



**“MINING AND ECONOMY: CHALLENGES AND
RECOMMENDATIONS” FORUM**



Adaptation in carbon-constrained world for Mongolia

*B. Tuvshintugs (NUM, ERI),
D. Unurjargal (ERI)*

01/18/2022



Presentation outline



1. International decarbonization policies
2. Mongolian current situation and decarbonization policy
3. Methodology and simulation scenarios
4. Simulation results
5. Conclusion

International decarbonization policies

International Background



- Paris Agreement (2016) – International effort to limit global warming to below 2°C
 - 196 countries signed, including Mongolia
- Top annual emitters of GHG – China, US, EU, India and Russia
 - G20 nations account for 75% of global GHG emissions
- Enforcement of Paris Agreement lacking
 - Global emission of GHG above target levels
 - Level of CO₂ in 2015-2019 20% higher than in 2010-2015
- Significant global reduction in emissions is only possible if major emitters such as USA, China and Russia comply

Country cases

- Studied the emission reductions strategies of major emitters (China, Russia), coal exporting countries (Indonesia, Australia), and major consumers (South Korea).

Country	Current standing	Goals and Strategies
China	<ul style="list-style-type: none"> • Accounts for 29% of the world's total CO₂ emissions • 2nd largest contributor • Emissions are dependent on economic growth 	<ul style="list-style-type: none"> • Lower CO₂ emissions per unit of GDP by over 65% from the 2005 level • Increase share of renewable energy in energy mix to 25% • Increase capacity of wind and solar power to over 1.2 billion kW • Pledged to reach carbon neutrality before 2060
Russia	<ul style="list-style-type: none"> • Emitted 1,585 Mt of CO₂ in 2019 • 4th largest contributor • Possesses one of the largest deposits of energy resources in the world • Highly reliant on fossil fuel exports • Possesses one of the richest sources of renewable energy 	<ul style="list-style-type: none"> • Contain GHG emissions at 25% - 30% lower levels than its 1990 levels by 2030 • Improve energy efficiency in buildings, change tariffs to incentivize energy efficient, commercialize heat supply systems • Increase share of renewable energy in total energy mix from 3.6% currently to 4.6% in 2030. • Aims to reach carbon neutrality before 2060 (not officially ratified)

Country cases

Country	Current standing	Goals and Strategies
Indonesia	<ul style="list-style-type: none"> Emitted 543 Mt of GHG in 2018 Emissions vary greatly depending on peatland “megafires” 5th largest exporter of coal, 60% of its electricity is produced using coal. 	<ul style="list-style-type: none"> Increase share of renewable energy in total energy mix to 31%, reduce oil sources below 20% and coal sources below 24% by 2050. Better management of land forest resources to fight deforestation and degradation Reduce GHG emissions 29% below baseline emissions by 2030
Australia	<ul style="list-style-type: none"> Emitted 499 million tons of GHG in 2019 14th largest contributor The highest coal power emitter in the world on a per capita basis In 2021, GHG emissions were 20.8% below its 2005 levels 	<ul style="list-style-type: none"> Committed to reduce its emission by 26-28% below of its 2005 levels by 2030 Decline in emission resulted from usage of lands, investments in renewable energy and reductions in emissions in transportation sector. Plans to invest and develop low emissions electricity technology, alternative fuels and energy storage. Aims to achieve net zero emission by 2050.
South Korea	<ul style="list-style-type: none"> Energy consumption is highly reliant fossil fuels (82.5% of total energy consumption) Closed and stopped financing the construction of coal power plants. 	<ul style="list-style-type: none"> Reduce emissions by 30% by 2030 compared to the 2018 levels Develop clean power and hydrogen, improve energy efficiency, carbon removal, improve industrial sustainability and enhance carbon sinks. Increase share of renewable energy in total energy mix to 35% by 2040, make it the major source of energy by 2050. Aims to reach carbon neutrality by 2050.

