MINISTRY OF ENVIRONMENT AND TOURISM

MONGOLIA'S SECOND BIENNIAL UPDATE REPORT

UNDER UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

November 2023

This report was compiled by the Climate Change Project Implementing Unit (CCPIU) under the Ministry of Environment and Tourism (MET) to meet Mongolia's obligation to prepare and submit Second Biennial Update Report (BUR2) to the United Nations Framework Convention on Climate Change (UNFCCC).

The Second BUR has been prepared in accordance with the UNFCCC Biennial Update Report guidelines for Parties not included in Annex 1 to the Convention.

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FOREWORD

As a Minister in charge of climate change issues, I am pleased to present the second Biennial Update Report of Mongolia (BUR2) within the implementation framework of the United Nations Framework Convention on Climate Change (UNFCCC).

Mongolia has demonstrated strong solidarity to contribute to the ultimate objective of the UNFCCC by submitting its Intended Nationally Determined Contribution (INDC) in 2015 and after ratification of the Paris Agreement in 2016 the Nationally Determined Contribution (NDC) in 2019.

The Government of Mongolia is actively working to resolve the financial, technical, and capacity-building challenges, along with strengthening the institutional capacity to build a robust mechanism for combating climate change.

To ensure collaboration with the UNFCCC, Mongolia's National Communication (NC) reports were developed and submitted in 2001, 2010, and 2018, and the initial Biennial Update Report (iBUR) on GHG emissions and removals was developed and submitted in 2017.

Mongolia is characterized by high consumption of solid fuel and the energy sector became one of the main contributors to the GHG emissions. In fact, there are plenty of renewable energy sources available in this country, such as solar and wind power, but their exploitation is limited due to high investment costs and weak development of infrastructure.

The previous goal of reducing GHG emissions fixed in INDC as 14% was recalculated to 22.7% in NDC by 2030. If removals of the forest are included, the reduction of GHG emissions can be increased up to 38.4%. In case of implementing some conditional measures, this target can be raised to 44.9%.

In addition to that, there is another opportunity for Mongolia to increase the GHG emissions removal through land use change and forestry. In this context, I should note that the President of Mongolia H.E. Mr. Khurelsukh Ukhnaa has initiated a “Billion Tree Campaign” which received nationwide support. Successful implementation of programs related to this campaign will result in a significant increase in GHG sink capacity of forests and associated vegetation cover of the country’s landmass. Thanks to this indispensable undertaking and other essential efforts of the Government of Mongolia like the extension of renewable energy use and development of new sources of energy, Mongolia could announce that it will reach the “net zero” target by the middle of this century.

This report is prepared genuinely by a national expert team composed of representatives of different environmental, economic, and social sectors and it is becoming available to the public. This second BUR has updated the information contained in iBUR, Mongolia’s Third National Communication (TNC 2018), National Inventory Report, and other related documents.

I believe that the information provided in this report will be practical source for both national and international policy makers, stakeholders and private sector entities to mobilize potential resources for global, regional and national climate initiatives.

Mongolia’s second BUR would not have been possible without the hard work and dedication of the national communication team and all engaged experts in developing the report. The valuable

contributions of other key ministries, agencies, research institutes and non-governmental organizations were also significant for the successful completion of the report.

Finally, I would also like to take this opportunity to thank the Global Environment Facility, the UNFCCC Secretariat and the United Nations Environment Programme for their financial and methodological supports in the preparation this report.

Mr. BAT-ERDENE Bat-Ulzii
Minister of Environment and Tourism

PREFACE

This report was compiled by the Climate Change Project Implementing Unit (CCPIU) of the Climate Change Research and Cooperation Centre (CCRCC) under the Ministry of Environment and Tourism (MET) to meet Mongolia's commitment to prepare and submit Second Biennial Update Report (BUR2) to the United Nations Framework Convention on Climate Change (UNFCCC).

The BUR2 has been prepared in accordance with the UNFCCC Biennial Update Report guidelines for Parties not included in Annex 1 to the Convention.

This Second BUR includes updated information on:

a) National Circumstances and Institutional Arrangements,
b) National Greenhouse Gas Inventory (1990-2020),
c) Climate Change Mitigation Actions and Their Effects,
d) Baseline Scenarios for Climate Change and Potential Options for Mitigation Measures,
e) Measurement, Reporting and Verification Systems for Greenhouse Gas Emissions in Mongolia.

Moreover, the BUR2 is presenting the projections of the climate change mitigation measures and relevant assessments up to 2030 and 2050 considering the country's development priorities, objectives and capacities. New input for this report was related to contribution of additional source of information like satellate data to GHG monitoring exersise.

In addition, the National Inventory Report (NIR) has been developed and presented as an annex of the BUR2.

In the BUR2, the inputs and reviews of related sectorial ministers, agencies and municipality have been considered to ensure the relevance of the priorities of different stakeholders concerned.

Special note of appreciation is going to the national project team (CCPIU), Ms. Undarmaa Khurelbaatar as a national project coordinator, and Dr. Gerelmaa Shaariibuu, Dr. Bujidmaa Borkhuu, Ms. Tegshjargal Bumtsend and Ms. Davaasambuu Ulzii-Orshikh dealing with different study sectors were responsible for overall implementation of the project under the general guidance and direct engagement of Dr. Batjargal Zamba, as a science and methodology advisor. Also the rest of the staff from the national project team, Ms. Ijiltsetseg Dorjsuren, Ms. Oyunbat Radnaabazar, Ms. Zolzaya Batgerel, Mr. Davaasuren Choijiljav and others have provided invaluable support and contributed significantly to the success of the work.

The gratitude extended to the thematic working group led by Dr. Erdenesukh Sumiya.

Dr. Tserendulam Shagdarsuren, as a National Director of the Project and Mr. Odbayar Odonchimed as National Focal Point for the UNFCCC, as well as Dr. Choikhand Janchivlamdan, as a Director of the CCRCC and many other entities and individuals who have contributed very much to this time consuming, skill and knowledge needed task is highly appreciated.

Last but not least, we acknowledge the Ministry of the Environment of Japan for supporting the joint research project on use of GOSAT data in GHG monitoring in Mongolia.

Climate Change Project Implementing Unit of the CCRCC

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ABBREVIATIONS

AAGR	Average Annual Growth Rate
AD	Activity Data
ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
AGB	Above-Ground Biomass
AHURP	Ulaanbaatar Green Affordable Housing and Resilient Urban Renewal Project
ALAMGAC	Agency for Land Administration and Management Geodesy and Cartography
ASDIP	Aimags and Soums Green Regional Development Investment Program
BAU	Business as Usual
BCEFs	Below-Ground Carbon and Expansion Factors
BGB	Below-Ground Biomass
BMZ	German Federal Ministry for Economic Cooperation and Development
BOD	Biochemical Oxygen Demand
BTR	Biennial Transparency Report
BUR	Biennial Update Report
BUR2	Second Biennial Update Report
CCAC	Climate and Clean Air Coalition
CCICD	Climate Change International Cooperation Department
CCMP	Climate Change Monitoring Plan
CCPIU	Climate Change Project Implementing Unit
CCRCC	Climate Change Research and Cooperation Centre
CDM	Clean Development Mechanism
CE	Collect Earth
CHP	Combined Heat and Power Plant
COD	Chemical Oxygen Demand
COP	Conference of the Parties
CRF	Common Reporting Format
CS	Country Specific
CSC	Carbon Stock Change
DCC	Department of Climate Change
DCCIC	Department of Climate Change and International Cooperation
DMKNL	German-Mongolian Cooperation Project Sustainable Agriculture
DOC	Degradable Organic Carbon
EAF	Electric Arc Furnace
EBRD	European Bank for Reconstruction and Development
ECF	Environment and Climate Fund
EF	Emission Factor
EIC	Environmental Information Center
ER	Emission Reduction
ERC	Energy Regulatory Commission
ERT	Expert Review Team
ETF	Enhanced Transparency Framework
EU	European Union
EX-ACT	Ex-Ante Carbon-Balance Tool
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistics

FOD	First Order Decay
FRA	Forest Resources Assessments
FRDC	Forest Research and Development Center
FRL	Forest Reference Level
GASL	Global Agenda for Sustainable Livestock Action Plan
GAVS	General Agency for Veterinary Services
GCOM	Global Change Observation Mission
GoM	Government of Mongolia
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation
GLs	Guidelines
GOSAT	Greenhouse Gases Observing Satellite
GPG	Good Practice Guidance
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
HOB	Heat Only Boiler
HPP	Hydropower Plant
HWP	Harvested Wood Products
IAF	International Accreditation Forum
iBUR	Initial Biennial Update Report
ICAO	International Civil Aviation Organization
IEA	International Energy Agency
IETC	International Environmental Technology Centre
ILF	Integrated Land Fund
ILT	Integrated Land Territory
INDCs	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IRIMHE	Information and Research Institute for Meteorology, Hydrology and Environment
JCM	Joint Credit Mechanism
JICA	Japan International Cooperation Agency
KP	Kyoto Protocol to the UNFCCC
KPI	Key Performance Indicator
LEAP	The Low Emissions Analysis Platform
LTO	Landing and Take-Off
LUC	Land Use Change
LULUCF	Land Use, Land Use Change and Forestry
MARCC	Mongolia Second Assessment Report on Climate Change
MASM	Mongolian Agency for Standard Metrology
MCAA	Mongolian Civil Aviation Authority
MCF	Methane Correction Factor
MCUD	Ministry of Construction and Urban Development of Mongolia
MEGD	Ministry of Environment and Green Development of Mongolia
MET	Ministry of Environment and Tourism of Mongolia
MGFC	Mongolian Green Finance Corporation
MIAT	Mongolian Airlines

MMHI	Ministry of Mining and Heavy Industry of Mongolia
MOE	Ministry of Energy of Mongolia
MOEJ	Ministry of Environment of Japan
MOH	Ministry of Health of Mongolia
MOFALI	Ministry of Food, Agriculture and Light Industry of Mongolia
MOUBC	Mayor's Office of Ulaanbaatar City
MRPAM	Mineral Resources and Petroleum Authority of Mongolia
MRTD	Ministry of Road and Transport Development of Mongolia
MRV	Measuring, Reporting and Verification
MSW	Municipal Solid Waste
NAMAs	National Appropriate Mitigation Actions
NAMEM	National Agency Meteorology and the Environmental Monitoring
NAPCC	National Action Program on Climate Change
NCC	National Climate Committee
NCs	National Communications
NCV	Net Calorific Value
NDA	National Designated Authorities
NDC	Nationally Determined Contribution
NEMA	National Emergency Management Agency
NFI	National Forest Inventory of Mongolia
NFP	National Focal Point
NGO	Non-Governmental Organization
NIES	National Institute for Environmental Studies
NIR	National Inventory Report
NOA	National Ozone Authority of Mongolia
NSO	National Statistics Office of Mongolia
ODS	Ozone Depleting Substances
OECC	Overseas Environmental Cooperation Center
PA	Paris Agreement
PAC	Pacific Accreditation Cooperation
PFCs	Perfluorocarbons
PO	President's office
PoM	Parliament of Mongolia
QA/QC	Quality Assurance and Quality Control
RA	Reference Approach
SA	Sectorial Approach
SAR	Second Assessment Report of IPCC
SNC	Second National Communication of Mongolia
SOCref	Reference Value of Soil Organic Carbon
SPP	Solar Power Plant
SWDS	Solid Waste Disposal Sites
TAM	Typical Animal Mass
TFI	Taxation Forest Inventory
TNC	Third National Communication of Mongolia
TOW	Total Organically Degradable Material in Wastewater
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFAO	Food and Agriculture Organization of the United Nations

UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations Collaborative Initiative on Reducing Emissions from Deforestation and Forest Degradation
UN-REDD	United Nations Reducing Emissions from Forest Degradation
USCSP	U.S. Country Studies Program
VVB	Validation and Verification Body
WA	Water Agency
WB	World Bank
WOAH	World Organization for Animal Health
WPP	Wind Power Plant
WWTP	Wastewater Treatment Plant

UNITS

%	Percent
°C	Degree Celsius
CO_2e	Carbon dioxide equivalents
g	Gram
Gcal	Giga calorie
Gg	Gigagram
Gcal	Gigacalories
GWh	GigaWatt hour
ha	Hectare
kg	Kilogram
km	Kilometre
kt	kilotonnes
kWh	kiloWatt hours
κWh	KiloWatt hour
m	Metre
m^2	Square metre
m^3	Cubic metre
mil.	Million
mm	Millimetre
MNT	Mongolian tugrik
Mt	Million tonnes
MW	MegaWatt
per-km	Person-kilometre
t	Tonne or tonnes
Thous.	Thousand
Thous. heads	Thousand heads
Thous. t CH_4	Thousand tonnes of methane
ton-km	Tonne - kilometre
USD	US dollar

EXECUTIVE SUMMARY

Mongolia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Paris Agreement in 2016. Mongolia's National Communication Reports were developed and submitted to the UNFCCC secretariat in 2001, 2010, and 2018, and the initial Biennial Update Report (iBUR) on GHG emissions and removals was submitted in 2017. The Mongolia Assessment Reports on Climate Change were developed in 2009 and 2014. This Second Biennial Update Report of Mongolia is developed as a part of the country's reporting commitments under the UNFCCC. The second National Inventory Report (NIR) is attached as Annex of this second BUR.

In 2019, Mongolia developed its Nationally Determined Contributions (NDC) in line with the Paris Agreement. It was developed based on the Green Development Policy and the National Climate Change Program, Sustainable Development Vision-2030 and other related documents. The mitigation target of Mongolia's NDC is a 22.7% reduction in total national greenhouse gas (GHG) emissions by 2030, compared to the projected emissions under a business as usual scenario (BAU) based on 2010. In addition, if conditional mitigation measures such as the carbon capture and storage and waste-to-energy technology to be implemented, then Mongolia could achieve a 27.2% reduction in total national GHG emissions. Along with that, if actions and measures to remove GHG emissions by forest are considered, then the total mitigation target of Mongolia can be fixed as 44.9% of GHG emission reductions by 2030.

NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

This section provides the national environmental and socio-economic circumstances of Mongolia and country's institutional arrangement for coordinating, organizing, implementing climate policy and reporting procedure in line with the UNFCCC requirements.

Mongolia is vulnerable to changing climate due to the high elevated altitude and deep continental location with a high range fluctuation of climate parameters. In addition to that, the principle economy sector as agriculture is mostly based on pasture grazed livestock and rainfed crop production. At present, more than 70% of the total territory is classified as degraded and affected by desertification. Average annual precipitation (ranging from 50-150 mm in Gobi and desert region to 400 mm at high mountain belts) remaining almost the same during the last decades of instrumental measurement, however intensity and frequency of extreme events like thunderstorms and heavy snowfall are increased. In Mongolia, 85% of the total precipitation occurs in the warm season, while 3% of it occurs during the cold season. The annual average air temperature has been increased by 2.46 ^{o}C during the last 83 years, with some extreme records like 44.0 ^{o}C in 1999 and -55.3 ^{o}C in 2016.

Following are the key facts on the country's current socio-economic situations that associated with the GHG emissions:

- The population of Mongolia was 2,760,968 in 2010 (growth rate of 1.6%), 3,057,778 in 2015 (growth rate of 2.1%), and the latest census results of 3,357,542 (growth rate 1.8%) in 2020.
- Main economic growth is observed moistly in association with the increased number of livestock. According to statistics, livestock head surveyed as 67.1 million in 2020 and 25.8 million in 1990, which was increased by 159.4%. In 2018, grazing capacity of Mongolia's pasture was identified as suitable for grazing of 51.6 million heads of livestock.

- The energy demand is increasing in line with an increase of population and extension of economy activities. In 2020, energy production was 7.2 billion kWh, out of which 90.9% was from coal combustion in power plants and 9.1% from renewable energy, and a 1.7 billion kWh of electricity was imported.
- Mongolian land use classified as 72.9% agricultural land including pasture, hay fields, arable farming land, fallow or abandoned land, and 7.96% of total area covered by boreal and Saxaul forests.
- In 2020, a total of 2.24 million tonnes of waste was delivered to waste dumping sites in Mongolia, while 48% of total waste generated in the capital city, Ulaanbaatar.

The Ministry of Environment and Tourism (MET) is the central state administrative organization in charge of environmental and climate change policy. Therefore, the MET is the national entity responsible for organizing and coordinating the compilation of the National Communication Reports (NCR) and the Biennial Update Report (BUR) at the policy level and submitting them to the UNFCCC Secretariat.

Since 2011, Climate Change Coordination Office (CCCO) was a responsible unit for fulfilling Mongolia's duties and responsibilities in terms of reporting under the UNFCCC framework. Hereafter, the CCCO was rearranged and established as a Climate Change Project Implementing Unit (CCPIU) in 2015 due to the government structural change. In 2020, the unit was transferred with same duties and responsibilities to the newly established by a government decree a state-owned enterprise, called as the Climate Change Research and Cooperation Centre (CCRCC)

Up to now, work on preparation of the National Communications, the National GHG Inventory, and the preparation of National Biennial Update Report, have been organized in the form of a project with the financial support of the Global Environment Facility (GEF). Climate Change Project Implementing Unit (CCPIU) is coordinating and organizing overall activities and conducts estimations within a framework of the preparation of national reports to the UNFCCC such as National Communication and Biennial Update Report. In order to undertake related research and assessments technical expert groups are establishing, engaging professionals from academia and universities and other research communities.

NATIONAL GREENHOUSE GAS INVENTORY

This section provides a summary of long-term trends of GHG emissions/removals from 1990 to 2020. More detailed report of the National GHG inventory (NIR) can be found as an Annex to this report.

The emissions/removals have been estimated from five sectors which are Energy, Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change, and Forestry (LULUCF) and Waste, defined by the 2006 IPCC Guidelines.

Mongolia's total GHG emissions (excluding LULUCF) were 43,081.62 Gg CO_2e in 2020. This represents a 82.17% increase from the 1990 level of 23,648.79 Gg CO_2e. Net GHG emissions in 2020 were 12,909.10 Gg CO_2e (including LULUCF). This represented a 340.02% increase from the 1990 level of minus 5,378.40 Gg CO_2e.

The emissions/removals are covered direct (CO_2, CH_4, N_2O, HFCs) and indirect (NO_x, CO) gases. In 2020, the most emitted gas was carbon dioxide (CO_2) without removals with 42.40% of national emissions, primarily from fuel combustion activities in energy sector. The second dominant gas was

methane (CH_4) and it contributed 33.82% to national total GHG emissions which mainly originated from enteric fermentation and manure management in agriculture sector and solid waste disposal in waste sector. The nitrous oxide (N_2O) is a third contributor with 22.46% of national total emissions, mainly originated from aggregated sources and non-CO_2 emissions sources on land and domestic wastewater treatment and discharge, and the remaining 1.33% attributed to HFCs emissions from utilization of equipment such as refrigerator, air conditioner, fire protector, and foam blowing equipment in IPPU sector.

- The agriculture sector is the most significant source of the GHG emissions (without LULUCF) with 51.97% (22,390.57 Gg CO_2e) share of the national total emissions in 2020. In agriculture sector, emissions from the enteric fermentation from livestock is contirbuted 56.90% of sectoral GHG emissions and the aggregated sources and non-CO_2 emissions sources on land subcategory is contributed 41.60% of sectoral GHG emissions and 1.49% from manure management.
- The energy sector is the second major contributor of the GHG emissions (without LULUCF) with 44.78% (19,292.48 Gg CO_2e) share of the national total emissions in 2020. Within the energy sector, share of energy industries (mainly from fuel combustion) source category contributes the most, namely 57.51%, followed by transport category with 25.38%, and other sectors, including commercial, residential, agriculture and forestry categories with 5.00%.
- The IPPU sector contributed 2.66% (1,147.75 Gg CO_2e) of the total GHG emissions in 2020. The main contributor subcategory was the mineral industry, which contributed 50.11% to the sectoral total GHG emissions, the second highest contributor subcategory was product used as substitutes for ozone-depleting substances by sharing 49.78%, and the rest of subcategories contributed a miner share with 0.11% of sectoral total emissions in 2020.
- Waste sector is an insignificant contributor to overall national GHG emissions (excluding LULUCF) with its share of 0.58% and 250.82 Gg CO_2 in 2020. Within the waste sector, emissions from solid waste disposal sites (SWDS) contributed 62.05%, domestic wastewater treatment and discharge 29.65%, and industrial wastewater treatment and discharge 8.30% to sectoral total emissions.
- The LULUCF sector is a major source of GHG emissions and removals with -30,172.52 Gg CO_2e. Mongolian forest is the most contibutor for GHG removals and the land conversions among land use types is also a notable contributor to GHG emissions. For instance, conversion of grassland into settlements, wetlands and croplands areas was around 1,037,932 ha area since 1986.

CLIMATE CHANGE MITIGATION ACTIONS AND THEIR EFFECTS

This section provides the implementation results of mitigation measures indicated in the objectives of iBUR as of 2020, and also, discusses the current updates on the key policies and programs; and Mongolia's possible engagement in the International carbon market related activities.

The key measures of the national level policies, programs and plans considered during iBUR reporting period are “Sustainable Development Vision-2030” (2016), “Action Program of the Government of Mongolia” (2016), “Green Development Policy” (2014), “National Action Program on Climate Change (NAPCC)” (2011), and sector-specific state policies.

Subsequent to the iBUR submission, the Mongolian Parliament and Government approved the "Vision-2050" (2019), "Mongolia's New Revival Policy" (2021), "Mongolia's Nationally Determined Contribution (NDC)" (2019), "Action Program of the Government of Mongolia" (2020), "Mongolia's five-year development guidelines for 2021-2025" (2020), "Mongolian National Program for Reducing Air and Environment Pollution" (2017).

Based on these policy documents, related climate change mitigation actions and measures were identified. Comparing to the iBUR an assessment which conducted from 2007-2015, the current assessments based on the implementation of policies and programs updated during the period from 2015 to 2020. In 2021, due to the revision of the law on development policy, planning and its management, changes were made to the several policies and programs. But a detailed estimation was not conducted, particularly, for development of measures to reduce GHG emissions and their impact.

In addition, the implementation status of market and non-market approaches within the framework of the Article 6 under the Paris Agreement in Mongolia to compliment global climate change mitigation goal is briefly described. Specifically, the results of the implementation of market mechanisms, such as Clean Development Mechanism, Joint Crediting Mechanism and other related activities, which are defined within the framework of the rules and regulations of the Convention, were summarized within this chapter. Regarding the implementation status, the overall certified emission reductions (CERs) are equivalent to 1,464,753 t CO_2e for the CDM scheme from a total of 4 projects, and 53,730 t CO_2e credits were issued to 5 registered projects under the JCM scheme in Mongolia, respectively.

BASELINE SCENARIOS FOR CLIMATE CHANGE AND POTENTIAL OPTIONS FOR MITIGATION MEASURES

This section provides the projections of the baseline scenarios, and mitigation scenarios considering the updates on medium and long term policies.

The future projection of GHG emissions and removals in Mongolia was estimated based on population growth, accompanying economic developments, and their demands if no additional steps are taken (BAU) and mitigation scenarios based on related policy measures at the national and sectoral levels. For the climate change mitigation assessments, internationally approved models such as the LEAP model (for energy and industry sector, livestock), the COMAP model (for land use change and forest) and the EX-ACT model (for removals by forest) were applied.

Future projections to 2030 and 2050, using 2010 as the base year and assuming no action is taken (BAU), show that emissions from the energy sector are expected to increase by 3.0 and 4.7 times, from the IPPU sector by 13.3 and 36.6 times, from the livestock sector by 2.4 and 3.4 times, from the cropland sector of 2.7 and 4.3 times, and from the waste sector 4.2 and 11.2 times, while the carbon sink potential of forests will increase by 14.0% and 31.0%, respectively.

Carbon dioxide (CO_2) emissions will rise by 3.2 and 5.3 times, methane (CH_4) emissions by 2.4 and 3.5 times, and nitrous oxide (N_2O) emissions by 2.1 and 3.2 times in 2030 and 2050 compared to the base year 2010, respectively.

The Mongolia's GHG emission reduction potentials were projected based on the currently implementing measures under the law and policies to achieve the country's target by 2030 and further, by 2050. Twenty mitigation measures and actions have been identified within the Energy, IPPU, Agriculture and Waste sectors, with the potential to reduce 14.94 Mt CO_2e of national total

emissions in 2030 and 26.65 Mt CO_2e in 2050, respectively. If the national policies and programs are implemented completely as described, GHG emissions could be reduced by 24.3% in 2030, 27.4% in 2050, respectively, compared to BAU, based on 2010. Furthermore, total GHG removals from forest sector is projected as a 4.8 Mt CO_2e in 2030 and 9.1 Mt CO_2e in 2050. Considering the removals by forests, the total reduction potential is projected as 19.4 Mt CO_2e in 2030 and 35.2 Mt CO_2e in 2050. Key mitigation measures and actions presented in the Table 1.

Table 1. Total GHG projected mitigation potentials by implementing of policies and measures by 2050

			2025	2030	2040	2050
		Total emission reductions, Mt CO_2e				
Total emission reductions Mt CO_2e			8.535	14.938	20.369	26.650
1	Energy		5.900	9.300	11.500	14.000
	1.1	*Use of renewable energy*	*2.100*	*3.100*	*3.500*	*3.900*
	1.2	*Energy efficiency improvement scenario*	*3.800*	*6.200*	*8.000*	*10.100*
2	Industrial Processes and Product Use		0.053	0.099	0.193	0.286
	2.1	*Utilizing waste heat from cement plants*	*0.010*	*0.013*	*0.021*	*0.028*
	2.2	*Utilizing fly ash in cement manufacturing*	*0.043*	*0.086*	*0.172*	*0.258*
3	Agriculture		2.525	5.446	8.451	11.898
	3.1	*Reducing the number of livestock to the optimum herding structure ratio under pasture carrying capacity*	*2.405*	*5.201*	*7.959*	*11.157*
	3.2	*Improving management of arable land*	*0.120*	*0.244*	*0.492*	*0.741*
4	Waste		0.058	0.093	0.225	0.466
	4.1	*Reducing the amount of waste to be buried and landfills by encouraging waste recycling factories*	*0.020*	*0.048*	*0.166*	*0.389*
	4.2	*Increasing the capacity of sewage treatment facilities by expanding and putting them into operation in the capital city and 16 provinces*	*0.038*	*0.045*	*0.059*	*0.077*
		Total emission reductions/removals Mt CO_2e				
Total GHG emissions accounting removals from forest			10.642	19.356	26.835	35.156
5	Enhancement of forest removal		2.428	4.791	6.944	9.097
	5.1	*Expansion of forest covered area*	*2.428*	*4.791*	*6.944*	*9.097*

MEASUREMENT, REPORTING AND VERIFICATION SYSTEM FOR GREENHOUSE GAS EMISSIONS IN MONGOLIA

This section covers current measurement, reporting, and verification (MRV) activities, requirements and opportunities for scaling up the development; structural and organizational potential options for measuring, reporting, and verifying national GHG emission reductions.

Continuous effort was made to increase public and professional organizations' awareness on participation of different level of mitigation actions of GHG emissions and removals through programs and schemes such as CDM, NAMAs, JCM and the UN REDD+ program supported by the donor and partner organizations and the Ministry of Environment and Tourism in cooperation with other ministries and agencies is coordinating the implementation activities.

Currently, there are three different MRV systems developed by the Mongolian government as follows:

- MRV of the national GHG inventory,
- MRV activity at the project level or MRV system of JCM,
- MRV activity at the sector level or MRV system of NAMA in the construction sector.

On the national level, overall national GHG Inventory estimation and compilation process plays the key role for developing the Measurement, Reporting, and Verification System for GHG emissions in Mongolia. GHG inventory is carried out at the national level according to international methodologies, and QA is conducted as external peer review and capacity for internal QC has been gradually increased in recent years.

The Joint Crediting Mechanism, as a bilateral offsetting mechanism that implements potential carbon emission reduction projects, has its own MRV process to monitor and evaluate the carbon emission and its reduction to calculate accurate Certified Emission Reductions (CERs). Adopting this MRV process was a encouraging initiative to develop the domestic MRV system of Mongolia involving institutional arrangement, validation and verification body and transperancy.

Although knowledge and experience of the MRV system for GHG emissions/removals have emerged in the circle of experts and specialists involved in this issue, a certain rules, regulations, and related documents to regulate the work of MRV have been developed for some sectors and programs. Currently, National MRV system and Registration and information Database on GHG emission reductions and removals or official regulation is not available in Mongolia and the issue is still at the stage of idea and discussion.

Additional best practices, the utilization of satellite observation results in GHG emission estimates in Mongolia: The government of Mongolia and Japan are been holding policy dialogue on environmental issues between the two countries. MOEJ has started consecutive projects on GOSAT series utilization to GHG emission estimates in Mongolia since 2014. This part on GOSAT project comprises three major groups: estimate a GHG inventory with the bottom-up method in the target area, observe in situ atmospheric GHG concentrations, and integrate collected data and estimate GHG emissions with an inverse model, respectively. The successful implementation of the projects demonstrated that utilization of the satellite-based method can be a good candidate to be a verification tools for the GHG national inventory, since, the result showed a great agreement with energy sector's emission inventory in 2018, as it was highlighted in the current report.

This is the last Biennial Update Report submitted by Mongolia within the framework of the UNFCCC implementation. As countries are expected to report in transparent manner starting from 2024, Mongolia is to submit the first Biennial Transparency Report (BTR) following the Modalities, Procedures and Guidance (MPG) under the Paris Agreement. Therefore, this report will serve as the basis for the transitioning of the transparent reporting process for Mongolia and expected to contribute to fulfilling the commitment for the enhanced transparency framework under the Paris Agreement.

CHAPTER 1

National Circumstances and Institutional Arrangements

CHAPTER 1. NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1.1 National circumstances

Geography and Climate

Mongolia is geographically located between north latitudes of 41°35'-52°09' and east longitudes of 87°44'-119°56', extends along the latitudes, and covers an area of 1,564,116 km² in the central part of the Eurasia continent. It is a landlocked and developing country that borders 3543 km on the north side with Russian Federation and 4677 km on the south side with the People's Republic of China (Yembuu, 2021) (Figure 1-1). The country distances 5000 km from the Mediterranean Sea, 3000 km from the Arctic Ocean and 1600 km from the Pacific Ocean, and due to the distant location of the oceans, the climate is a harsh and continental.

The country is located at an average altitude of 1580 m above sea level (the capital city, Ulaanbaatar, is located at 1311 m above sea level), and the mountain landscape is dominated in the west and the north, while the steppe and Gobi Desert in the east and the south. The altitude decreases from west to east and north to south, while 86% of the country's territory is elevated above 1000 m above sea level. Therefore, the highly elevated location of the country creates a cold and harsh climatic conditions.

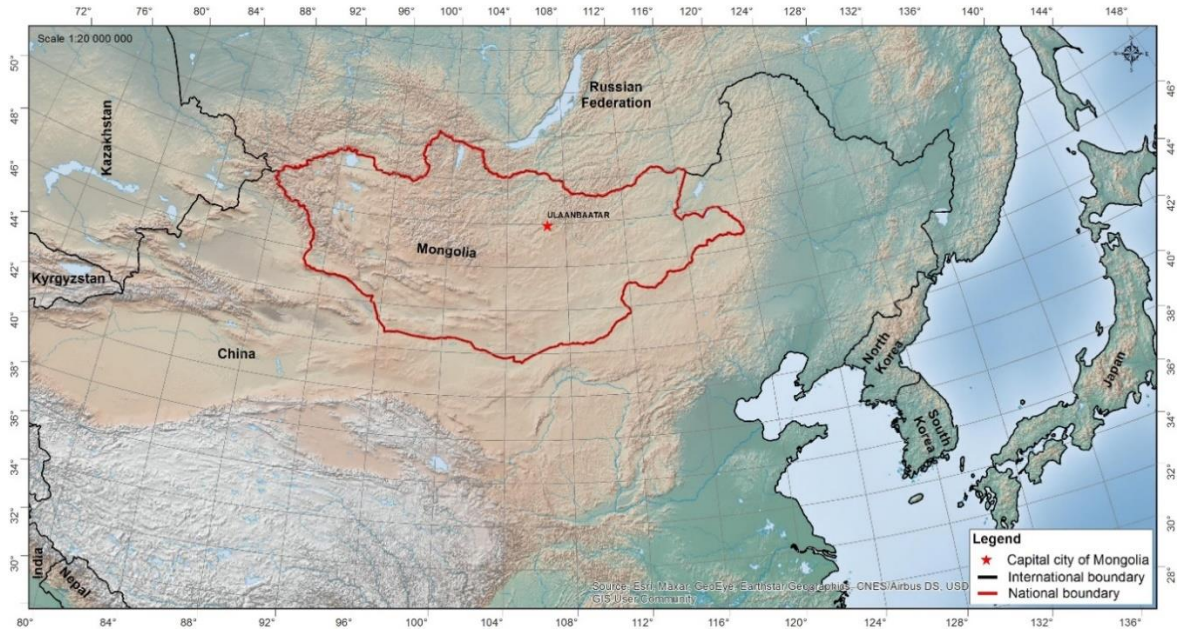


Figure 1-1: The Geographical location of Mongolia

The main feature of the country's climate is a high seasonality or significant differences between the four seasons of the year, which result in high fluctuations of temperature and low precipitation, and the latitude and altitude belts affect the geographical distribution of climatic parameters (Jambaajamts, 1989).

The average annual air temperature is -6.0°C in mountain areas, while in intermountain depressions and along large river valleys, it ranges from -10.0 to - 8.0°C. However, it is about 2.0°C in desert areas and reaches 6.0°C in the southern Gobi.

The average temperature for the coldest month of January is -32.0 to -11.0°C, and it for the warmest month of July is + 17.0°C to + 29.0°C. According to long-term climate and meteorological

data in Mongolia since the 1940s, the absolute minimum temperature was recorded at as -55.3°C in 1976 and 2016, and the absolute maximum temperature was 44.0°C in 1999.

Due to the arid climate, precipitation amount is generally low. Total annual precipitation is over 400 mm in high mountain belts, 300-400 mm in mountainous areas, 250-300 mm in forest-steppe zones, 150-250 mm in steppe areas, and about 150-50 mm in the Gobi Desert. The desert zone even receives annually less than 50 mm of precipitation. The precipitation amount decreases from north to south and east to west in Mongolia. The spatial distribution of precipitation greatly depends on surface relief and altitude. About 90.0% of the total annual precipitation falls in the warm season of the year (July to October), and 50.0-60.0% of which in July and August only.

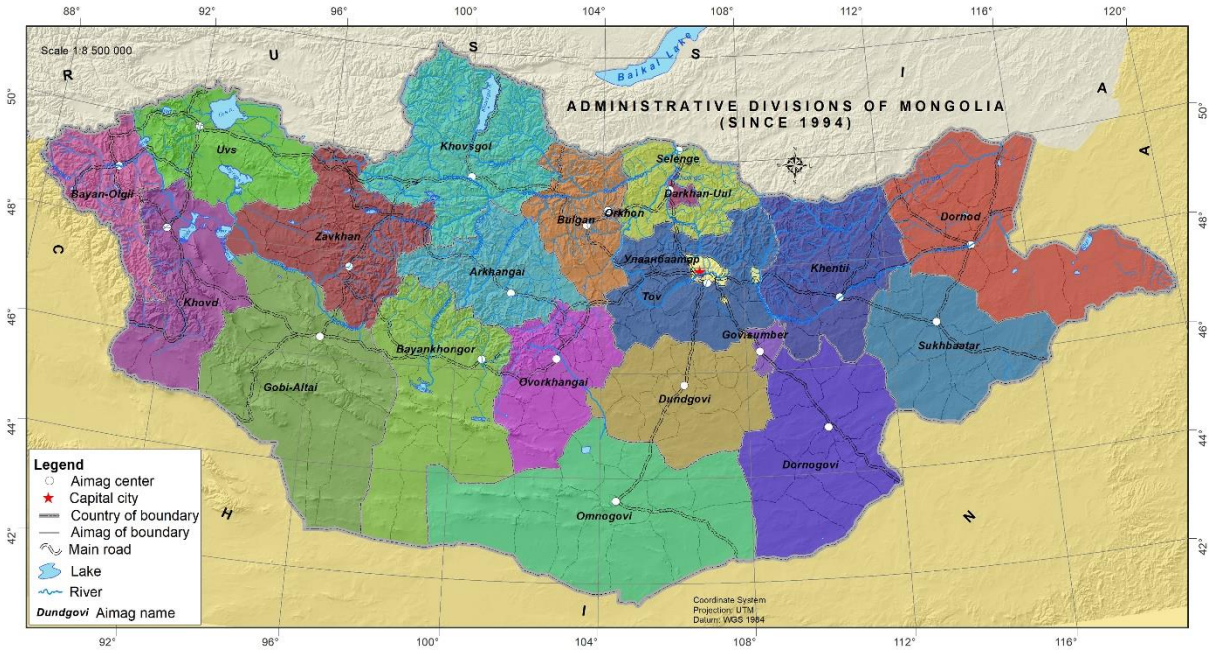
The percentage of snow is about 10% of the annual precipitation sum. The amount of precipitation in the cold season does not exceed 25-30 mm in the mountains and 5-10 mm in the Gobi Desert.

Although the total amount of precipitation is low, the intensity of precipitation is high. According to meteorological observations since the 1940s, the maximum daily precipitation reached 138 mm in the Gobi area, and in 1956, daily maximum rainfall amounts reached 120-126 mm in other sites. For the hourly rainfall intensity cases, it reached 40-65 mm in some sites.

Demography

Mongolia has 21 provinces with administrative delimitation with Ulaanbaatar city (Figure 1-2). The capital city is partitioned into districts and khoroos, and provinces partitioned into soums and bags (the smallest administrative unit). Ulaanbaatar has 9 districts and 152 khoroos, while 21 provinces have 330 soums and 1568 bags (NSO, 2021).

About 45% of the total population of the country lives in the capital city, creating extreme centralization and concentration in terms of demography and economic development. Therefore, the capital city is considered the main source of GHG emissions of the country.



Source: Mongolian National Atlas, 2009

Figure 1-2: Administrative delineation of Mongolia since 1994

The population of Mongolia was 2,760,968 in 2010 (growth rate of 1.6%), 3,057,778 in 2015 (growth of 2.1%), and the latest census results of 3,357,542 (growth from the previous census is 1.8%) in 2020 (NSO, 2021). The population growth of Mongolia separated by gender demographic is shown in Figure 1-3.

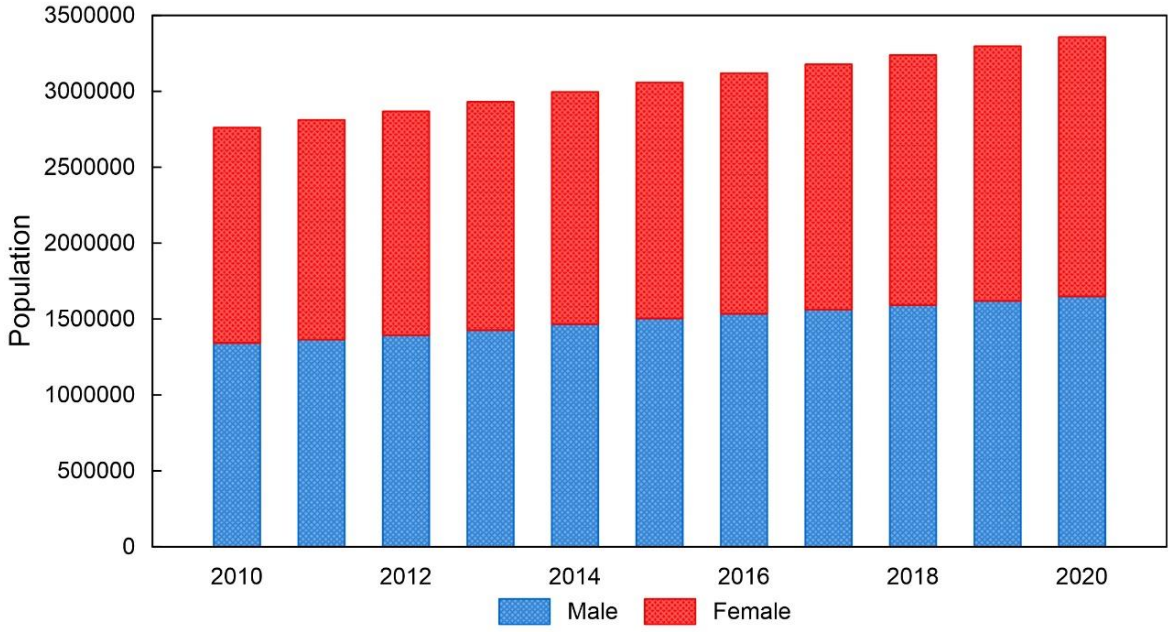


Figure 1-3: The population of Mongolia, 2000-2020

Mongolia is the most sparsely populated country in the world, with a density of fewer than two persons per square kilometre.

However, due to the rapid urbanization of Mongolia in the second half of the last century, the urban population has increased dramatically, especially, in the capital city. The urban population density is approximately 250-270 people per square kilometre (NSO, 2021). According to the 2010 Population and Housing Census, two out of three Mongolians live in urban areas. Table 1-1 presents changes in the ratio of urban and rural populations in Mongolia since 2010.

Table 1-1: The ratio of the urban and rural population in Mongolia

No	Population	2010		2015		2020	
		Number	Percentage	Number	Percentage	Number	Percentage
1	Urban	1,910,745	69.2	2,096,180	68.6	2,316,499	69.0
2	Rural	850,223	30.8	961,598	31.4	1,041,043	31.0

According to the Law on 'The legal status of cities and villages in Mongolia', settlements with a population above 15,000 are considered as towns or urban areas.

Governance

In terms of governance, Mongolia is a parliamentary democratic country. The Constitution of Mongolia legislates the right of Mongolian citizens to freedom of expression, their fundamental human rights, and the right to religion. The supreme legislative body of Mongolia is the Great Hural (Parliament). The Parliament has 76 seats and elects its members for a four-year term. The party or coalition that takes the majority in seats will chair the Parliament. The Government is formed by the Prime Minister in consultation with the President and then presented to the Parliament and must

work closely in coordination with the Parliament. The Speaker is elected from the members of Parliament. As a result of the last 2020 parliamentary elections of Mongolia, the Government is formed from 15 ministries and 19 ministers (NSO, 2021). According to the Constitution, amended in 2020, the President of Mongolia will be elected every six years.

Economy

Mongolia's economy is mainly dependent on the mining and livestock sectors. In addition, services, banking, and the trade and retail sectors will contribute. This situation has been remained in the economic development for the last 30 years. Table 1-2 shows the percentage shares of Gross Domestic Product (GDP) by economic sectors in 2020.

Table 1-2: Components of Gross Domestic Product (GDP) by economic sectors in 2020

No	Sectors	Percentage
1	Agriculture, forestry, fishing	11.9
2	Mining and quarrying	22.5
3	Processing and manufacturing	12.1
4	Electricity, gas, and heat supply	2.0
5	Water supply; wastewater, waste management and treatment	0.6
6	Construction	4.6
7	Wholesale and retail trade, repair, and maintenance stations	15.4
8	Transportation and warehousing	3.5
9	Hotels, apartments, accommodation, and catering services	0.9
10	Information and communication	2.1
11	Financial and insurance activities	4.5
12	Real estate activities	5.4
13	Professional, scientific, and technical services	1.7
14	Management and support activities	0.9
15	Public administration, defence, law enforcement and social protection	4.6
16	Education	4.6
17	Health and social welfare	2.2
18	Arts and Entertainment	0.4
19	Other service-related activities	0.3

Source: NSO, 2021

Table 1-3 shows key socioeconomic parameters of Mongolia. Mongolia's GDP was 7.9, 11.8, and 13.1 billion USD in 2010, 2015, and 2020, respectively.

Table 1-3: Key socioeconomic parameters of Mongolia

No	Parameters	2010	2015	2020
1	Population (million)	2.7	3.0	3.4
2	GDP per capita (USD)	2,650	3,971	4,167
3	Urban population percentage (%)	69.2	68.6	69.0
4	GDP (billion USD)	7.9	11.8	13.1
5	Share of industry in GDP, (%)	36.0	33.7	41.3
6	Share of agriculture in GDP, (%)	11.6	13.3	10.7
7	Share of service sectors in GDP, (%)	52.3	53.1	48.0

Source: NSO, 2021

1.2 Current situation in the sectors of GHG emissions and removals

1.2.1 Current situation of the energy sector

The energy sector is not only a vital economic sector that needs to be developed ahead to ensure the country's security and economic and social development but also represents half of the total national GHG emissions. GHG emissions are mostly from burning, mining, and transporting of coal and liquid fuels. According to future economic and social development trends, GHG emissions in the energy sector are expected to increase sharply. The GHG emissions associated with this sector are divided into two subsectors: energy production and consumption. In addition to heat and electricity generation, fuel quarrying is included in the power generation sub-sector, while the energy consumption sub-sector includes the amount of fuel and energy used in construction, industry, transportation, and agricultural activities (iBUR, 2017; NDC, 2019).

In 2020, 90.9% of total electricity generation in Mongolia came from coal-fired thermal power plants, 6.4% generated by wind power plants, 1.5% from solar power plants, 1.2% from hydropower plants, and 0.04% from diesel stations. 80.7% of the electricity supply is produced domestically, and 19.3% is imported. The country has three power systems: Central, Eastern, and Western electricity grid system. At the same time, the independent power systems of Dalanzadgad and Altai Uliastai play important roles in local energy production (Table 1-4).

Table 1-4: Shares and dynamics of electricity and heat production

Parameters		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total electricity production, billion kWh		4.7	4.5	4.9	5.1	5.4	5.6	5.8	6.1	6.6	7.0	7.2
Percentage	Thermal (Coal) power plants	98.7	98.4	98.3	98.7	96.6	96.1	95.8	95.7	92.9	90.6	90.9
	Diesel power station	0.5	0.4	0.6	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.0
	Hydropower plants	0.8	1.2	1.1	1.2	1.2	1.1	1.5	1.4	1.2	1.2	1.2
	Wind power plants	-	-	-	-	2.0	2.8	2.8	2.5	5.1	6.6	6.4
	Solar PVs	-	-	-	-	-	0.1	0.1	0.3	0.8	1.6	1.5
Imported electricity, billion кWh		0.3	0.3	0.3	0.4	1.4	1.4	1.4	1.5	1.7	1.7	1.7
Heat production, thous. Gcal		8.4	8.7	9.3	9.5	10.0	10.7	10.8	11.3	12.5	13.3	14.1

Sources: NSO, 2021; ERC, 2021

Currently, there are 3 wind power plants, 6 solar power plants, and 4 hydropower plants operating in the country's energy generation system. Their capacities are: 3 wind stations have a total capacity of 155 MW and generated 443.05 million kWh of electricity; 6 solar power stations have a total capacity of 90 MW and generated 100.1 million kWh of electricity that contributed to the Central power supply system in 2020 (ERC, 2021).

Table 1-5 shows the electricity balance and its consumptions categorized by distribution type.

Table 1-5: Electricity balance and consumption in Mongolia

№	Parameters		2010	2015	2020
1	Total electricity, billion kWh		5.0	7.0	8.9
2	Produced, %		94.3	79.6	80.0
3	Imported, %		5.7	20.4	20.0
4	Consumption, %		73.8	76.2	79.4
	Subsectors	Industry and construction, %	45.8	47.1	49.3
		Residential and public utilities, %	17.7	18.4	19
		Transportation and communication, %	3.1	3.1	3.3
		Agriculture, %	0.8	0.8	0.8
		Other, %	6.5	6.8	6.9
5	Distribution and transmission loss, %		11.0	11.3	10.3
6	Own use of thermal power plants, %		14.7	11.2	10.0
7	Export, %		0.5	0.7	0.3
8	Electricity generated per capita, kWh		1,574.8	1,860.0	2,163.1
9	Coal consumption in the power generation sector, thous. tonnes		6,184.5	6,275.1	7,534.9

Note: Percentages are expressed as a percentage of total energy production.

Sources: NSO, 2021; ERC, 2021

More than 90% of total electricity generation of Mongolia belongs to the central power supply system, while about 70% of the total heat demand is provided by thermal power plants, 20% by medium and small-capacity boilers, and about 10% by low-pressure and household (ger) stoves. Table 1-6 shows the heat balance on Mongolia and its distributions by consumer types.

Table 1-6: Heat balance and consumptions in Mongolia

№	Parameters		2010	2015	2020
1	Total heat production, thous. Gcal		8.3	10.7	14.1
2	The heat for own use of thermal power plants, %		4.0	6.1	9.3
3	Heat loss by distribution and transmission, %		2.4	3.0	4.4
4	Distribution, %		93.5	90.9	86.3
	Subsectors	Industry and construction, %	24.9	22.1	22.5
		Transport and communication, %	3.4	3.0	2.7
		Agriculture, %	0.5	0.4	0.4
		Residential and public utilities, %	40.2	37.8	32.0
		Other, %	6.5	6.8	6.9

Note: The percentages are expressed as a percentage of total heat production.

Source: NSO, 2021

Annual coal consumption in Mongolia was 10.25 million tonnes in 2019 out of which 66% is used for thermal power plants, 16% is used for low-pressure household boilers and 10% is used for heating-only boilers (ERC, 2021).

The steady increase in electricity and heat consumptions in each subsector indicates a continuous rise in GHG emissions in the energy sector of the country.

One of the most important sectors of energy consumptions is the transport sector, and the volume of freight and passengers are key indicators of GHG emissions (Table 1-7).

Table 1-7: Carried freight and passengers of Mongolia

Years		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Freight turnover, billion ton-km		12.1	16.3	15.7	14.6	17.4	13.8	16.6	19.2	22	23.6	23.9
Percentage	Railway	84.8	69.9	77.6	82.5	71.6	82.8	74.4	70.4	69.7	73.7	80.3
	Road	15.1	30.1	22.4	17.5	28.3	17.1	25.5	29.5	30.2	26.3	19.6
	Air	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Passenger turnover, billion per-km		3.6	4.7	5	4.6	5.2	4.9	5	5.4	6.6	7.1	3.4
Percentage	Railway	33.8	29.8	29.9	30.3	22.8	20.2	19.2	17.9	15.1	15.6	17.0
	Road	41.0	49.4	45.5	41.2	53.3	39.3	39.3	37.6	44.3	40.9	63.7
	Air	25.1	20.7	24.6	28.5	23.8	40.4	41.5	44.5	40.7	43.5	19.3
	Water	0.00	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.00	0.00	0.00

Source: NSO, 2021

Due to the increase in population and intensive socioeconomic development, freight volume doubled in 2020 compared to 2010 and passenger turnover also doubled in 2019 compared to 2010. However, due to the COVID-19 quarantine, passenger turnover dropped sharply below the 2010 level in 2020 (Table 1-7).

1.2.2 Current situation of the industrial sector

Before 1990, during the period of a centrally planned economy, the added value of the industrial and processing sectors accounted for one third of the GDP in Mongolia. However, industrial production declined during the transition period to the market economy, and the recovery process has intensified in recent years.

Figure 1-4 shows the changes in the industrial sector shares in the country's GDP over the last 30 years.

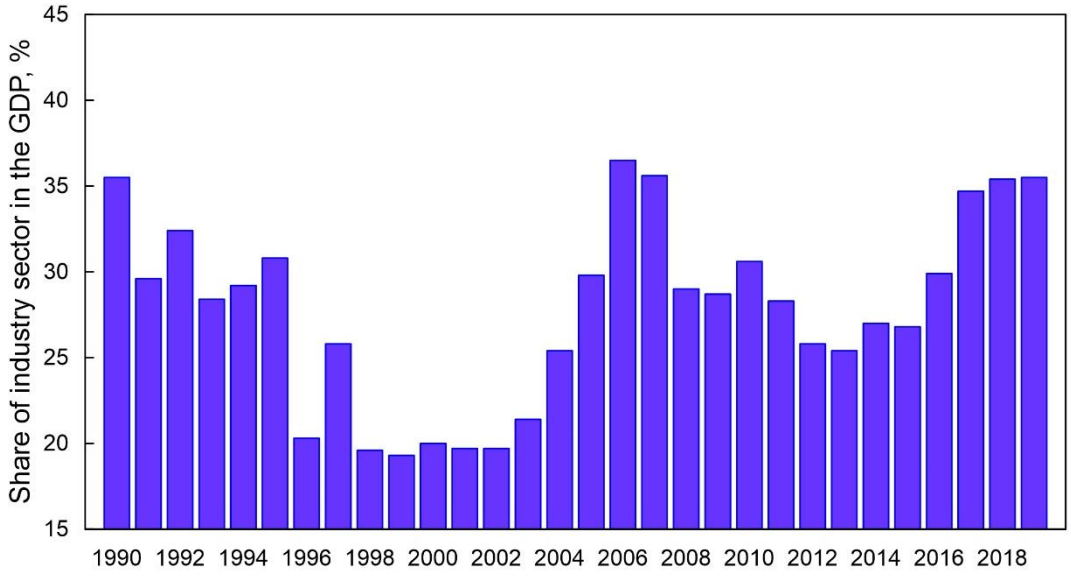


Figure 1-4: Variations in the share of the industry sector in the GDP

As shown in Figure 1-4, the industrial sector's share in the GDP decreased from 35.5% in 1990 to 19.3% in 1999, but since 2000, it has increased continuously and reached 36.5% in 2006. The share of the added value of the industrial sector in GDP in 2020 was approximately 5.3% higher than in 2010. The share percentages of the mining and processing sector are 41.3% and 36.0% of the GDP of Mongolia, respectively. The mining industry accounted for 16.1% of the total industrial sector in 1990, while this percentage increased to 56.5% in 2020. However, the share of the manufacturing sector decreased from 71.8% in 1990 to 33.4% in 2020 in the industry (Table 1-8).

Table 1-8: Composition of cross-industrial output, %

Subsector	1990	2000	2010	2012	2014	2016	2018	2020
Mining	16.1	51.7	63.6	58.9	64.4	58.0	62.1	56.5
Manufacturing and processing	71.8	32.4	25.0	30.7	28.1	31.0	28.3	33.4
Others	12.1	15.9	11.4	10.4	7.5	11	9.6	10.1
Total	100	100	100	100	100	100	100	100

Source: NSO, https://www.1212.mn/

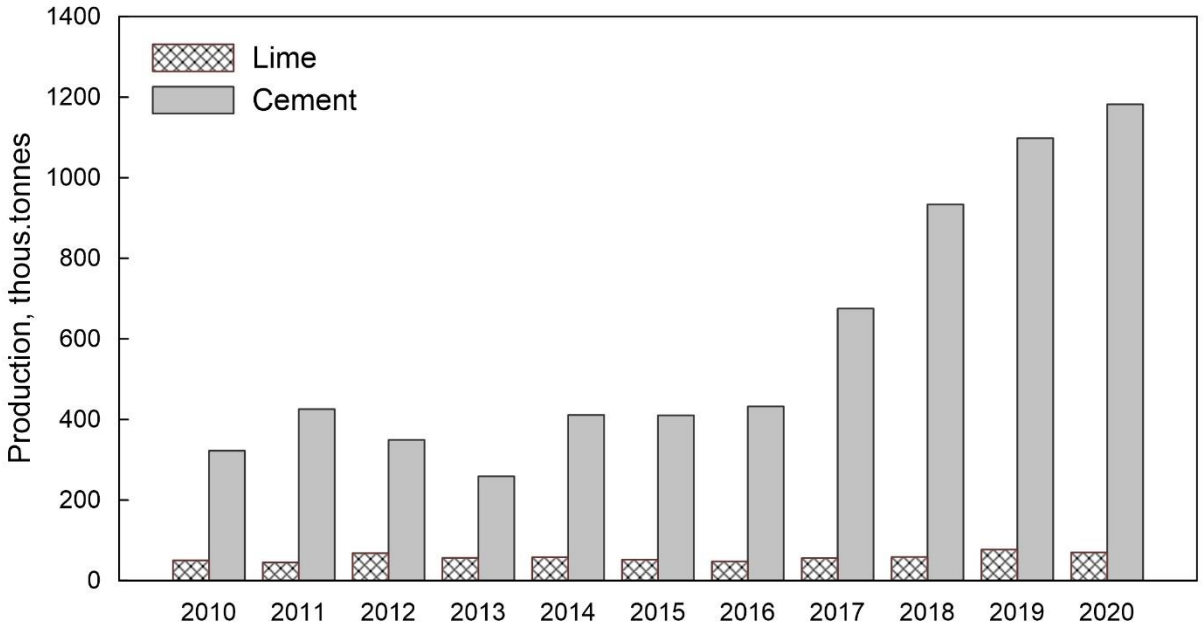
The country's industrial sector is based on mining, agriculture, and raw materials. The production rate of some major industrial products is shown in Table 1-9. As shown in Table 1-9, coal production has increased dramatically since 2000. Coal production was 25.16 million tonnes in 2010, or five times more than it was in 2000. Similarly, in 2019 it was 55.80 million tonnes, which was 11 times more than it was in 2000. Due to the situation in COVID-19, coal production decreased by 12 million tonnes in 2020 compared to 2019.

