amount of energy generated, for example, Mongolia would need to take more actions to meet the target. Furthermore, if energy sector demand increased at a higher than expected rate, more renewable electricity generation would need to be installed to maintain the balance indicated by the decarbonization indicator. Due to the risk of being bound to the achievement of the target, this type was not considered the most appropriate construction for Mongolia.

9.1.5. Policies and measures

This option is suitable for countries where limited data availability prevents the development of reliable bottom-up calculations for emission reduction potential in any sectors. The format is also suitable for countries who do not wish to be bound to a quantified target, but would rather be bound”only” to the execution of activities. It is highly advisable if presenting policies and measures to include an illustrative indication of the potential scale of the mitigation impact, as far as the data allows. This enhances transparency and international understanding of the contribution, and will also attract much greater interest from potential funders.

The international community would consider the unconditional contribution fulfilled as long as the measures have been implemented, regardless of the outcomes of these measures or changes in uncertain factors such as economic development. Use of this format of INDC need not restrict the ambition of the contribution, as ambitious policies and actions can be put forward.

Due to limited data availability in some sectors, uncertain development of national circumstces, the risk entailed by specific quantified targets, and the potential for ambitious action through policies and measures, the mitigation team along with the consulted stakeholders deemed a **”policies and measures” approach to be the most appropriate construction** for the mitigation contribution of Mongolia’s INDC.

9.1.6. Format of mitigation contribution

Countries are free to submit their INDCs in any format which they consider to be appropriate. However, for the sake of transparency and comparability it is preferable for countries to follow a common format. There is a general consensus on the elements that INDCs should ideally contain, and several organisations have developed templates for INDC submissions, which are likely to be widely used.

Most existing official submissions, as of August 2015, contained concisely summarised information on the mitigation contribution, occupying around 3-5 pages including a number of specific elements for transparent communication.

Mongolia’s proposed mitigation contribution also follows this format and uses international templates for maximum clarity and transparency.

9.2. Timing considerations for mitigation contribution

9.2.1. Target year for activities

Countries can choose a post-2020 target year for their actions. To date, countries have chosen 2025 and/or 2030 as target dates. Some developing countries and environmental NGOs argue that a short timeframe for developed countries (i.e. 2025) allows for more frequent review and increasing ambition over time. On the other hand, a 2030 target provides longer-term strategy and investment signals.

The target dates for the individual policies and measures contained in Mongolia's mitigation contribution vary depending on the target date of the original strategy. For the most important actions in the contribution, the target date for full implementation of the activities is 2030.

9.2.2. Period of implementation

The international climate change agreement to be reached in Paris in December 2015 is a post-2020 agreement. That is to say, that the agreement will be based around common post-2020 international targets.

However, this does not mean that the proposed national contributions should only include measures to be implemented post-2020. For countries with internationally-communicated climate change targets for 2020 it is logical that only post-2020 actions are relevant, since pre-2020 actions are covered under the existing target. However, for countries without existing internationally-communicated climate change targets for 2020, all activity that takes place up to the date of the target is relevant to the achievement of the target, including measures that begin pre-2020.

As Mongolia does not have a formal internationally communicated climate change target for any previous date, all activities are immediately relevant to the achievement of the implementation of the listed policies and measures. As such, the INDC includes the main policies and measures that will be implemented between 2015 and 2030.

9.3. Unilateral and supported contributions

Some countries have indicated that they wish to present a conditional contribution, based upon specific conditions regarding the availability of international finance, or the level of ambition proposed by other countries. For this reason, some countries are expected to put forwards two sets of potential contributions, typically referred to in the international community as unconditional or unilateral contributions, and conditional or supported contributions.

For these countries, a major challenge in determining an INDC is to identify how much should be done unilaterally by the country and how much could be done with the support of the international community.

A conceptual approach that could be used to identify both the conditional and unconditional pledge is by developing analysis to determine what should a country do, given its responsibility and capability, and what could the country do, given its national circumstances.

Many developing countries will define their unconditional contributions based on an assessment of the impacts of existing ongoing programmes and plans with climate/energy implications, alongside other measures that the country is able to put forward unilaterally under its best efforts. For many developing countries, additional measures put forward unilaterally are likely to be measures that align very closely to national development priorities, and therefore entail considerable other benefits for the country.

Other potential mitigation actions that cannot be covered as part of the unilateral contribution could be considered a conditional addition, based on the receipt of sufficient support. Here, a country has the opportunity to state a list of actions (or collectively, an enhanced target) that it may implement if sufficient external support is received. Showing ambition in the unilateral and the conditional parts makes a country attractive for international funding for the implementation of actions, and these actions may have major synergies with the national development agenda.