Country cases summarized



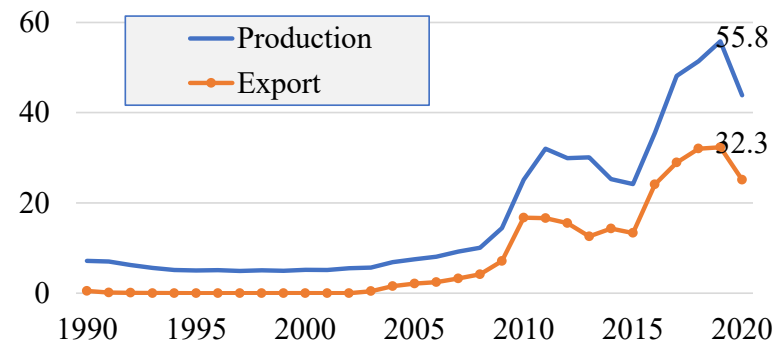
- There is no “one size fits all” strategy to the significant reduction in emission.
- Countries devising their own strategies based on unique characteristics:
 - Russia - improve energy efficiency
 - Indonesia – better land management to combat deforestation
 - China – increase solar and wind power capacity
- Countries such as South Korea and Australia focused on investing in renewable energy and technological developments
- All countries plan to increase their use of renewable energy

*Mongolian current situation and
decarbonization policy*

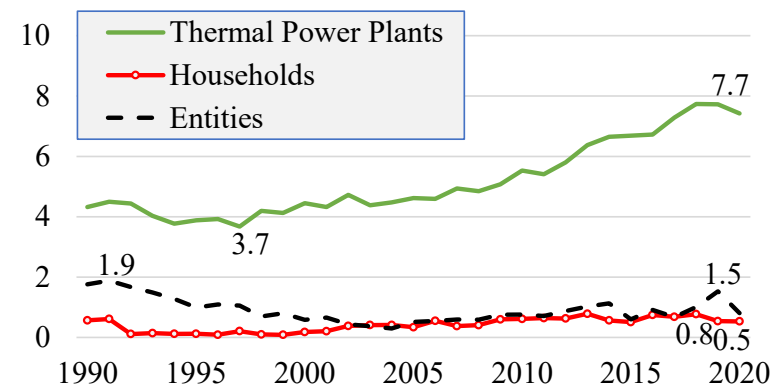
Mongolian coal sector

- Mongolia's coal sector has expanded rapidly in the recent decade
- In 2019
 - Production peaked at 55.8 Mt
 - Export volume reached 32.6 Mt (USD 3 billion, 40% of total exports)
 - Made up 10% of budget revenue
- The coal sector took a hit due to the COVID-19 pandemic
- GoM plans to promote the coal sector and coal exports to revive the economy post-COVID-19
- Domestically, coal is used in electricity production
- In 2019, GoM banned burning raw coal in Ulaanbaatar