Table 1-9: Main industrial productions of Mongolia

Main products	1990	2000	2010	2012	2014	2016	2018	2020
Mining exploitation								
Coal, million tonnes	7.16	5.19	25.16	29.93	25.29	35.52	51.4	43.8
Oil, million barrels		0.07	2.18	3.64	7.41	8.25	6.39	4.11
Copper concentrate, million tonnes	0.35	0.36	0.36	0.35	0.71	0.4	0.39	0.0
Gold, tonnes		11.81	6	5.98	11.5	18.44	0.02	0.02
Iron ore, million tonnes			3.08	6.9	6.29	4.94	6.23	9.22
Processing industries								
Cathode copper 99%, thous. tonnes		0.64	2.75	2.28	6.99	15.01	14.17	9.49
Metal billets, thous.tonnes		13	64.2	68.1	64.4	16.8	29.2	15.3
Metal roll/cast, thous.tonnes		7.4	61.8	57	73.9	16.6	31.6	16.7
Cement, thous.tonnes	440.8	91.7	322.5	349.3	411.3	432.4	933.8	1,182
Lime, thous. tonnes	103	37	50.2	68.2	58	47.6	58.7	70.2
Combed cashmere, thous.tonnes	0.24	0.45	0.82	0.42	0.63	0.78	1.16	0.52
Carpets, thous.m^2	1,971	704.8	609.6	915.8	743.6	439.1	528.2	361.4
Knitting products, thous.pieces	4,249	1234	731.1	795.1	954.4	812.5	1461	1361
Milk products, million litres	59.6	1.5	42.04	72.4	70.45	63.29	135	176.2
Spirit/Alcohol, million litres	3.47	3.8	8.44	10.76	9.13	8.65	10.58	10.06

Source: NSO, https://www.1212.mn/

The dynamics in cement, lime and oil production are shown in Table 1-9 and Figures 1-5 and 1-6. Dry technology was introduced in cement and lime production in 2011, and since 2016, new factories with the capacity to meet full domestic needs have been opened.



Source: NSO, https://www.1212.mn/

Figure 1-5: Variations in annual cement and lime production

In 2010, 2015, and 2020, production of cement was 322.5, 410.1, and 1,182.2 thousand tonnes, while 50.2, 52.3 and 70.2 thousand tonnes of lime were manufactured, respectively (Figure 1-5).

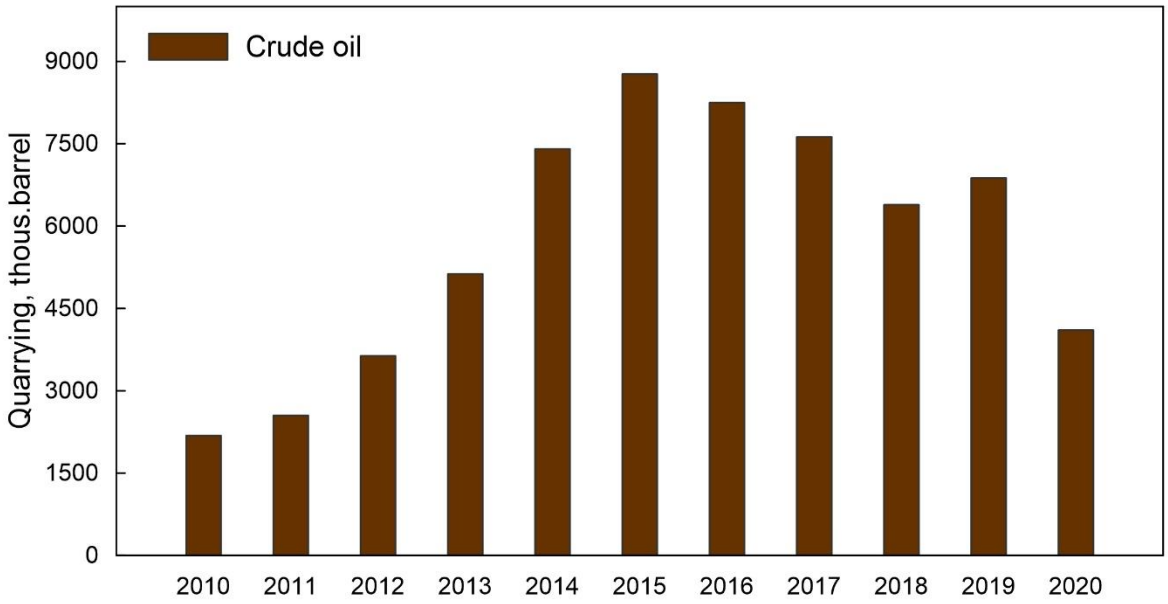


Figure 1-6: Variations in annual crude oil quarrying

In 1998, oil quarrying began and produced 44.8 thousand barrels in Mongolia. As of 2010, the production was 2,181.4 thousand barrels and reached a maximum of 8,769.3 thousand barrels in 2015. However, due to the pandemic, it decreased to 4,105.9 thousand barrels in 2020 (Figure 1-6).

1.2.3 Current situation of the Agriculture, Forestry, and Land Use (AFOLU) Sector

The current situation in the livestock sector

Mongolians traditionally engaged in nomadic animal husbandry adapted to seasonal climatic conditions. During the socialist period (before 1990), the number of livestock in the country was stable at around 25 million animals. However, since 1991, when the socioeconomic system of Mongolia shifted to the market economy and after the privatization of livestock to herders, the number of livestock has continuously increased, and the highest number of livestock was counted, reaching 70 million 969 thousand in 2019 (Figure 1-7). The natural factors affecting a sudden decrease in livestock numbers are climate extremes such as dzud (harsh winter) and drought. For example, due to extreme cold and heavy snowfall in the winter of 2001-2002 and 2009-2010, as well as long-term severe coldness and drought, Mongolia lost more than 23% of all livestock or 10 million animals (NSO, 2016).

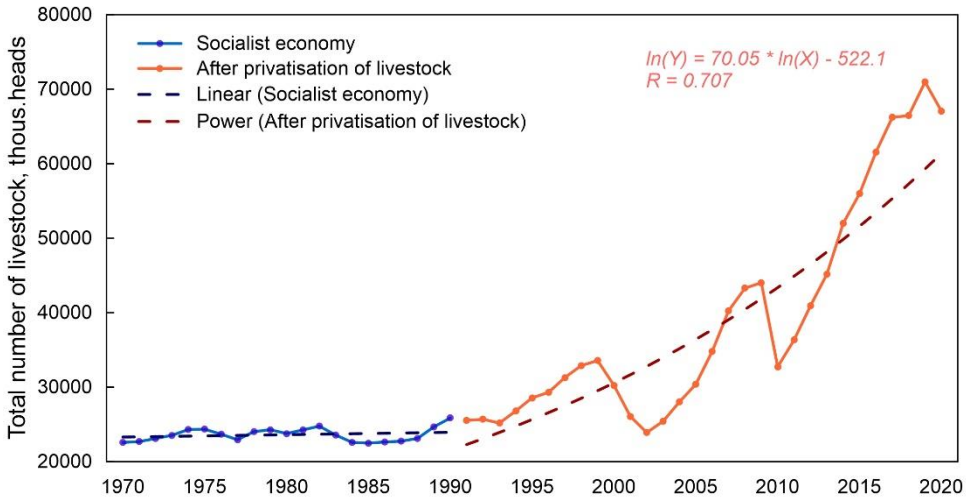


Figure 1-7: The total number of livestock in Mongolia

As shown in Figure 1-7, the number of livestock in Mongolia increased year by year, and according to the final census of 2020, it reached 67.07 million heads (NSO, 2021).

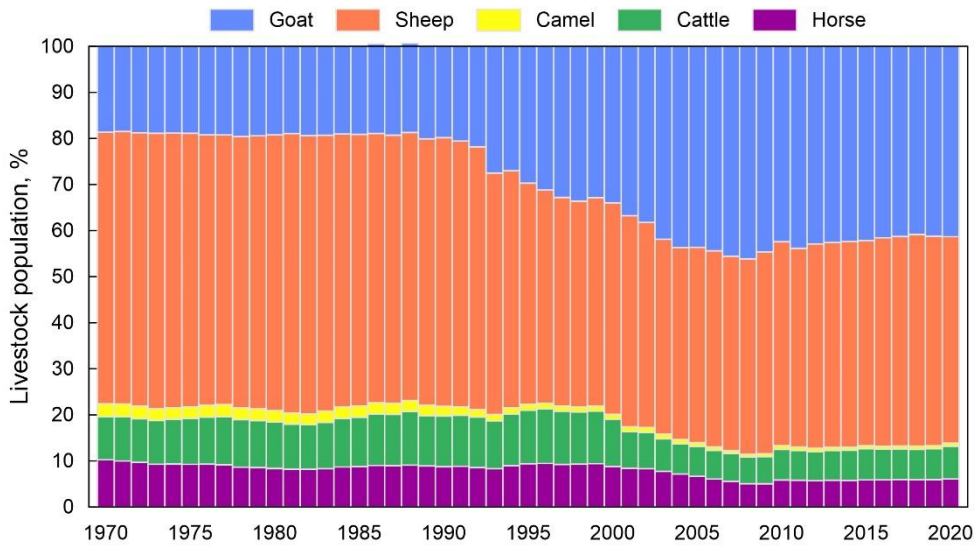


Figure 1-8: The share percentage of livestock type in total number of animals

The proportion of animals by livestock type remained stable between 1970 and 1990, with horses and cattles each accounting for approximately 10% of total livestock and camels for 3%. In above mentioned periods, the number of sheep was the largest, approximately 58-59% of total number of livestock, and number of goats 18-19%. However, after the transfer of livestock to private ownership, this livestock-type proportionality was lost and due to the demand for goat cashmere, its heads increased sharply to over 42% by 2010. Horse and cattle numbers each represented around 5-6%, camels 0.8%, and sheep 45% of the total livestock (Figure 1-8).

Table 1-10: Changes in the livestock number by type, by 5 years

Animal type	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020
Total	140.8	-206.5	272.7	2,547.6	5,101.9	-4,691.8	12,256.3	7,050.9	20,380.6
Horse	-152.6	-108.1	149.7	216.9	560.8	-872.6	99.8	534.2	1,294.1
Cattle	154.0	-46.7	271.6	281.6	608.6	-1,637.0	464.1	631.1	1,461.5
Camel	-10.7	-30.8	-26.0	-150.7	-48.8	-88.5	4.3	59.5	123.2
Sheep	-10.2	59.8	-230.5	280.6	163.6	-2,717.4	5,204.3	3,622.3	9,760.8
Goat	160.3	-80.7	161.6	2101.1	3,582.0	623.8	6,483.8	2,203.8	7,741.1

According to Table 1-10, compared to the average of the total number of animals in 1976-1980, the average of the following five years decreased by 206,472 heads, namely, horses decreased by 108,100, goats by 80,720, cattle by 46,700, and camels by 30,840, while sheep increased by 59,820. Due to consecutive droughts which occurred in 1999-2001, the number of livestock decreased by 4,691,792 heads in the following five years compared to the average number of 1996-2000. For example, during this period, the number of sheep decreased by 2,717,360, cattle by 1,637,040, horses by 872,580, camels by 88,520 and only the number of goats increased by 623,760.

The statistics show that the number of livestock decreased by 25.7% due to drought in 2010. However, after this, the number of livestock continuously increased and reached the highest number of 70.97 million animals in 2019. Then the number of livestock decreased by 3.9 million in 2020 from the previous year reaching 67.07 million. The proportion of young animals in the herd was relatively high during the socialist era and reached 39.2% in 1989. In the last 10 years (2011-2020), the average share of young animals was 33.1%.

The current situation of the agricultural sector

According to the Mongolian Integrated Land Fund, agricultural land occupies 114,041.8 thous. ha or 72.9%, the urban area is 917.6 thous. ha or 0.6%, road and network cover 474.8 thousand hectares or 0.3%, while 14,255.9 thousand ha or 9.1% of forest land, 660.9 thousand ha or 0.4% of water bodies and 26,060.7 thousand ha or 16.7% of state special needs land cover in the total land fund area in 2020 (https://www.gazar.gov.mn).

Most of the land, or 72.9% of the total area, is occupied by agricultural land classified as pasture, hay fields, land for arable farming land, fallow or abandoned land, and other uses.

The area where agricultural plants and crops are planted, owned, or leased by households, farmers, enterprises, and organizations, and finally, engaged in agricultural production is defined as a cultivated area. The size of the cultivated area is defined by the total land where the seeds were planted each year. The cultivated area includes the area planted by human activities (NSO, 2021).

The statistics show that the total cultivation area has increased in Mongolia since 2010 (Figure 1-9).

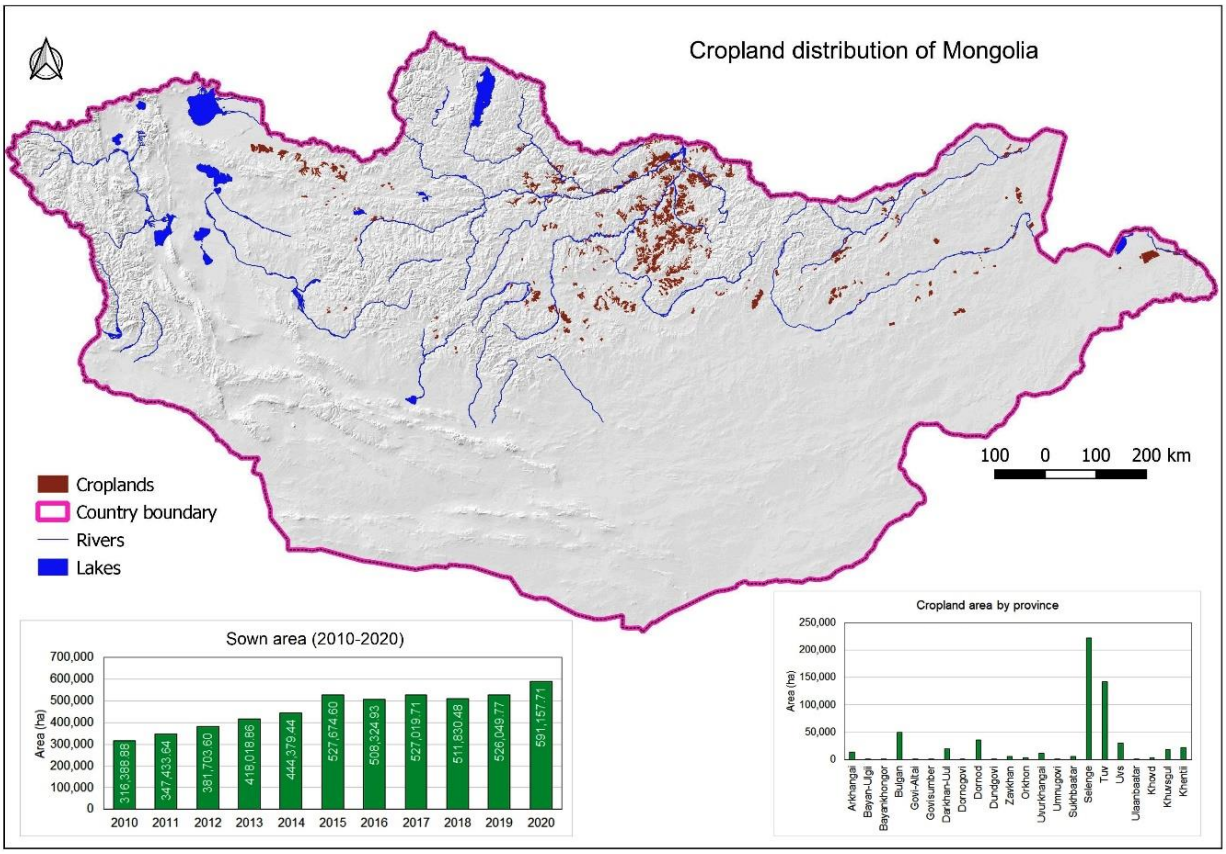


Figure 1-9: The cropland distribution and total sown area of Mongolia, 2020

Cultivation is carried out along the fertile valleys of the Orkhon, Selenge, Tuul, Kherlen and Tes rivers in the central part of Mongolia. Soil fertility and other characteristics, climate regime, availability of water sources and morphology, and relief of land surface are the primary geographical conditions that affect arable farming. High activity clay mineral and organic soils dominate cultivated regions, and annual rainfall varies around 250-300 mm in these areas. It is seen that a suitable area for arable farming is generally located at an elevation of 750-1400 meters above sea level and with a well-developed river network along the valleys of the largest rivers. If considering the agricultural area by province, most of the agricultural area is in the Selenge, Central, Bulgan, Dornod, Khentii, Uvs, Khuvsgul and Darkhan-Uul provinces. In terms of total crop area, it increased by 274,769 ha by 2020 compared to 2010 (Table 1-11).

Table 1-11: The total sown area in Mongolia

Year	2010	2015	2020
Sown area (ha)	316,388.9	527,674.6	591,157.7

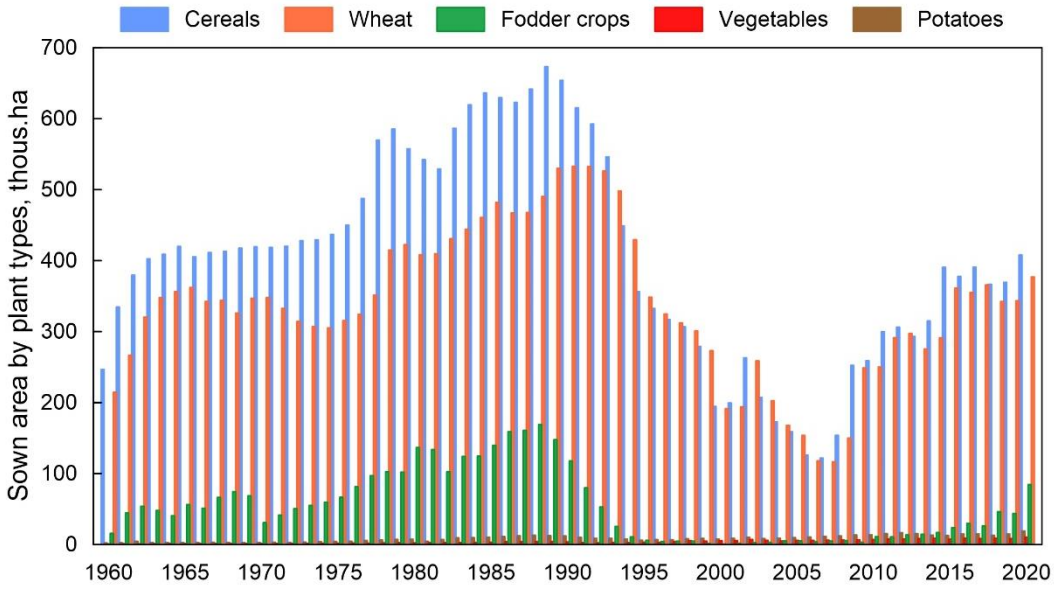


Figure 1-10: Variations in the total sown area by type of crops

In 2020 compared to 2010, the area grown for fodder increased by 6.6 times, while the area cultivated for wheat increased by 51%, and the area cultivated for potatoes and vegetables increased by 38% and 50%, respectively.

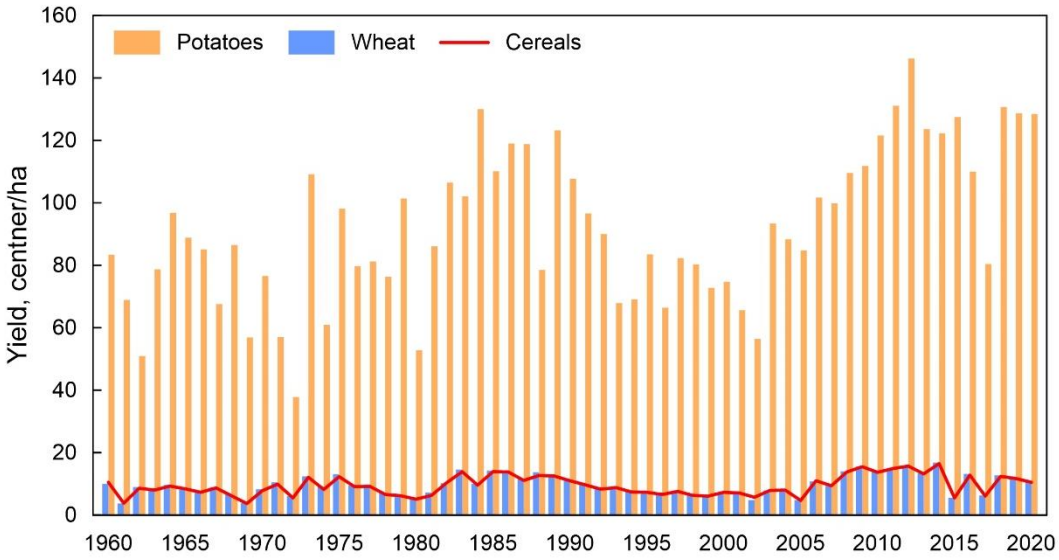


Figure 1-11: Yields of crops per ha by type of plants

From 2010 to 2020, the highest yield of potatoes per hectare was 146.8 tonnes in 2012, and the lowest was 80.4 tonnes in 2017. Similarly, the highest wheat harvest was 16.8 tonnes in 2014, and the lowest was 5.6 tonnes in 2015 (Figure 1-11).

As mentioned, dark brown and brown soils are dominant in the most of the cultivated land of Mongolia. The fertile layer of the soil is relatively thin and does not exceed 30 cm in depth in the Tuv and Selenge provinces of the main cultivation area. Agricultural fields are usually located along river valleys, or back sides of mountain valleys where the fertile soil layer is relatively thick in these locations and even the ability to accumulate moisture is relatively high.

Cultivation soil is mainly light loam with a mechanical composition of 3-4% organic matter, slightly acidic to neutral, with a pH of about 6.0-7.0. The calcium content of the soil is relatively high, but there is some deficiency in the phosphate concentration. Due to its light and sparse mechanical nature, the soil has a low moisture holding capacity and a high risk of erosion. Due to improper land use, soil erosion has been occurring rapidly in agricultural and pasture areas. Soil erosion and land degradation are becoming more pressing ecological problems.

Inappropriate human activities, including overuse of pastures, irresponsible mining, the construction of paved and unpaved roads, and deforestation, are the main causes leading to the loss of soil fertility.

The degradation of arable soil has become a major problem in the agricultural sector. Approximately 0.7 million acres (283,280 ha) of land have been degraded to the point where it cannot be used for agriculture. 47% of the cultivated area is degraded out of which 13% is degraded severely, 28% moderately, and 59% lightly.

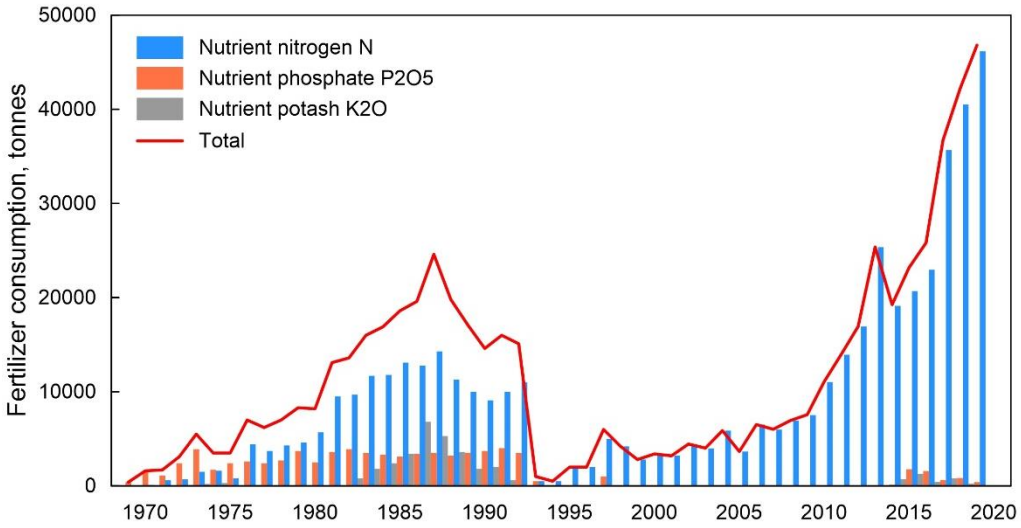
According to a study by the Mongolian Soil Science Association, 35-50 tonnes of soil have been lost by the wind erosion in the last 30 years on each hectare of land processed for cultivation.

Soil moisture in the upper layer of the soil is significantly lost, and the content of organic matter (humus) decreases rapidly due to the combined effects of soil degradation and climate warming. As a result, the threat of wind erosion increases, soil moisture capacity decreases, and soil salinization occurs. Also, there is a decrease in percolation and an increase in water loss due to the hard and dry soil surface.

The capacity of the fertilizer and plant protection agents is relatively small in Mongolia, and these markets are managed and regulated under the control of relevant ministries (such as the Ministry of Food, Agriculture and Light Industry (MOFALI), the Ministry of Environment and Tourism, and the Ministry of Health), agencies, and professional organizations (the State Inspection Agency and Research Institute for Plant Protection). Fertilizers and plant protection agents are mainly imported from China and Russia and a small percentage from the European Union (EU).

The amount and type of fertilizers and plant protection agents to be imported every year have been redetermined by the State Inspection Agency and Research Institute for Plant Protection since 2006. This decision is based on the total and potential demand for each product category. The experiences show that the estimated potential demand is lower than the actual Mongolian demand in agriculture, especially for fertilizers. This situation relates to the high cost of fertilizers and the lack of knowledge among farmers about the use of fertilizers. It is common in Mongolia not to use fertilizers in agriculture or lesser use than the required amount.

The annual demand for total fertilizer is estimated to be around 150,000 to 200,000 tonnes, and the amount of imported and used fertilizer is much lower, roughly 10% of the estimated amount (DMKNL, 2016).



Source: www.theglobaleconomy.com/Mongolia/fertilizer_use/

Figure 1-12: Variations in annual fertilizer consumption in Mongolia

Three fertilizers types are used in Mongolia such as nitrogen, phosphorus and potassium since the 1970s. Annual fertilizer consumption is an average of 8.7 kg per hectare with a minimum of 0.4 kg per hectare in 1994 and a maximum of 31.8 kg per hectare in 2018 (Figure 1-12).

The current situation of the forest resources

11.79% or 18,592.4 thousand hectares of the unified land fund of Mongolia belong to the forest fund. The area covered by forests in the country is 12,552.9 thousand hectares, which is 7.96% of the total area.

The percentage of coniferous and deciduous forests is 84.7% or occupy 10,063.2 thousand hectares, while 15.2% or 1,836.5 thousand hectares belong to the saxaul type of forest. The forest area affected by the fire is estimated to be 1,196.8 thousand hectares, the logging area is 124.1 thousand hectares, and the area affected by harmful insects is occupied by 95.7 thousand hectares of area. Finally, forests affected by natural disasters was around 0.9 thousand hectares (MET, 2016).

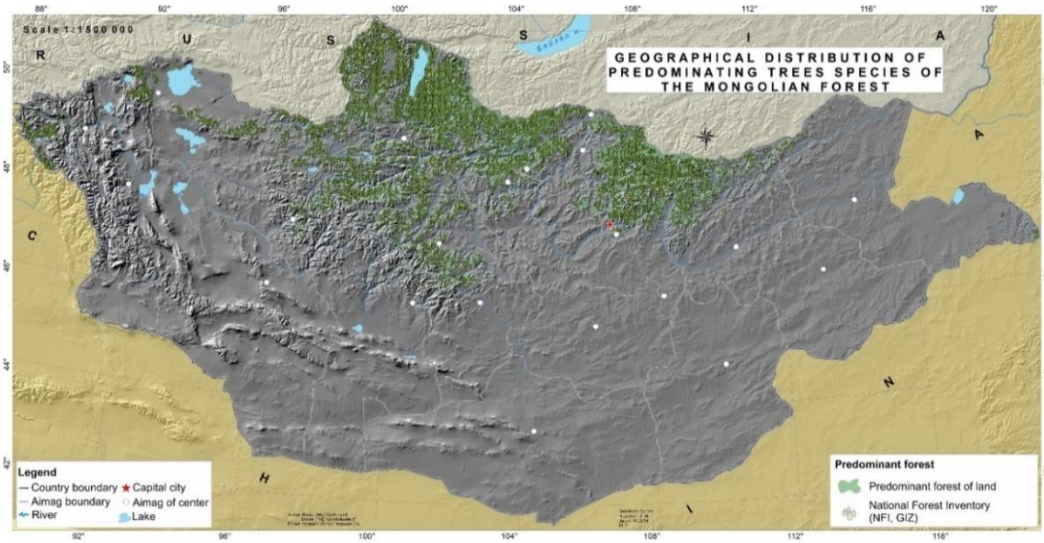


Figure 1-13: Distribution of the dominant forest area in Mongolia

In 2016, 76.9% of the total territory was affected by desertification and land degradation, and essential measures and ways to improve the ecosystem of the rapidly desertified region are reforestation and restoration of degraded forests and increased restoration measures of Saxaul forest reserves in the Gobi region.

The situation of 2019 showed that it is necessary to implement afforestation measures on 643.1 thousand hectares of coniferous and deciduous forests and 855.8 thousand hectares of Saxaul forests, and in total, 1,498.9 thous. ha of area that needs to be reforested in the country scale.

Recently, 500 hectares of afforestation, plantation of forest strips in 170 hectares area and supporting measures of natural regeneration growth have been taken in 1,050 hectares area, and 1,047 hectares of forest clearing have been carried out in degraded forests by the state budget. Also, supporting measures of natural regeneration are taken in 2,000 ha of the area by forest maintenance and reclaiming measures in the nature and selected areas (MET, 2021b).

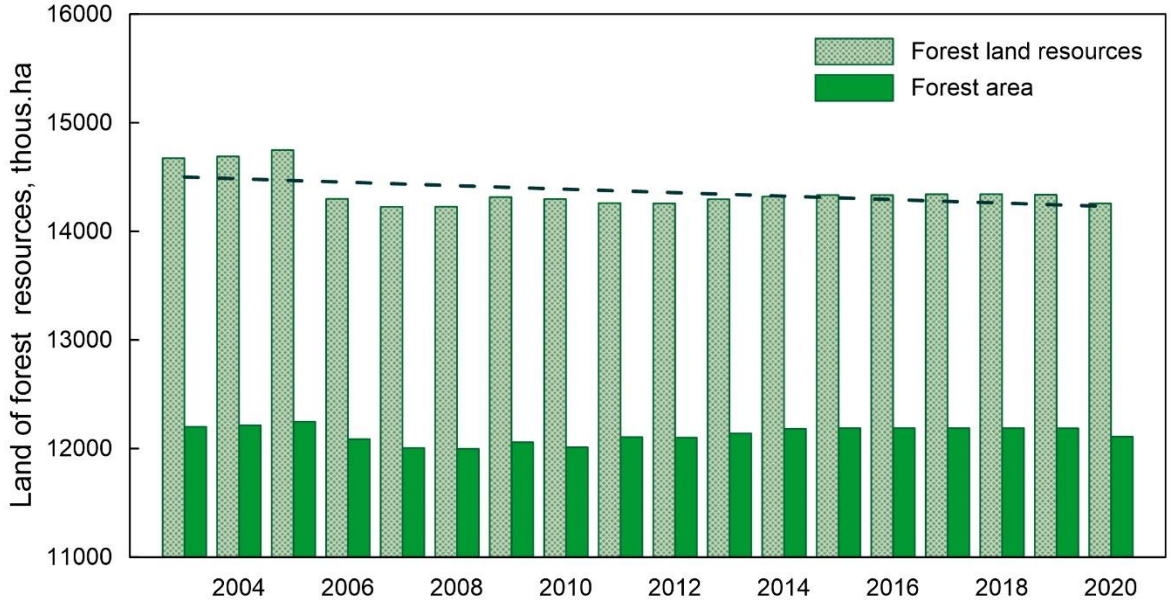


Figure 1-14: Changes in forest land area in Mongolia

The forest area decreased by 450.2 hectares in 2010 and 492.2 hectares in 2020 compared to 2005. At the same time, recent statistics show that forest areas decreased by 14,341.4 hectares in 2018 and by 14,255.9 hectares in 2020.

According to the preliminary evaluation of the factors that cause changes in forest resources in Mongolia are: 2.0% of the area is due to forest fires and 10.0% due to forest logging, and the forest area is decreased annually by 47,000 hectares (0.4%). In terms of forest logging amount, 18.8% of harvested wood is used for industrial purposes, and 81.2% is applied as fuel.

Effective policies and measures to protect forests should focus on the most influential factors in forest degradation, such as forest fires, illegal logging, and successive degradation (pests, livestock grazing), and should be based on sustainable forest management for the appropriate use of forest resources (MET, 2018).

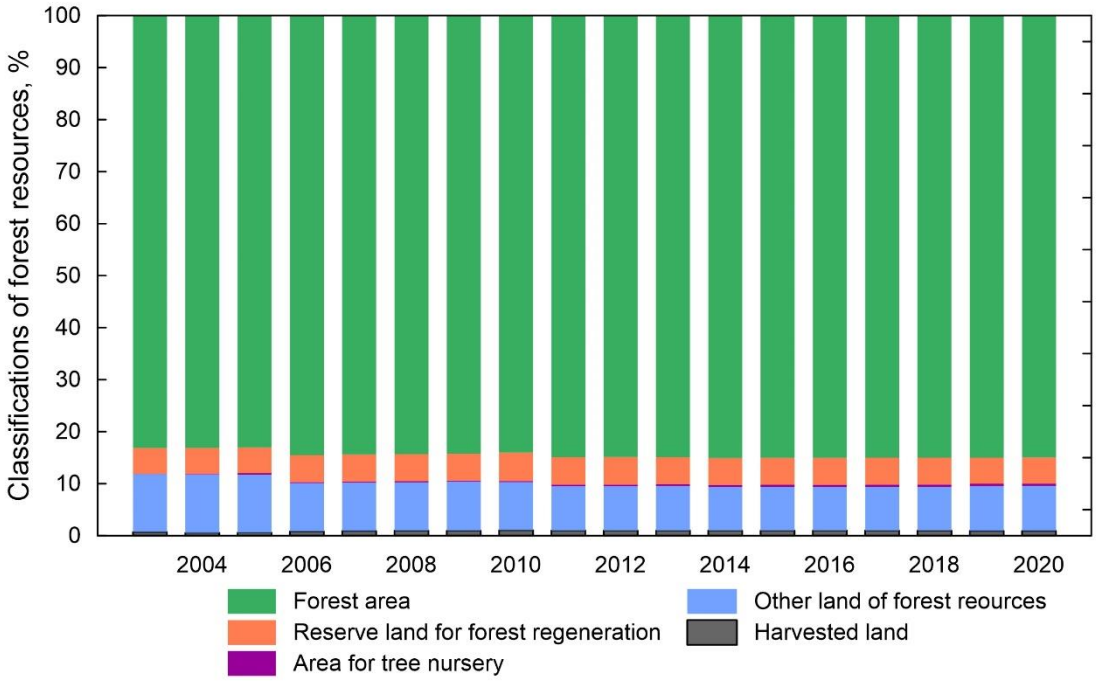


Figure 1-15: Classification of forest resources of Mongolia

Recently, some positive changes in forest management have been observed, and the area affected by logging decreased by 18.2 hectares, while the tree nursery area increased by 32.5 hectares in 2020 compared to 2010 (Figure 1-15).

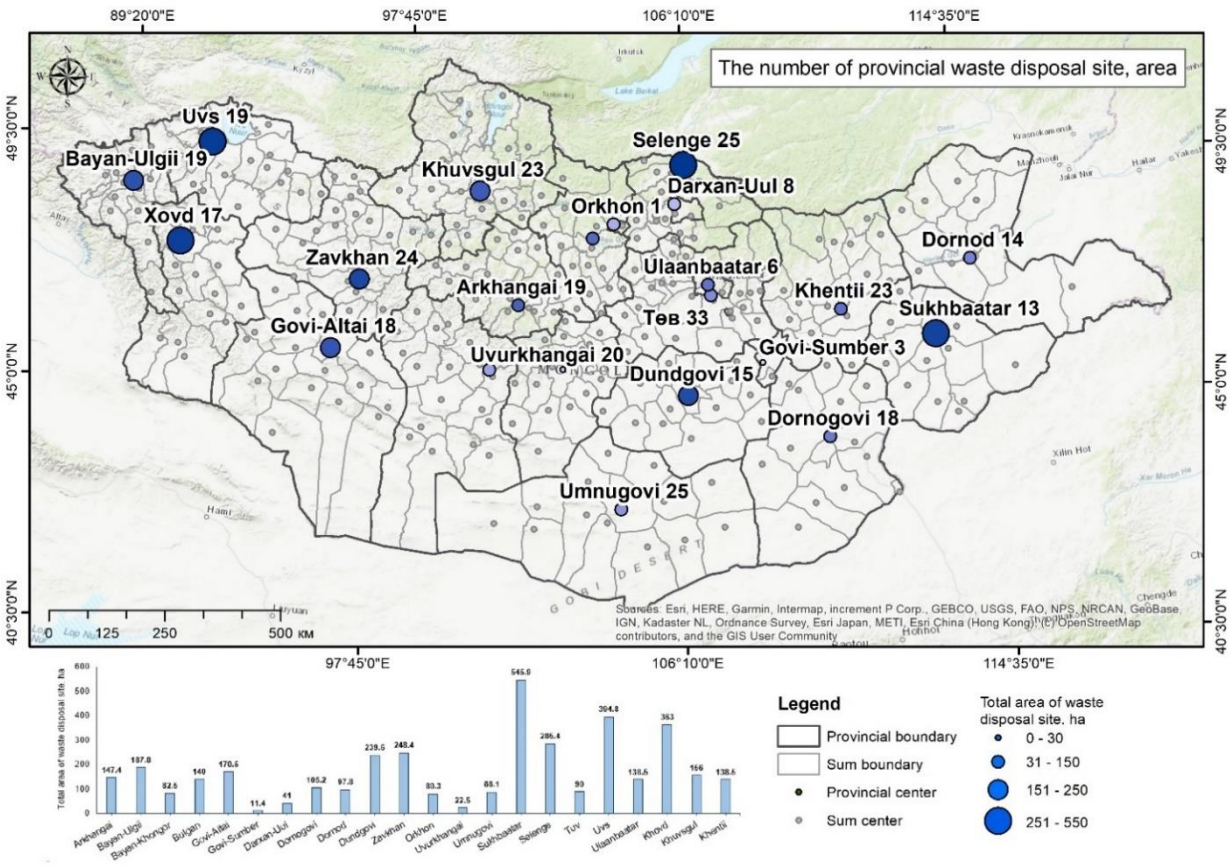
1.2.4 Current situation of the waste sector

Solid waste

GHG emissions from the waste sector are classified into methane from solid waste sites, methane from domestic and industrial wastewater treatment, and nitrogen oxides from household or municipal wastewater (iBUR, 2017).

In 2021, 381 authorized waste sites were operating in the capital city, 21 provincial centres, and 329 soums of Mongolia, and their total area covered 3,840.6 ha (NSO, 2021).

Figure 1-16 shows the number and locations of authorized and centralized waste disposal sites and their total area by province.



Source: NSO, 2021

Figure 1-16: The number and total area of waste collection points in Mongolia by provinces

In 2020, a total of 2.24 million tonnes of waste was delivered to waste dumping sites in Mongolia, and 52% or 1.16 million tonnes were generated in rural areas of provinces and soums, while 48% or 1.08 million tonnes of waste were generated in Ulaanbaatar, whereas 45% of the total population resides (NSO, 2021).

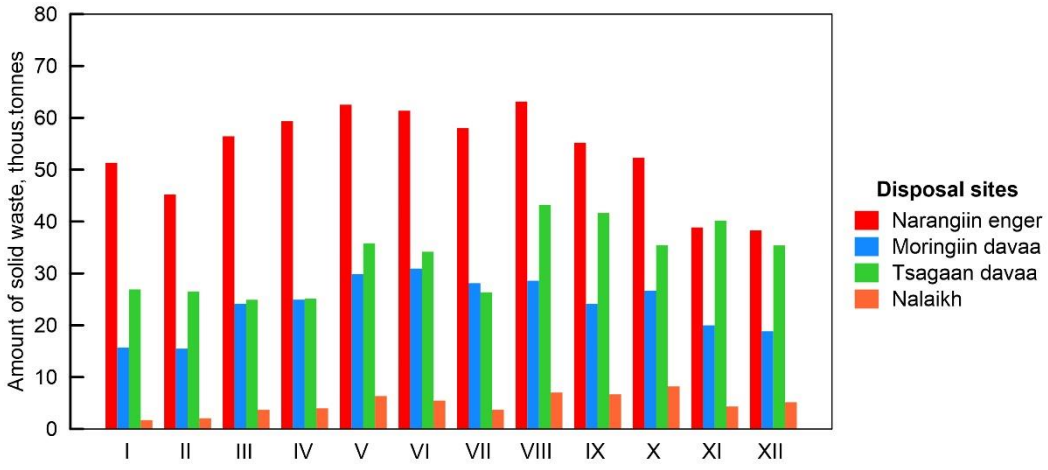
The waste generated in Ulaanbaatar is dumped at three centralized landfill sites (Figure 1-17), such as Naran Enger, Tsagaan Davaa, and Morin Davaa, with the size of waste area size 30, 22 and 17 hectares, respectively.

Source: MOUBC, 2021

Figure 1-17: Location of waste disposal sites in Ulaanbaatar city

Waste generation is increasing every year, for example, the amount of waste delivered to Ulaanbaatar waste dumping sites increased from 1.09 million tonnes in 2013 to 1.38 million tonnes in 2021, and the increase is 20% or 283.9 thousand tonnes.

In 2021, the waste generated in Ulaanbaatar has been dumped and buried at following sites: Narangiin Enger (46%), Tsagaan Davaa (28%) and Moringiin Davaa (20%). The remaining 4% of the solid waste was transported to the Nalaikh waste dumping site. In terms of the composition of the total waste coming to the centralized landfills: household waste takes about 86%, construction waste is 9%, sludge and ash is 3%, and the remaining 2% is animal waste and other industrial waste (MOUBC, 2021).

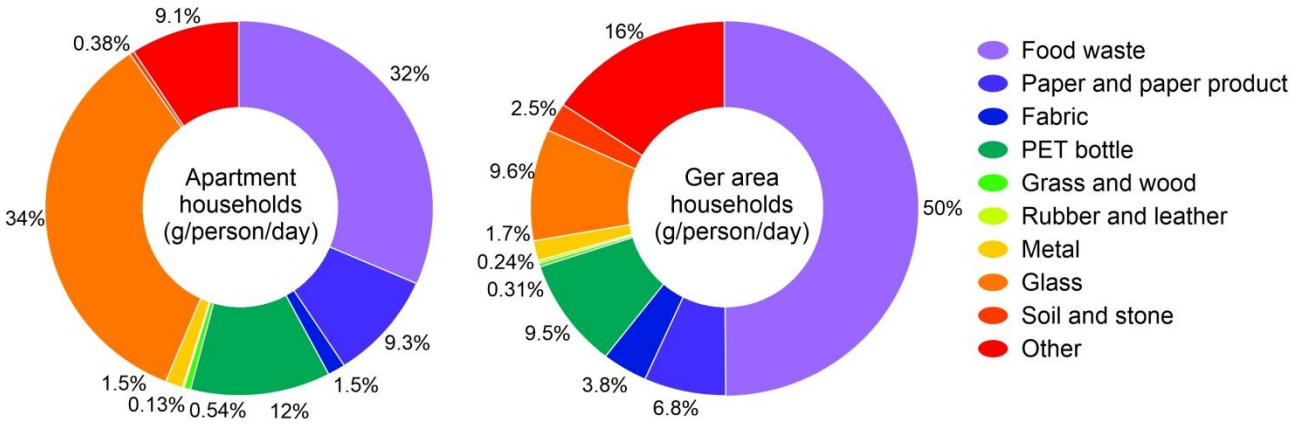


Source: MOUBC, 2021

Figure 1-18: The report of waste delivered to the centralized landfills of Ulaanbaatar city

The quality of quantitative data is still insufficient, although waste is delivered to dumping sites and buried also, the amount of waste in collection points has been recorded in the Environmental Database since 2004 at the provincial, local, and municipal levels.

A survey of the structure of waste was carried out within the framework of the projects “Study on developing a master plan to improve solid waste management in Ulaanbaatar city” and “Strengthening the capacity of solid waste management in Ulaanbaatar city” implemented by the Japan International Cooperation Agency (JICA) during 2004-2011. The composition of residential and ger area wastes is shown in Figure 1-19 as a result of the project mentioned above.



Source: JICA, 2011

Figure 1-19: Composition of solid waste in Ulaanbaatar city in 2010

Considering the waste composition of households living in apartments in Ulaanbaatar city, 34% is comprises glass and bottles, 32% is food waste, 12% is plastics, and 9.3% is paper products. In the case of waste composition from the ger area, 50% is food waste, 16% is ash, about 9.6% is glass and bottles, and the remaining 9.5% is composed of plastics.

Also, considering the source of the waste generated in winter season, 68.5% of the total waste comes from households living in ger area, 17.3% is from enterprises, government organizations and public service sectors, 13% is from families living in apartments and 1.2% is from public streets and squares.

However, the situation is different in warm season, as 43.7% of waste was collected from enterprises, government organizations and public service sectors, 29.3% is from households living in ger areas, 23.1% is from households living in apartments, and 3.9% is from public streets and squares.

During winter season, 1,019.0 tonnes of solid waste is generated per day in the Ulaanbaatar city, while 507.2 tonnes of waste is generated per day in warm season which is twice as less than winter season. This is due to the ash from the ger areas during the heating period, and it accounts for more than 84% of the total solid waste from the ger area.

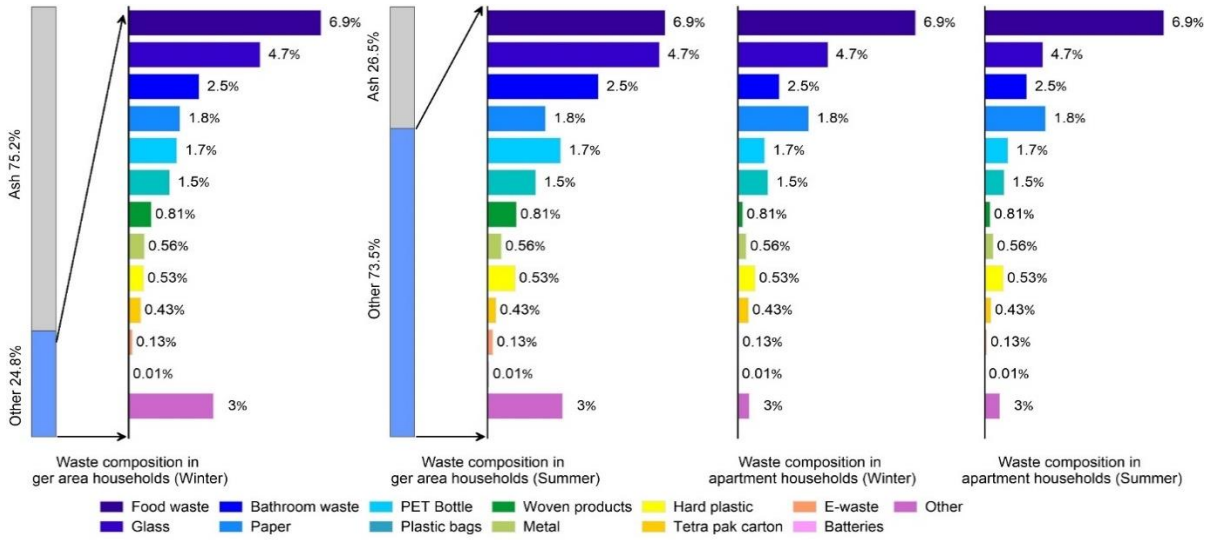
The amount of solid waste produced per resident per day was also determined using data from the residential and residential area population census (Table 1-12).

Table 1-12: Amount of solid waste per resident per day

Classification	By 2005, g/per resident/per day	By 2010, g/per resident/per day
Apartments	256	312
Ger area	163	164
Ger area (ashes only)	788	870
Ger area (total)	951	1,034

Source: JICA, 2011

Another survey of household waste composition in Ulaanbaatar was conducted as a part of the Asia Foundation project on “Waste and Climate Change” in 2019. Figure 1-20 shows the composition of the results of household waste from the above survey.



Source: AF, 2019

Figure 1-20: Composition of solid waste by apartment and by ger area, by seasons

According to the results of the above project, the waste from households living in apartments and ger areas was divided into 13 compounds in 2018. For example, in the winter season, 75% of whole waste was ash, food waste is 6.9%, glass is 4.7%, hard plastics is 3.3% of waste from households living in the ger areas, while in the warm season, ash is 26.5%, food waste is 16.3% and 15.8% plastic bottles account for glass. Regarding households living in apartments, food waste accounted for 36.2%, glass 18.3%, and paper 14% in the winter season, while food waste accounted for 41%, paper 14%, and glass 13.3% in the warm season. As a result of the survey, the ash amount represented 75.2% of the total waste and 26.5% in the summer season. Furthermore, according to the composition of the residential waste collected, 41.0% was food waste from households in summer season, 16% higher than food waste from households in the ger area (AF, 2019).

Waste and garbage were generally dumped in open fields or buried in thin layer of soils, and the control for waste was very weak in most areas of Mongolia. Since 2009, the situation has improved, and waste is starting to be managed in hygienic level II and IV landfills, especially, in Ulaanbaatar city in 2016, as part of the project mentioned above (MOUBC, 2021).

Partial closure of the landfill area of the centralized disposal sites in Ulaanbaatar city is underway during 2020-2021, 16 hectares of Narangiin Enger, 8 hectares of Tsagaan Davaa and a total of 24 hectares were partially closed and rehabilitated. Therefore, the methane emission coefficient of

solid waste in the GHG inventory is calculated as 0.4 (open) and 1.0 (landfill) according to the IPCC 2006 method.

According to Mongolia's "Solid Waste Account", 71% or 2,034,900 tonnes common waste generated in 2019 was buried in landfills, 8.9% or 246,500 tonnes were buried, and 11.5% or 330,500 tonnes of waste were left in an open field or nature in 2019. Only 8.7% or 250.6 thousand tonnes of garbage was reprocessed.

The total recycled and processed waste is classified by flow types as follows: Paper and paper product waste 74.3 thousand tonnes; glass and glass products waste 17.6 thousand tonnes; scrap metal 62.6 thousand tonnes; plastic products waste 28.2 thousand tonnes; construction waste 9.7 thousand tonnes; food waste 3.1 thousand tonnes; electronic waste 0.1 thousand tonnes; automobile parts 1.1 thousand tonnes; while another waste is estimated to be 53.9 thousand tonnes according to the 2019 statistics (NSO, 2021).

In 2021, there are 40 recycling plants and more than 160 waste separating and processing sites with about 1500 employees registered in Mongolia (https://mofa.gov.mn/). Currently, 17 recycling plants actively operate to produce value-added products in eight areas of waste recycling and processing in Ulaanbaatar city (Table 1-13).

Table 1-13: Waste recycling plants

№	Types of Waste recycling plants	Numbers
1	Brown cardboard paper processing plant	3
2	Plastic and plastic bag processing and recycling plant	7
3	Waste Tire Processing and Rubber Plate Factory	1
4	Factory for fuel oil from waste tires and used oil	2
5	Waste battery disassembly and sorting plant	4
6	Factory for steel balls and aluminium ingots(bars) production from the processing of waste fusion and metals	7
7	Fertilizer plant for processing animal waste (manure, dung etc.)	4
8	The plant neutralizes and destroys plastic bags and chemical packaging.	2

Source: MOUBC, 2021

Liquid waste

A total of 57 wastewater treatment plants and facilities are registered in Mongolia out of which 21 in the centre of 21 provinces, 28 in soums and 8 in Ulaanbaatar (BDC, 2021).

Domestic or household and public service wastewater are treated mechanically and biologically by aerobic (open environment) methods in these wastewater treatment plants, and the treatment capacity ranges from 35 m^3/day to 170,000 m^3/day (BDC, 2021).

Figure 1-21 shows the level of treatment of wastewater treatment plants in the provinces of Mongolia.

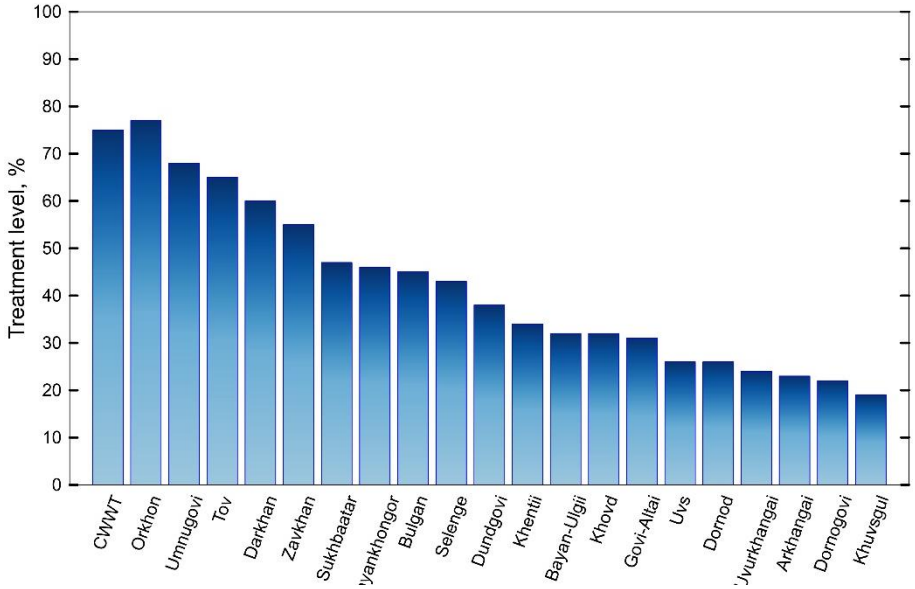


Figure 1-21: Treatment level of sewage water treatment plants by provinces

The sanitary facilities used by the entire population of Mongolia are divided into four categories: connected to a centralized system, independent cleaning and treatment systems, pits, and open.

In general, 27% of the residents of the provincial centre are connected to a centralized sewage treatment plant and 61% use pit latrines (pits). However, in the case of soums, only 37% used the pit latrines.

The share percentage by sanitation facilities types used in 21 province centres, soums, and Ulaanbaatar city is shown in Table 1-14.