In Mongolia, stakeholders communicated concern at the wording of unilateral or unconditional contributions, since the ongoing national climate change strategy is dependent on the continuation of existing support from various sources. Therefore, the wording of this split contribution was adjusted: the 'national contribution', which contains the main policies and measures proposed under Mongolia's INDC, is "contingent upon the continuation of international support to complement domestic efforts"; an 'additional actions' section highlights further measures that Mongolia would also be "interested to pursue".

9.4. Political and legal implications of the mitigation component

INDCs are provisional contributions, not commitments. They are designed as an input to the negotiation of the 2015 climate change agreement in Paris. Upon their submission to the UNFCCC, these documents remain provisional contributions, not legally-binding commitments. It is quite probable, but not certain, that INDCs (intended NDCs) will become anchored in an agreement to be negotiated in Paris, but the original INDCs will not be legally binding, and can be adjusted at any time until a final agreement is reached. However, it is possible that final INDCs anchored in the Paris agreement may become legally binding (depending on how Parties choose to negotiate the structure of the agreement), and so it is of key importance that all Parties receive provisional political approval for their intended INDCs in advance. Countries are expected to go through this political process in advance of their submission to the UNFCCC.

9.5. Type and format of Mongolia's mitigation contribution

A blend of approaches based on policies and measures, with illustrative information.

The mitigation component of Mongolia's contribution is based on a policies and measures approach. That is to say, fulfilment of the INDC will be considered complete if the policies and actions listed in the INDC are implemented. The proposed policies and measures represent the ambitious plans of existing national strategy and legislation, including the state policy for the energy sector (Parliament resolution No. 63, 2015), Urban public transport investment programme (2015), the National action plan for climate change (Government resolution No. 171, 2012), and the "Mongolian Livestock" national programme (Parliament resolution No. 23, 2010).

Furthermore, Mongolia's contribution includes elements of the other types of contribution, for illustrative purposes. The potential impacts of the proposed policies and measures are calculated and indicated, presenting the potential sectoral and economy-wide GHG emissions impact. Furthermore, the policies and measures themselves include a decarbonization indicator in the form of a renewable energy target.

The type and format of Mongolia's mitigation contribution are a good practice for the following reasons:

- The proposed policies and measures are ambitious yet grounded in national strategy and legislation, and therefore realistic.
- The proposed policies and measures hold major synergies with the national development strategy and non-climate related objectives. Implementation of the INDC measures will assist with the achievement of these objectives, and the INDC plans will help to mainstream climate considerations in development planning in all sectors.

- The type and format of the mitigation contribution are highly transparent in its potential impact (through illustration of potential sectoral and economy-wide GHG emission impact), whilst managing the risk by being bound only to the implementation of the actions rather than the achievement of the expected outcomes.
- The format for presenting the mitigation contribution follows closely the examples of existing submissions and uses international templates for maximum clarity and transparency.
- The INDC highlights, in addition to the main policies and measures that are included in the national contribution, additional areas of action that it would be interested to explore further in the case that resources and capacity are available. In doing so, the INDC shows both a way that Mongolia can be supported by international funds to increase its mitigation level and also shows how Mongolia intends to expand its existing targets and sectoral coverage in the future, as capacity and resources for climate change mitigation planning within other sectors is enhanced.

CHAPTER 10. MONGOLIA'S INDC: MITIGATION CONTRIBUTION

By 2030, Mongolia intends to contribute to global efforts to mitigate GHG emissions by implementing the policies and measures listed in Table 10.1, contingent upon the continuation of international support to complement domestic efforts. These policies and measures were identified by technical experts, in consultation with key Mongolian stakeholders, and subjected to a series of validation meetings and workshops in 2015.

Table 10.1. Proposed policies and measures for Mongolia's INDC

Sector	Measure	Policy/strategy document
Energy (power and heat)	Increase renewable electricity capacity from 7.62% in 2014 to 20% by 2020 and to 30% by 2030 as a share of total electricity generation capacity.	- State policy on energy (Parliament resolution No. 63, 2015); - Green development policy, 2014
	Reduce electricity transmission losses from 13.7% in 2014 to 10.8% by 2020 and to 7.8% by 2030.	
	Reduce building heat loss by 20% by 2020 and by 40% by 2030, compared to 2014 levels.	
	Reduce internal energy use of Combined Heat and Power plants (improved plant efficiency) from 14.4% in 2014 to 11.2% by 2020 and 9.14% by 2030.	
	Implement advanced technology in energy production such as super critical pressure coal combustion technology by 2030.	
Energy (Transport)	Improve national paved road network. Upgrading/Paving 8000 km by 2016, 11000 km by 2021.	- National Action Programme on Climate Change (NAPCC), 2011; - Urban public transport investment programme, 2015; - Nationally Appropriate Mitigation Actions (NAMAs), 2010; - Mid-term new development programme, 2010
	Improve Ulaanbaatar city road network to decrease all traffic by 30-40% by 2023.	
	Increase the share of private hybrid road vehicles from approximately 6.5% in 2014 to approximately 13% by 2030.	
	Shift from liquid fuel to LPG for vehicles in Ulaanbaatar and aimag (province) centres by improving taxation and environmental fee system.	
	Improve enforcement mechanism of standards for road vehicles and non-road based transport.	
Industrial sector	Reduce emissions in the cement industry through upgrading the processing technology from wet- to dry-processing and through the construction of a new cement plant with dry processing up to 2030.	- NAMAs, 2010; - NAPCC, 2011; - Government resolution No. 171, 2012: Building materials programme
Agriculture	Maintain livestock population at appropriate levels according to the pasture carrying capacity.	- "Mongolian livestock" national programme, 2010