Mongolian coal production and export, million ton

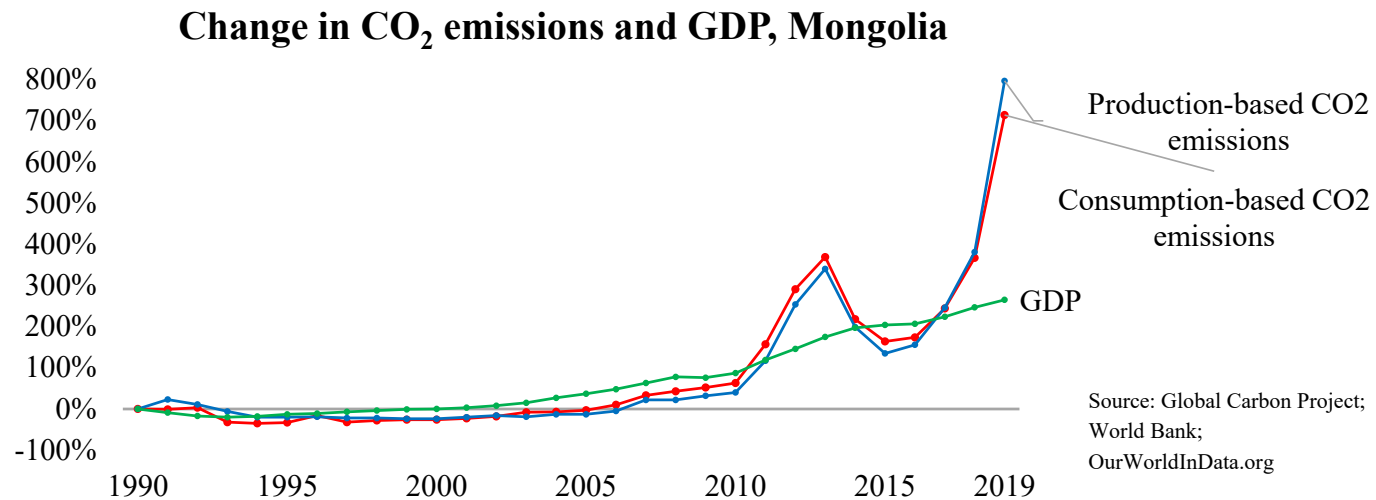


Mongolian domestic coal consumption, million ton



Mongolian carbon emissions

- Mongolia's CO₂ emissions reached a historical peak at 88.7 million tons in 2019 (World Bank)
- The growth of CO₂ emissions and GDP have a similar trend.
- CO₂ emissions grew at a slower rate than GDP until 2010 after which coal production and exports increased significantly.



Decarbonization policies in Mongolia



Paris Agreement

- Approved the National Contribution Target
- Current goals:
 - Government Decree #407 – reduce national GHG emissions by 22.7% from BAU level
 - COP26 meeting – raised target to 27.2%, plant a billion trees by 2030, spend 1% of GDP to mitigate adverse effects of climate change
- To achieve this, the following activities will be carried out:
 - Improve energy supply efficiency and use of renewable energy of energy sector
 - Limit growth and improve quality and productivity of livestock
 - In manufacture sector, saving industrial energy, extracting methane from coal mines to generate electricity, and using powdered ash in cement production
 - In transportation sector, switching to Euro-5 standard fuel and coal export from road to rail
 - In construction sector, using improved coal in Ulaanbaatar and warming up outdated apartments
 - In waste sector, supporting waste recycling industry

Decarbonization policies in Mongolia



Vision 2050 – long-term development policy paper

- Develop a low-carbon, productive and inclusive green economy and contribute to international efforts to mitigate climate change
 - Support renewable energy, reduce GHG emissions in sectors such as energy, agriculture, construction, transportation, heavy and light industries and waste, and will encourage carbon capture activities.
- Carbon neutral by 2050
 - Reduce GHG emission by 12.3 percent from baseline scenario in 2025 and by 22 percent in 2030.

Decarbonization policies in Mongolia



Action Program 2020-2024

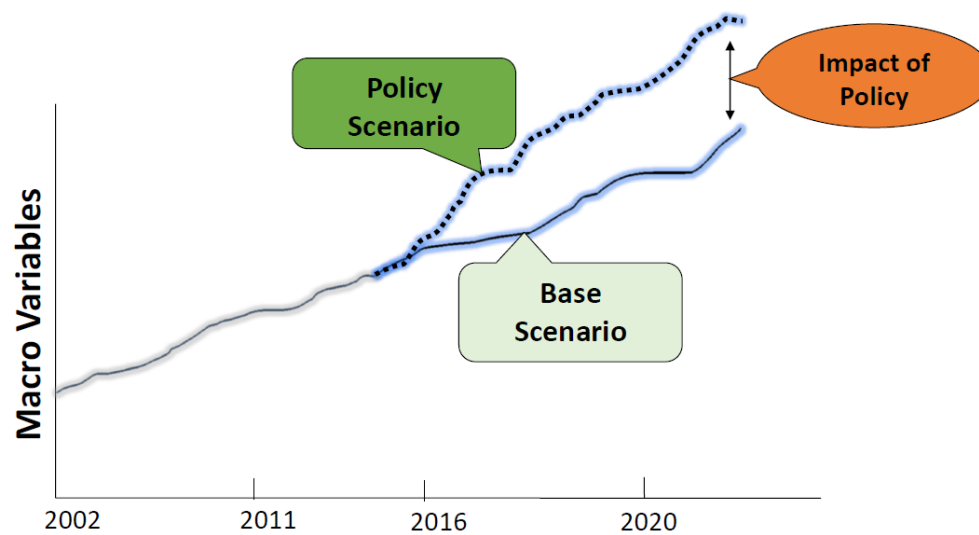
- Develop renewable energy production for domestic use
- Unclear in terms of financing and technology
- GoM plans to expand and promote coal mining for export
 - Construct a coal washing plant as part of the Tavan Tolgoi coal deposit infrastructure
 - Establish an industrial and technology park
 - Build several coal-fired power plants in upcoming years

