MINISTRY OF ENVIRONMENT AND TOURISM

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GHG NET ZERO target of Mongolia and its feasibility

BATJARGAL Zamba
Special Envoy of Mongolia on Climate Change,
Climate Change Research and Cooperation Center (CCRCC)

What about the discission?

Key concerns related to "Net ZERO" target

Possible options to address the issues

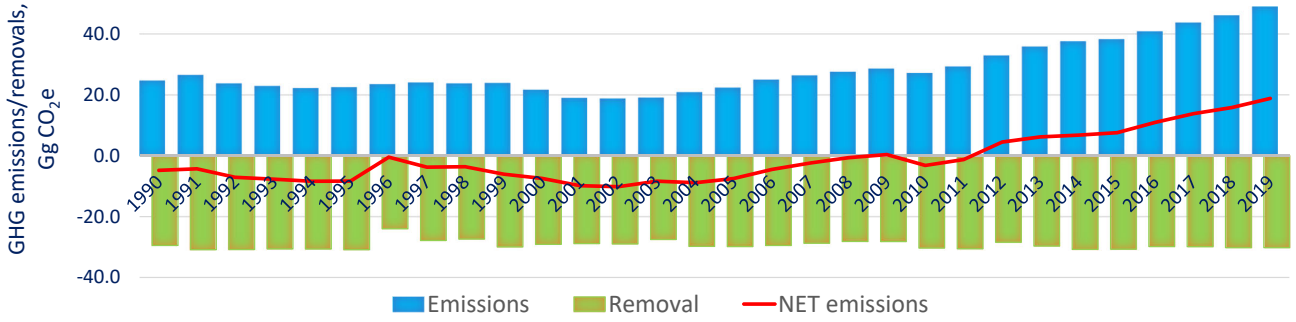
Challenges associated to options

Focus on energy sector as key emitter of GHG

Alternative approaches from GHG emission reduction to GHG sink and removal

Question about feasibility

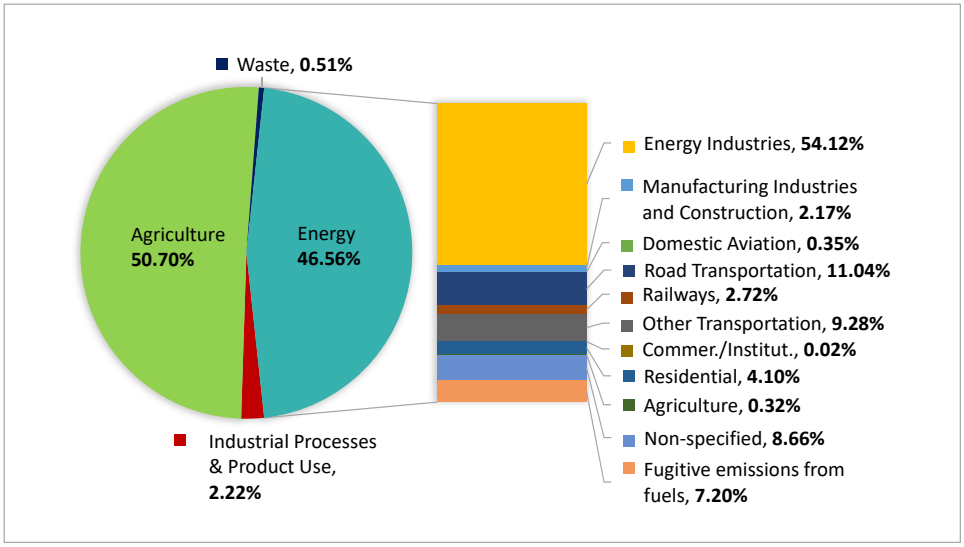
1990-2019 GHG inventory results of Mongolia



Sectors	GHG emissions/removals, (Gg CO_2e)		Changes from 1990 (Gg CO_2e)	Changes from 1990 (%)
	1990	2019		
Energy	12,086.55	21,386.93	9,300.38	77.86%
Industrial Processes & Product Use (IPPU)	284.98	1,020.46	735.49	258.09%
Agriculture	11,221.74	23,287.71	12,065.96	107.52%
Waste	55.62	234.28	178.66	321.21%
TOTAL (excl. LULUCF)	**23,648.89**	**45,929.38**	**22,280.48**	**94.68%**
LULUCF	-29,027.19	-30,200.88	-1,173.69	4.04%
TOTAL (incl. LULUCF)	**-5,378.30**	**15,728.50**	**21,106.79**	**-394.50%**

Source: Climate change research and cooperation centre

GHG emissions by sectors including energy



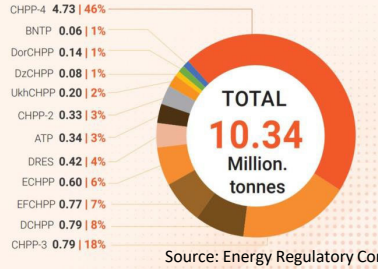
54.12 per cent of total Greenhouse Gas Emissions (GHG) from Energy Sector.