Mongolia has also identified a series of additional mitigation actions in:

- Reduce fuel use in individual households through improving stove efficiency (with co-benefit of air pollution reduction),
- Transport (development of Bus Rapid Transit [BRT] system and improvement of the public transport system in Ulaanbaatar),
- Agriculture (development of a comprehensive plan for emission reductions in the livestock sub-sector for implementation between 2020 and 2030),
- Waste sector (development of a waste management plan, including recycling, waste-to-energy, and best management practices), and
- Industry (motor-efficiency improvements, improved housekeeping).

Furthermore, for forestry, a programme is underway in Mongolia to develop a detailed inventory along with the identification of mitigation options for this sector. In future communications, Mongolia intends to include actions for mitigation in the forestry sector to reduce GHG emissions from deforestation and forest degradation by 2% by 2020 and 5% by 2030 (according to State Policy on Forest, 2015).

These measures are largely in-line with the NAMAs submitted 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 (Table 10.2).

Table 10.2. List of NAMAs of Mongolia to the Copenhagen Accord

Sectors	Technologies
Energy supply	• PV and Solar heating • Wind power generators and Wind farms • Hydropower plants • Coal beneficiation • Coal briquetting • Improve efficiency of existing HOBs and install boilers with new design and high efficiency • Convert hot water boilers into small capacity thermal power plants • Change fuels for household stoves and furnaces • Modernize existing and implement the new design for household stoves and furnaces • Improve efficiency and reduce internal use in CHPs • Use of electricity from grid for individual households for local heating in cities
Building	• Improve district heating system in buildings • Install heat and hot water metres in apartments • Make insulation improvements for existing buildings and implement new energy efficient standards for new buildings • Improve lighting efficiency in buildings
Industry	• Improve housekeeping practices • Implement motor efficiency improvements • Introducing dry-processing in cement industry
Transport	• Use more fuel efficient vehicles
Agriculture	• Limit the increase of the total number of livestock by increasing the productivity of each type of animal, especially cattle
Forestry	• Improve forest management • Reduce emissions from deforestation and forest degradation, improve sustainable management of forests and enhance forest carbon stocks

Source: http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5265.php

CHAPTER 11. ASSESSMENT OF MITIGATION IMPACT, FAIRNESS AND AMBITION OF THE INDC

11.1. Mitigation impact of INDC

The emissions inventory for 2010 was compiled using IPCC 2006 guidelines and GWP values from IPCC AR4, as described in Mongolia's Second National Communication. The BAU baseline was defined according to the methodology given in Mongolia's Second National Communication. Indicative emissions reductions of the measures in table 10.1 were determined using LEAP modelling (energy: power and heat, energy: transport), 2006 IPCC GPG (energy: transport), and Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (industry). Agricultural emission reduction measures could not be estimated due to a lack of available background information, and are thus not included in the indicative estimate.

11.1.1. GHG Mitigation Scenarios in energy sector

The following mitigation measures have been modelled in a mitigation scenario using LEAP and correspond to the mitigation contribution of the INDC.

Renewable energy scenario

The RENEWABLE scenario comprises all individual measures listed in Table 11.1 and has been calculated separately as the effects of individual measures cannot be added up. Calculation results are shown in Table below:

Table 11.1. Capacity of renewable energy sources for electricity generation, MW

No.	Name of energy sources	Newly installed capacity, MW		Source
		2015-2023	2024-2030	
1	Hydropower plants:			
	Eg HPP	315	-	State policy on energy sector (Parliament resolution No. 63, 2015), Ministry of Energy (MOE)
	Erdeneburen HPP in Khovd river	60	-	State policy on energy sector (Parliament resolution No. 63, 2015), MOE
	HPP in Selenge river	-	300	State policy on energy sector (Parliament resolution No. 63, 2015), MOE
2	Wind Parks:			
	Oyutolgoi wind park	102	-	Feasibility study (FS) approved by MOE
	Sainshand wind park	-	52	MOE
	Wind Park in Gobi region	-	200	State policy on energy sector (Parliament resolution No. 63, 2015), MOE