Current policy measures are limited and reluctant to directly restrict coal production and consumption due to the sector's economic importance

Challenge: Trade-off between “carbon neutral requirement from the world” and “revenue sustainability in the Mongolian energy sector”

Methodology and simulation scenarios

Dynamic CGE model



- Developed a long-term baseline economic projection between 2021-2030
- Extended with CO₂ emission rate and CO₂ emission function
- Main database is the Mongolian SAM-2018
- Calculated CO₂ emission rate from GTAP 7 database

Scenarios



Baseline scenario: No carbon reduction policies

Scenario 1: Increase the capacity of the renewable energy sector to 30% of the total capacity of the energy sector by 2030

Scenario 2: Provide improved fuel to all coal-consuming households in Ulaanbaatar and 40% of rural coal-consuming households by 2030

Scenario 3: No new investments into the raw coking coal sector after 2025, a 75% reduction in investments into the washed coking coal sector after 2025

Scenario 4: Combination of Scenario 1, 2 and 3.



Scenario 1: Increase the capacity of the renewable energy sector



Installed capacity, Mwt			
	2020	2030*	Growth %
Conventional energy	1211.8	1822.8	50%
Renewable energy	271.2	782.2	188%
Diesel power	2.3	2.3	0%
Total	1485.3	2607.3	76%
Share of renewable energy in total installed capacity %	18.3%	30.0%	

*researchers' calculations, source: the "Vision 2050" document

- In 2020, the renewable energy sector produced 7.1% of the total domestic electricity supply and makes up 18.3% of total electricity installed capacity
- MNT 1.5 trillion investment into renewable energy sector from 2021-2030
- 1.8-fold increase in renewable energy production
- Decreased investment in and production of the conventional energy sector



Scenario 2: Increase the production and use of improved coal briquettes



- Usage of improved coal briquettes in 2020
 - 28% of all Mongolian households that burn coal
 - 77% of households that burn coal in Ulaanbaatar
- Assumption in 2030
 - 60% of all Mongolian households will use improved coal briquettes by 2030
 - ❖ All households that burn coal in Ulaanbaatar will use improved coal briquettes
 - ❖ 40% of rural households that burn coal will use improved coal briquettes.
 - Increase investment into the improved coal briquette sector



Scenario 3: To decrease investment and production of export coal and coking coal sectors

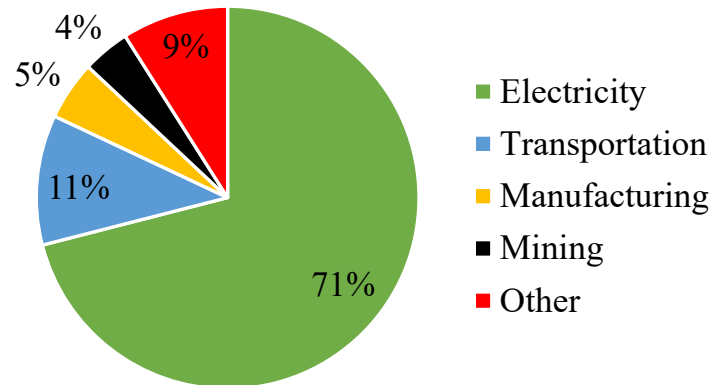
- Assumption

- No additional investments made into the export coal sector (raw coking coal) after 2025
- By 2030, raw coking coal exports will fall 25% compared to 2025
- Investments made into the coke sector (washed coking coal) will fall 75% after 2025
- Washed coking coal production will decrease 10% in 2030 compared to 2025
- We assume that FDI will fall by a value equivalent to the total decrease in investments into the raw and washed coking coal sectors

CO₂ emissions

- This study used GTAP 7 Database’s CO₂ emission data.
- We used CO₂ emissions generated by sectoral intermediate consumption and households.