Table 1-14: Types of sanitation facilities in urban and rural areas

Types of sanitation facilities	In Ulaanbaatar	In 21 province centres	In soums
Centralized	41%	27%	3%
Individual	1%	1%	0%
Pit latrine	49%	61%	37%
Open	9%	12%	60%

Source: MET, 2019

The Ulaanbaatar City Central Treatment Plant was established in 1963 and is considered a treatment plant with the highest capacity. This treatment plant can treat 170,000 m^3 of wastewater per day. In 2019, 61.18 million m^3 of wastewater was treated mechanically and biologically, meaning an average of 164.4 thousand m^3 of wastewater was treated per day in the treatment plant. Figure 1-22 illustrates the annual variation of wastewater treated at the central treatment plant.

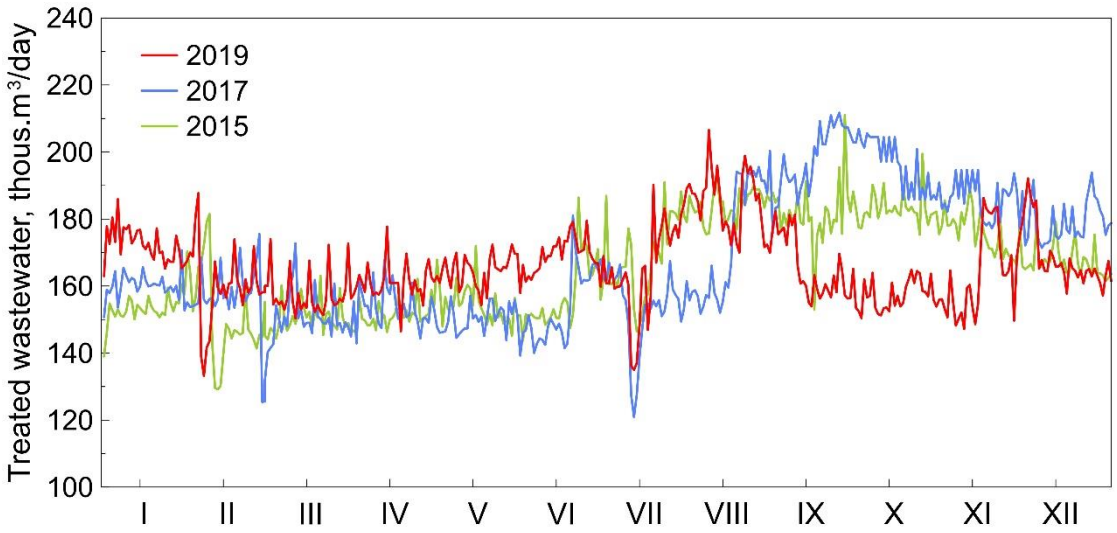


Figure 1-22: The seasonal amount of wastewater treated at the central treatment plant

Figure 1-22 shows the seasonal pattern of treated wastewater at the Central Treatment Plant of Ulaanbaatar. There is seen the effect of national holidays on changes of wastewater.

The maximum amount of treated wastewater increased sharply before the school semester starts in the middle of August, while the next higher amount occurred during the Lunar New Year celebration period (Mongolian national holiday), as shown in 2015 and 2017. At the same time, the lowest values of treated wastewater coincided with long public holidays after major national holidays, such as Lunar New Year and the Naadam festival.

According to the Mongolian Population and Housing Census conducted every 10 years, the number of households in Mongolia was 908.7 thousand, and the number of households in Ulaanbaatar was 414.2 thousand or 54% in 2020.

The total number of households connected to centralized wastewater treatment plant systems increased by 119% (2.2 times) from 124.6 thousand in 2000 to 273.0 thousand in 2020. The total number of households in Ulaanbaatar was 78.7 thousand in 2000 and increased by 159% (2.6 times) to 204.1 thousand households in 2020. Table 1-15 shows the number of households with and without connection to centralized sewage treatment plants and sewer networks.

Table 1-15: Number of households with and without connection to sewage treatment facilities

Administrative units	Status	2000	2010	2020
Mongolia (thous. households)	Connected	124.6	165.4	273.0
	Without connection	416.6	548.4	624.4
Ulaanbaatar city (thous. households)	Connected	78.7	116.1	204.1
	Without connection	82.6	186.1	207.3

Source: NSO, https://www.1212.mn/

Furthermore, according to the results of the 2020 housing census in Ulaanbaatar, 47.8% of the 411.4 households in the capital city are connected to the central sewage treatment plant, 0.7% have facilities that are lined to prevent leakage, 48.2% have dedicated wooden pit latrines and remaining 3.3% have not any facilities (open use).

Industrial wastewater containing organic matter emits methane. Methane emissions were calculated based on the production of meat, milk, and alcoholic beer factories in the report of the project

“Establishing the calculation parameters of GHG emissions and removals under the specific conditions of Mongolia”. The amount of methane emitted varies depending on the type of wastewater treatment and disposal system.

On average, more than 8.2 million heads of livestock are used for food in Mongolia, and about 200,000 tonnes of meat are produced that fully meets domestic needs. More than 55 slaughterhouses were operating in the meat-producing sector in 2020, and 744.5 thousand tonnes of meat were prepared from the animal husbandry sector. 3.4% of the whole-produced meat is processed by domestic meat factories (Table 1-16) (www.mofa.gov.mn).

Table 1-16: Meat processing and meat products in Mongolia

Meat amount (thous. Tonnes)	2010	2015	2020
Meat prepared by the herders, farms	241.1	448.0	744.5
Industrially processed meat and meat products	11.7	12.6	25.8

Source: NSO, https://www.1212.mn/

In Mongolia, there are operating 204 milk and milk product factories and workshops, 77 freezing centres, and 176.2 million litres of milk and milk products were processed by factory methods in 2020 (Table 1-17). Some dairy farms have wastewater treatment facilities, while many factories directly pour wastewater into the central treatment system (Namkhainyam et al., 2014).

Table 1-17: Milk and milk products in Mongolia

Amount of milk and milk products	2010	2015	2020
Milk and milk products prepared by the herders, farms (thous. tonnes)	365.8	874.4	1,082.4
Industrially processed milk and milk products (million litres)	42.0	69.6	176.2

Source: NSO, https://www.1212.mn/

In 2021, there were total of 44 alcoholic beverage factories were operating in Mongolia, including 6 spirits, 12 beer, and 26 vodka. In 2020, 24,350.8 thousand litres of alcohol, 92,802.2 thousand litres of beer, 10,063.7 thousand litres of spirits and 286.4 thousand litres of wine were produced (Table 1-18).

Table 1-18: The amount of spirits and alcohol products in Mongolia

Alcohol products	2010	2015	2020
Alcohol (thous. litres)	20,244.8	21,131.9	24,350.8
Beer (thous. litres)	44,878.5	74,857.2	92,802.2
Spirit (thous. litres)	8,440.1	8,668.6	10,063.7
Wine (thous. litres)	146.9	75.0	286.4

Source: NSO, https://www.1212.mn/

The amount of wastewater and organic matter contained in producing one tonne of products was used in the industries mentioned above in the GHG inventory calculation.

1.3 Institutional arrangement for preparation of Biennial Update Report

The Ministry of Environment and Tourism (MET) is the central state administrative organization in charge of environmental and climate change policy and is the national entity responsible for organizing and coordinating the compilation of the National Communication Reports (NCR) and the Biennial Update Report (BUR) at the policy level and submitting them to the UNFCCC Secretariat.

According to Article 24, Clause 2 of the Law on Air, the MET is responsible for organizing the national GHG inventory and preparing and submitting reports on the implementation to the UNFCCC secretariat.

In 2015, the Ministry of Environment, Green Development and Tourism (by former name) set the Climate Change Project Implementation Unit (CCPIU), which is responsible for researching climate change, preparing reports under the Nature Conservation Fund (name has changed to Environment and Climate Fund since 2017) and the new unit responsible for facilitating the smooth implementation of commitments and submission of national reports to the UNFCCC secretariat.

The Climate Change Project Implementation Unit (CCPIU) has developed the Intended Nationally Determined Contribution of Mongolia (INDC, 2015), the Initial Biennial Update Report (iBUR, 2017), the Third National Communication Report (TNC, 2018) and the Mongolia's Nationally Determined Contribution to the Paris Agreement on climate change (NDC, 2019) in cooperation with the United Nations Environment Program (UNEP) and with the financial support of the other international partner organizations and submitted to the UNFCCC Secretariat in the framework of its main functions and responsibilities.

The State-Owned Enterprise named “Climate Change Research and Cooperation Centre” (CCRCC) was established by Government Resolution under No. 181 of 20 May 2020, and CCPIU as the UNFCCC national reporting team was reassigned under the CCRCC by the order under A/37 of the Minister of Environment and Tourism. This UNFCCC national reporting team serves as the national technical experts to prepare and develop the NCs, NIRs, and the BURs, additionally BTRs in line with the UNFCCC guidances and decisions. In addition, the current arrangement of the preparation of these reports are based on the form of a project with the financial support of the Global Environment Facility (GEF) due to the limited resource allocation for the climate change reporting from the government.

The national reporting team consists of project personnel, national project coordinator and national GHG inventory team carries the same responsibilities as CCPIU which ensures the smooth implementation of the reporting process under the UNFCCC on the national level. Within the scope of its primary functions, one of the main duties of the team is to organize an inventory of GHG emissions in Mongolia along with the resolution of the Convention under a number 20/CP.19 and to develop National BURs of Mongolia using the methodology of the 2006 IPCC guidelines. In addition, the consulting team for the thematic working group to conduct baseline research on measures to reduce GHG emissions in Mongolia following the Law on “Procurement of Goods, Works and Services with State and Local Property Assets” of Mongolia are selected under the supervision of MET.

Chapters and some components of the Initial National BUR submitted to the UNFCCC, such as national characteristics and the financial, technology, and needs of the capacity building carried out by the “Mongolian Water Forum-Water Deal” NGO and components related to measures to reduce GHG emissions developed by the consulting team of the “Ecotycoon” LLC. In the case of the Second National BUR, the consulting team of the “Ecotycoon” LLC has covered topics such as evaluation on reducing GHG emissions in Mongolia, determining and prioritizing cost-benefits, developing potential alternatives to mitigate climate change, and action plans except for GHG Inventory part.

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The MET manages climate change activities and ensures inter-sectoral coordination in developing these reports at the policy level. The structure and composition of the National Climate Committee (NCC) were briefly established by order of the Minister of Meteorology in 2019 to provide interdisciplinary participation and cooperation to ensure the implementation of the UNFCCC, and the Committee became the leading organization responsible for climate change issues, technical management, and interdisciplinary policy coordination. The NCC comprises 21 members and is chaired by the Minister of MET and the Deputy Minister of Energy. The members consist of the Deputy Ministers of the following ministries and the heads of agencies: Deputy Minister of Finance, Deputy Minister of Food, Agriculture and Light Industry, Deputy Minister of Construction and Urban Development, Deputy Minister of Road Transport and Development, Deputy Minister of Mining and Heavy Industry, Head of the National Development Agency, Head of the National Emergency Management Agency, President of the Academy of Sciences, Special Envoy for Climate Change, and other representatives from MET, Ministry of Health, Heads of Departments of the Ministry of Education and Science, representatives of the Governor office of the Capital City, the Mayor’s Office of Ulaanbaatar City, NAMEM, and IRIMHE. Also, it includes some representatives of non-governmental organizations.

The newly formed Mongolian Government in 2016 gave vital importance to the issue related to climate change and expanded the Department of Foreign Relations of the MET and established the Department of Climate Change and International Cooperation (DCCIC). According to Government Resolution No. 71 dated 25 August 2020, which approved the operational strategy, organizational restructuring program, and vacancy limits of the MET, and within this restructuring, the DCCIC was renamed as the Climate Change Department (CCD). The head of the DCC works as the National Director of the projects for developing the National Communication Reports and the BURs, which ensure the Implementation of the UNFCCC in Mongolia (Figure 1-23).

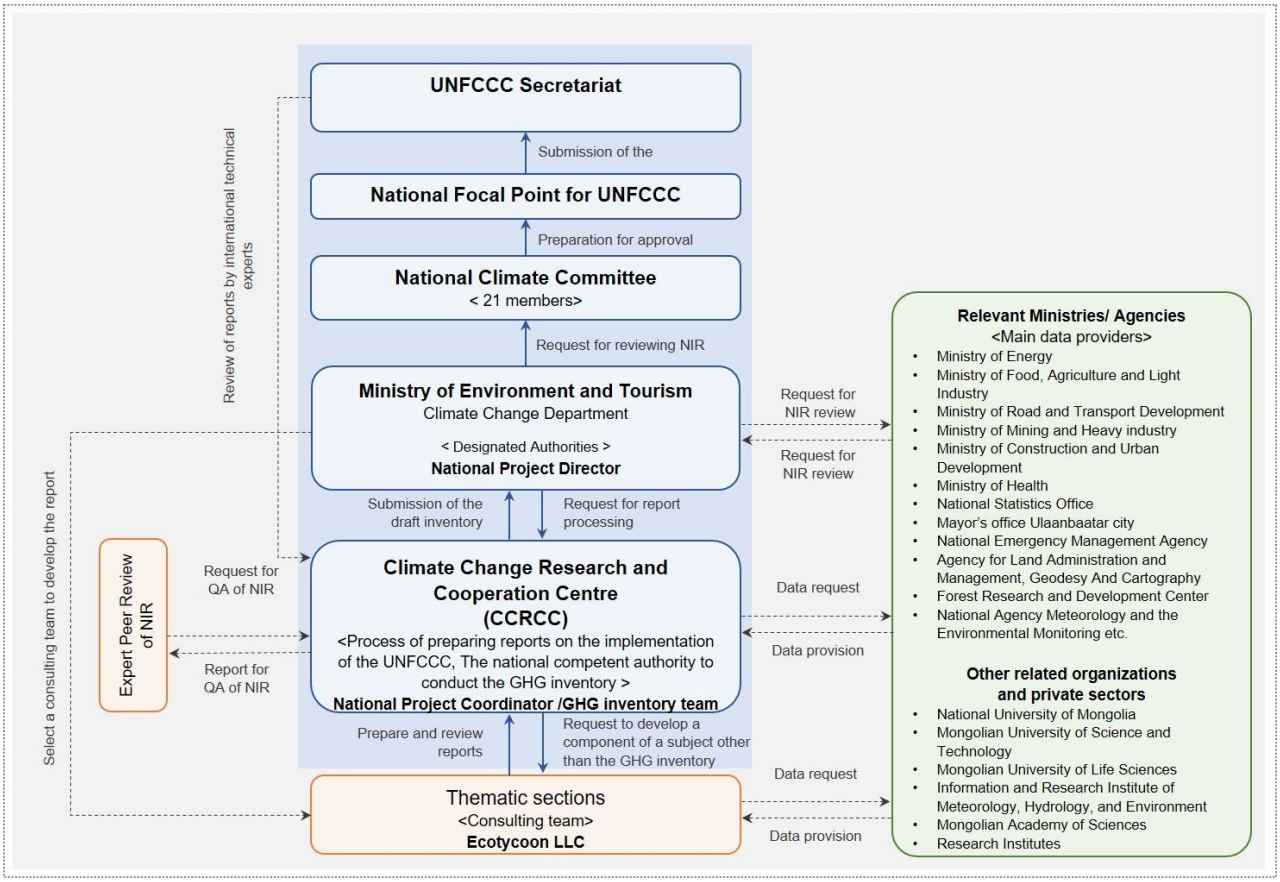

Figure 1-23: The institutional arrangements for compiling the second BUR

National GHG inventories are monitored by a third party or an independent national expert performing quality assurance (QA). In 2017, the National Inventory of GHG was submitted to the UNFCCC only after a review by an independent consultant. The National QA Consultant, by reviewing the entire inventory, also verifies the data's quality, completeness, and accuracy. The second review and verification were carried out by international experts appointed by the UNFCCC for the monitoring and analysis; for example, the Initial Biennial Update Report was analysed by the International Consultation and Analysis (ICA) for six months, from December 2017 to June 2018. During the inspection by the international technical experts, the technical team cooperated with the members of the consulting team that developed the BUR and the experts who conducted the national GHG Inventory by answering questions via email and online meetings with the technical team. In addition, the iBUR was presented to the Multistakeholder Exchange of Views during the 24th Conference of the Parties, which hold in Katowice. The technical summary of international technical experts on the iBUR of Mongolia was published on the UNFCCC website in June 2018.

Finally, the "National Committee on Mitigation of Climate Change and Desertification" was established by Government Resolution No. 333 on 20 October 2021, with a proposal of an extension of the framework of the Climate Change issues, and the general composition of the Committee was approved. The National Committee on Mitigation of Climate Change and Desertification is responsible for organizing and monitoring the implementation of the "Billion Trees" national campaign at the national level as well as responsible for ensuring the Paris Agreement of the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification, and coordinating inter-sectoral coordination of land degradation reduction.

The head of the above National Committee is the Prime Minister of Mongolia, the deputy's head is the Minister of Environment and Tourism and the Head of the Presidential Office. The Secretary of the National Committee shall be the Deputy Head of the Cabinet Office, the Head of the Department of Desertification and Land Degradation of the Ministry of Environment and Tourism. Members: Chairman of the Standing Committee on Environment, Food and Agriculture of the Parliament; Head of the lobby group on desertification reduction of the Mongolian Parliament of Mongolia, member of the State Parliament (by agreement); Minister of Defence; Minister of Education and Science; Minister of Construction and Urban Development; Minister of Road and Transport Development; Minister of Food, Agriculture and Light Industry; Minister of Mining and Heavy Industry; Governor of Ulaanbaatar city; Senior Advisor to the President of Mongolia (by consensus); Advisor to the Prime Minister of Mongolia on Environmental and Green Development Policy; Environmental and Green Development Policy Adviser to the Prime Minister of Mongolia; Deputy Minister of Foreign Affairs; Deputy Minister of Justice and Internal Affairs; Deputy Minister of Finance; Head of the National Agency for Emergency; Head of National Agency for Meteorological and Environmental Monitoring; Head of Water Agency; President of the Academy of Sciences (by consensus); it has a total of 20 members, including the deputy head of the General Department of Professional Inspection.

The Gold Standard Foundation provided technical assistance focused on creating a national system of Measuring, Reporting, and Verification (MRV) to make transparent the Nationally Determined Contribution (NDC) of Mongolia to the Paris Agreement with the financial support of the Danish Government in 2021.

The following recommendations are made to improve the structure and organization of Mongolia further using the above assistance (Table 1-19). Where:

1. Train and improve capacity building to increase human resources and mobilize resources to strengthen relationships and cooperation between the MET, the Climate Change Research and Cooperation Centre (CCRCC), and other ministries and agencies. Additionally, appoint vacancies or specialists responsible for climate-related issues in each relevant ministry and agency.
2. To secure sustainable and long-term financial costs in the state budget to create the conditions for retaining specialists and experts for developing and delivering reports and presentations on time under the obligations assumed by the Paris Agreement.
3. Obtain financial support from the Green Climate Fund, the World Environment Fund and bilateral and multilateral development financial institutions to strengthen capacity building, develop electronic systems, and conduct research studies.
4. Improve and develop the NDC Platform-52 and create a unified (integrated) electronic system of the NDC in terms of technology and use it as a unified information management system to provide a transparent system that meets the requirements of the Paris Agreement.
5. Additionally, the quality control and quality assurance plan were approved, and the revised structure and organization of the measurement, reporting and Verification (MRV) system followed the National GHG Inventory process and planned to reinforce the roles and responsibilities of the stakeholders.

Table 1-19: Duties and responsibilities of structural and organizational stakeholders

Responsible bodies/Stakeholders	Duties and responsibilities	Note
Ministry of Environment and Tourism	Having specialized coordinators in the field of transparency on climate change issues, the coordinators should work closely with multistakeholder organizations, identify the needs of the parties, provide methodology and support, monitor the implementation progress, goals and measures, and should be responsible for evaluating and developing improvement plans for implementation of MRV system and results of the process	For interdisciplinary coordinators and facilitators for the implementation of measurement, reporting, and verification (MRV) systems
Climate Change Research and Cooperation Centre	Continuously strengthen the capacity building of the organization and personnel and then provide multilateral stakeholders with data and information, providing professional and methodological guidance and training climate change coordinator experts in sectoral ministries and other government organizations.	The core or principal contractor of the National Measurement, Reporting, and Verification System Develop and approve the Transparency Report preparation process, related forms, and methodologies, including data collection, integration, and analysis, and implement and investigate at the national level.
National Statistical Committee	The primary responsibilities are to obtain and provide from the relevant parties related data and information required for the National GHG Inventory and Transparency Report to the Climate Change Research and Cooperation Centre" (CCRCC) and to conduct after-quality control in accordance with the international methodology on time.	It is necessary to carry out a readiness study on data and information in cooperation with the Climate Change Research and Cooperation Centre (CCRCC) and to determine the need for data information and, based on this study, if necessary, to make decisions on a collection of new data, on the development of methodologies and forms for use.
Ministries and other government agencies	It is responsible for submitting the report on implementing the target action plan of the Nationally Determined Contribution (NDC) to the Paris Agreement to the MET within a fixed period.	The report will include key performance indicators to track the NDC's goals and identify the needs and requirements for international support and assistance.
Information and Research Institute for Meteorology, Hydrology and Environment	Responsible for monitoring and managing data and information related to climate change and adaptation issues in Mongolia	The IRIMHE will support evidence-based planning by conducting climate change risk, vulnerability, and impact studies in collaboration with the Joint Research Team on Adaptation.
Joint Research Team	Conduct research studies on mitigation and adaptation to climate change determined by the Government according to international methods.	It is necessary to establish two new research teams within the two areas of adaptation and mitigation and to support the continuous improvement process to strengthen the National MRV system further. The research

		teams will be part of the Climate Change Research and Cooperation Centre (CCRCC) and will further work closely together, the quality of research on climate change will be improved, and it will be possible to achieve optimal planning and practical results at the national level.
National Committee on Climate	Responsible for approving and verifying the national reports and Reports to be submitted to the UNFCCC Office.	Authorizes the obligations and responsibilities of the parties involved in the MRV system and monitors its implementation, and in accordance with a resolution of the National Committee for Climate, the MRV system is to be enforced on time.

1.4 Identification of barriers in the structural and organizational areas, assessment of gaps, and the needs for financial, technical, and capacity building

The Government of Mongolia signed the UNFCCC on June 12, 1992 at the Rio Conference and the Parliament of Mongolia ratified it on September 30, 1993. The Government of Mongolia ratified the Kyoto Protocol on 15 December 1999 and signed the Paris agreement on April 22, 2016 and ratified September 21, 2016. The National Communication Reports have been submitted three times in 2001, 2010 and 2018; the National initial BUR was submitted in 2017, the Intended Nationally Determined Contribution (INDC) of Mongolia to Mitigate Global Climate Change was issued in 2015 and finally, the 2nd document of Nationally Determined Contribution Target (NDC) for the implementation of the Paris Agreement to the UNFCCC in 2020. Many projects are being implemented in cooperation with international donor organizations and foreign countries in preparing the above reports, reducing GHGs, capacity building, and different technical assistance.

The Green Climate Fund was established in 2010 to provide financial support and technical assistance to developing countries to implement the UNFCCC.

Mongolia actively cooperates with the Green Climate Fund, proposing and implementing projects and programs to solve climate change issues in accordance with the goals of sustainable development. Similarly, related national authorities in Mongolia and national coordinators are working with national, regional, and accredited international organizations with the support of the Green Climate Fund.

Currently, there are two organizations at the national level that have been authorized to receive funding from the Green Climate Fund in Mongolia. These include: (i) XacBank – which has accreditation rights to attract financing for small projects and programs up to 50 million USD, and (ii) Trade and Development Bank – which has accreditation rights to attract financing for medium-sized projects and programs up to 250 million USD. In addition, Mongolia closely cooperates with other international organizations that have the right to receive funding from the Green Climate Fund, such as the United Nations Environment Program (UNEP), the United Nations Development Program (UNDP), the Asian Development Bank (ADB), and the European Bank for Reconstruction and Development (EBRD).

The Green Climate Fund has approved 20 large, small, national, and regional projects, and programs in Mongolia, with total funding of 436 million USD from 2015 to the first quarter of 2022. Additionally, more than 1 billion USD in funding through these projects and programs are being raised from other parties. The projects and programs approved by the Green Climate Fund for implementation in Mongolia include the following:

- Capacity building – 8 projects,
- Research projects in the field of project preparation – 2 projects,
- Investment – 7 projects,
- Regional investment – 3 projects and programs are included.

Table 1-20 shows the list of the total investment projects currently approved and implemented in Mongolia. 6 of these projects aim to mitigate climate change, and the expected reduction of total GHG emissions will be 126.07 Mt CO_2e.

Table 1-20: Approved and funded projects by the Green Climate Fund

#	Project title	Project type and objective	Expected GHG emission reduction. (Mt CO_2e)	Funding types	Funding by Green Climate Fund (USD)	Trusted organization (Implementing period)
1	Small and Medium Business Loan Programs to reduce the GHG emissions	Independent; Climate Change Mitigation	1.2	Grants and soft loans	20 mil. (loan: 19.5 mil., grants: 0.5 mil.)	XacBank (2017-2022)
2	Renewable energy program 1 (Construction of a 10 MW solar power plant in Sumber sum, Gobi-Sumber region)	Independent; Climate Change Mitigation	0.3	Equity and soft loans	8.6 mil. (loan: 8.6 mil.)	XacBank (2017-2029)
3	Ulaanbaatar green affordable Housing and resilient Urban Renewal Project (AHURP)	Independent; Change Mitigation and Adaptation	7.9	Equity, grants, soft loans,	145 mil. (loan: 95 mil., grants: 50 mil.)	ADB (2018-2027)
4	Energy Efficient Consumer Credit Program		0.469	Grants, soft loans,	10.0 mil. USD. (loan: 9 mil. grants: 1 mil.)	XacBank (2018-2029)
5	Improving the adaptability of rural people in Mongolia and risk management to climate change	Climate Change Adaptation	-	Equity, grants	23.1 mil. USD (grants: 23.1 mil.)	UNDP (2021-2028)
6	Mongolian Green Finance Corporation (MGFC)	Climate Change Mitigation	3.8	Equity, grants, soft loans,	(stock: 5 mil., loan: 20 mil., grants: 2 mil.)	XacBank (2020-2026)

7	Mongolia: Aimags and Soums Green Regional Development Investment Program (ASDIP)	Resolving the Problem of pasture degradation and Reduction of pasture capacity in Mongolia	112.4	Equity, grants, soft loans	175 mil. (grants: 45 mil., loan: 130 mil.)	ADB (2021-2031)
	Total		126.07		408,751,326	

Source: Batjargal Z., 2022

Some examples of some projects and programs: XacBank is successfully implementing the project aimed at introducing energy-efficient, low-carbon technologies and renewable energy to micro, small, and medium-sized businesses by attracting 20 million USD from the Green Climate Fund and 40 million USD from other sources.

Another example is the Asian Development Bank (ADB) project named the construction of eco-districts with 10,000 apartments in Bayankhoshuu and Selbe areas within the framework of Ulaanbaatar green affordable Housing and resilient Urban Renewal Project (AHURP), and these projects attracted 145 million USD from the Green Climate Fund and more than 470 million USD of additional funds from other sources.

Regarding regional projects, the reduction of total GHG emissions of the countries involved in the three projects implemented in Mongolia at the regional level is 93.1 Mt CO_2e, according to preliminary estimates. Table 1-21 provided information on the amount of funding and expected reduction from GHG emissions of the mentioned projects.

Table 1-21: Regional projects with investment and approval by the Green Climate Fund

#	Project title	Project type and objective	Expected GHG emission reduction (Mt CO_2e)	Funding types	Funding by Green Climate Fund (USD)	Trusted organization (Implementing period)
		Total amounts applicable to countries where the projects are implemented.				
1	Sustainable Energy Financing Project (10 countries)	Mitigation of climate change on a regional scale	27.5	Grants and soft loans	Total: 1,400,000,000 Joint: 1,007000,000 From GCF: 344,000,000 – loan 34,000,000 – grants	European Bank of Reconstruction and Development / EBRD (2016-2033)
2	Green City Facility (9 countries)	Climate Change Mitigation and Adaptation on a regional scale	11.9	Grants, soft loans, and others	Total: 303.200,000 Joint: 201,172,332 From GCF: 76,201,641 – loan 25,791,324 – grants	European Bank of Reconstruction and Development / EBRD (2018-2034)
3	Climate Investor (18 countries)	Mitigation of climate	53.7	Equity and grants	Total: 821.500,000	Dutch Development

		change on a regional scale			Joint: 721,500,000 From GCF: 100,000,000 – grants	Bank /FMO (2018-2039)
4	Total		93.1			

Source: Batjargal Z., 2022

Table 1-22 shows the list of projects that international organizations are implementing in Mongolia for GHG emission reduction, capacity building, and technical assistance within the framework of cooperation with foreign countries.

Table 1-22: Projects for GHG emission reduction, capacity building and technical assistance

No	Project title	Implementing organizations and period	Funding organization, Budget	Objective	Purpose of the project
1	Strengthening the capacity building of agriculture and land use sectors to improve the transparency of implementation and monitoring of Nationally Determined Contribution (NDC) under the Paris Agreement	FAO, (2019-2022)	GEF 863,242 USD	To meet the goal of reporting the implementation of the Nationally Determined Contribution (NDC) of Mongolia under the Paris Agreement and The UNFCCC from 2020,	Strengthening of capacity building
2	"Ensuring tolerance and stability of Mongolia's native nature" project	MET, MOFALI UNDP (2018-2025)	GEF-grants, 7,900,000 USD	It aims to improve ecosystem services by reducing the degradation of pasture and forest resources and protecting biodiversity through sustainable livelihoods in the Sayan, Khangai mountains, and the Southern Gobi region.	Mitigation of ecosystem degradation
3	Sustainable Landscapes and Biodiversity Conservation of the Eastern Mongolian Dry steppe	Food and Agriculture Organization of the United Nations, WWF (2021-2026)	GEF 5,354,586 USD	Based on the participation of parties to the integrated level of the land and the market-value network, the aim is to reduce the degradation of ecosystems in arid regions and prevent the loss of biological diversity by supporting nature conservation and	Mitigation of ecosystem degradation

No	Project title	Implementing organizations and period	Funding organization, Budget	Objective	Purpose of the project
				sustainable and adapted livelihoods of local people in the steppe region of eastern Mongolia. The project has the following 3 main components. These include: 1. Creating a favourable legal environment for sustainable management of arid regions 2. To improve sustainable land management in the eastern steppe zone of Mongolia. 3. To improve the protection of biological diversity and territorial integrity.	
4	Development of the Fourth National Communication Report and Second BUR on the Implementation of the UNFCCC	MET, UNDP (2019-2022)	GEF 946,666 USD	According to the decisions of 17/CP8 and 2/CP.17 issued by the Conference of the Parties and other guidelines and instructions, to develop and prepare the Fourth National Communication BURII and submit it to the Office of the UNFCCC	Provide support to activities
5	Strengthening a national capacity-building project to improve climate-change adaptation planning processes	MET (2019-2022)	GCF UNEP 2,890,000 USD	The project aims to strengthen the institutional and technical capacity of the parties involved in improving the climate change adaptation planning process at the national and local levels.	Strengthening of capacity building
6	“Regional project “Waste and Climate Change”	MET (2017-2022)	Government of Germany, UNEP-IETC	Strengthening the capacity of policymakers and implementers to	Strengthening of capacity building

No	Project title	Implementing organizations and period	Funding organization, Budget	Objective	Purpose of the project
			168,705 USD	reduce GHG emissions from waste and short-lived pollutants that affect climate change in Mongolia, Bhutan and Nepal based on the concept of a zero-waste economy	
7	“Prevention and Reduction of Sand and Dust Storms Caused by Dry Regions of Mongolia”	FAO (2019-2022)	UNCCD 564,000 USD	Create a sustainable land management to reduce the risk and impact of sand and dust storms	Strengthening of capacity building
8	“Contributing to Ecosystem Conservation by Supporting Specially Protected Areas” (SPACES) Project	GIZ, MET (2019-2024)	The EU, BMZ, grants 10,830,000 Euros	The primary conditions for the sustainable development of specially protected areas have improved.	Strengthening of capacity building
9	Agricultural Management and ecosystem sustainability (stream) project	FAO, MET, MOFALI (2021-2024)	The European Union 1,650.000 Euros	To solve the problems faced with the food system and climate change in Mongolia and increase the capacity for landscape management through innovative, sustainable approaches.	Strengthening of capacity building
10	Joint Crediting Mechanism	Secretariat of JCM, Ministry of Environment of Japan (2013-2030)	Government of Japan 2,500,000 yens.	Mongolia and Japan signed an agreement to establish the “Low Carbon Development Partnership” to mitigate climate change and reduce GHGs. On 8 January 2013, this project intended to contribute to the efforts of the global community and countries to reduce GHG emissions.	Strengthening of capacity building and technical assistance
11	Development Program in the Forestry sector	MET (2021-2023)	Japanese Fund on reduction of poverty and	Increase the sustainability and productivity of the forest sector in Mongolia by	Technical assistance

No	Project title	Implementing organizations and period	Funding organization, Budget	Objective	Purpose of the project
			ADB 779,000 USD	providing technical assistance	
12	Mongolian Korean "Green Wall" project	"Green Wall" project (2022-2026)	Forest Agency of the Republic of Korea 1,718,484 USD (per year)	1. To give the Mongolian Government the forested areas and strips in several phases over five years 2. Establishment of a city forest garden in Dambadarjaa Park which belongs to the Forest Research and Development Centre (FRDC) of the MET 3. Maintenance and protection of forest strips against desertification	Afforestation

Due to the lack of legal, structural, and organizational environment, human resource capacity, technology, and financing have faced constraints and obstacles during preparing the reports and implementing measures to reduce GHG emissions. In addition, the weak legal environment, management, and unified coordination and regulation are much affected (TNC, 2018).

The following challenges and difficulties related to financial and economic opportunities, advanced technical technology, and human resources can be identified in implementing the goals and objectives of policy documents on climate change in Mongolia. These are listed as follows:

- Insufficient and inadequate action planning for the implementation of laws and legal policies on climate change,
- The results and outputs of research studies on the future trends of climate change, its potential risks and impacts, and the implementation of countermeasures are not integrated,
- The sufficiency and sustainability of financial resources to address climate change issues are inadequate,
- Inadequate technical support and lack of knowledge, skills, and expertise,
- Strengthen availability and capacity for measures and actions against climate change,
- Uncertainty in the status of systems supported by national and international conventions for action against climate change,
- Reconsider effective inter-agency coordination on continuous preparation of national reports on climate change,
- Insufficient human and technical capacity to develop project proposals for submission to the Global Climate Fund and other international climate funds,
- Weak Integration and Coordination of national, regional and Sectoral Planning of programs which address climate change challenges,

- Previous reports have also indicated that there is limited and weak coordination between government ministries and agencies, international funding organizations, and project implementation organizations.

Mongolia continuously has been incorporating GHG emission reduction measures into national programs, legislative bases, and documents. The most recent and main policy documents are the Government program “Vision - 2050” and the Nationally Determined Contribution (NDC). The above documents and reports show the barriers, constraints, gaps, and financial, technical, and technological needs in implementing GHG emission reduction measures in Table 1-23.

Table 1-23: Issues encountered in the implementation of measures to reduce GHG emissions

Barriers	Gaps	Financial needs	Technology needs
Insufficient and inadequate action planning for implementation and requirements of laws and legal policies on climate change Lack of financial resources for implementing measures to reduce and mitigate the negative effects of climate change. Inadequate technology and human resources Weak governance, financing, implementation, and intersectoral coordination Lack of legal and policy implementation and planning for measures to mitigate climate change Uncertainty in the implementation analysis and conclusions of the studies on the possible impact and future trends of CC, measures on climate change mitigation, Climate change issues are not explicitly addressed in national or sectoral development plans and programs. Inadequate financial leverage, lack of funds and financial resources, uncertain macroeconomic environment The political situation is unstable (high risk for investors), lack of government control over the implementation and enforcement of the legal framework	Currently, Mongolia does not have a specific law on climate change that regulates interdisciplinary and national activities to solve problems related to climate change. Basic concepts, principles, and legal regulations on climate change are not clearly reflected in the primary national development policy documents. The participation of parties at the sector level is unclear in legal documents. Have not yet formed a transparency system. There is no such system that measures and reports the implementation of the NDC transparently. It is necessary to create a national system for the implementation of policies and measures aimed at reducing climate change Carbon market development is weak	Directing climate finance to priority sectors for the implementation of the NDC objectives To build their internal capacity, sectors can rely on their resources to receive long-term external support. Disclosure of financial flows A total of 11.5 billion USD was needed to be allocated for the implementation of the NDC goals. USD 6.3 billion is needed for mitigation measures. USD 5.2 billion is needed for adaptation measures. 80% will be financed by foreign loans, aid, and other investments, and 20% by the state budget and other revenues and sources.	Technologies for the Use of Renewable Energy Sources Technologies to improve the efficiency of electricity and heat production. Introduction of Energy-Effective Technologies in the industry Increase the heat retention capacity of the building. Introduction of Electric Vehicles Fuel Quality Improvement and replacement Improve the processing of livestock manure. Protection against soil damage and erosion

Sectors	Barriers	Gaps	Financial needs	Technology needs
Energy	Inadequate laws and regulations Policy succession and continuity are lost. The cost is high. The source of the funding is uncertain. Technological backwardness and extensively dependent on imports Free-market competition is weak and low. There is a lot of government involvement, and the free-market mechanism has not been introduced.		2,800.0 billion MNT to increase renewable energy sources. 1400.0 billion MNT to improve production efficiency. 3080.0 billion MNT for the construction of a large new source of clean energy with high technology To increase the efficiency of energy consumption: • Industry 1,120.0 • Building 840.0 • Transport 980.0 billion MNT • The amount of necessary investment in the energy sector is estimated to be 10.22 trillion MNT (NDC).	• Use energy-efficient technologies and low-carbon energy sources • Clean coal technology and clean fuel production • Construction of a combined coal-gas thermal power plant • Increasing renewable energy sources • Construction of a large new source of clean energy with high technology
Agriculture (Arable farming)	Agricultural areas have overlapped with livestock pastures. Crop production is extremely dependent on nature and climate conditions	Abandonment and loss of farmland due to poorly planned farming and inappropriate land use The transparency of government support to farmers is weak and unclear	2,520 billion MNT are needed for the measures taken in the agriculture sectors (agriculture and livestock) (NDC).	• Introduction of advanced tillage technology in cultivated and fallow areas • Increase the type of cultivated plants and the recurrence of planting • Introduction of drip irrigation system to reduce water loss
Agriculture (Livestock)	The number of headstocks has exceeded the carrying capacity of the pasture. Weak pasture management Poor pasture	Improve legal regulations for pasture use Establishing a pasture use tax system Appropriate use of pastures, monitoring and increasing community participation (TNC)		• Create an early warning system to prevent livestock loss due to dzud and drought • Improving the quality, breed, and stock of livestock

	watering The methods and techniques used, and processing animal manure are weak. Animal disease outbreaks are high			• Development and improvement of livestock management to prevent infectious animal diseases • Mitigation of pasture degradation
Forest	Degradation of forests (forest fires, pests, illegal logging)	Irrigation system for forest plantation forest Lack of forest professionals, capacity building	840.0 billion MNT (NDC)	• Introduction of planting technology. • Use of aircraft to fight forest fires • Introduction of biological technology against insects and pests • Improving the efficiency of forest clearance technology
Industry	There is a lack of technology that reduces GHGs. The processing industry is not yet much developed	Industrial Complex	23 million USD (TNC)	Formation of a pre-treatment system in the industrial sector
Waste	Separation of waste by Types and sources unaccustomed Weak management of open waste disposal at sites Inadequacies and discrepancies in data and information	Improving the legal framework for incentive systems related to waste reduction. Public Awareness, Training, and promotion Introduction Recycling System Recycling of Ash	1,400 billion MNT (NDC)	Eco Park construction technology Water-saving technology Gray water use Technology to Improve the capacity and efficiency of wastewater treatment plants and facilities

The main constraints and barriers in preparing Mongolian reports are the lack of clear legal documents that reflect intersectoral coordination and participation of parties and the absence of a transparency system. It includes:

- There is no unified assessment method for evaluating GHG emission reduction and adaptation measures, the reference values of international experiences and methods are mainly used for the inventory of GHG emissions, and there is a lack of research on improvement and development of own values.
- Systems for including information on climate-relevant measures in the national GHG inventory and verifying inventory results have yet to be formed.

- Quality assurance and quality control are weak.
- There is no unified national methodology for assessing vulnerability, risk, and impact of climate change, data processing, risk estimation in economic and financial sectors, reduction of GHG and double benefits.
- Lack of qualified personnel to perform specific tasks.

There is a clear priority, and it is necessary to improve the interdisciplinary management structure to manage these activities, focus funding on the priority sectors of the NDP goals, clarify the sources of funding, strengthen human resource capacity, create qualified and professional human resources in relevant ministries, agencies, and professional organizations, and increase public awareness of direct and double benefits of climate change mitigation and adaptation measures and GHG emission reduction measures in the near future.

Due to the use of raw coal, the primary source of GHGs in Mongolia is the energy sector. The demand for heat and electricity increases dramatically in the cold season, and raw coal consumption will increase accordingly.

At the same time, Mongolia has enough renewable energy sources such as water, solar and wind to introduce clean, low-carbon technologies. However, costs increase depending on the import of expensive technologies.

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CHAPTER 2

National Greenhouse Gas Inventory

CHAPTER 2: NATIONAL GREENHOUSE GAS INVENTORY

2.1 National Greenhouse Gas Inventory System

2.1.1 Overview of Institutional arrangements for compiling GHG inventory

Mongolia's Second National Inventory Report (NIR) has been prepared as part of second Biennial Update Report. The NIR contains updated information on net greenhouse gas (GHG) emissions estimate for the period of 1990-2020.

According to the Article of the Law on Air of Mongolia (1995; 2012), the legal basis for the greenhouse gas inventory is regulated as follows: "The national inventory of greenhouse gas emissions and removals will be organized by the Bureau in accordance with the methodology approved by the Conference of the Parties to United Nations Framework Convention on Climate Change (UNFCCC)". At national level, the Ministry of Environment and Tourism (MET), the central government body responsible for the development and implementation of climate change policies, and liaises the national, subnational, and local as well as international stakeholders. Thus, the MET and its Climate Change and International Cooperation Department (CCICD) are the national entities with overall responsibility for organizing and coordinating the compilation of National Communications, Biennial updated reports, GHG inventory and submitting them to the UNFCCC Secretariat through the National focal point for the UNFCCC. In order to facilitate smooth implementation of commitments under UNFCCC, the MET established climate change project implementing unit (CCPIU) at the Environment and Climate Fund (ECF) under the ministry in 2015. Since its establishment the CCPIU has prepared and submitted the Third National Communication, Initial Biennial Update Report, Intended Nationally Determined Contribution to the 2015 Agreement, Nationally Determined Contribution to the Paris Agreement and other climate change related reports.

Since May 2020 the Climate Change Research and Cooperation Centre (CCRCC) has been established by the Cabinet based on functions of former CCPIU. Although the CCRCC was established as a self-financing state-owned enterprise, the former project unit, the CCPIU, is still fully operational with old staff and preparing reports for the implementation of the UNFCCC. The CCPIU is currently preparing the Fourth National Communication, National Inventory Report, and Second Biennial Update Report. The inventory team of CCPIU, which consists of four sectorial experts, with the cooperation of relevant ministries, agencies and organizations, prepares national GHG inventory and compiles supplementary information.

Figure 2-1 shows the overall institutional arrangement for Mongolia's GHG inventory preparation. More detailed information on the role and responsibility of relevant ministries, agencies and organizations in the inventory preparation process is described in the Table 2-1.

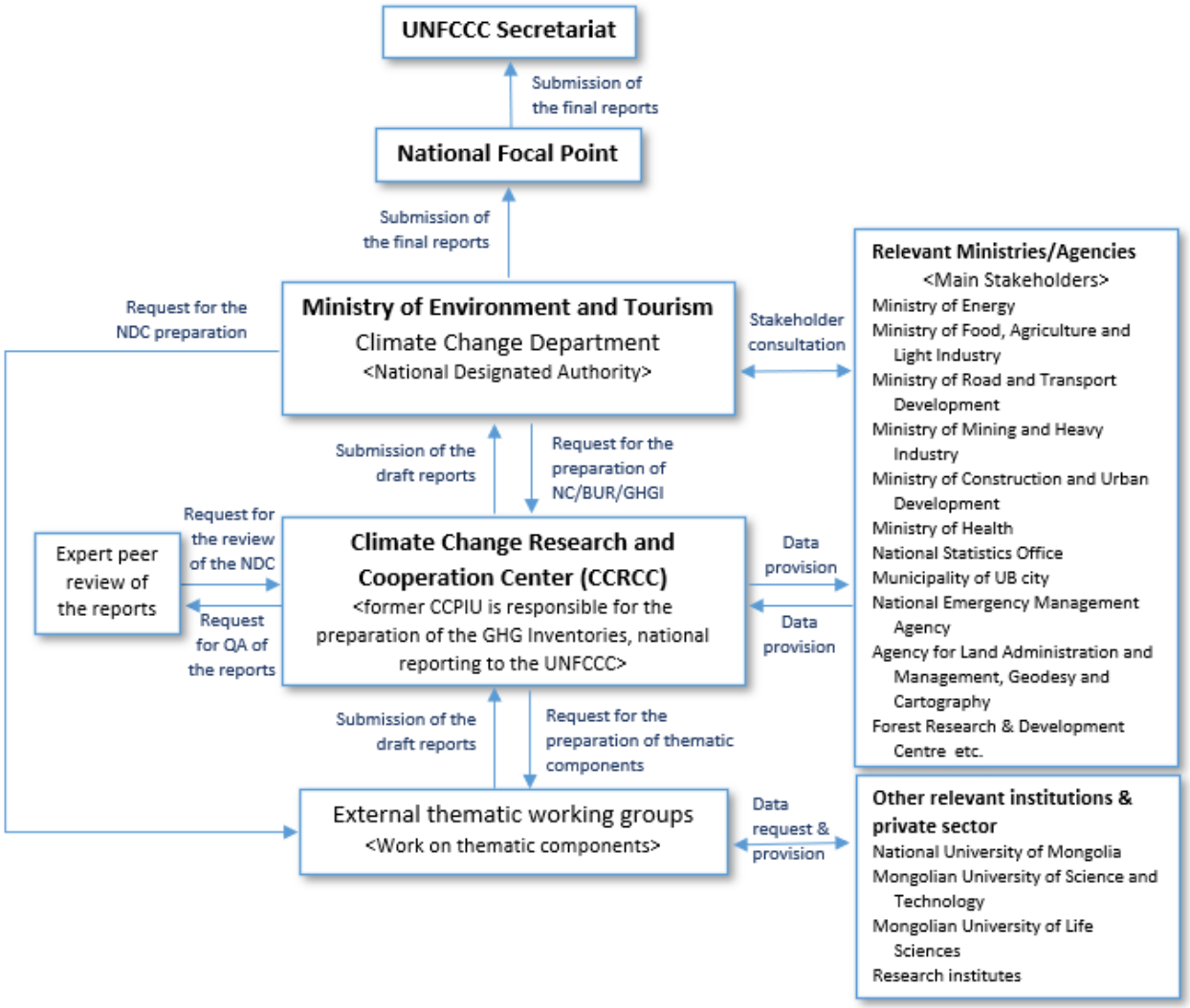

Figure 2-1: Institutional arrangements for preparation of the national GHG inventory and national reports to the UNFCCC

Conducting the GHG inventory is a challenging task, which requires technical knowledge of the UNFCCC reporting requirements and IPCC methodologies, and other varying technical and analytical skills. In Table 2-1, the roles and responsibilities, and required capacities of the main stakeholders engaged in the GHG inventory process are presented.

Table 2-1: Roles, responsibilities, and capacities required for GHG inventories

Individuals/Entities	Roles and responsibilities	Staff capacities required
National focal point	- Submission of the GHG inventory - Communication with UNFCCC	- Knowledge about the UNFCCC procedures and reporting guidelines/requirements
Ministry of Environment and Tourism	- Coordination with the stakeholders - Coordination of Steering Committees - Organization of the wider consultations - Submission of draft reports to	- Knowledge of the UNFCCC reporting requirements including MRV and ETF - Capacity to coordinate and facilitate the stakeholder consultations

	stakeholders for comments and feedback	
CCPIU	- Overall supervision of GHG inventory development - Management of contracts and delivery of GHG inventory - Collaboration with various stakeholders - Identification of necessary resources to improve the inventory - Undertake ICA process	- Technical and administrative expertise, - Technical knowledge of the UNFCCC reporting requirements and IPCC methodologies - Capacity to coordinate and lead the process
Data providers	- Collecting GHG inventory related sectorial data and analysis - Timely delivery of data in appropriate format - Providing the review and recommendation on the inventory report - Communication with a lead institution/GHG inventory expert	- Understanding of UNFCCC reporting guidelines, including MRV and ETF, and IPCC methodologies - Technical skills to analyze, process and archive data
Independent entity/individual	- Conducting quality assurance (QA) activities by reviewing the reports, estimation methods, activity data, emission factors, and other items in national inventory	- Technical skills to review the GHG inventory - Technical knowledge of the UNFCCC reporting requirements, including MRV and ETF, and IPCC methodologies
GHG inventory team	- Coordination with lead entity to prepare the GHG inventory - Scheduling of tasks and responsibilities - Collecting data, estimating GHG emission, inventory management, planning, improvement - Undertake research, data collection, calculations, drafting, QC, archiving, and documentation - Data analysis, processing and reporting - Checking the transparency, accuracy, comparability, completeness, and consistency data and methods - Identification of areas to improve GHG inventory data quality - Coordinate with other sector experts to identify and resolve cross-sectoral issues - Conduct QC activities and	- Technical knowledge of the UNFCCC reporting requirements, including MRV and ETF - Technical expertise in IPCC methodologies and software - Technical knowledge of inventory sectors - Technical skills to analyze, process and archive data - Skills in report writing

			crosscheck data - Overall QA/QC coordination and/or overall data and document management - Conduct key category analysis, uncertainty analysis and identify trends - Combine sector experts' work into a cohesive inventory product - Facilitate the international consultation and analysis (ICA) - Communication of GHG inventory results to national statistics for publication

2.1.2 Overview of inventory planning, preparation and management

Currently the preparation of national GHG inventory is centralized and is being compiled at CCPIU, MET. The main source of activity data is the National statistics office (NSO) of Mongolia and relevant institutions shown above in Figure 2-1. Additional statistics from international sources were used such as International Energy Agency (IEA), Food and Agriculture Organization (FAO) and World Bank (WB). Some expert assumptions were made for unavailable activity data in order to complete the time series.

Table 2-2 provides more detailed information about the current preparation process of the national GHG inventory. The actual task of national GHG emissions and removals estimation, writing and compiling the national inventory report is conducted by four sectoral experts, include: (1) Energy, (2) IPPU, (3) Agriculture and Waste and (4) LULUCF sector experts. These four experts facilitate activities such as stakeholder consultations, cooperation with relevant ministries, agencies and organizations, for the preparation of national GHG inventory and compilation of supplementary information. The GHG inventory system is not yet institutionalized given the fact that collaboration and data sharing with some stakeholders are facilitated by the memorandum of understanding (MOU).

Table 2-2: Activities and responsibilities of each entity involved in the GHG inventory preparation process

Phase	Activities	Responsible entities	Description
Measurement & Reporting	Review of previous GHG inventories	CCPIU	- Reviews previous inventory against recommendations provided by external consultants
	Gather activity data, emission factors and coefficients	CCPIU and Relevant entities	- Updates the activity and input data taking into consideration data gaps and areas needed improvement identified in previous GHG inventories - Identify the major sectors and institutions holding data and information required for GHG inventory - Discuss, agree and sign MOU with line entities

			for the data request from relevant ministries, agencies and organizations - Collecting information required for GHG inventory
	Prepare initial estimates and draft report	CCPIU	- Conduct sectorial and national GHG emissions estimation - Prepare draft of the National Inventory Report (NIR)
	Expert and interagency review	CCPIU and Relevant entities	- Organise review and validation workshops with relevant ministries, agencies and organizations - Confirm data provided for the preparation of the inventory
	Implementation of IPCC GHG inventory guidance	CCPIU	- Implements IPCC GHG inventory guidance
Verification	Internal (QC)/External Review (QA)	CCPIU and external consultants	- Verification of the drafts of sectorial NIR - Preparation of the final draft of the NIR
Approval and Deliberation	Approval	MET	- Approval of the national GHG inventory
	Submission	MET and NFP for the UNFCCC	- Submission of NCs/BURs and NIR to UNFCCC secretariat
Publication	Archiving and publication	CCPIU	- Archiving of the relevant data and documentations - Publishing and distributing the national GHG inventory to the public

2.2 Trends in Greenhouse Gas (GHG) Emissions and Removals

2.2.1 Description and interpretation of emission trends for aggregated GHG emissions/removals

The main sources of GHG emissions have been divided into the following sectors: Energy, Industrial processes and product use (IPPU), Agriculture, Waste, and Land use, land use change and forestry (LULUCF).

In 2020, total GHG emissions of Mongolia were 43,081.62 Gg CO_2e (excluding LULUCF). This represents a 82.17% increase from the 1990 level of 23,648.79 Gg CO_2e and 6.20% decrease from the 2019 level of 45,927.72 Gg CO_2e. Net GHG emissions in 2020 were 12,909.10 Gg CO_2e (including LULUCF). This represented a 340.02% increase from the 1990 level of -5,378.40 Gg CO_2e and 17.92% decrease from the 2019 level with 15,726.84 Gg CO_2e (Figure 2-2 and Table 2-3).

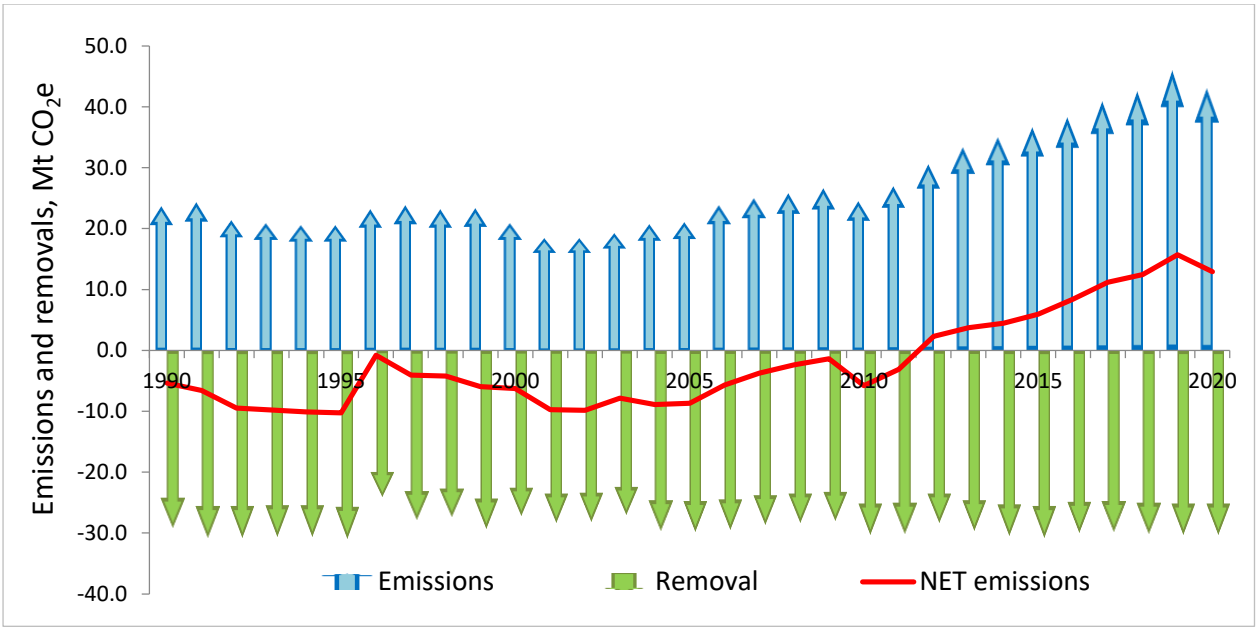

Figure 2-2: Mongolia's total and net GHG emissions and removals, 1990-2020 (Mt CO_2e)

In general, emissions and removals from each sector showed an increase in 2020 compared to the base year, and the changes are presented in Table 2-3 as an absolute value and percentage for each sector of the GHG inventory.