3	Large scale solar PV:			
	Solar PV in Darkhan city	10	-	FS approved by MOE
	Large scale solar PV in Gobi region	-	100	State policy on energy sector (Parliament resolution No. 63, 2015), MOE
	Solar PV in Taishir	10	-	Government programme, MOE
	Solar PV in Durgun	10	-	Government programme, MOE
	Solar PV in Western region	15	-	Government programme, MOE

Energy efficiency scenario

Assumptions for energy efficiency measures are shown in Table 11.4 and Table 11.5.

Table 11.2. Assumptions for reduction of electricity transmission and distribution of power plant own use losses and building energy efficiency

Activities	2014	2023	2030
Electricity transmission and distribution losses	13.7	10.8	7.8
Power plant (station) own use	14.4	11.2	9.14
Building energy efficiency	0	20	40

Source: State policy on energy sector (Parliament resolution No.63, 2015)

Table 11.3. Assumptions for power plant electric efficiency improvement, %

Power plants	Reference (BAU) scenario (high pressure technology)	Mitigation (EE) scenario (super critical pressure technology)
Tavan Tolgoi Power Plant	35	43
Baganuur Power plant	35	43

Source: Namkhainyam B., Environment, energy and technology, Ulaanbaatar, 2014, page 171.

Calculation results from LEAP are shown in Table 11.4.

Total GHG emission reductions in energy sector

The combined effect of the different measures elaborated above is represented in the following section. The total effect of each scenario is given separately as well as the effects of totalling scenarios as the effects of individual scenarios cannot be added up. The total effect results in an emission reduction of 4.9 million tonnes CO_2-eq. by 2030. The table below illustrates the cumulative effects of all of the measures.

Table 11.4. GHG emissions in different scenarios, million tonnes CO_2-eq.

Scenarios	2015	2020	2025	2030
Reference (BAU) scenario	**20.23**	**25.93**	**32.80**	**41.81**
Mitigation scenarios				
Building Energy efficiency (EE) improvement	20.23	25.83	32.07	40.34
Transmission and distribution losses improvement	20.21	25.66	32.20	40.86
Station own use improvement	20.21	25.63	32.19	40.95
Power plant EE improvement	20.23	25.58	32.35	41.21
EE Total	**20.19**	**25.03**	**31.14**	**39.52**
Hydro Power Plant	20.23	25.87	32.21	40.68
Wind Park	20.23	25.78	32.58	41.21
Solar PV	20.23	25.90	32.74	41.56
RENEWABLE TOTAL	**20.23**	**25.69**	**31.86**	**39.96**
TOTAL	**20.19**	**24.78**	**30.21**	**36.93**

Source: LEAP calculation

11.1.2. Energy (transport) emissions reductions calculation

11.1.2.1 Business as Usual (BAU)

Mongolia has a wide territory with sparse population. Thus the transport sector is one of the important sectors in the economy. 2006 IPCC GPG and LEAP modelling were used for emissions and reductions estimates for the energy (transport) sector and results compared to the BAU baseline.

Based on the assumptions that as a result of an implementation of the policies listed in the Table 10.1, it is agreed among experts and stakeholder the emissions reduction will be 10% by 2020, 25% by 2025 and 35% by 2030. Assumption for the estimation include comparison of emissions from paved and unpaved roads, mid-to-low speeds (e.g. between 20km/h and 40km/h, decreases in emissions are roughly proportional to decreases in journey times (according to analysis from http://www.dcsc.tudelft.nl/~bdeschutter/pub/rep/09_004.pdf), percentage of population live in urban area and journeys in the city center etc.

Some countries without emissions standards have estimated emissions reductions from the introduction of fuel economy or emissions standards of around 25%-35%. Given the lack of information available for fuel economy or vehicle emissions in Mongolia, it is conservatively assumed that the design and implementation of an emissions standard could reduce road transport emissions by 20%.

Table 11.5. GHG emission reduction, million tonnes CO_2-eq.

Sector	2015	2020	2025	2030
Energy-transport	0	297	970	1760

11.1.3. Industrial measure (cement) emissions reductions calculation

Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories used for emissions reductions estimates for the industrial measure (cement processing). Calculation based on the following assumptions: (1) the recent annual use of cement, which is 3.5 million tonnes, (2) all planned dry technology plants are in place by 2030. This results in a 0.7 million tonnes CO_2-eq. per annum reduction in 2030.