Total CO₂ emissions by sectors, %

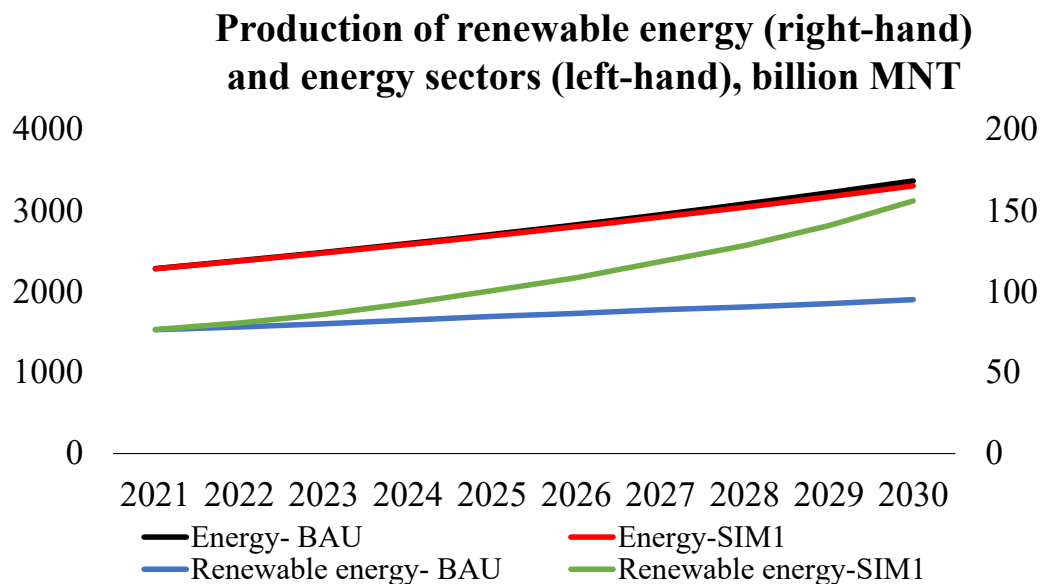


CO₂ emissions of household consumption, %

	% in total CO ₂
Coal usage	68.5
Fuel usage	31.3
Electricity usage	0.1
Improved coal briquette usage	0.001
Total	

Simulation result

Scenario 1: To increase the capacity of renewable energy sector



- The energy sector produces electricity and heat and is responsible for electricity and heat distribution
- In 2020, renewable energy accounted for only 2.2% of the energy sector’s total production
- By 2030, renewable energy production will only account for 4.5% of the energy sector’s total production

- The production of the renewable energy sector will increase 1.8-fold between 2021-2030
- The installed capacity of renewable energy will increase to 30% of total electricity installed capacity

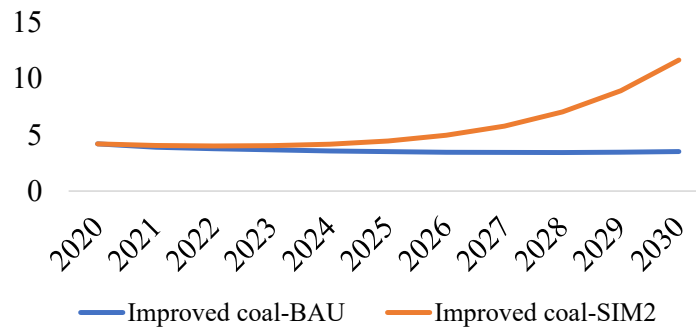
Scenario 1: To increase the capacity of renewable energy sector

	Average growth %: 2021 to 2030				
	Baseline scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
GDP growth	4.76	4.71	4.76	4.73	4.69
Government income	4.46	4.46	4.46	3.45	3.44
Household income/consumption	4.40	4.40	4.40	3.42	3.41
Wage rate	2.33	2.32	2.34	1.18	1.17
Total investment	4.70	4.69	4.70	2.34	2.33
Export	4.33	4.32	4.33	3.62	3.61
Import	4.43	4.42	4.43	3.16	3.15
CO2 emission of households	5.15	4.86	0.00	4.17	-1.02
CO2 emission of sectors	4.42	4.28	4.44	4.24	4.13
Total CO2 emission	4.49	4.36	4.06	4.23	3.71