Source: Tegshjargal.B presentation, Climate Change Research and Cooperation Centre

CO2 EMISSION OF CHPPs

Million tonnes

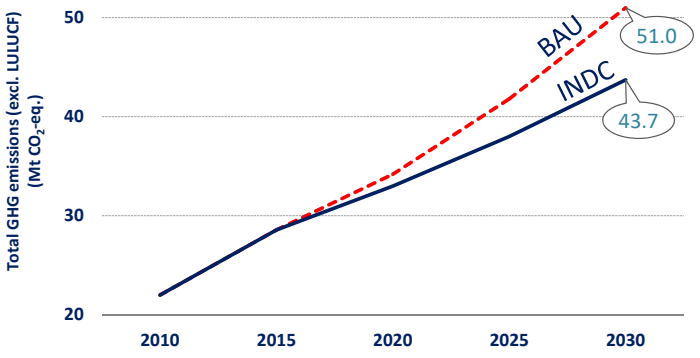
Generation set	CO2 emission coefficient		2018	2019	2020	2021
	Electricity kg/kWh	Heat kg/kGJ				
CHPP-2	1.49	98.6	0.32	0.33	0.33	0.33
CHPP-3	0.75	95.7	1.70	1.69	1.75	1.84
CHPP-4	0.68	94.3	4.04	4.24	4.38	4.73
DCHPP	1.42	126.7	0.66	0.73	0.80	0.79
ECHPP	0.94	126.7	0.46	0.47	0.47	0.60
EFCHPP	1.48	142.4	0.74	0.75	0.71	0.77
UkhCHPP	2.00	-	0.25	0.23	0.20	0.20
DRES	1.72	-	0.39	0.40	0.40	0.42
DzCHPP	2.00	104.0	0.04	0.04	0.09	0.08
DorCHPP	-	96.2	0.12	0.13	0.14	0.14
BNTP	-	88.3	0.06	0.05	0.06	0.06
TPND	-	88.3	0.04	0.03	0.03	0.04
ATP	-	108.6	0.29	0.33	0.34	0.34
Total			9.16	9.48	9.75	10.34

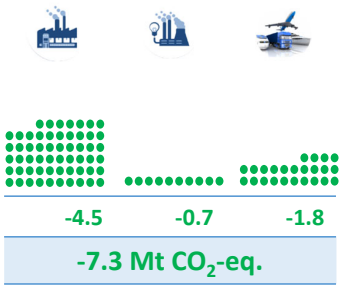


Source: Energy Regulatory Commission

INDC TARGETS

14.0%

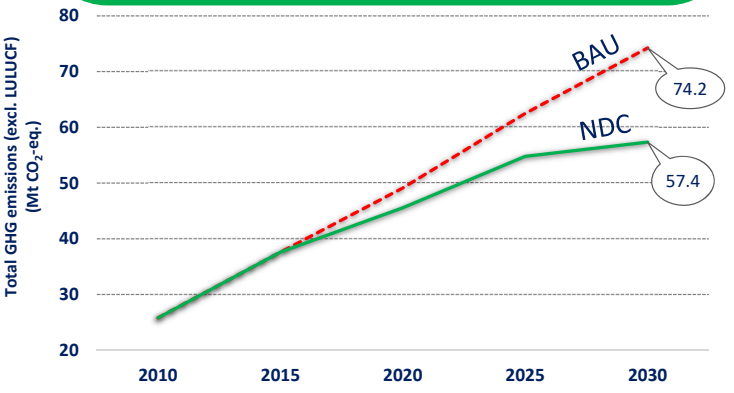


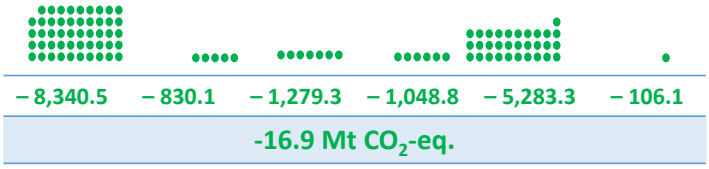


-7.3 Mt CO_2-eq.