11.1.4. Agriculture emissions reductions calculation

Agricultural emission reduction measures could not be estimated due to a lack of available background information, and are thus not included in the indicative estimate.

11.2. Net emissions reductions

The cumulative impact of the measures listed in Table 10.1 is estimated to result in approximately an annual reduction of 7.3 million tonnes CO_2-eq. of economy-wide emissions in 2030, corresponding to a 14% reduction compared to a BAU scenario, excluding LULUCF.

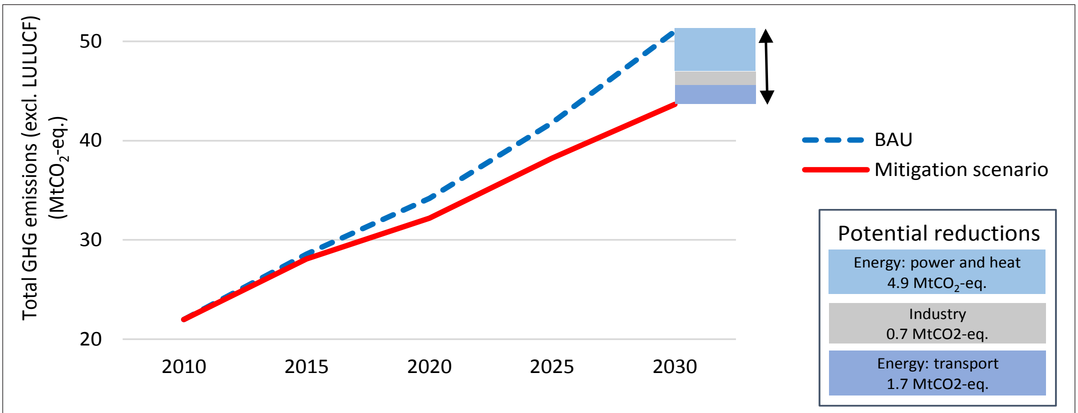

Figure 11.1. Indicative potential emissions reductions of the measures compared to BAU emissions

11.3. Fairness and ambition of INDC

Mongolia has a low responsibility for climate change mitigation in terms of its historic emissions, and limited capacity due to relatively challenging environmental conditions including a long lasting heating season, a coal-based electricity production system, a lack of access to cleaner fossil fuels and a highly dispersed population particularly in remote areas (lack of access to the electricity grid). This has led to a high emission per capita ratio. Mongolia is committed to the decarbonization of its growing economy and intends to reduce its emissions intensity by implementing the proposed measures.

The proposed targets have their origins in the Green Development Policy of Mongolia, which is an over-arching and comprehensive approach delivering low-carbon economic growth taking into account national circumstances in the context of its sustainable development. This ambitious strategy mainstreams both mitigation and adaptation in a way to reduce social and environmental vulnerability. Parliamentary approval of the most significant energy measures, and corresponding commitment to implement an important part of the mitigation actions with domestic means demonstrates the ambition of the Mongolian Government.

CHAPTER 12. MEANS OF IMPLEMENTATION FOR THE MITIGATION CONTRIBUTION

12.1. Anchoring the mitigation contribution in legislation

Parties are free to determine how their INDC is embedded in national legislation. It is considered good practice for Parties to receive internal political approval for adoption of the INDC from the appropriate level of governance prior to submission to the UNFCCC, and for countries to embed the INDC in national strategy and/or policy after finalization of the Paris agreement. Parties are likely to do this in different ways: China embedded its pledge from Copenhagen in its Five Year Plan; South Korea and Indonesia have embedded their targets previously in a designated climate change policy; some other countries have embedded specific components of their targets in various different sector-specific policies, such as the energy policy. Embedding the INDC in national legislation in some form or another has the key advantage of reducing the risk of reversibility after government change. It also provides a strong signal and certainty to the market/investors as well as the donor community, who also consider this to be good practice.

For Mongolia's mitigation contribution, it is a great strength that the proposed policies and measures have already been introduced as legislation and/or proposed in national development strategies or plans, including the following:

- Green development policy, 2014 (2014-2030)
- National Action Programme on Climate Change (NAPCC), 2011 (2011-2021)
- State policy on energy, 2015 (2015-2030)
- National agriculture development policy, 2010 (2010-2021)
- State policy on forest, 2015 (2016-2030)
- MDGs based comprehensive national development programme, 2008 (2008-2021)
- Law on renewable energy, 2015
- Law on energy, 2015
- State policy on Industry, 2015 (2015-2030)

As such, the various policies and measures are well anchored in national strategy and the responsibilities for implementation are mostly already identified within each of the respective policy or strategy documents.