Table 2-3: Mongolia's GHG emissions/removals by sectors in 1990 and 2020

Sector	Emissions and removals, (Gg CO_2e)		Change from 1990 (Gg CO_2e)	Change from 1990 (%)
	1990	2020		
Energy	12,086.55	19,292.48	7,205.92	59.62%
IPPU	284.98	1,147.75	862.77	302.75%
Agriculture	11,221.64	22,390.57	11,168.93	99.53%
Waste	55.62	250.82	195.20	350.95%
Total (excluding LULUCF)	23,648.79	43,081.62	19,432.82	82.17%
LULUCF	-29,027.19	-30,172.52	-1,145.33	3.95%
Net total (including LULUCF)	-5,378.40	12,909.10	18,287.49	340.02%

In 2020, GHG emissions from the agriculture sector were 22,390.57 Gg CO_2e, representing 51.97% and from the energy sector were 19,292.48 Gg CO_2e, representing 44.78% of the national total emissions. Emissions from the IPPU and waste sectors contributed 1,147.75 Gg CO_2e (2.66%) and 250.82 Gg CO_2e (0.58%), respectively (Figure 2-3).

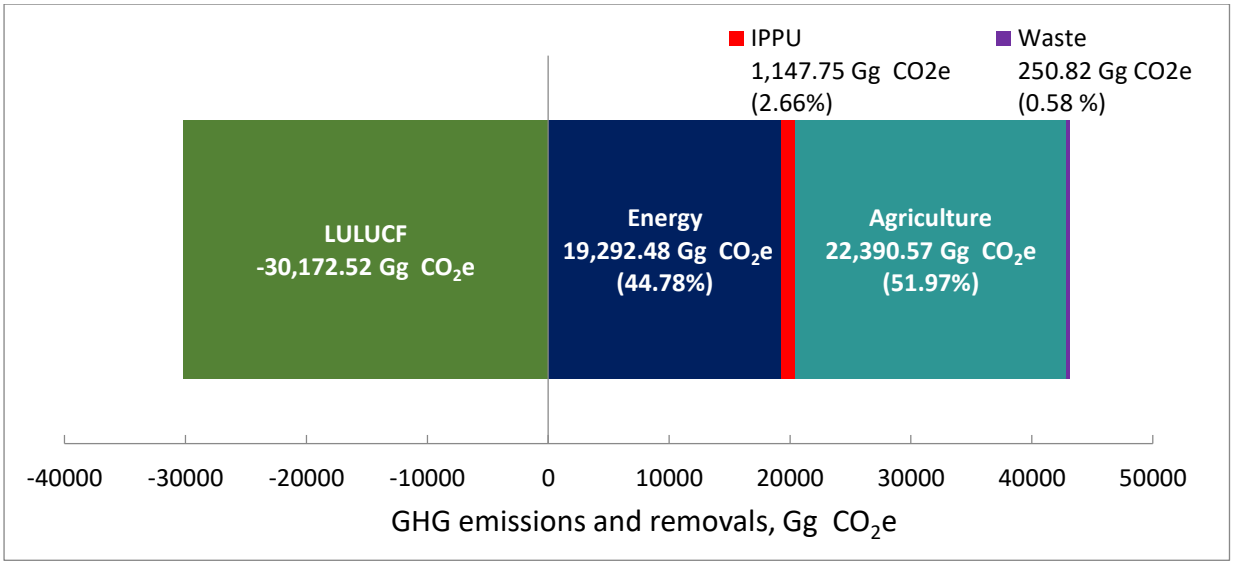

Figure 2-3: Sectoral distribution of GHG emissions of Mongolia in 2020

Table 2-4 shows an average annual growth rate (AAGR) calculated by 5 years within the inventory period, by sectors including national totals. The average annual growth rate of the energy sector was decreasing 1990-1995 and the IPPU sector was decreasing 1990-1995 and 1996-2000 subsequently, and then growth rate was increasing gradually in the energy sector, while in the IPPU sector it increased rapidly in 2001-2005. The agriculture sector's growth rate mainly depends on changes in livestock populations. Livestock population dropped rapidly in 2000-2002 and 2009-2010 due to harsh winter conditions (dzud). In the waste sector, the rate is increasing from 1996 to 2020 gradually mostly due to increased urban population and volume of light industry production. Overall, total GHG emissions annual growth changed 2.25% per year from 1990 to 2020 at the national level.

Table 2-4: Average annual growth rate, %

Sector	1990-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020	1990-2020
Energy	-6.05	0.13	2.32	6.36	4.23	3.66	1.78
IPPU	-18.38	-4.08	26.20	15.73	9.27	29.16	9.65
Agriculture	0.95	1.53	-0.78	0.48	12.94	2.59	2.95
Waste	0.05	3.49	4.78	5.38	9.41	8.16	5.21
Total (excluding LULUCF)	-2.65	0.61	0.38	3.31	8.44	3.45	2.25
LULUCF	1.24	-1.62	1.92	0.47	0.35	-0.33	0.34
Net total (including LULUCF)	14.95	72.37	9.39	35.27	-20.88	19.02	21.69

The aggregated greenhouse gas emissions and removals by sector between 1990 and 2020 are shown in Table 2-5 including national total emissions with and without LULUCF. The trends in emissions and removals from the sectors show different patterns along the time series, and the main factors affected by trend fluctuations in each sector are described later in this section.

Compared to 1990, emissions in 2020 increased by 59.62% in the energy sector, 302.75% in the IPPU sector, 99.53% in the agriculture sector, 350.95% in the waste sector and removals in the LULUCF sector was 3.95%.

Table 2-5: The aggregated GHG emissions and removals by sectors, Gg CO_2e

Year	Energy	IPPU	Agriculture	Waste	LULUCF	Total (excl. LULUCF)	Net (incl. LULUCF)
1990	12,086.55	284.98	11,221.64	55.62	-29,027.19	23,648.79	-5,378.40
1991	12,218.09	159.92	11,779.02	56.18	-30,777.08	24,213.22	-6,563.86
1992	10,589.40	116.78	10,552.74	54.96	-30,796.13	21,313.88	-9,482.24
1993	10,062.97	80.92	10,588.77	53.66	-30,583.27	20,786.32	-9,796.96
1994	8,751.24	90.79	11,574.18	54.00	-30,565.82	20,470.21	-10,095.61
1995	8,752.15	88.50	11,638.09	55.71	-30,820.64	20,534.44	-10,286.19
1996	8,466.61	90.03	14,556.30	56.56	-23,973.92	23,169.49	-804.42
1997	8,306.43	94.96	15,300.84	58.27	-27,806.97	23,760.49	-4,046.48
1998	8,339.22	92.56	14,639.94	58.57	-27,328.36	23,130.29	-4,198.07
1999	8,385.13	85.84	14,836.47	62.71	-29,321.59	23,370.14	-5,951.44
2000	8,792.39	70.55	11,933.07	66.03	-27,139.37	20,862.04	-6,277.33
2001	8,786.65	55.15	9,523.69	68.45	-28,193.79	18,433.94	-9,759.85
2002	9,398.39	101.84	8,727.06	74.16	-28,132.70	18,301.45	-9,831.25
2003	9,119.37	108.38	9,834.85	76.51	-26,968.87	19,139.11	-7,829.77
2004	9,370.65	55.48	11,232.86	79.03	-29,624.81	20,738.03	-8,886.78
2005	9,833.17	116.83	10,977.51	83.32	-29,684.24	21,010.83	-8,673.41
2006	11,039.76	114.37	12,493.57	87.74	-29,450.74	23,735.44	-5,715.30
2007	11,715.13	123.37	13,019.70	92.25	-28,676.81	24,950.45	-3,726.37
2008	11,836.39	176.51	13,707.12	97.65	-28,205.77	25,817.67	-2,388.09
2009	12,333.01	160.31	13,952.16	103.10	-27,917.77	26,548.57	-1,369.20
2010	13,344.88	222.85	10,786.05	108.25	-30,265.24	24,462.03	-5,803.21
2011	14,308.90	289.13	12,264.68	122.13	-30,115.90	26,984.84	-3,130.78
2012	15,637.24	302.13	14,472.57	137.79	-28,257.61	30,549.72	2,292.12
2013	16,942.32	264.32	16,032.15	148.16	-29,648.23	33,386.95	3,738.71
2014	16,902.95	339.28	17,513.60	159.90	-30,466.11	34,915.74	4,449.63
2015	16,313.23	326.58	19,787.87	169.46	-30,691.25	36,597.14	5,905.89
2016	16,920.24	422.96	20,707.36	183.13	-29,852.24	38,233.68	8,381.44
2017	18,333.25	630.67	21,784.24	198.54	-29,743.29	40,946.70	11,203.41
2018	19,813.99	841.88	21,669.69	218.66	-30,087.02	42,544.22	12,457.19
2019	21,386.93	1,018.81	23,287.71	234.28	-30,200.88	45,927.72	15,726.84
2020	19,292.48	1,147.75	22,390.57	250.82	-30,172.52	43,081.62	12,909.10
Diff % 1990/ 2020	59.62	302.75	99.53	350.95	3.95	82.17	340.02
Diff % 2019/ 2020	-9.79	12.66	-3.85	7.06	-0.09	-6.20	-17.92

Note: Totals of columns not consistent due to rounding.

Compared to 2019, 2020 emissions were decreased by 9.79% in the energy sector and by 3.85% in the agriculture sector, while emissions in the IPPU sector increased by 12.66% and in the waste sector by 7.06%. The removals in the LULUCF sector decreased by 0.09%. The main driving factors behind the overall decrease in emissions in the energy sector are: decrease in emissions from the manufacturing industries and construction category, caused by reduced industrial production during Covid-19 pandemic; the decrease in emissions from fuel production and its transportation due to the overall decline in coal and crude oil production; the decrease in electricity and fuel consumption due to the partial and/or complete closure of small- and medium-sized

industries, public places, and offices during the pandemic; the decrease in emissions from civil aviation and rail transport due to the closure of international borders.

The decrease in emissions in the agriculture sector in 2020 depends on the following reasons: (i) a large number of livestock were pre-emptively slaughtered to prevent dzud risk, (ii) loss of 2.1 million head of livestock due to dzud that year, (iii) summer hay and crop productions were affected by drought.

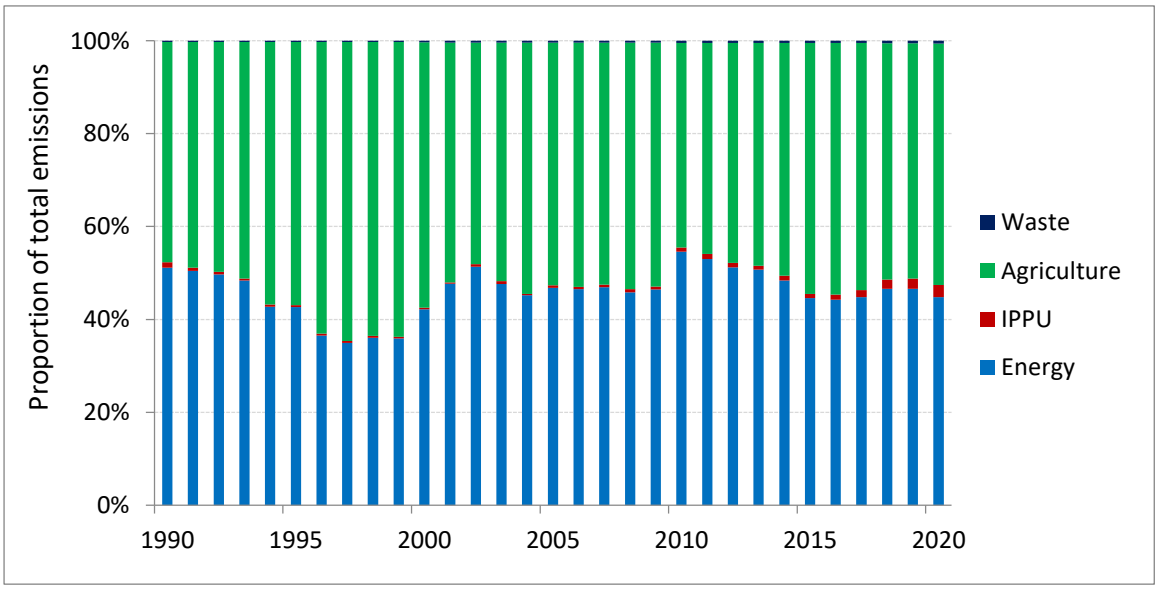

Figure 2-4: The contribution of sectors to Mongolia's total emissions for the period 1990-2020

As seen from Figure 2-4, the agriculture and energy sectors are major sources for GHG emissions consistently through the entire time series. However, percentages of each sector relative to national total varied depending on the socio-economic and climatic factors, for example, an increasing energy demand in the energy sector and increasing frequency of severe weather in the agriculture sector.

CHAPTER 3

Climate Change Mitigation Actions and Their Effects

CHAPTER 3. CLIMATE CHANGE MITIGATION ACTIONS AND THEIR EFFECTS

3.1 Updates on policy and program after the submission of the Initial Biennial Update Report (iBUR)

The key measures of the national level policies, programs and plans considered during iBUR reporting period are as follows: “Intended Nationally Determined Contributions” (2015), “Sustainable Development Vision-2030” (2016), “Action Program of the Government of Mongolia” (2016), “Green Development Policy” (2014), “National Action Program on Climate Change (NAPCC)” (2011), “State Policy on Energy” (2015), “State Policy on Forest” (2015), “State Policy on Industry” (2015), “State Policy on Food and Agriculture” (2015).

After iBUR submission, Mongolian Government approved the following policy documents and based on these updates, the GHG emissions and removals projections were made. Those are “Vision-2050” (2019), “Mongolia’s New Revival Policy” (2021), “Mongolia’s Nationally Determined Contribution (NDC)” (2019), “Action Program of the Government of Mongolia” (2020), “Mongolia’s five-year development guidelines for 2021-2025” (2020), “Mongolian National Program for Reducing Air and Environment Pollution” (2017). Some of the policy documents discussed in this report are no longer valid due to policy changes made by the Government of Mongolia. In particular, long-term and mid-term policy documents such as "Vision-2050" and "New Revival Policy-2030" with a goal of reducing the negative impact of the coronavirus infection /COVID-19 pandemic on the economy and expanding the economic base were approved in 2020 and 2021 respectively. According to the Parliament of Mongolia’s resolution No.89, Nov 12th, 2021, 17 resolutions of the Parliament of Mongolia has been annulled. This decision was made in order to ensure coherence and consistency of development policy and planning documents, and to eliminate duplication and contradictions within the framework of the implementation of the Law on Development Policy, Planning and Its Management.

Thus, in order to make development policy and planning within the legal framework, the (1) State policies, (2) Strategies, goals and targets, and (3) National programs that were implemented at the national, regional and local levels in accordance with the law were considered invalid. Certain measures and actions from those annulled policy documents have been incorporated into newly approved national and regional development documents. As for the Green Development Policy, it was repealed by Resolution No. 89 of the Parliament of Mongolia dated November 12, 2021. However, the "Action Plan for Implementation of Green Development Policy" was approved on January 11, 2016 by the annex of Resolution No. 35 of the Government of Mongolia and is still in force today.

Mongolia’s Nationally Determined Contribution (NDC) document was approved by the Government Resolution No.407 of November 2019 to contribute to the Paris Agreement. The previous goal of reducing GHG emissions fixed in INDC as 14% was recalculated to 22.7% in NDC by 2030. If removals of the forest are included, the reduction of GHG emissions can be increased up to 38.4%. In case of implementing some conditional measures, this target can be raised to 44.9%.

3.1.1 Updates on policies and programs to reduce GHG emissions from the energy sector

In addition to heat and electricity production, the energy sector has developed closely with the construction, transportation, and agriculture sectors, which use a large amount of energy. Therefore, GHG emissions from the above sectors and mitigation measures are directly related to the laws, legal and policy documents for the development of those sectors, as well as the planning and implementation of related projects and programs. Table 3-1 shows the primary documents of

policies and measures related to climate change mitigation and reducing GHG emissions in the Mongolian energy sector.

Table 3-1: Updates on policies and programs to reduce GHG emissions from the energy sector

Legal documents	Policy documents	Related programs and actions
- Law of Mongolia on Energy (PoM, 2001, updated by 2023) - Law of Mongolia on Renewable Energy (PoM, 2007 and 2015) - Law of Mongolia on The Energy Conservation (PoM, 2015	- Green Development Policy, 2014-2030 (PoM, 2014a) - State policy on energy 2015-2030 (PoM, 2015a) - *State policy on railway transport (PoM, 2010a and 2018) - *State policy on transportation 2018-2026 (GoM, 2018a) - *State policy on the construction industry 2018-2029 (GoM, 2019a) - *Vision-2050 (PoM, 2020c) - *State policy on the development of the petroleum sector for 2018-2027 (GoM, 2018f) - "The Government action program 2016-2022 and 2020-2024" (GoM, 2020)	- *Action plan for the implementation of Mongolia's Green Development Policy for 2016-2030 (GoM, 2016) - *National program to reduce air and environmental pollution 2017-2025 (GoM, 2017a) - *Mongolian national energy conservation action program 2018-2022 (GoM, 2017c) - *The national midterm program to develop the state policy on energy 2018-2023 (GoM, 2018e) - *The national program "150 thousand households- apartments" 2018-2023 (GoM, 2019b) - *Action plan for the implementation of Nationally Determined Contribution (NCC, 2021) - Medium term Strategy on Energy, 2019-2030 (GoM, 2019)

**Newly approved and amended documents after submitting iBUR*

Note: Some policy documents in this table were annulled by decision of Parliament resolution No 89, Nov 12th 2021, Government of Mongolia, Resolution No 314, Oct 13th 2021.

The following measures were included in iBUR:

- Increasing the share of renewable energy in energy production,
- Reducing heat and electricity loss in transmission and distribution systems and ineffective consumption,
- Decreasing heat loss in buildings and increasing energy efficiency,
- Reducing the consumption of solid and liquid fuels by improving road and transport infrastructure,
- Increasing the number of vehicles that use gas fuel and low fuel.

In addition to the above measures, following policies and measures reflected in the newly approved and revised policies and programs were included in this report:

- Banning the use of raw coal in Ulaanbaatar and use improved fuel,
- Implementing advanced technology in integrated energy systems to store energy in the power grid.

3.1.2 Updates on policies and programs to reduce GHG emissions from the industry sector

The primary policy documents for reducing GHG emissions in Mongolia's industrial sector including cement and lime productions, consumption of refrigeration and air conditioning are displayed in Table 3-2.

Table 3-2: Updates on policies and programs to reduce GHG emissions from the industry sector

Legal documents	Policy Documents	Related programs and measures
- Law on Small and Medium Enterprises (SME) (PoM, 2007c, 2016) - Law on Manufacturing Promotion (PoM, 2015c)	- Green Development Policy 2014-2030 (PoM, 2014) - 'The State Industrial Policy of Mongolia' (PoM, 2015b) - 'Mongolia Sustainable Development Vision-2030" (PoM, 2016) - Government Action Programme 2016-2020" (PoM, 2016) - *State policy on the construction industry of Mongolia 2018-2029 (GoM, 2019a) - *Vision - 2050 (PoM, 2020c) - *National Program for the Development of Heavy Industry (GoM, 2019c) - *Mongolia's Five-Year Development Guidelines for 2021-2025 (PoM, 2020b)	- *Action plan for the implementation of the Green Development Policy 2016-2030 (GoM, 2016) - *National program for the reduction of air and Environmental Pollution 2017-2025 (GoM, 2017a) - *'National programs' industrialization 21: 100' (2018-2021), (GoM, 2018g) - 'Cashmere' (2018-2021), (GoM, 2018h). - *"150,000 Family Housing" National Program 2018-2023 (GoM, 2019b) - *Action plan for the implementation of Nationally Determined Contribution (NCC, 2021) - *Implementation plan of the Action Plan of the Government of Mongolia for 2020-2024 (PoM, 2020a). - *National Program for the Development of Heavy Industry (GoM, 2019c)

**Newly approved and amended documents after submitting iBUR*

Note: Some policy documents in this table were annulled by decision of Parliament resolution No 89, Nov 12th 2021, Government of Mongolia, Resolution No 314, Oct 13th 2021.

The following measures were included in iBUR:

- Introducing dry technology in cement production,
- Increasing productivity through advanced technology,
- Supplying fuel demand by domestic production.

In addition, following NDC measures were considered to reduce GHG emissions:

- Using waste heat from cement plants,
- Using of fly ash in cement production.

3.1.3 Updates on policies and programs to reduce GHG emissions from the agriculture sector

The Ministry of Food, Agriculture and Light Industries (MOFALI) has approved the implementation of the Mongolian Sustainable Livestock Development Plan (2018-2020) to address issues in the livestock sector at an adequate level, to ensure consistency with approved programs, and to increase Mongolia's contribution to the Global Agenda for Sustainable Livestock Action Plan (GASL, 2022).

Regarding the current agricultural (arable farming) situation, the cultivated land area increases every year, and the area of abandoned land decreases. The appropriate solution to reducing GHGemissions from cropland is not to plough additional land and use advanced technology.

The main law on arable land is the Law on Crop Farming (2016), which addresses the issue of protection of the physicochemical properties and improvement of soil fertility. In addition, the following government resolutions were approved: "The National Vegetables Program", "National Program on Fruits and Berries", and "The Atar-IV Campaign".

Forests are the main removals of GHG and are subject to depletion due to improper use associated with human activities, the impact of forest fires on pests, and grassland degradation (MET, 2018a). In 2020, Mongolia had an area of 14.2 million hectares of forest land, of which 12.1 million hectares are covered with forests, 133 thousand hectares of forest-felled area, 719.2 thousand hectares of forest expansion reserve and 62.3 thousand hectares of tree farming area, and 955.3 thousand m^3 of logging per year (NSO, 2021).

Mongolia conducted a "Multipurpose National Forest Inventory" (2014-2016) and the "National UN-REDD program for Mongolia" (2016-2019). In 2019, the "National Strategy Action Plan for the Reduction of GHG Caused by forest depletion and degradation (REDD+)" was approved. The President of Mongolia announced at the 76th session of the UN General Assembly on September 22, 2021 that Mongolia is planning to grow a billion trees by 2030. In 2021, Resolution No.350 of the Government approved the measures to be implemented within the framework of the national campaign for "One billion trees" (GoM, 2021a).

Mongolia's forest policy programs mainly focus on reducing GHG emissions caused by deforestation, degradation and increasing forest removals (Table 3-3).

Table 3-3: Update on policies and programs to reduce GHG emissions in the agriculture and forest sectors

Legal documents	Policy documents	Related programs and measures
- Law on Crop Farming (PoM, 2016b) - Law on Animal Health (PoM, 2017c) - Law on Livestock Tax (PoM, 2020d) - Resolution on the announcement of the "Atar-IV campaign" for sustainable agricultural development (GoM, 2019d) - Presidential Resolution No. 58 Instructions to the Government to initiate the national campaign 'One billion trees" (PO, 2021))	- *Vision-2050 (PoM, 2020c) - *Nationally Determined Contribution to the implementation of the Paris Agreement (NDC, 2019) - Green Development Policy (PoM, 2014) - State Policy on Agriculture (PoM, 2015b) - *State policy on forests (Parliament of Mongolia, 2015d) - *Mongolia's Five-Year Development Guidelines for 2021-2025 (PoM, 2020b)	- Implementation Plan of the Mongolian Government Action Plan for 2020-2024 (PoM, 2020a) - Action Plan for Implementation of Nationally Determined Contributions (NCC, 2021) - *Action plan for the implementation of the Green Development Policy 2016-2030 (GoM, 2016) - Implementation measures for the national campaign for "One billion trees" 2022-2030 (GoM, 2021a) - National Program on Promoting the Development of Intensive Livestock Farming in 2019-2023 (GoM, 2018d) - National Program on Fruit and Berries 2018-2022 (GoM, Resolution No. 223, 2017b) - National Program on Livestock Health 2018-2021 (GoM, 2018b) - Action Plan of Mongolian Agenda for Sustainable Livestock (MASL), 2018-2020 (MOFALI, 2018) - Action Plan for the implementation of the "Atar IV" campaign for sustainable agriculture development in 2020-2025 (Resolution of MOFALI Minister, 2020; GoM, 2018c) - National Strategy and Action Plan to Reduce Emissions from Deforestation and Forest Degradation (REDD+) in 2020-2025 (MET, 2019)

**Newly approved and amended documents after submitting iBUR*

Note: Some policy documents in this table were annulled by decision of Parliament resolution No 89, Nov 12th 2021, Government of Mongolia, Resolution No 314, Oct 13th 2021.

The following measures were included for AFOLU:

Livestock:

- Establishing upper limits on the number of animals in totally and in regard of type of animals, and structure of animal herdings in accordance with the grazing capacity of pasture,
- Improving animal manure management,
- Protecting animal health and improving the quality and productivity of livestock,
- Meet domestic needs in animal products, increase the level of agricultural product processing and export.

Arable land:

- Adopting an advanced agrotechnical and irrigation-efficient technology to replace the outdated crop field processing technology,
- No new land ploughing while reusing abandoned land and soil maintenance,
- Fully adopt zero and reduced till technology in crop production, develop the use of eco-friendly fertilizers, protect, and improve soil fertility,
- Ensuring that domestic demand for drought-, disease-, and pest-resistant crops is fully met through the introduction, reintroduction, and adoption of certified varieties,
- Implementing comprehensive eco-friendly plant protection measures against the spread of plant diseases, weeds, insects, and rodents and adopt appropriate practices.

Forest:

- Supporting forest restoration and conservation measures, and climate change mitigation efforts, increase the area of forest cover of the country's total territory up to 9% by 2030, and up to 10.5% in 2050, and enhance carbon dioxide removals;
- Increase the amount of green area in Ulaanbaatar, promote urban greening activities using economic incentive instruments including funds, loans and taxes.

3.1.4 Updates on policies and programs to reduce GHG emissions from the waste sector

Population growth, urbanization, and industrialization led to the increase in waste and the change of compositions of the waste; the average volume of waste increased by 500 thousand tonnes per year in Mongolia. Based on data from the national GHG inventory, methane emissions from solid waste disposal sites account for more than 45% of the waste sector. Emissions of methane (CH_4) and nitrous oxide (N_2O) from solid waste and domestic wastewater have continuously increased yearly matching with population growth. However, methane emissions from industry wastewater fluctuate depending on the food production and the economic situation of the year (MEGD, 2014).

The objectives and activities in the waste sector have been directly and indirectly included in laws, legal documents, long-term government policies, and medium and short-term programs. Mongolia's primary legal and policy documents and related reforms of programs to reduce GHG emissions in the waste sector are displayed in Table 3-4.

Table 3-4: Update on policies and programs to reduce GHG emissions from the waste sector

Legal documents	Policy documents	Related programs and measures
- Law on Waste (PoM, 2017b) - Law on Hygiene (PoM, 2017a) - *Law on Water (PoM,	- *Vision-2050 Long-term Development Policy and Annexes (PoM, 2020c) - Mongolia's five-year	- Action Plan for implementation of Nationally Determined Contributions (NCC, 2021) - *The Action Plan to Make Ulaanbaatar a Green City (Ulaanbaatar City Administration, 2019) - *The Water Supply Project (Millennium challenge

2012a) - *Law on Water Contamination Fees (PoM, 2012b) - *Law on the City and Settlement Area's Water and Sewerage (PoM, 2011b) - *Law on hazardous and toxic chemicals (PoM, 2006) - *Law on the Import, Export and Cross-border Transport of Hazardous Waste (PoM, 2000)	development guidelines for 2021-2025 (PoM, 2020b). - Nationally Determined Contributions (NDC, 2019) - Green Development Policy (PoM, 2014) - Mongolia Sustainable Development Vision 2030 (PoM, 2016a)	account, 2018) - National program to reduce air and Environmental Pollution 2017-2025 (GoM, 2017a) - Action Plan for the implementation of the Green Development Policy 2016-2030 (GoM, 2016, Resolution No. 35) - *Ulaanbaatar Waste Management Improvement Strategy and Action Plan for 2017-2030 (Ulaanbaatar City Administration, 2017) - Mongolian National Waste Management Improvement Strategy and Action Plan for 2014-2022 (GoM, 2014) - *National Program on Persistent Organic Pollutants for 2014-2040 (GoM, 2014) - National Action Program on Climate Change, 2011-2020 (PoM, 2011a). - *National Water Program for 2010-2021 (PoM, 2010)

**Newly approved and amended documents after iBUR submission*

Note: Some policy documents in this table were annulled by decision of Parliament resolution No 89, Nov 12th 2021, Government of Mongolia, Resolution No 314, Oct 13th 2021.

In the waste sector of the iBUR, the issue of GHG emissions and removals related to the increase in liquid waste estimates were reflected in line with following legal documents, such as the "Law on Hygiene" (2017), "Law on Water" (2012), "Law on Water Contamination Fees" (2012), "Law on the City and Settlement Area's Water and Sewerage" (2011) and "Law on Hazardous and Toxic Chemicals" (2006).

Regarding the solid waste, the "Law on Waste" was newly approved in 2017. The purpose of this Law is to regulate relations concerning reduction, sorting, collection, transportation, storage, re-use, recycling, recovery, disposal and export of waste, and prohibition of hazardous waste import and cross-border transportation with the aim of reducing and preventing adverse impacts of waste on human health and the environment, putting waste into economic turnover, saving natural resource and wealth, and raising public awareness of waste.

The following measures were included:

Solid Waste

- Reducing and saving the consumption of natural resources and raw materials, reducing waste by increasing production efficiency, and supporting the introduction of advanced zero-waste technology,
- Introducing a recycling system for product containers and packaging through manufacturers,
- Supporting activities that create value-added products by means of waste recycling, energy generation, fertilizer, and road and construction material production.

Liquid Waste

- Supporting any activities and initiatives for the treatment and reuse of wastewater within the laws and regulations.
- Conserving water, expanding wastewater treatment plants and facilities, and increasing the number of people provided with newly built and standard sanitary facilities,

- Renovating of non-standard sanitary facilities of households, processing excrement and sludge into compost, extracting gas fuel, and putting it into economic turnover,
- Step-by-step implementation of measures to limit the use of groundwater for industrial purposes and the introduction of graywater use.

3.2 Implementation of policies and measures reported in the Initial Biennial Update Report on GHG emissions and removals

3.2.1 Implementation of policies and measures in the energy sector

The main measures taken to reduce GHG emissions in the energy sector are divided into two main groups: increasing the use of renewable energy and improving energy efficiency. These are reflected in details in the iBUR, and the implementation of the targets set for 2015-2020 for these measures is shown in Table 3-5.

Table 3-5: Implementation of policies and measures for the energy sector reported in iBUR

No	Policies and measures	Targets reported in iBUR. (In 2020)	Implementation
1	Increasing the share of renewable energy in energy production	Optimizing the pricing policy will increase energy efficiency, and the share of renewable energy in energy production will reach 20% by 2020. The share of renewable energy in the total installed capacity for domestic needs will reach 20% in 2023.	Renewable energy sources account for 9.1% of the total energy production, and the utilization rate is 46% (ERC, 2021) by January 2021. However, the share of installed capacity share reached 17.2% in 2020, and the implementation is 86% (MoE, 2021). In 2017, a 10 MW solar plant in Darkhan-Uul province, a 10 MW solar plant in suburb of Ulaanbaatar, in 2018 15 MW solar power plant in Zamyn-Uud, Dornogovi province, and a 10 MW solar plant in Sumber soum, Gobisumber province, have been put into operation. In 2019, 15 MW of Solar Power Plant in Khushigt valley in Sergelen soum of the Tuv province started its operation . In accordance with the Renewable Energy Promotion Program from 2019 to 2023 endorsed in 2020, in western region of Mongolia would be installed renewable energy sources with capacity of 40.5 MW (GoM, 2021b). In that way, the western region of Mongolia is expected to be the first region in Mongolia which is able to meet its electricity demand using renewable energy sources.
2	Reducing heat and electricity loss in transmission and distribution systems and ineffective consumption	By renewing energy production and industrial technology, the internal consumption of thermal power plants will be reduced from 14.4% in 2014 to 11.2% in 2023, and the loss of electricity transmission and distribution networks will be reduced by 15.29% in 2014 to 10.8% in 2023.	As of January 2021, the internal consumption of electricity by Thermal Power Plants accounts for 13.3%, the losses of transmission and distribution networks account for 13.6%. The implementation related to internal consumption is 34% and target related to transmission loss is 51%, respectively (ERC, 2020; MoE, 2021). “The Second Energy Sector Project” /2017-2022/ is being implemented to reduce the loss of the distribution network, with the loan funds of the World Bank. Reducing losses in the transmission and distribution network, installing smart meters,

			introducing intelligent meters, and integrating sales software are in progress (GoM, 2021b).
3	Decreasing heat loss in buildings and increasing energy efficiency	Localization of green solutions, advanced technologies, and standards, such as the green building evaluation system and energy audits, implementation of incentives and discount mechanisms to support them, and reduction of building heat loss by 20% in 2020.	A 10% target corresponds to a 2% decrease in building heat loss by 2020. (MoE, 2021). Some of the implementations are already under the NAMA for construction sector.
4	Reduce the consumption of solid and liquid fuels by improving road and transport infrastructure.	Increase the length of paved roads to 8,000 km in 2015 and 11,000 km in 2021 and reduce coal and liquid fuel consumption by electrifying railways (PoM, 2008; PoM, 2016a).	In January 2021, the length of paved roads reached 10,151 km (NSO, 2021). Implementation is 96%.
5	Increasing the number of vehicles that use gas fuel and low fuel cars	Development of new gas emission standards for vehicles and engines, a transition of fuel-powered vehicles to liquefied gas fuel by improving environmental tax and payment systems, and increasing the share of vehicles with low fuel consumption in total vehicles from 6.5% in 2014 to 13% in 2030.	As of 2018, 18.53% of all vehicles registered in Mongolia are vehicles with a hybrid engine, 2.34% with a gas engine, and 0.02% with an electric engine (NRTC, 2018) In 2020, compared to 2016, the number of electric vehicles increased by 4.3 times and cars using gas fuel increased by 1.7 times. The number of gasoline and hybrid vehicles was 816,800, or 72.5%; diesel vehicles were 284,600, or 25.3%, and gas vehicles were 24,100, or 2.1% (MRTD, 2021).
6	Development of the chemical industry sector, the needs of major brands, and the demand for fuel types for domestic production products that meet international standards	In 2020, 20% of the main fuel demand will be fully met with fuel meeting the Euro 4 standard in 2025, 70% of the demand with fuel meeting the Euro 5 standard in 2030, 100% of the demand with fuel meeting the Euro 5 standard (PoM, 2016a).	In 2020, 20% of domestic production did not meet the need for Euro 4 fuel, but imports accounted for 26.2% of Euro 4 fuel (MRPA, 2021), and the implementation is 106.2%. Gasoline and diesel fuel meeting the requirements of the Euro-5 standard accounted for 12.8% of the total imported fuel (MET, 2021a).

3.2.2 Implementation of policies and measures in the industry sector

The implementation of the goals set for 2015-2020 for these measures is shown in Table 3-6. The perspectives and provisions related to the reduction of GHG emissions in relation to the industrialization growth, and technological innovation of Mongolia's industrial sector are discussed in details.

Table 3-6: Implementation of policies and measures for the industry sector reported in iBUR

No	Policies and measures	Targets reported in iBUR (in 2020)	Implementation
1	Development of industries based on advanced techniques, technology, and innovation, increase productivity	The share of processed manufacturing in total exports will increase to 15% in 2020 and 25% in 2025, and the full processing of raw materials such as leather, wool, and cashmere will be increased to 60% in 2020, 70% in 2025, and 80% in 2030 (PoM, 2016a).	As of January 2020, the share of the processing industry in total exports was 16.9% (NSO, 2021), and the implementation is 112.7%.
2	Introduction of dry technology in cement production	In 2030, Mongolian cement factories will be completely transferred to dry technology, and the product price will be reduced by 30-40% (PoM, 2011a).	On November 15, 2021, 6 complete cement factories and four clinker mills (dry technology) were operating in Mongolia, with a total annual cement production capacity of 3.6 million tonnes; in addition, to meet the demand of the domestic market 100%, but also it is possible to export up to 2.0 million tonnes of cement per year (MCUD, No. 3/4468, 2021).
3	Development of processing industries and complete processing of raw materials such as leather, wool, and cashmere	Complete processing will reach 60% in 2020, 70% in 2025, and 80% in 2030, and the share of processing and service sector products in the total domestic product will have doubled from the level of 2014 (PoM, 2016a, PoM, 2015e)	Depending on the type of production, the installed capacity of the factories is utilized by 5-61% due to conditions such as the state of the country's socioeconomic status, the income level of the population, and relatively low sales in domestic and foreign markets. Of this, 41% are used for washing, 51% for combing, 46% for spinning, 48% for knitting and weaving, 45% for carpets, 57% for non-woven goods, 61% for felting, and 5% for wool insulation materials (MOFALI, 2021). In 2020, the production rate for complete leather processing was 41%. 50% of the leather processing industry is semi-processed, 38% is leather, and 12% is processing factory wool cashmere, which is industrial waste (GoM, 2021b). 44.48% of the leather is semi-processed, 6.17% is deep-processed, and the remaining 55.52% is devalued (MOFALI, 2020b).

3.2.3 Implementation of policies and measures in the agriculture sector

The main measures included in iBUR were reducing the number of livestock, supporting exports, and improving livestock health. The implementation of these measures for 2015-2020 is shown in Table 3-7.

Table 3-7: Implementation of policies and measures included in iBUR to reduce GHG emissions in the animal husbandry sector

No	Policies and measures	Targets reported in iBUR. (In 2020)	Implementation
1	Adjust herd composition and numbers based on the assessment of	To have 36,475.6 thousand head of livestock by 2021. By 2021, compared to 2008, the share of camels will increase by 0.3%,	In 2021, there was 67,068.49 thousand head of livestock. In 2021, the share of livestock particularly camels 0.67%, horses 6.42%, cattle 7.49%,

	pasture capacity and conditions to improve livestock profitability (Mongolian Livestock National Program, 2010)	horses by 3.1%, cattle by 8.0%, sheep by 2.7%, and goats will reduce by 14.1%.	sheep 46.16% and goats 39.29%. Compared to 2008, the ratio of camels increased by 0.06%, horses increased by 1.37%, cattle increased by 1.67%, sheep increased by 3.74% and goats decreased by 6.85% as of 2021 (NSO, 2022).
	Adjust the number, type, and composition of livestock based on assessment of pasture carrying capacity and status (State Policy on Food and Agriculture, 2015)	To increase the share of cattle in the total herd from 6.7% in 2014 to 8.0% in 2020. Increase industrially processed meat from 16.8 thousand tonnes to 100 thousand tonnes.	The share of cattle in the total herd is 7.75 %, and industrially prepared meat has reached 26.8 thousand tonnes as of 2021.
2	Increase the number of raw materials for export and improve the health and profitability of animals.	Establishing a suitable relationship between traditional and intensive livestock husbandry.	The National Program "Supporting the Development of Intensified Animal Husbandry" was approved by Resolution No. 400 of the Government in 2018 (GoM, 2018d). Despite the Government policy in this area, the significant progress hasn't been made except cattle breeding (number of cattle for industrial meat and milk production by 2021 increased by 60%-100% since 2016). These data were gathered and computed from the website of the MOFALI (https://mofa.gov.mn/).
		Develop the production of veterinary drugs, disinfectants, and biotechnology based disinfectants, improve herd's health.	As of 2020, 95.2% of veterinary drugs and biological preparations (vaccines, diagnostics) are produced domestically (GoM, 2020).
		Forming an appropriate ratio for the number and type within herds, increasing the number of areas with animal disease-free status to at least 10% of the total area to meet the trade and quarantine requirements certified by the World Organization for Animal Health (WOAH).	In 2018, The Government of Mongolia approved The National Livestock Health program (GoM, 2018b). Within the framework of the Law on Animal and Animal Health, the General Department of Veterinary Medicine, the Veterinary Departments in 21 provinces and capitals, and the Veterinary Departments in 331 districts have been established and are transitioning to a vertical system. According to order No. A/84 and A/85 of the head of the General Authority for Veterinary Services (GAVS), the territory is divided into three zones, and measures are being implemented to prevent and fight highly contagious foot and mouth diseases and small animal scurvy, and improve the animal health. In 2020, Mongolia submitted to WOAH a request to obtain a foot-and-mouth disease free status for the provinces of the western region of Mongolia. Law on Animal Health and "Procedures for reporting the absence of infectious diseases and peacefulness by

			country, region, and territory" approved by Order No. A/40 of 2019 of the MOFALI, by Order No. A/256 of 2019 of the Head of the GAVS, cattle herds of Darkhan-Uul and Selenge provinces were declared as "Cattle Tuberculosis and Bovine Leukosis free and peaceful zone", respectively, ensuring healthy livestock from the following types of diseases: - dairy cattle are free of leukosis, 98.1% - sheep and goats are free of brucellosis, 99.2%
		Bring animals and animal-derived products to the markets of neighbouring countries and increase the number of purebred cattle to 100,000.	In 2014, there were 72,504 meat and dairy cattle, and in 2020, there were 126,223, which is 26.2% higher than expected. (MOFALI, 2020b). The number of purebred cattle reached 193.7 thousand head as of 2021 (NSO, 2022).

General provisions of the arable land included in iBUR were abandoning the outdated technology of overturning soil and protecting against soil erosion. Table 3-8 shows the implementation of these measures for 2015-2020.

Table 3-8: Implementation of policies and measures included in iBUR to reduce GHG emissions in the arable land

No	Policies and measures	Targets reported in iBUR (in 2020)	Implementation
1	Reject the outdated technology of overturning soil	Increase the nutrient quality of the soil in the fields used for cultivation and reduce erosion and damage by reaching 70% by the introduction of zero-till technology in grain production areas; increase the irrigated agricultural area to 65.0 thousand hectares by introducing efficient and advanced irrigation technology; increase the supply of elite seeds of indigenous varieties up to 75%, respectively.	In grain production, reduced and zero-till technology has been investigated and introduced to 360,000 hectares, and in 2020, 196,000 hectares of fallow have been developed using advanced technology. 45% of the total fallow land is processed with zero-till technology. Harvesting is 100% straw mulching, and 70% of grain threshing is done with gas threshers. In 2019, 54,089.83 hectares of land were engaged in irrigated agriculture.
2	Establishing a protective forest strip to protect the soil from erosion and degradation	Expansion of irrigated agriculture based on water conservation and soil protection technologies adapted to drought conditions.	The Government is taking measures to provide discounts for the use of straw mulch to protect agricultural soil from wind erosion, fencing of agricultural fields, construction of forest strips, and introduction of irrigation equipment with low water consumption. By 2020, 342,000 hectares of arable land were covered by 10,400 km of fences, and there are 340 km of forest strips for protecting 6,200 hectares of arable land. This means that 1/3 of the total cultivated area is fenced and protected (MOFALI, 2020b).

3	Bring agricultural land fully into economic turnover and use it efficiently.	In 2020, the crop rotation area will increase up to 960 hectares and the wheat yield up to 17.3 centner per hectare.	The crop rotation area reached 896.9 thousand hectares in 2020 (91% implementation) and the wheat yield per hectare is 12.6 centner (NSO, 2021).

Forest sector main provisions included in the iBUR were reducing deforestation, increasing the number of forested areas through restoration and afforestation, and creating sustainable management. The implementation of the goals set for 2015-2020 for these measures is shown in the following table (Table 3-9).

Table 3-9: Implementation of policies and measures included in iBUR enhancing GHG removals in the forest sector

No	Policies and measures	Targets reported in iBUR (in 2020)	Implementation
1	Maintaining the balance of forest ecosystems in Mongolia, stopping forest depletion and degradation of forests, increasing the area covered by forests through forest restoration and afforestation, and creating sustainable forest management with the aim of proper and sustainable use	- In 2020, the area of regrown and cultivated forests will increase by 310,000 hectares.	In 2019, the area under natural afforestation reached 151.7 thousand hectares, and the intentionally afforested area reached 25.8 thousand hectares (57.2% implementation).
		- The average forest area affected by fire will be reduced to 30% in 2020.	In 2015, 1,703.9 thousand hectares were affected by fire, and in 2019, it reached 1,645.4 thousand hectares, which decreased by 58.5 thousand hectares or by 3.4%.
		- The spread of harmful insects and diseases will be reduced by 60% in 2020.	The area affected by harmful insects was reduced by 24.6% from 135.7 thousand hectares to 102.2 thousand hectares (41.0% implementation) (MET, 2019).

3.2.4 Implementation of policies and measures in the waste sector

The main measures taken to reduce GHG emissions in the waste sector are divided into four main groups: waste reduction, reuse, recycling, and reducing the waste disposal in nature. The implementation situation of the goals set for 2020 for these measures is shown in Table 3-10.

Table 3-10: Implementation of measures and policy reported in iBUR to reduce GHG emissions in the waste sector

No	Policies and measures	The target reported in iBUR (in 2020)	Implementation
1	Reducing waste	The ISO 14000 standard for the environmental management system will be introduced from 1 in 2013 to 4 in 2014-2017 in phase I, and to 20 in 2018-2022 in phase II (GoM, 2014).	At the meeting of the 2019 Technical Committee of the Environmental Management System, the draft of 5 standards of the ISO 14000 package was discussed and approved (GoM, 2021b).
		From 2014, the number of enterprises and organizations that supported and approved the introduction of the MNS	In 2017-2020, a total of 13 organizations (Tsetsuh LLC, Ag LLC, Darkhan-Uul province ASUIS branch School of Medicine, Eurokhan

		ISO 14001 set of environmental management standards will increase as follows: - 2 times in 2016-2020 in phase I - 5 times in 2021-2025 in phase II, - 10 times in 2026-2030 in Phase III (PoM, 2016a).	LLC, Khaanzaa Services LLC, Alliance Mineral LLC, APU LLC, Energy Resource LLC, MSS Property LLC, Eco Wool LLC, Janson Construction LLC, Active Adventure Tours Mongolia LLC, and Moncrem LLC) introduced and certified the MNS ISO 14001 environmental management system in their operations (MASM, 2020). The number of ISO 14001-certified organizations registered with the Department of Standardization and Metrology increased by 1 in 2019, totaling to 4 (100% implementation) (MASM, 2020).
2	Reusing waste	Establishment of plants for solid waste separation, complete treatment and recycling ([Phase I 2011-2016; Phase 2017-2021], PoM, 2011a).	In 2021, there were 40 waste recycling plants and more than 160 sorting points in Mongolia, with more than 1500 employees (MOFALI website, 2021). As a result of the implementation of the project to introduce waste sorting at the source, there were 376 sorting points throughout the Ulaanbaatar city. The amount of sorted waste was 7.8 thousand tonnes in 2018, 16.9 thousand tonnes in 2019, and 25.7 thousand tonnes in 2020 and these sorted waste were included in the recycling process (GoM, 2021b).
3	Recycling waste	Increase processing and recycling of waste, and increase value-added products as follows: Green Development Policy (PoM, 2014) - 20% in 2014-2020 in phase I, - 40% in 2021-2030 in phase II. Sustainable Development Vision of Mongolia (PoM, 2016a) - 20% in 2016-2020 in phase I, - 30% in 2021-2025 in phase II, - 40% in 2026-2030 in phase III.	According to the results of Mongolia's "Solid Waste Account" (2019), 8.7% or 250.6 thousand tonnes of waste was recycled and reused out of 2.9 million tonnes of waste generated in 2019 (NSO, 2021). As of 2020, there are 28 waste recycling plants in Ulaanbaatar city, of which ten are actively operating for plastic waste processing, 2 for cardboard paper processing, 2 for waste tire processing, 1 for waste engine oil processing, 2 for waste bone processing, and 1 for alloy processing. Furthermore, these companies are generating value-added products (GoM, 2021b). In 2020, 160,000 tonnes of garbage were recycled in the Ulaanbaatar city (MOUBC 2021).
4	Others	Provide 40% of the population with improved sanitation facilities, as follows: - 20% in 2016-2020 in phase I - 30% in 2021-2025 in phase II, - 40% in 2026-2030 phase III (PoM, 2016a).	According to the Mongolian population and housing census (2020), approximately 29.66% of households were connected to centralized aerobic wastewater treatment plants. The 49.24% of households use latrines, 20.46% of households lack wastewater disposal points and only 0.64% use septic tanks (NSO, 2021b). In 2018-2019, around 400 sewage repellent improved pit latrines were installed and used in the centre of the Arkhangai and Uvurkhangai

			provinces (GoM, 2021b). According to the study of pit latrines in the Ger quarter of Ulaanbaatar city, of 133.1 thousand pit latrines registered, 11.8 thousand pit latrines meet the document requirements of the standards MNS5924: 2015 and UCS 0704B: 2020 (MOUBC, 2021).

3.3 International Carbon Market and Mongolia's Participation

Mongolian economic and social sectors are directly dependent on natural and climatic conditions, the implementation of obligations at the international level, for example, the implementation of the Paris, Agreement of major projects and programs aimed at reducing GHG emissions, it is a need to closely cooperate with multilateral and bilateral mechanisms of the international carbon market, as well as financing mechanisms.

The Mongolian Government ratified the UNFCCC on September 30, 1993, its Kyoto Protocol on December 15th, 1999, and the Paris Agreement on September 1st, 2016. In this way, Mongolia has ratified the Kyoto Protocol and the Paris Agreement within the framework of the Convention, and has been positively responding to the mechanisms and initiatives for their implementation. Mongolia has implemented the Clean Development Mechanism, which is one of the three main market-based mechanisms for implementation of the Kyoto Mechanism, and has the experience of trading project-level emission reductions in the international market. Furthermore, within the framework of the Paris Agreement, when implementing activities in this direction, the Joint Crediting Mechanism was implemented by developing bilateral cooperation in the implementation of market and non-market mechanisms within the framework of the Article 6 under the Paris Agreement. The feature of this mechanism is that currently, CERs or credits equivalent to the reduction of greenhouse gas emissions are non-tradable, and are used to reach the country's Nationally Determined Contributions targets defined in the framework of the Paris Agreement.

In recent years, the private sectors have been actively interested in these approaches and are implementing them in real situations in order to improve their efficiency in implementing projects and programs, expand their scope, raise funds, and integrate environmental and social governance.

3.3.1 Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM) is the largest regulated carbon offset market. The mechanism enables developing countries to implement projects to reduce GHG emissions, because of which Certified Emission Reduction (CER) equivalent to 1 tonne of CO_2 can be traded on the international carbon market, enabling developed countries to meet their GHG emission reduction goals following the Kyoto Protocol.

Five projects were officially registered with CDM in Mongolia. Three renewable energy projects and one program in the field of energy savings have been calculated as credits equivalent to 1,464,753 t CO_2e for the certified reduction of GHG emissions from a total of 4 projects. Information on CDM projects in Mongolia is shown in Table 3-11.

Table 3-11: Clean Development Mechanism projects

#	CDM project name	Purpose	Registration date	Targeted GHG emission reductions per year	Verified emission reductions	Implementing Parties (Credit calculation period)
1	Project 0786: Durgun 10 MW Hydroelectric Power Station	Reduce GHG emissions by building small-scale hydroelectric power plants to meet local energy needs with clean energy	16 Mar 2007	30,400 t CO_2e per year	57,768 t CO_2e was issued according to the results of 3 monitoring reports conducted between 01 Nov 2008 and 31 May 2012	Mongolia, Japan (2007-2014)
2	Project 0787: Taishir 11 MW Hydroelectric Power Station	Reduce GHG emissions by building small-scale hydroelectric power plants to meet local energy needs with clean energy	23 Mar 2007	29,600 t CO_2e per year	The equivalent of 19,182 t CO_2e was issued according to the results of 4 monitoring reports between 01 Nov 2008 and 31 May 2012	Mongolia, Japan (2008-2015)
3	Project 5977: Wind Park of 49.6 MW	Reducing GHG emissions by increasing renewable energy production	30 Mar 2012	178,778 t CO_2e per year	CER's equivalent to 1,037,492 t CO_2e were issued according to the results of 14 monitoring reports conducted between 24 Jun 2013 and 23 Jun 2020	Mongolia, Sweden (2013-2027)
4	Project 0295: Improving the technology of decentralized heating boilers	Reducing GHG emissions by improving the technology of small boilers	28 Jul 2006	11,904 t CO_2e per year	No request submitted	Mongolia, Germany (2006-2016)
5	PoA*8142: Microfinance Program for Clean Energy Products	Reducing GHG emissions by increasing the purchase of energy-efficient electrical equipment, heaters, home, and house insulation materials, and improving boilers	12 Nov 2012	50,133 t CO_2e per year	CER's equivalent to 350,311 t CO_2e issued according to the results of nine monitoring reports conducted between 01 Aug 2013 and 30 Apr 2019	Mongolia, In the United Kingdom, Sweden (2013-2033)

Source: UNFCCC, CDM website: https://cdm.unfccc.int/ jsearch.HTML/

Note: PoA - Program of Activities

The current status of CDM implementation is defined as above, and that emission reductions in within this framework are not included in the mitigation measures considered in this report.

No new projects have been registered under the Clean Development Mechanism since 2013 and there are several factors related to this situation.

The implementing period of the Kyoto Protocol consisted of two phases and ended by 2020, countries that implemented large-scale projects dominated the CDM market, reducing opportunity for the countries with small-scale projects and programs like Mongolia. On the other hand, it is also related to Mongolia has transitioned from a lower-income country to a lower-middle income country.

3.3.2 Joint Credit Mechanism (JCM)

JCM is an internationally recognized as one of the financing mechanisms that encourages public and private organizations to work together to reduce the negative impact of climate change. It's a project-based bilateral offset crediting mechanism and currently 27 partner countries have joined the JCM with more than 217 projects. Those projects have been triggering an investment for renewable energy use in the country, transfer of technology, and capacity building activities. The most of the projects have been focusing greatly on a contribution to sustainable development through synergy and co-benefits effects of involved activities along with the targets for reduction of GHG emissions and credit sharing issues.

The Governments of Mongolia and Japan signed a bilateral cooperation document for the introduction of the JCM on January 8th, 2013. The ultimate goal of JCM is to reduce the GHG emissions or its removals, quantitative evaluation and application of measurement, reporting and verification (MRV) methodologies are used to achieve emission reductions targets both in Japan and Mongolia. Since then, several projects within the JCM scheme of cooperation have been implemented, particularly, on renewable energy use, energy efficiency, improvement of heating facilities, and others. A total of 150 million USD has been invested, of which about 40 million USD has been in the form of grants from the Government of Japan. As of today, certified emission reductions (CER) equivalent to 53,730 t CO_2 credits were issued to 5 registered projects in Mongolia.

Table 3-12 shows the list of the projects that are registered officially under the JCM scheme.

Table 3-12: Projects registered under JCM as of April 2022

No	Project titles	Objective	Registration date	Emission reductions per year	Certified emission reductions	Status
1	MN001: Installation of high-efficiency Heat Only Boilers in 118th School of Ulaanbaatar City Project	Reduce GHG emissions by creating energy savings by retrofitting old energy-inefficient boiler technologies	30 Jun 2015	2016 - 2020: 92 t CO_2e per year	2016 - 2018:168 t CO_2e (Mongolia - 34 t CO_2e, Japan - 134 t CO_2e)	Registered and credit issued.
2	MN002: Centralization of heat supply system by installation of high-efficiency Heat Only Boilers in Bornuur soum Project	Reduce GHG emissions by creating energy savings by retrofitting old energy-inefficient boiler technologies	30 Jun 2015	2016 - 2020: 206 t CO_2e per year	2016 - 2018: 315 t CO_2e (Mongolia - 64 t CO_2e, Japan - 251 t CO_2e)	Registered and credit issued.