NDC TARGETS

22.7%



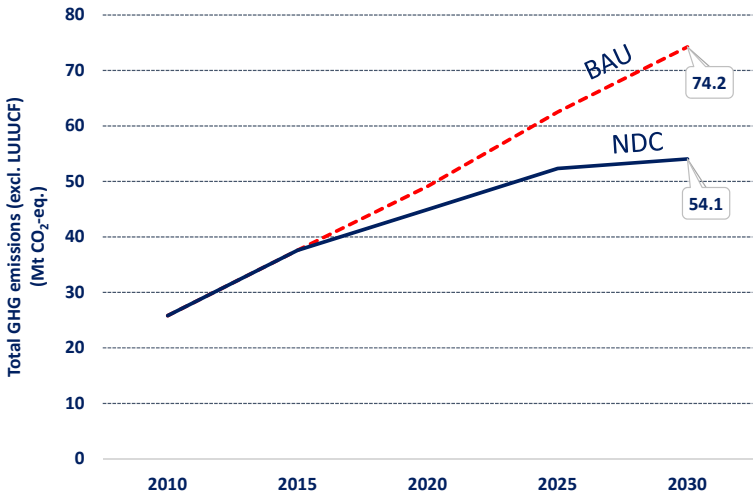


-16.9 Mt CO_2-eq.

NDC TARGETS

(Unconditional + Conditional measures)

27.2%



Total GHG mitigation potential (including conditional measures)

-20,188.1 Gg CO_2-eq.

Total GHG mitigation potential from unconditional measures

-16,888.1 Gg CO_2-eq.

Total GHG mitigation potential from conditional measures

-3,300.0 Gg CO_2-eq.

– Deploy Carbon Capture and Storage (CCS) technology

-3,288.0 Gg CO_2-eq.

– Construct power plant to produce energy capturing and purifying landfill methane gas from the Narangiin enger waste disposal site in Ulaanbaatar city

-12.0 Gg CO_2-eq.

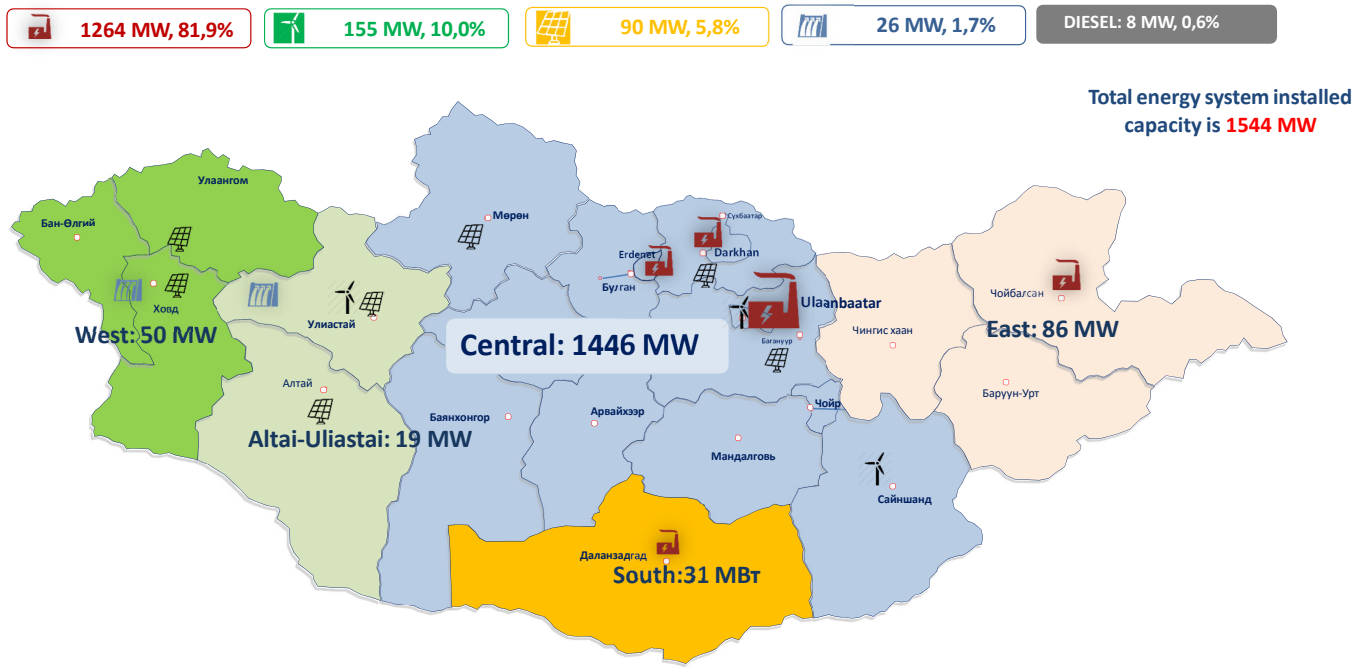
Sectoral reductions of GHG emissions in 2030 and 2050 compared to different baseline scenario