12.2. Obtaining international support

In order to successfully implement the mitigation contribution in the INDC, Mongolia will seek international funding and capacity to complement domestic allocations and efforts. For the additional measures listed outside of the main national contribution, new sources of support will need to be identified and engaged, in addition to the continuation of existing support streams which will be required to implement the main proposed national contribution.

In a first step to achieving this, it is anticipated that a detailed plan will be elaborated to articulate the specific needs of each proposed measure under the INDC contribution, and to communicate clearly the potential supportive role of the international community. As a preliminary indication, some specific measures that will be important to reach the proposed targets are described in Table 12.1, with estimates of investment needs. The cumulative investment needs of these measures for which costs could be identified is at least 3.5 billion USD. However, these preliminary indications are provided for transparency and initial planning purposes, and should be replaced by a more thorough analysis in the next steps. Such analysis should also articulate clearly the specific financing modalities: it is anticipated that the majority of the investment requirements will be met by the private sector, leveraged by public sector funds.

Table 12.1. Policies and measures for implementation up to 2030

Stated contribution	Specific measures	Investment needs USD	Source
Increase the share of renewable electricity capacity to 30% of total electricity generation capacity by 2030, from 7.62% in 2014.	Installation of 675MW capacity large hydro power facilities.	1,350 mln	LEAP analysis with costs based on average of IPCC data[2]
	Installation of 354MW wind power facilities.	584 mln	
	Installation of 145MW solar PV power facilities.	573 mln	
Reduce building heat loss by 40% by 2030, compared to 2010 levels.	Improved insulation of 300 existing panel apartment buildings in Ulaanbaatar.	90 mln	Technology Needs Assessment (TNA), 2013
Improved efficiency of coal fired heating plants and thermal power plants.	Improved efficiency of coal-fired power plants.	900 mln	TNA, 2013

A large volume of finance for both climate change mitigation and adaptation is expected to become available through the Green Climate Fund (GCF). In this regard, Mongolia can already begin to communicate preliminary support needs to the GCF, and Mongolia could begin to undertake GCF-readiness activities so that it will be in a position to submit bankable support proposals to the GCF in 2016 and 2017.

Furthermore, the use of crediting mechanisms may be a potential means to finance and implement the proposed measures. A number of regional and international crediting mechanisms which may be attractive for Mongolia are under development, and discussions at the international level continue on the potential future global mechanisms, including the New Market Mechanism (NMM). More clarity on the likely trajectory of the international discussions in this regard will be likely following the 21st Conference of Parties (COP21) in Paris, December 2015; Mongolia will then take stock of the options available from market mechanisms as part of its detailed implementation strategy.

12.3. Next steps for implementation

The INDC preparation process has built momentum and common understanding for climate change strategy and policy across broader governmental actors and non-governmental stakeholders. It is a key for the momentum of this multi-stakeholder and inter-ministerial process to be maintained following the COP21 in Paris. From early 2016 Mongolia should begin an inter-ministerial process for the development of a comprehensive plan for the implementation of the INDC. Activities for the development of this plan might include:

2 https://www.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf

- More detailed analysis and development of each individual proposed policy and measure, including precise technical requirements, cost and impact analyses (including the analysis of potential non-GHG related benefits), development of potential financing models, and implementation plans.
- A detailed roadmap with a timeline for phased implementation and measurable milestones.
- Design and implementation of the framework and infrastructure required for effective MRV and progress review. In this regard, MRV infrastructure may hold major synergies with other non-climate related objectives and should be designed in parallel with other sector-specific processes.
- Plans should be devised for the sustainable earmarking of a proportion of the national budget for the continuation of national efforts to implement the activities.
- Proposals for support should be prepared and submitted to existing and new sources of climate and development finance.

A first step of the compilation of a comprehensive implementation strategy should be the identification of responsibilities. Experiences from Mongolia and other countries in the development of climate change strategies show that an inter-ministerial process, perhaps led by a high-level inter-ministerial steering committee, is a highly effective means of mainstreaming climate change policies within sectoral plans and ensuring the identification and exploitation of synergies where possible.

CHAPTER 13. TRACKING AND MONITORING PROGRESS

13.1. Sectors and gases covered

In 2000, Mongolia has adopted the first National Action Plans on Climate Change and updated in 2010. Also, Mongolia has presented two National Communications with their respective greenhouse gas inventories and mitigation options to the UNFCCC. Mitigation options communicated in both National Communications covered energy, industrial processes, agriculture and waste sectors. Thus, Mongolia's INDC aimed to also cover all of these sectors.

Mongolia's INDC covers three main GHGs (as foreseen under the UNFCCC and the Kyoto Protocol): carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Generally, the base year was selected as 2010.