3	MN003: Installation of 12.7 MW Solar Power Plant for Power Supply In Ulaanbaatar Suburb	Contribute to the reduction of air pollution in the city of UB by increasing the production of clean energy and reducing the emission of greenhouse gases	16 Nov 2017	2017 - 1,016 t CO_2e, 2018 - 2030: 12,009 t CO_2e per year	2018 - 2022: 44,299 t CO_2e (Mongolia – 8,860 t CO_2e, Japan – 35,439 t CO_2e)	Registered and credit issued.
4	MN004: 10MW Solar Power Project in Darkhan City	Reducing GHG emissions by increasing renewable energy production	26 May 2017	2017 - 2030: 11,221 t CO_2e per year	2017 - 8,947 t CO_2e (Mongolia – 1,789 t CO_2e, Japan– 7,158 t CO_2e)	Registered and credit issued.
5	MN005: A High Efficiency and Low Loss Power Transmission and Distribution System in Mongolia	To reduce GHG emissions by reducing energy losses by upgrading power lines	26 May 2017	2017 - 12 t CO_2e 2018 - 25 t CO_2e 2019 - 93 t CO_2e 2020 - 2024: 441 t CO_2e per year 2025 - 2029: 685 t CO_2e per year 2030: 779 t CO_2e	2019 -1 t CO_2e (Mongolia)	Registered and credit issued.
6	MN006: 15 MW solar power plant system near the new airport	To reduce GHG emissions by installing large-scale solar power plant and displacing electricity generation based on fossil fuel	02 Jun 2023	2019 - 8,115 t CO_2e 2020 - 2030: 18,438 t CO_2e per year	CER not issued yet	Registered
7	Fuel Conversion by Introduction of LPG Boilers to Beverage Factory	By introducing the most efficient and newest model of LPG once-through boilers and vacuum type water heaters, the efficiency of	2019	4,783 t CO_2e per year until 2030 based on the Bilateral cooperation agreement.	CER not issued yet	Implementation ongoing, not registered.

		the system is improved with less fuel consumption.				
8	Upscaling Renewable Energy Sector Project	The project is to introduce battery storage system for utility-scale renewable energy generation.	2018	6,423 t CO_2e per year, 160,575 t CO_2e will be reduced in 25 years.	CER not issued yet	Implementation ongoing, not registered.
9	15 MW Solar Power Project in Erdene, Dornogovi Province	The project contributes to the Mongolia government's policy of increasing renewable energy and reducing dependence on imported.	2022	19,515 t CO_2e per year until 2030 based on the Bilateral cooperation agreement.	CER not issued yet	Implementation ongoing, not registered.

Source: Government of Japan - https://www.jcm.go.jp/mn-jp, Secretariat of the Joint Credit Mechanism between Mongolia and Japan

3.3.3 Nationally Appropriate Mitigation Actions (NAMAs)

According to the "Copenhagen Agreement" issued by the 15th Conference of the Parties to the Framework Convention on Climate Change held in Denmark in 2009 on the implementation of NAMA, Mongolia expressed its implementation of NAMAs. List of It listed the main areas of measures to reduce GHG emissions. In the first month of 2010, it was submitted to the Secretariat of the United Nations Framework Convention on Climate Change. Table 3-13 shows the measures to reduce GHG emissions according to Mongolia's national characteristics.

Table 3-13: List of appropriate national mitigation actions (NAMA) to reduce carbon emissions in Mongolia

Sectors	Measures to be implemented
Energy supply	Increase renewable energy opportunities - Solar cells, solar heat - Wind energy production, wind park - Hydro powerplant
	Improve the quality of coal - Coal Processing - Making briquettes from coal
	Improve the efficiency of low-pressure furnaces - Improving the efficiency of existing solar plants and installing new high-efficiency solar plants - Converting a Water Heater into a small-scale thermal power plant

	Improving the Efficiency of household Stoves and stoves - Change the fuel of the home stove and fireplace - Improvement of home stoves and fireplaces, new designs
	Improving the efficiency of thermal power plants - Improve efficiency and reduce internal consumption
	Increase the conditions to provide urban heating with electric sources - Use of the energy grid for the heat consumption of households in urban areas
Construction	Reduction of Building Heat Loss - Improvement of the Partially Insulated Building System - Installation of heat and hot water meters - Improve the insulation of existing buildings and introduce new energy efficiency standards in new buildings - Improving the efficiency of building lighting
Transportation	Use fuel-efficient vehicles
Agriculture	Limit the number and types of livestock, especially cattle, in a manner that maximizes profitability
Forestry	- Improve forest management - REDD+ or reducing GHGemissions caused by deforestation and forest degradation, improving sustainable forest management, and activating the carbon market in the forestry sector

Source: iBUR, 2017

Registration of NAMA. The UNFCCC has opened NAMA registry based on the decision of the 16th and 17th Conference of the Parties, and the purpose is to make the measures implemented by the countries related to NAMA open and transparent to the public. The parties to the convention believed that this type of cooperation would enable the development of NAMA, the exchange of best practices between countries, and the provision of information to international organizations that support NAMA. Our country's state administrative organization authorized to register NAMA is the Ministry of Environment and Tourism. Obtaining international support and appropriate financial assistance for implementing NAMA, improving the technology and personnel capacity, and obtaining support for NAMA are the most critical issues facing developing countries in implementing NAMA. In our country, the development of a national program to improve lighting efficiency and introduce new technologies for construction materials and cement is currently registered.

Implementation of NAMA. The Ministry of Environment and Tourism is working to develop and implement the measures mentioned in the list of NAMAs by approaching various international financing mechanisms. Table 3-14 shows information about the ongoing and implemeneted projects and measures by the Ministry in collaboration with international organizations within the NAMA.

Table 3-14: Projects and actions in the field of NAMA

Sectors	Name of project	Objectives/GHG emission reductions	Implementing Partners (Implementation period)
Construction	Energy Saving of buildings.	Reducing the annual growth rate of greenhouse gases emitted by the construction industry by saving energy consumption in newly built	MCUD/MEGD/UNDP (2009-2013)

		apartments and public buildings in Mongolia's construction industry.	
	Construction NAMA	Reducing the GHG emissions from construction industry through the implementation and improvement of NAMA. GHG emission reductions: During implementation period: 10,709 t CO_2e per year After project completion: 64,219 t CO_2e	MCUD/ MET /UNDP (2017-2020)
Transportation	Green Public Transport	Identify the potentials of switching from diesel buses to environmentally friendly engines to reduce carbon dioxide emissions and improve air quality.	MEGD/ GGGI (2012-2013)
Agriculture, pasture	Improving Carbon Finance for Rangeland Management in the Northeast Asia Region	Reducing the number of livestock, especially in terms of cattle by increasing its productivity.	MEGD / MOFALI / ADB (2011-2013)
Forestry-REDD+	Biodiversity and adaptation of key forest ecosystems to climate change	Improving the livelihoods of local people in some regions of ecological importance while implementing sustainable management and conservation measures that consider climate change and improving the policy and structural environment by creating the capacity to protect biological diversity.	MEGD/ GIZ (2012-2022)
Energy	Joint study to improve the power supply of Thermal Power Plants 3 and 4	Determine the scenario of the GHG emissions and NAMA of energy supply under the same conditions.	MEGD / OECC, Japan (2013)

Source: NCC, 2021

In 2018-2020, a model (pilot) project to reduce GHG emissions was implemented in a total of 5 buildings within the framework of the project titled "National measures to reduce GHG emissions in the construction sector" that was implemented with the support of UNDP and the GEF. Trial monitoring and procedure was performed for the central heating system of Erdenedalai Soum in Dundgovi Province and the Jargalan Soum School Building in Gobi-Altai province in 2018-2019. During this period, GHG emission reductions equivalent to 2,838.5 t CO_2e and 102.7 t CO_2e were measured and reported, respectively.

3.3.4 International Voluntary Carbon Markets

Voluntary, regional, national, and bilateral multilevel carbon markets continue to emerge based on CDM principles and methodologies. Voluntary markets rely more on private sector initiatives than formally regulated carbon markets. In Mongolia, private entities such as XacBank, Clean Energy Asia LLC, and the Mongolian Grassland Management Association have developed projects and

programs that meet the voluntary carbon market requirements, in particularly energy conservation, land use, pastures, and renewable energy sectors.

A total of 3 projects have been registered from Mongolia in the international voluntary carbon market: Gold Standard, Verra, and Plan Vivo (See Table 3-15).

Table 3-15: Projects registered in the International Voluntary Carbon Market

Voluntary Carbon Markets	Project titles	Objective	GHG emission reductions	Implementing Partners (Implementation period)
Gold Standard	The microfinance program for clean energy products consists of 6 small projects	Increase the purchase of energy-efficient electrical equipment, heaters, and home and house insulation materials for households in the neighbourhood and reduce the cost of living by improving boilers.	49,199 t CO_2e per year	XacBank LLC, Micro energy credits (2012-2019)
Verra	"Tsetsii" 50 MW wind park project	Reducing GHG emissions by increasing clean energy production.	175,767 t CO_2e per year	Clean Energy Asia Ltd. (2017-2027)
Plan Vivo	Pasture, Nature Conservation, and climate change in Mongolia	Improve pasture management based on the participation of herder households to increase the carbon removal capacity of 77,000 hectares of pasture; protect biodiversity; and support household livelihoods.	100,000 t CO_2e per year	Mongolian Grassland Management Association NGO, University of Leicester, UK (2015-2019)

Source: MFS, 2022

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Clean Development Mechanism (CDM): https://cdm.unfccc.int/

Secretariat of the Joint Crediting Mechanism (JCM) between Mongolia and Japan: https://www.jcm.go.jp/mn-jp/projects/registers

Ministry of Food Agriculture and Light Industry (MOFALI): https://mofa.gov.mn/branch/maa/616f8ea773bc4a5fc70f21f1

National Statistics Office (NSO) of Mongolia: https://www.1212.mn/.

CHAPTER 4

Baseline Scenarios for Climate Change and Potential Options for Mitigation Measures

CHAPTER 4. BASELINE SCENARIOS FOR CLIMATE CHANGE AND POTENTIAL OPTIONS FOR MITIGATION MEASURES

4.1 Impact Assessment of the Measures to Reduce GHG Emissions

Figure 4-1 summarizes the key policies and measures taken in previous assessments and updated documents to determine the present and future measures to reduce GHG emissions in Mongolia.

	Year	2010	2015	2020	2025	2030	2040	2050
Total	Baseline scenario (BAU), Mt CO_2e	20.9	29.3	36.1	51.9	61.4	77.2	97.4
	Mitigation scenario, Mt CO_2e	20.9	29.3	36.1	43.3	46.5	56.8	70.7
	Total GHG emissions reduction, Mt CO_2e	-	-	-	8.5	14.9	20.4	26.7
	Total GHG emissions reduction, %	-	-	-	16.5	24.3	26.4	27.4

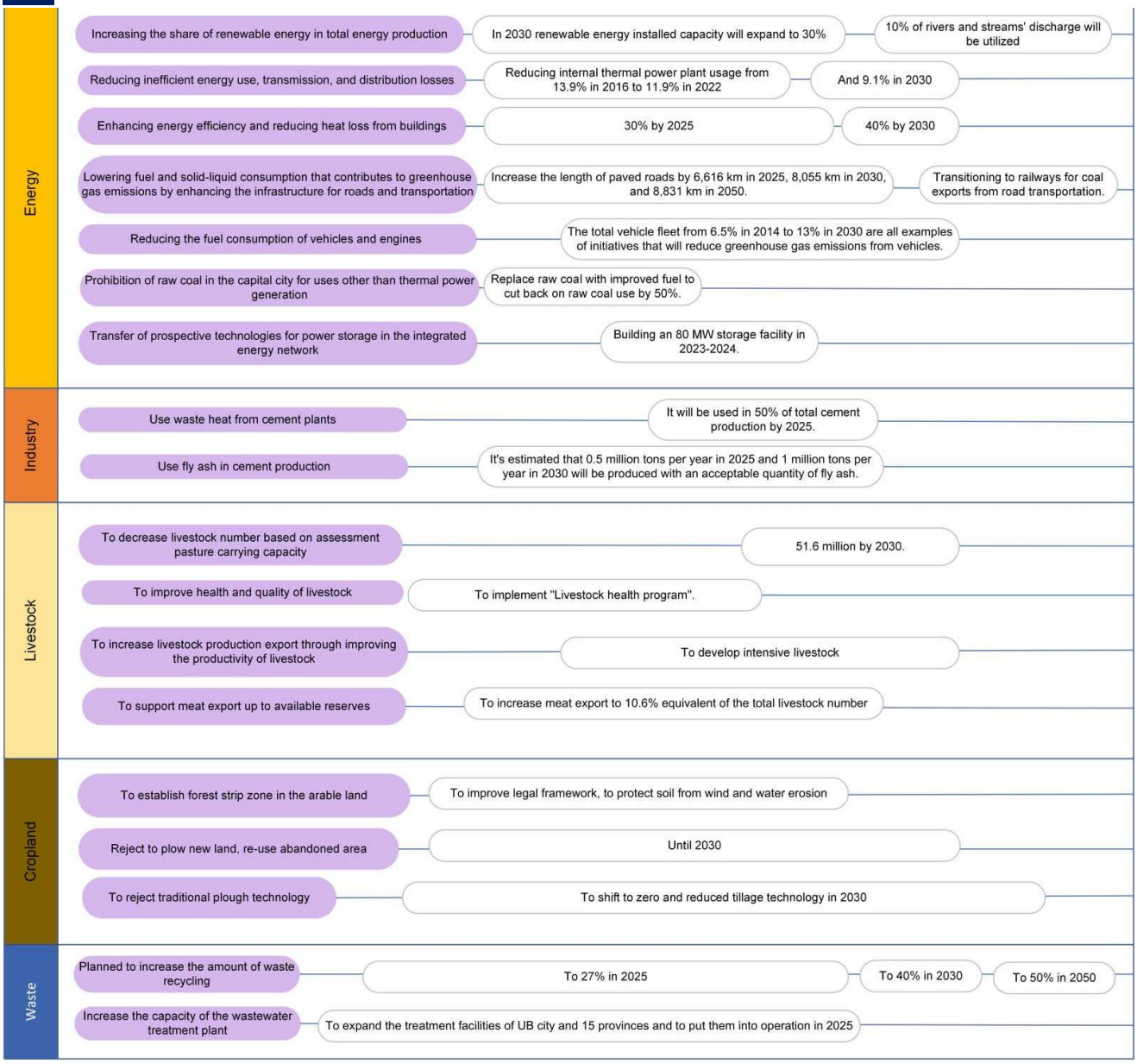

Figure 4-1: Policies and measures to reduce GHG emissions in Mongolia

As discussed in Chapter 3, section 3.1, the long-term policy documents “Vision-2050”, “New Revival Policy-2030”, and “Nationally Determined Contribution (NDC)” and relevant policy documents of Mongolia should be taken into consideration when conducting assessment on measures to reduce GHG emissions and their impact in this report. However, due to the preparation of policy documents for the medium or 10-year period is in-progress, it was not possible to include detailed estimation within this report.

The future projection of GHG emissions and removals in Mongolia was estimated based on population growth, accompanying economic developments, and their demands, if no additional steps are taken (BAU) and mitigation scenario GHG emissions based on related policy measures at the national and sector-level using international guidelines, methodologies, and models. The results are shown in Figure 4-2.

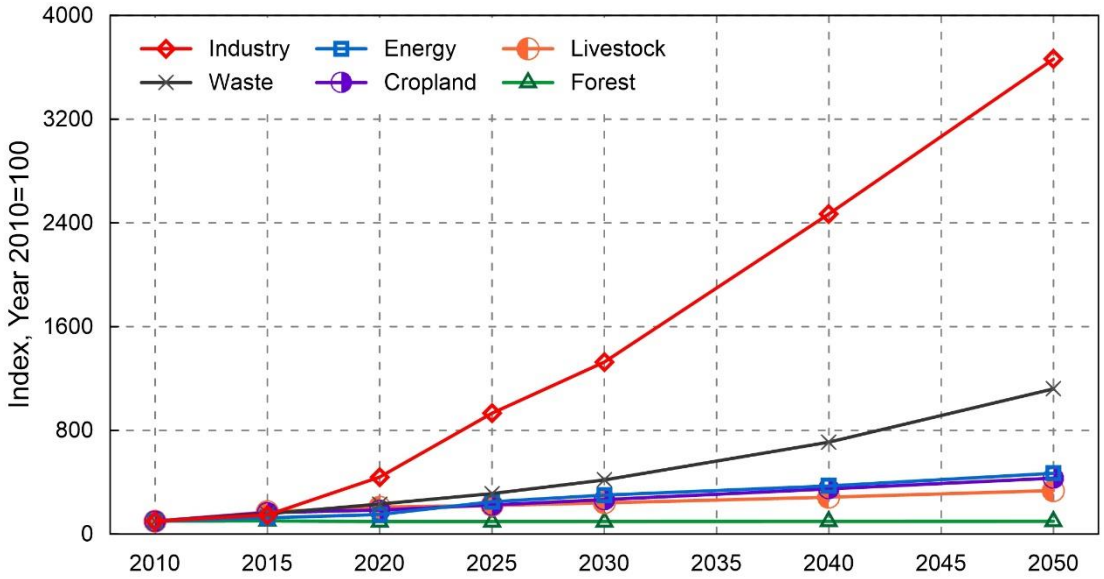

Figure 4-2: Future projections of GHG emissions and removals by sector

Future projections to 2030 and 2050, using 2010 as the base year and assuming BAU scenario, show that emissions from the energy sector are expected to increase by 3.0 and 4.7 times, the industrial sector by 13.3 and 36.6 times, the livestock sector by 2.4 and 3.4 times, the cropland by 2.7 and 4.3 times, and waste sector 4.2 and 11.2 times, while the carbon sink potential of forests will rise by 14.0% and 31.0%, respectively.

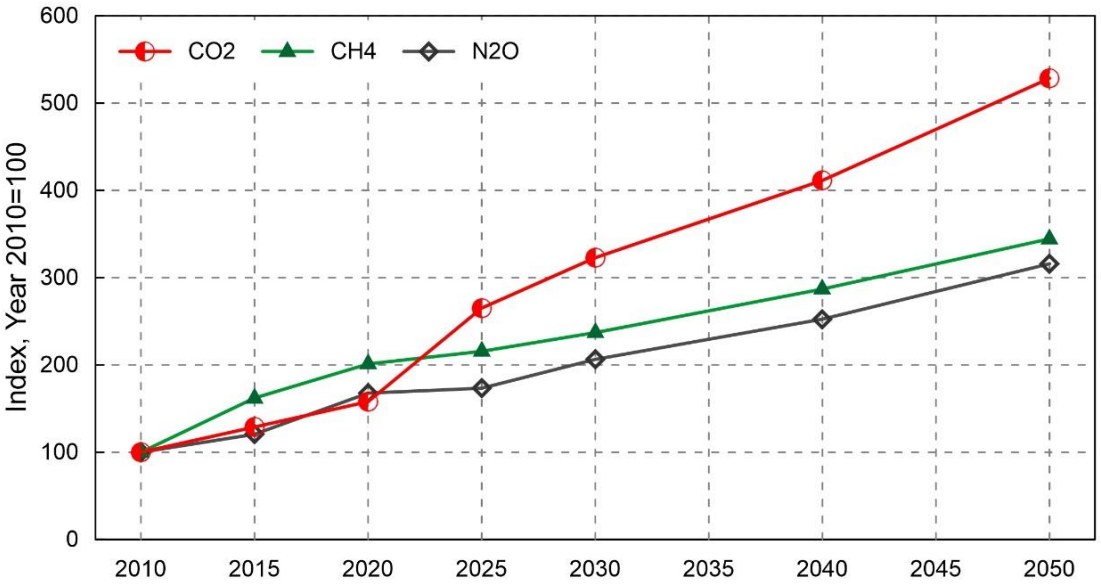

Figure 4-3: Future projections of GHG emissions by gas

Carbon dioxide (CO_2) emissions will increase by 3.2 and 5.3 times, methane (CH_4) emissions by 2.4 and 3.5 times, and nitrous oxide (N_2O) emissions by 2.1 and 3.2 times in 2030 and 2050 compared to the base year 2010, respectively (Figure 4-3).

If the measures outlined in the policies, plans and programs for sectors that emit GHG emissions are completely implemented, the total GHG emissions could be reduced by 24.3%, 26.4%, and 27.4% in 2030, 2040, and 2050, respectively, according the mitigation scenario (without LULUCF) (Figure 4-1).

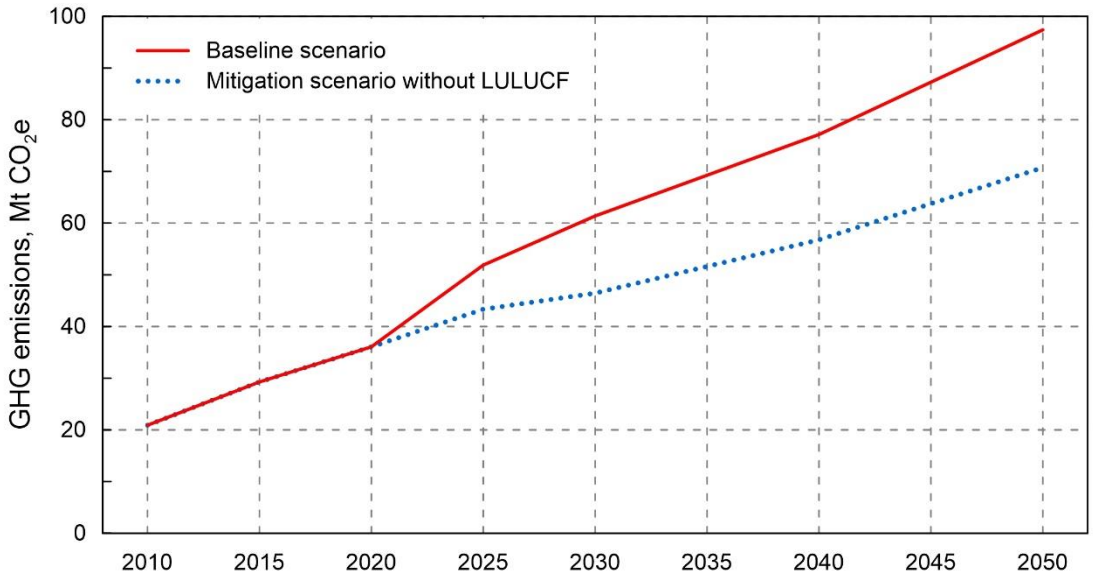

Figure 4-4: Comparison of the baseline and mitigation scenarios of GHG emissions of Mongolia

Figure 4-4 demonstrated the scenarios of GHG emissions without LULUCF, when all mitigation measures considered by national policy documents are fully implemented, compared with the baseline scenario for Mongolia.

Table 4-1 shows the total GHG mitigation potential including land use, land use changes, and forest (LULUCF) removals. As seen from the table the amount of GHG reductions could be reduced by 57.8%, 55.0%, and 51.3% compared to the baseline scenario in 2030, 2040, and 2050, respectively.

Table 4-1: Total GHG mitigation potential including LULUCF, Mt CO_2e

	2010	2015	2020	2025	2030	2040	2050
GHG baseline scenario (including forest removals)	-7.3	0.5	9.0	24.7	34.1	49.6	69.6
GHG mitigation scenario (including increased forest removals)	-7.3	0.5	9.0	13.8	14.4	22.3	33.9
Total GHG mitigation potential (including forest removals)	-	-	-	11.0	19.7	27.3	35.7
Total GHG mitigation potential (including forest removals), %	-	-	-	*44.3*	*57.8*	*55.0*	*51.3*

4.2 Sectorial Baseline Scenario and Potential Mitigation Options for Reducing GHG Emissions

4.2.1 Energy sector

The Energy sector shares 50% of total GHG emissions related to energy production and consumption using solid and liquid fuels. Energy production in 2020 used 7.5 million tonnes of raw coal and 1.4 million tonnes of imported oil products, which is 1.2 and 1.5 times more compared with 2010. Mongolia has a wealth of renewable energy resources, including geothermal, wind, and solar power (PoM, 2005; PoM, 2007).

According to the “Nationally Determined Contribution”, the energy sector will be responsible for 66.7% of the overall reduction in GHG emissions in 2030, which is estimated to be 16.9 million t CO_2e.

Increasing the use of renewable energy and the efficiency of energy production and consumption are the two primary strategies outlined in the development documents for reducing GHG emissions in the sector. However, they may also be categorized by the energy sector as follows:

- Increasing the share of renewable energy in total energy production: In 2030, renewable energy installed capacity will expand to 30%, and 10% of rivers and streams’ discharge will be utilized for energy production and other purposes (PoM, 2016; PoM, 2020a etc.),
- Reducing inefficient energy use, transmission, and distribution losses: Reducing internal thermal power plant usage from 13.9% in 2016 to 11.9% in 2022 and 9.1% in 2030 through the renewal of energy production, and industrial technologies would also reduce power transmission and distribution losses from 15.7% in 2016 to 13.7% in 2022 (GoM, 2011; PoM, 2015c; GoM, 2017d),
- Transfer of prospective technologies for power storage in the integrated energy network: Building an 80 MW storage facility in 2023–2024 (PoM, 2020b),
- Prohibition of raw coal uses in the capital city for other than thermal power generation: Replace raw coal with improved coal briquette to cut back on raw coal use by 50% (PoM, 2017b),
- Enhancing energy efficiency and reducing heat loss from buildings: Reduce building heat loss by 30% by 2025 and 40% by 2030 by using locally sourced green technology, energy-efficient solutions, and advanced standards, including energy audits and green building assessment systems (PoM, 2014a; PoM, 2015c). Using geothermal energy to increase the

heat supply to the soum, the provincial capital, and the surrounding districts, as well as the effectiveness of the heating boilers (NDC, 2019),

- Lowering fuel and solid-liquid consumption that contributes to GHG emissions by improving the infrastructure for roads and transportation: Increase the length of paved roads by 6,616 km in 2025, 8,055 km in 2030, and 8,831 km in 2050. Reduce the usage of coal and liquid fuel by switching passenger railways to electric heating and transitioning to railways for coal exports from road transportation (PoM, 2016; NDC, 2019; PoM, 2020a),
- Increase the use of gas-powered and low-fuel vehicles: Improvements to the environmental tax and payment system, conversion of liquid fuel-using vehicles to liquefied gas vehicles, and an increase in the proportion of low-fuel-consumption vehicles in the total vehicle fleet from 6.5% in 2014 to 13% in 2030 are all examples of initiatives that will reduce GHG emissions from vehicles and engines (PoM, 2008; INDC, 2015; PoM, 2016). Vehicles with a gas engine will rise from 1.7% in 2016 to 2.3% in 2022, while those with a duo-drive system will rise from 11.6% in 2016 to 21% in 2022 (PoM, 2016, GoM, 2017d).

The LEAP (Heaps C.G, 2022) model input data must be carefully planned to estimate future GHG emissions of energy sector. The model requires data on social and economic variables, associated future energy requirements, and present and foreseeable capacity, output, and efficiency of energy generation. The projection of all input data will consider past, present, and future objectives as reflected in the nation's policies, programs, and plans. However, depending on the socioeconomic circumstances of the base year, the calculation of the future scenario of GHG emissions differs significantly. The base year used in this study was 2010, but actual social and economic data from earlier years and up to 2020 were integrated and computed; therefore, it is anticipated that a considerably more accurate scenario.

The most significant factors influencing energy generation and long-term energy planning are the population, the number of households, household income, gross domestic product (GDP), and their future variations. These data were gathered and computed from the website of the International Energy Agency (https://www.iea.org), the NSO of Mongolia (NSO, 2021), the Energy Statistics Bulletin published by the Energy Regulatory Commission (ERC, 2021), and other sources. The data for the estimation of population growth scenario was retrieved from National Statistics Office's website and an appendix of the "Vision-2050" policy document was used for calculating GDP at the 2018 rate (Table 4-2).

Table 4-2: Baseline scenario of socio-economic indicators of Mongolia

Indicators	2010	2015	2020	2025	2030	2040	2050
Population number, thous. person	2,761.0	3,057.8	3,357.5	3,641.3	3,922.2	4,552.0	5,283.6
GDP, billion USD	7.9	11.8	13.1	25.0	32.6	54.6	77.6
Household number, thous. Households	742.3	859.1	908.7	978.9	1,054.6	1,223.9	1,420.4
Household income, USD	2,604	3,843	3,914	6,875	8,299	12,004	14,682

Sources: NSO (www.1212.mn), Vision-2050 of Mongolia

The challenge of estimating GHG emissions from future energy requirements is a crucial next step that needs data from the energy-using industries. The installation and installed energy capacity, efficiency-coefficient, and energy output data are relevant to satisfying that demand data will be incorporated into the model after this has been done. The capacity of thermal power plants

presently operational and may be set up in the near future is displayed in Table 4-3. This is the most crucial detail in the baseline scenario, since it explains the vast majority of GHG emissions from the energy sector.

Table 4-3: Information about thermal power plants, both existing and to be constructed in the future

№	Name	Installed capacity, MW	Commissioning year	Power source	Measures, description	Annual energy output in GWh
1	CHP2	24	Functional since 1961	Coal	No upgrades or additions are anticipated	The installed capacity of thermal power plants was 905.7 MW, 4,256 GWh in 2010, 1,078.7 MW, 5,323.5 GWh in 2015, and 1,278.4 MW, 6,493.4 GWh in 2021.
2	CHP3	198	Functional since 1968	Coal	Expansion of 12 MW in 2021	
3	CHP4	772	Functional since 1983	Coal	Expansion of 89 MW in 2020	
4	Darkhan CHP	83	Functional since 1965	Coal	Expansion of 35 MW in 2019	
5	Erdenet CHP	71	Functional since 1987	Coal	Expansion of 12 MW in 2021	
6	CHP of the Erdenet plant	53	Functional since 2011	Coal	Expansion of 48 MW in 2017	
7	Choibalsan CHP	36	Functional since 2007	Coal	Expansion of 50 MW in 2023	
8	Dalanzadgad CHP	9	Functional since 2000	Coal	Expansion of 6 MW in 2015 to 9 MW in 2018	
9	Ukhaa khudag CHP	18	Functional since 2011	Coal	It began delivering to the central energy system in 2019	
10	Diesel station	14.4	Existing	Diesel	It will continue to decline.	
11	CHP5	450	From 2025	Coal	To support the infrastructure of CHP3	Total 2030 Capacity: 2,968.7 MW, 14,164.3 GWh, including 1,690 MW of new capacity.
12	Baganuur CHP	700	From 2026	Coal	2,160,000 million kWh per year	
13	Oyutolgoi/Tavantolgoi CHP	450	From 2025	Coal	2021-2025	
14	Amgalan TPP	50	From 2023	Coal		

Sources: ERC, 2021a; GoM, 2018b; MoE: https://www.energy.gov.mn/; NSO: https://www.1212.mn/; ERC: https://erc.gov.mn/; NDC, 2019; National Dispatching center: https://ndc.energy.mn/; Second thermal power plant: http://www.tpp2.mn; Third thermal power plant: http://tes3.energy.mn; Fourth thermal power plant: http://tpp4.mn; Erdenet thermal power plant: http://erdpp.energy.mn; Darkhan thermal power plant: http://dpp.energy.mn.

The capacity, output, and efficiency-coefficient data for currently installed coal-fired and renewable energy producers make up the next section of the baseline scenario. It was gathered from the sources mentioned above and placed into the program. A baseline scenario was designed utilizing mathematical and statistical approaches by adding data from several energy consumption sectors and the energy production information mentioned above. The information on the heat output of coal mines and the coefficient of GHG emissions is taken from Tables 3.2 and 3.7 in the report "Development of a National Methodology for Determining GHG Emissions in the Energy Sector" by B. Namkhainyam et al., 2021, which approved by the Energy Regulatory Commission (ERC). The LEAP model computed the overall GHG emissions from the energy sector, considering all sources mentioned above. The results are displayed in Figure 4-5.

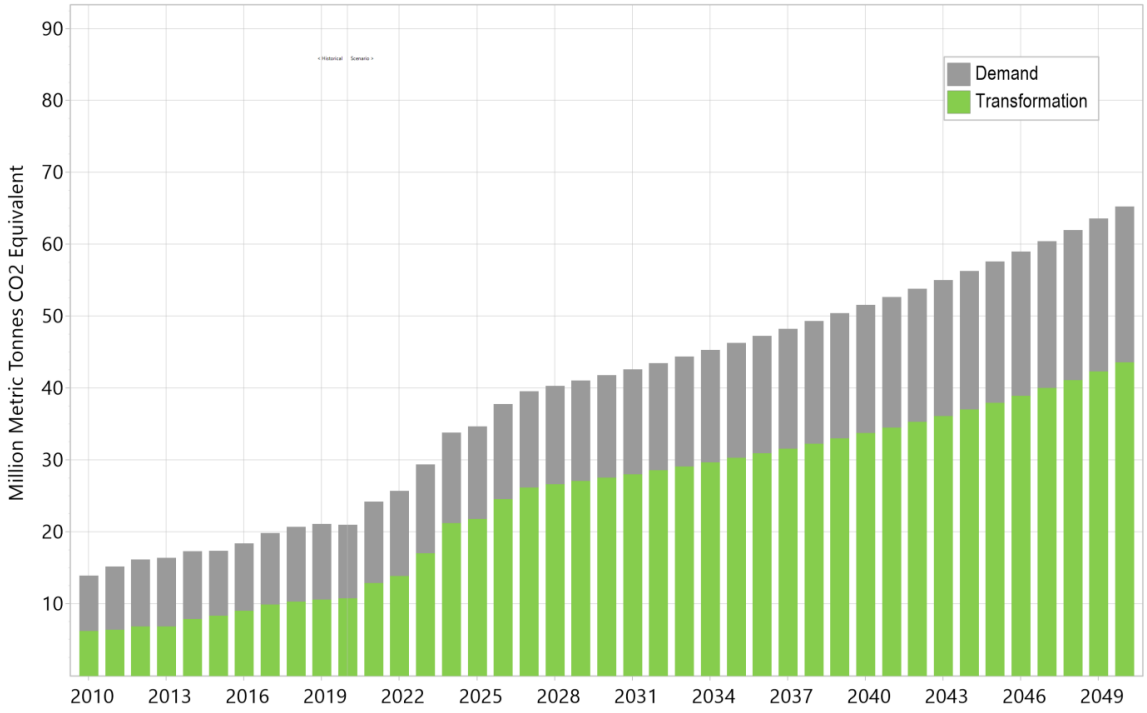

Figure 4-5: Baseline scenarios for GHG emissions from the energy sector using the LEAP model

In 2020, energy sector emitted 21.0 Mt CO_2e GHGs, as shown in Figure 4-5. The amount will rise to 34.7 Mt CO_2e, 41.8 Mt CO_2e, 51.6 Mt CO_2e, and 65.2 Mt CO_2e in 2025, 2030, 2040, and 2050, respectively.

The policy and program's actions were divided into two main categories to calculate the reduction of GHG emissions from the energy sector such as "Improving energy efficiency" and "Expanding the usage of renewable energy and output."

Solar, wind, and hydro-power plants are the main targets of policies to expand renewable energy generation shown in Table 4-4.

Table 4-4: Information on implemented and upcoming renewable energy resources as of 2021

№	Title	Location	Installed capacity, MW	Commissioning year	Power resource	Measures, description, expenses, million USD	Annual energy output in GWh
Implemented Project							
1	Salkhit WPP	Sergelen soum, Tuv province	50	Currently operational (since 2013)	Wind	120.0	168.5
2	Durgun HPP	Durgun soum, Khovd province	12	Currently operational (since 2009)	Hydro	26.5	38.0
3	Taishir HPP	Taishir soum, Govi-Altay province	11	Currently operational (since 2008)	Hydro	20.0	37.0
4	Nar SPP	Khongor soum, Darkhan-Uul province	10	Currently operational (since 2017)	Solar	20.0	14.2
5	Shand WPP	Sainshand soum, Dornogovi province	55	Currently operational (since 2018)	Wind	110.0	200.0
6	Tsetsii WPP	Tsogttsetsii soum, Umnugovi province	50	Currently operational (since 2017)	Wind	118.0	201.8
7	Gobi SPP	Sainshand soum, Dornogovi province	30	Currently operational (since 2020)	Solar	70.0	52.0
8	Gegeen SPP	Zamiin-Uud soum, Dornogovi province	15	Currently operational (since 2018)	Solar	25.0	28.6
9	Sumber SPP	Sumber soum, Govi-Sumber province	10	Currently operational (since 2018)	Solar	17.3	17.1
10	Bukhug SPP	Sergelen soum, Tuv province	15	Currently operational (since 2019)	Solar	27.0	22.7
11	Monnaran SPP	Bayanchandmani soum, Tuv province	10	Currently operational (since 2017)	Solar	23.0	14.5
12	Tosontsengel HPP	Tosontsengel soum, Zavkhan province	0.37	Currently operational (since 2006)	Hydro	Small size	1.5
13	Bogd's River HPP	Aldarkhaan soum, Zavkhan province	2	Currently operational (since 1997)	Hydro	Small size	2.9
Planned to be implemented (within the next four years)							
14	Eg river	Khutag-Ondor	315	2022-2023	Hydro	827	606.0

		soum, Bulgan province					
15	Wind Farm Choir	Sumber soum, Govi-Sumber province	50.4	2023-2025	Wind		154.5
16	AB Solar Wind	Dalanjargalan soum, Dornogovi province	100	2023-2025	Wind		306.6
17	“Cleantech”LLC	Khanbogd soum, Umnugovi province	102	From 2025	Wind		312.7
18	“Mosheaeco energy” LLC	Sergelen soum, Tuv province	50	2022-2025	Solar		73.6
19	“Luxtum” LLC	Sergelen soum, Tuv province	9	2022-2025	Solar		14.2
20	“Solar power Mongolia” LLC	Zuunmod soum, Tuv province	30	2022-2025	Solar		48.6
21	“Sun steppe” LLC	Bayandelger soum, Tuv province	50	2022-2025	Solar		76.7
22	“Sun road trade.”	Sumber soum, Govi-Sumber province	30	2023-2025	Solar		48.6
23	“Uni Solar” LLC	Khongor soum, Darkhan-Uul province	30	2023-2025	Solar		48.6
24	“DSTSTS”LLC	Erdene soum, Dornogovi province	20	2023-2025	Solar		32.4
25	“Newcom Solar Energy “LLC	Saintsagaan soum, Dundgovi province	24	2023-2025	Solar		38.9
26	Power storage Station	Songinokhairkhan district, Ulaanbaatar city	80	2023-2024	Accumulator	114.0	200.0
27	Aldarkhaan SPP	Aldarkhaan soum, Zavkhan province	5	2022-2023	Solar	195.0	9.0
28	Erdeneburen HPP	Erdeneburen soum, Khovd province	90	2023	Hydro		
There was 23.37 MW, 79.4 GWh of installed renewable energy plants in 2010, 75.37 MW, 247.9 GWh in 2015, and 270.37 MW, 803.2 GWh in 2020.				Between 2022-2025, 895.4 MW and 1,970.4 GWh of capacity is planned to be installed. As a result, a total installed capacity will reach 1,165.77 MW and energy production of 2,773.6 GWh in 2025.			

Sources: ERC, 2021; GoM, 2018b; MoE: https://www.energy.gov.mn/; NSO: https://www.1212.mn/; ERC: https://erc.gov.mn/; NDC, 2019, National Dispatching Center: https://ndc.energy.mn/.

Based on the information above, planned for inclusion in national level plans and programs, Table 4-5 displays the proportion of renewable energy in the overall energy output. The objectives outlined in the policy programs can be accomplished from this perspective if all scheduled projects are completed on time. The relevant policy and action provisions are no longer effective due to the sectoral policy documents being modified under the planning of the Vision-2050, the long-term policy document. However, in accordance with the condition that the proportion of renewable energy in total production would reach 30% in 2030, sustaining the share of renewable energy production in 2030 has been adopted to achieve policy consistency between 2030 and 2050.

Table 4-5: Share of renewable energy in total electricity production

Indicators	2010	2015	2020	2025	2030	2040	2050
Total energy production, GWh	4,312.8	5,541.7	7,145.0	10,169.9	13,122.6	14,762.9	16,403.3
By existing and planning to be implemented renewable energy projects, GWh	79.4	247.9	803.2	2,773.6	4142.4	4,665.1	5,183.4
Share of renewable energy production, %	1.8	4.5	11.2	27.3	31.6	31.6	31.6
GHG emission reduction, Mt CO_2e	-	-	-	2.1	3.1	3.5	3.9

By adopting steps to gradually raise the proportion of renewable energy generation in total energy production, as shown in Table 4-5 and Figure 4-6, the GHG emissions will be decreased by 2.1 Mt CO_2e, 3.1 Mt CO_2e, 3.5 Mt CO_2e, and 3.9 Mt CO_2e in 2025, 2030, 2040, and 2050, respectively.

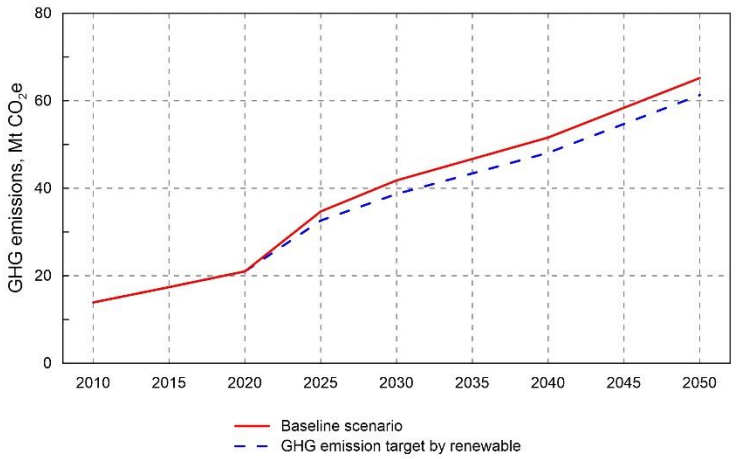

Figure 4-6: A scenario for reducing GHG emissions in the energy sector by increasing renewable energy

Alternatively, in the section on enhancing energy efficiency, the power transmission included in the Mongolian construction NAMA implemented in 2016 and 2020, NAMA Energy Efficient Lighting (2015), NAMA Urban Passenger Transport Ulaanbaatar (2016), and other policies and programs, calculations by previous researchers including reducing on distribution losses and internal consumption of stations, increasing the use of efficient household lighting (reducing the use of incandescent lamps), reducing heat loss in buildings and homes, and increasing the number of gas and electric vehicles that consume less fuel.

To prepare scenarios, calculations were done using the numbers in Table 4-6. According to the above sources, insulating buildings and homes can reduce energy use by up to 30%. If improved

fuel is used for purposes other than thermal power plants in the capital city, raw coal consumption can be cut by 50%. Moreover, if full LED lights are used, the annual energy consumption for lighting can be reduced by 73.6%. On the other hand, the internal demand of stations and losses associated with power transmission and distribution have been converted into GHG emissions by deducting the policy and program's targeted amount from the potential value in the future.

Table 4-6: Calculation of scenario for reducing GHG emissions by improving energy efficiency

Indicators		2010	2015	2020	2025	2030	2040	2050
Reduction of losses during the transmission and distribution of energy	Percentage of total reserve electricity (reduction rate), %	13.5	14.2	10.8	9.3 (4.1)	7.8 (6.1)	5.3 (6.5)	3.5 (6.8)
	Reduction, Mt CO_2e	-	-	-	0.3	0.6	0.7	0.8
Reduction of heat distribution losses	Heat dissipation percentage (reduction rate), %	2.4	3.6	2.1	1.9 (2.3)	1.6 (4.1)	1.3 (4.2)	0.9 (4.3)
	Reduction, Mt CO_2e	-	-	-	0.8	1.4	1.9	2.1
Reduction of the internal demand for plants	Percentage of electricity produced, %	15.6	14.1	11.2	11.2 (2.2)	9.1 (4.1)	6.7 (5.4)	3.5 (7.7)
	Reduction, Mt CO_2e	-	-	-	0.8	2.0	3.0	4.7
Use of coal briquettes in the capital city for purposes other than thermal power plants	Reduction of raw coal consumption by 50%, thous. households	204	197	228	259	204	197	228
	Reduction, Mt CO_2e	-	-	-	0.6	0.6	0.7	0.7
Insulation of old buildings and apartments	Number of apartments, %	-	20	50	70	90	90	100
	Reduction, million t CO_2e	-	-	-	1.1	1.3	1.3	1.3
The proportion of city homes using LED lighting	City households, %	-	50	60	75	90	100	100
	Reduction, Mt CO_2e	-	-	-	0.1	0.1	0.1	0.1
Share of vehicles with low fuel consumption in the total number of vehicles, %	The share of hybrid, gas, and electric transport, %	-	6.5	8.7	10.9	13.0	17.4	21.8
	Reduction, Mt CO_2e	-	-	-	0.1	0.2	0.3	0.4
Total GHG emission reduction, Mt CO_2e		-	-	-	3.8	6.2	8.0	10.1

Sources: ERC, 2021a; GoM, 2018b; MoE: https://www.energy.gov.mn/; NSO: https://www.1212.mn/; ERC, 2021; NDC, 2019: ERC: https://erc.gov.mn/, National Dispatching center: https://ndc.energy.mn/.

Increasing energy efficiency will cut the sector's GHG emissions by 3.8 Mt CO_2e, 6.2 Mt CO_2e, 8.0 Mt CO_2e, and 10.1 Mt CO_2e in 2025, 2030, 2040, and 2050, respectively, if all the projects and policies mentioned above are successfully implemented.

Table 4-7: Total GHG mitigation potential in energy sector, Mt CO_2e

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU)	13.9	17.4	21.0	34.7	41.8	51.6	65.2
Mitigation scenario	13.9	17.4	21.0	28.8	32.5	40.1	51.2
Total GHG emissions reduction	-	-	-	5.9	9.3	11.5	14.0
-Use of renewable energy	-	-	-	2.1	3.1	3.5	3.9
-Energy efficiency improvement scenario	-	-	-	3.8	6.2	8.0	10.1
Total GHG emissions reduction, %	*-*	*-*	*-*	*17.0*	*22.2*	*22.3*	*21.5*

The sector's overall GHG emission reductions by scenario estimates are shown in Table 4-7 and Figure 4-7. It will be able to cut the overall GHG emissions from the energy sector by 5.9 Mt CO_2e, 9.3 Mt CO_2e, 11.5 Mt CO_2e, and 14.0 Mt CO_2e in 2025, 2030, 2040, and 2050, respectively, if all the stated projects and actions are successfully implemented.

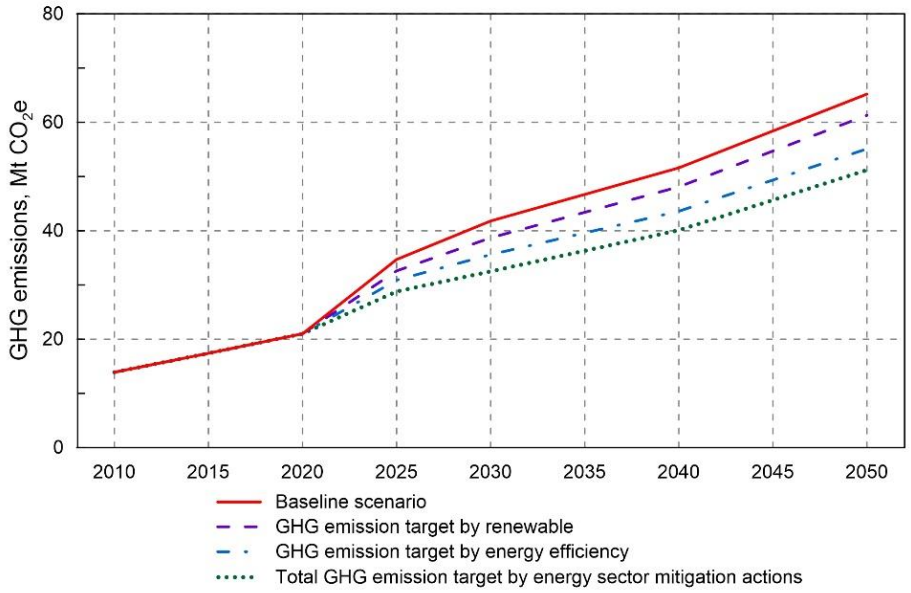

Figure 4-7: Comparison of the baseline and mitigation scenarios for GHG emissions in the energy sector

Table 4-8 shows the integrated information on projects and policy measures to reduce GHG emissions implemented in the energy sector.

Table 4-8: Integrated table of measures to reduce GHG emissions implemented in the energy sector

GHG emission sector: Energy (Renewable) sector mitigation action No.1

Description	
Name of the action:	Durgun Hydro-power plant, CDM project
Type: Project	*Implementation duration:* 2007-2025 *Target gases:* CO_2
The main objective of mitigation action:	Increasing the proportion of renewable energy in the energy balance.
Description of mitigation action:	By installing a 10 MW HPP, it will be possible to fulfil the demands of residential and public services in the provinces of Uvs, Hovd, and Bayan-Ulgii, also producing 38,000 MWh of energy annually without burning coal and reducing 30,400 t CO_2e.
Type of instrument	
By policy:	Vision-2050, National Renewable Energy Commission (NREC), 2015-2030
Implementation	
Status of implementing:	It has been implemented since November 2008
Implementing entity :	Mongolian side: Energy Administration Japanese side: Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (withdrawn); The Chugoku Electric Power Co., Ltd
Progress indicators:	Production varies depending on rainfall, with 28.4 million kWh produced in 2013, 42.7 million kWh in 2014, 34.0 million kWh in 2015, 37.9 million kWh in 2016, 42.5 million kWh in 2017, and 46.0 million kWh in 2018, 48.9 million kWh in 2019, 55.5 million kWh in 2020, and 53.8 million kWh in 2021, respectively (ERC, 2021). As of now, 389.6 million kWh have been generated between 2013 and 2021.
Steps taken/ envisaged:	A hydro-power plant was constructed on the Chono kharaikh river, and the produced electricity was connected to the western region's power grid.
Methodology	
Methodologies/ Assumptions: An integrated framework technique for renewable energy producers connected to the electricity distribution network	
Effects	
Outcomes achieved:	Between 2008 and 2012, 57,768 t CO_2e credits for emission reductions were granted with 3 issuances, while a total of 159,640 t CO_2e were reduced between 2008 and 2015. GHG emissions were reduced by 73% of the estimated water deficit.
Co-benefits:	The power used by the western region integrated system supplied 24.9% or 216.0 million kWh of energy in 2021. Also, in addition to supporting other sustainable development indicators, it contributed to increasing local employment.
Potential reduction for GHG emissions:	According to preliminary estimations, an annual reduction of 30,400 t CO_2e is expected.

GHG emission sector: Energy (Renewable) sector mitigation action No.2

	Description
Name of the action:	Taishir Hydro-power plant, CDM Project
Type: Project	*Implementation duration:* 2007-2025 *Target gases:* CO_2
The main objective of mitigation action:	Increasing the proportion of renewable energy in the energy balance.
Description of mitigation action:	By installing an 11 MW HPP, it will be possible to fulfil the demands in the Zavkhan and Govi-Altay provinces and produce 37,000 MWh of energy annually without burning coal and reducing 29,600 t CO_2e.
	Type of instrument
By policy:	Vision-2050, NREC, 2005-2020, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030
	Implementation
Status of implementing:	It has been implemented since November 2008
Implementing entity :	Mongolian side: Energy Administration Japanese side: Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (withdrawn); The Chugoku Electric Power Co., Ltd
Progress indicators:	The annual production amount varies significantly due to a lack of water; at present, it was produced in amounts of 13.3 million kWh in 2013, 19.9 million kWh in 2014, 20.4 million kWh in 2015, 16.0 million kWh in 2016, and 24.8 million kWh in 2017, 25.3 million kWh in 2018, 32.8 million kWh in 2019, 22.8 million kWh in 2020, and 18.3 million kWh in 2021. (ERC, 2021). A total of 193.6 million kWh of energy were produced between 2013 and 2021.
Steps taken/ envisaged:	On the Zavkhan River, a hydro-power plant was built, and its electricity was connected to the Altai Uliastai Energy System.
	Methodology
Methodologies/ Assumptions:	An integrated framework technique for renewable energy producers connected to the electricity distribution network.
	Effects
Outcomes achieved:	Between 2008 and 2012, 19,182 t CO_2e credit for granted to emission reductions with four issuances, while a total of 69,792.6 t CO_2e emissions were reduced from 2008 to 2015. GHG emissions were reduced by 33% of the estimated water deficit.
Co-benefits:	It supports sustainable development indicators, including job creation and supplies 41.4% (or 78.4% at total capacity) of the energy needed by the Altai Uliastai Energy System. Near the hydropower plant, an artificial lake with 1 billion cubic meters of water was made. Along its 100-kilometre coastline, four households of soums participated in traditional livestock husbandry, and the air humidity in that region has dramatically risen.
Potential reduction for GHG emissions:	According to preliminary estimations, an annual reduction of 29,600 t CO_2e is expected.

GHG emission sector: Energy (Renewable) sector mitigation action No.3

Description		
Name of the action:	Salkhit Wind Farm, CDM Project	
Type: Project	*Implementation duration:* 2013-2025	*Target gases:* CO_2
The main objective of mitigation action:	Increasing the proportion of renewable energy in the energy balance.	
Description of mitigation action:	A 49.6 MW wind farm can create 168,500 MWh of electricity per year and supply it to the central power system without burning coal, reducing 178,778 t CO_2e per year	
Type of instrument		
By policy:	Vision-2050, NREC, 2005-2020, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030	
Implementation		
Status of implementing:	It has been implemented since June 2013	
Implementing entity :	Mongolian side: Clean Energy LLC Sweden side: Swedish Energy Agency	
Progress indicators:	The production of electricity varied from 8.7 million kWh in 2013, 122.7 million kWh in 2014, 139.5 million kWh in 2015, 295.4 million kWh in 2016, 237.4 million kWh in 2017, 154.9 million kWh in 2018, and 140.8 million kWh in 2019, 138.3 million kWh in 2020, and 175.6 million kWh in 2021. (ERC, 2021).1,413.2 million kWh in total were generated between 2013 and 2021.	
Steps taken/ envisaged:	A wind farm was built on the Salkhit Mountain, and the generated electricity was connected to the central power system.	
Methodology		
Methodologies/Assumptions:	An integrated framework technique for renewable energy producers connected to the electricity distribution network	
Effects		
Outcomes achieved:	The credit for the emission reductions of up to 1,037,492 t CO_2e was granted based on the findings of 14 monitoring reports between 2013 and 2020.	
Co-benefits:	As of 2021, it contributes 2.3% of the energy required by the Central Region's integrated system and helps with other sustainable development indicators, including local employment growth.	
Potential reduction for GHG emissions:	According to preliminary estimations, an annual reduction of 178,778 t CO_2e is expected.	

GHG emission sector: Energy (Energy efficiency) sector mitigation action No.4

	Description
Name of the action:	"Program for Microfinance of Clean Energy Products"
Type: Project	*Implementation duration:* 2013-2033 *Target gases:* CO_2
The main objective of mitigation action:	To reduce heat loss and improve energy efficiency.
Description of mitigation action:	By promoting improved stoves and home insulation technologies, which are clean energy products with minimal emissions, we can decrease the fuel required to heat homes, houses, and other structures.
	Type of instrument
By policy:	Vision-2050, NAPCC, 2011-2021, Law on air, 2012
	Implementation
Status of implementing:	It has been implemented since October 2012
Implementing entity :	Mongolian side: XacBank, Great Britain Sweden side: Micro Energy Credits, Swedish Energy Agency
Progress indicators:	18,638 households received renovated stoves for the heating season of 2013–2014, while 1,270 households received home insulation at a cheaper rate.
Steps taken/ envisaged:	Households in the ger district are provided with home insulation and low-emission stoves.
	Methodology
Methodologies/Assumptions:	Techniques to increase energy efficiency by using alternatives to construction fuels
	Effects
Outcomes achieved:	A credit for emission reductions totalling 31,767 t CO_2e to a one-time issue was awarded for the control period between 2013.01 and 2014.05, which is 63.4% of the projected quantity. The monitoring report on emission reduction for May 2014 to May 2016 has been sent, and the issuance of credits are awaiting.
Co-benefits:	It also provides families with a comfortable living environment while saving 118 GWh of energy annually and lowering GHG emissions.
Potential reduction for GHG emissions:	According to preliminary estimations, an annual reduction of 50,133 t CO_2e is expected.