Table 5.4. Sectoral reductions in GHGs in 2030 and 2050 compared to a baseline scenario

Sector	2019 GHG emissions (million tonnes CO_2e)	2030 baseline GHG Emissions (million tonnes CO_2e)	2030 mitigation (million tonnes CO_2e)	2050 baseline GHG Emissions (million tonnes CO_2e)	2050 mitigation (million tonnes CO_2e)
Energy	21.85	44.3	33.6 (-24%)	68.1	34.1 (-50%)
IPPU	0.50	0.84	0.8 (-5%)	2.22	2.22 (0%)
Agriculture	15.91	19.1	17.1 (-10%)	21.8	18.5 (-15%)
Waste	0.41	0.5	0.48 (-4%)	0.69	0.69 (0%)
Total	38.7	64.7	51.9 (-20%)	92.8	55.5 (-40%)

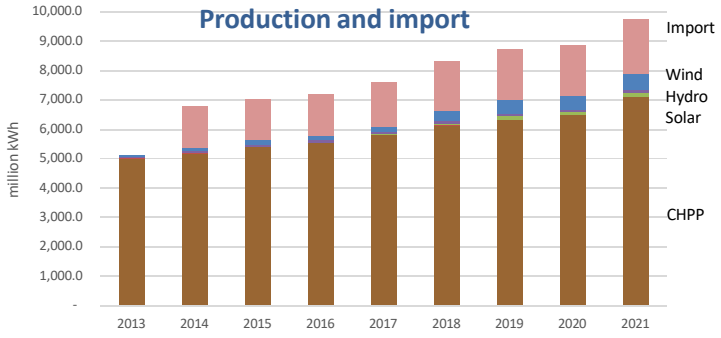
CCAC, SEI, GGGI: "Greenhouse gas mitigation assessments to inform future NDC updates in Mongolia: Technical guide", 2021.

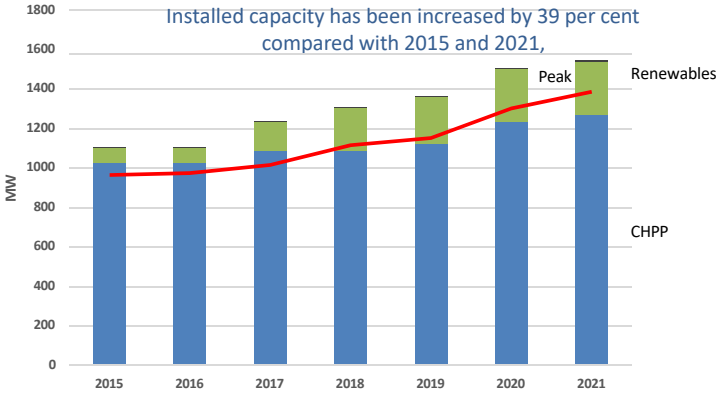
Mongolian energy system structure and production