13.2. Accounting Methods for tracking the mitigation contribution

As described in Mongolia's Second National Communication, the emissions inventory for Mongolia was compiled using Intergovernmental Panel on Climate Change (IPCC), Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, IPCC 2006 Good Practice Guidance (GPG) and Global Warming Potential values from IPCC Fourth Assessment Report (AR4). The BAU baseline was defined according to the methodology given in Mongolia's Second National Communication (see Chapter 8). Thus, these methods will be used for tracking the mitigation contribution.

13.3. Accounting method used for forest mitigation actions

Currently, the inventory of GHG emissions and sink of the Land Use, Land-Use Change and Forestry (LULUCF) is lacking because of data availability to comply with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, and IPCC Good Practice Guidance for LULUCF.

As such, Mongolia's Inventory team will make all efforts to determine the data source and methodology to account GHG sink in forest sector during the preparation of "Third National Communication".

13.4. Institutional arrangements for INDC implementation (mitigation part)

The Ministry of Environment, Green Development and Tourism (MEGDT) of Mongolia is the key ministry to develop, update and implement climate related policies. A simplified chart of Institutional arrangement for GHG mitigation analysis and implementation is shown in Figure 13.1.

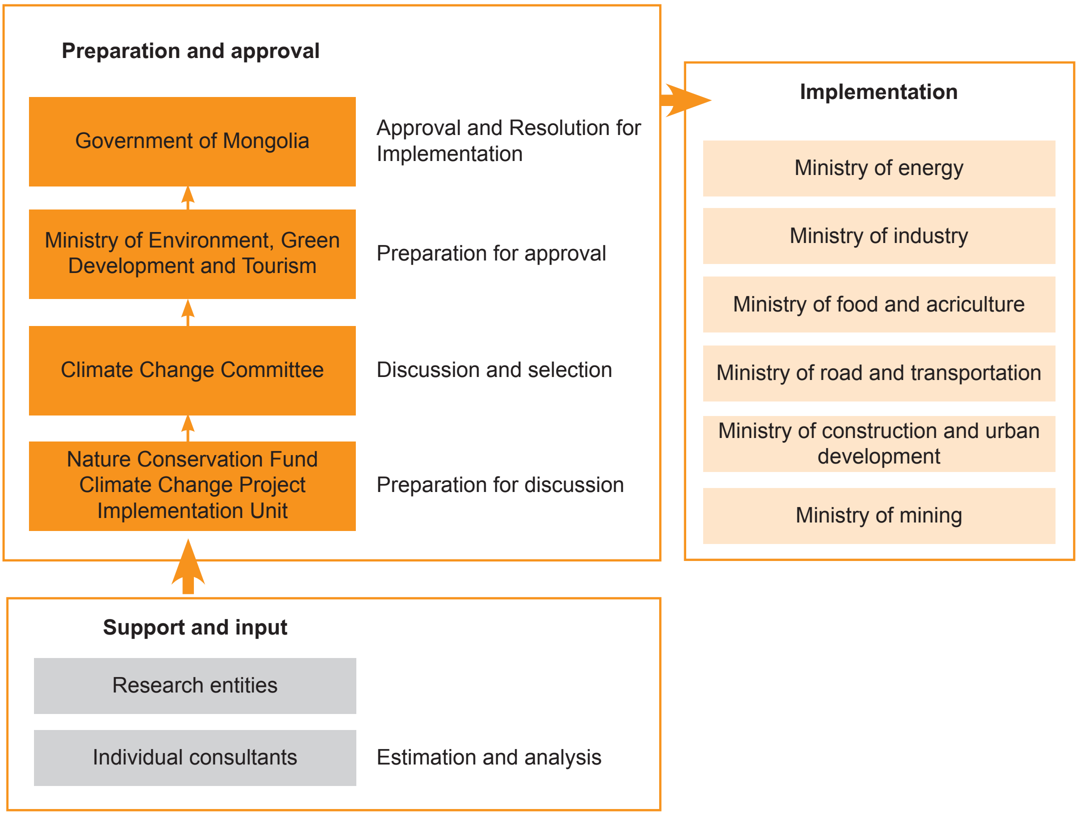

Figure 13.1. Simplified chart of Institutional arrangement for GHG mitigation analysis and implementation

The interdisciplinary and inter-sectoral National Climate Committee (NCC), now led by the MEGDT, coordinates and guides 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 are members of the NCC. Therefore, the NCC is the main body to integrate implementation national as well as sectoral policies and measures specified in INDC. In addition, the government is working to raise public awareness on climate change and its impacts.

The Climate Change Coordination Office (CCCO) has been established within the MEGDT to communicate with UNFCCC Secretariat and implement the commitments and duties under the UNFCCC and the Kyoto Protocol, to manage and to integrate climate change activities at national level. The CCCO has been closed down according to the amendment (13th of November 2015) of the Law on Air. The Climate Change project implementation unit (CCPIU) has been established under the Nature Conservation Fund (NCF) in accordance with an Order No. A-118 of the Minister of Environment, Green Development and Tourism from 27th of February 2015.