Source: Projects by the Clean Development Mechanism (CDM): http://cdm.unfccc.int/Projects/projsearch.html

GHG emission sector: Energy (Renewable) sector mitigation action No.5

	Description
Name of the action:	"10MW Solar Photovoltaic Power Station Project in Darkhan", a model project of the joint Crediting Mechanism (JCM)
Type: Project	*Implementation duration:* 2017-2030 *Target gases:* CO_2
The main objective of mitigation action:	Increasing the proportion of renewable energy in the energy balance and supplying sustainable energy.
Description of mitigation action:	A project to install a 10MW solar power plant (SPP) on 36 hectares next to a 110kW sub-station in Darkhan to generate 14,182 MWh of power annually and transmit that electricity into the central power system (CPS) to reduce GHG emissions.
	Type of instrument
By policy:	Vision-2050, NREC, 2005-2020, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030
	Implementation
Status of implementing:	It has been implemented since December 2016
Implementing entity :	Mongolian side: Solar Power International, LLC Japanese side: Sharp Co., Ltd
Progress indicators:	The power plant's solar panels, each of which has a maximum 310 W capacity, generated 16.6 million kWh in 2018, 17.8 million kWh in 2019, 15.7 million kWh in 2020, and 15.7 million kWh in 2021. From 2018 to 2021, a total of 65.2 million kWh was generated.
Steps taken/ envisaged:	A solar power plant (SPP) has been installed in Darkhan City, and that is connected to the central power system.
	Methodology
Methodologies/ Assumptions:	A technique with an integrated framework for renewable energy producers connected to the electricity distribution network
	Effects
Outcomes achieved:	In 2017, GHG emission reduction was 8,947 t CO_2e Regarding this: Mongolia: 1,789 t CO_2e, Japan: 7,158 t CO_2e
Co-benefits:	Other requirements of sustainable development have been accomplished, including supplying people with energy by producing electricity without burning coal and reducing air pollution.
Potential reduction for GHG emissions:	According to preliminary estimations, an annual reduction of 11,211 t CO_2e is expected.

Source: Projects registered within the Joint Crediting Mechanism (JCM): https://www.jcm.go.jp/projects/registers

GHG emission sector: Energy (Energy efficiency) sector mitigation action No.6

Description	
Name of the action:	Installation of high-efficiency Heat Only Boilers in 118th School of Ulaanbaatar City Project (JCM registered project)
Type: Project	*Implementation duration:* 2016-2020 *Target gases:* CO_2
The main objective of mitigation action:	To improve energy efficiency.
Description of mitigation action:	To minimize coal consumption, increase energy efficiency, and lower GHG emissions. 1-2 inefficient low-pressure furnaces at school 118 in Ulaanbaatar will be replaced with high-efficiency low-pressure furnaces.
Type of instrument	
By policy:	Vision-2050, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030
Implementation	
Status of implementing:	It has been implemented since September 2014 (2015-2020)
Implementing entity :	Mongolian side: Anu Service LLC Japanese side: Suuri keikaku LLC
Progress indicators:	A total of 1,183 GJ of thermal energy was generated between 2015 and 2020.
Steps taken/ envisaged:	Increased energy efficiency by switching the outdated, inefficient furnaces for highly efficient low-pressure furnaces. The replacement stove is expected to reduce emissions of GHGs by 11.4%.
Methodology	
Methodologies/Assumptions:	Techniques for installing and replacing outdated, inefficient furnaces with new, high-efficiency furnaces with low pressure
Effects	
Outcomes achieved:	Between 2016 and 2018, GHG emission reduction was calculated at 168 t CO_2e. Regarding this: Mongolia: 34 t CO_2e, Japan: 134 t CO_2e.
Co-benefits:	Other sustainable development indicators have been achieved by burning less coal, producing power, supplying energy to businesses, reducing air pollution, and producing less ash and other waste.
Potential reduction for GHG emissions:	It is projected to eliminate 92 t CO_2e per year and 552 t CO_2e during the entire duration of the project.

Source: Projects registered within the Joint Crediting Mechanism (JCM): https://www.jcm.go.jp/projects/registers

GHG emission sector: Energy (Energy efficiency) sector mitigation action No.7

	Description
Name of the action:	Centralization of heat supply system by installation of high-efficiency Heat Only Boilers in Bornuur soum Project (JCM registered project)
Type: Project	*Implementation duration:* 2015-2020 *Target gases:* CO_2
The main objective of mitigation action:	To improve energy efficiency.
Description of mitigation action:	Reduce GHG emissions by saving energy by updating outdated, inefficient boiler systems.
	Type of instrument
By policy:	Vision-2050, NREC, 2005-2020, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030
	Implementation
Status of implementing:	It has been implemented since September 2014
Implementing entity :	Mongolian side: Anu Service LLC Japanese side: Suuri keikaku LLC
Progress indicators:	
Steps taken/ envisaged:	
	Methodology
Methodologies/Assumptions:	Techniques for installing and replacing outdated, inefficient heat-only boilers with new, high-efficiency heat-only boilers with low pressure
	Effects
Outcomes achieved:	Between 2016 and 2018, GHG emission reduction was calculated at 315 t CO_2e. Regarding this: Mongolia: 64 t CO_2e, Japan: 251 t CO_2e.
Co-benefits:	Other sustainable development indicators have been achieved by burning less coal, producing power, supplying energy to businesses, reducing the air pollution, and producing less ash and other waste.
Potential reduction for GHG emissions:	It is projected to eliminate 206 t CO_2e per year and 1,236 t CO_2e during the entire duration of the project.

Source: Projects registered within the Joint Crediting Mechanism (JCM): https://www.jcm.go.jp/projects/registers

GHG emission sector: Energy (Renewable) sector mitigation action No.8

	Description
Name of the action:	"Installation of 12.7 MW Solar Power Plant for Power Supply In Ulaanbaatar Suburb" (JCM registered project)
Type: Project	*Implementation duration:* 2018-2030 *Target gases:* CO_2
The main objective of mitigation action:	Increasing the proportion of renewable energy in the energy balance and supplying sustainable energy.
Description of mitigation action:	To increase the generation of clean energy, lower GHG emissions, and reduce air pollution in Ulaanbaatar city
	Type of instrument
By policy:	Vision-2050, NREC, 2005-2020, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030
	Implementation
Status of implementing:	It has been implemented since May 2017
Implementing entity :	Mongolian side: Bridge LLC, Everyday Farm LLC Japanese side: Farmdo corporation
Progress indicators:	The amount of energy produced in 2018 was 17.7 million kWh, 18.2 million kWh in 2019, 15.0 million kWh in 2020, and 18.0 million kWh in 2021. From 2018 through 2021, 68.9 million kWh of energy was generated.
Steps taken/ envisaged:	
	Methodology
Methodologies/ Assumptions:	MN AM003
	Effects
Outcomes achieved:	Between 2016 and 2018, GHG emission reduction was calculated at 44,299 t CO_2e. Regarding this: Mongolia: 8,860 t CO_2e, Japan: 35,439 t CO_2e
Co-benefits:	Other requirements for sustainable development, such as supplying people with energy by producing electricity without burning coal and reducing air pollution, have been achieved.
Potential reduction for GHG emissions:	It is projected to eliminate 12,009 t CO_2e per year and 157,133 t CO_2e during the entire duration of the project.

Source: Projects registered within the Joint Crediting Mechanism (JCM): https://www.jcm.go.jp/projects/registers

GHG emission sector: Energy (Energy efficiency) sector mitigation action No.9

	Description
Name of the action:	"National initiatives to reduce the construction sector's GHG emissions in Mongolia"
Type: Project	*Implementation duration:* 2017-2020 *Target gases:* CO_2
The main objective of mitigation action:	Implement national measures in Mongolia to reduce GHG emissions from the building industry, encourage the adoption of energy-saving technology, and support the market.
Description of mitigation action:	To increase the generation of clean energy, lower GHG emissions, and reduce air pollution in Ulaanbaatar city.
	Type of instrument
By policy:	Vision-2050, NREC, 2005-2020, NAPCC, 2011-2021, Green Development Policy, 2014-2030, GPE, 2015-2030
	Implementation
Status of implementing:	It has been implemented since May 2017
Implementing entity :	Government of Mongolia, Ministry of Construction and Urban Development, United Nations Development Programme Co-implemented by: Ministry of Environment and Tourism, Ministry of Energy, United Nations Development Programme
Progress indicators:	The building's owners will monitor and report on the reduction in GHG emissions at the Erdenedalai soum central heating system and the Jargalan soum school building in Gobi-Altai province. In the heating season of 2018–2019, GHG emission reductions of 102.7 t CO_2e in the school building of Jargalan soum and 2,838.5 t CO_2e in the heating system of Erdenedalai soum were measured and reported.
Steps taken/ envisaged:	As of 2020, 10,709 t CO_2e have been reduced.
	Methodology
Methodologies/Assumptions:	The 2006 IPCC GLs methodology for calculating GHG emissions will be used in the estimation.
	Effects
Outcomes achieved:	Heat loss from the buildings was reduced by 2% in 2020, which achieved a 10% of implementation. (ERC, 2021)
Co-benefits:	Long-term reductions in energy prices will lower household living expenditures and increase financial stability. Air pollution may be decreased significantly by lowering energy use, which will also diminish the need for coal-fired power plants and boilers to provide electricity and heat. This will have a positive impact on the overall population's health.
Potential reduction for GHG emissions:	By 2020, 10,709 t CO_2e, and by 2030, 64,219 t CO_2e will be reduced over the project's duration.

Source: United Nations Development Programme

4.2.2 Industry sector

GHG emissions from the Industrial sector are mainly emitted from cement, lime and metal productions and the use of refrigeration and air conditioning equipment in Mongolia. Although, GHG emissions from the sector have been increasing due to some social and economic factors such as population and the construction industry's growth since 2010, this sector contribute less than 3% of the national total GHG emissions.

In the future, according to "Vision-2050," "State Industry Policy," "State Oil Policy," "State Mineral Resources Policy," "Law on the Promotion of Production," "Investment Program of Mongolia 2018-2021" and other documents, the government planned to implement large projects such as an oil refinery, copper smelter, synthetic natural gas from coal, and steel complex. Long-term emissions of GHGs from industrial processes and product use are predicted to increase dramatically.

According to NDC (2019), industry sector study contrasts more than ten national and sector level policy documents which are implemented in Mongolia analysed, including the government's policy on the industry, high-tech industry, mineral resources, and oil, among others.

Since the NDC submission in 2019, the following policy documents have been freshly adopted, which would affect GHG emissions by industry and product use as follows.

1. National Program for Heavy Industry Development (GoM, 2019b)

The primary material is on the heavy industry goals included in the government's 2016-2020 action plan, which was accepted as an action plan and contained targets affecting GHG emissions. It includes:

- Building a ferrous metallurgy complex with infrastructure in the Orkhon and Darkhan-Selenge areas,
- Building a coal-chemical plant on the Tavantolgoi deposit,
- Building a coal gasification plant based on the Nyalga-Choir district's coal reserves,
- In the Dornogovi province, a factory for processing oil and generating goods such as gasoline and diesel fuel is being built.

2. Mongolia's long-term development policy, "Vision-2050", (PoM, 2020a)

According to this long-term policy, the Mongolia's economy will grow at a 6.0% annual rate, along with the major topics identified Mongolia's long-term social and economic development orientations targeted such as mining deposit will be operational, and the following high-tech heavy industry complexes will be constructed until to 2030.

3. Mongolian Government Action Plan for 2020-2024 (GoM, 2020)

According to this document following plants will be built:

- Ferrous metallurgy (coke, cast iron, direct reduced iron) in Darkhan-Uul, Orkhon, and Dornogovi provinces will be developed,
- A precious metal refining plant will be built,
- An oil refinery plant, based on domestic raw materials, will be built.

4. Mongolia's five-year development guidelines for 2021-2025 (PoM, 2020/08)

According to this five-year direction documents for Mongolia's growth in line with the legislation on development policy, planning, and management, a list of measures to be executed, criteria for monitoring and evaluating implementation, and investment plans. To support export of the most dominant of mineral resources such as of coal, copper concentrate, iron ore, and crude oil, heavy industries such as coal-chemical, copper concentrate, and metallurgy should be immediately started and put into operation.

The following measures concerning GHG emissions in the industrial and production sectors are included in Mongolia's long-term development policy document "Vision-2050," passed by Resolution No. 52 of 2020 of the Parliament of Mongolia (Tables 4-8 and 4-9).

The following measures concerning GHG emissions in the industrial and production sectors are included in Mongolia's long-term development policy document "Vision-2050," passed by Resolution No. 52 of 2020 of the Parliament of Mongolia (Tables 4-8 and 4-9).

Table 4-9: Provisions relating to GHG emission reductions in the industry sector

Objective	Target	Effects on GHG emissions
Objective 4.2. Leading economic sectors will be developed, and an export-oriented economy will be established.	Appendix 2-4.2.14 The mining deposit will be used, and the following high-tech heavy industry complexes will be established and erected. Including: - Copper concentrate processing plant, - Petrochemical, coke-chemical, and metallurgical industries, - Coal washing plant, - Coal-chemical, coal-energy, methane gas production, technology park, - Steel industry, - Feldspar concentrator.	GHG emissions from industrial operations and energy consumption will significantly increase.
Objective 6.4. Develop a low-carbon, productive, and inclusive green economy, and contribute to global efforts to mitigate climate change.	- Increase the capacity to adapt to and endure climate change and mitigate potential risks. - Develop and build the national green finance system, which will be built on public-private partnerships, and we will employ international financial methods to finance environmentally friendly green projects and activities. - Climate change mitigation measures will be adopted, and the difference between GHG emissions and removals will be zero.	There will be progress in designing, financing, and executing GHG emission reduction and adaptation initiatives. It is necessary to define the steps to be done to close the gap between GHG emissions and removals.

Table 4-10: Mitigation measures of "Vision-2050" for industry sector

No	Assessment criteria	Baseline level (2015)	Level of achievement			Description of the assessment criteria
			2025	2030	2050	
1	Share of the manufacturing sector in gross domestic product	10.9	12.0	14.6	27.4	Economic sector development is expressed as a percentage of GDP
2	Percentage of domestic	8.0	70.0	100	100	Import, consumption

	supply of major gasoline brands and types in compliance with the Euro 5 standard					volume, and proportion of total fuel, 2015 baseline

Source: PoM, 2020a

The key industrial projects described in the recently accepted policy papers are identical to those used in the NDC (2019) industry sector report, and no new major projects have been added i.e. no changes have occurred in the baseline level of GHG emissions.

Regarding policy texts, the most central aim of "Vision-2050" is to reduce the national gap in GHG emissions and removals by 2050. However, the sector's GHG emissions will multiply several times due to the planned deployment of a considerable number of heavy industry projects.

According to the "Vision-2050" policy document, the gross domestic product will be 23.9 billion USD in 2025 and will increase almost 10 times up to 209 billion USD in 2050. It is also predicted that the manufacturing sector will account for 12% of the gross domestic product in 2025, 14.6% in 2030, and 27.4% in 2050 (Table 4-10), which will lead to substantial increase in GHGs emissions.

The goal of minimizing the gap between GHG emissions and removals by 2050 can be met and achieved by implementing measures such as underground storage of carbon dioxide emitted by heavy industry, developing industries with the low emission technology and increasing the application of renewable energy. Once such a target has been established, it is vital to build a strategy for achieving it, as well as outline the actions to reduce GHG emissions until 2050.

Table 4-11 shows outlines the measures included in the NDC (2019) to reduce GHG emissions from industrial processes

Table 4-11: Measures included in NDC (2019) to reduce GHG emissions for industrial process

No	Measures	Description
1	Utilization of waste heat from cement plants	Waste heat-generating technology from cement plants will be implemented in 50% of the whole cement sector by 2025, based on researches done in 2019
2	Use of fly ash in cement manufacturing	The demand for raw materials should be reduced by incorporating fly ash from power plants into clinker mills. Due to the scarcity of fly ash, it is expected that 0.5 million tonnes per year will be generated until 2025 and 1 million tonnes per year until 2030 from various brands of cement that contains 25-35% fly ash.
3	Utilization of methane gas emitted from coal mine	Methane gas emitted during coal mining and transportation accounts for the most GHG emissions in the industrial process and product consumption sectors. According to the NDC 2019, only a small portion of this, or underground mining tailings methane will be used. It is based on the premise that Mongolia now has no underground coal mines and/or plan to be built a new one by 2025.
4	Conditional measures: underground storage of carbon dioxide	Due to scientific and budgetary limitations, this strategy was regarded as a "conditional option" for reducing GHG emissions from heavy, chemical-industrial operations. Starting in 2028, 50% of carbon dioxide emissions from coal gasification facilities are expected to be stored underground, which is not included in the industry's baseline assumption.

Source: NDC, 2019

On July 6, 2021 the National Committee for Climate adopted the strategy for implementing measures 1–3 demonstrated Table 4-11 and its implementation period and the stakeholders' duties are shown in Table 4-12.

Table 4-12: Implementation duration and duty of stakeholders

Measures	Implementation duration	Implementer	Co-Implementer
Utilization of waste heat from cement plants	2020-2025	Ministry of Energy, Ministry of Mining and Heavy Industry	Ministry of Finance, Energy Regulatory Commission, Ministry of Urban Development and Construction, Ministry of Environment and Tourism
Utilization of fly ash in cement manufacturing	2020-2025	Ministry of Energy, Ministry of Urban Development and Construction	Mongolian Association of Construction Materials Manufacturers, Ministry of Environment and Tourism, Ministry of Mining and Heavy Industry, Thermal power plants, Cement plants
Utilization of methane gas emitted from coal mine	From 2025	Ministry of Mining and Heavy Industry	Ministry of Mining and Heavy Industry, Ministry of Energy

Source: NCC, 2021

This report discusses the following ways to reduce GHG emissions based on the characteristics of the sources of GHG emissions in the industrial process and product consumption sectors, as well as current technological breakthroughs. It includes:

- Utilizing waste heat from cement plants,
- Utilizing fly ash in cement manufacturing.

1) Utilizing waste heat from cement plants

Aside from the use of dry technology in the cement industry, the utilization of waste heat is the next method for reducing GHG emissions. It is feasible to utilize waste heat generated from the high heated components during the cement manufacturing process, for example, the part exiting the furnace, the clinker cooling part, and the preheating part, and generate power using a steam turbine or organic oil turbine technology. Under various conditions, the potential power generation rate ranges from 7 to 20 kWh/t cement and high-temperature gas from dry technology furnaces can be further used to generate energy. The investment to generate power from waste heat is 2-4 USD per tonnes with annual operating expenses of 0.2-0.3 USD per tonnes (EPA, 2010).

Because Mongolia's cement companies have all transitioned to dry technology, there is a technological potential for using waste heat. Assuming that the technology mentioned above is used for 50% of cement production, it is conceivable to create 27 million kWh of energy by 2050, reducing GHG emissions from coal and power consumption in the cement industry by 28.2 thous. t CO_2e.

2) Utilizing fly ash in cement manufacturing

Using fly ash from power plants during clinker grinding decreases the requirement for raw materials in the cement industry, lowering GHG emissions. Because fly ash may constitute up to 25-35% of the weight of cement, the energy required to create one tonne of cement can be decreased by 200 MJ -500 MJ, GHG emissions can be reduced by 0.045 t CO_2e -0.127 t CO_2e (NDC, 2019), and the

investment required is around 0.75 USD per tonnes of cement. If the average value of this standard or 0.086 t CO_2e cement will reduce GHG emissions, on the other hand, considering the limited resources of powdered coal, it is estimated that 0.5 million tonnes per year in 2025 and 1 million tonnes per year in 2030 will be produced with an acceptable quantity of fly ash. As a result, GHG emissions may be decreased by 43.0 thous. t CO_2e in 2025, 86.0 thous. t CO_2e in 2030, 172.0 thous.t CO_2e in 2040, and 258.0 thous. t CO_2e in 2050.

Figure 4-8 shows the baseline scenario of GHG emissions from cement and lime industries as computed by the LEAP model.

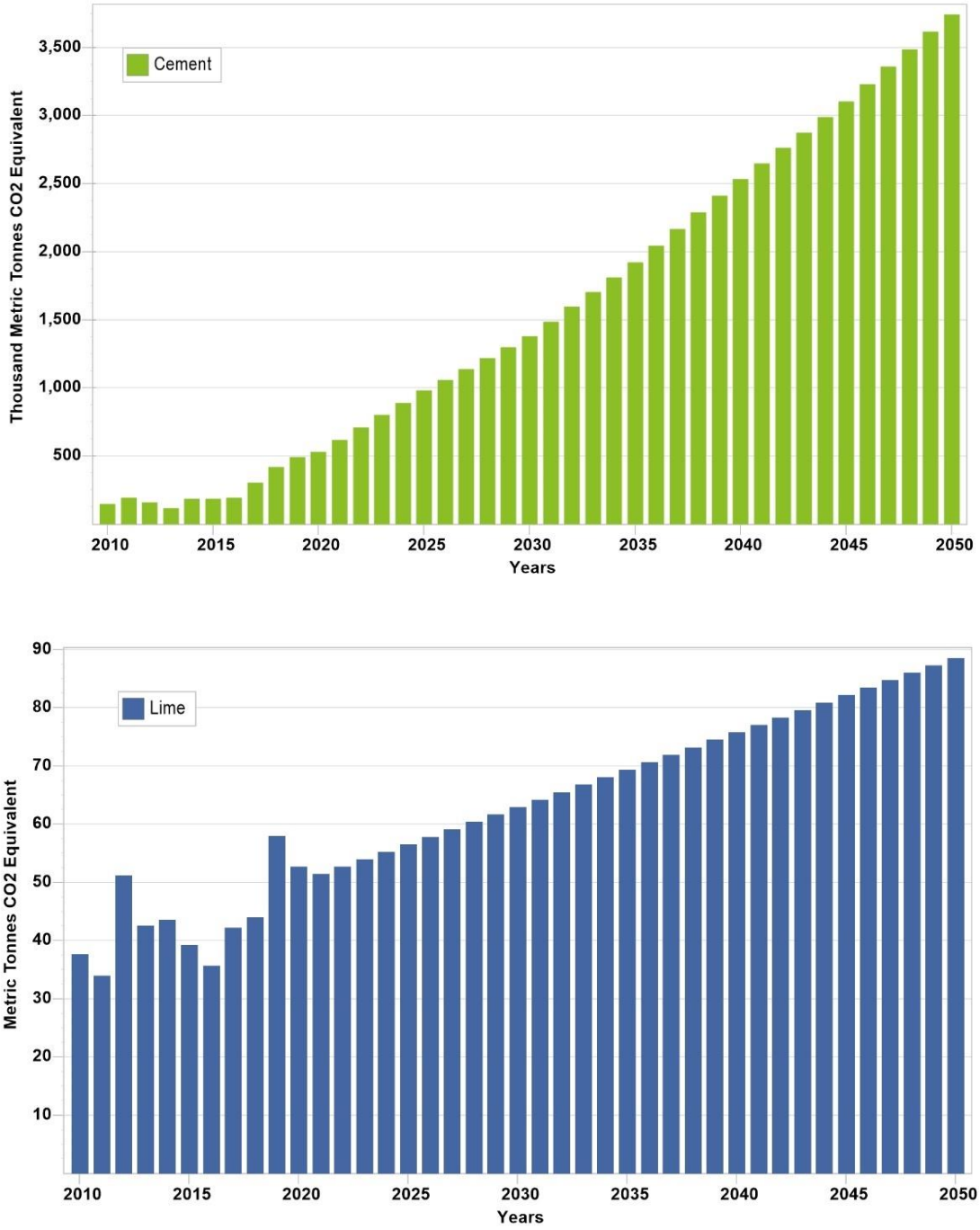

Figure 4-8: The baseline scenario for GHG emissions from the cement and lime industries (LEAP model)

Figure 4.9 shows GHG emissions from industrial sector by mitigation measures until 2050 compared to the baseline scenario.

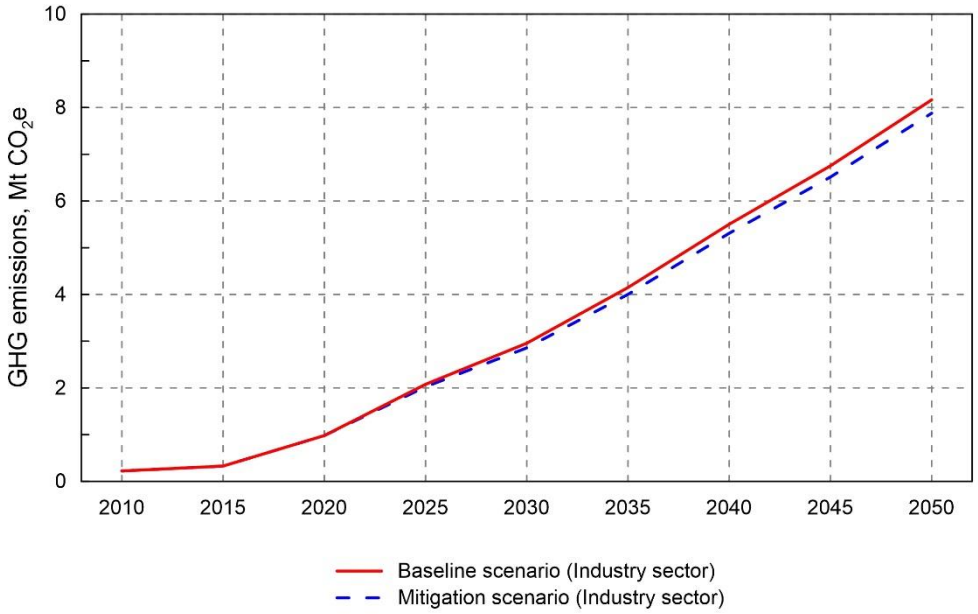

Figure 4-9: Comparison of the baseline and mitigation scenarios for GHG emissions in the industry sector

By implementing the actions outlined above in the industrial sector, GHG emissions in 2025, 2030, 2040, and 2050 will be 52.7 thous. t CO_2e, 99.4 thous. t CO_2e, 192.8 thous. t CO_2e, and 286.2 thous. t CO_2e or reduced 2.5%, 3.4%, 3.5%, and 3.5% compared to the baseline scenario (Table 4-13 and Figure 4-9).

Table 4-13: Total GHG mitigation potential in IPPU sector, thous.t CO_2e

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU)	222.9	327.9	980.7	2,077.3	2,956.9	5,503.2	8,165.2
Mitigation scenario	222.9	327.9	980.7	2,024.6	2,857.5	5,310.4	7,879.0
Total GHG emission reduction	-	-	-	52.7	99.4	192.8	286.2
- Utilizing waste heat from cement plants	-	-	-	9.7	13.4	20.8	28.2
- Utilizing fly ash in cement manufacturing	-	-	-	43.0	86.0	172.0	258.0
Total GHG emissions reduction, %	*-*	*-*	*-*	*2.5*	*3.4*	*3.5*	*3.5*

4.2.3 Agriculture, Forestry and Other Land Use (AFOLU)

Different models, such as the LEAP model for the baseline scenario of the livestock sector, the COMAP model for land use change and forest and the EX-ACT model for Forest sink, estimated the emissions for the baseline and mitigation scenario. EX-ACT is an FAO model for evaluating individual projects, programs, and actions to reduce GHG emissions (https://www.fao.org/in-action/epic/ex-act-tool/suite-of-tools/en/). It is based on the IPCC's GHG Estimation Manual. This model is used in the AFOLU sector to estimate how much GHG will be removed or eliminated due

to the activity's implementation. The EX-ACT model was used to forecast the future outcomes of the "Billion Tree" national campaign. When determining the number of trees to be planted per hectare, the 2008 Joint order by the Minister of Finance and Minister of Environment on the "Standard Price of Planted Forests and Trees to be purchased from Citizens, Communities, Enterprises, and Organizations" the maximum number of trees to be planted is 2500 per hectare, with a total area of 400,000 ha, and only above-ground biomass carbon sink is considered. In the estimation, the above-ground biomass of 1 ha is 55 t/ha, and carbon is 26.8 t/ha values are used (Mongolia's Forest Reference Level submission to the UNFCCC 2018).

The COMAP model was developed to quantify CO_2 emissions (https://unfccc.int/resource/cd_roms/na1/mitigation/Module_5/Module_5_2/b_COMAP/Manuals/COMAP)Manual.pdf) from land use changes and was used to predict forest and cropland absorption concerning crop yields.

The NDC, Vision - 2050, the Mongolian Government's 2020-2024 action program, and sector-specific programs and plans are the national documents that reflect the essential efforts to reduce GHG emissions. The policies in the above documents for the AFOLU sector are summarized in Tables 4-14, 4-15, and 4-16.

Table 4-14: Provisions in Vision-2050 related to the reduction of GHG emissions in the AFOLU sector

Objective	Sector	Implementation duration	Measures/specific objectives	Expected outcomes
Name: Vision-2050 Type: Policy of Mongolia Objective: Leading economic sectors will be developed, and an export-oriented economy will be established.				
A legislative and regulatory framework will be established to stimulate investment in the processing of livestock and animal-derived raw materials, as well as the manufacture of final products	Livestock	2020-2050	Increase agricultural processing and livestock exports	The number of livestock will drop, while the herder's revenue will rise
Maintaining environmentally sustainable and organic livestock while preserving traditional nomadic culture, as well as diversifying intense agricultural production		2021-2030	Intensification of resource utilization and economic circulation of agricultural production, shifting from quantity to quality	Will have livestock suitable for the ecology and pasture capacity
To protect livestock health and to achieve the sanitary and hygienic requirements of animal-derived raw products	Livestock		Increase the number of food products exported by stepping up efforts to protect livestock health and improve livestock quality and production	Increase the number of livestock-related raw products export
Define the legislation that controls relations involving the use, improvement, and			Develop an integrated pasture management system to decrease	The capacity of pastures will increase

protection of pastureland			pasture degradation and desertification	
Improve crop rotation area usage, supply domestic demands with the major crop varieties, and expand production of other profitable crops	Agriculture	2021-2030	Abandon old crop-ploughing and crop-processing technologies in favour of innovative agrotechnical and irrigation technologies; do not plough new land; instead, recycle arable land and use the soil	To conserve and increase soil fertility, fully implement zero and reduced technologies in agricultural production
A forest ecosystem has been developed by implementing sustainable management of forest conservation and restoration	Forestry	2021-2050	Prevent deforestation and expand forest coverage by promoting afforestation, forest growth, restoration, and forest preservation	In 2019, forest covered area was 7.9%; by 2025, 2030, and 2050 this amount will rise to 8.7%, 9%, and 10%, respectively
Becoming to provide a healthy and safe living environment for its citizens, preserve ecological balance, and become a city with a pleasant living environment, low GHG emissions, and green technology	Forestry	2021-2030	Develop an ecosystem in the forest that is resistant to the effects of urban climate change, use sustainable management to keep the forest protected, and eventually adopt a payment system for ecosystem services	Building new and updated dirt strips in Ulaanbaatar to prevent forest fires

Table 4-15: Provisions in NDC (2019) related to the reduction of GHG emissions from the AFOLU sector

Objective	Sector	Implementation duration	Measures/specific objective	Expected outcomes
Name: Objectives for Nationally Determined Contributions (NDC) to the implementation of the Paris Agreement Type: Policy of Mongolia Objective: Determination of main objectives and measures for reducing GHG emissions in Mongolia's key economic sectors				
Increase livestock productivity and limit the number of livestock	Livestock	2021-2030	Limiting and reducing the rise in the number of livestock, establishing an acceptable ratio of the	To reduce livestock numbers by 5% per year from 2015 levels under pasture capacity and to have 51.2

			number and type of livestock consistent with the carrying capacity of pastures, and developing intensive animal husbandry further	million practical livestock in 2033.
			Improving the livestock manure and dung management	GHGs released from livestock manure and dung will decrease.
Increase soil fertility and reduce land degradation			Implementation of measures aimed at protecting pastures and soil	If the Pasture Law is passed and enforced, the number of animals will be reduced by 6% yearly.
Increase forest carbon sink	Forestry	2021-2030	-The average forest fire area will be decreased by 35% in 2025 and 70% in 2030. - The spread of harmful insects and diseases will be decreased by half by 2025 and entirely controlled by 2030.	-The forest area affected by the fire will decrease to 84.3 thousand ha/year in 2025 and 38.9 thousand ha/year in 2030. -Once hazardous insect populations are totally under control, the amount of forest area being destroyed each year by these pests will drop to 4.9 thousand ha in 2025 and 0.0 thousand ha in 2030.

Table 4-16: Provisions included in the Government of Mongolia's 2020–2024 action plan for reducing GHG emissions in the AFOLU sector

Objective	Sector	Implementation duration	Measures/specific objective	Expected outcomes
Name: Government of Mongolia's 2020–2024 action plan Type: Plan Objective: The government of Mongolia's 2020–2024 action plan aims to promote regional and local development, environmental governance, and economic and social advancement				
To assist the growth of the intensive livestock sector by increasing animal pasture resources, enhancing livestock quality and productivity, shifting	Livestock	2020-2024	Based on agricultural regions, intensive dairy cattle farming will be established. Deep wells and water storage facilities will be constructed to	The pasture and livestock quality will increase.

livestock numbers to quality, and adopting "Mongolian Livestock-II" measures.			enhance pasture utilization, and pasture reserves and hayfields will be expanded.	
Create law and legal framework for the utilization, protection, and preservation of grasslands and decrease pasture deterioration and desertification.	Land use	2020-2024	Combat rodents and pests that damage pasture crops in a way that is less harmful to the environment.	Grassland crops will recover, and their absorbing capacity will enhance.
Agricultural raw materials processing facilities will be built regionally to produce and export value-added goods, increasing herder and citizen income.	Livestock		Support in the production of value-added goods for export.	Meat and meat products export amount (thousand tonnes): 59 t thous. t in 2019, 70 thous. t in 2021, 90 thous. t in 2022, 120 thous. t in 2023, and 150 thous. t in 2024.
Fight infectious and highly contagious diseases, provide a calm zone free of highly contagious diseases, and create opportunities for livestock raw materials and products export.	Livestock		Empower veterinarians and increase the quality of veterinary services. It prevents livestock and animal infectious diseases.	The number of animal and zoonotic infectious disease foci and cases will decrease.
Enhance the productivity of the livestock processing factory, construct an environmentally friendly complex, and increase agricultural commodities and product exports.	Livestock		Introduction of advanced technologies and innovations to improve the productivity of the manufacturing industry, The "Darkhan leather complex" production and technology park, as well as the "Shine Khovd" manufacturing and technology park, will be intensified.	Amount of meat reserves (thousand tonnes): 11 thous. t in 2019, 20 thous. t in 2021, 20 thous. t in 2022, 20 thous. t in 2023, and 20 thous. t in 2024.
This will make it easier for national small and medium-sized businesses to carry out specific work for large factories like Oyutolgoi and Erdenet.			It will establish a process for delivering quality goods and products to significant national development projects, government agencies, and large corporations and implement the "National	

			Supply" program.	
To ensure stable agricultural output growth, expand the ability to export and process products, and increase the industry's productivity and competitiveness by improving crop rotation and feed production by executing the “Atar IV” campaign.			-Agricultural production intensification through technological innovation - Increase soil fertility and unit yield -Expand the amount of irrigated land -Improve sea buckthorn competitiveness, increase exports, test various fruits, and berry crops and varieties, develop growing techniques and technologies.	Supply of vegetables: 2019-40% 2021-55% 2022-60% 2023-70% 2024-80% Supply of potatoes and wheat in 2019-2024 will be 100%.
Environmental protection, appropriate use of natural resources, the introduction of innovative methods and technologies, reduction of pollution and deterioration of the environment, and establishment of conditions for residents to live in a healthy environment.	Forestry	2020-2024	Forest coverage will be extended to 8.6%, and a legislative and regulatory framework will be established to provide monetary incentives to residents and businesses that contribute to green development by planting trees.	Forest coverage as a percentage of total area: 2019-7.9%, 2021-8.0%, 2022-8.2%, 2023-8.4%, 2024-8.6%
	Land use	2020-2024	Mining-related land damage will be rehabilitated.	8,000 hectares of mining-damaged land that has been abandoned for many years will be rehabilitated.

Analysing the preceding policy documents:

Livestock sector

- Determine the maximum quantity, type, and structure of livestock that is compatible with natural ecology and pastureland capacity,
- Increase the number of agricultural goods that are processed and the number of livestock products that are exported,
- To step up efforts to protect livestock health and improve livestock quality and production.

Agricultural sector

- Abandon conventional agricultural ploughing and processing procedures in favour of new agrotechnical and irrigation systems,
- Do not plough new land; instead, reuse abandoned land,
- Full implementation of zero and reduced technology in cropland,

- Promoting the use of ecologically friendly fertilizers, as well as preserving and enhancing soil fertility,
- It will apply environmentally friendly plant protection methods and offer suitable techniques to combat the spread of diseases, weeds, dangerous insects, and rodents.

Forestry

- Preventing deforestation through encouraging afforestation, forest extension, restoration, and forest preservation measures, increasing forest coverage from 9% of the total land in 2030 to 10.5% in 2050, and enhancing carbon sink,
- Reducing average forest fire area by 35% in 2025 and 70% in 2030,
- To entirely limit the spread of pests and diseases in forests by 2030,
- It also includes expanding green space in metropolitan areas.

4.2.3.1 GHG emission reduction in the livestock sector

“Vision-2050”, “Nationally Determined Contribution (2019)”, “Mongolia's Sustainable Development Concept-2030 (2016)”, and “Mongolia’s 2020-2024 Government Action Plan” are national level policies that included measures to reduce GHG emissions from the livestock sector. To address problems in the livestock sector at a certain level, as well as to ensure the coherence of approved programs, and to contribute to the “Action Plan for the Implementation of the Global Sustainable Livestock Program”, the Ministry of Food, Agriculture, and Light Industry launched the “Mongolian Livestock Program on Sustainable Economic Development Plan”, which was approved by Order No. A-105 in June 2018 and that implemented between 2018 and 2020. The key steps included in the above policy plans are reduction of livestock numbers and optimization of pasture capacity. The primary cause of grassland deterioration is livestock overpopulation. The NSO researched Mongolia’s current grazing capacity and herd structure in 2018. According to the study, the acceptable number of livestock were 51.6 million, which is 22.0% or 14.6 million higher than the number of livestock recorded in 2017 (NSO, 2018). The carrying capacity of the pasture has been exceeded by all animals except camels, as seen in Figure 4-10.

The improper reduction of livestock is a factor that inevitably influences the change in the number of animals. The NSO study estimates the unusual loss of large animals as animals that died from causes other than unexpected danger, natural catastrophes, illnesses, eaten by wild animals, or other factors.

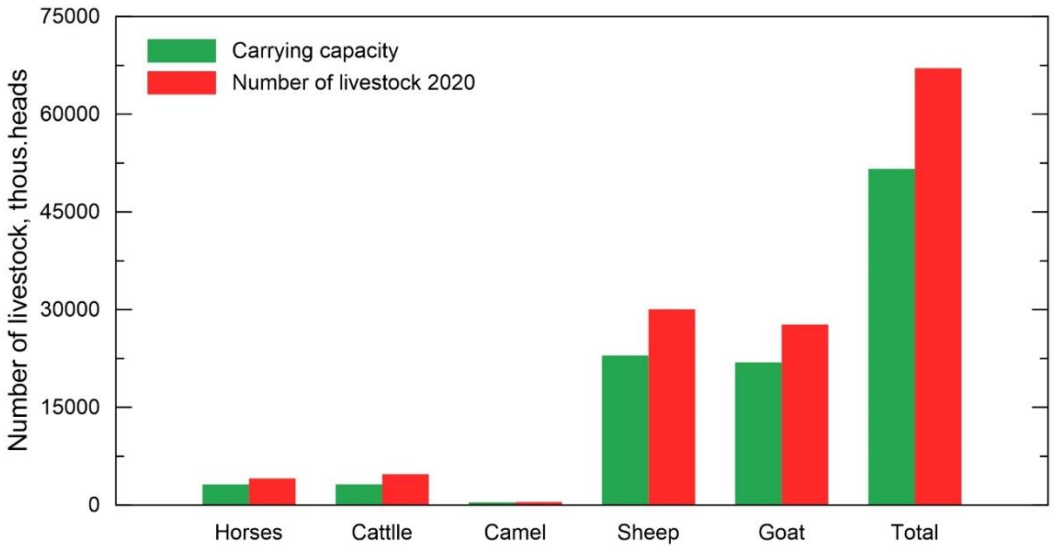

Figure 4-10: The number of suitable livestock for grazing capacity in Mongolia

The Dzud catastrophe in 2010 resulted in the highest loss of livestock, amounting to 10.3 million animals or 35% of large livestock. This drop has been rather consistent in recent years, averaging 1.9% over the past 10 years (2011-2020) and 4.6% on average during the past 50 years (1971 to 2020). The production of animal meat and the export of raw materials (wool, skin and leather materials) are two other important factors that affect changes in the number of livestock in Mongolia. For example, 4 million skins and leathers were exported in 2000, however, this was followed by a sharp decline in exports.

Between 2017 and 2019, our nation exported the most meat production; in 2018, 39,300 tonnes of meat were exported overseas. Since the Covid 19, meat exports have been declined in recent years. According to statistical analysis, 10–12 million animals heads were provided from animal husbandry to food in the last five years. Compared to the overall number of animals, proportion of animals for food production accounted, sheep accounted for 23%, goats 21%, cattle 16%, horses 10%, and camels 7%.

The Mongolian government has been implementing policies to increase livestock fattening in animal husbandry; thus, at least 25% of sheep and goats, no more than 15% of cattle and horses, and no more than 3% of camels are being prepared for food production in 2017-2018. Considering the above policy, meat, and export reserves in 2017-2018 accounted for 3,412.4 thous. heads of sheep or 61.4 thous. tonnes of meat, 3,132.9 thous. goats or 47.0 thous. tonnes of meat, 214.2 thous. tonnes of cattle or 27.9 million tonnes of meat and 291.0 thous. horse or 43.6 thous. tonnes of meat (Table 4-17). Therefore, the number and amount of meat exports, including 27.9 thous. tonnes of beef and 43.6 thous. tonnes of horse meat, were determined at a meeting of the Government's National Food Safety Council on November 29, 2017, and the export volume of sheep and goat meat was decided separately without imposing limitations.

Table 4-17: Meat export reserve

Meat export reserve in 2018			
Livestock	1000 head	1000 tonnes	Weight per animal (kg)
Sheep	3,412.4	61.4	17.8
Goat	3,132.9	47.0	15.0
Cattle	214.2	27.9	130.2
Horse	291.0	43.6	149.8

Table 4-18 shows food consumption and export reserve estimated based on data provided in Table 4-17, if the number of animals used for food and export is set at 1000.

Table 4-18: Food consumption and export reserve

Livestock	Livestock number in 2018 (1000 heads)	Percentage of livestock in food consumption	Percentage of livestock in food consumption (1000 heads)	Export reserve (1000 heads)	Share of export reserves	Total food consumption and export reserves (1000 heads)	Total food consumption and export reserves (%)
Horse	3,940.1	10.0	394.0	291.0	7.4	685.0	17.4
Cattle	4,380.9	16.0	700.9	214.2	4.9	915.1	20.9
Camel	459.7	7.0	32.2	0.0	0.0	32.2	7.0
Sheep	30,554.8	23.0	7,027.6	3,412.0	11.2	10,439.6	34.2
Goat	27,124.7	21.0	5,696.2	3,132.9	11.5	8,829.1	32.5
Total	66,460.2	20.8	13,850.9	7,050.1	10.6	20,901.0	31.4

To predict the pattern number of livestock head changes in the future, the following scenarios were considered (Figure 4-11):

1. From 1990 to 2020, pattern defined via linear regression of changes in the number of livestock (BAU1),
2. Average annual growth rate (2.48%) from 1970 to 2020 (BAU2),
3. Based on the NDC's average (0.5%) annual growth (BAU) scenario.

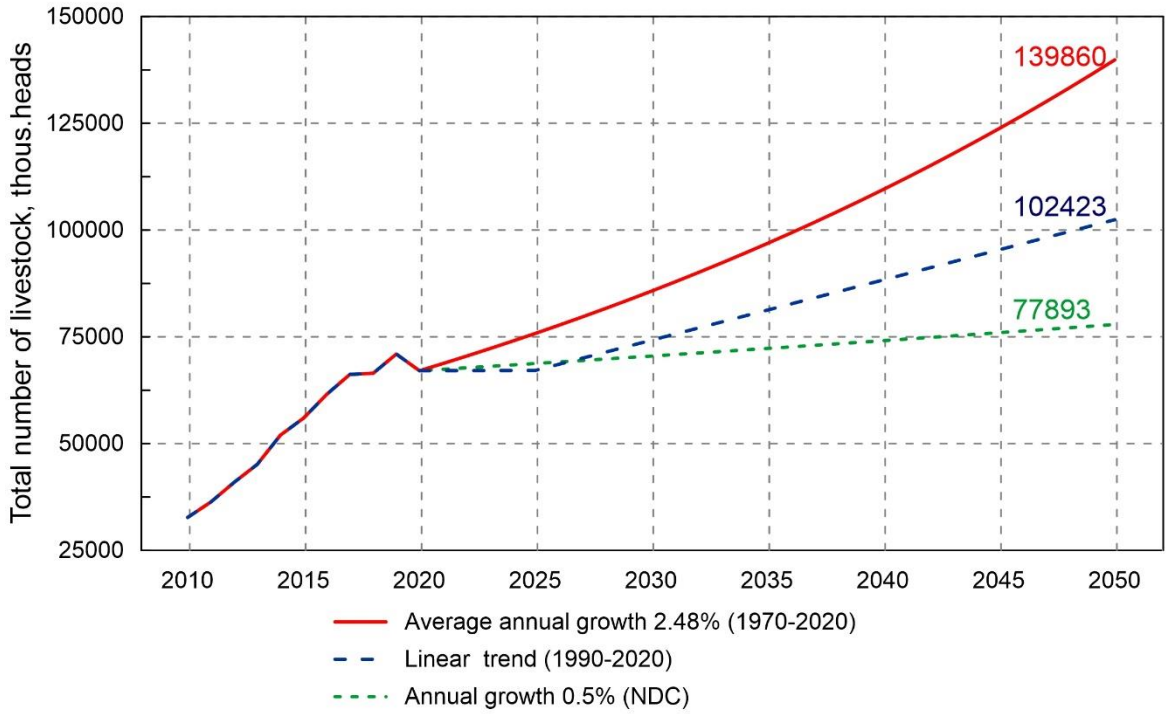

Figure 4-11: The future growth trend for livestock number

Based on above mentioned three scenarios that considered different measures to reduce number of livestock, it was estimated baseline scenario for LEAP model. The baseline scenario demonstrated in Figures 4-12 and 4-13, and Tables 4-19.

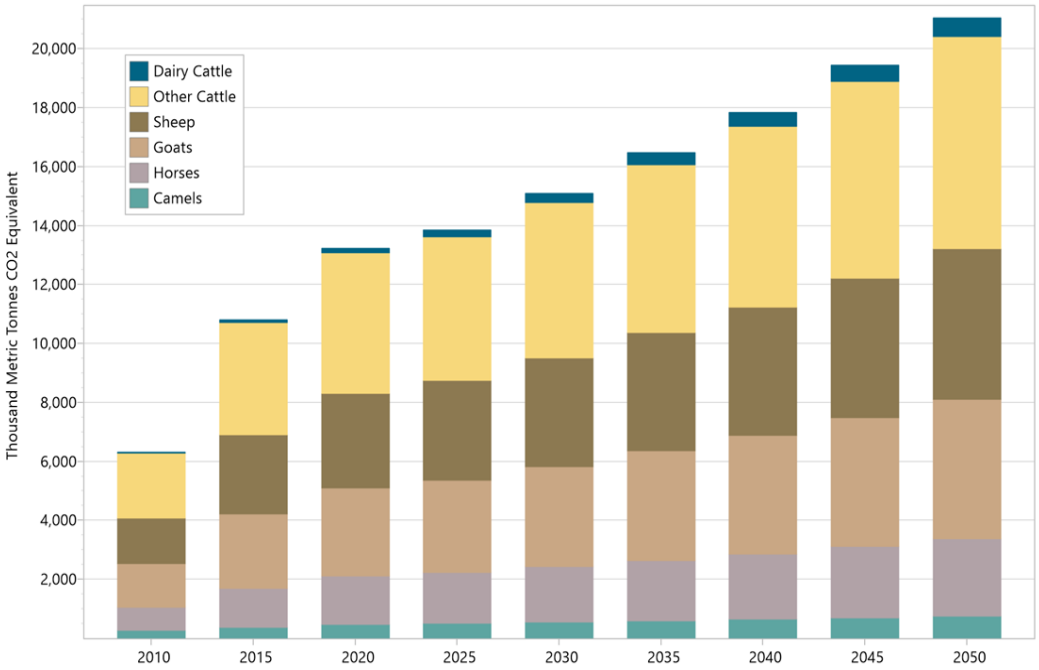

Figure 4-12: Baseline scenario of GHG emissions from livestock by animal type (LEAP model)

Table 4-19: Baseline scenario of GHG emissions from livestock by animal type, thous. t CO_2e

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU) of GHG emissions from total number of livestock	6,273.1	10,702.4	13,075.1	13,847.7	15,091.3	17,848.8	21,047.4
- Dairy cattle	34.4	99.3	155.9	242.6	323.4	438.1	572.0
- Cattle (other)	2,181.9	3,776.0	4,713.5	4,867.8	5,260.0	6,178.8	7,244.0
- Sheep	1,542.8	2,647.1	3,180.3	3,386.4	3,685.0	4,353.2	5,128.1
- Goat	1,482.0	2,508.8	2,939.5	3,130.0	3,406.0	4,023.6	4,739.9
- Horse	765.8	1,309.1	1,621.8	1,726.9	1,879.2	2,220.0	2,615.1
- Camel	266.3	362.1	464.0	494.1	537.7	635.2	748.2

The baseline scenario of GHG emissions includes methane emissions from enteric fermentation and manure management. However, N_2O emissions from Aggregate sources and non-CO_2 emission sources from land not considered in the baseline scenario.

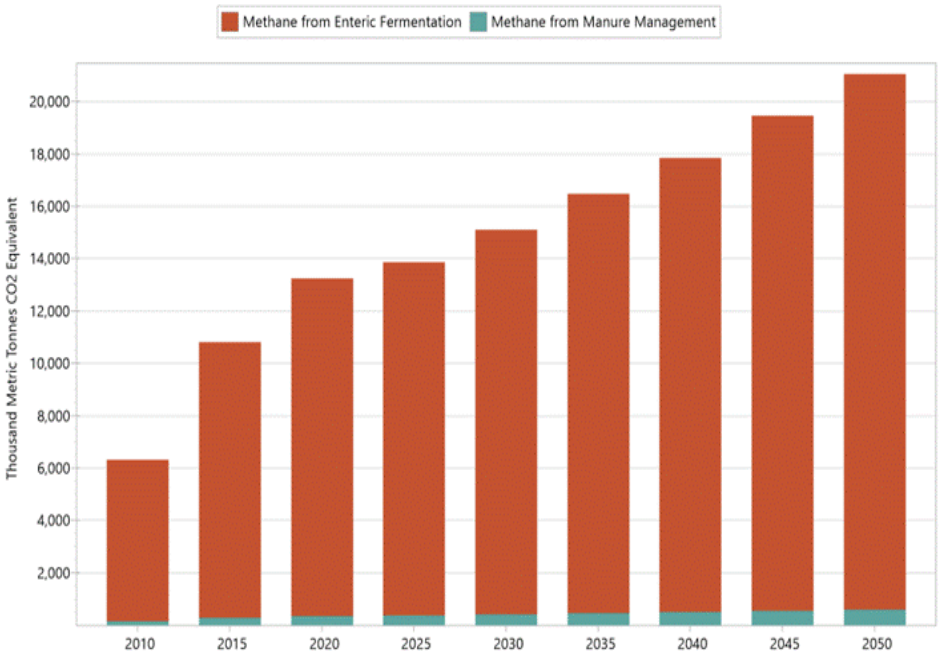

Figure 4-13: Baseline scenario of GHG emissions from livestock by sources (LEAP model)

As a result, the primary goal of minimizing GHG emissions from livestock is to restrict the quantity of livestock and develop an optimum herd structure ratio to adjust to pasture capacity.

According to the Ministry of Food, Agriculture, and Light Industry statistics for the last five years, assuming 10-12 million livestock are utilized for food, 18-21 million are accessible for food consumption and export, which is about 20% of total livestock is used for food, while about 10% can be exported.

The following options are considered in the computation of feasible strategies for GHG emission reductions based on the data presented above such as:

1. Setting the upper limit for the quantity, and defining the type, and structure of livestock in accordance with natural ecology and pasture carrying capacity (Vision-2050),
2. Reducing the number of livestock up to 51.6 million to keep the optimum herding structure ratio under pasture carrying capacity (NSO, 2018),
3. Supporting the meat export and deliver it to the potential reserves.

The mitigation scenarios demonstrated in Figure 4-14, which considered all measures to support export capacity to be reached 10.6% and to optimize carrying capacity of pasture.

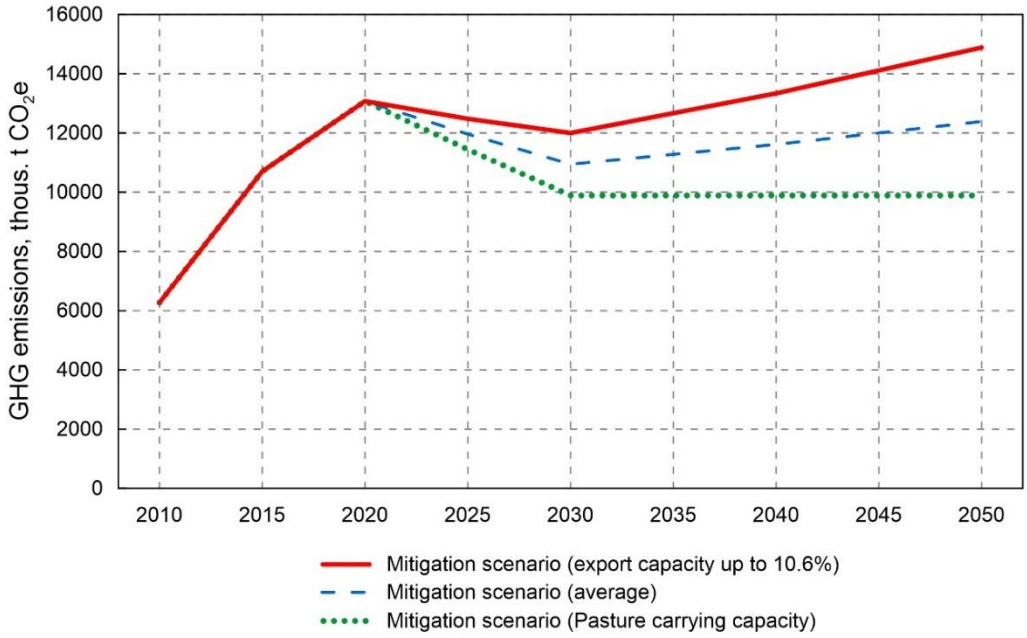

Figure 4-14: Mitigation scenarios for measures to support export capacity and pasture carrying capacity in livestock sector

In Table 4-20 shown the GHG mitigation potential in livestock sector by 2050. GHG emission reductions from livestock sector are predicted by 17.4%, 34.5%, 44.6%, and 53.0% in 2025, 2030, 2040, and 2050, respectively, compared to the baseline scenario.