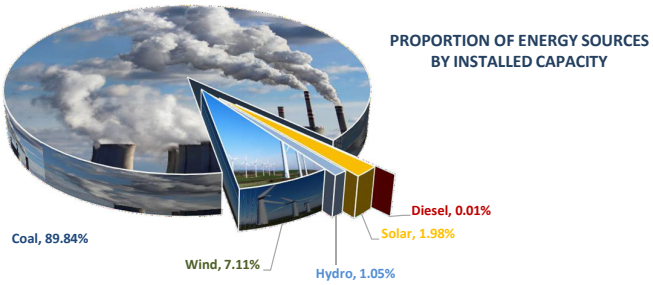


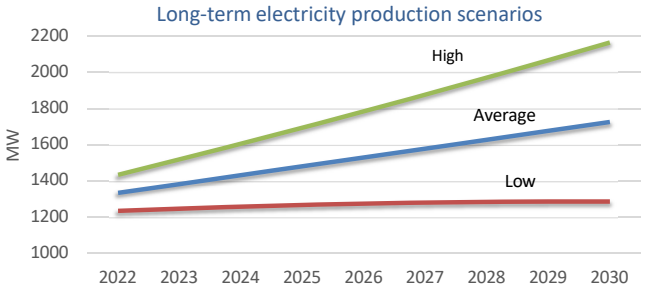
Source: Ministry of Energy, Mongolia

Energy production and structure of sources









Source: Ministry of Energy, Mongolia

GHG emissions in energy sector

The energy sector alone accounts for half of Mongolia's greenhouse gas emissions and is directly related to the consumption of solid and liquid fuels used in energy production and consumption.

- **In 2020, 7.5 million tons of raw coal** were burned, and **1.4 million tons of oil products** were imported and consumed for energy production, which is **1.2 and 1.5 times more than in 2010**.
- Mongolia has **abundant renewable energy resources** such as wind, sun, hydro and geothermal energy.
- According to the Nationally Determined Contribution (NDC) document, the total reduction in greenhouse gas emissions is **16.9 million tons CO_2e in 2030**, and **66.7% of the reduction is attributed to the energy sector.**
- It is indicated that the **policy and measures** of the energy sector play a vital role **in achieving the target of GHG emissions reduction in Mongolia**.

Source: Mitigation team presentation (Erdenesukh S.), page 54, National University of Mongolia

Development policies and long-term goals

"Vision 2050" is the key long-term plan that was approved by Parliament in 2020

Long-term goals:

- "Energy will be exported through Asian interconnection grid",
- "Introduce new technologies and increase renewable energy production in the energy sector ",
- "Enhance Nuclear R&D",
- "Reach the Nationally Determined Contribution (NDC) goals under the Paris-Agreement",

26 projects require 33.56 trillion MNT ($9.8 billion USD) investment until 2050

Source: Vision 2050, Government of Mongolia

Energy Development policies and long-term plan

"New Revival Policy" is one main policy development document under the "Vision 2050", announced in 2021

Transmission and Distribution

New energy sources, transmission, distribution and networks will be constructed, capacity will be expanded, and the reliability of energy production and supply will be improved.

Renewable energy will be developed in an appropriate ratio including hydro and battery storage will be built, and the reliability and secure integrated energy system will be connected.

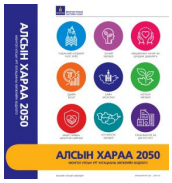
The energy sector will be gradually transferred to an independent financial and economic system.

The construction of a natural gas pipeline from the Russia to the People's Republic of China through the territory of Mongolia will be intensified.

Supplying renewable energy sources to the North Asian super grid, preparation of ultra-high voltage transmission overhead lines and substations to be connected to the power grid.