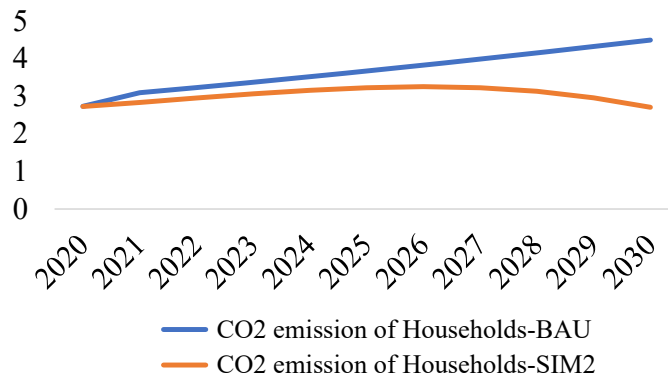
- Does not have a significant macroeconomic impact
- Household CO₂ emission growth decreases by 0.29 percentage points
- Sectoral CO₂ emission growth decreases by 0.14 percentage points

Scenario 2: To increase the production and use of improved coal

Improved coal production, billion MNT



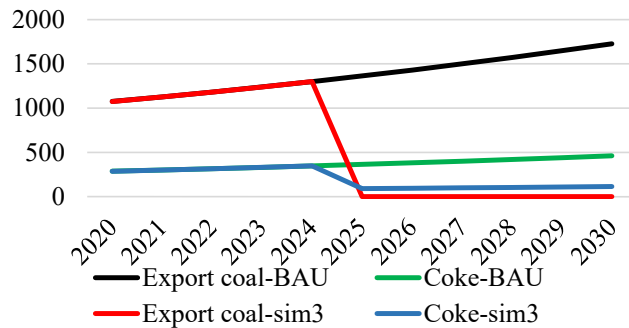
CO₂ emission of households, Mt



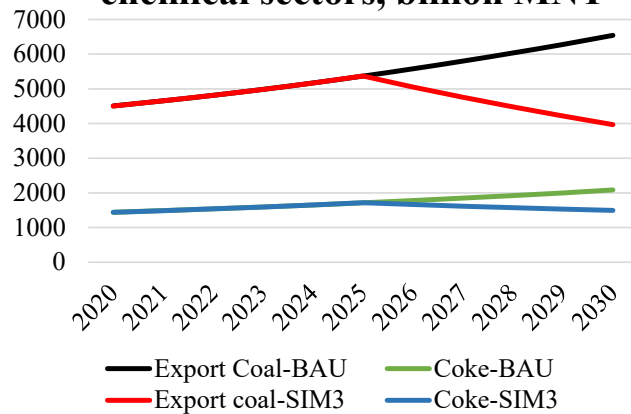
- By 2030, 60% of all Mongolian households that burn coal will use improved coal briquettes
- Does not have a significant macroeconomic impact
- Average household CO₂ emission growth is 0%
- Household CO₂ emissions in 2030 are 39.8% lower than the baseline scenario

Scenario 3: To decrease investment and production of export coal and coking coal sectors