Table 4-20: Total GHG mitigation potential in livestock sector, thous. t CO_2e

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU)	6,273.1	10,702.4	13,075.1	13,847.7	15,091.3	17,848.8	21,047.4
Mitigation scenario	6,273.1	10,702.4	13,075.1	11,442.9	9,890.0	9,890.0	9,890.0
Total GHG emission reduction	-	-	-	2,404.8	5,201.3	7,958.8	11,157.4
Total GHG emissions reduction, %	*-*	*-*	*-*	*17.4*	*34.5*	*44.6*	*53.0*

4.2.3.2 GHG emission reductions in the agriculture land

Changes in soil conditions influence GHG emissions from agricultural activities. “Vision-2050” “Sustainable Development Concept of Mongolia-2030”, and the Government’s food and agriculture policies included the measures potential to reduce GHG emissions from the agricultural sector. Regarding to the above mentioned policies, the following decisions were made from 2016 to 2020 as follows:

- Government resolution No. 476 of 2019 on the Introduction of the “Atar-IV” campaign for the sustainable development of agriculture,
- Government resolution No. 131 of 2018 on the Introduction of certain Agricultural areas,
- Government resolution No. 278 of 2017 on approving the “National Vegetable Program”,
- Approval of the program by Government resolution No. 223 of 2017/ “Fruits and Vegetables National Program”,
- The Government resolution No. 212 of 2016 on launching a “National Campaign Approval”.

The key agricultural legislation updated after 2015 is the Law on Agriculture, enacted in 2016. The legislation is noteworthy in that it explicitly addresses the challenges of assessing soil physical and chemical qualities, preserving it, and promoting soil fertility. The actions of soil conservation and enhancement are expressed in Article 25 of Chapter 4 of the Law “Protection of Agricultural Land Soil”as follows:

- Utilizing zero-tillage and reduced-tillage techniques for soil cultivation during crop production,
- Fencing agriculture land,
- Planting a forest strip,
- Cover the agricultural field with straw mulch.

The indicators for figuring out the agrochemical and physical properties of the soil are also described in details, and the local administrative body in charge of agriculture will determine those properties every five years using the landowner’s funds. The local governor was given the authority to withdraw the certificate of ownership and usage if restoring the soil quality was not completed and causing soil degradation. Given the current condition of agriculture, the quantity of cultivated land is increasing each year while the amount of abandoned land decreasing. The primary ways to minimize GHG emissions from agricultural production are not to plough additional new areas and rather to utilize better technologies.

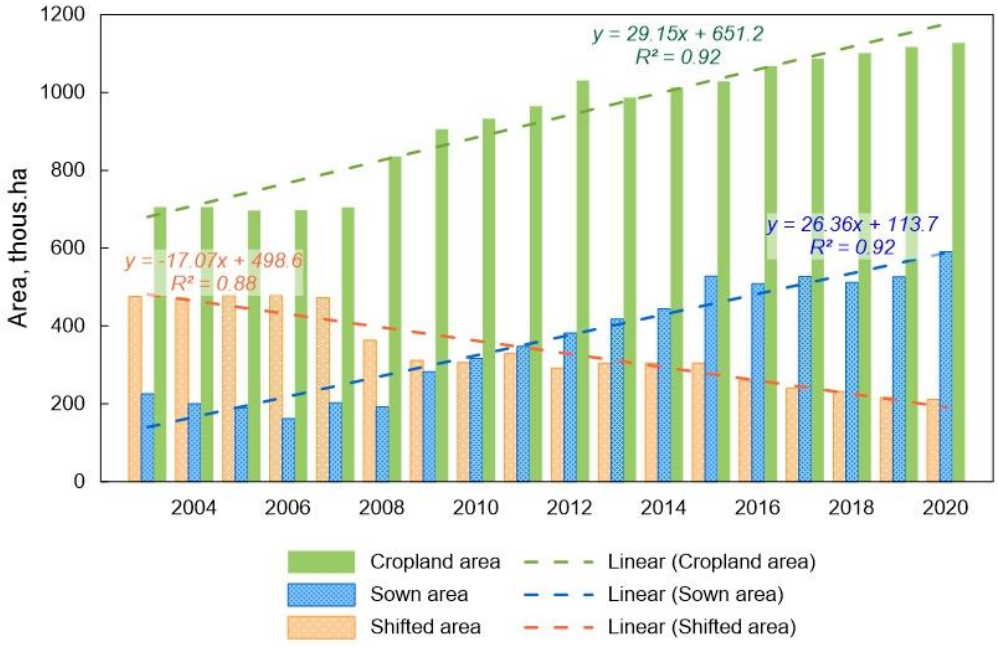

Figure 4-15: Changes in arable land area in Mongolia

As seen in Figure 4-15 the amount of cultivated land and arable land area is steadily growing and based on this trend the baseline scenario for GHG emissions from agriculture land was estimated. However, estimating the emission reductions, it considered the “Vision-2050” program’s provisions for 2022-2030, which specifies that only abandoned land would be cultivated, and no new land would be ploughed.

The key measures in cropland sector as follows:

- Eliminate traditional agricultural ploughing and processing technologies in favour of advanced agrotechnical and water-saving irrigation techniques, refrain from ploughing new land, and only recycle previously cultivated land (Parliament of Mongolia, 2021),
- Step by step shift to zero and reduced tillage technology in agriculture land,
- Protection of agricultural land soils.

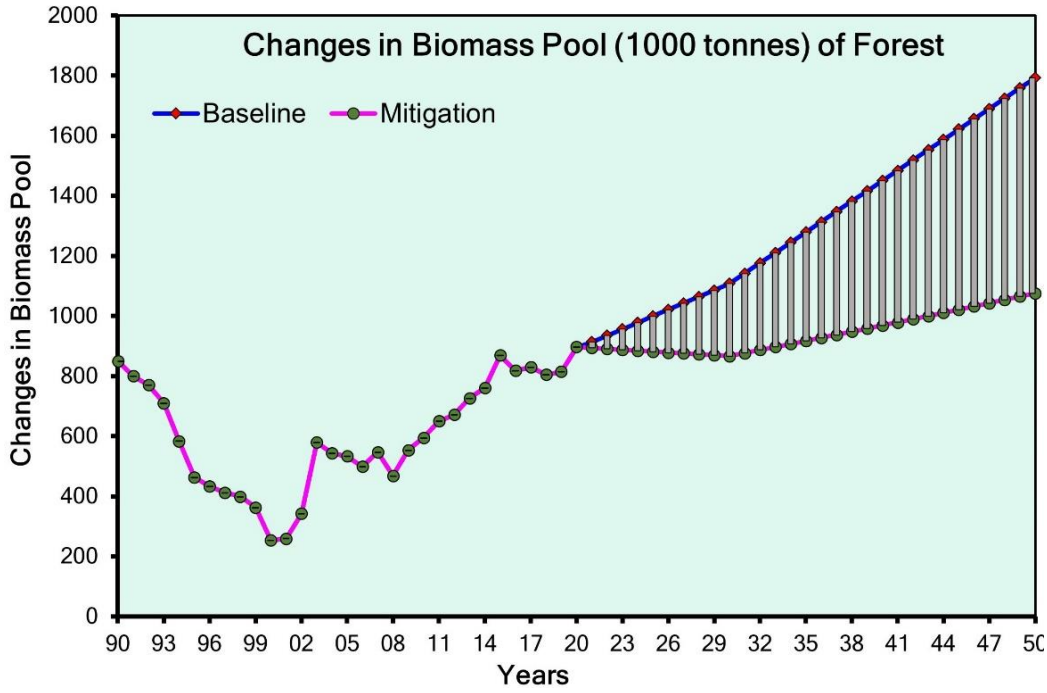

Figure 4-16: Changes in biomass pool of cultivated cropland (COMAP)

The COMAP model was used to determine the biomass change of total cropland, and the yield per hectare was projected to be 13 tonnes/ha for the average wheat production from 2015 to 2020. Figure 4-17 shows the extent to which emissions will continue to rise in the MoD’s baseline scenario, i.e., if no action is taken (BAU) and, if the above-mentioned key measures in the arable land are implemented.

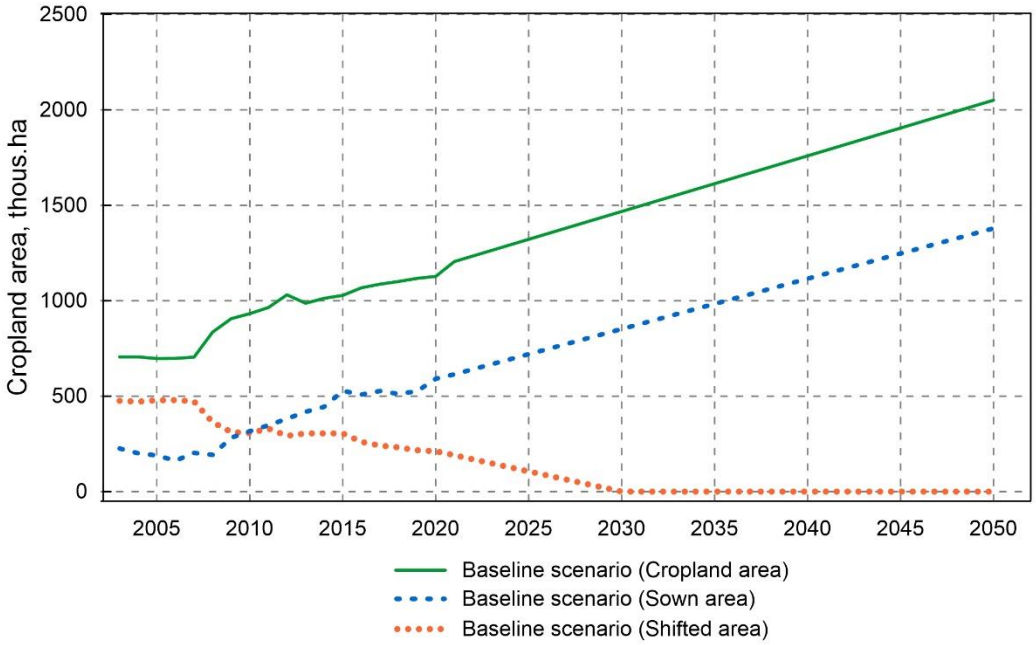

Figure 4-17: The baseline scenario of arable land of Mongolia

According to Figure 4-18, it is estimated that in the baseline scenario, in case no action is taken, the amount of cropland and the sown area will continue to grow linearly, but there will be no shifted land or zero shifted land from 2030.

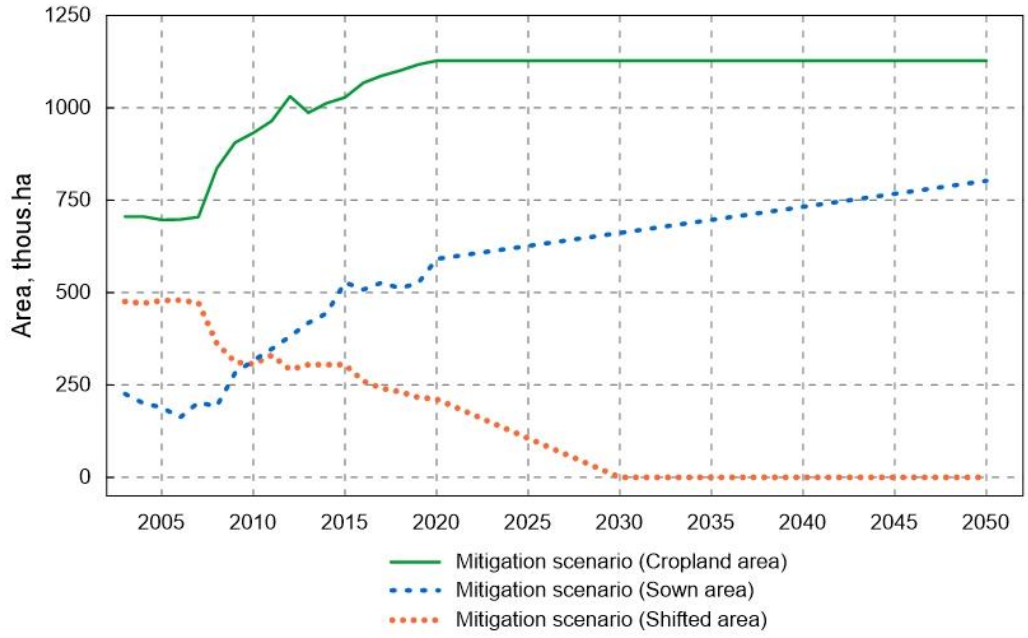

Figure 4-18: The mitigation scenarios of arable land of Mongolia

Figure 4-18 and Table 4-23 shows the extent of the reduction of cropland, sown and fallow areas if the measures are fully implemented.

Table 4-21: Changes in cropland area, thous. ha

Cropland area scenarios	2010	2015	2020	2025	2030	2040	2050
Cropland area (baseline)	932.4	1,028.2	1,127.5	1,321.9	1,467.6	1,759.2	2,050.8
Cropland area (mitigation)	932.4	1,028.2	1,127.5	1,127.5	1,127.5	1,127.5	1,127.5
Sown area (baseline)	316.4	527.7	591.2	720.1	851.9	1,115.5	1,379.1
Sown area (mitigation)	316.4	527.7	591.2	626.4	661.7	732.2	802.7
Fallow (baseline)	309.4	195.5	324.8	496.0	615.8	643.7	671.7
Fallow (mitigation)	309.4	195.5	324.8	395.3	465.8	395.3	324.8
Shifted (abandoned) area (baseline)	306.6	305.0	211.5	105.8	0.0	0.0	0.0
Shifted (abandoned) area (mitigation)	306.6	305.0	211.5	105.8	0.0	0.0	0.0

Figure 4-19 and 4-20 are shows the baseline and mitigation scenarios in cropland and sown area of Mongolia, respectively, taking into account the mitigation actions.

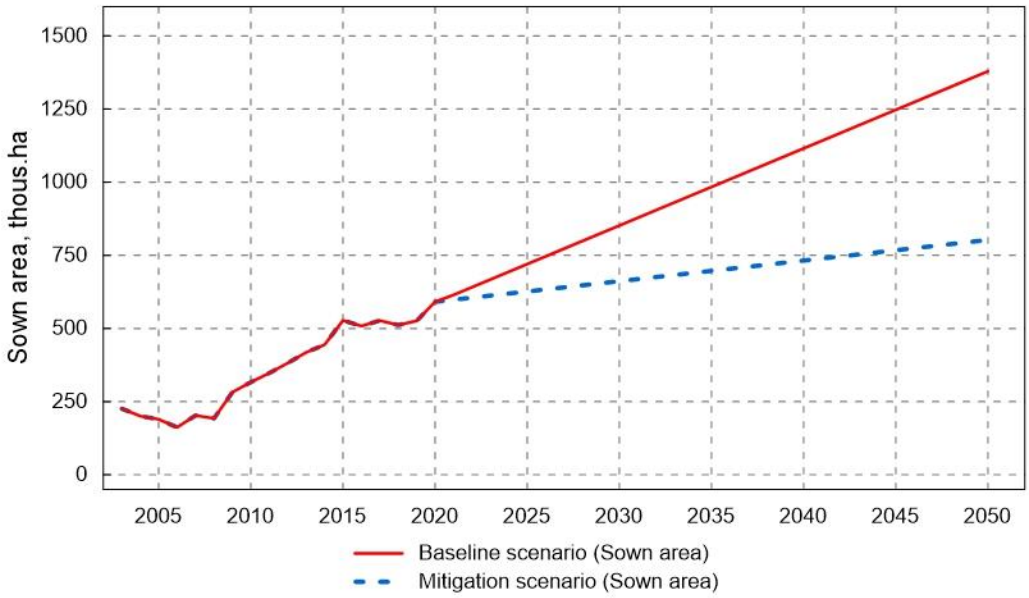

Figure 4-19: The baseline and mitigation scenarios of sown area in Mongolia

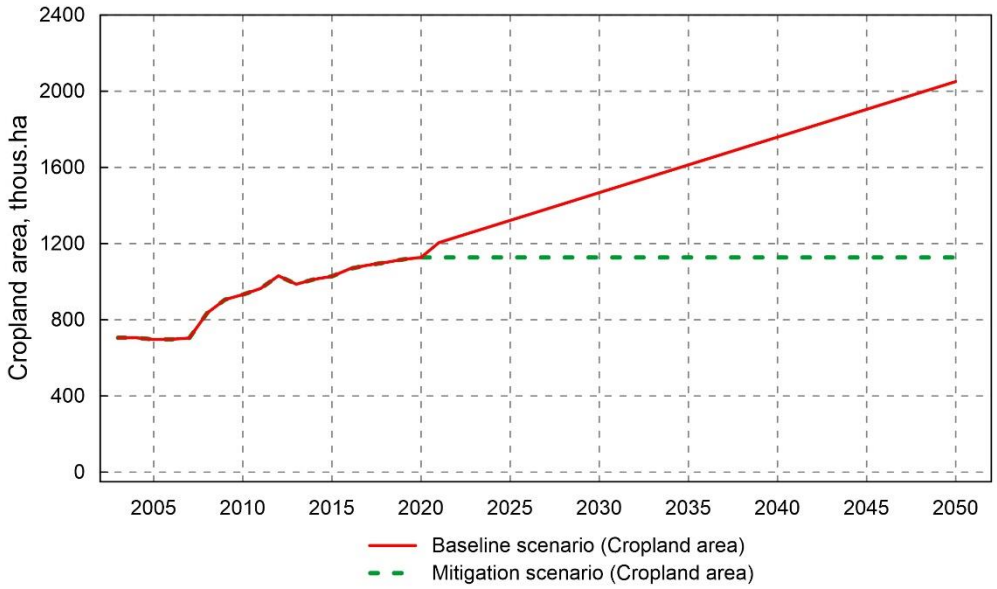

Figure 4-20: The baseline and mitigation scenarios of cropland area in Mongolia

Results from total GHG mitigation potential in cropland demonstrated in Table 4-24. The quantity of CO_2 emitted from the soil of the sown area is expected to drop by 13.0%, 22.3%, 34.4%, and 41.8% compared to the baseline scenario in 2025, 2030, 2040, and 2050, respectively.

Table 4-22: Total GHG mitigation potential in cropland, thous. t CO_2e

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU)	406.4	677.8	759.3	924.9	1094.2	1,432.9	1,771.5
Mitigation scenario	406.4	677.8	759.3	804.6	849.9	940.5	1,031.0
Total GHG emission reduction	-	-	-	120.3	244.3	492.4	740.5
Total GHG emissions reduction, %	*-*	*-*	*-*	*13.0*	*22.3*	*34.4*	*41.8*

4.2.3.3 Contribution of the forest sector to GHG removals

Forests in Mongolia are divided into two main categories. In the northern part of the mountain-steppe region, forest covers with the dominance of coniferous forest, while in the south, there are Saxaul forests. Forests constitute a significant removal environment of GHGs, and forest cover is being depleted and degraded due to anthropogenic influences, forest fires, pest and insect impacts and grassland degradation (MET, 2018).

The forest resource of Mongolia is estimated to be 14.2 million ha of land, and forests cover 12.1 million ha, 133 thous. ha of cut-down forests, 719.2 thous. ha of reserve land for reforestation and 62.3 thous. ha of forest nurseries for statistics as of 2020. Annually, 955.3 thous. m^3 of wood was logged for different purposes (MET, 2022).

The forests of Mongolia are highly vulnerable to drought, fire and forest pests and have a low productivity. Moreover, due to their slow growth rate, the forest cover quickly loses ecological balance and has poor regeneration capacity. Therefore, sustainable forest management is necessary to prevent forest protection and degradation.

“Multipurpose National Forest Inventory” have conducted in 2014-2016 in Mongolia and also the “UN-REDD National Program of Mongolia” was implemented in 2016-2019. Within the framework of the “UN-REDD National Program of Mongolia” implementation, the “Forest Reference Level Report” was developed and submitted to the Secretariat of the UN-REDD.

The “State policy on Forests” was approved in 2015 to maintain the balance of the forest ecosystem in Mongolia, ceasing the depletion and degradation of forests; and increasing the area covered by forests through forest restoration and afforestation; and creating the sustainable forest management aimed at the appropriate use.

The national strategic action plan on “Reduction of GHG emissions due to Forest Depletion and Degradation (REDD+)” was approved by order of the Minister of Environment and Tourism on September 25, 2019. In addition, many other policies and measures related to the forest have been included in different national policies and programs such as "Vision-2050" and "Green Development Policy".

On September 22, 2021, the President of Mongolia, while participating in the 76th session of the United Nations General Assembly, announced that “Mongolia has planned to grow a billion trees by 2030 (GoM, 2021a)” then, the implementation measures of this program were approved as a “Billion trees” national campaign.

If the “Billion Trees” national campaign is fully implemented by 2030, the total removal of CO_2 is expected to be 16 million tonnes, and it has a potential to remove more than 2 million tonnes CO_2 per year.

The main purpose of forest policies and programs in Mongolia is to reduce GHG emissions caused by deforestation and increase forest capacity to store GHG. Those are:

1. Reduction of GHG emissions from forested lands by preventing the degradation and deforestation:

- Prevent forest from fire and reduce the its risk,
- Prevent and control harmful insects,
- Improve management measures to combat illegal logging.

2. To increase carbon sink capacity of forest by implementing sustainable forest management with proper forest restoration techniques:

- Support the natural regeneration of forests,
- Increase the reforestation,
- Main goals to be included in the policy documents such as:
- As reflected in “Vision-2050”, the area covered by forests will increase up to 10.5% by 2050
- Within the “Billion Trees” national campaign, it is planned to plant one billion trees by 2030,
- GHG emission reductions due to forest degradation is reflected in the national strategy and action plan of the UN REDD+ (MET, 2019),
- Carbon released from forested area reduced from 3,551,439 t CO_2e per year to 2,649,844 t CO_2e per year by 2025,
- Forest carbon sink will be increased from 74,055 t CO_2e per year to 99,973 t CO_2e per year (MET, 2018),

- According to the policy decisions the area covered by forests will increase up to 9% in 2030 and 10.5% in 2050 (the area covered by forests will increase by 2 million ha),
- Planting a billion trees by supporting the regeneration capacity of natural forests for afforestation between 2022 and 2030,
- The afforested area will be increased from 8,000 ha to 15,000 ha in 2025, while the regenerated area will be increased from 2,000 ha will be to 80,000 ha,
- Reduce the forest area degraded by fire from 130,000 ha per year (MET, 2018) to 103,000 ha per year by 2025,
- Reduce the area degraded by insects and pests from 10,000 ha per year (MET, 2018) to 5,900 ha per year in 2025,
- Reduce the amount of illegally logged wood from 550 m^3 (MET, 2018) to 300 m^3 in 2025.

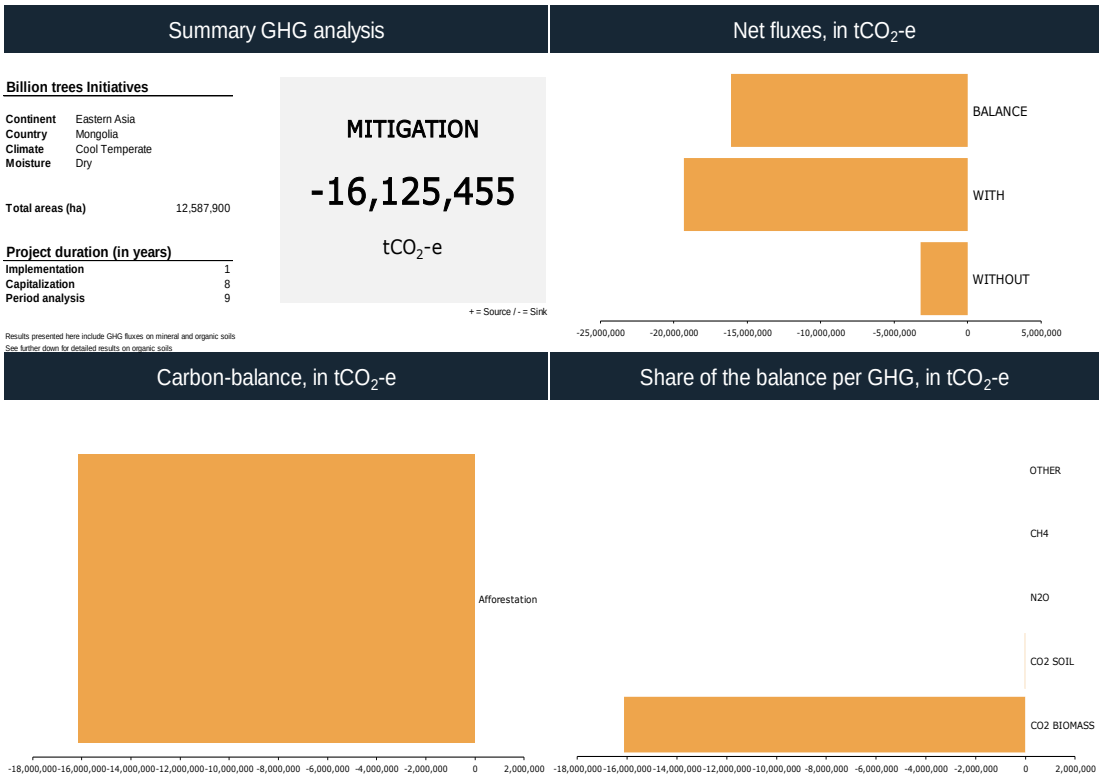

Figure 4-21: Estimation of the results of the “Billion Trees” national campaign using the EX-ACT tools

DETAILED RESULTS

Project name Billion trees Initiatives
Continent Eastern Asia
Country Mongolia
Climate Cool Temperate
Moisture Dry

Project duration (in years)	
Implementation	1
Capitalization	8
Period analysis	9

Total area (ha)	12,587,900
Mineral soil	12,587,900
Organic soil	0
Waterbodies	0

Global warming potential	
CO_2	1
CH_4	34
N_2O	298

GROSS FLUXES

In tCO_2-e over the whole period analysis

PROJECT COMPONENTS		WITHOUT	WITH	BALANCE
Land use changes	Deforestation	0	0	0
	Afforestation	-3,180,746	-19,306,201	-16,125,455
	Other land-use	0	0	0
Cropland	Annual	0	0	0
	Perennial	0	0	0
	Flooded rice	0	0	0
Grasslands & Livestock	Grasslands	0	0	0
	Livestock	0	0	0
Forest mngt.		0	0	0
Inland wetlands		0	0	0
Coastal wetlands		0	0	0
Inputs & Invest.		0	0	0
Total emissions, tCO_2-e		**-3,180,746**	**-19,306,201**	**-16,125,455**
Total emissions, tCO_2-e/ha		**-0.3**	**-1.5**	**-1.3**
Total emissions, tCO_2-e/ha/yr		**0.0**	**-0.2**	**-0.1**

SHARE PER GHG OF THE BALANCE

In tCO_2-e over the whole period analysis

CO_2 BIOMASS	CO_2 SOIL	N_2O	CH_4	ALL NON-AFOLU EMISSIONS*
0	0	0	0	
-16,125,413	-42	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
		0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	0
	0	0		0
-16,125,413	**-42**	**0**	**0**	**0**
-1.3	**0.0**	**0.0**	**0.0**	**0.0**
-0.1	**0.0**	**0.0**	**0.0**	**0.0**

AVERAGE ANNUAL EMISSIONS

In tCO_2-e/yr

WITHOUT	WITH	BALANCE
0	0	0
-353,416	-2,145,133	-1,791,717
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
-353,416	**-2,145,133**	**-1,791,717**

+ = Source / - = Sink
Results presented here include GHG fluxes on mineral and organic soils
See further down for detailed results on organic soils
* Includes fisheries, acquaculture and inputs & investments that are not included in the AFOLU definition.

Uncertainty level	tCO2-e/yr	Percent
Without	-353,416	20%
With	-2,145,133	20%
Balance	-1,791,717	20%

Figure 4-22: Outputs of the EX-ACT for the “Billion Trees” national campaign

The COMAP model was used to determine the baseline scenario and mitigation scenarios for GHG emission reductions. The results are presented in Table 4-25 and Figure 4-23. Measures are as follows:

- Planting one billion trees between 2022-2030 within the framework of the “Billion Trees” national campaign,
- According to the “Vision-2050” policy document, it is estimated that by 2030 the area covered by forests will reach 9% of the Mongolian territory or 2 million ha, and it will be increased up to 10.5% or 3.8 million ha by 2050.

Table 4-23: Change in forest biomass, thous. tonnes of biomass per thous. ha

COMAP model	2010	2020	2025	2030	2040	2050
BAU (biomass pool)	962,021	970,028	972,226	976,825	986,261	996,021
Mitigation (biomass pool)	962,021	976,352	1,059,354	1,148,784	1,236,030	1,324,093
BAU (forested area)	12,011	12,109	12,134	12,188	12,296	12,204
Mitigation (forested area)	12,011	12,109	13,209	14,329	15,399	16,469
Change of biomass, %	0.0	0.0	9.0	17.6	25.3	32.9
Area covered by forest, %	0.0	0.0	8.9	17.6	25.2	34.9
Growth, compared to 2010, %	0.0	0.8	10.0	19.3	28.2	37.1

According to Figure 4-23, if no measures are taken regarding forests (in the baseline scenario), the biomass of the forested area will increase from 6,797 thous. tonnes to 9,760 thous. tonnes every decade until 2050, while by implementing measures to increase forest absorption, the biomass will drastically increase from 88,063 thous. tonnes to 172,432 thous. tonnes every 10 years.

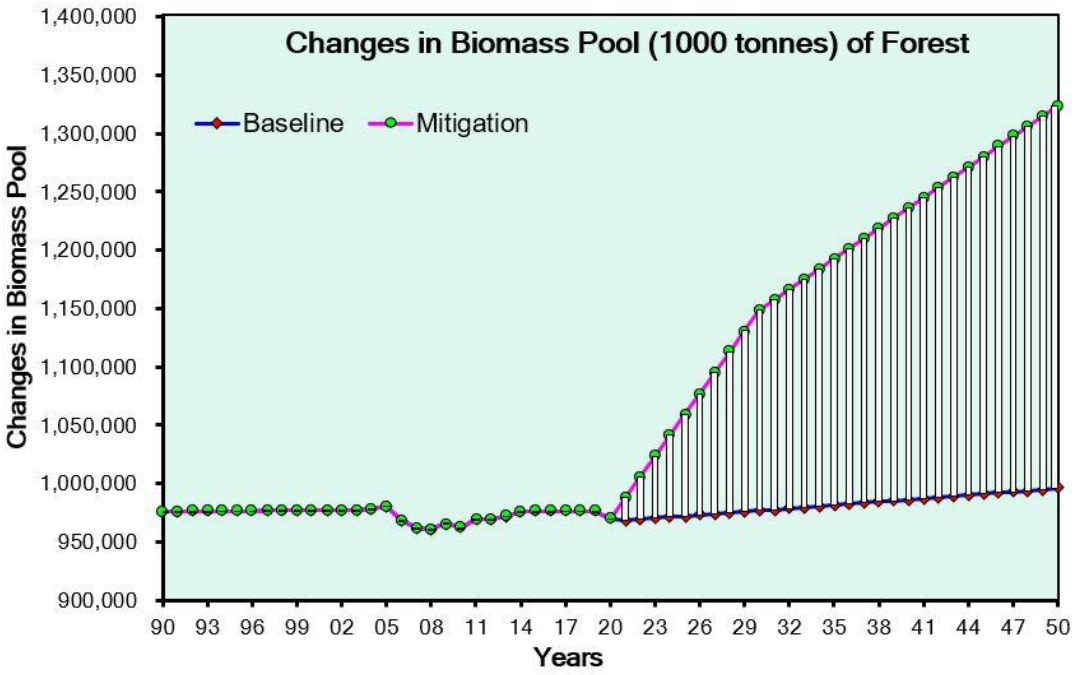

Figure 4-23: Changes of biomass of forested area estimated by COMAP model

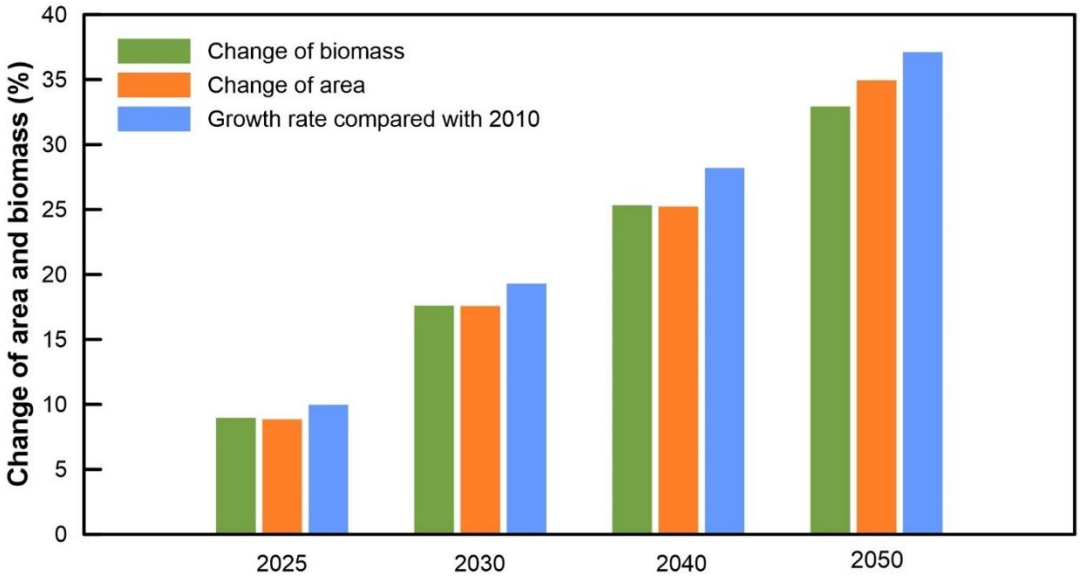

Figure 4-24: Changes of forest area and biomass in Mongolia

According to the future projection estimated by the COMAP model, the area covered by forest will increase by 9% in 2025, 17% in 2030, 25.3% in 2040 and 35.0% in 2050, compared to the baseline scenario (Figure 4-24).

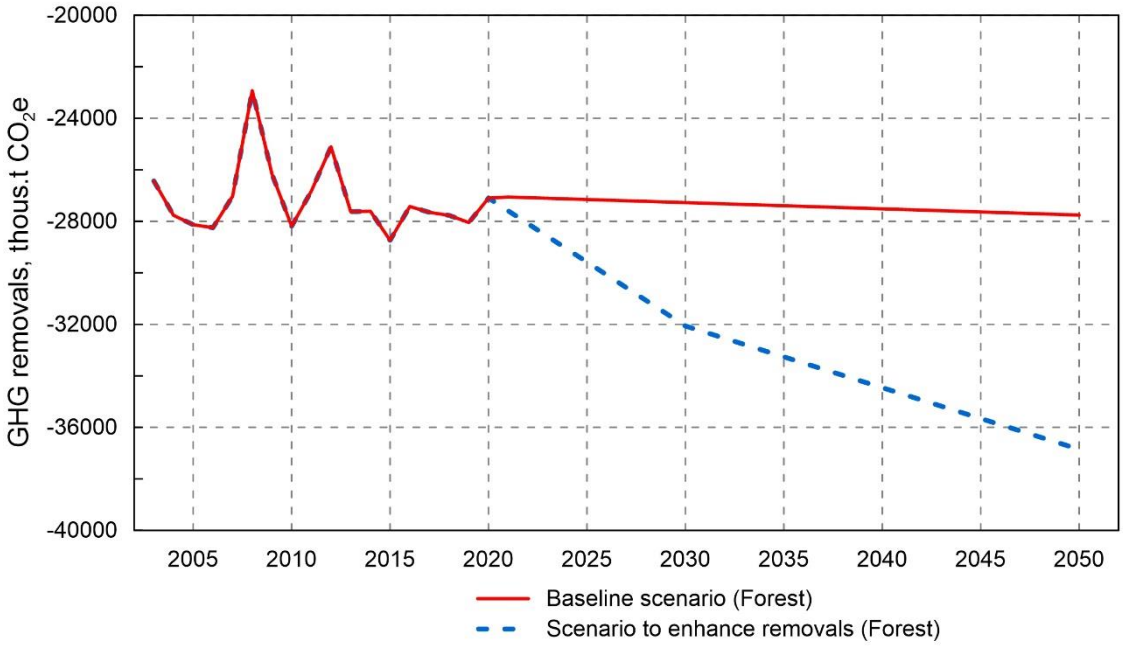

Figure 4-25: Comparison of the baseline scenario and the scenario to enhance removals by forest

If the forest management measures planned by policies are implemented successfully, the sink or removal of forests is expected to increase by 8.9%, 17.6%, 25.2% and 32.8% in 2025, 2030, 2040 and 2050, respectively, compared to the baseline scenario (Figure 4-25 and Table 4-26).

Table 4-24: GHG removals by forested areas in Mongolia, thous. t CO_2e

Removals by forested areas	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU)	-28,188.4	-28,736.7	-27,096.9	-27,152.8	-27,273.5	-27,515.1	-27,756.7
Scenario to enhance removals	-28,188.4	-28,736.7	-27,096.9	-29,580.8	-32,064.7	-34,459.1	-36,853.5
Enhancement of forest removals	-	-	-	-2,428.0	-4,791.1	-6,944.0	-9,096.8
Enhancement of forest removals, %	*-*	*-*	*-*	*8.9*	*17.6*	*25.2*	*32.8*

Table 4-27 shows the integrated information on projects and measures to reduce GHG emissions implemented in the agriculture, land use and forestry sectors.

Table 4-25: The integrated table of measures to reduce the GHG emission implemented in the agriculture, land use and forestry sectors

GHG emission sector: AFOLU-Forest

Description	
Name of the action:	National strategic action plan to reduce GHG emissions related to deforestation and forest degradation /REDD+/
Type:	Action plan /Approved by order of Minister of Environment and Tourism on 25th September 2019/
The main objective of mitigation action:	By reducing deforestation and forest degradation to reduce GHG emissions from forests
Implementation duration:	2020-2025
Target gases:	CO_2
Required financing/ budget:	490 billion /per year/ 186,31 million USD by 2025
Description of mitigation action No.1:	Forest fire prevention and awareness and promotion activities and measures, Reduce the number of fires caused by human activities by improving the early warning system of forest protection, monitoring patrolling and implementing fire protection measures
Type of instrument	Mineralized protection strips against fires Warning and public awareness Increase patrolling and improve the early warning system. Close cooperation with neighbouring countries in the field of transboundary and cross-border fires
Implementation	
Status of implementing:	In the implementing stage
Implementing entity :	Government of Mongolia, MET, Administrative units
Progress indicators:	The baseline parameter of the degraded area by fire is 130,000 ha/year. (Average of 2005-2015)
Steps taken/ envisaged:	Construction of 2,000 km of ground dirt strip against fire Placing at least 1,600 warning boards in fire-risk provinces and villages, and districts Providing complex fire equipment to 31 forest units, 10 administrations of State Special Protected Area (SSPA), and 12 provinces and 210 sums Establish volunteer groups with incentives for patrol and control in 12 provinces and 210 soums. Introduce satellite technology for fire control and information at Regional Hydrometeorological Centres of 12 provinces. Close cooperation with neighbouring countries in the field of transboundary and cross-border fires
Methodology	
Methodologies/Assumptions:	The estimated information included in the plan was used

	Effects
Outcomes achieved:	Area degraded by fire will be reduced by 103,000 ha/year by 2025.
Co-benefits:	The forestry sector's contribution to the GDP will increase from 142 billion MNT in 2017 to 400 billion MNT in 2025. The number of employees in the forestry sector will reach from 5,000 in 2017 to 8,000 by 2025.
Potential reduction for GHG emissions:	The carbon amount released from forests is currently 3,551,439 t CO_2e by 2018. Achieved aims by 2025 will be 2,649,844 t CO_2e. The reduction rate is expected to be 901,545 t CO_2e. Concerning Carbon removal today's level is 74,055 t CO_2e/year by 2018. In 2025, it is planned to reach 99,973 t CO_2e/year, increasing removal by 25,918 t CO_2e over the years.
Description of mitigation action No.2:	Reducing forest degradation by increasing the effectiveness, organization and capacity of measures related to forest insect prevention and combating
Type of instrument:	Monitoring the migration of harmful forest insects Determination of the propagation period of harmful forest insects Increase the supply of biopreparations for combating insects. Conducting awareness and knowledge, training activities.
Progress indicators:	Forest degraded area due to harmful insects is 10,000 hectares /year (as the average of 2005-2015)
Steps taken/ envisaged:	To establish monitoring points for harmful insects in 12 provinces (provinces) To produce domestically 600 tonnes of bio-preparations to kill harmful insects
Outcomes achieved:	Reducing the degraded area due to the impact of harmful forest insects up to 5900 ha/year by 2025.
Description of mitigation action No.3:	Improve management measures to combat illegal logging by increasing public participation, improving monitoring and information delivery systems
Type of instrument:	Improving methods and measures for combating illegal logging Coordinate local supply of wooden materials with type of wooden products. Encouraging local people to participate in activities to combat and control illegal logging. Introduction of a smart system for obtaining and delivering information.
Implementing entity	MET, National Police Agency, General Agency for Specialized Inspection and Local governors
Implementation	Afforested area to reach 15,000 ha/year by 2025.
Progress indicators	The amount of illegal logging is 550 m^3 (as the average of 2005-2015)
Steps taken/ envisaged:	Detection of forest crime violations has increased by 50%.

	The wood supply from the forestry community has increased by 15%. The owned forest area has reached 4.5 million hectares.
Outcomes achieved:	The amount of illegal logging will be reduced to 300 m^3 by 2025.
Description of mitigation action No.4	To improve the quality of forest plantation and seedlings based on new scientific and technological achievements and improve the results and quality of forest restoration and afforestation measures by supporting the natural regeneration ability and capacity of afforestation.
Type of instrument:	To improve the legal medium for banning livestock grazing in regenerating forest areas. Improve the development of technical guidelines for forest restoration. Increase technological capacity for reforestation. Support private sectors and nursery planting units which use underground system planting technology
Progress indicators	The forested area of 8000 ha/year (as the average of 2005-2015) The area that promotes the natural regeneration ability of forest is 2000 ha per year (average for 2005-2015)
Steps taken/ envisaged:	Advanced techniques and technologies/transplantation to support coniferous forest regeneration. Support regrowth and regeneration of saxaul/sedge forest and afforestation and setting of forest strips to combat desertification. Deciding prohibiting livestock grazing in forest reclamation areas Create standards for general requirements of forest restoration which account for local conditions. Uplifted and improved the forest restoration methods and technology and the provision of dedicated tools and instruments. To build a factory to produce cylinders (cartridges) for the seeding of nurseries.
Outcomes achieved:	Afforested area to reach 15,000 ha/year by 2025. The afforested area, supporting the natural regeneration, will reach 80,000 ha per year. The area of specially protected areas will reach 5.3 million hectares.

GHG emission sector: GHG emission sector: AFOLU-agriculture

Description	
Name of the action:	National program on “Fruits and berries”
Type:	Program /Approved by Government Resolution No. 223 of 2017/
Implementation duration:	2018-2022 *Target gases:* CO_2
The main objective of mitigation action:	To provide the population with ecologically clean and nutritious fruits and berries, to reduce imports and to increase export income and improve competitiveness by increasing the variety and production of fruits and berries, increasing the cultivation of sea buckthorn to 10,000 hectares and the cultivation of other types of fruits and berries to 2000 hectares (GoM, 2017b)
Description of mitigation action:	The cultivation of Seabuckthorn will reach 10,000 hectares, and the cultivation of other types of fruits will reach 2,000 hectares by increasing the variety and production of fruits and berries
Type of instrument	
	- Creating a favourable legal and business environment for the sector - Increase the provision of seedlings of adopted varieties that are resistant to drought, cold and diseases - Introducing of advanced techniques and technologies - Capacity building of the particular sector - Determine the market needs of domestic and foreign customers
Implementation	
Status of implementing:	Under implementation
Implementing entity :	Government of Mongolia, MOFALI administrative and business entities and individuals
Progress indicators:	By 2018, 6,070 hectares of cultivated area of sea buckthorn, fruits, and berries. The harvested fruits are 2,560 tonnes. The prepared seedlings' number is 2.4 million.
Steps taken/ envisaged:	Sea buckthorn 10000 ha, Apples 450 ha, Plum 300 ha, Cherries 200 ha, Blackberries 820 ha, Blueberries 150 ha Other fruits (in the greenhouse) 80 ha
Methodology	
Methodologies/Assumptions:	Researchers estimate that the average height of sea buckthorn is about 3.5 m, and planting distance should be 2 m, resulting in 2500 trees in 1 hectare. The dry mass corresponding to 1 tree of 3.5 m in height is 4.77 kg. The dry mass per 1 ha is 12 tonnes. 50% of the dry mass is estimated to be carbon.
Effects	
Outcomes achieved:	The area cultivated with sea buckthorn, fruits and berries is expected to reach 12,000 hectares, and harvest will reach 20,000 tonnes by 2022. 3.0

	million prepared seedlings. The supply of fruits and vegetables to the domestic factories will reach 10%.
Co-benefits:	Supply of fruits and vegetables to domestic factories will be 1.5% to 10%. The number of new jobs in the sector will increase by 11,000. The number of exported products is estimated to reach 0.2 -5.0 million USD.
Potential reduction for GHG emissions:	Expected to remove approximately 264 thous. t CO_2e.

GHG emission sector: GHG emission sector: AFOLU-Forest

Description	
Name of the action:	An initiative on the national campaign “Billion Trees”
Type:	Guidance (mainstream) to the Government/ Presidential Resolution No.58 dated October 4, 2021/
Implementation duration:	2022-2030 *Target gases:* CO_2
The main objective of mitigation action:	Living in harmony with mother earth, treasuring and respecting Mongolian traditions, customs and culture, reducing the impact of global climate change, protecting and increasing forest and water resources and ensuring ecological balance
Description of mitigation action:	To grow a billion trees by rehabilitating degraded forests through afforestation and supporting natural regeneration, creating reserves of seeds and seedlings, and implementing forest protection measures to reduce fires, harmful insects, and illegal logging
Status of implementing:	Implementing
Implementing entity :	MET, Ministry of Industry and Commerce /Trade and other related ministries
Type of instrument No.1	
Provide policies and regulations	
Implementation	
Steps taken/ envisaged:	Must be included in national environmental target programs. The location of the afforestation target area and the necessary funding will be determined and secured. Develop methods and recommendations for planting trees suitable for the specific conditions of the different natural belts.
Methodology	
Methodologies/Assumptions:	The aboveground biomass is estimated only by the EX-ACT model from FAO.
Effects	
Outcomes achieved:	Plant and grow a billion trees by 2030.

Co-benefits:	The contribution of the forestry sector to GDP will increase. The number of employees in the forestry sector will increase. The income of employees in the sector will increase
Potential reduction for GHG emissions:	By 2030, 2,145,133 t CO_2e per year will be able to sink. The total sink will reach 16,125,455 t CO_2e in 8 years.
	Type of instrument No.2
	Improving the legal environment
	Implementation
Steps taken/ envisaged:	Gradually create a legal framework for allocating at least one per cent of the country's Gross Domestic Product to environmental protection, climate change and combating desertification activities annually.
	Type of instrument No.3
	Implementation of organizational measures and ensuring management
	Implementation
Steps taken/ envisaged:	Set up protection forest strips in agricultural areas and fields. Construction of protection forest strips along highways and railways Intensification of technical and biological restoration and rehabilitation measures in mining and processing areas Creation and conservation of genetic resources of tree and plant seeds, Creation of advanced technologies (biotechnology, agrotechnology) used to increase the production of seeds and seedlings and to adapt to own specific natural conditions. Implementation of joint projects with other countries Establish parks with green facilities in provinces, capital, sums and districts, and acquire land for tree planting
	Type of instrument No.4
	Implement training and advocacy activities
	Implementation
Steps taken/ envisaged:	Develop projects on educational and training curriculum programs, guidelines, and methods in the field of tree planting, tree caring and nursing, growing and climate change, Preparing trained and qualified staff

4.2.4 Waste sector

The baseline scenario of GHG emissions (methane, CH_4 and nitrogen oxide, N_2O) from the waste sector in Mongolia considered the following three sources: a) methane generated from solid waste collection points, b) methane and nitrogen oxides generated during the treatment and discharge of household wastewater, and finally, c) methane gas emissions generated during the treatment and discharge of industrial wastewater.

According to the methodology of the Intergovernmental Panel on Climate Change in 2006 (the 2006 IPCC GLs), the baseline scenario of the GHG emissions was calculated using the half-decomposition method based on the amount of degradable organic compounds.

The amount of methane that can be generated from the centralized points of urban waste is estimated to increase annually by 6% considering following parameters: the population growth and waste generated per capita with the Gross Domestic Product (GDP) growth.

When determining the future trend of GHG released from household wastewater, considered the population growth trend and the characteristics of wastewater treatment and disposal technologies of households in Ulaanbaatar city and the centres of provinces, villages, soums and rural areas.

In addition, the trend of methane gas emissions from industrial wastewater was calculated based on statistical data on products containing degradable organic compounds in industrial wastewater from 1990-2020. The total GHG emissions from the waste sector were calculated by LEAP model considering all above mentioned sources. The results are demonstrated in Figure 4-26.

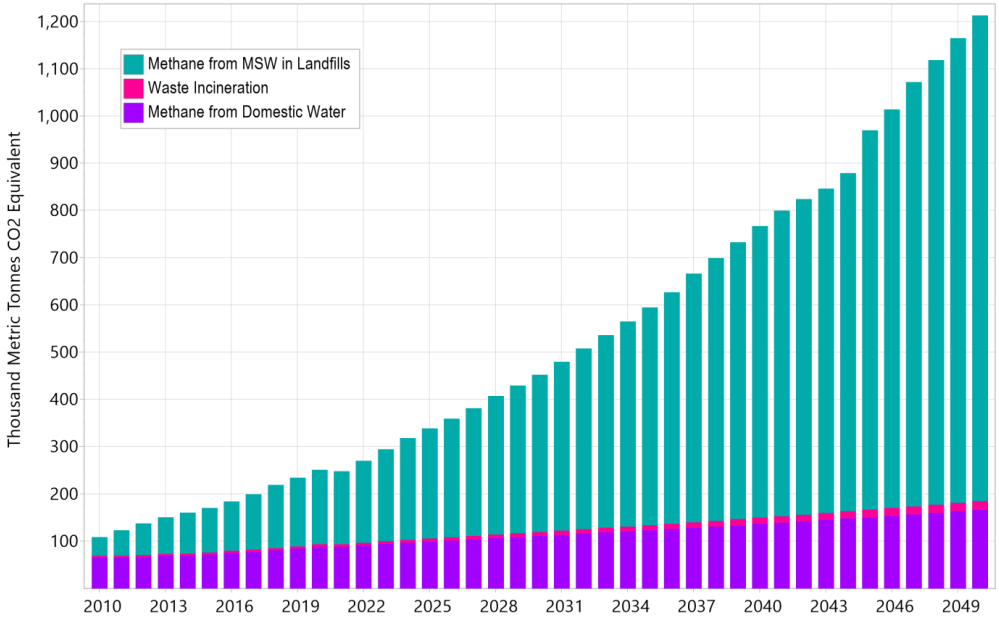

Figure 4-26: Baseline scenario for GHG emissions from the waste sector using the LEAP model

After the determination of the baseline scenario of the GHG emissions, GHG emission reductions have been estimated by considering the impact of measures such as increasing the capacity of sanitation facilities, separating and sorting, and recycling waste which are included in the laws, regulations, long-term and medium-term development policy documents, and action programs of Mongolia at the national level.

According to Mongolia's long-term policy document, "Vision-2050" (PoM, 2020) and policy documents such as "New Revival Policy" (PoM, 2021), which aims to create the primary conditions for its implementation and promptly solve the limiting factors of development, planned to increase the amount of waste recycling to 27% in 2025, to 40% in 2030, and to 50% in 2050.

Similarly, potential options for reducing the GHG generated from the centralized points of waste and the treatment of household wastewater were based on the objectives to expand the treatment facilities of UB city and 15 provinces and to put them into operation by 2025, which were included in the implementation of NDC action plan.

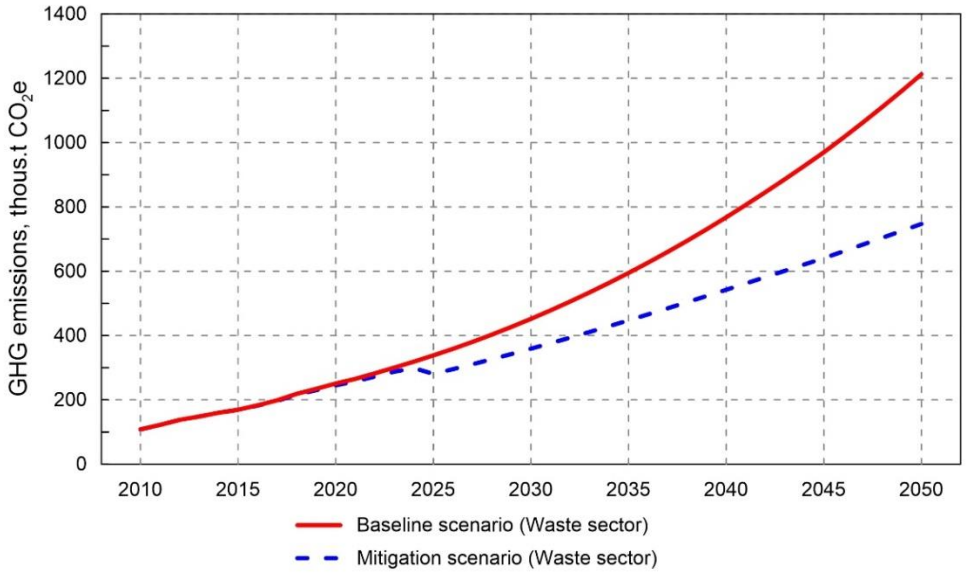

Figure 4-27: Comparison of the baseline and mitigation scenarios of GHG emissions from the waste sector

By taking the two measures mentioned above in the waste sector, the amount of GHG emissions can be reduced by 92.8 thous. t CO_2e or by 20.5% in 2030, by 225.3 thous. t CO_2e or by 29.4% in 2040, and by 465.5 thous. t CO_2e or by 38.4% in 2050, compared to the baseline scenario (Figure 4-27, and Table 4-28).

Table 4-26: Total GHG mitigation potential in waste sector, thous. t CO_2e

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario (BAU)	108.3	169.5	250.9	338.3	452.0	767.7	1,212.5
Mitigation scenario	108.3	169.5	250.9	280.7	359.2	542.4	747.1
The total reduction of GHG emission	-	-	-	57.6	92.8	225.3	465.5
- Reducing the amount of waste to be buried and landfills by encouraging waste recycling factories	-	-	-	19.7	48.0	165.8	388.8
- Increasing the capacity of sewage treatment facilities by expanding and putting them into operation in the capital city and 16 provinces,	-	-	-	37.8	44.8	59.5	76.6
Total GHG emission reduction, %	*-*	*-*	*-*	*17.0*	*20.5*	*29.4*	*38.4*

Table 4-29 shows detailed information on measures of national level programs and plans to reduce the GHG emissions in the waste sector.