Major entities involved in climate change and energy policy include the Ministry of Energy, CDM Bureau, the National Renewable Energy Centre, and the Clean Air Foundation. Ministry of Road and Transport, Ulaanbaatar Municipality, local transport authorities will look over transport sector. Ministry of Construction and Urban Development will be in charge of mitigation measures in construction and building sector. Other line ministries will be in charge of implementation and monitoring of their respective policies and measures.

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 UN-REDD Programme will work with the Government of Mongolia to assess the institutional context and entry points for these instruments, and integrate them into national strategies for REDD+ and green development. The MEGDT coordinates UN-REDD+ activities and thus will also be responsible for mitigation in the forestry sector.

REFERENCES

Adaptation Part

1. Kelly Levin et al. 2015. Designing and Preparing Intended Nationally Contributions (INDCs), World Resource Institute and UNDP
2. TNA 2013. Technology Needs Assessment, Volume 1 - Climate Change Adaptation in Mongolia. Ministry of Environment and Green Development (MEGD)
3. MARCC 2014. Mongolian Second Assessment Report on Climate Change. Ulaanbaatar. Ministry of Environment and Green Development (MEGD)
4. MARCC 2009. Mongolian Assessment Report on Climate Change. Ulaanbaatar. Ministry of Nature, Environment and Tourism (MNET)
5. SNC 2010. Mongolia Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC), Ulaanbaatar, Mongolia
6. NAPCC 2011. National Action Programme on Climate Change (2011-2021), Resolution No. 317, The Government of Mongolia, 07 November 2011
7. UNEP, 1992. Aridity index
8. Multi-criteria analysis: A manual, 2009 Department for communities and local government, London
9. Green Development Policy, 2014. Great Khural Resolution No. 43, Ulaanbaatar
10. Climate change impacts in the forest, water and agricultural sectors and their vulnerability and risk assessment. Institute Meteorology, Hydrology and Environment (IMHE), 2012
11. Need of development of strategic plan of climate change adaptation measures in the forest, water and agricultural sectors, 2013
12. Enkhtaivan L., Natsagdorj L., Gomboluudev P., Borchuluun D., Galbaatar T. and Sarantuya G., 2012, “Preliminary risk and impact assessment of climate change on nature and socio economics of Mongolia” Report (in Mongolian language)
13. Managing the risks of extreme events and disasters to advance climate change adaptation: IPCC, 2011: Summary for Policymakers. In: Intergovernmental Panel on Climate Change Special Report
14. Climate change vulnerability and adaptation in the livestock sector of Mongolia, A final report submitted to assessments of impacts and adaptations to climate change (AIACC), Project No. AS 06, 2006
15. MFA, 2014. Monitoring and assessment report of “Mongolian livestock” national programme, Mongolia (in Mongolian language)
16. Water law, 2012. Renewed by parliament “State Great Khural”
17. Burmaajav B. et al., 2010. Climate change and human health, Mongolia. Climate change and health in Asia. The Proceedings of 4th scientific conference of regional forum on environmental and health in southeast and east asian countries, Seoul, Korea 2010

Mitigation Part

1. Kelly Levin et al. 2015. Designing and Preparing Intended Nationally Contributions (INDCs), World Resource Institute and UNDP
2. MARCC 2014. Mongolia Second Assessment Report on Climate Change, Ulaanbaatar, 2014. Ministry of Environment and Green Development Ulaanbaatar, 2014
3. SNC 2010. Mongolia Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC), Ulaanbaatar, Mongolia
4. Economics of climate change in East Asia. Michael Westphal, Gordon Hughes, Jorn Brommelhoerster (Editors), 2013. Asian Development Bank (ADB)
5. TNA 2013. Technology Needs Assessment, Volume 2 - Climate change mitigation in Mongolia. Ministry of Environment and Green Development (MEGD)
6. GHG mitigation scenarios in energy sector: Prepared by Dr. Jargal Dorjpurev, EEC Co., Ltd, February 2013. Ministry of Environment and Green Development (MEGD)
7. Strategies for development of green energy systems in Mongolia, Final report, Mongolia

country programme, March 2014, Ulaanbaatar. Global Green Growth Institute (GGGI)
8. Climate Change Mitigation: GHG emission potential, Ulaanbaatar (in Mongolian language) Dagvadorj D., Dorjpurev J., Namkhainyam B., 2010
9. “Mongolian Livestock” national programme, 2010, Resolution No. 23 of the State Great Khural (in Mongolian language). State Great Khural