Investment of export coal and coke sectors, billion MNT



Production of export coal and coke and chemical sectors, billion MNT

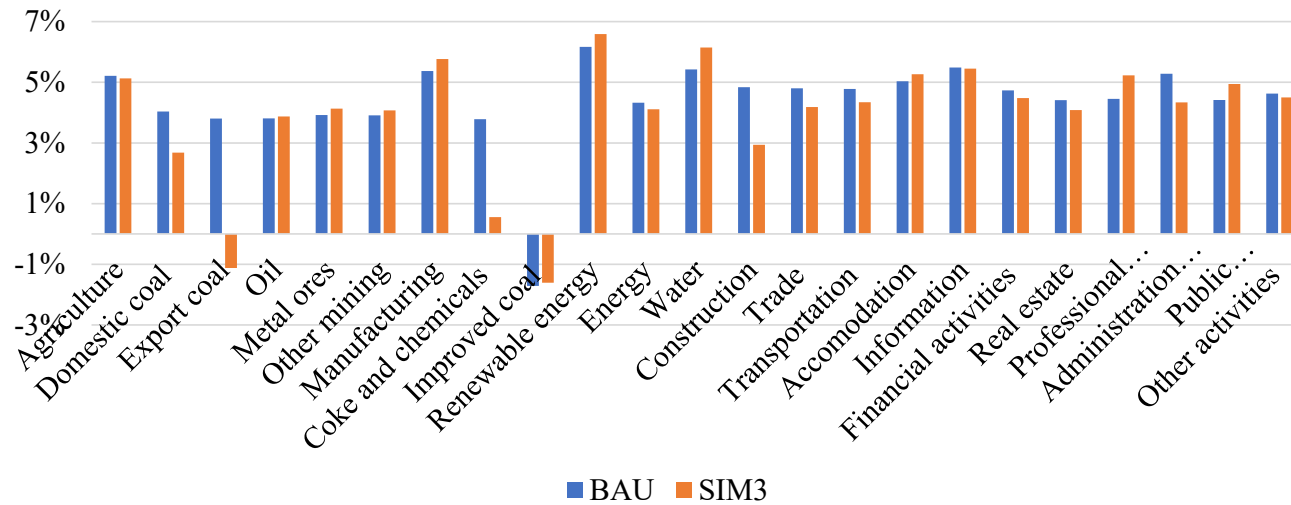


- Average GDP growth decreased by 0.03 percentage points
- Average total investment growth decreased by 2.36 percentage points due to a decrease in FDI
- The labor force shifted to low-wage sectors, and the average wage rate growth decreased by 1.15 percentage points
- Average household income growth decreased by 0.98 percentage points
- The average growth of total imports and exports decreased by 1.27 and 0.71 percentage points, respectively
- Average household CO₂ emission growth decreased by 0.97 percentage points
- Average total CO₂ emission growth decreased by 0.26 percentage points

Scenario 3: To decrease investment and production of export coal and coking coal sectors



Average growth of production in all sectors, %, 2021-2030

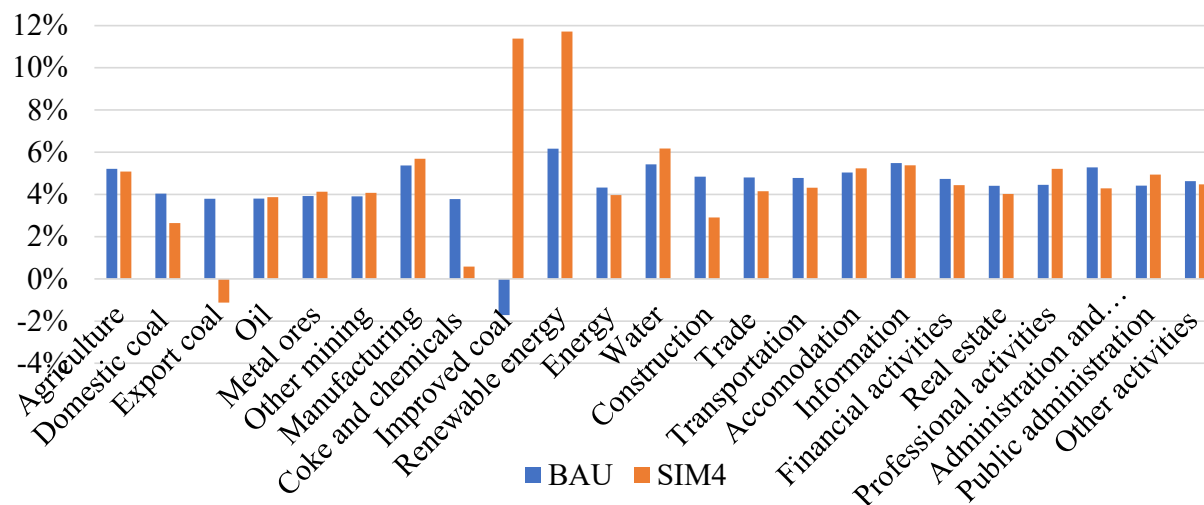


- The average production growth of domestic coal, export coal, coke and chemical, construction, trade transportation, and administration and support decreased moderately compared to baseline scenario.
- Average production growth increased in oil, metal ores, other mining, manufacturing, renewable energy, water, accommodation, professional activities and public administration.
- Average CO₂ emission growth of sectors decreased by 0.18 percentage points