Table 4-27: Programs and plans to reduce the GHG emission in the waste sector

GHG emission sector: Mitigation actions in the solid waste sector

	Description
Description of mitigation action:	Increase the rate and proportion of recycled waste
	Type of instrument
By policy:	"Vision-2050" Parliament Resolution No. 52 of May 13, 2020 The share of recycled waste will increase from 7.6% in 2018 to 27% in 2025, to 40% in 2030, and to 50% in 2050.
Other related policies and programs	"New Revival Policy" 2021-2030, Parliament Resolution No. 106 of 2021: The amount of waste recycling should be increased to 27% in 2030 Resolution No. 298, dated September 18, 2014, of the Government's "National Program on Waste Reduction" Increase the amount of waste to produce recycled and value-added products from 4.4% in 2013 to 10% in 2018 and 22% in 2022.
	Implementation
Status of implementing:	Implementing
Implementing entity:	Government of Mongolia
Progress indicators:	There are 40 waste recycling factories, and more than 160 waste separation points will operate in Mongolia, with more than 1,500 employees by 2021 (https://mofa.gov.mn/). By implementing the project to introduce waste sorting at the source, 376 sorting points have been established in the capital city, and the amount of sorted waste was 7.8 thous. tonnes in 2018 and 16.9 thous. tonnes in 2019. About 25.7 thous. tonnes of reusable waste will be recycled in 2020. (Report on the implementation of PGD, 2021).
Steps taken/ envisaged:	Regulation on "Promoting and awarding incentives to citizens, enterprises and organizations engaged in waste reduction, collection, transportation, storage, recycling, reuse and disposal activities and introduction of zero-waste technologies" was approved by Government Resolution No. 263 dated June 29, 2015. The Parliament approved the updated Law on Waste on May 12, 2017.
	Methodology
Methodologies/Assumptions:	The 2006 IPCC GLs methodology for calculating GHG emissions will be used for the estimation.
	Effects
Outcomes achieved:	According to Mongolia's "Solid Waste Account" statistics, 8.7% or 250.6 thous. tonnes of 2.9 million tonnes of waste was recycled and reused in 2019 (NSO, 2021).
Co-benefits:	A waste recycling framework and system will be created and put into the economy. New jobs will be created in the waste sector. The number of imported goods and products will decrease.
Potential reduction for GHG emissions:	As a result of such policies and measures in the waste sector, it is expected to reduce GHG emissions by 19.7 thous. t CO_2e in 2025. Similarly, 48.0 thous. t CO_2e in 2030, 165.8 thous. t CO_2e in 2040, and 388.8 thous. t CO_2e By 2050, respectively, will be reduced.

GHG emission sector: Mitigation actions in wastewater

Description	
Name of the actions:	Construction of a new treatment plant in Ulaanbaatar Renovation and construction of a new water treatment plants in the centres of 10 provinces, including and Khujirt sum centre in Uvurkhangai province. Renovation and construction of treatment facilities in centres of 5 provinces and soums.
Implementation duration:	2017-2020
Target gases:	CH_4
Type:	Project
The main objective of mitigation action:	
Description of mitigation action:	Increase the capacity of sanitation and sewerage facilities.
Type of instrument	
By policy:	"Goals of the Nationally Determined Contribution for implementation of the Paris Agreement" Government Resolution No. 407, dated November 19, 2019. "Action Plan for goals of Nationally Determined Contribution for the Implementation of the Paris Agreement"
Other related policies and programs	"New Revival Policy" 2021-2030, Parliament Resolution No. 106 of 2021: The amount of waste recycling should be increased to 27% of total waste generated in 2030 Resolution No. 298, dated September 18, 2014, of the Government's "National Program on Waste Reduction" Increase the amount of waste to produce recycled and value-added products from 4.4% in 2013 to 10% in 2018, and to 22% in 2022.
Implementation	
Status of implementing:	Under implementation
Implementing entity:	Mongolian government, Ministry of Construction and Urban Development (MCUD), and Ministry of Defense Co-executives: Provincial Governors, Governor's Office of the Capital City
Progress indicators:	The contractor has been selected and awarded, the feasibility study has been completed, and the construction work of the Wastewater Treatment Plants in the province and soum centres has been initiated.
Steps taken/ envisaged:	Regulation on "Promoting and awarding incentives to citizens, enterprises and organizations engaged in waste reduction, collection, transportation, storage, recycling, reuse and disposal activities and introduction of zero-waste technologies" was approved by the Government Resolution No. 263 dated June 29, 2015. The Parliament approved the updated Law on Waste on May 12, 2017.

Methodology	
Methodologies/Assumptions:	The 2006 IPCC GLs methodology for calculating GHG emissions will be used for the estimation.
Effects	
Outcomes achieved:	Progress of implementation by 2022: Construction work of a new treatment plant in Ulaanbaatar city is ongoing and 70% completed. The construction works of treatment plants in Arkhangai, Uvurkhangai and Bulgan provinces have been completed. 90% of the construction work of treatment plants in Umnugovi, Dornogovi, Khuvsgul, Khentii, Sukhbaatar, Dundgovi, and Darkhan-Uul provinces is complete. The construction works of treatment plants in Bayan-Ulgii, Dornod, Govsumber, Zavkhan, and Uvs provinces have started.
Co-benefits:	Creating conditions for the citizens of the province and soum centres to live in a healthy and favourable environment. Supported other indicators of sustainable development, such as local job creation
Potential reduction for GHG emissions:	GHG emissions will be reduced by 37.8 thous. t CO_2e in 2025, 44.8 thous. t CO_2e in 2030, 59.5 thous.t CO_2e in 2040, and 76.6 thous.t CO_2e in 2050.

Measures on reduction of the amount of waste to be buried in centralized landfills by promoting waste recycling, reducing the amount of GHG emitted from solid waste and increasing the proportion of the population covered with improved sanitation facilities by improving sanitation capacity are included in the Action plans of the Goals the Nationally Determined Contribution (NDC) for the implementation of the Paris Agreement. Moreover, it is planned to reduce the CO_2 emission from liquid waste by 106.1 thous. t CO_2e by 2030.

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CHAPTER 5

Measurement, Reporting, and Verification System for Greenhouse Gas Emissions in Mongolia

CHAPTER 5. MEASUREMENT, REPORTING AND VERIFICATION SYSTEM FOR GREENHOUSE GAS EMISSIONS IN MONGOLIA

5.1 A Developing Process of the Measurement, Reporting, and Verification System for GHG Emissions in Mongolia

5.1.1 Policies to Mitigate Climate Change and GHG Emission Reductions and Their Implementation

Mongolia ratified the UNFCCC in 1993 and the Kyoto Protocol in 1999 and took some steps to mitigate climate change). The Mongolian parliament approved the National Climate Change Program in 2011. Under clause 5.1.2 of this program, the objective of "Establishing an external audit system targeted at reducing GHG emissions" was stated. The Mongolian Ministry responsible for Environmental Affairs has started introducing the international standards for measuring, calculating, and reporting GHG emissions and removals as the first step to implementing this program. Training and model projects with the participation of specialists of the state administrative organizations, standardization and accreditation agencies, and private sector experts were carried out as capacity building, from 2013 to 2015, in collaboration with international organizations. It was the base of Mongolia's national GHG measurement, reporting, and verification (MRV) professional capability.

5.1.2 Initiation of the Measurement, Reporting and Verification Activities

Measurement, reporting, and verification of GHG emissions and removals were performed several times in Mongolia at the national and project levels. Since 2001, the reports on Mongolia's National GHG Inventory have been developed and delivered to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat.

Then GHG emissions and removals were estimated based on statistical data obtained at the national level or from every sector; the report was prepared, and national and international experts verified the information in the report.

Between 2004 and 2012, projects to reduce GHG emissions were implemented under the Clean Development Mechanism (CDM), and foreign specialists measured, reported and verified the emission reductions. For instance, the 19,182 t CO_2e amount was verified at the 11 MW hydropower plant in Taishir soum of Govi-Altai province between 2009 and 2012, and 57,768 t CO_2e at the 12 MW hydropower plant in Durgun soum of Khovd province between 2008 and 2011.

The Japanese and Mongolian companies have implemented GHG projects within the framework of the Joint Crediting Mechanism (JCM) program since 2014. The project participants conducted Measuring, Reporting, and Verification (MRV) activities of GHG emission reductions of these projects on a cooperative basis. The Mongolian validation and verification organization has verified the GHG Emission reductions of some projects. That made progress in the development of the domestic MRV system in Mongolia.

Another successful step in developing the domestic MRV system was made in 2018-2019 by the Ministry of Construction and Urban Development (MCUD), which implemented the "Nationally Appropriate Mitigation Actions in the Construction Sector" project funded by the United Nations Development Program and other international organizations. Within the framework of the project developed, the structure, institutional arrangement, and procedure of MRV system in the construction

sector, a simplified calculation methodology of GHG emission reduction of buildings and the guide for regulation of GHG registration and information of GHG emission reductions in the sector. As a rule, these documents were approved by the Minister of MCUD to obey in the construction sector.

In previous years, Mongolian government organizations and companies have implemented several projects and measures to reduce GHG emissions. International organizations and donor countries funded these projects and measures. Most of these initiatives aimed to increase the capacity to develop GHG projects, implement the project and develop guidelines and recommendations for measuring, reporting, and verifying GHG information. In particular, the UN REDD+ program has been successfully implemented with the assistance of the United Nations Development Program and other international organizations. The Forest Reference Level (FRL) in Mongolia was determined and submitted to the UNFCCC within the framework of this project.

As a result of the above-listed measures, the awareness among society about the MRV framework of GHG emissions, removals, and their purpose and necessity has been increased.

5.2 Activities of Measurement, Reporting, and Verification of GHG emissions in Mongolia

Today, the following MRV systems have been formed and worked.

1. MRV of the national GHG inventory,
2. MRV activity at the project level or MRV system of JCM,
3. MRV activity at the sector level or MRV system of NAMA in the construction sector

5.2.1 Measurement, Reporting, and Verification of the National GHG Inventory

The Ministry of Environment and Tourism (MET) is responsible for planning, implementing, and reporting national climate change policy and activities at the state level in Mongolia. Previous reports of the National GHG Inventory (2001, 2010, 2018) and a Mongolia’s Initial Biennial Update Report (2017) were prepared by the Climate Change Research and Cooperation Centre and submitted to the UNFCCC Secretariat.

The report has been prepared according to the information and data on GHG emissions and removals collected by the National Statistics Office and obtained from the Research institutions, project units and administrative organizations.

The National Climate Change Committee was established in 2019 under the Ministry of Environment and Tourism to improve data exchange between sectors. In this committee, representatives from the Ministry of Energy, Ministry of Finance, Ministry of Food and Agriculture and Light Industry, Ministry of Road and Transport, Ministry of Construction and Urban Development, Ministry of Mining and Heavy Industry, Ministry of Science and Education, Ministry of Health, Academy of Science, Governor's office of the Capital city, and Information and Research Institute of Meteorology, Hydrology, and Environment.

The national GHG inventory reports (National Communications) have been verified as reviewed by the national experts first, then by the international experts in accordance with the IPCC Guidelines of the UNFCCC.

5.2.2 Measuring, Reporting and Verification activity at the project-level or MRV system of the JCM program

Mongolian and Japanese governments signed the “Low Carbon Development Partnership” in 2013 and established the Joint Crediting Mechanism (JCM) to reduce GHG emissions cooperatively. The Mongolian and Japanese companies have started to implement mitigation projects in Mongolia.

The training on MRV of emission reductions of the projects and demonstration projects for MRV activity implemented within the framework of JCM significantly contributed to the capacity building for MRV activity by the Mongolian companies - project participants and domestic validation verification body.

Institutional arrangement:

Through the investment and deployment of advanced Japanese technologies, products and services that produce less GHG emissions, the Joint Crediting Mechanism (JCM) is the bilateral partnership that supports Mongolia’s sustainable development. The JCM structure of the measuring, reporting and verification system is illustrated in Figure 5-1. The Joint Committee consists of representatives from two governments and oversees managing the project and emission reduction measures, while the state-owned and private business entities from the two countries are responsible for the project implementation. This committee develops and approves rules of procedures of the JC, rules, and guidelines regarding the JCM methodologies to quantify the GHG emission reductions or removals and other matters relating to overall project implementation and administration of JCM. The Joint Committee prepared and approved 12 rules and guidelines and 17 forms necessary for the Joint Crediting Mechanism, which are regularly updated.

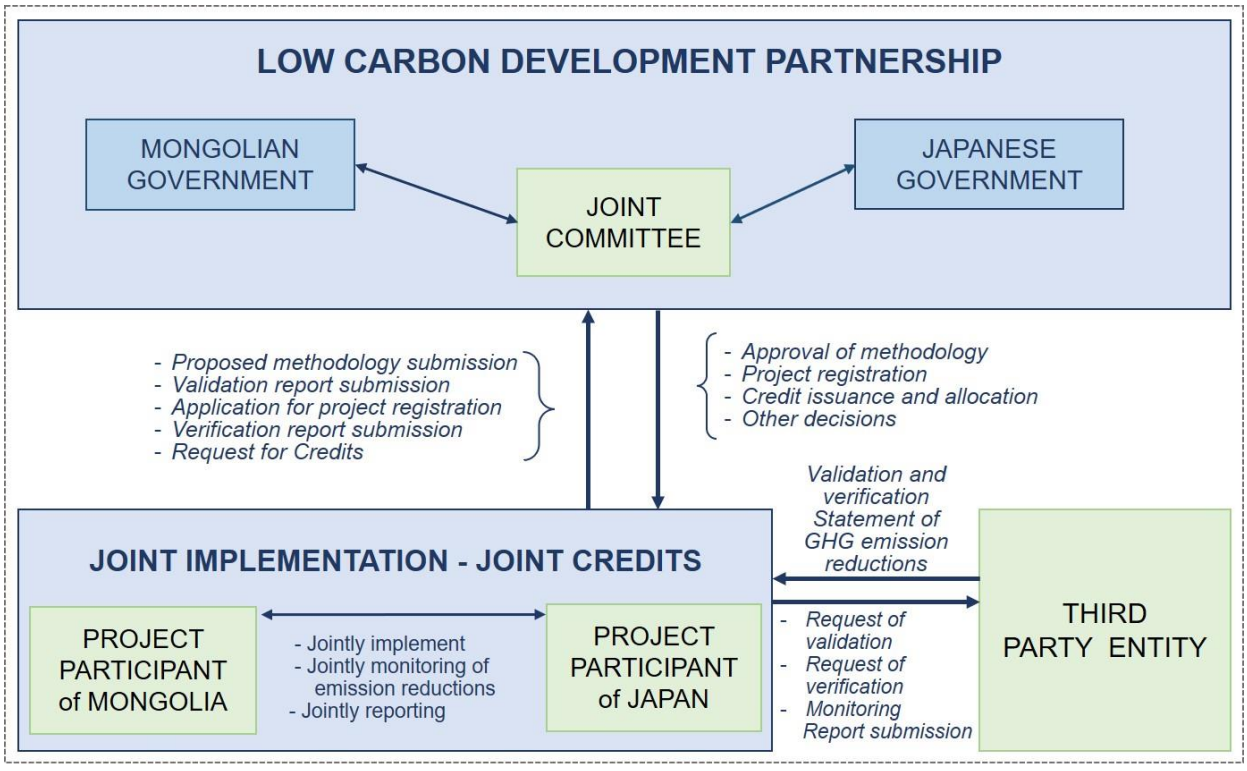

Figure 5-1: MRV system of the Joint Crediting Mechanism program

The Measurement, Reporting, and Verification activities

The project participants will jointly develop project documents and the monitoring plan. The project document and monitoring plan must validate by the Third-party entity (Validation verification body); the Joint Committee (JC) will register the validated project as a JCM project and becomes eligible for funding and credit sharing.

The Japanese government provides financial support for registered projects. The following guidelines were used for this stage of the project:

- JCM Project Cycle Procedure (JCM_MN_PCP),
- JCM Guidelines for Developing of Proposed Methodology (JCM_MN_PM),
- JCM Guideline for developing Project Design Document and Monitoring report (JCM_MN_PDD_MR).

The project participant will measure and calculate the project's Emission reductions according to the monitoring plan. A monitoring report will be prepared using the measured data to determine how much the JCM project reduces GHG emissions. The Third-party Entity must verify the report. Third-party Entities designated by the JC shall verify the monitoring report of the project according to the guidelines for "JCM Guidelines for Validation and Verification (JCM MN GL VV)." The project participant submits a monitoring and verification report to the JC. The credit for verified Emission reductions will then be formally submitted and shared with the project. The project credit of the JCM is currently in non-tradable form.

Parties performing the Measurement, Reporting and Verification actions:

Project participants: Companies from Japan and Mongolia jointly implement the JCM project. The project participant performs followed operations:

- Development of the Project Design Document and the Methodology for calculation of GHG emissions, to be approved by the Joint Committee,
- Conducting the monitoring of GHG emission reductions,
- Submit validated Project Design Document and verified Monitoring report to the Joint Committee, acquiring credits for the GHG emission reductions.

Validation and Verification Body: The Joint Committee of the JCM designates the Third-party Entity (Validation and Verification Body). Third-party Entities must be accredited under ISO14065 by an accreditation body that is a member of the International Accreditation Forum (IAF) or Pacific Accreditation Cooperation (PAC) or must be the Designated Operational Entity (DOE) accredited by the Executive Board under the Clean Development Mechanism. The third-party entity performs followed operations:

- Validates the project based on requests from the Project participant and sends the validation report to the Project participant,
- Verifies GHG emission reductions or removals achieved by the project based on requests from project participants and sends the verification report to the Project participant.

The third-party entity performs validation, and verification activities in line with the guidelines for the validation and verification as developed by the JC of the JCM.

Transparency: At the project development stage, the JCM MRV system has a procedure for a consultation meeting with the local stakeholders and received comments reflected in the project implementation. The project participant submits the developed draft Methodology for calculating the GHG emission reductions of the project to the JC. After its completeness is checked, the JC receives public comments on the Methodology, by uploading it on the JCM website.

The information about the validation and verification body, the validation verification reports and other relevant information about the JCM projects must be publicly available through the website.

The JCM MRV system is a model that can be enhanced and modified as a national MRV system of the supported projects and measures regarding institutional arrangement, operational requirements and criteria.

5.2.3 MRV activity at the sector level or MRV system of Nationally Appropriate Mitigation Actions in the construction sector

The construction sector uses a substantial amount of energy, making it crucial to avoid heat loss from buildings due to Mongolia's extreme climate conditions. The project 'Nationally Appropriate Mitigation Actions in the construction sector" was carried out in 2018–2019 by the MCUD with the support of UNDP and the GEF.

This project aimed to implement pilot projects to reduce GHG emissions at buildings, develop a MRV system suited for them and train and practice MRV activities according to that system.

The development of documents that defined the structure and operations of the MRV system and the roles and responsibilities of its leading players was carried out during the project's first phase. Related training workshops were also conducted. The proposal "Institutional Structure and Roles and Responsibilities of the Measurement, Reporting, and Verification System of the GHG Emission reductions in the construction sector" were developed and introduced at the final stage of the project in 2020. The following documents were authorized by Order #37 of the Minister of Construction and Urban Development:

1. Guidelines for the measurement, reporting, and verification of GHG emission reductions of buildings,
2. Procedure for registration of the GHG emission reductions in the construction sector,
3. Methodology for calculation of GHG emission reductions of building: CNR 25-101-20 (Construction Norms and Rules).

These documents will be followed in the construction sector from the date of their approval.

Organizational Structure

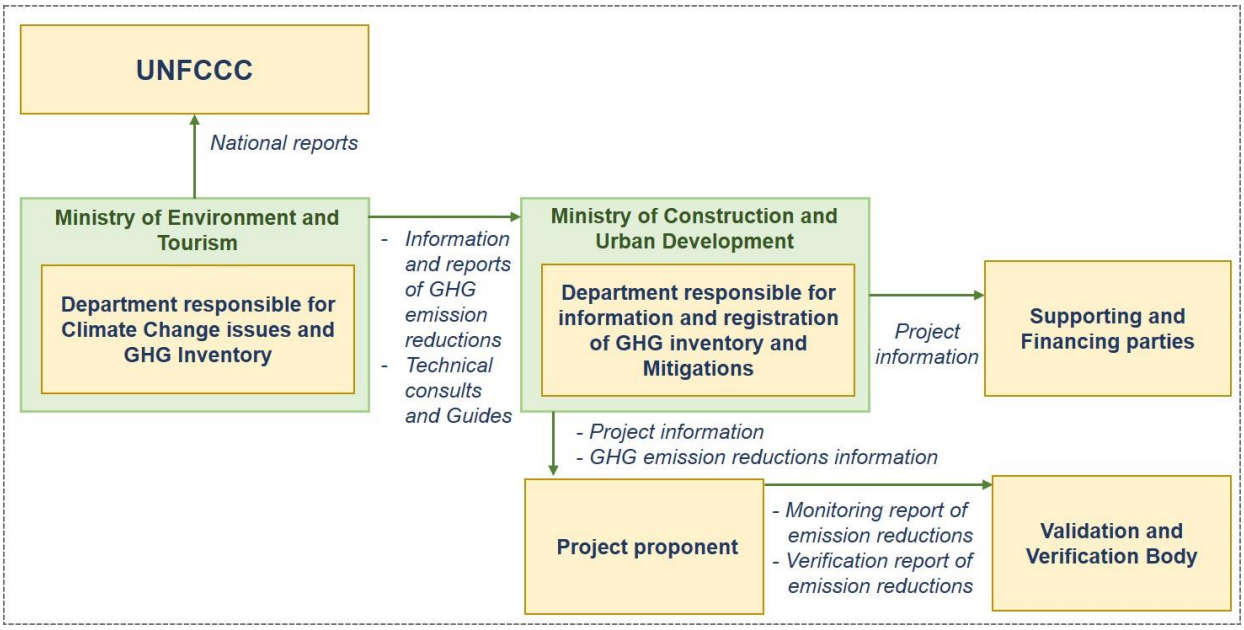

Figure 5-2: MRV system of measurement, reporting and verification of GHG emissions in the construction sector

The Department of Policy Planning and the Construction Development Centre was assigned by the Minister of MCUD to charge G HG inventory and GHG Emission reductions information from the projects implemented in the construction sector, set out the GHG emissions database, and submit regular reports to the National Climate Change Organization.

MCUD will coordinate the registration of emission reductions of the GHG in the construction sector each year following the “Procedure for registration of the GHG Emission reductions in the construction sector”.

GHG Project implementers must register emission reductions and provide brief details of the GHG projects and mitigation measures implemented within the deadline specified by the MCUD. The Emission reductions of mitigation projects and measures of buildings can be registered as verified and not verified amounts of GHG emissions. The collected data on GHG emission reductions or registered results of the mitigation measures must be submitted to the National Organization responsible for Climate Change.

Parties involved in the Measurement, Reporting, and Verification actions:

State administrative organization in charge of Construction (Ministry of Construction and Urban Development):

An administrative unit responsible for the registration and information of GHG emissions in the sector must be worked at the MCUD, with at least one full-time employee, is included in the proposal for the structure of this MRV system. The Construction Development Centre is currently responsible for the mentioned task. This unit mainly concentrates on whether the measurement, reporting, and verification of the GHG projects and measures implemented in buildings comply with the appropriate standards, rules, and regulations and also on whether other financial organizations have not granted this project.

The unit will be responsible for forming a database of mitigation actions quantity of emission reductions and reporting and submitting the integrated report of the construction sector to the National Climate Change Organization. Tabular forms have been created and prepared for reporting and submission to higher-level organizations.

Project Implementer: Monitoring of the GHG emissions of the implemented project, as well as calculating and reporting of its emission reductions, is the responsibility of the owner of the building where the mitigation measures are implemented or the legal entity that performs the technology installation of the project. Monitoring shall be done in accordance with the guidelines outlined in the "Guidelines for the measurement, reporting, and verification of GHG Emission reductions of buildings".

Third-party entity: The MRV system of the construction sector requires an accredited validation and verification body (VVB) to verify GHG emission reductions of the project implemented in buildings. The VVB can operate in Mongolia after being registered and accepted accreditation from the National Accreditation Centre of Mongolia or other authorized international organizations.

Measurement, Reporting, and Verification Techniques

Monitoring Activity: The guidelines for measurement, reporting, and verification of the GHG emission reductions in buildings will be used to monitor GHG emission reductions in buildings (Figure 5-3). The "Methodology for calculating the GHG emission reductions of buildings: CNR 25-101-20" calculates the project's GHG emission reduction.

- Measurements and estimates will be performed to determine the baseline emissions of the building before developing the project proposal. Furthermore, the monitoring plan will be designed in accordance with the guidelines provided here. The details on measuring parameters, measurement equipment, quality assurance and control, the procedure for gathering and storing measured data or measurement frequency, data storage and transmission mechanisms, and the information on monitoring staff are to be described in the Monitoring plan,
- The monitoring period cannot be shorter than a year, and the GHG emission reductions must be estimated and reported throughout the year,
- The nationally specific indicators and criteria for GHG mitigation projects in construction were established for use,
- The methodology for calculating GHG emission reductions of buildings: CNR 25-101-20 (Construction Norms and Rules) can be applied depending on the project's nature and the specific program's requirements.

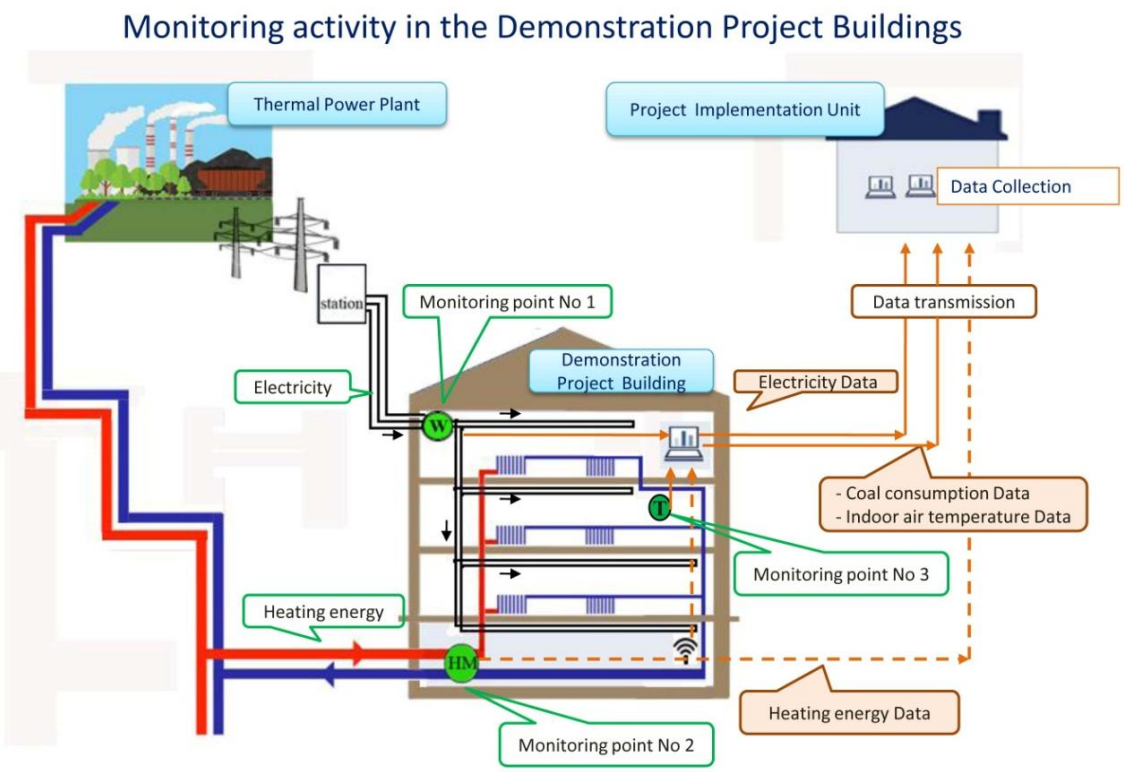

Figure 5-3: Measuring points of monitoring for determining the GHG emission reductions in the construction

Reporting activity: The "Guidelines for the measurement, reporting, and verification of GHG emission reductions of buildings" will be used for this activity. The monitoring report must include followed data:

1. Project Information,
2. Measured quantity,
3. Emission Reductions of the GHG,
4. Project result,
5. Team members who carried out the monitoring task.

The following indicators are defined as project result criteria for NAMAs in the construction sector:

1. GHG emission reductions, including direct and indirect emissions in the project building per year, t CO_2e /year,
2. GHG intensity, t CO_2e /MW/year,
3. The intensity of energy use, MW/year/m^2,
4. Building-specific heat energy consumption, kWh/year/m^2,
5. Compliance with the requirements of Building Codes, Norms and Standards (BCNS), %

The MRV guidelines provide all data to be presented in tables for easy. For example, the following table contains the results of measurement and monitoring.

Table 5-1: Results of national-specific measurements to reduce GHG emissions from buildings

Measured parameters	EC: Electricity consumption	WC: Heating Energy consumption	FC: Coal consumption	Other
Measured quantity, unit				
Data source				
Measurement tool				
Monitoring scenario				
Monitoring frequency				
Quality assurance and quality control method				

These parameters are appropriate under the Mongolian conditions since they must be measured and assessed to identify the primary sources of GHG emissions from buildings. Gas fuel is not included as it is not currently used to heat the buildings.

Verification activity: An authorized Validation and verification body must assess the GHG emission reductions and removals in Mongolia. Guidelines shall be used for measuring, reporting and verifying GHG emission reductions in buildings. Unless specifically instructed otherwise by the project investor, the Third-party entity for validation and verification shall develop a verification statement and report of GHG emission reductions of the project.

As part of the verification process, the project shall be evaluated on-site using the project proposal, monitoring report, and following tests.

- Approved Project mitigation measures and their actual implementation,
- Calibration and verification of measuring equipment,
- Monitored data and calculation of GHG emission reduction,
- Analysing the transparency of the project by determining whether it is not registered in other funds or programs that support climate change mitigation, determining whether changes have been made to the measures, methods and investments used for the project implementation and determining whether an energy audit was carried out prior to the project implementation,
- Evidence quality assessment.

Depending on whether the project is included in the national GHG Emission Reduction statistics or the criteria of the financial sponsor, it may not be verified by the authorized validation and verification body. The task of developing a report has been greatly simplified by using report forms and a unified format to put data-measured parameters.

Transparency

The Minister of Construction and Urban Development approved the “Procedure for Registration of the GHG Emission Reductions in the Construction Sector “by the order in 2020, and Chapter 3 of this procedure contains provisions intended to ensure the transparency of the MRV system for the GHG emission reductions in the construction sector. For example:

3.1. The state administrative organization in charge of construction shall release to the public a list of projects for GHG emission reductions, by the 20 March of each year,

3.2. The list of projects in the construction sector shall be posted on the website of the State administrative organization in charge of construction and at the electronic registry of the sector's GHG inventory.

By 30 March each year, the Centre for Climate Change Research and International Cooperation, under the Ministry in charge of environmental issues, receives information on the GHG emission reductions of the implemented projects, as well as the list of reduction measures in the construction sector that the Ministry registered in charge of construction issues. Furthermore, in compliance with this procedure, a consistent database of GHG emission reductions and information on the mitigation measures taken across the sector will be developed.

The provisions of the "Guidelines for the measurement, reporting, and verification of GHG emission reductions of buildings" shall prevent double counting of emission reductions and double financing of the project.

5.3 Some Experiences in Measurement, Reporting, and Verification Activities in Mongolia

Since 2015, Mongolia has implemented some Joint Crediting Mechanism projects. Among them, the MRV activities of five projects were carried out. The corresponding credit allocation information can be viewed from the JCM's official website (www.jcm.go.jp).

One of the first JCM projects implemented in Mongolia was the High-Efficiency Heat Only Boiler project in Bornuur soum.

1. Project name: MN002: "Centralization of heat supply system by installation of high-efficiency Heat-only Boiler in Bornuur soum" Joint Crediting Mechanism Project,
2. Project Location: Bornuur soum of the Tuv province,
3. Project Implementation parties: Suuri Keikaku LLC of Japan, Anu Service LLC of Mongolia,
4. Heat-only Boiler's power capacity: 1800 kW,
5. Date of Project's start: 15 September 2015,
6. Information on measured data (activity data) and data used in estimations (default data):
   a. Amount of heat produced by the Heat-only Boiler, GJ,
   b. Total worked hours, hrs,
   c. The efficiency of the Boilers, Efficiency of the project boiler: 0.610, Efficiency of the reference boiler: 0.533,
   d. The GHG emission factor of burnt coal - 0.0909 t CO_2/GJ,
   e. Approach to estimate reference emissions and emission reductions
7. The quantity of reduced GHG emissions as a result of the project:

Table 5-2: Verified GHG emission reduction

Year	2015	2016	2017	2018	2019	2020	2021
Verified reduction of GHG emissions, t CO_2e	50	94	102	130	140	126	52

The staff of Anu Service LLC is the project implementer of the Mongolian side, and Suuri Keikaku LLC is the project implementer of the Japanese side, jointly carrying out the project's monitoring and

reporting. The Low Carbon Technology Centre of Mongolia conducted the verification work of the project.

Table 5-3: Project performance of measurement, reporting, validation, and verification

Project name	Project participant	Performer of the validation	Performer of the verification	Duration
MN002: "Centralization of heat supply system by installation of high-efficiency Heat-only Boiler in Bornuur soum, Tuv province".	- Anu Service LLC (from Mongolia), - Suuri Keikaku Ltd (from Japan),	National Renewable Energy Centre (Mongolian Third-party entity)	Low Carbon Technology Centre (Mongolian Third-party entity)	2015-2021

The demonstration MRV activities have been conducted within the framework of the NAMA in the construction sector in Mongolia.

The projects to reduce GHG emissions were implemented in the buildings and heating system as part of the NAMA project. The project for improving the heating system of the soum centre by replacing existing boilers with a centralized heating system with energy efficient Heat only Boilers was implemented at Erdenedalai soum of Dundgovi province. Another project for GHG emission Reduction of the old school's building through thermal performance improvement was implemented in Jargalan soum of Gobi-Altai province. The Monitoring and Reporting activities of the GHG emission reductions of these projects were conducted with the participation of project implementers using the "Guidelines for the measurement, reporting and verification of GHG emission reductions of buildings" developed at the first stage of implementation of the NAMAs in the construction sector.

During the heating season of 2018 - 2019, measurements and reports were made on the reduction of 102.7 t CO_2e in the school building and 2,838.5 t CO_2e in the Erdenedalai soum central heating system, respectively.

5.4 Additional information/best practice - Utilization of satellite observation results in GHG emission estimates in Mongolia

Introduction. The Ministry of Nature, Environment, and Tourism, Mongolia, and the Ministry of Environment of Japan (MOEJ) signed a Memorandum of Cooperation on the "Mongolia-Japan Environmental Policy Dialogue" in 2011 and exchanged opinions on environmental issues between the two countries. At the latest policy dialogue in 2021, the two countries agreed that Japan would provide the technology and information to support Mongolia in preparing the National GHG Inventories of Mongolia utilising the GOSAT series data. Regarding this, MOEJ has started consecutive projects on GOSAT series utilization to GHG emission estimates in Mongolia since 2014 (referred to below as the GOSAT project). Each GOSAT project comprises three major groups: estimate a GHG inventory with the bottom-up method in the target area, observe in situ atmospheric GHG concentrations, and integrate collected data and estimate GHG emissions with an inverse model, respectively. Each group established a joint international collaboration: Climate Change Research and Cooperation Centre (CCRCC), the Information and Research Institute of Meteorology, Hydrology, and Environment (IRIMHE), and Chuo University, Japan. The GOSAT-project attempts to compare and evaluate Mongolia's National GHG inventory with the estimated emissions from the GOSAT series observation.

Also, the GOSAT-project is an ambitious undertaking to introduce interdisciplinary knowledge into the policy by building a cross-sectoral collaboration with the international science team and policymakers, including the Special Envoy of Mongolia on Climate change. It is also believed that inputting efforts from the GOSAT project into inventory compiling has helped increase the transparency of the national GHG emissions inventory. This long-term relationship of trust through the GOSAT project has also led to the formation and enhancement of institutional capacity in terms of technology and analytical methods for Mongolian use of the GOSAT series data.

Recently, inverse modelling frameworks to estimate surface GHG emissions have rapidly developed. The inverse model can estimate GHG emissions using the observed concentration of GHG gases in the atmosphere. The 2019 Refinement to the IPCC 2006 refers to the collaboration needed between inventory compilers and inverse modellers for GHG emission inventory verification using atmospheric measurements. For a successful Global Stocktake, it is essential to give a verification/quality check (QC) on the GHG emission inventories by the bottom-up method using an independent approach. This section describes a good practice of ambitious efforts on verification and QC of CO_2 emissions in the Energy sector in 2018 by inverse modelling based on satellite-based CO_2 observations. It will be a critical challenge to fill the gap in knowledge and resources in BTR (Biennial Transparency Report). Notably, this is the first case to have a good practice verifying the GHG inventory by inverse modelling in BUR.

Method. Urban areas account for over 70% of energy-related CO_2 emissions. Therefore, cities play a crucial role in mitigation strategies under the Paris Agreement's action plan. Similarly, in Mongolia, emissions from Ulaanbaatar account for about 68% of the country's anthropogenic CO_2 emissions. Therefore, the GOSAT-project has set Ulaanbaatar as the target region for estimating CO_2 emissions. In the Ministry of Environment, Japan, the GOSAT project estimated CO_2 emissions using a bottom-up approach in Ulaanbaatar. The result indicates that the energy sector is the dominant CO_2 emission source in the Ulaanbaatar area, and therefore, it was assumed that their estimated anthropogenic CO_2 emissions represented the Energy sector. In collaboration with the Meteorological and Hydrological Research Institute, Chuo University employs a regional atmospheric transport model to finely reproduce the distribution of CO_2 concentration in Ulaanbaatar at 9 km resolution. Inputs of anthropogenic hourly CO_2 emissions for the atmospheric transport model are estimated using in situ time series CO concentrations. Air pollutant monitoring stations in Ulaanbaatar have long monitored CO concentrations at various locations such as ger districts, residential areas, and along major roads.

Next, the inversion modelling system (also known as a top-down approach) is developed to estimate CO_2 emissions, which achieves the best fit for GOSAT satellite observation data (Watanabe M, et al., 2022), (Watanabe M, et al., 2023). The GOSAT series satellites, GOSAT1 and GOSAT2, orbit over Ulaanbaatar every three days and have been intensively observed since 2017. Our inverse modelling system used the GOSAT1 data from the lower troposphere in the GOSAT-EORC-Daily-Partial-Column-GHGs products by JAXA/EORC. This product is unique because it calculates column-averaged concentrations for the upper and lower layers in the troposphere at atmospheric pressure. Furthermore, GOSAT-EORC-Daily-Partial-Column-GHGs is a product that removes aerosol and thin cloud contamination (Kikuchi N, et al., 2016), (Kuze A, et al., 2022). Therefore, GOSAT-EORC-Daily-Partial-Column-GHGs increase the GOSAT data availability even in areas with heavy air pollution, such as Ulaanbaatar. Hence, the number of available data in a monitoring zone (10.5 km diameter focused on IRIMHE) in 2018 was 2.2 times larger than that of the XCO_2 National Institute for Environmental

Studies (NIES) product, NIES V02.95-02.97. In addition, anthropogenic CO_2 emission sources exclusively account for emissions from the land surface. Therefore, the lower troposphere data would be more appropriate.

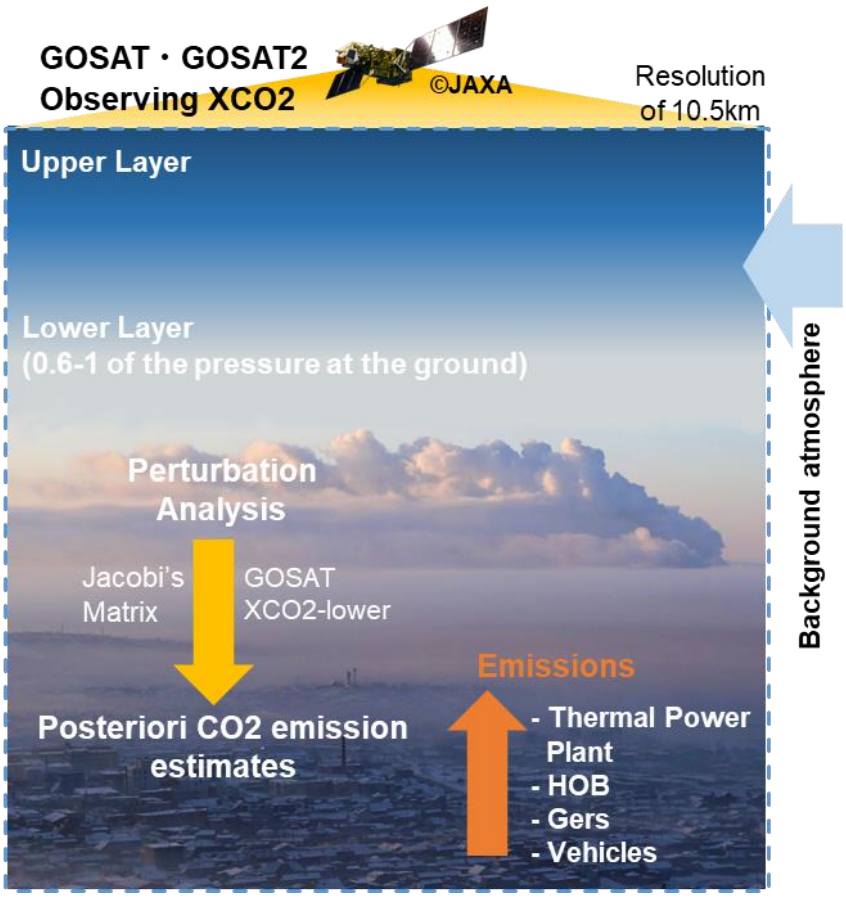

Figure 5-4: Inverse optimization technique for Mongolia using GOSAT

A 50 km x 50 km control volume, including Ulaanbaatar, is set up for the analysis. The days for the inverse analysis were selected when 70% of the 14 GOSAT target observations (10 stations) are available. The inverse analysis in the GOSAT-project uses the Bayesian inversion method based on the synthesis inversion (the Green function) (Equation [5.1] (Pillai D, et al., 2016)). This method minimizes the difference between the estimated atmospheric CO_2 concentration by the regional atmospheric transport model and the satellite-observed CO_2 concentration, which modifies the a priori CO_2 emissions (Equation [5.2] (Handrich L, et al., 2015)).

$$J = (C_{obs} - C_{fwd} - H_x)^T R^{-1} (C_{obs} - C_{fwd} - H_x) + (x_0 - x)^T P_0^{-1} (x_0 - x) \quad [5.1]$$

where C_{obs} is the observed CO_2 mole fraction, C_{fwd} is the pre-estimated CO_2 mole fraction, H is Jacobi's matrix (number of emission sources x number of observations per optimization period; e.g., one day), R is the $C_{obs} - C_{fwd}$ error covariance matrix (observed errors including atmospheric transport model errors), x is the modified amount of CO_2 flux at the observation point, x_0 is the a prior estimate of x, and P_0 is the error covariance matrix of x_0 (error in prior flux).

$$\hat{x} = (H^T R^{-1} H + P_0^{-1})^{-1} (H^T R^{-1} (C_{obs} - C_{fwd}) + P_0^{-1} x_0) \quad [5.2]$$

where $\hat{x}$ is the a posteriori estimate of CO_2 emissions.

Result. The modified CO_2 emissions are the a posteriori estimate of CO_2 emissions. The inverse analysis method allows for including observational and atmospheric transport model errors and calculates uncertainty in the estimated CO_2 emissions. The uncertainties in the GOSAT observational error and the error in a priori CO_2 emissions are considered. Based on the annual energy sector CO_2 emissions for Ulaanbaatar calculated from the top-down method, Mongolia's energy sector CO_2 emissions were estimated. The energy sector generally shows a strong positive correlation between GDP and energy consumption (Handrich L, et al., 2015). Although, in recent years, some reports suggest that there has been a decoupling trend between GDP and CO_2 emissions in developed countries (Handrich L, et al., 2015), suppose no decoupling occurred in Mongolia from 2015-2018. Additionally, it is assumed there is a minor alteration in the economic structure between Ulaanbaatar and Mongolia: resulting from CO_2 emissions studied by Chuo University, Ulaanbaatar's CO_2 emissions from the energy sector account for 68% of the Energy sector of Mongolia's iBUR in 2014. Based on the above two assumptions and the Ulaanbaatar/Mongolia Initial BUR CO_2 emissions ratio, the energy sector's CO_2 emissions were estimated in Mongolia. Comparing the energy sectoral CO_2 emissions estimated using the top-down with BUR2 and the EDGAR v6.0 inventory in 2018 in Mongolia shows a difference of a few percentages higher than BUR2 and several percentages smaller than the EDGAR, respectively.

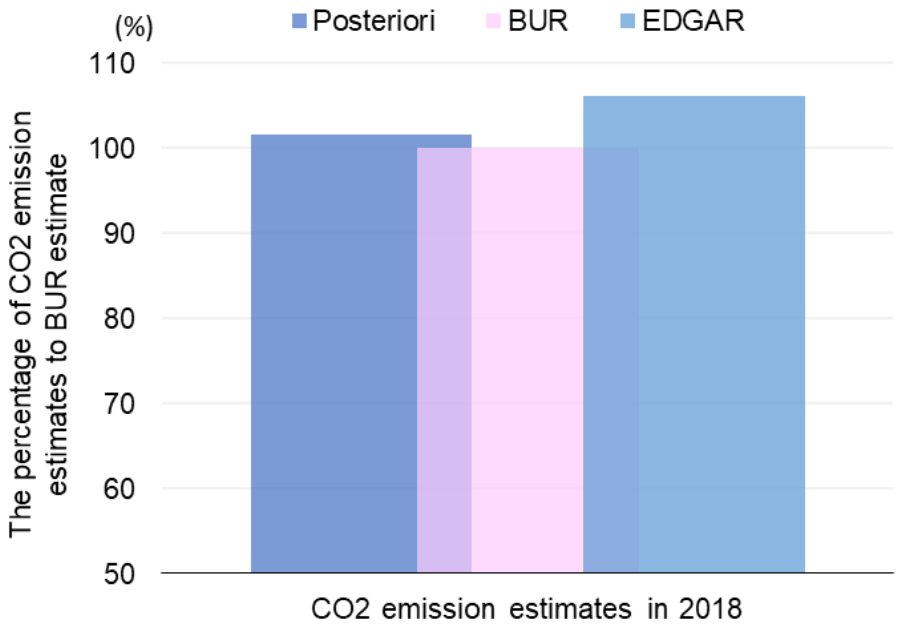

Figure 5-5: Comparison of CO_2 emission estimates between BUR, satellite-based estimate, and EDGAR v6.0 in 2018

Conclusion

The GOSAT project GHG emission estimation in Mongolia in the energy sector using the satellite-based method showed an excellent agreement with BUR2 in 2018. The Japanese Ministry of Environment/NIES/JAXA plans to launch the successor to the GOSAT series, GOSAT-GW, in 2023, which will increase the number of available satellite observation data further. Therefore, with more frequent observations, GHG absorption and emissions estimates using top-down methods based on satellite observation data will be more accurate. Through the GOSAT project, Mongolia independently verified its energy sector's CO_2 emission in BUR2 through science-based techniques. The results of the GOSAT project are expected to contribute to scientific transparency in reporting to the UNFCCC and will be integrated into the enhanced transparency framework of the Paris Agreement.

5.5 Opportunities and Needs to Enhance and Develop Current Measurement, Reporting and Verification Activities

Although knowledge and experience of the MRV system for GHG emissions and removals have emerged in the sphere of experts and specialists involved in this issue, rules, regulations and related documents to regulate, the work of MRV has been developed for some sectors and programs we do not have a National MRV system and Registration and information Database on GHG emission reductions and removals or no kind of official regulation in Mongolia.

The national MRV system can be built using the knowledge and experience accumulated through the works carried out in this sector in past years.

The rules, procedures, guidelines and instructions and the reporting forms of the MRV system for emission reductions and removals developed within the Joint Crediting Mechanism (JCM) framework are clear and straight forward.

The requirements per the principles and international standards related to the UNFCCC objective have been precisely defined, and the parties' roles, obligations, and organizational structure of the MRV activity have all been clearly defined. Therefore, experience has been built on, and knowledge and information that can be used to develop any MRV system in the future have been generated.

It could be claimed that the Nationally Appropriate Mitigation Actions (NAMA) carried out in the construction sector in 2018-2019 have made the foundation for the national MRV system by describing the structure, organization, and overall functioning of the MRV system within its context.

The construction sector becomes the first to approve and use the MRV system documents. It is remarkable that throughout this work, the new Chapter #25, in the Building Norms & Rules classification, was created concerning GHG emission reduction activity in the construction sector.

The currently used approach to determine the reduction of GHG emissions in the construction sector and the selection of parameters and indicators for mitigation measures are straightforward, user-friendly techniques for the NAMA and self-financed mitigation measures and are open for future Improvement.

The Ministry of Environment and Tourism (MET) collaborated with the international organization Gold Standard' for the study "Monitoring, Reporting and Verification for Mongolia's Nationally Determined Contribution to the Paris Agreement" in 2021. This study's report must be used to establish Mongolia's

National MRV system for reporting on the NDC and meeting the Paris Agreement obligations according to the requirements of the Enhanced Transparency Framework and MRV of other mitigation measures within the country.

Some tasks need to be completed or added.

Approving the job positions in charge of information on GHG emission reductions and removals and registration of GHG projects in the structure of the Ministries is one of the tasks that should be completed first. In addition, mechanisms need to encourage GHG emission reduction measures.

There is a need to be determined Mongolia's specific emission factors for calculating the GHG emission reductions in various sectors, by the relevant institutions and to be updated annually, which requires an official regulation.

5.6 Potential Design for a National Measuring, Reporting and Verification System

The main parties to be involved in the process of the Measurement, Reporting and Verification System can be as follows:

- Project implementers,
- Sectoral units responsible for the GHG related issues,
- National Centre for Climate Change Research and International Cooperation,
- Third-party Entities (GHG Validation and Verification Body),
- Experts and consultants' groups.

The National Centre for Climate Change Research and International Cooperation compiles the national GHG inventory, the findings of projects and measures to reduce GHG emissions, receives and records GHG emission reduction data from sectors in ministries, consolidates the results, measures, reports and reporting and verifies the emission reductions of the project implemented in the sectors. It also provides guidance and recommendations.

The duties of this organization should include planning and coordinating work to identify the GHG indicators of the national industries mentioned in the preceding chapter, as well as the variables and parameters of GHG emissions calculated under Mongolian-specific conditions, which are required for the estimation of the GHG emission reductions.

The unit under the relevant Ministry is responsible for informing the issues related to Climate change, GHG emission reduction measures and necessary information for GHG inventory at the National Centre for Climate Change Research and International Cooperation.

Organizing the Database of mitigation measures and information on GHG emission reductions and removals is essential in the structure of the National MRV system. Data collection and exchange of the information are to be organized as suggested in Figure 5-6. Creating GHG registration and information units in the relevant State administrative organizations or Ministries is advisable. The categories of information charges by the registration and information units can be the same as those of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

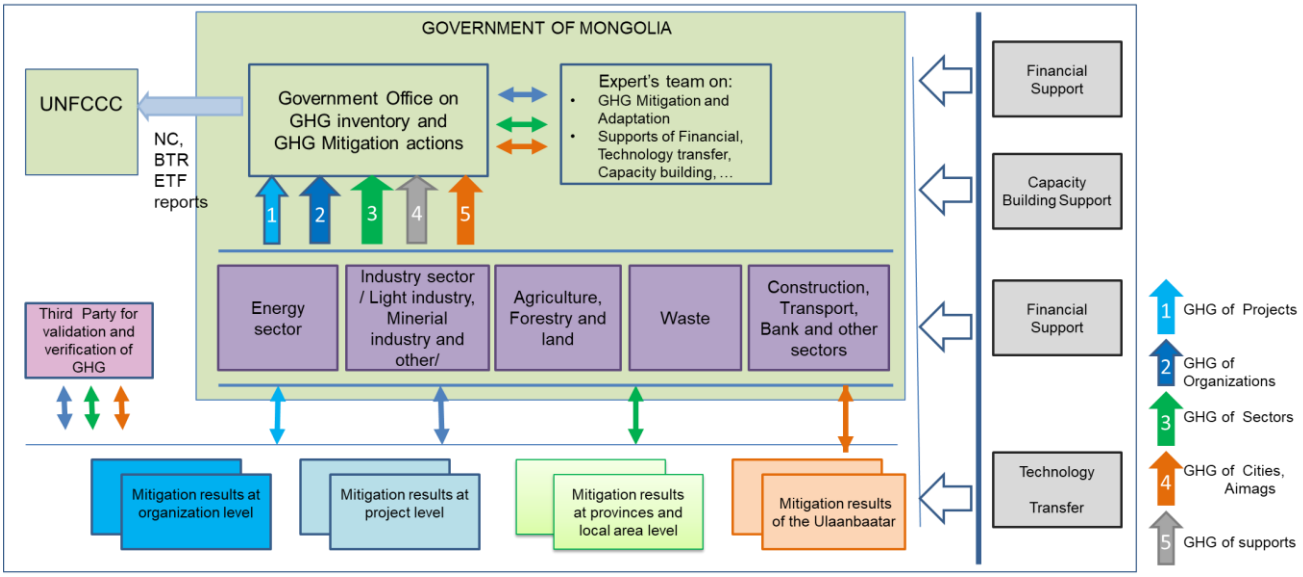

Figure 5-6: Design of a potential system for national measurement, reporting and verification

Information and data categories and relevant Ministerial Units in charge of tracking the GHG emission reduction of the sectors can be as follows:

1. Energy,
2. Industry (Light and Mineral industry and other),
3. Agriculture, Forestry and Land Use,
4. Waste,
5. Building, Mining, Transportation and Financial Services.

For some ministries, the work and responsibility related to GHG emissions information can be integrated with the work and responsibility related to Environmental information within the Ministry, saving the budget and job position.

Only rules and guidelines that accurately reflect the particulars of the sector, define the GHG emission reduction indicators, GHG emissions factors and measurement parameters of the sector, and specify the measurement tools and conditions that should be developed and followed. It will be very suitable for enforcement.

Establishing report forms that are easy to understand and employ for data input, calculation, and use in measurement and monitoring activities is essential. These forms should not only make reporting more accessible but should also allow data comparison, prevent data omission, and allow evaluation. To develop and use reports, news forms and instructions, as well as to prioritise developing an electronic system of information exchange between branches and working groups, it will be necessary for this organization to regularly train information experts and methodologists of mitigation measures or the experts in charge of this issue of the ministries. These must adhere to the Paris Agreement's transparency obligations.

The "Enhanced Transparency Framework-ETF" that needs to function following the Paris Agreement will be built upon the existing MRV activities in Mongolia and their legal regime. The core function of the

MRV system, monitoring GHG emission reduction, requires proper development and implementation in each sector in accordance with Mongolian-specific conditions. According to international standards, this effort will serve as a basis for reliable reporting of the results of mitigation measures.

A team of specialists independent of implementing GHG projects selected by government agencies in charge of climate change can be enlisted to validate nationally appropriate mitigation measures in addition to recognized third-party entities. This is because, depending on the program criteria and the project's financing, the degree of assurance and verification for the potential of specific mitigation measures to reduce GHG emissions will vary. The specification defines the conditions that the third-party entities have. However, the organization responsible for the country's climate change mitigation efforts must identify and supervise the standards of independent experts.

Finally, Section 4.5.3 of the National Energy Saving Program (2018-2022) states that it aims to "establish a national system for measuring, reporting and verifying the reduction of GHG emissions resulting from the energy savings and a united database". Mongolia should also establish a mechanism to track the development of the "Nationally Determined Contribution" to reduce GHG emissions as a nation that has ratified the Paris Agreement. It is necessary to arrange Mongolia's "National MRV System for the Reduction of GHG emissions" and make useful structural adjustments/additions to the ministries in accordance with these demands and requirements.

The national MRV system that will be established on this basis will likely be more stable because oriented from the bottom to upward, starting at the project level. However, measuring, reporting and verifying GHG emissions currently depend on social development's internal and external conditions.

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