Source: New Revival Policy, Government of Mongolia

Time frame of planned projects

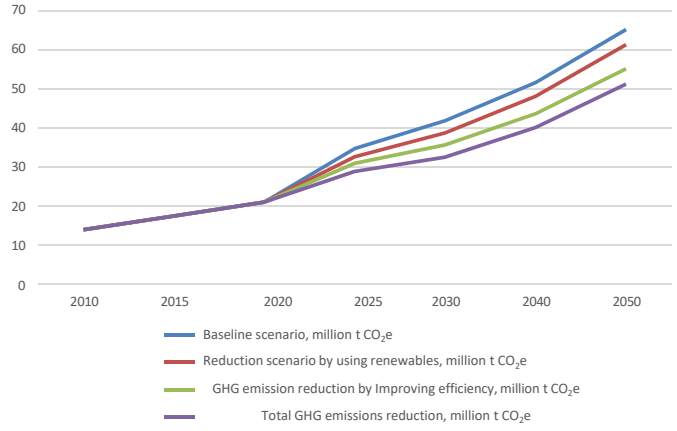


	2023	2024	2025	2026	2027	2028	2030	2040	2050
Expansion of power plants		Choibalsan 50 MW	First stage CHPP-3 75 MW			CHPP-3 250 MW			
New construction		Tavantolgoi CHPP (block 1) 150 MW	Tavantolgoi CHPP (block 2) 150 MW Baganuur CHPP 400 MW	Tavantolgoi CHPP (block 3) 150 MW	Bagakhangai CHPP 300 MW	Buuruljuut CHPP 300 MW	Telmen CHPP 100 MW		
Renewable sources	Battery 80 MW	Solar 35 MW	Wind 15 MW			Erdeneburen Hydro 90 MW		Egiin Hydro 315 MW	Solar 3000 MW Wind 4000 MW
Alternative sources						Gas CHPP 2 100 MW	Gas CHPP-2 200 МВт	Nuclear 300 MW	Nuclear 300 MW

Source: New Revival Policy, Government of Mongolia

Scenarios and possible mitigation measures for the energy sector

	2010	2015	2020	2025	2030	2040	2050
Baseline scenario, million t CO_2e	13.9	17.4	21	34.7	41.8	51.6	65.2
Reduction scenario by using renewables, million t CO_2e	13.9	17.4	21	32.6	38.7	48.1	61.3
GHG emission reduction by Improving efficiency, million t CO_2e	13.9	17.4	21	30.9	35.6	43.6	55.1
Total GHG emissions reduction, million t CO_2e	13.9	17.4	21	28.8	32.5	40.1	51.2
Total reduction amount, million t CO_2e	-	-	-	5.9	9.3	11.5	14.0
Percentage of reduction, %	-	-	-	17.0	22.2	22.3	21.5



Source: Mitigation team presentation (Erdenesukh S.), page 65, National University of Mongolia

Table 5.3. Summary of GHG emission reduction potential in 2030 compared to a baseline scenario (emissions: 78.3 million tonnes CO_2e) for mitigation measures extracted from plans and strategies in Mongolia

No	Sector	Mitigation Measure	Source: Plan/Strategy/Regulation	2030 GHG emission reductions (thousand tonnes)	2050 GHG emission reductions (thousand tonnes)
1	Energy (energy industries)	Erdeneburen HPP 90 MW comes online in 2025	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015-2030	**0.33 (-0.52%)**	**0.41(-0.44%)**
2	Energy (energy industries)	Eg River HPP 314 MW comes online in 2040	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015-2030	**1.2 (-1.86%)**	**1.41 (-1.52%)**
3	Energy (energy industries)	Shuren HPP 300 MW comes online in 2028	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015-2030	**1.15 (-1.77%)**	**1.35 (-1.46%)**
4	Energy (energy industries)	Wind power plants: Oyu Tolgoi 102 MW, Govisumber 50.4 MW, Uvs 10 MW, Zavkhan 5 MW to come online in 2030 (implementation remains uncertain)	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015-2030	**0.52 (-0.80%)**	**0.63 (-0.68%)**
5	Energy (energy industries)	Sainshand 30 MW solar power plant online in 2023	Ministry of Energy, 2021	**0.07 (-0.1%)**	**0.08 (-0.1%)**
6	Energy (energy industries)	Solar power plants: 35.3 MW in Khovd, Gobi-Altai, Khuvsgul	NDC Action Plan, 2021		
7	Energy (energy industries)	Solar rooftop: 1.5 MW by 2025	NDC Action Plan, 2021		

CCAC, SEI, GGGI: "Greenhouse gas mitigation assessments to inform future NDC updates in Mongolia: Technical guide", 2021.

8	Energy (energy industries)	Build 100 MW hydropower in central region between 2031 and 2040	Vision 2050, Long-Term Development Policy of Mongolia		
9	Energy (energy industries)	Construct 100 MW Dornod Nuclear Power Plant between 2041 and 2050	Vision 2050, Long-Term Development Policy of Mongolia	**0**	**1.07 (-1.16%)**
10	Energy (energy industries)	Construct 100 MW Khovd Nuclear Power Plant between 2031 and 2040	Vision 2050, Long-Term Development Policy of Mongolia	**0**	**1.07 (-1.16%)**
11	Energy (energy industries)	Build 30 MW renewable energy between 2031 and 2040 in Altai in Western Mongolia	Vision 2050, Long-Term Development Policy of Mongolia	**0**	**0.08 (-0.1%)**
12	Energy (energy efficiency)	Efficiency of heat transmission and distribution reduces to 1.6% losses by 2030	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015–2030		
13	Energy (energy efficiency)	Efficiency of electricity transmission and distribution reduces to 7.8% by 2030	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015–2030	**1.01(-1.56%)**	**2.39 (-2.58%)**
14	Energy (energy efficiency)	Station own electricity consumption of CHPs reduces to 9.1% in 2030	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015–2030	**0.74 (-1.14%)**	**1.75 (-1.89%)**
15	Energy (energy efficiency)	CHPs efficiency increases to 43% in 2030 due to use of super critical and ultra-supercritical technology	NDC to the Paris Agreement, 2020 State Policy on Energy, 2015-2030	**2.36 (-3.64%)**	**6.49 (-6.99%)**