Scenario 4: Combination of Scenario 1, 2 and 3

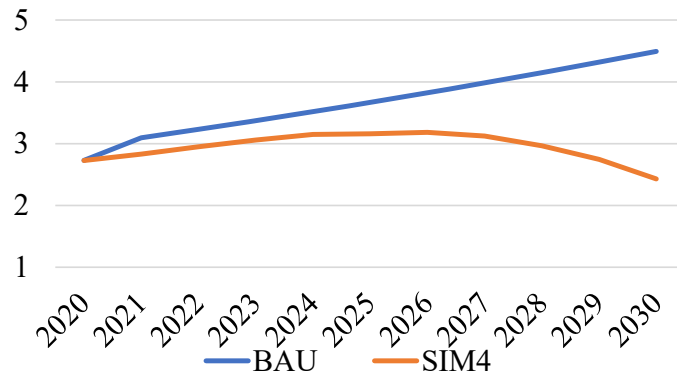
- The impact on macroeconomic indicators is the same as in Scenario 3
- The average production growth rates of the improved coal and renewable energy sectors increased moderately
- The average production growth rates of the domestic and export coal, coke and chemical, energy, construction, trade, transportation, financial activities, real estate, and administration and support sectors decreased
- The production growth of other sectors accelerated

Average growth of production in all sectors, %, 2021-2030

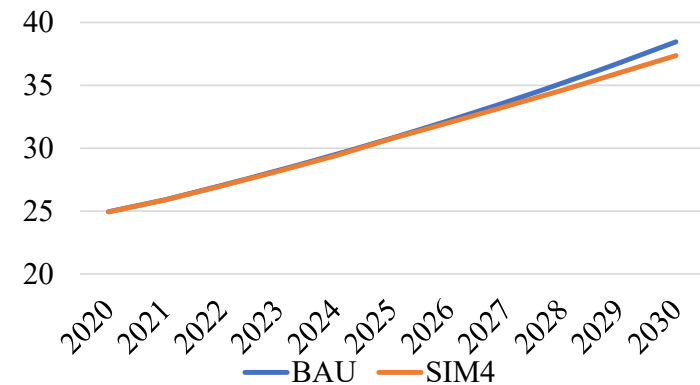


Scenario 4: Combination of Scenario 1, 2 and 3

CO₂ emission of households, Mt 2020-2030



Total CO₂ emission, Mt 2020-2030



- In 2030, household CO₂ emissions were 45.9% lower than in the baseline scenario due to the usage of improved coal briquettes
- Total CO₂ emission decreased by 2.8% in 2030 compared to the baseline scenario

Conclusion

Conclusion

- Mongolia must also consider the carbon reduction policies of other countries. Currently, the GoM has no policy targets aimed at reducing the mining sector's production and has not considered how the mining sector may be affected by international carbon reduction policies from other countries such as China.
- As the Mongolian economy is highly dependent on the mining sector, a decline in the investment into and production of the coal sector may result in the slowdown of several dependent sectors and negative impact macroeconomic indicators.
- As countries continue to focus on reducing CO₂ emissions and aim to eventually eliminate coal consumption, Mongolia needs to diversify and develop its non-mining sectors.
- In Mongolia, 68.5% of household CO₂ emissions are due to the burning of high emission raw coal. Thus, the implementation of a policy to increase the production of improved coal briquettes and provide them to households is likely to be effective in reducing household CO₂ emissions.

Conclusion

- The GoM needs to reconcile conflicting energy sector targets. While the GoM has a target to increase renewable energy production, it also plans to construct several coal-fired power plants in the near future. Attempts to increase renewable energy production are likely to be ineffective in reducing CO₂ emissions if Mongolia remains reliant on the coal sector for energy.
- The renewable energy sector's production accounted for only 2.2% of the energy sector's total production in 2020. As such, even if the installed capacity of the renewable energy sector improved, its share of the energy sector's total production is likely to remain low. This will weaken the effect of policies aimed at improving the installed capacity of the renewable energy sector.
- To make meaningful improvements in reducing CO₂ emissions, there is a need to improve the installed capacity of the renewable energy sector, limit investments into the conventional energy sector, and improve the overall efficiency of the entire energy sector.

Thank you for your attention