CCAC, SEI, GGGI: "Greenhouse gas mitigation assessments to inform future NDC updates in Mongolia: Technical guide", 2021.

Option and challenges

Barriers	Investment need	Technology need
• Inadequate laws and regulations • Inheritance of policy continuity is lost • The cost is high • The funding source is unknown • Technologically backward and dependent on imports • Market competition is low • There is a lot of government involvement, and the free-market mechanism has not yet penetrated or penetrated with certain market distortion	1. 2,800.0 billion MNT ($830 million USD) to increase renewable energy sources 2. 1,400.0 billion MNT ($415 million USD) to improve production efficiency 3. 3,080.0 billion MNT ($910 million USD) for the construction of a new large source of clean energy with high technology 4. Improve consumption of energy efficiency • Industry 1,120.0 billion MNT ($350 million USD) • Construction 840.0 billion MNT ($250 million USD) • Transport 980.0 billion MNT ($290 million USD) • The required investment in the energy sector is 10.22 trillion MNT ($3.6 billion USD) (NDC).	• energy efficient and low carbon energy sources use technologies • Clean coal and clean fuel production technologies • Technologies for coal-gas combined heat power plant • Affordable technologies for use of renewable energy sources • Development of clean and low emissions technologies, engaging local engineers and technicians

Source: Mitigation team presentation (Erdenesukh S.), page 97, National University of Mongolia

Mitigation priorities

M3: Green Hydrogen

Green hydrogen production potential study conducted by GIZ & NewClimate Institute.

Levelized cost of electricity

	Solar PV	Wind
Lowest observed cost in Mongolia	4.9	3.7
Global average in 2020	5.7[1]	3.9[1]

- Division of **four geospatial** regions
  - Full load hours for wind and solar considered
- Highest potential for **wind** in the **south**
- More **homogenous** picture for **solar PV**
- Electricity costs are used as **input** to estimate **green hydrogen production costs**

Lower than global average

[1] IRENA (2021) Renewable Power Generation Costs in 2020

Mitigation priorities

M3: Green Hydrogen

Modelling results –on costs

	MNG1	MNG2	MNG3	MNG4
Full load hours (PV and wind)	2,800	3,600	5,000	4,200
Electricity cost ($/kWh)	0.058	0.044	0.041	0.043
Demineralised water cost 2020 ($/m^3)	30	40	40	25
Expected H_2 cost ($/kg)	4.73	3.83	3.30	3.40

Compared to a global average price of $4.8/kg

- Green hydrogen could presently be produced at a cost between **$3.30** and **$4.73** per kg
  - Most cost efficient in the south and south east
- Based on the application of a 18 MW electrolyser with an efficiency of 75%
- Based on current CAPEX and OPEX for electricity generation and electrolysis

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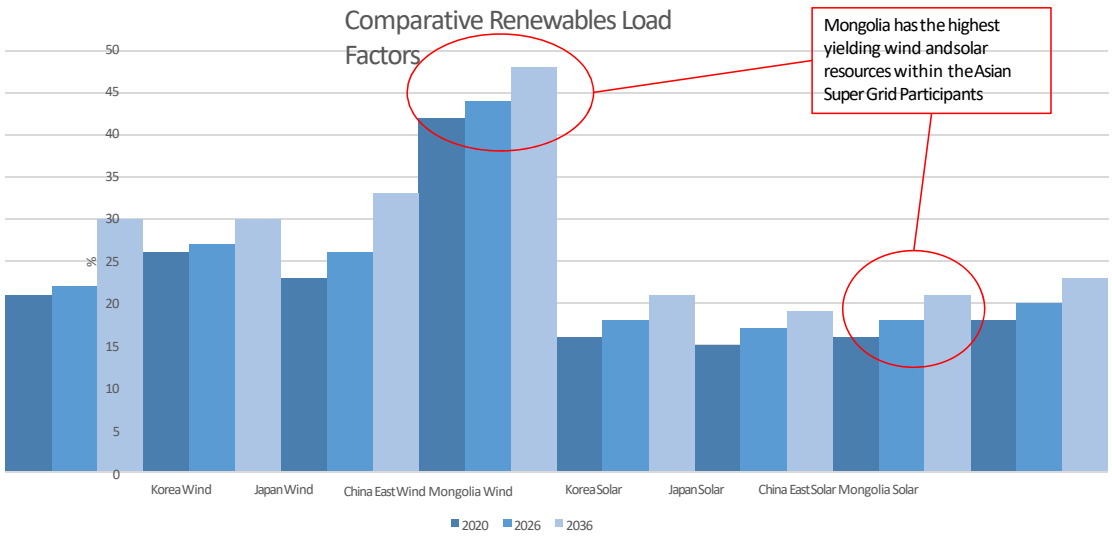
27.09.2021

Mongolia Should have Some of the Lowest Cost Hydrogen in Asia given its advantages in Wind and Solar generation



Additional Information

Supergrid, Smart Energy Belt

Asian Renewable Super Grid:

- **Could the Green Hydrogen be included in the super-grid?**

Billion Trees National Campaign: Amount of greenhouse gases to be reduced by reforestation (planned and alternative versions)

Type of vegetation (that will be planted)	An area that will be afforested/reforested	Implementation phase 2022-2030	Capitalization phase 1	Capitalization phase 2
	ha	tCO_2 eq	tCO_2 eq	tCO_2 eq
Boreal forestation	296,200	-28,199,612	-31,037,722	-38,132,995
Saxual forestation	10,000	-908,929	-947,255	-1,043,073
Cropland windshelter	60,000	-5,681,271	-6,509,633	-8,580,537
Urban forest and/or permaculture	7,276	-661,336	-689,223	-758,940
Road windbreak	79,200	-10,053,056	-13,002,730	-20,376,915
Railroad windbreak	8,640	-785,314	-818,429	-901,215
Silvopasture	130,000	-10,717,354	-11,215,604	-12,461,230
Total	591,316	-57,006,873	-64,220,596	-82,254,904

Type of vegetation	An area that will be afforested/reforested	Implementation phase 2022-2030	Capitalization phase 1	Capitalization phase 2
	ha	tCO_2 eq	tCO_2 eq	tCO_2 eq
Boreal Afforestation with multicriteria consistency (index 0.85-0.99)	114,986	-10,947,241	-12,049,010	-14,803,433
Boreal Adforestation with multicriteria consistency (index 0.73-0.99)	884,725	-84,229,955	-92,707,158	-113,900,164

GREEN REVIVAL AGENDA

GREENHOUSE GAS EMISSION REDUCTION THROUGH FORESTATION

Boreal and saxaul forestation
306,200 ha

2022 – 2030
29.1 Mt CO_2-eq.

Windbreaks and urban green infrastructure
155,116 ha

2022 – 2030
17.2 Mt CO_2-eq..

Silvopasture
130,000 ha

2022 – 2030
10.7 Mt CO_2-eq.

2030
591 thousand ha
57 Mt CO2-eq.

Concluding remarks focused on energy sector and options for cooperation engaging Mongolia

- Because of urgency in energy sector it is necessary to move the GHG related focus back to the energy sector while overturning the challenges to opportunity. suggested to develop a more integrated network to use in efficient way the plenty of renewable energy source of Mongolia establishing some sort of super grid covering the high demand in electricity areas in the Northeast Asia, introducing more innovative transmission systems like mixed use of AC and DC lines etc.
- The partner countries could be invited to develop joint demonstration projects for production and use of green hydrogen in Mongolia, keeping in mind a goal of scaling up further within Northeast Asia and beyond it.
- Mongolia could share its two decades experiences, including both best practices and lessons learnt from implementation of the "National Green Belt Program" and invite partner countries to develop cooperation programs in line with the goals of the BTC, in order to increase resilience of ecosystem to global warming while providing good enough ecosystem service including GHG removal and soil moisture retention.
- Feasibilty ??? a guaranteed answer about the feasibility of the GHG "Net Zero" target can be provided only after complex science based analysis involving all driving factors, partly highlighted above. Finding of such kind of analysis should be used as a basis for development of strategy and roadmap , which could be upgraded periodically depending on rate of change of key leading factors involved